Unidad de Políticas Comparadas (CSIC)
Working Paper 03-15

# Coping with researchers' labour market problems through public policy:
## The Spanish Ramón y Cajal Programme

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October 2003

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**Abstract**

This paper presents a government policy initiative aimed to increase the number of researchers in the Public Research Sector and to cope with the problem of employability and stabilisation of people holding a PhD and working in research in Spain and abroad. The paper explains the way in which policy makers link problems and solutions and presents a policy case that deals with Spain's main problems in S&T human resources, in the context of a policy sequence.

## 1. Introduction

Since the mid-Fifties, governments have systematically promoted the development of science and technology. Although one of the chief goals of the classic statement of modern science policy (Bush, 1945) was improving the production of human resources in S&T, the type of policies promoted by governments have focused more on general funding of research than on human resources.

S&T human resources policies, especially those developed by governments, are an unknown realm of science analysis; the reason probably has to do with the wide variety of developments and strategies in S&T human resources at national level that make it difficult to build up knowledge about the different models.

This paper presents a government policy initiative aimed to increase the number of researchers in the Public Research Sector and to cope with the problem of employability and stabilisation of people holding a PhD and working in research in Spain and abroad. The paper explains the way in which policymakers link problems and solutions (Kingdon, 1984/1995) and presents a policy case that deals with today's main problems in S&T human resources in Spain. It also shows the connection with previous policies in the field in the context of a policy sequence.

[1] This paper has been presented at the OECD-CNR Workshop on Fostering the Development of Human Resources for Science and Technology, Rome (Italy), 5-6 June 2003. I thank the participants for the comments, Laura Cruz for her suggestions and the Ministry of Science and Technology for the data and funding (sec-2001-2411-c02-01). Usual disclaimers apply.

In section 2 a general diagnosis and characterisation of the problems and challenges in S&T human resources in Spain is presented. In section 3, the general objectives and context for the Spanish Human Resources R&D Policy, as defined in general S&T policy documents, is presented. In section 4 the objectives of the *Ramón y Cajal Programme,* a relevant case of S&T Human Resources policy, and its main principles are described. The Programme was targeted to improve the "academic career prospects" and employment opportunities of PhDs in the public research sector, despite the fact that the media attracted attention to the issue of bringing Spanish researchers back from abroad. Section 5 describes the Programme's design and operating mechanisms, while section 6 highlights the provisional results of the first two calls for hiring in the Public Research Sector the first 1,300 PhDs, from all scientific and technological fields, from the 2,000 expected for the period 2000-2003.

## 2. The situation in S&T human resources as a general frame

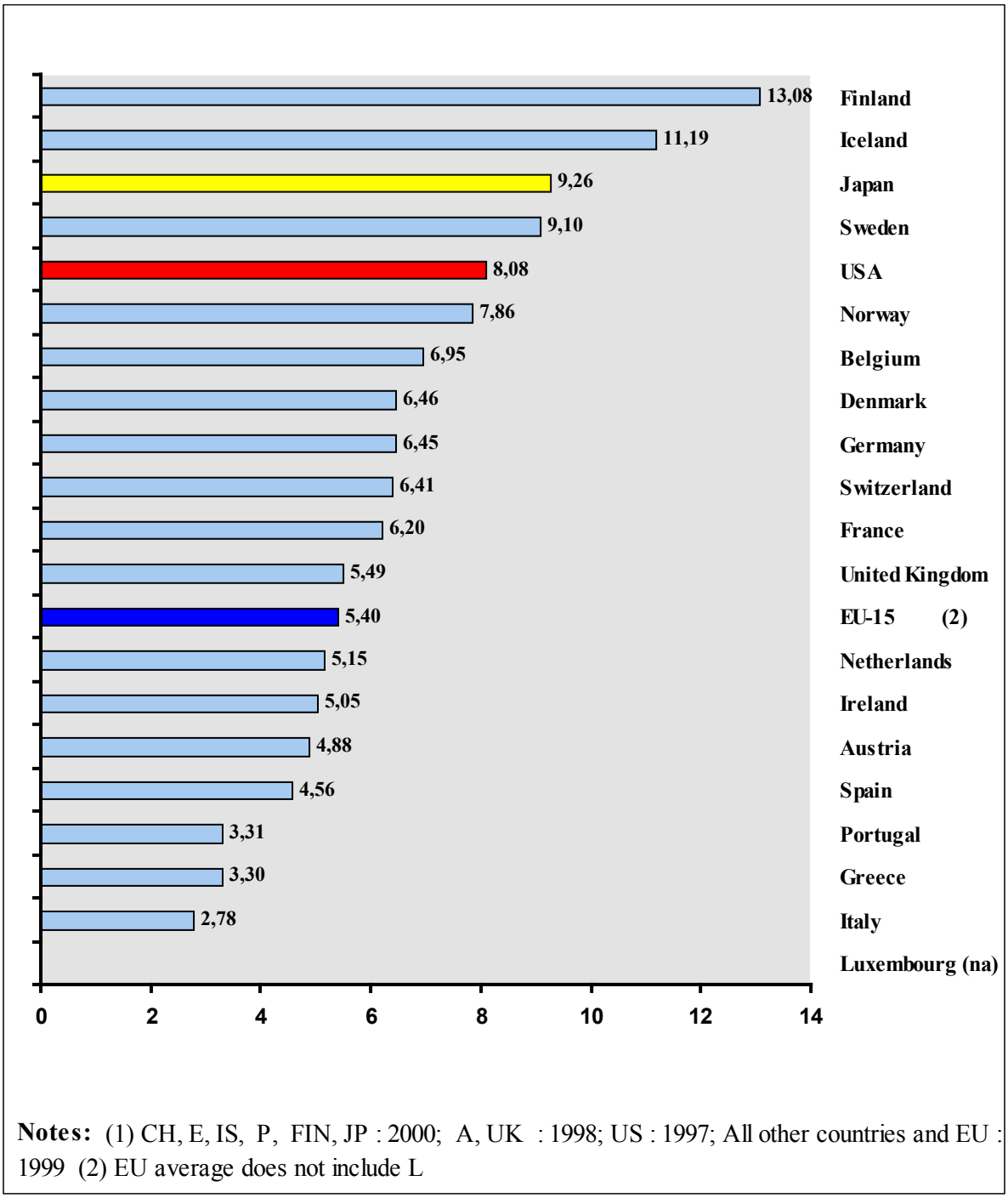
At the end of the Nineties, it was generally agreed that the main problem of the Spanish S&T system was the low level of R&D investment**.** While European Governments complained about the gap between EU and the US, the gap between Spain and the EU average was also significant. While the Spanish GDP per capita is 85% of the EU average, in 2001 Spain had 0.96% of the GDP allocated in R&D, while the EU average was 1.98%[2]; in other words, 48.5% of the EU average. Additionally, there was an insufficient GERD executed (52.4% in Spain vs. 64.5% in the EU average) and financed (47.2% in Spain vs. 56.2% in the EU average) by the Spanish industry and very small BERD in relation to industrial output.

While the issue of the R&D expenditure was the main problem identified in policy documents and public debate, concerns also emerged regarding human resources in S&T and some problems were identified: Firstly, insufficient human resources in R&D (80% of the average EU ratio of researchers per working population), especially researchers in firms (researchers in business sector represented 23.6% of the overall researchers in Spain vs. 49.8% in the EU average). Second, in a context of growth in the number of people obtaining PhD degrees, an emerging mismatch between the supply of PhDs and the demand of PhDs, especially as regards the discipline and S&T specialisation. Third, a perception of the precarious state of the research sector emerged, because some of the statistical increase in the numbers of researchers had been based on temporary positions with low salaries (the fellowship had become the regular labour relationship in S&T, even for experienced PhDs). The labour market situation presented serious problems regarding "academic careers" opportunities and long-term employment prospects even for PhDs with high quality scientific records.

While the total number of researchers in Spain represents approximately 8% of the EU total, the country has fewer researchers per 1,000 labour force than the EU average (see figure 1), despite showing a significant increase in the last years.

[2] Data from Eurostat and OECD, last year available

**Figure 1. Total Researchers (FTE) per thousand labour force by country (1)**



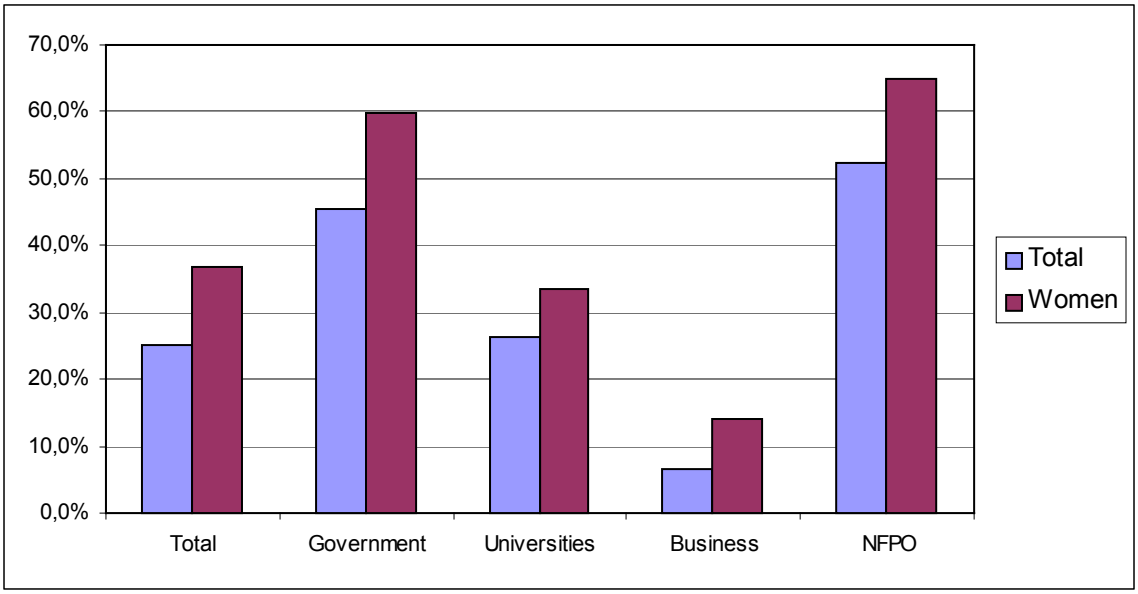

**Notes:** (1) CH, E, IS, P, FIN, JP : 2000; A, UK : 1998; US : 1997; All other countries and EU : 1999 (2) EU average does not include L

Source: EC-European Commission (2002) *Science Technology and Innovation. Key Figures 2002S&T Key Figures* 2002

However, the improvement in the situation on S&T human resources in Spain witnessed in the last years could be the result of a small change in the methodology of Spanish

S&T statistics[3]. In 2001, grant holders (*becarios*) represented approximately 25% of the total number of researchers (see figure 2).

**Figure 2. Grant holders (*becarios*) as % of the total number of researchers by sector. 2001**

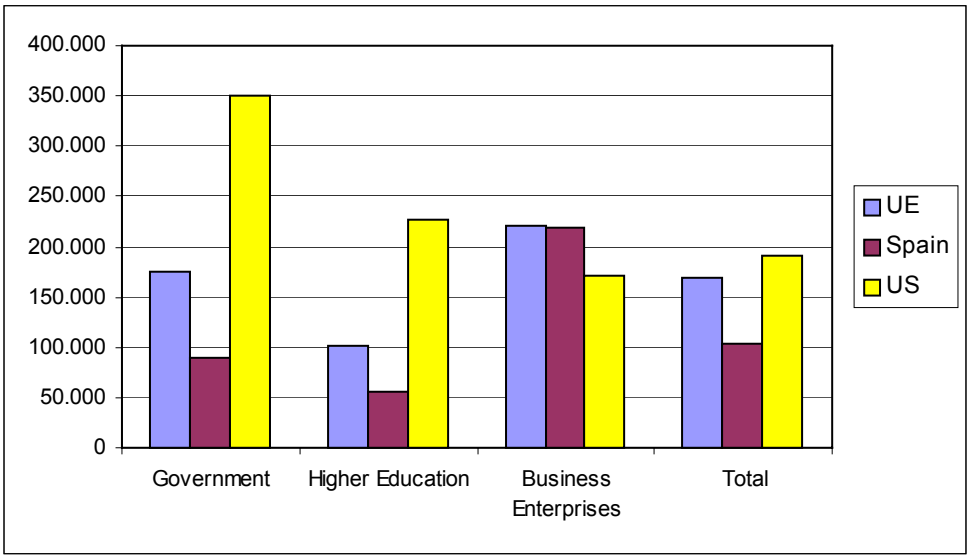



Source: Spanish Statistics. INE *Estadistica de Actividades de I+D, 2001*

The Spanish labour market for research is not only characterised by a very high proportion of temporary researchers and trainees, but also by the fact that the average expenditure "per capita researcher", in power parity purchase (ppp), in the public research sector (government labs and universities) is significantly lower in Spain than in other EU countries (see figure 3). Considering that the "labour cost" usually accounts for 60% of total expenditure, one could assume that there is also an problem associated with low wages in the Spanish research system, mainly in University and Government sectors, in comparison with other countries.

[3] Since year 2,000 the R&D questionnaires for elaboration of the Spanish statistics of R&D include as researchers (following the Frascati Manual (OECD, 2002) recommendations) the "doctoral and post doctoral personnel" with fellowships (and not contracts), known in Spanish as "becarios". That means many young persons still under R&D training activities, preparing the PhDs at universities and PRCs, have been started to be counted as researchers.

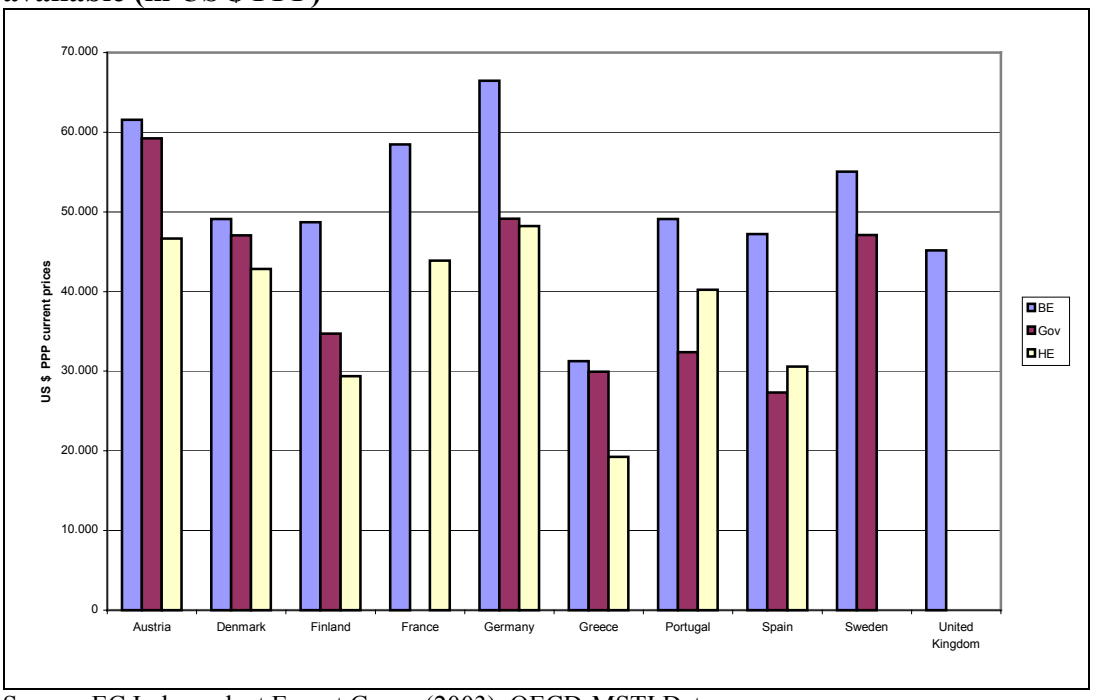
**Figure 3. Expenditure in R&D per researcher (FTE) by sector. 1999 or last year available**




Source: OECD, *Main Science and Technology Indicators*, November 2001; Data EU & Spain 1999; USA: 1997

From the OECD statistics on R&D activities, we could also build some comparative data on the "labour cost" as a component of the GERD. If we divide "labour cost" by the number of R&D personnel, we get an idea of wage levels in the different countries. For example, Spanish universities have approximately 30,000 $ ppp per year of labour cost per capita R&D personnel, while the German universities are about 50,000 $ ppp a year (see figure 4).

**Figure 4. Labour cost at GERD per capita R&D personnel, 1999 or last year available (in US $ PPP)**

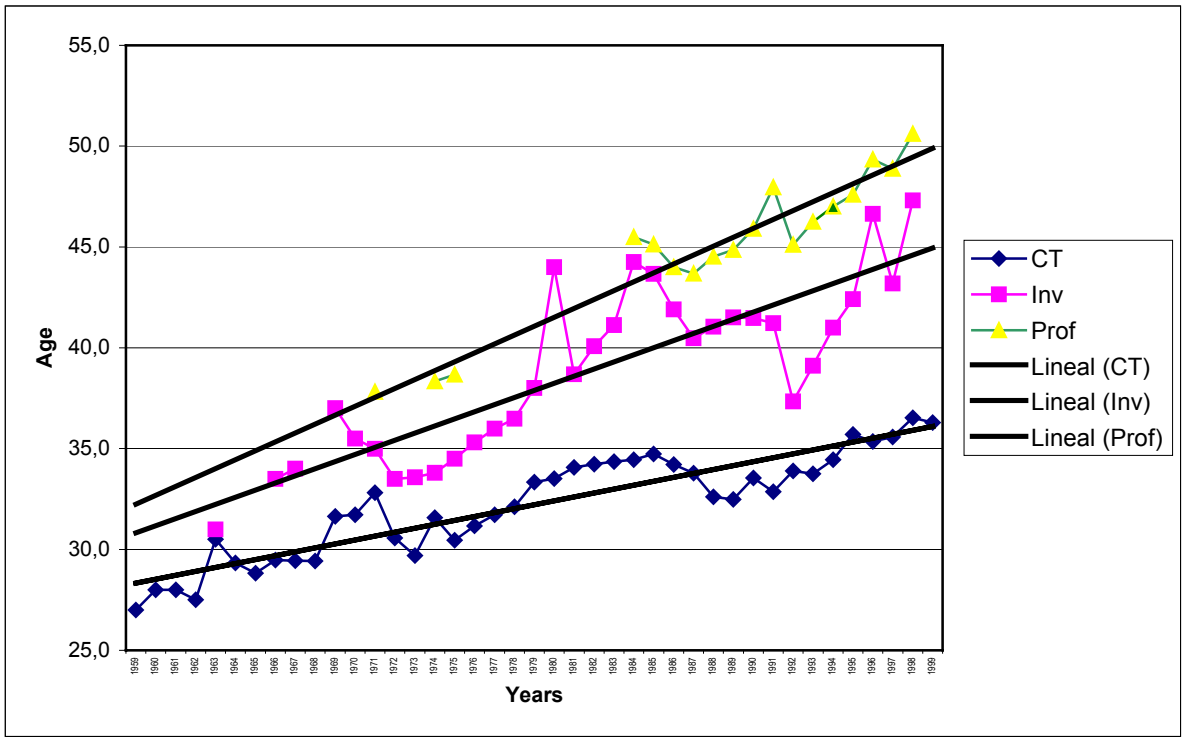



Source: EC Independent Expert Group (2003). OECD-MSTI Data

The wage gap between Spain and the EU average, especially in research, has become more evident after the publication of various reports on the issue (Pedró y Salas, 2002). By way of example, a permanent professor in Spain, in ppp, gets 70% of the average of the EU.

Insofar as academic career prospects are concerned, the situation has worsened significantly in recent years. Obtaining a tenure or permanent research position in a PRC is much more difficult today than it used to be, one side effect being a delay in the age that researchers obtain their tenure. For example, in the case of the CSIC, the most important public research institution in the country, in 1960, the average tenure age (Research Scientist -CT) was 28 years, while today it is 36. Another very significant problem has been the increasing delay in the age of getting professional promotion after good performance for people who already have a tenure. For example, when looking at promotion from CT or Senior Researcher (Inv) to the highest professional ranks (Prof-Research Professor) at the CSIC, one observes that the average promotion age has risen from 33 to 50 years. (see figure 5).

**Figure 5.- Evolution of tenure (CT) and promotion ages at CSIC**



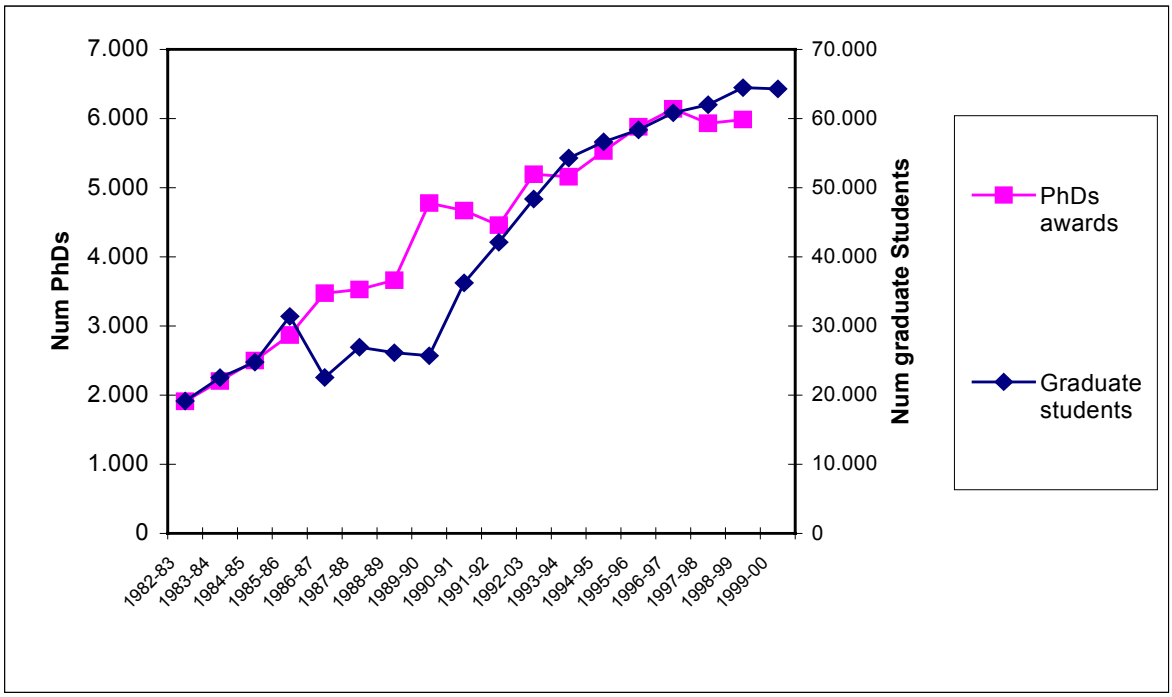

Source: CSIC Personnel databases

A significant explanation of today's problems of researcher employability in the Public Sector is associated with the relative low increase of new permanent positions over the last 10 years, but more with the very significant growth in the production of new PhDs (the supply side).

Due to the growth in investment in higher education in the Eighties and the "research training programmes", in a context of low employment opportunities, the Eighties and early Nineties witnessed a significant increase in the students enrolled in graduate programmes in Spain and in the supply of PhDs. In 2000, Spain had more than 60,000

students enrolled in PhD programmes and around 6,000 persons getting their PhD degrees every year. If one considers that Spanish universities produced in 1982/83 less than 2,000 PhDs the increase has been very significant (see figure 6).

**Figure 6.- Evolution of the Graduate students and PhDs. Spain**

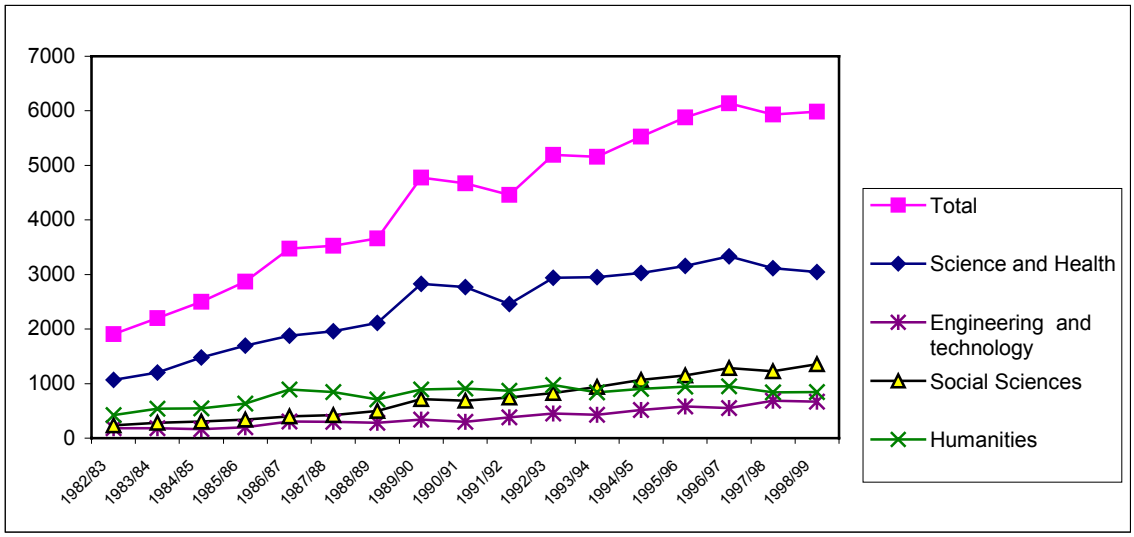



Source: Spanish Statistics. INE. *Estadisticas de Enseñanza Superior*. Various years

The explanation is related with multiple factors, such as the bigger size of generations, the high level of unemployment and limited labour market opportunities for young graduates, and the significant amount of government grants for funding 4 years of doctoral preparation. In fact some of the current problems of the "employability" (or limited demand of PhDs in some areas) relate with "successful" research training policies in the mid and late Eighties. Over the last 20 years, more than 20,000 individuals have had a grant related to their PhD studies. In the same period, almost 80,000 new PhDs have been awarded: 7,000 from Engineering and Technology and more than 45,000 in Science and Medicine. The central government ratio of PhDs coverage with grants could be around 20-25%; i.e., 1 out of every 4.5 new PhDs were awarded a government grant to conduct their activities; this created a good situation for taking the research career, especially in times of bad general prospects of finding employment rapidly after graduation in the Eighties and early Nineties. Possible mismatches by areas also relate with the unequal distribution of the training grants by areas over the years.

One should also observe that the distribution between disciplines and S&T areas has evolved too. Today, of the 6,000 new PhDs per year, more than 3,000 are in "experimental sciences and medicine" and 700 in engineering (see figure 7).

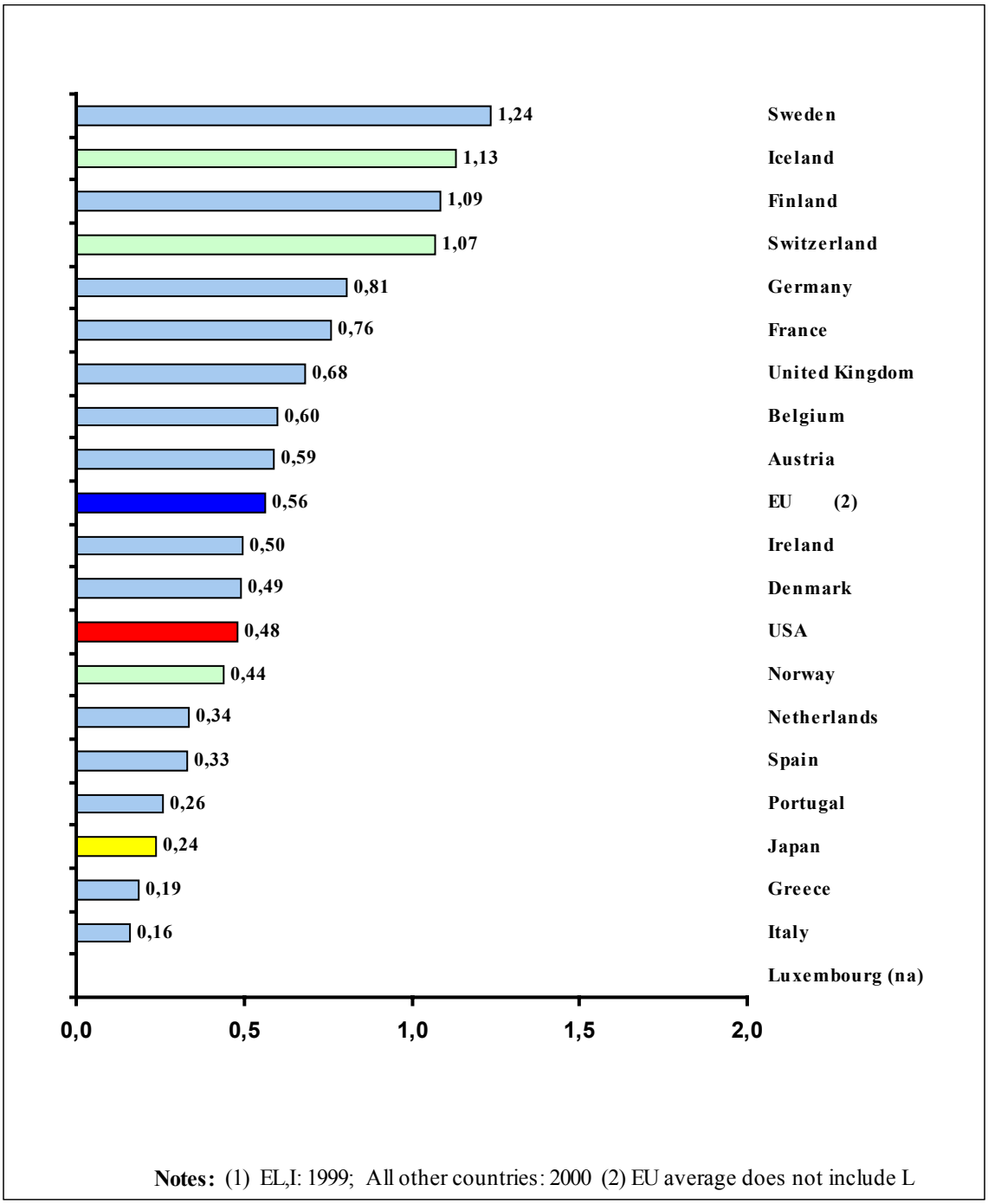
**Figure 7- Distribution of PhDs by disciplines**




Source: Spanish Statistics. INE. Estadisticas de Enseñanza Superior. Various years

While the evolution of annual PhD production has evolved positively in absolute terms, the situation is not so positive if one only considers S&T PhDs, especially when one compares the percentage of the people from some population cohorts who obtain a Ph degree (see figure 8). Spain is still significantly below the EU average of annual production of new PhDs in S&T per thousand population aged 25-34.

**Figure 8: New Science and Technology PhDs per 000 population aged 25 to 34 years, latest available year (1)**




Source: EC-European Commission (2002) *Science Technology and Innovation. Key Figures 2002S&T Key Figures* 2002

The balance of the problems that Spain faces in the field of S&T human resources could be summarised as follows: fewer researchers than required by international standards, a significant level of researchers working and employed in poor conditions, with a significant proportion of low level salaries either for permanent or temporary researchers, with deteriorating career prospects in terms of age of entrance and promotion, and also with significant imbalances between the growing supply of PhDs and the real demand, and even with apparent mismatches in the supply is some S&T areas.

If one considers the 3 different types of problems related to S&T human resources (OECD, 2003), a) low level of production of high qualified scientist (scarce supply), b) strong mismatches between supply and demand because bias by S&T areas, or c) low demand of PhDs or low employment opportunities, in public and private sectors, the Spanish situation has some elements of all three, but fits much better in the last one.

In 2000, the key problem in S&T human resources was the mismatch between the supply of PhD and the stagnation of the research employment opportunities and academic career prospects (in Public Sector) with a slow growth of demand of researchers in the private sector[4]. The main feature of the Spanish situation is not one of general lack of production of PhDs, but one characterised by low opportunities of academic career and employment prospects in Spain, for those that already started to invest in education throughout the doctoral cycle in the late Eighties and early Nineties. Now I will present the human resource policies to cope with the problems in the context of a policy sequence.

## 3. The role of Human Resources in S&T policies

S&T human resources policy has evolved significantly in the last decades. It started as research training, in the Sixties, as in many other countries, as a "decentralised policy" under the direct responsibility of the Public Research Centres. PRC were able to provide grants and fellowship to cover the expenses of the trainees either in a centre in Spain or abroad.

In the Seventies, in the context of a financial collapse in the research system (Sanz Menéndez, 1997) training new scientists and researchers through doctoral programmes became a political objective and then emerged as a "government policy" (Fernández Esquinas, 2002). A very big and centralised programme (*Formación de Personal Investigador*) became consolidated as a mechanism for giving grants to thousand of individuals, to pay them a salary or a compensation, while they were preparing their PhDs.

The Ramon y Cajal programme that we are going to analyse is part of a policy sequence (Weir, 1992) that began in early Eighties associated to what was called "research training policy" or, more precisely, the *formación de personal investigador* (FPI-training of research personnel) programme. These grants for training research personnel were a monthly government subsidy given to young people engaged in dissertation activities. Worth mentioning is a policy tool precursor (*contratos de reincorporación*) that enabled young researchers who were working abroad to return to or be employed in Spain.

Over the years, the focus of policy has shifted. The specific policy tools and instruments have changed; new instruments or a change of emphasis have appeared, building up and making the existing portfolio more complex. Government policy has shifted from a

[4] As mentioned earlier, it is usual that a very successful policy in year n, such as the "research training" policy, could -even if they have created new capabilities- contribute to create new "policy problems" related with that policy in year n+5 or n+10.

simple training or mobility policy to a policy focused also on employability issues. Over the long run, there has been a swing from simple (individually based) strategies of training researchers (with more or less focus on some priority areas) to much more oriented actions on the issue of researcher employability (either in private companies or in the public research sector) as a way of creating capabilities (see table 1).

**Table 1.- Some stages of the S&T human resources policy, based in the addition of new instruments to the focus**

| |
|---|
| **60s and 70s**. Training strategies abroad defined by the PRCs |
| **80s.** Governmental research training programme (FPI) in Spain and abroad |
| **Late 80s**. Mobility schemes between public and private sector |
| **Early 90s**. Reincorporating (from abroad) of researchers |
| **Mid 90s.** PhDs employability scheme in firms (Acción IDE) |
| **2000s**. Employability of PhDs in the public sector (Ramon y Cajal) |

In Spain, as in many southern countries, training in research activities has followed a "centralised model" in which the government acts as "guarantor", while in many other countries, with much "wealthier" institutions, the PRCs develop and implement the research training policy in a "decentralised way". Also worth mentioning is the fact that, in the Nineties, regional governments were very active in supporting S&T human resources as a way of creating a high qualified labour force in their regions.

Due to the evolution of S&T human resources actions, the actual policy mix that the central Government, through the Ministry of Science and Technology, is managing includes a combination of different tools and instruments, including their main features, such as:

- Training young researchers (FPI): 4 year-fellowships for preparing dissertations. Personal subsidies of approx. €1,000/month. Stock of people with the grant: 3,000.
- Researcher mobility fellowships (to allow Spaniards to travel abroad, foreigners to come to Spain, for researchers in large scientific facilities, for temporary exchanges between PRCs and firms, etc.). Personal subsidies of between 1,200-2,800 €/month depending on the specific situation.
- Spanish PhDs returning from abroad. Subsidies for contracting researchers doing training or working abroad. The scheme has finished and been integrated into the Ramon y Cajal Programme.
- Employment of PhDs and technologists in firms (Acción IDE and Torres Quevedo Programme). Subsidies for companies hiring PhDs and Engineers up to 28,550 euros/year. Stock of people under the programme: 600
- Employment of PhDs in Public Research Institutions (Ramón y Cajal Programme). Subsidies for PRCs hiring PhDs up to 43,750 euros/year, for 5 years. Stock of people under the programme: 2,000.

Yet while the first four lines of action started earlier, the Ramon y Cajal Programme was in fact a new type of instrument, whose objectives were ambiguously set out in the National R&D and Innovation (R&D&I) Plan (2000-2003). The new Plan had defined very ambitious objectives, such as spending 1.29% of GDP on R&D, but no new significant budgetary amount was added to the traditional RTD budget, and most of the new ideas never got off the drawing board.

After a huge participatory process with research actors and users, the National R&D&I Plan was approved, with a new policy instrument known as 5 year contracts (+5) of PhDs in Public Research Institutions. 2,000 contracts were forecast. That was the limited policy constraint within which the Ramon y Cajal Programme started to be designed.

## 4. Context and design of the Ramon y Cajal Programme

In April 2000, after the elections, the reshaping of S&T policy domain in government and the creation of the Ministry of Science and Technology transformed the environment in which the National R&D&I Plan was expected to operate.

In 2000 no specific new measure was launched, and the "new instrument" was only put on the agenda at the end of the year, due to pressure from university representatives. The mass media have also played a role because the issue of Spanish eminent researchers working abroad emerged as a problem. Thus the issue of "bringing Spanish researchers back home" emerged also as a relevant objective in the policy discourse. Those two elements could explain why the Ramon y Cajal Programme (Sanz Menéndez, *et al*, 2001) was one of the few that, even without new additional funding, was launched, while many others still remain on paper.

The Ministry and university representatives set up a "negotiating" Committee, although it did not actually negotiate; it was really a group in which to test the proposal developed at the Ministry. Furthermore, a second level of policy action was needed, to inform other Ministerial departments with powers in order to avoid them vetoing the proposal. A certain amount of serious opposition did come from the Ministry of Education, which has university regulatory powers. Last but not least, some internal resistance at the Ministry of Science and Technology was also overcome.

The debates inside the Ministry and with the university representatives triggered a growing perception that not only the problem of "bringing Spanish researchers back home", but also many other problems could be tackled with this costly initiative. Administrative and organizational resources were scarce and launching new initiatives is very costly; in the end, as in many other policy initiatives, the new policy instrument became "the solution" for many of the public research system's different problems. Also relevant was the need to amend the Basic Labour Act (*Estatuto de los Trabajadores*) to permit temporary 5 years contracts in research[5]

The programme was designed to provide subsidies to PRCs for hiring researchers with 5 years contracts, but the preference given to the secondary objectives and the process mechanisms designed were the outcome of a interactive process between political actors, S&T policy makers, legal and accounting advisors and customers of the programme (Sanz Menéndez *et al*, 2001).

[5] Under Spanish general labour law, a temporary employee becomes a permanent employee of a company after 3 consecutive years with temporary contracts. The five years period requested for the programme was considered as the standard first part of the tenure track.

It could be said that, in order to achieve some balance, the main objectives of the *Ramon y Cajal Programme* were defined in two ways, helping to match supply and demand: on the one hand, to provide 2,000 temporary research positions (with 5 year contracts) in PRCs and universities, so as to increase S&T capabilities in PRCs and universities and to influence their selection procedures. On the other, to offer stable jobs to excellent researchers in Spain and from abroad, to increase their employability and to improve their academic career opportunities.

Different tensions were present in the definition of the Ramon y Cajal Programme, tensions that appear in the specification of the objectives of the programme. The objectives were laid down as follows:

1. To create (define) an entry point in a "research career" (tenure track) for PhDs with a 5 year contract.
2. To stabilize and improve the working conditions of "post-doc" researchers.
3. To facilitate the return of Spanish researchers working abroad.
4. To identify the best quality researchers and facilitate their employment within the Spanish R&D system.
5. To encourage R&D centres to define their strategic priorities.
6. To support the demand of researchers on priority areas of the National R&D&I Plan.
7. To establish co-responsibility of hosting institutions and the Regional Governments.
8. To support mobility of researchers.

1. The specification of the objectives was related to the fact that, in the Nineties, the growth of tenure track positions in the PRCs and universities (the demand) had slowed down in relation to the supply of PhD available for R&D activities. For example, the stock of university tenure jobs for PhDs increased by less than 10,000 between 1991-2002, with CSIC tenure scientists only increasing a few hundred, just to compensate retirements, while the PhDs produced by the system exceeded 50,000. The policy instrument was meant to send a clear signal on the "future" prospects and opportunities, to avoid discouraging effects on research vocations.

2. The growth in the number of researchers in Spain in recent years, has been mainly based on "post-doctoral" fellowships usually with low wages. Offering contracts with much better conditions (in wages and stability) was essential to keep good young researchers in research careers waiting and working for the tenure.

3. In the Eighties and Nineties, hundreds of young researchers moved abroad, either temporarily or permanently. Some of them became recognised scientists. The debate on bringing them back to Spain had been in the newspapers and the media. There are estimated to be around 2,000 Spanish PhDs working in the US alone[6].

4. After the changes in the university tenure track regulations in the early Eighties, some criticism emerged regarding Selection Committees' marked tendency to appoint not the best candidates but the ones with more local connections[7]. Therefore the programme, by establishing a more centralised selection system of researchers to be contracted, has

[6] *Science*, 300, 4 April 2003, p. 51, with data from the Institute of International Education.
[7] *Nature*, 396, 712, 1998

been used as a way to improve the information and reputation in the labour market of researchers and then to try to disrupt the inbreeding (endogamy) in the selection process.

5. The definition of the profile of the new tenure jobs in universities and PRCs has not usually followed a strategic approach by research organizations. The reproduction and increase of tenure jobs has followed the distribution of existing resources in S&T areas, with very little selectivity, focus and orientation. The aim of the programme was to influence the "selection of S&T priorities and people" made by PRCs and universities because, given the Spanish situation, competing in all research domains was not an option.

6. The qualification standards of the Spanish S&T system were imbalanced, so the new positions aimed to foster the increase of researchers, but mainly in the priority research areas defined by the R&D National Plan (2000-2003), such as "biotechnology", "nanotechnology", "materials sciences and technologies", "engineering", etc.

7. Traditional subsidies for S&T human resources were given to individuals through a grant, rather than to the organizations. The Programme aimed to increase the PRCs' and universities' involvement in the "personnel" policy. Therefore the institutions were given subsidies for hiring some of the researchers selected after the evaluation process; the public subsidy would be given to the PRC in a decreasing proportion of 10% every years until the completion of the 5-year period.

8. Also the issue of promoting the mobility of researchers was clearly an objective and providing 5 years contracts would serve as a mechanism for exchanging people and for encouraging long term mobility in some of the cases.

As mentioned, this initiative was envisaged in the National R&D&I Plan, but no specific new funding was approved to accomplish the objectives. The RyC Programme funding has come from the "reallocation" of already existing budgets for other purposes. In fact in the budget for 2001 an amount of 8,000 Million pesetas (approx. 48 M€) was approved as a mechanism for supporting European Social Fund actions, mainly aimed at employability in the private sector. A reallocation of this amount, and also funds from the National Fund for R&D, a general budget item mainly addressing for competitive funding projects, have been used to cover the new expenditures.

With an expected selection of 2,000 PhDs, and with the estimated level of subsidies, the overall cost forecast, in subsidies to PRCs and universities, for the Ramon y Cajal programme for Government, between 2001 and 2007, was 315 Million euro; the first call in 2001, with 800 selected represented 35 Million euros (for the 1st year) and 115 (for the 5 years period of reference). The total first year subsidy to a PRCs per researcher contracted was 43,750€ in 2001. Payment to the PRCS was expected to be made on annual basis.

# 5. How the Ramon y Cajal Programme worked out in practice

As a result of the definition of the Programme objectives and the interaction with the groups involved, a set of design principles was defined, as follows:

- Matching the researcher demand of PRCs with the available supply of PhD as a mechanism for "allocation" of resources.
- The "competitive evaluation" of candidates at national level was a basic procedure for the Programme.
- The evaluation was based mainly on scientific records ("scientific productivity"), but also considered the "candidate's potential" and the "interest of the research proposal".
- The PhD applicant needs the "ex ante acceptance" of the PRCs to which he/she intends to go; that meant a "veto point" for institutions in relation with some individuals.

However, if PRCs "pre-accepts" a researcher and the researcher is selected, the MCYT organises an annual call for research centres and PhDs alike, via a procedure divided into different stages:

- Stage 1 (DEMAND). After the call, PRCs submit their prospects on S&T human resources and the new researchers they need to the Ministry of Science and Technology. The PRCs and universities define the maximum number of PhD researchers they can recruit upon a financial analysis (because from the second year of the period the PRCs have to contribute with their own resources) and distribute them into S&T areas (24 in the evaluation procedure). After receiving the proposals, the Ministry aggregates and publishes the information.
- Stage 2 (SUPPLY). PhD researchers, after checking the availability of jobs in the different PRCs, submit an application to the MCYT for their evaluation as candidates; applicants have to indicate their preferences for the different positions offered by PRCs or universities [which should have the right to not accept the candidate].
- Stage 3 (Evaluation and Selection). The 24 Evaluation Committees assess the candidates' quality on the basis of defined criteria and, for each S&T area, they establish an ordered "ranking" of the candidates. A Selection Committee receives the evaluations, and decides how many contracts to allocate to each S&T area in line with policy criteria; the order of candidates selected is respected in all the areas. The list of selected candidates in each area is published.
- Stage 4 (Contracting the PhDs). The selected PhDs sign the final agreements with the PRCs of their preference. Most of the PhDs join PRCs that have already accepted them, but researchers are always entitled to change their mind and go to another PRC. The Ministry pays the annual amount of the subsidies to the institution hiring the PhDs selected.
- Stage 5 (Ex-post evaluation). Ex-post performance evaluation procedures are defined for monitoring and assessing the outputs of the research activity developed by the contracted researcher, either to renew the contract at mid term or for the final assessment.

As has been explained, there is a clear distinction between the evaluation of the quality and competence of the candidates, which is left to the research community, and the strategic decision about on the allocation of the number of contracts to the different R&D areas. The general criteria used for distribution of subsidies by S&T areas are: a) Relative quality of researchers among different S&T fields; b) the thematic RTD priorities of the National R&D Plan, and c) the distribution of the aggregated demands of PRCs and universities by S&T areas.

The Ministry's annual call includes the definition of the financial framework conditions for the subsidy, but also some regulatory terms of the labour relation between the PRCs and the PhD to be hired.

The Ministry defines the minimum financial conditions of the researchers to be hired, after a competitive selection process. In 2001, the minimum annual gross wages for contracted researchers was defined as 28,550€, the same amount as a researcher who just got the tenure without any incentives or extras. The salaries were the same amount as any researcher would receive as a civil servant, as basic salary the first year after getting the tenure, as a way of avoiding conflicts with researchers already in the system. Contracted researchers' wages could include any additional bonuses that had to be defined and paid by the PRCs, but under the general regulations of public service. Under the programme, contracted researchers are also allowed to teach.

## 6. First results of the Ramon y Cajal programme. 2001 and 2002 calls

The National R&D&I Plan estimates for 2000-2003 were 2000 contracts for PhDS. The analysis of the results presented here is based on data from the first two calls (2001 and 2002), already closed and finished[8]. Almost 65% of the programme has already been completed, while at the time of writing this presentation the 2003 call, with expected 700 new contracts, had not finished yet.

**Table 2. Basic Figures of the Ramon y Cajal programme, 2001 and 2002 Calls**

| | 2001 | 2002 (1) |
|---|---|---|
| Contracts approved | 800 | 500 |
| Researchers finally contracted | 774 | 498 |
| Demands from Research Centres | 2,064 | 2,059 |
| Number of Applicants Research Centres | 151 | 155 |
| Number of Research Centres getting at least 1 researcher | 84 | 74 |
| Researcher (PhDs) supply | 2,807 | 3,025 |
| Demand from PRCs / Contracts approved | 2.6 | 4.1 |
| Researcher supply / contracts approved | 3.5 | 6.0 |

(1) provisional data
Source: Ministry of Science and Technology

The table shows the main figures for the two first calls, 2001 and 2002, which have already finished. In 2001, a total of 800 researchers were selected from more than 2,800

[8] Data on 2002 is based on selected researcher not in the final number of contracted researchers by PRCs.

applicants. Tentative demand from PRCs was estimated to amount to more than 2000 PhDs.

In 2001, 151 different Research Centres applied, and demand was distributed as follows: Universities (64%), PROs (20%); Regional PRC (8%); other R&D Centres (8%); the biggest institutions demanding subsidies were: CSIC (225), Universidad de Valencia (111), Universidad Complutense de Madrid (75), Universidad Autónoma de Madrid (70), Universidad Politécnica del Valencia (62), Universidad Autónoma de Madrid (52); Universidad de Barcelona (50) and INIA (50). The demand of the PRCs was concentrated in 4 regions that accounted for more than 70% of the demand of PhDs: Madrid, Catalonia, Valencia and Andalusia. Data for 2002 on demand and supply appear stable.

Some other features from the selected PhDs also reveal the presence of the diverse type of objectives in practice.

**Table 3. Basic characteristics of the PhDs selected under the Ramon y Cajal programme, Calls of 2001 and 2002**

| | | 2001 | 2002 (1) |
|---|---|---|---|
| Number of contracted candidates | | 774 | 498 |
| Number of contracted foreign candidates | | 105 | 99 |
| Number of contracted Spaniards living abroad | | 108 | 116 |
| Average age of contracted candidates (years) | | 35,8 | 35,6 |
| Sex distribution of contracted candidates (%) | Male | 63% | 66% |
| | Female | 37% | 34% |

(1) provisional data
Source: Ministry of Science and Technology

In relation to the Spanish people coming back from abroad, it is worth mentioning some of the results of the 2001 call: Only 13% (99) of the Spanish people contracted were living abroad: 44 in the USA, 13 in UK and France, 11 in Germany, 4 in Switzerland; and 14 in other countries. In the 2002 Call, the number of selected Spanish people who were living abroad rose to 23% of the total (116): 47 in the US, 21 in the UK, 14 in France, 10 in Germany, 6 in The Netherlands, and 18 in other countries

Looking at the nationalities of the PhDs selected, one observes a significant increase in foreigners. In the 2001 call, from a total of 774 finally contracted by PRCs, 86.4% (669) were Spanish; 7.8% (60) from other European Union Countries, 0.9 % (7) from US; 0.8% (6) from Russia; 0.6% (5) from Morocco; 0.5% (4) from Argentina; 0,4% (3) from Cuba; and 2.6% (20) from other nationalities.

In the 2002 call, the distribution of the 498 PhDs selected by nationalities was: 80.1% (399) from Spain; 9.2% (46) from other EU countries; 3.0% (15) from Argentina; 1.4% (7) from Russia; 0.6% (3) each from US, Australia and China; 4.4% (22) from other nationalities.

The available data can be used to assess the extent to which the different objectives have been achieved.

**Table 4. Objectives of the Ramon y Cajal Programme from the total contracted people, Calls of 2001 and 2002**

| | 2001 | 2002(1) |
|---|---|---|
| Returned Spaniards | 14.0% | 23.0% |
| Foreigners attracted | 13.6% | 19.9% |
| Improvement in employment conditions and career prospects | 73.4% | 57.1% |

(1) provisional data
Source: Ministry of Science and Technology

On account of the situation throughout the system, the first objective of the RyC programme, especially in 2001, has been to "improve the employment conditions and the academic career prospects", thus evidencing that many people in the system had poor employment conditions. Apparently, after many good young researchers in such poor conditions joined the system, in the second call, the programme has earned a solid reputation abroad. This has created opportunities for advancing in some of the other objectives, such as increasing the number of foreign researchers winning contracts, and in fact the numbers were not really expected. Although the policy idea was to boost the diversity, the programme was not expected to attract many foreign researchers on account of the wage gap. However, it is obvious that in some countries, the research system situation may be worse.

PhDs are less interested in joining universities and more attracted to full time research centres, where there are no teaching obligations, meaning that they can consolidate their personal curricula, in which publications and results are more important.

**Table 5. Distribution of the contracts by type of Research Centres. Calls of 2001 and 2002**

| | 2001 Call | | 2002 Call (3) | | TOTAL | |
|---|---|---|---|---|---|---|
| Universities | 441 | 57.0% | 312 | 62.7% | 757 | 59.5% |
| Public Research Centres (1) | 267 | 34.5% | 144 | 28.9% | 411 | 32.3% |
| Other PRCs (2) | 66 | 8.5% | 42 | 8.4% | 104 | 8.2% |
| Total | 774 | | 498 | | 1272 | |

(1) CSIC, CIEMAT, IAC, IGME, ISCIII, INIA, INTA, IEO.
(2) Hospitals, R&D Regional centres, NFPO, and others
(3) provisional data
Source: Ministry of Science and Technology

The distribution of PhDs by areas has been the result of a policy decision made by the Ministry of Science and Technology, and goes against the traditional distribution of human resources in S&T areas, which is dominated by Social Sciences and Humanities. However, the most important factor in the allocation has in fact been the existing supply, the distribution of applications by areas and the demand of the PRCs, which is indirectly shaped by the existing supply; also the consideration of using the "human capital" accumulated in the last ten years has been relevant in the allocation.

**Table 6. Distribution of the contracts by research areas. Calls of 2001 and 2002**

| | | 2001 Call | | 2002 Call (1) | | TOTAL | |
|---|---|---|---|---|---|---|---|
| 1 | Physic and Space Sciences | 76 | 9.8% | 40 | 8,0% | 116 | 9,1% |
| 2 | Earth Sciences | 42 | 5.4% | 18 | 3,6% | 60 | 4,7% |
| 3 | Materials Science and Technology | 39 | 5.0% | 30 | 6,0% | 69 | 5,4% |
| 4 | Chemistry | 74 | 9.6% | 39 | 7,8% | 113 | 8,9% |
| 5 | Chemical technology | 19 | 2.5% | 22 | 4,4% | 41 | 3,2% |
| 6 | Plant and animal biology. Ecology | 56 | 7.2% | 34 | 6,8% | 90 | 7,1% |
| 7 | Agriculture | 42 | 5.4% | 31 | 6,2% | 73 | 5,7% |
| 8 | Livestock and fishing | 28 | 3.6% | 18 | 3,6% | 46 | 3,6% |
| 9 | Food Science and technology | 31 | 4.0% | 14 | 2,8% | 45 | 3,5% |
| 10 | Molecular and cellular Biology and genetics | 139 | 18.0% | 59 | 11,8% | 198 | 15,6% |
| 11 | Physiology and Pharmacology | 40 | 5.2% | 25 | 5,0% | 65 | 5,1% |
| 12 | Medicine | 50 | 6.5% | 32 | 6,4% | 82 | 6,4% |
| 13 | Mechanical, Ship and Aeronautical Engineering | 8 | 1.0% | 9 | 1,8% | 17 | 1,3% |
| 14 | Electrical and Electronic Engineering and Robotics | 12 | 1.6% | 11 | 2,2% | 23 | 1,8% |
| 15 | Civil Engineering and architecture | 5 | 0.6% | 12 | 2,4% | 17 | 1,3% |
| 16 | Mathematics | 18 | 2.3% | 14 | 2,8% | 32 | 2,5% |
| 17 | Computer Sciences | 11 | 1.4% | 25 | 5,0% | 36 | 2,8% |
| 18 | Information & Communication Technologies | 15 | 1.9% | 20 | 4,0% | 35 | 2,8% |
| 19 | Economy | 17 | 2.2% | 10 | 2,0% | 27 | 2,1% |
| 20 | Law | 3 | 0.4% | 3 | 0,6% | 6 | 0,5% |
| 21 | Social Sciences | 5 | 0.6% | 7 | 1,4% | 12 | 0,9% |
| 22 | Psychology and Education Sciences | 7 | 0.9% | 4 | 0,8% | 11 | 0,9% |
| 23 | Philology and Philosophy | 18 | 2.3% | 10 | 2,0% | 28 | 2,2% |
| 24 | History and Art | 19 | 2.5% | 11 | 2,2% | 30 | 2,4% |
| | | 774 | | 498 | | 1272 | |

(1) provisional data
Source: Ministry of Science and Technology

These figures reflect an amazing predominance of the area of Molecular biology and biotechnology and, in general, life sciences, and a small aggregate number in engineering, mainly due to the lack of PhDs available.

The regional distribution of PhDs contracts has been quite similar to the distribution of S&T capabilities among the Spanish regions, and thus the programme has helped to highlight the PRCs with a reputation for attracting good young researchers. We have observed the impact of the regions' existing capabilities to attract excellent researchers. This brings into the debate the need for other policy tools to spread excellence or to develop new capabilities in less developed regions.

**Table 7. Distribution of the contracts by regions, calls of 2001 and 2002, and comparison with the regional share of the researchers (FTE) in universities and government sectors**

| | 2001 Call | | 2002 call (1) | | TOTAL | | % Researcher in Public Sector (FTE) |
|---|---|---|---|---|---|---|---|
| Andalusia | 77 | 9.9% | 64 | 12.9% | 141 | 11.1% | 16.00% |
| Aragon | 28 | 3.6% | 10 | 2.0% | 38 | 3.0% | 2.70% |
| Asturias | 16 | 2.1% | 10 | 2.0% | 26 | 2.0% | 1.90% |
| Balearic Islands | 6 | 0.8% | 2 | 0.4% | 8 | 0.6% | 0.80% |
| Canary Islands | 8 | 1.0% | 5 | 1.0% | 13 | 1.0% | 3.50% |
| Cantabria | 11 | 1.4% | 4 | 0.8% | 15 | 1.2% | 0.70% |
| Castilla –La Mancha | 4 | 0.5% | 2 | 0.4% | 6 | 0.5% | 1.80% |
| Castilla-Leon | 35 | 4.5% | 22 | 4.4% | 57 | 4.5% | 6.00% |
| Catalonia | 199 | 25.7% | 154 | 30.9% | 353 | 27.8% | 15.90% |
| Valencia | 88 | 11.4% | 34 | 6.8% | 122 | 9.6% | 7.30% |
| Extremadura | 1 | 0.1% | 1 | 0.2% | 2 | 0.2% | 1.60% |
| Galicia | 21 | 2.7% | 15 | 3.0% | 36 | 2.8% | 5.80% |
| La Rioja | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0.50% |
| Madrid | 238 | 30.7% | 159 | 31.9% | 397 | 31.2% | 28.70% |
| Murcia | 16 | 2.1% | 8 | 1.6% | 24 | 1.9% | 2.00% |
| Navarre | 9 | 1.2% | 5 | 1.0% | 14 | 1.1% | 1.90% |
| Basque Country | 17 | 2.2% | 3 | 0.6% | 20 | 1.6% | 3.10% |
| | 774 | | 498 | | 1272 | | 100.00% |

(1) provisional data
Source: Ministry of Science and Technology

# 7. Conclusions

It is too early to assess the effects of the Ramon y Cajal Programme on the S&T system, and further evaluations are required. However, the programme can be said to have contributed significantly to provide a short term solution to the key problem in the Spanish system today: The employment opportunities and conditions and the academic career prospects of PhDs.

The Programme clearly has many different objectives, which can be quantified by averaging the two calls examined: 2 out of every 3 PhDds contracted by PRCs come under the “improving working conditions” category, while the other 1/3 falls under the category of Spanish or foreign researchers brought into the Spanish S&T system from abroad.

However, as in many other public policy interventions, the “solution” for today's problems might be a “problem in the future”. Over the next few years, the S&T system will require significant growth of the annual tenure employment or a change in the labour relations system if it is to offer PhDs stability.

One significant short term effect of the programme has been to create an information system on the quality of PhD researchers and institutions in Spain. The Ramon y Cajal programme has become a tool for consolidating the reputation of the different research institutions and has demonstrated their capability to attract good researchers in the different fields.

The organisational impact of the Ramon y Cajal Programme has been to pressure the PRCs to develop strategies for human resource recruitment by research fields, to organise their priorities in terms of growth of competitive research capabilities.

However, since the first call, the Programme has also shown that it can do little to allocate researchers, under the national R&D priorities, in areas where there is scant supply of PhDs, such as the engineering and technological fields. The problem that these areas face is one of insufficient supply and production of PhDs than of employability.

Therefore there is evidence of a large-scale impact in terms of the way that PhD labour markets and academic careers operate in Spain, but also in terms of the way in which PRCs manage their human resource strategies. Two additional relevant effects refer to distribution of the information as a way of improving quality and reputation, and to the changing way in which the Spanish universities conceive full time research, without teaching obligations.

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