

New orientation of human resources policies in Science and Technology (s&t): from brain drain to brain circulation and talent

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Abstract

This study focuses on analysing human resource mobility policies in Science and Technology (s&t). The analysis of mobility programmes provides information about the fast changes occurring within the Spanish s&t system, particularly with regard to the flow of human resources. Since the late 1990s, human resource policies have been aimed at reversing brain drain and strengthening the internationalisation of s&t activities. Policies have evolved greatly, now oriented toward actively stopping brain drain and encouraging brain circulation and, perhaps most importantly, recruiting talent. This article's methodology is based on analysing the scientific policies and opinions of the key players involved in those programmes. Empirical evidence indicates that despite these changes, human resource policies have appeared through random initiatives rather than careful plans enacted by governmental agencies. This practice increases the risk of brain drain, as talented young people must seek gainful employment elsewhere due the current economic crisis.

Key words: Mobility programmes; human resources in s&t policy; highly skilled personnel; international flows.

Resumen

Nuevas orientaciones en las políticas de recursos humanos de Ciencia y Tecnología (I+D): desde la fuga de cerebros a las políticas de circulación de cerebros y reclutamiento del talento

El estudio está centrado en el análisis de las políticas de recursos humanos en Ciencia y Tecnología (c&t) referidas a movilidad. El análisis de los programas de movilidad proporciona información sobre los rápidos cambios producidos en el sistema español de c&t, particularmente en los flujos de recursos humanos. Desde finales de 1990, las políticas de recursos humanos tratan de revertir la fuga de cerebros reforzando la internacionalización de las actividades de ciencia y tecnología. Las políticas han evolucionado de una manera importante, ralentizando la fuga de cerebros y estimulando la circulación de cerebros y, quizá más significativamente, reclutando talento. La metodología está basada en el análisis de las políticas científicas y en las opiniones de los actores claves de esos programas. Los resultados empíricos indican que, a pesar de los cambios producidos, las políticas de recursos humanos en ciencia y tecnología han surgido más como iniciativas esporádicas que como un diseño cuidadoso de las agencias gubernamentales. Esta práctica amenaza la pérdida de talento de los jóvenes que deben buscar empleos en la presente crisis económica.

Palabras clave: Programas de movilidad; políticas de recursos humanos en ciencia y tecnología; personal altamente calificado; flujos internacionales.

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SCIENCE AND TECHNOLOGY SYSTEMS AND THE FLOWS OF HIGHLY SKILLED PERSONNEL

People's journeys to every corner of the world have always been connected to spreading ideas and technological advances, and scientific activity has been historically linked to the creation and exchange of knowledge (Gibbons *et al.*, 1994). Thus, the mobility of highly skilled personnel is a sign of the universalism of science because of collaboration between scientists and the advance in science emerged from the struggle of competitive ideas (Laudel, 2005). Travel has been linked to the appearance of ideas, discoveries and new methods and it was a key factor in the appearance of scientific disciplines such as anthropology, geography and biology. Across history, the mobility of scholars, or simple travellers, has played an essential role in the production and dissemination of s&t knowledge.

However, education, science and other fields related to business and innovation are changing profoundly as a consequence of globalisation, the widespread use of information technologies and low-cost and faster travel (Nowotny *et al.*, 2001; De Meyer *et al.*, 2004; Castells 1996). Factual arguments on the universalism of science are gaining ground, which highlight increasing mobility rates as a consequence of social forces in our contemporary economy. The high number of students, scientists and other highly skilled personnel is transforming higher education, the s&t system and the global economy. According to Turpin *et al.* (2002), mobility has modified education and scientific institutions, reorienting their aims, organisation and policies. Regarding science, the internationalisation of scientific activity pinpoints a new dynamism referring to the learning process that emphasises 'transnational practices' (Connell and Wood, 2002; Connell, 2007). Furthermore, internationalisation of the labour market enhances the free movement of professionals, who develop 'borderless careers' (Williams, 2006) pursuing excellence and competitiveness. Favell (2008) claims it has generated a new social class involved in a permanent flow all over the world. International mobility has also been associated with the creative role of newcomers in cosmopolitan cities (Florida, 2005).

Studies on international mobility consider people's motivations for moving abroad. Some authors have stressed they were pushed by institutional constraints in professional careers (Ackers, 2008; Kley, 2010; González and Malpica, 2013), pulled by professional challenges, such as training and

language abilities (Mahroum, 2000, 2001; Peixoto, 2001). Other authors have pointed out that collective motivations related to standard of living and family wellbeing lead to the mobility of entire families of highly skilled people (Kofman, 1999, 2000; Urry, 2007; Raghuram, 2008; González and Vergés, 2013; Vergés and González, 2013). This description provides a classification (Iredale, 2001) of mobility strategies according to the main mobility objectives, mobility type (short-term and limited, or a long-term definitive strategy for living abroad), and profiles of movers (for example, whether they are single or married, whether or not they have children, and their professional orientation and occupation). The complexity of characterisation makes it difficult to design effective policies to bolster flows of highly skilled personnel.

Some other studies provide information about how policies focus on the international mobility of highly skilled personnel. These studies mainly refer to the evaluation of specific mobility programmes (Teicher and Maiworm, 1997; King and Ruiz-Gelices, 2003; Auriol 2004; Ackers, 2005; Luchilo, 2009), the analysis of migration policies outlined in certain regions (Kyvik *et al.*, 1999; Pellegrino and Vigorito, 2009; Flores, 2010) and ethnical and national groups (Khadria, 2004; Harvey 2009; Ho 2009). These studies underline the impact of higher mobility rates on the global dynamics of the economy and in science and higher education. A glance at mobility policies highlights, firstly, their goal of encouraging young people to travel abroad for learning and job purposes and, secondly, the increasing interest in attracting new talent to education, research and business institutions.

In accordance with its specific goals, every country has designed certain mobility policies (Mahroum, 2001; Lowell *et al.*, 2002; Daugeliene and Karcinkeviciene, 2009). Some countries have focused on training functions among younger people to strengthen their present professional careers while fostering future s&t competitiveness; other countries have centred on mobility programmes based on the transfer of ideas, exchange of skilled workers and collaborative work in strategic lines of research. Countries with high levels of brain drain have launched diaspora management programmes (Meyer, 2001). Such policies attempt to minimise the loss of talent abroad, creating a virtual network—plus physical support—between scientists and highly skilled personnel living in their home countries and abroad and local research centres and companies. In summary, international mobility policies attempt to take advantage of the new scenario of international flows.

I have organised the present work into four main sections. The first section briefly describes the aims and methodology employed while conducting this research. The second section is devoted to a description of the theoretical model proposed for addressing the empirical data on the Spanish case study. It explains how training and collaboration become two main functions of mobility programmes, and it reshapes scientific policies based on strengthening human resources, which is the driving force to the Spanish s&t system. The third section looks at the evolution of these policies based on empirical data. The fourth part takes into account the opinion of some key players who are interviewed with the aim of obtaining additional information on the specific design of mobility schemes. These opinions confirm the improvement of human resource policies in Spain, but also reveal problems regarding legal and social issues dealing with the mobility of highly skilled people.

AIMS AND METHODOLOGY

In this paper I have considered the extent to which the internationalisation of human resources has reinforced s&t activities in Spain; this case study displays an exemplary depiction of the evolution of brain drain to brain circulation schemes due to the internationalisation of s&t and global migration. Its description evolves into a reflection on the essential functions of mobility programmes in the context of the contemporary knowledge based economy. The strength of the global economy entails new demands regarding mobility from higher education, research centres and multinational companies.

Thus, this study involved an analysis of public and private s&t policies concerning human resources. The first approach provides an analysis of policy strategies and data from national s&t policies. The second source of information analyses the expert opinion of 14 key players from s&t. They were selected according to their expertise and contribution to the design of mobility programmes in recent decades. Seven women and six men were interviewed because they were managers and responsible for mobility programmes: four from national institutions (Ministry of Science and General Directorates), four managers from regional government programmes (ICREA, Ikerbasque, Erasmus and Argos programmes), three directors of non-profit institutions (Fulbright and Carolina schemes) and three managers of multinationals, small- and medium-sized enterprises with high levels of international business. We recorded and analysed the content of the interviews according to the main discourses of managers and executives.

THE LEARNING AND KNOWLEDGE TRANSFER FUNCTIONS OF INTERNATIONAL MOBILITY PROGRAMMES

International mobility is generally associated with positive effects for movers and institutions (Mahroum, 2001; King and Ruiz-Gelices, 2003; Florida, 2005; Saxenian, 2006; Favell, 2008; Kley and Mulder, 2010). These advantages are related with several dimensions of professional and personal lives. Although some students and scientists consider mobility as a training period for acquiring more specialised knowledge, studying abroad does not just concern excellence programmes; it is also about having new experiences and gaining new personal competences. When younger people talk about the positive effects of their experience abroad, most of them stress language achievement rather than specialised knowledge in their area, and the network of colleagues and friends rather than the learning of innovative techniques and research methods (González, 2011). In general, informal and tacit dimensions of knowledge come to the fore even more than other formal aspects of the training programmes. In fact, mobility strategies in the earlier phases of their professional lives play an important rite of passage and socialisation function for future advancement in their career trajectories (Murphy-Lejeune, 2001; Mahroum, 2000; Laudel and Gläser, 2008; Thorn, 2009). Thus, a learning function is present in the mobility experience regarding the early phases of the professional career.

Mobility is also associated with the accomplishment of transnational practices in s&t activities. An essential function of mobility programmes is related to the collaboration and exchange of ideas between human resources in s&t (Laudel, 2005). Taking the European Union (EU), the Marie Curie Programme is aimed at promoting researcher mobility in order to invigorate the European Research Area (Council of the European Union, 8799/10). The purpose of these programmes concerns the enhancement of the international dimension of research activity which is associated with excellence and global competitiveness (Daugeliene and Marcinkeviciene 2009). Furthermore, emphasis has recently been placed on the launching of programmes centred on the attraction of talent and the exchange of professionals between the public and private sector in order to strengthen innovation activities in the s&t system. An additional example of knowledge transfer is the development of transnational research projects and collaborative work in large international facilities, laboratories and research centres. Therefore, these types of mobility programmes are related to basic functions of science associated with knowledge interchange and transfer.

Although learning and knowledge transfer functions appear to be closely related, the explicit aims of mobility schemes are defined according to diverse objectives. Some programmes lead to going abroad with the purpose of continuing training or providing a first work experience, whereas other programmes are designed to launch new projects and lines of research, set up networks, exchange personnel from different institutions or disseminate ideas at conferences and international meetings. The main function of the first type of programme focuses on training, whilst the most salient function of the second type is knowledge transfer. According to this, training programmes are carried out during the early phases of professional careers, and knowledge transfer programmes are usually presented in later phases because they require a certain degree of expertise. Another aspect that distinguishes both types of programmes is related to the recipients, because training programmes are concerned with the learning process of young graduates, while transfer programmes provide mutual advantages to both sides of the exchange in the home and host institutions through the work of their professionals.

The Table 1 classifies the EU and Spanish mobility programmes according to definition provided above. Table 1 includes mobility schemes from diverse funding sources (the European Union, national and regional governments and non-profit institutions) which constitute the range of programmes in Spanish s&t. These programmes give support to inflows and outflows of both national and foreign professionals.

The programmes displayed in Table 1 comprise a wide range of functions and phases of research careers. They are associated with internationalising the learning process (e.g. the Erasmus and Argos programmes) and encouraging mobility in research centres and higher education institutions (post-doctoral grants and José Castillejo, among others), or returning personnel from abroad and attracting national or foreign talent (Ramón and Cajal, Icrea and Ikerbasque).

According to the number of schemes associated with learning and training versus the transfer and interchange of information and collaboration, it seems that the strengthening of s&t activity requires different types of resources oriented towards promoting the mobility of human resources. Historically, mobility programmes were focused on the learning process and the target population was young graduates who wanted to improve their competences abroad. But recently, other kinds of programmes have been launched, focusing on the attraction of talent, the return of nationals and the stimulation of knowledge exchanges and brain circulation. Trai-

ning programmes still play an important role in making young people more competitive; however, the transfer of personnel is increasingly more relevant in public research institutions as well as at private companies.

Table 1. Mobility schemes: a classification based on functions and phases of research careers

S&T functions	Phase of careers	Some examples
Learning and training	Students	Socrates Erasmus Argos Integrants
	International training in companies	
	Master and doctoral degree grants	Short-term visits Long-term courses for pre-doctoral students Fulbright actions Carolina actions for foreign students Several private and non-profit institutions
	Mobility of teaching and research staff	Post-doctoral grants Marie Curie actions Fulbright actions Humboldt actions José Castillejo and Blas Cabera grants
Transfer and collaboration		Sabbaticals Foreign visiting professors
	Attraction and return of foreign and national talent	Juan de la Cierva Ramón y Cajal Severo Ochoa Icrea Ikerbasque

Source: Own elaboration.

The promotion of mobility programmes in Spain is not the result of a single top-down governmental plan, but the result of actions by a wide range of institutions (from public to private initiatives). It also derives from the internationalisation of the scientific labour market, which impels people to move abroad for employment purposes. In addition to national and regional governments, universities and research centres, non-profit organisations, private agencies and enterprises make significant efforts to promote the internationalisation of human resources in s&t. Through mobility, organisations connect their staff beyond national borders and reinforce their presence in other countries (Connell and Wood, 2002; Turpin *et*

al., 2002; Florida, 2005; Williams, 2006). Thus, human resource policies match highly skilled people's motivations with the main aims of s&t institutions in order to take advantage of globalisation.

Although the increasing number and types of mobility programmes improve the support of highly skilled personnel to pursue their professional goals, some problems are still unresolved, due to the complexity of the phenomenon. Firstly, mobility programmes mainly focus on research careers in the academic sector, overlooking other mobility patterns of different profiles, albeit still highly skilled personnel, such as managers and business people. Secondly, the support of mobility policies usually concerns the researcher, despite the fact that they move with the whole family (González and Vergés, 2013). And, thirdly, mobility policies and migration regulations are very restricted and even comprise contradictory principles, and reverse the positive expectations of highly skilled professionals (Solimano, 2008).

The rate of international mobility varies according to the economic standards in the home and host countries, according to the legislative framework of migration policies. Every country has a set of initiatives oriented at promoting (or impeding) the entrance of highly skilled personnel (as well as the lower-skilled). European countries have recently adopted several policies and actions for promoting brain circulation, although legal and labour issues of non-OECD researchers and highly skilled personnel remain unresolved (Peixoto, 2001; Franchino, 2009; Fahey and Kenway, 2010). Migration policies are mainly affected by the supply side of the private labour market, whilst scientific policies operate differently under the direction of an s&t strategy. In addition, highly skilled personnel seem to be motivated by non-economic factors, such as personal motivations, love, and professional job opportunities (Favell, 2008; Benhabib and Resnik, 2009).

National and international legislation regulates flows of people, impeding or encouraging entrances, selecting nationalities and the areas of expertise of movers, their maximum stay period and the family members who are allowed to enter the country. However, the legal scenario has been altered by the actions of different key players promoting the mobility of talent: research centres, large companies and non-profit institutions. They transform, to a degree, the norms of entry and exit, and provide different labour conditions, resources for accommodation and family rights. Then, although migratory policies establish the legal conditions for entry and

residency, specific institutions provide other kinds of support to individual highly skilled people, thus facilitating mobility strategies.

Public policies differ from private policies dealing with the mobility of highly skilled people. Mobility is a promotion and project of internationalisation for companies, movers are professionals who are accomplishing specific goals defined by the corporation. Multinationals carefully outline the benefits and family conditions for their employees, especially when they are on long-term international assignments. However, there is also a difference when enterprises are not multinationals, but medium and small companies, because of the dearth of incentives for their staffs. These companies' international orientation is mostly incentivized by salary. These enterprises lack mobility schemes, protection for the movers' families and even the capability to overcome legal restrictions on migration issues.

EVOLUTION OF SPANISH S&T HUMAN RESOURCE POLICIES

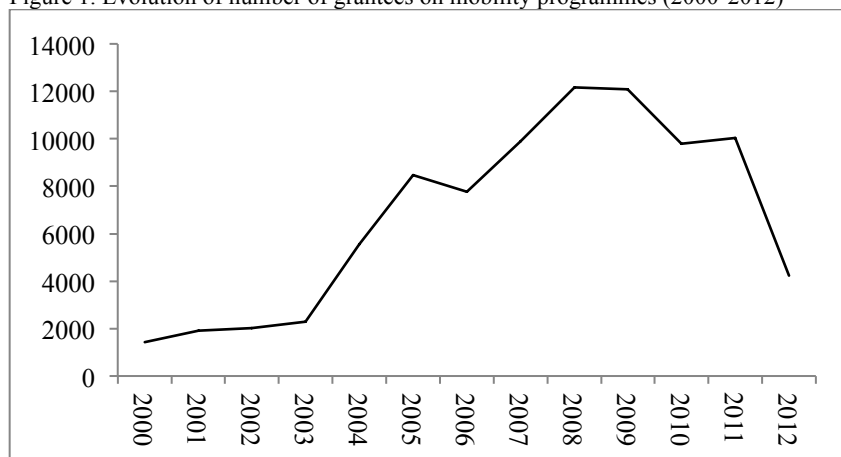
The development of the Spanish s&t system has evolved at a faster rate since the mid1980's, after the autarchy period of the Spanish dictatorship, integration into the EU economic framework, and the adoption of the new Act 13/1986, which transformed the higher education system into a modern scientific institution (Muñoz, 1999; Parrado-Díez, 1999; Sanz, 1997; Sebastián and Muñoz, 2006). One of the most important factors that triggered the modernisation of Spanish s&t was the rationalisation of human resource policies (López Facal *et al.*, 2006). A large number of scientists were in exile during the dictatorship, impeding the normal development of science. In the 1980s, international mobility programmes fostered scientific development through the training of postdoctoral researchers. Thus, to a certain degree, brain drain was the first step in the modernisation of science, because international students introduced new topics, methods and lines of research when they returned home. In addition, these scientists acted as a bridge with international nodes that connected young scientists to excellence laboratories and research institutions abroad, and created new links with the most innovative research institutions. Most of these initial mobility programmes were launched by non-profit organisations such as the Rockefeller and Fulbright foundations, and were inspired by cooperation and peace goals to foster international exchange.

The strengthening of human resources has been central for the implementation of Spanish s&t strategy. The aims of programmes launched in the late 20th century were focused on training functions in which young researchers learned in prestigious European and North American labs and

departments. Later, their competences offered a significant service to the s&t departments at which they held relevant assignments and an even greater service when they held management positions responsible for creating public policies on s&t (Parrado-Díez, 1999).

Recent s&t strategy in Spain has increased resources for mobility programmes, although this evolution has been very irregular across time. In line with this economic effort, the number of grants has also grown over time, as detailed in Figure 1. The graph reflects the irregular situation of human resource policies in Spain, the increasing number of recipients from 2003 to 2009, decreases because of the economic situation that particularly affect the national s&t strategy. The first jump around 2003 was due to more carefully planning public s&t policies and positive indicators for the Spanish economy. These factors opened the door to stakeholders' demands (for example, research institutions, regional governments and the most competitive research teams) to attract talent into their organisations. Even in the most favourable scenario (2003-2009), human resource policies were unstable: the nature, functions and stages of careers differ from one call to another. One serious problem was the pressure exerted by key agents, such as Spanish universities and large research institutions, which greatly influence the number of recipients and their geographical distribution according to scientific disciplines. The great variability in human resource policies in Spanish s&t makes accountability and the long-term evaluation of mobility schemes difficult.

Figure 1. Evolution of number of grantees on mobility programmes (2000-2012)



Source: Own elaboration from Spanish R&D and Innovation Reports.

In addition to quantitative trends, the variety of programme schemes reflects a transformation of the s&t context regarding the nature of grants that denotes a greater professionalization of scientific careers and the spreading of activities related to research and innovation. Moreover, grant schemes improve the salary and social benefits of grantees as a consequence of high demands due to young scientists' poor conditions and the precarious scientific labour market. The Spanish government set up a common legislative framework (Royal Decree 1326/2003 and Royal Decree 029/2006, commonly known as the Scholarship Statute) aimed at ensuring homogeneous labour conditions, improving salaries and social benefits (such as maternity leave); although the request for stability in scientific careers still remains unresolved.

Additionally, more types of programmes were created to satisfy stakeholder demands and the new goals of scientific policy. Transformation of higher education in Europe (European Higher Education Area) promotes institutional demands such as the Bologna process, which inspired teacher exchange programmes in order to coordinate new tertiary education programmes. As a consequence of the political effects of the brain drain on research, the Juan de la Cierva and Ramón y Cajal schemes (for junior and senior scientific careers, respectively) were launched to attract research talent from abroad. Other programmes involved several functions related to knowledge transfer among teachers at the tertiary educational level. In summary, new functions inspired mobility programmes that proportionally decreased the mobility programmes based on learning and training functions.

The autonomous communities have also played a relevant role in the promotion of international mobility. Initially, regional policies were weak and a mere replication of national s&t policies (Sanz 1997). However, s&t strategies gradually did start to be promoted that were related to areas of interest for this region, encouraging start-up companies to take up innovative activities, and creating new research centres focused on strategic sectors. These actions increase the flows of researchers and the number of international programmes. Nevertheless, historical disparities among regions are still reflected in regional s&t policies (López Facal *et al.*, 2006). Madrid, Catalonia and the Basque Country present the best rates regarding s&t and innovation activities.

In 2003, the Government of Catalonia created the ICREA programme for attracting excellent scientists from an international pool of candidates into strategic research departments and research centres. Its success is based on

the simplicity of the recruitment process and the minimisation of bureaucratic procedures of labour contracts, working visas and accommodation in the host country. A well-balanced combination of economic and social incentives makes this programme more attractive than others. Salary is one of the most important stimuli, as well as social support. For example, ICREA helps scientists and their families settle into their new environment. Therefore, this scheme entails an advantage for individual career advancement, as well as a positive contribution to the host research centres.

Later the Foundation for Science in the Basque Country launched Ikerbasque, a similar scheme aimed at attracting national and international researchers who were assigned to new research centres. Both programmes are examples of strategic human resource policies that have contributed positively to stimulating regional s&t indicators.

Universities, spurred on by competitiveness among higher education institutions, are also involved in the internalisation of their s&t activity through the mobility of students and professors. These programmes concern learning and knowledge transfer, providing support to training programmes for pre-doctoral and graduate students and facilitating the short-term mobility of academic staff. Despite fewer scholarships and the restricted population covered by these programmes, they are advantageous for the community of students, professors and administrative staff. The economic crisis interrupted the universities' actions regarding mobility, as well as other human resources' initiatives like hiring new personnel.

As mentioned above, non-profit institutions played a decisive role in promoting mobility programmes in Spain. The Rockefeller and Fulbright foundations were active agents that encouraged outflows of young Spanish scientists who then renewed older structures in the s&t system. Fulbright grants are still one of the most prestigious international mobility programmes between the US and Spain. In addition, other non-profit institutions have recently emerged from the Spanish scenario to promote brain circulation. Some (such as the Fundación Castilla del Pino, Ramón Areces and Juan March) are focused on specific research areas, while others form part of corporate social action programmes (for instance, La Caixa, Caja Madrid, and Cátedra Telefónica) or complement other cooperative activities in developing countries (for example, Fundación Carolina).

Outbound mobility programmes in Spain have the opposite situation of the s&t system. While in the late 20th century Spanish scientists were received by foreign organisations that promoted international interchanges, Spanish foundations are currently promoting cooperation with other

countries. The most representative of these programmes were launched by the Fundación Carolina, a mixed public and private non-profit institution that promotes cultural and cooperative relationships between Spain and Latin America. Broadly speaking, it seems like the levels of outflows and inflows promoted are equal, which suggests a huge strengthening of the s&t system. It demonstrates the success of mobility programmes' main aim in promoting brain circulation and a broad range of programmes focusing on learning, knowledge transfer, short-term visits, cultural activities and international cooperation.

Such a broad network of promoter institutions offering mobility programmes entails some drawbacks. Firstly, multiple actors lead to greater propensity for duplication and overlapping mobility programmes. There is a lack of coordination between institutions at national, regional and local agency levels that hinders efficient implementation of mobility programmes for diverse candidates. The schemes grew spontaneously as a consequence of different targets and initiatives of promoter institutions and the pressure of stakeholders. Similarly, the programmes disappear and requirements and timelines change. There is no strategic policy that informs the actions of a rational plan, coordinated by key agents on the lookout for a sustainable scheme. The social benefits of mobility programmes ignore recipients' real demands, and there is no monitoring or evaluation of mobility programmes. The aims of these programmes usually derive from particular interests, rather than a careful plan that contributes to a new dynamic in the s&t system that truly supports scientists.

A glance at the overall human resource programmes highlights a narrow vision of research careers according to the current challenges of science, particularly linked to internationalisation. Firstly, training programmes do not offer future expectations of a professional career because of shortages in the scientific labour market in both public and private sectors. The design of scientific careers is associated with interrupted phases of training, which discourages young people from pursuing scientific studies. Secondly, the recruitment of candidates is still highly dependent on a very traditional evaluation process based on a patronage system instead of talent and academic merits (Parrado-Díez, 1999). In such a way, candidates with interrupted careers, less orthodox progression and fewer connections with local networks are often excluded from the system, despite their competitiveness and creativity. On the contrary, candidates with regular and linear careers have more opportunities to be promoted by mentors or to receive the support of local networks in the host institution.

There are tensions in institutional discourse with regard to the mobility of highly skilled personnel arising from antagonistic approaches based on an elitist or mass model. According to some scholars, university graduates and doctors are dropping out of the system because they cannot ever become fully integrated at Spanish research institutions. On the other hand, other scholars maintain that all these doctors should be kept on in research activities, in order to strengthen the s&t system (De Miguel, 2004). The fact is that the traditional 'brain drain' discourse underlines the failings of higher education with respect to the specialised labour market, and the waste of public economic resources because of the waste of talent (Solimano, 2008).

THE OPINION OF KEY PLAYERS ON MOBILITY PROGRAMMES

The extensive experience of managers and executives in human resource policies illustrates the evolution of the s&t system and casts some light on decisions supporting the specific implementation of these mobility programmes. Common topics were discussed in the fourteen personal interviews, focusing on the aims, functions and implementation of the mobility programmes and the interviewees' opinions on the influence of internationalisation in the s&t system.

According to key players' perspective, human resource flows are associated with the internationalisation of the labour market. Mobility is necessary to achieve individual goals (personal and professional) and collective ones (dynamism in business and research excellence, among others). It is considered a global tendency caused by the easier movement of people and ideas (Castells, 1996; Urry, 2007), and surpassing the restrictions of national legislation (Fahey and Kenway, 2010). If in the past only the elite used to travel abroad for training purposes—according to a male manager from the Ministry of Education—, now training courses, research stays and business meetings are accessible to the majority of people. The key players' opinions stress the natural tendency of movement and its positive consequences. In fact, they reject the idea that mobility causes a brain drain of national talent, confining it as a risk of developing countries and the programmes oriented to fostering inflows of highly skilled personnel into Spain. The increase in international mobility is considered a positive sign of high level and quality s&t in Spain in recent years.

Similarly to other countries, flows of Spanish highly skilled personnel are motivated by the globalisation of science that moves people freely around the world to share experiences and acquire competences. Accor-

ding to most of the stakeholders, Spanish scientists travel for learning and training to excellent institutions, from where they return bringing extensive experience and professional networks. This discourse was claimed previously to the economic crisis in Spain, which explains the key players' optimistic outlook. They would probably nuance their explanations in the current situation that provokes a serious brain drain of highly skilled personnel.

Some of them suggested that a slight brain drain from national candidates is sustainable if, in parallel, foreign talent continues to arrive. According to a second male manager at a public institution, the brain drain is a result of the pulling effect of the foremost laboratories and research centres in Europe and the United States, but likewise Spanish universities and research institutions pull in other foreign students and scientists. Thus, they have an ambivalent opinion towards the brain drain and brain circulation equation, depending on strategic lines of development, personal opinions about scientific careers and s&t strategy.

However, from the company managers' point of view, the attractiveness of the Spanish s&t system depends on the regulatory framework and the public image of their institutions. Companies need competitive candidates and have grown with the participation of foreign employees, but they do not invest in them if legal rules make it difficult to hire them (female and male managers at small and medium sized enterprises). In this case, international mobility is an additional criterion for supporting the selection of the best candidates, but it is not the only reason and could even impede recruitment (according to a male manager from a midsized enterprise).

The negative effects of the brain drain are accentuated by managers of non-profit institutions who look at the impact of mobility in developing countries. This is an important topic for institutions whose main mission is international cooperation, particularly in the case of Fundación Carolina. As a part of this mission, mobility programmes are provided to support the training of local human resources, although institutions are concerned about the side effects. The promotion of flows could be negative if temporary mobility finally becomes definitive, according to a male manager at the Fundación Carolina, since the home country might lose the necessary driving force for economic development. This could cause individual and collective interests to clash: on the one hand, countries need the highly skilled to return; but, on the other hand, these personnel have more opportunities for developing careers in fruitful scientific environments abroad than in poor environments in home countries. If the aim is to develop coo-

peration it would be better to launch programmes with a global approach where a training period abroad would be extended to the home country by implementing similar projects with the necessary equipment and economic resources.

Key players have a positive opinion about the development of mobility programmes in Spain. Firstly, the diversity of programmes covers different steps of professional careers, sectors of performance (universities, research institutions, and companies), main goals of scientific policy and more basic objectives for human resource policies (inspired by the attraction, retention or return of scientists). Secondly, the increasing internationalisation of students, scientists and other highly skilled personnel creates more competitive careers, contributing to the improvement of scientific outcomes and the modernisation of the s&t system. According to female manager in the Fulbright scheme, if the first programmes were designed to support the international training of younger graduates during their PhD stages, at present there are more resources aimed at exchange and knowledge transfer, for instance, short-term visits to share ideas about new research projects.

However, a female manager at the General Directorate of Ministry of Science explained that current programmes have been very useful for enforcing the s&t system and for fostering human resources careers in the past; but new challenges of the knowledge-based economy require other kinds of schemes to lead competitiveness of the s&t system. In this sense, recruitment of talent programmes are the next generation of schemes for nurturing excellence in S&T institutions.

Key players express negative opinions regarding the application process, such as the deadlines for different application procedures, frequently leading to delays that cause a number of problems, to candidates who have to spend a long time waiting for submission, then suffer administrative overload and slow processing to resolve evaluations. This is also a problem for promoter institutions because it causes bottlenecks in daily work. Again, the woman from the Directorate General thinks it makes the management of different calls complex and quite inefficient for both the candidates and the organisations.

An important opportunity to improve mobility programmes is to make lengthy documentation requirements more flexible. This procedure is very hard for both applicants and institutions. This is the opinion of the manager of the ICREA scheme who thinks that the program's success consists of how well researchers are supported and taken care of. On the contrary, the heavy-handed control of hierarchical and bureaucratic institutions —such

as public and national administrations— would obstruct the reinforcement of the s&t system.

Although one of the most important tasks of European mobility programmes is to strengthen citizenship, a male manager from the Ministry of Science claims that there is a wide range of uncovered common issues for European citizens and frequent movers. These aspects concern scientists and their families (i.e. health security, marriage rights, driving licenses, and taxes and pensions). In a mobile society, more inter-country common rules and transfer policies will have to be implemented to improve labour conditions, retirement rights, health and educational rights. These criteria will make the free movement of highly skilled personnel around the world easier. Another consideration refers to EU migration policies, which select populations and certain professionals depending on politics and national s&t strategies (Peixoto, 2001, Benhabib and Resnik, 2009).

Managers from regional and non-profit institutions also highlight recent appearance of networks of former holders of mobility programme grants. In some cases, there was a bottom-up initiative of the community itself in order to maintain contact during their stay abroad and in the future. Information and communication technologies make it easier to create virtual groups, mailing lists and social networks. Consequently, promoter institutions took charge of the matter in order to enlarge their community through continued contact with their grant holders.

In summing up, when key players were interviewed they thought that if the extraordinary growth of mobility support were qualified as positive, the multiplicity of initiatives would cause widespread disruption. At a glance, there were a great number of grants for pre-doctoral and post-doctoral mobility, but none were aimed at promoting other highly skilled personnel. In addition, these grants were insufficient to reinforce the s&t system owing to shortages in the scientific labour market, which was only supported by public institutions, due to the lower dynamism of the Spanish private sector in s&t. These drawbacks have been decisive in this period characterised by cuts in s&t financing resources, which greatly influence investment in human resource policies; in addition, the unemployment situation and lack of expectations for highly skilled people have pushed them into a precarious situation.

FINAL REMARKS

Globalisation has increased the flows of highly skilled personnel by facilitating an increase in mobility programmes and migration frameworks. The

response of key players has been irregular, demonstrated by unplanned and erratic s&t public policies. The wide variety of mobility strategies responds to heeding the new functions and demands on the international arena. In this way, mobility programmes referring to knowledge transfer have been added to the more traditional learning mobility programmes for young scientists. It implies a new direction of s&t strategy that is reflected in human resource policies. Although there are two broad types of programmes (according to the learning and transfer functions), positive trends of the s&t system have developed in recent years' transfer and collaboration programmes recruiting new candidates from abroad.

Thus, brain circulation is the prevalent scheme in mobility policies for programmes related to learning and knowledge transfer. However, the internationalisation of the specialised labour market blurs the limits of both permanent and short-term flows of highly skilled personnel, as well as the brain drain and brain circulation equation. The search for talent puts forward the model of brain circulation because institutions are more interested in attracting an excellent workforce in order to improve their outputs. This is one of the reasons why there are more programmes based on knowledge transfer than in the past, and the s&t system is strengthened through the entrance of newcomers and the exchange of ideas. In addition, people's personal initiative has increased the internationalisation of s&t impelled by professional challenges or the pressure of the precarious labour market in Spanish research institutions.

The analysis of mobility policies in public and private institutions displays a great variety of actions derived from the multiplicity of key players. However, the diversity of programmes inspired by different aims makes it difficult for the system to operate efficiently. The diversity of opinion among the key players reflects multiple directions of s&t strategy that the Spanish government has adopted in recent decades and which has been severely affected by the economic situation. The design of policies depends on key players' goals, who act under no coordination, overlapping and creating duplicity in some areas while others remain uncovered. A serious unresolved and multifaceted problem is unemployment rates and the instability and poor conditions of the Spanish scientific labour market. Additionally, most mobility programmes have grown according to institutional aims that rarely pay attention to lifestyles and necessities of highly skilled people and their families (Vergés and González, 2013). Human resource policies seem derived from erratic instead of the planned strategy of pursuing an efficient s&t system. Mobility schemes should be planned

according to realistic targets and focused on long-term goals in s&t as well as the necessities of highly skilled personnel.

As a consequence of the internationalisation of s&t, Spain is also recruiting foreign talent. The increasing flows of highly skilled personnel around the world are happening in parallel to the increment of attractive international programmes and job positions. Therefore, the present moment could be described as brain circulation. In fact, scientists more frequently collaborate and transfer their knowledge with a wide international community, contributing to increase the number of reasons why the scientists develop short —and long— term visits.

In summary, some changes have been positive for scientists (for example, improvement of labour conditions and number of grants) and the s&t system (growth rates of scientific productivity), but the design of mobility programmes is not driven by a strategic plan defined by clear goals. Considering the success of Nobel scientist Ramón y Cajal, a key player (male from national public administration) said that if Spanish science was not so good in the past, some people were the best. However, it is time to make decisions that involve encouraging excellent professionals in the most comfortable scenario of research for them and wellbeing for their families. Broadly speaking, new challenges are waiting for the development of a knowledge-based economy.

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