HIGH SKILLED MIGRATION: STILL A BRAIN DRAIN PROBLEM?

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Introduction

The path of international migration has a long history that reaches its highest peak in the late nineteenth and early twentieth century when millions of people moved from their countries of origin to another one to find a job and a future for them and their families. Most of these migrations were, for decades, relevant only for the poorest workers and the lower levels of society. The elite side of migration being significant only for a very little minority (Brandi, 2001). Migration, in terms of intellectual mobility, has a relatively short history in ‘mass’ terms, and particularly for the highly skilled, as researchers, that have often been relatively mobile workers as this has always been considered an essential characteristic of their work. Skilled migrant workers are today mainly medical doctors and personnel, information technology specialists, students, entrepreneurs and, of course, researchers.

Ever since exchanging ideas, experiences, has been the nurturing ground in culture and science but the debate on pros and cons of scientists mobility has enlarged when realizing that mobility often became brain drain and the direction of flows have been one way: from the most feeble to the stronger countries only. Is it still the case? Are we still allowed to refer to brain drain or is more appropriate to refer to brain circulation?

1. Background

Nations are increasingly viewing technology transfer as a people-oriented phenomenon and fearing that they might be losing their competitive edge in what seem like a global competition for certain skills. At present and even more in future, the competition for highly skilled workers is believed to be fierce. Traditionally, flows of talented people between countries tended to go from the
south to the north. In some cases the geographical mobility map is now reversed. Particularly South East Asia and parts of Eastern Europe are catching up technologically, and moved quickly towards knowledge-based economies. Thus, highly skilled scientists and engineers might stop flowing out from these countries. A likely scenario is that movement of brain drain and brain gain will be going in all directions: north-north, north-south, south-north and south-south. This might threaten those countries (like the US) that heavily depend on foreign talents.

Immigration, particularly of the highly skilled people, became an inseparable segment of national technology policies. This has been reflected in the immigration policies of major industrialised economies such as France, Germany, and the US. In France, a so-called ‘Scientific visa’ was introduced in 1998 as a fast track procedure to allow scientists from non-EU countries to get permission for work. Likewise, in Germany the government has issued a US style ‘Green Card’ for IT professionals from third countries. Australia, Canada and the US have a long tradition of selective immigration policies targeting highly skilled professionals.

Far from all countries and regions can benefit from a growing international circulation of highly skilled labour: While for instance UK participates very actively in the international mobility of professionals by sending and receiving talents, Russia and some Eastern Europe countries mostly have suffered from severe brain drain. In the latter case, the outflow of professionals became a serious threat to their economic and social recovery, but this phenomenon is difficult to influence through immigration policy alone. Other factors can have significant impact on the attractiveness of a country: taxation, schemes for sending students abroad, labour relations and quality of work, communication infrastructures, schemes for business expansion abroad, labour market supply and demand signals. These factors vary between countries. Professions and various groups of highly skilled persons are driven by different push and pull factors. As people are lured and pushed by different motivations and circumstances, the issue of migration and international mobility of highly skilled personnel becomes quite complex.

Across the OECD, there is growing demand for a better understanding of the scale, direction and drivers of the international mobility of scientific and technical talent. An increasing number of countries are implementing policy measures to attract foreign researchers and to facilitate their access to the labour market. However, competition for skilled researchers is increasing, and policy makers need to be concerned with measures both to attract researchers and to retain them. There has been an increase in return flows to some countries, especially to non-Member countries such as China and India who are actively courting expatriate researchers. In addition, some OECD countries have developed policy measures to promote the temporary outward flow of students and researchers to enhance international mobility and ‘brain circulation’.
The effort to boost research and innovation has been growing steadily in the last 20 years: in 1985 3% of the total EU budget was devoted to research and innovation, and it reached in 2008 almost 11%, of course with very significative differences among countries. The importance of the EU funds for R&D and innovation is witnessed by the fact that EU Research Framework Programme represents nearly 25% of all project-based funding in Europe, and that in most EU-12 Member States, Structural Funds directed to Research, Technological Development and Innovation represent more than 60% of the national R&D budget.

In building the European framework for innovation mobility has frequently been addressed as an essential feature in many terms. “Far greater mobility is needed at three levels: Human resources need a step change in mobility across boundaries; Financial mobility requires an effective venture capital sector and new financial instruments for the knowledge-based economy; Mobility in organisation and knowledge means cutting across established structures to allow new linkages to be made through the instruments of European technology platforms and clusters”1.

The five targets have been set for the European Union in 2020, these are in a nutshell:

- **Employment** 75% of the 20-64 year-olds to be employed;
- **R&D** 3% of the EU’s GDP to be invested in R&D;
- **Climate change / energy** greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990 20% of energy from renewables 20% increase in energy efficiency;
- **Education** Reducing school drop-out rates below 10% at least 40% of 30-34–year-olds completing third level education;
- **Poverty / social exclusion** at least 20 million fewer people in or at risk of poverty and social exclusion.

Within the European objectives of Horizon 2020 we can find the “necessity of increasing European attractiveness for talents and investments by strengthening its capacity to produce excellence in cutting-edge research infrastructures, investing in young talents and promoting awareness of the social and economic value of research, science and culture in contemporary society”.

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The EU and OECD have been tackling the question since the late nineties either by organizing study projects and groups, conferences, and issuing formal declarations. 

2. Mobility issues

What kind of mobility and how much mobility? Let’s start from the first question.

Many kinds. Geographical: national, international, inter-regional; between different kind of jobs or different typologies (short/long term part time etc. contracts); among different sectors and levels; from education to work and back, to cite the most common ones. Moreover the different kinds of mobility are often intertwined: a change in position may imply a change of country or of sector and so on. All these kinds of mobility may be associated to a proper mobility experience or to what has been called either brain drain or brain waste or brain gain or brain circulation. A mobile highly skilled worker can gain a better and profitable position in another country or institution and this individual gain may become an institutional or national loss. (Regets, 2007).

Mobility is a typical double faced question: positive and negative aspects can be found in a phenomenon that could apparently be considered as neutral.

An excess, but sometimes also a physiological amount of mobility if not correctly oriented and exploited can cause as many problems as its absence.

Mobility of scientists and engineers has been discussed for a long time in western countries, and in the negative form of brain drain has been experienced by many of them, especially considering the attractiveness of the USA, as far as scientific opportunities are concerned, since the first decades of last century.

At the level of an individual, an institution and a Country the benefices deriving from the experience of cooperating, studying and working in a different environment with foreign partners are certain and obvious and the fruitful and positive potentialities of such an experience are evident to anyone. The risks can be found essentially in missing the opportunity to develop fully the positive spill over of this experience or that the mobility experience looses its temporary nature and becomes a permanent escape.

2 Just to mention a few: the EU The Career and Mobility of the researcher Conference 2010, held in Brussels from 9-10 November; the OECD, Committee for Scientific and Technological Policy (CSTP) & Steering and Funding of Research Institutions (SFRI) Workshop the International Mobility of Researchers, Paris, 28 March 2007 The European Commission funded projects MORE, closed, and MORE2, ongoing, (Mobility and career paths Of Researchers in Europe).
Measuring mobility is an hard exercise. It has to deal with some preliminary questions that can delimit the area to analyze:

How big is international mobility of people involved? What is the profile of migrating HRST (diploma, experience, occupation, age)? What share of migrating skilled workers return back home? What is the length of their stay abroad? What is the purpose of migrating: studying, working?

What are the causes of international migration (in the recipient and sending countries)? What is its economic impact on the recipient country (gain in knowledge) and the sending country (loss of educated people vs. acquisition of foreign technology from those returning back)?

Which policy measures can help reach a win/win situation, where international migration contributes to an efficient allocation of resources world wide and to the international diffusion of technology?

How can the mass exodus of the best brains, if any, be stopped? And in the other way round how can the EU attract and retain the best researchers? Is still a question of drain or we can refer to brain circulation?

2.1. Factors influencing international mobility

The main factors are linked to the working conditions in the country of destination compared to those of the country of origin concerning particularly salary and pay levels, qualification required, career prospects (is mobility a plus when coming back to the country of origin or does the long period spent abroad prevent from obtaining careers advances and benefits?).

Legislative regulation concerning immigration rules in the host country and general migration policy of the country of origin that can facilitate or hinder the mobility choice, are major issues too. But a relevant number of concurring factors are at stake:

- Family ties;
- Cost of living;
- Cultural circumstances;
- Supply and demand of professors-researchers in the country of destination;
- Mobility schemes;
- Salaries and pay scale level;
- Language requirements;
- Qualification needed
- Shortage or surplus of researchers-professors;
- Policies of the hosting nation;
Countries with poor working conditions are of course not attractive but also countries with good working-studying conditions may become not attractive due to other questions such as the elevate cost of living, the difficulties in settling (finding a proper housing conditions, etc).

If the experience abroad is not fully recognized home the incentive to move is obviously much less regarded as a good option by the individual and the accreditation system goes exactly in the direction of giving to mobile students an incentive to move as they experience that their progress and attainment made abroad are fully recognized home.

Pull factors may be identified in the offer available in the countries in terms of funding to attract foreign students, PhDs, Post Docs and researchers by offering grants and scholarships that multiply the number of positions that attract them from all over the world. As for the push factors we have to include direct government or institution policies of sending countries that stimulate the demand.

2.2. Possible effects of international mobility: positive and negative consequence

A number of different effects and consequences may be envisaged:
- On science and technology
- On Higher education systems
- On Human capital and Labour markets
- At individual level

As for the possible positive effects on science and technology and higher education systems (Regets 2007) on sending Countries, should be mentioned the opening of knowledge flows and collaboration with other countries and the increased ties to foreign research institutions. Specifically for the higher education system the return of natives with foreign education and in general of high skilled human capital may prove, directly or indirectly, of benefit. The return of a mobile student or researcher means for the originating country acquiring the new knowledge and experience gained, knowledge and experience brought back to the institute upon his/her return.

The returnees may in fact either bring or built with their study experience gathered (acquired) abroad, valuable entrepreneurship or management skills and give the home country, for instance, a better insight on export opportunities for technology or on access to global networks.

Likewise, benefits of the activities of a post doc abroad can have positive spillovers for the country of origin. For example when using foreign facilities not
available in the country of origin to further that country's R&D agenda (i.e. big science facilities).

The receiving Countries also may benefit from hosting higher education students and researchers or highly skilled professionals including of course university professors. This may also turn into an increased R&D and economic activity due to availability of additional high skilled workers that favors entrepreneurship especially in high growth areas. Receiving countries as well benefit from stronger knowledge flows and collaboration with sending countries. Diversity and creativity are certainly further promoted by the melting pot of intellectual mix brought by the inflow of people with different backgrounds.

A number of possible negative effects on science and technology and higher education systems can as well be referred both to sending and to receiving countries, that as for the positive ones may affect nations, institutions and individuals. As for the sending Countries the most studied effect is the one, related to human capital and well known as “Brain Drain”. The departure of many highly qualified and high skilled people may turn into the loosing of part of the national capacity to generate high level activities that turns into a weaker intellectual and productive capacity due to the absence of high level students and high skilled workers. If using the same example of a post doc working abroad made to point out some positive effects, we recognize that the same experience may turn into a negative effect for the country of origin if out of his-her studies a concrete output comes, i.e. in terms of patents, this may provide instant benefit to the host country with little or no like benefits to the originating country.

A direct loss can be envisaged also in pure economic terms: having spent a lot of money, often if not always public, the investment made in tertiary education turns into a benefit for another nation and in a perceived waste of national public resources that give poor returns from public investment.

Higher education systems of receiving Countries may also suffer from the situation as native students may feel discouraged of enrolling in higher education, especially in certain fields that are crowded of foreign applicants that may prove more qualified to get the positions opened in those courses.

2.3. Push and pull factors

As the research carried out for the European Commission (Avveduto, Hansen 2003) points out there are common positive evaluation of the mobility experience at individual level which prevail because of the high level of work environment and of the research experience mainly linked to the scientific level of hosting institution and then on the quality of research carried out, to the available resources for R&D and of the availability of scientific equipment.
The negative evaluation of the experience is commonly due to obstacles linked to bureaucracies’ red tape, difficulties in obtaining work permits and residence visa. For people coming from some higher revenue level countries some concerns were linked to the low salary levels as compared to country of origin.

Post docs and young researchers lamented also the fear of being losing opportunities home while abroad, of leaving them to people who preferred staying in the home institution even if at a lower level, but just for being there could catch more opportunities.

The push and pull factors appear clearly in the following outline: scientific reasons overcome all the other ones.

Table 1 – Push and Pull factors.

<table>
<thead>
<tr>
<th>Factors of mobility</th>
<th>Strong factor</th>
<th>Medium factor</th>
<th>Not a factor</th>
</tr>
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<tbody>
<tr>
<td>To be involved in another research milieu</td>
<td>55%</td>
<td>31%</td>
<td>15%</td>
</tr>
<tr>
<td>Specialize in sector not at home</td>
<td>29%</td>
<td>29%</td>
<td>42%</td>
</tr>
<tr>
<td>Study and scientific opportunities</td>
<td>46%</td>
<td>39%</td>
<td>15%</td>
</tr>
<tr>
<td>Availability of scientific equipment</td>
<td>37%</td>
<td>38%</td>
<td>25%</td>
</tr>
<tr>
<td>Forefront of the research sector</td>
<td>24%</td>
<td>51%</td>
<td>25%</td>
</tr>
</tbody>
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Source: CNR-MERIT Survey for EC on Brain Drain and mobile high skilled.

3. Some figures and data

The following paragraphs present some background figures and data on R&D and on mobility issues.

3.1. Researchers and expenditures for research and development

In OECD Countries, the levels of expenditures and people working in research and development (R&D) is very scattered among nations. The research expenditures volumes today, as expressed in 2000 US dollars in constant prices and in purchase parity power (PPP), is depicted in figure 1, as well as the number of researchers per thousand employees. As the figure shows the expenditures on R&D as a percentage on gross domestic product (GDP) are very different irrespectively of the size of the Country. The recommended level of 3%, benchmarked by the European Commission as the optimal level to be reached by Member countries, is already exceeded by a little but very highly technologically relevant country as Finland, and very far away by our country that either by
expenditures and by number of researchers per thousand employment’s behind almost all EU countries let alone countries with big technological and innovative systems such as US, Japan or Korea (Figure 1).

**Figure 1 – Researchers and expenditures on R&D.**

Source: OECD.

The performing sectors vary substantially across countries (Figure B). Many different systems are strongly polarized and either centered on academic or industrial research as primarily employers of researchers, in others the balance between the two, changes very much. In Japan or Korea, for instance, most of the R&D personnel are employed in business sector while in New Zealand or Australia the higher education sector is the most important one as a research performer. The Italian case is almost divided fifty fifty between the two sectors with a relatively important government sector that traditionally has been a good founder of public research also via public research Institutions such as CNR. The Italian situation is more similar to the EU 27 average one than to the OECD one.
If we focalize on the changes occurred in ten years on the business enterprise sector as main employer of R&D research personnel, we can follow the difficulties or the success stories ‘even if at a very highly aggregate level of a nation (Figure 3).

Some countries have experienced a highly level boost in business enterprise sector and a parallel upsurge in R&D employment, Finland, Iceland, but most of all Korea and countries of new highly industrialization such as Hungary and Estonia.
more than doubled the industrial researchers. Others maintain the same levels, and Italy is among these, but in the average both EU27 and OECD member countries, experience a growth, even if rather moderate.

3.2. Qualifications

Before focalizing upon mobility of the highly skilled, it is useful to start from the very roots of highly qualified work force: the tertiary qualified and the PhD holders.

**Figure 4 – HRST Tertiary qualified. Tertiary educated individuals, as percentage of population, 25-64 year olds.**

We are referring to the Human resources for science and technology (HRST) following the Canberra Manual indications. Tertiary educated individuals as a

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3 The Canberra Manual (OECD, 1995) definition is based on both notions of educational attainment and of occupation and further developed in reference to both international standard classifications of education and occupations, ISCED and ISCO. The Canberra Manual defines HRST as people who fulfil either one or the other of the following conditions:
- They have successfully completed education at the tertiary level in an S&T field of study.
- They are not formally qualified as above, but are employed in an S&T occupation where the above qualifications are normally required.

The Manual on human resources in science and technology attempts to identify the particular group of persons who can contribute most to the knowledge-based society.
percentage of population in working age (over 25 as we refer to higher education) reach in the Oecd on average some 30% and this potential is much higher in Nordic Countries. Italy unfortunately holds one of the last positions just above Turkey and Brazil (Figure 4).

To refine our analysis we should now refer to the highest level of study: the PhD level. Supranational bodies such as EU and Oecd have extensively worked on policy studies since the nineties (Blume, 1995, Avveduto, 1995), and have been collecting and producing data and figures on graduate studies and doctorate levels. At present OECD in cooperation with Eurostat and Unesco has set up an extensive network on Careers of Doctorate Holders to study and track careers of all PhD holders all across member countries, addressing several topics, including mobility patterns.

Figure 5 shows the evolution of the graduation rates at doctorate levels in a ten years time span: from 2000 to 2009. All countries have experienced a growth often very significant.

**Figure 5** – New doctorate graduates graduation rates at doctorate level 2000-2009. As a percentage of population in reference age cohort.


If we refer only to the science and engineering fields (Fig F), we notice that the new doctorate graduates (in 2009 or the latest available data), as a percentage of all new degrees awarded are well above 40% in many countries, while the presence of female PhDs in these fields is still rather low.
Figure 6 – Scoreboard 2011, new doctorate graduates. Science and engineering (NSE) graduates at doctorate level, 2009. As percentage of all new degrees awarded at doctorate level.

Source: OECD, Education Database September 2011; and OECD, calculations based on national sources, May 2011.

Figure 7 – New doctorate graduates where do they graduate? S&E graduates at doctorate level, by country of graduation, 2009. As a percentage of total OECD new science and engineering degrees at doctorate level.

Source: OECD, Education Database, 2011; and OECD calculations based on Nordic Institute for Studies in Innovation, Research and Education (NUFU), 2011.

The geographical distribution of graduates (Figure 7) shows how over 60% of all newly graduates are concentrated in five countries (US, Germany, UK, France, Canada).
and Japan) and by adding the following five ones (Italy, Korea, Spain, Canada, Australia) we reach the 76% of the Oecd total.

3.3. Mobility Issues

If we refer to the entire population of the European Union we acknowledge that 2% of all citizen in working age, live and work in a country different from the one they were born in. This percentage reaches 3% for the highly skilled, 7% of PhDs and 12% of Post Docs.

Although it is not easy to cross geographical mobility figures with data on job to job mobility, it is very likely that the two often match. Figure H shows the job to job mobility of HRST (25 to 64 years) in two given years (2000 and 2010). Calculations have been made by OECD on ad hoc tabulation of Eurostat Labour Force Survey. Except from very few exceptions mobility has grown in all countries and substantially in Northern ones (excluding Norway).

**Figure 8 – HRST Mobility. Inter-sector mobility of HRST, 25-to-64-year-olds, 2010. As a percentage of HRST changing jobs.**

The above mentioned survey on CDH allows us to focus also on qualitative information. Following the results we can confirm also those of the CNR-Merit

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4 Inter-sector mobility reflects the flow of employed HRST whose economic activity at the NACE two-digit level differs from that of the previous years as a percentage of employed HRST who changed employers over the one year period. The rates are calculated for those employed both in the present and previous years and whose economic activity and HRST status could be identified.
survey on highly skilled mobility: the most important reasons are all linked to the academic factors (Figure 9).

**Figure 8** – *International mobility-reasons Reasons cited by national citizens with a doctorate for going abroad or returning to the home country, percent, 2009.*

![Image](image_url)

*Source: OECD, Based on OECD/UNESCO Institute for Statistics/Eurostat data collection on CDH 2010.*

4. Conclusions

The following statement is taken from the preparatory work done for the OECD main activity on HRST5 that took place from the late nineties. When addressing the mobility issues these were the main question raised.

*How mobile are the human resources in science and technology?* Mobility of highly skilled and scientific personnel is seen as important for the diffusion of knowledge and transfer of technologies. It is necessary to make the distinction between job-to-job mobility on the national territory and international mobility. Policy measures have been implemented lately to promote co-operation between industry and public R&D laboratories. National authorities also implement policies aimed at encouraging the mobility of their scientific personnel. In many cases, these policies aim at attracting foreign researchers or retain their own unless they take place in the context of a formal exchange program. Many questions are raised

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around the issue of “brain drain”. Several European countries have expressed concerns about the migration of their best scientists abroad, especially to the US. A recent report commissioned by the British government states that “some evidence for this is found, although, in fact, more scientists and engineers locate to the UK than leave the UK” [Gareth Roberts Report, 2002]. This suggests a pattern of “brain circulation” rather than of “brain drain”. The challenge is therefore to implement conditions aimed at attracting both national and foreign students and scientists through the development of “centres of excellence” for example.

Although these words are some ten years old, they may sound still very up to date. Even though much has been done, many of the issues identified by Oecd are still more than valid.

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SUMMARY

High skilled migration: still a brain drain problem?

The paper presents some insights and data on the scenario of mobility of the highly skilled. The main aspects discussed concern the brain drain and brain gain questions. Facing the demand for a better understanding of dimensions and drivers of the international mobility of S&T talent, the paper revises some data and figures on Oecd Countries. The main indicators concern some background figures and data on R&D and on mobility issues both quantitative and qualitative on the stock and on the in going and out going human resources for science and technology. The main question facing countries and institutions is finding the right balance to attract foreign researchers in the domestic labour market and to implement a positive circulation of talents.

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