DG Research and Innovation

Monitor human resources policies and practices in research
(LOT 1 Part 1)

The Researchers Report 2012

Issue sheets

Deloitte.

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Introduction

Each chapter of the 2012 Researchers Report is accompanied by an Issue Sheet, providing a) a short introduction into the topic and b) a summary of the main findings per chapter. The Issue Sheets are presented in accordance with the individual chapters of the 2012 Researchers Report:

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2. Women in the research profession;
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4. Education and training;
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Each Issue Sheet is limited to a length of one to two pages to ensure readability. It can be used as a stand-alone document or in conjunction with the 2012 Researchers Report.

1. The stock of researchers in Europe

Key issue

Europe hosts a large pool of talented and skilled researchers. However, their stock as a share of the active labour force is well below that of its main trading competitors (United States, China and Japan). In addition, the proportion of researchers employed in the business sector is insufficient to sustain Europe's position as a global economic leader. Recent estimates suggest that an additional one million researchers may be needed in Europe by 2020 to meet an R&D intensity target of 3% of GDP[1]. The number of researchers actually required is significantly higher, as many researchers will retire over the next decade[2]. This, combined with the need for many more high-quality research jobs as the research intensity of the European economy increases, will be one of the main challenges facing European education, research and innovation systems in the years ahead[3].

Key findings

The stock of researchers in Europe in comparison with its main economic competitors:

- The EU is lagging behind its main competitors in the share of researchers in the total labour force. In 2009, this stood at 6.63 per 1000, compared to 9.4 in the US and 10.32 in Japan. The Nordic countries and France do relatively better;
- In absolute terms, there were 1.58 million full time equivalent (FTE) researchers in the EU-27 in 2009 compared to 1.46 million in the United States, 0.68 million in Japan and 1.6 million in China. Between 2000 and 2009, the stock of researchers in the EU grew by an annual average of almost 4%. This was faster than in the US and Japan, but slower than in China.

The stock of researchers in the business sector:

- In the EU-27, less than half of the researchers (44%) work in the business sector, and 56% in the public sector. The share of researchers employed by the business sector is much higher, e.g. 80% in the United States, 74% in Japan and 68% in China;
- There were 2.94 full time equivalent researchers in the business sector per thousand active labour force in the EU-27 in 2009 compared to 7.51 in the US, 7.67 in Japan and 1.37 in China;
- The number of researchers in the business sector (FTE) per thousand active labour force is highest (>6) in a number of the Nordic countries (e.g. Finland, Denmark and Iceland) and lowest (<1) in some of the new Member States such as Latvia, Bulgaria, Poland, Slovakia, Romania and Lithuania.

[1] According to recent estimates, achieving the target of spending 3% of EU GDP on R&D by 2020 could create 3.7 million jobs and increase annual GDP by close to EUR 800 billion by 2025 (see European Commission (2010b). For more information on the impact of the 3% R&D target on the number of researchers needed in the European research system in 2020, see European Commission (2010a, Appendix 2, p. 82ff).

[2] This estimate does not include the additional need for researchers to replace those leaving their employment for retirement.

[3] European Commission (2011), "Proposal for a Regulation of the European Parliament and of the Council establishing Horizon 2020 – The Framework Programme for Research and Innovation (2014-2020)", COM(2011) 809 final, 2011/0401 (COD), Brussels, 30.11.2011.

Countries' measures to increase the stock of researchers:

- Member States and Associated Countries[4] have reported a range of measures aimed at ensuring they train enough researchers to meet their national R&D targets in their respective countries: National Action Plans, programmes, strategies and legislative acts. In many cases, however, it is too early to measure the direct or indirect impact of these measures ;
- Member States and Associated Countries have established a number of awareness schemes to raise young people's interest in science and research in general. Dedicated programmes aim to make pursuing a researcher career attractive to specific groups, such as schoolchildren – and in particular girls. Member States have also set up measures to improve the quality and relevance of doctoral training[5].

[4] Countries associated with the Seventh Framework Programme for research and technological development: Norway, Iceland, Liechtenstein, Switzerland, Israel, Turkey, Croatia, the Former Yugoslav Republic of Macedonia, Serbia, Albania and Montenegro and Bosnia and Herzegovina.

[5] In line with the Principles for Innovative Doctoral Training

2. Women in the research profession

Key issue

While the proportion of women at the first two levels of tertiary education is higher than that of men, the proportion of women at PhD level is lower. It diverges even more in academic positions, and is greatest in the higher (more prestigious) academic positions. The participation rate of women in science and technology, especially in top-level positions and decision-making bodies, is well below that of men. Men are over-represented in senior academic positions.

The reasons for the gender imbalance in the research profession are multifaceted. They range from unattractive working conditions for women in public research institutions (e.g. insufficient security during maternity leave), persisting gender stereotypes in European countries (e.g. 'male bonus'[6]), and unfair and opaque recruitment procedures favouring men above women researchers[7]. Resources, time, networks and encouragement – which are unevenly distributed between the sexes – are prerequisites for becoming a successful scientist[8].

The correction of the remaining gender imbalances is a key factor for the success of a European Research Area. It is essential to ensure equal opportunities for women and men in access to research funding, promotion and decision-making bodies.

Key findings

Women researchers in top-level positions – the evolution of a researcher career:

- Women researchers in all countries face difficulties in climbing the career ladder in the research profession (Glass Ceiling Index). While the proportion of women is relatively high at the level of tertiary education, their proportion diminishes in the later stages of an academic career, especially in top-level positions (scissors effect); in the EU-27, women head only 13% of universities and HEIs (higher education institutions);
- Men outnumber women in the highest academic positions (Grade A positions) in the natural sciences, and engineering and technology. The proportion of women in Grade A positions is highest in the humanities and social sciences, but still lower than men in most cases;
- The ratio of women in top-level positions in research between 2004 and 2007 rose in every country at a different pace;
- The probability of women of reaching a top-level (Grade A) position in research is highest in Romania, Latvia, Turkey and Croatia and lowest in Ireland, Cyprus, Malta and Luxembourg;
- Women researchers are paid less than men at the same level (gender pay gap).

[6] "(...) the problem is not so much that women encounter discrimination as such, but that people – men and women – who resemble those who are in powerful positions and behave according to masculine traditions of full-time devotion and competition enjoy a bonus that allows them to be assessed as better scientists" (European Commission (2004), "Gender and Excellence in the making", Study, Science and Society, EUR 21222c, p. 19)

[7] "The low female presence at the highest levels of the scientific hierarchy is an indicator of the inability of research institutions to follow changes in society, such as the increase in women in higher education, which in turn highlights the dysfunction of a system for the evaluation of scientific excellence that has not abolished or weakened the old boy network of co-optation" (Ibid.)

[8] Ibid.

Countries' measures to promote women researchers in top-level positions:

- The great majority of European countries have adopted measures to promote gender equality in the research profession. These include setting up special bodies dedicated to the issue of gender balance, the anchoring of the gender balance principle in national constitutions, charters, action plans, etc;
- Other measures encompasses activities and instruments to facilitate women's access to top-level positions (on boards, in the higher education sector and public research institutes) and raise their chances of appointments and promotions to top-level research jobs. They encompass concrete gender targets and quotas, work-life balance provisions, advanced training, mentoring and empowerment as well as measures to enhance transparency in the appointment procedures;
- Several countries confer awards of excellence on women scientists to raise awareness of women in science and to reward outstanding women researchers for their contribution to research;
- A new edition of the 'She Figures' publication with more recent data from 2009 and 2010 is due for publication by the end of 2012.

3. Open, transparent and merit-based recruitment

Key issue

Open, transparent and merit-based recruitment procedures in public research institutions across Europe are a prerequisite for the realisation of the European Research Area (ERA). They are a precondition of high academic performance and teaching excellence by ensuring optimal allocation of human resources based on merit and academic excellence. Moreover, transparent recruitment procedures offer researchers equal opportunities at all stages of a researcher career by granting applicants fair access to competition-based research posts nationally and internationally. Fair access to attractive research positions in turn has a positive impact on the attractiveness of the research career. Transparent recruitment procedures are also indispensable for facilitating researchers' mobility.

The vast majority of national authorities consider the recruitment system in their countries to be largely fair and transparent. This is in sharp contrast to the perceptions of many researchers, who perceive the public institutions' recruitment rules and procedures as neither fair nor transparent. Researchers frequently cite the absence of open access to job opportunities as a disincentive to starting or remaining in a research career in Europe[9].

Key findings

Public authorities' perception of the national recruitment system in public research institutions:

- Most countries report having taken concrete steps to encourage or require institutions to make the recruitment system more open, transparent and merit-based, by establishing selection panels, granting rights to applicants to receive adequate feedback and establishing rules for the composition of selection panels;
- The vast majority of national authorities consider the recruitment system in their country to be largely open and transparent. They widely acknowledge the positive impact of open recruitment on scientific quality and productivity, researchers' international mobility, the attractiveness of research careers, and equal access to job opportunities for women and men;
- They consider explicit recruitment policies on the part of the hiring institution, a legislative framework, and awareness on the part of the institution of large job portals as very influential factors in the degree to which vacancies are advertised, and selection criteria/procedures are transparent.

Stakeholders' perception of the national recruitment system in public research institutions:

- Many researchers perceive the public institutions' recruitment rules and procedures to be neither open nor transparent. The lack of open and transparent recruitment procedures is regarded by the majority of stakeholders as one of the main factors hindering researchers' international mobility. Protectionism/nepotism (85%) is considered to be the main reason, followed by the lack of a human resources strategy in institutions (77%). Information is also felt

[9] European Commission (2008), "Communication from the Commission to the Council and the European Parliament. Better Careers and More Mobility: A European Partnership for Researchers", COM (2008)317 Final

to be critical, with 67% citing the lack of awareness of job portals such as EURAXESS Jobs as a key factor inhibiting open and fair recruitment procedures;

- Stakeholders emphasise the importance of an open, transparent and merit-based recruitment system as a precondition for excellence and innovation in research. They believe policy makers need to take concrete actions to remove the remaining bottlenecks to guarantee an attractive and efficient research career.

Key indicators to assess the openness and fairness of a recruitment system for researchers:

- The share of research posts advertised on the EURAXESS Jobs portal (per thousand researchers in the public sector) is relatively high in the United Kingdom, the Netherlands, Ireland and Norway;
- The length of time for which researchers in the higher education sector have been employed by their principal employer provides an indication as to the opportunities for and extent of mobility within a country. Many factors are at play but there appears to be a link with the degree of openness of recruitment structures in institutions in the EU-27. The share of researchers employed by their principal employer for more than 10 years is 42% in the EU-27. It is highest (>50%) in Bulgaria, Portugal, Hungary, Lithuania, Romania, Spain and Greece and lowest (<30%) in the Netherlands, the UK, Austria and Finland.

4. Education and training

Key issue

There is a significant shortage of people taking science to an advanced (doctoral) level and thus, pursuing a research career, albeit the basic education system in Europe is good compared with many parts of the world[10]. Europe's success in securing an adequate science base depends on a number of key factors. First, national governments and institutions must secure the foundation of their research systems by attracting sufficient numbers of young people into taking science to an advanced (doctoral) level and thus pursuing a research career. Second, the quality of Europe's education systems including the universities must throughout meet the highest international standards in order to attract and retain the most talented minds in Europe. Third, researchers must have access to the highest quality of (doctoral) training in order to be fully equipped to pursue and develop their careers in Europe. Fourth, there is a need to develop a strong relationship between the academic world and the business sector with a view to the latter attracting and absorbing more researchers as well as establishing an "environment of open innovation"[11,] where research results are commercialised and ideas are effectively exploited.

Key findings

Tertiary graduates in Europe:

- The Europe 2020 growth strategy has set a key target of increasing the share of the EU population aged 30-34 having completed tertiary education from 31% in 2010 to at least 40% by 2020. In 2010, the average was 33.6%, a significant increase of 11.2 percentage points since 2000 (22.4%);
- The number of new tertiary graduates per thousand population aged 20-29 climbed from 39.3 in 2000 to 61.8 in 2008 in the EU-27, but this is still less than in the United States (65.5) and Japan (68.8);
- The number of new tertiary graduates in Science, Technology, Engineering and Mathematics (STEM) subjects per thousand population aged 20-29 in the EU-27 increased from 10.1 (in 2000) to 14.3 (in 2009), a higher growth rate than in the US and Japan, but is still less in absolute terms;
- The number of women graduates in STEM subjects per thousand women population aged 20-29 increased from 6.3 (in 2000) to 9.4 (in 2009), significantly outstripping the increase in the US and Japan, but is still less in absolute terms.

Doctoral graduates in Europe:

- The number of new doctoral graduates in the EU-27 increased from 83 000 (in 2001) to around 115 000 (in 2010). The increase for the US was from 44 904 in 2001 to 69 570 in 2010. In Japan, the number of new doctoral graduates increased from 13 179 in 2001 to 15 867 in 2010;

[10] European Commission (2010)," Commission Staff Working Document 'A Rationale For Action' accompanying document to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "Europe 2020 Flagship Initiative. Innovation Union", SEC (2010)1161, Brussels, 6.10.2010

[11] European Commission (2008), "Communication from the Commission to the Council and the European Parliament. Better Careers and More Mobility: A European Partnership for Researchers", COM (2008)317 Final

- The number of new doctoral graduates per thousand population aged 25-34 in the EU-27 stood at 1.6 per thousand in 2009. It was also 1.6 in the US and was 1.0 in Japan;
- The highest number of new doctoral graduates per thousand population aged 25-34 in Europe in 2009 was in Switzerland. The leading EU-27 countries were Sweden and Finland;
- The average number of new women doctoral graduates in the EU-27 increased from 0.9 to 1.4 per thousand women in the population aged 25-34 between 2000 and 2009. In 2009, Portugal reported the highest number of new women doctoral graduates; Cyprus the lowest.

Countries' measures to attract people to science and provide quality training for researchers:

- European countries are implementing various measures to attract people to a research career (e.g. via mentoring programmes, science communication action plans and financial support programmes for students (scholarships), to upgrade the quality of doctoral training (e.g. offering structured programmes in line with the Principles for Innovative Doctoral Training[12]), and post-doctoral career paths (e.g. in-company training programmes, professional development provision and tenure tracks) and to encourage academia-industry partnerships (e.g. via research traineeships in companies and inter-sectoral mobility programmes), in line with the Charter and Code[13].

[12] Available at: http://ec.europa.eu/euraxess/pdf/research_policies/Principles_for_Innovative_Doctoral_Training.pdf

[13] European Charter for Researchers and Code of Conduct for the Recruitment of Researchers

5. Working conditions

Key issue

Employment and working conditions are essential determinants of the attractiveness of any career. The level of attractiveness depends largely on (the combination of) the following factors: clear career prospects with attractive employment opportunities (permanent positions), competitive salaries, sufficient social security benefits (including statutory pension rights, healthcare and unemployment benefits), and the possibility of balancing work and personal life. Attractive working conditions and career prospects are a prerequisite for attracting and retaining the most talented researchers in Europe and ensuring the realisation of the European Research Area. They are a key driver for attracting young people into a researcher career and ensuring top-quality research results in public research institutions in Europe. However, research careers in the public sector in Europe are relatively unattractive. Researchers consider unclear career prospects, a lack of (research) funding by universities and research institutions, relatively low wages in academia and insufficient cooperation between academia and the private sector as the main inhibiting factors for ensuring attractive careers in Europe[14].

Key findings

Researchers' contractual conditions and remuneration:

- The majority of EU researchers (59%) have an open-ended (permanent) contract while others have fixed-term contracts of varying duration (2009 data);
- Researchers' remuneration levels differ substantially across European countries (correlating with the cost of living) and in comparison with other parts of the world. There is a substantial difference between the progression of researchers' salaries across seniority levels and across countries.

Researchers' career development – mobility, life-long learning and European Charter and Code:

- For the vast majority of EU researchers (80%), mobility has had a positive impact on their career progression across different employment sectors;
- Measures aimed at encouraging life-long learning (e.g. via dedicated career programmes) and improving working conditions (e.g. via the European Charter and Code) show a positive impact on researchers' career development and overall job satisfaction.

Social security in the researcher profession:

- While researchers on stable employment contracts tend to enjoy social security coverage (including statutory pension rights, healthcare and unemployment benefits), those without stable employment contracts, in particular doctoral candidates, lack this provision to varying degrees.

[14] European Commission (2012), "Areas of untapped potential for the development of the European Research Area. Preliminary summary and analysis of the response to the ERA Framework Public Consultation"

6. Collaboration between academia and industry

Key issue

Close collaboration between research, education and innovation is vital for the realisation of the European Research Area and for maintaining Europe's competitiveness vis-à-vis its main economic competitors (US, Japan and China). However, the degree of researcher employment in the business sector differs significantly between the EU and other major economies.

In the EU-27, more than half of all researchers (56%) work in the public sector, and only 44% (700 000) are in the business sector. The share of researchers employed by the business sector is much higher within the EU's main economic competitors, e.g. 1 117 000 (80%) in the United States, 1 109 000 (68%) in China and more than 500 000 (74%) in Japan[15].

The business sector in Europe needs additional researchers to keep up with its international competitors. There is a need to develop a strong relationship between the academic world and the business sector with a view to attracting and absorbing more researchers as well as establishing "an environment of open innovation"[16], where research results are commercialised and ideas are exploited effectively.

Key findings

Collaboration between researchers from academia and industry:

- Only one in three public sector researchers in the EU-27 collaborates formally with researchers from the business sector and only one in five do so across borders (2009 data);
- The number of cross-sector scientific co-publications per million inhabitants is considerably higher in the US and Japan than in the EU;
- On average only 17% of EU researchers have been employed in both the public and private sector (2009 data);
- Cross-sectoral mobility is mostly from the public to the private sector, with low levels of movement in the other direction, or flows back and forth.
- Only 22% of respondents to the ERA public consultation felt that EU researchers are equipped for the business sector market. Three in four acknowledge lack of awareness of intellectual property rules and knowledge-transfer opportunities.

Countries' measures to increase collaboration between academia and industry:

- European countries have put in place various measures to boost partnerships between universities, research institutions and private companies. These include the implementation of joint projects, commercialisation programmes, research traineeships in companies, inter-sectoral mobility programmes and industrial PhD programmes. Some countries also encourage and sustain long-term cooperative partnerships (for instance, under a memorandum for

[15] For more information on the stock of researchers in the business sector, see also Chapter 1 of this report "The stock of researchers in Europe" and the Issue Sheet "The stock of researchers in Europe".

[16] European Commission (2008b)

cooperation), whereas other countries prefer to create networking platforms and innovation clusters to link universities and the business world.

7. Mobility and international attractiveness

Key issue

Mobility is a core concept of the ERA. This in turn is fundamental to the EU's Growth and Jobs Strategy and Vision for 2020, which aim to improve the dynamism and competitiveness of the EU economy. Mobility is strongly associated with excellence, the creation of dynamic networks, improved scientific performance, improved knowledge and technology transfer, improved productivity and ultimately enhanced economic and social welfare.

Key findings

Mobility of researchers in Europe:

- More than half of EU researchers (56%) have been 'internationally mobile' (outward mobility for at least three months) at least once in their career and more than one quarter (29%) in the last three years (2009);
- Around half the recently mobile (some 14% of EU researchers) moved to a new employer in a different country. This compares with around 1.5% of the EU workforce[17] (2009).

Mobility of doctoral candidates:

- EU-wide, there are around 600 000 doctoral candidates: 76% are EU nationals studying in their own country. Of these, 7% (around 40 000) are EU nationals studying in another EU country. The remaining 17% (around 110 000) are from outside the EU. The highest number of foreign (non-EU) doctoral candidates in the EU-27 came from China (2007);
- The proportion of non-national researchers serves as a useful indicator of the degree of openness of national recruitment systems. France, the UK and Norway have a relatively high proportion of non-EU doctoral candidates as a percentage of all doctoral candidates[18] whereas the UK, Austria and Belgium have a relatively high proportion of doctoral candidates who are citizens of another EU-27 Member State;
- Compared to the EU average (7%), the UK (15%) is the EU country most likely to be chosen by other Europeans to do their doctorate in, followed by Austria (13%) and Belgium (12%). Member States with the lowest inflows of other EU doctoral candidates are the new Member States, Italy and Portugal.

Factors influencing and motivations for mobility:

- The most important factors influencing researchers' mobility are 'personal education and/or research agenda', 'career progression goals & possibility of evolving further', 'the prospect to work with leading experts in your field' and 'getting access to the facilities/equipment necessary to your research'. Conversely, 'personal/family factors' are the most important factors dissuading researchers from becoming mobile.

Barriers to mobility:

[17] Percentage of the EU workforce that lives and works in a different Member State from their country of origin

[18] "Non-EU doctoral candidates" refers to foreign doctoral candidates in case of non-EU countries.

- The most important factor inhibiting researchers' international mobility is the lack of transparent, open and merit-based recruitment (78% of respondents, see chapter 3);
- A majority of respondents (66%) also point to the lack of portability of publicly funded grants as an inhibiting factor, while 58% of respondents report that burdensome and complicated immigration rules and procedures are important obstacles to mobility. In addition, a majority of researchers report facing difficulties in moving from the public to the private sector and vice versa[19].

Countries' measures to remove the remaining barriers to mobility:

- European countries have put in place various measures to remove obstacles to researchers' mobility. These include reforms in the university and higher education sectors linked to the Bologna process. In addition, many countries have introduced national mobility schemes to boost different types of researcher mobility (inward, outward and cross-sectoral). Many of these schemes promote inward mobility from both EU and non-EU countries providing financial incentives for early stage researchers while others promote outbound mobility. Non-financial incentives include measures promoting 'dual careers'[20]. Some countries provide tax incentives to facilitate researchers' mobility in Europe.

Attractiveness of public research institutions:

- In 2010, the EU-27 was the runner-up in the production of international scientific co-publications behind the United States;
- The number of scientific co-publications provides insight into cooperation between researchers from different countries. European researchers co-publish mainly with colleagues from other European countries (85-95%) but a growing number of co-publications are produced in collaboration with at least one author from a country outside of the EU. Within Europe, researchers from most countries collaborate intensively with colleagues from large countries in particular (i.e. Germany, France, Italy and the UK);
- The EU-27 lagged behind the US in terms of scientific publications in the top 10% most-cited publications worldwide (in 2007). The indicator is a proxy for the excellence of the research system as highly cited publications are assumed to be of higher quality;
- The residence of Nobel Prize winners by continent serves as an indication of the attractiveness of countries and institutions for performing research. Far more Nobel Prize winners have been from the US (70%) than from Europe (22.5%);
- The 'Leiden Ranking' indicates that Europe has 171 top research universities. This provides an indication of which European universities are attractive for third-country researchers;
- Several excellence initiatives, such as 'poles' or clusters, as in France and Germany, may add to the visibility, attractiveness and performance of the European systems.

[19] European Commission (2012a)

[20] Dual career couples are defined by the fact that both partners are highly qualified, and follow their career path while not renouncing having children and a satisfying family life.