Bringing S&T Human Resources back in: The Spanish Ramón y Cajal Program

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Spanish Policy Research on Innovation & Technology, Training and Education (SPRITTE)

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Problems in the Spanish RTD System related to Human Resources

- Insufficient Human Resources in R&D (80% below average EU), especially researchers in BE sector (27% vs. 49% EU)
- Increase in numbers, in last years, based on temporary researchers and low salaries (fellowships)
- Problems with “academic careers” opportunities and employment prospects
- Mismatches between supply of PhDs and the demand by the universities and PRCs (in some areas)
TOTAL RESEARCHERS PER THOUSAND LABOUR FORCE

Sources: DG Research, Key Figures 2002, Eurostat, Member States, OECD, Main Science and Technology Indicators
Grant holders (doctoral and post doctoral) as a share of the total number of researchers. 2001

% of Fellowships among Researchers (FTE)

- Total
- Women
GERD PER RESEARCHER BY SECTOR (current PPP$)

- **Total**
  - UE: 103,544
  - Spain: 169,096
  - US: 191,219

- **Business Enterprises**
  - UE: 171,386
  - Spain: 218,408
  - US: 220,139

- **Higher Education**
  - UE: 56,708
  - Spain: 100,771
  - US: 225,902

- **Government**
  - UE: 90,246
  - Spain: 174,569
  - US: 350,785

Data 1999; (1) 1997; Source: OECD, Main Science and Technology Indicators, November 2001.
Labour cost of GERD per capita R&D personnel, 1999 or last year available

Source: OECD
GERD PER RESEARCHER. GOVERNMENT SECTOR (current PPP$)
GERD PER RESEARCHER. HIGHER EDUCATION SECTOR (current PPP$)

- **Australia**: 52,387
- **Japan**: 78,874
- **US**: 100,770
- **UE**: 103,883
- **UK**: 113,498
- **Sweden**: 56,705
- **Spain**: 59,410
- **Portugal**: 100,269
- **Netherlands**: 172,640
- **Italy**: 100,269
- **Ireland**: 85,810
- **Greece**: 51,259
- **Germany**: 117,695
- **France**: 88,673
- **Finland**: 71,113
- **Denmark**: 105,328
- **Belgium**: 98,376
- **Austria**: 181,841

0 50000 100000 150000 200000 250000

- **Austria**
- **Belgium**
- **Denmark**
- **EU**
- **Japan**
- **Netherlands**
- **Portugal**
- **Spain**
- **Sweden**
- **UK**
- **US**
- **Australia**
- **France**
- **Finland**
- **Germany**
- **Greece**
- **Ireland**
- **Italy**
Evolution of tenure (CT) and promotion ages at CSIC
Graduate students and PhDs awards

Evolution of Graduate Students and PhDs. Spain

Years

Num gradient Students

Num PhDs

PhDs awards
Graduate students
Evolution of PhDs by research area

PhDs by research area

- Science and Health
- Engineering and technology
- Social Sciences
- Humanities
NEW SCIENCE AND TECHNOLOGY PhDs –per thousand population aged 25 to 34, 1999-2000

- Sweden: 1.24
- Finland: 1.09
- Germany: 0.81
- France: 0.76
- UK: 0.68
- Belgium: 0.60
- Austria: 0.59
- EU-15: 0.56
- Ireland: 0.50
- Denmark: 0.49
- US: 0.48
- Spain: 0.36
- Netherlands: 0.34
- Portugal: 0.26
- Japan: 0.24
- Greece: 0.19
- Italy: 0.16
Research Training Program
(4 years grants)

- In the 80s’ more than 1,000 new grants per year for preparing PhDs.
- The annual average stock of doctoral grants around 4000
In 2000 the key problem was

The mismatch between the successful “research training” policy, with the subsequent increase in the supply of PhD since the early nineties, 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.
Evolution of S&T Human Resources policies

- 60s and 70s.- Training strategies abroad defined by the PRCs
- Mid 80s.- Governmental research training program (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 (IDE and Torres Quevedo)
- 2000s.- Employability of PhDs in the public sector (Ramon y Cajal)
- Still pending.- Bringing back to Spain senior high level Spanish scientist working abroad
Key S&T policy interventions in S&T human resources in 2003

- Training young researchers (FPI): 4 years
  Fellowships for preparing dissertations (€1,000/month)

- Mobility of researchers

- Employment of PhDs and technologists in firms (Torres Quevedo Program)

- Employment of PhDs in Public Research Institutions (Ramón y Cajal Program)
Main general objectives RyC

- To provide **2000** temporary research positions (with 5 year contracts) in the PRCs and universities, in addition to regular procedures of “tenure track”,
  - hoping to increase the S&T capabilities in PRCs and universities and to influence their selection procedures

- To offer stable jobs to excellent researchers in Spain and from abroad,
  - to increase their employability and to improve their academic career opportunities
General data of the RyC Program

**Overall direct cost for Government (2001-2007):**

- 315 Million euro in subsidies to PRCs and universities
- 1st call: 35 Million (1st year) and 115 (5 years)
- Minimum annual gross wages on 2001 for researchers contracted: 28,550€
- First year subsidy to PRCs per researcher contracted: 43,750€
Specific Objectives (I)

- To create (define) an entry point in a “research career” (tenure track) for PhDs with a 5 year contract
- To stabilize and improve the working conditions of “post-doc” researchers
- To facilitate the return of Spanish researchers working abroad
- To identify the best quality researchers and facilitate their employment within the Spanish R&D system
Specific Objectives (II)

- To incentivate R&D centers to define their strategic priorities
- To support the demand of researchers on priority areas of the National R&D&I Plan
- To establish co-responsibility of hosting institutions and the Regional Governments
- To support mobility of researchers
Program procedures: Annual call

1. **DEMAND OF Human Resources.** - PRCs and universities define the “maximum” number of PhD researcher to be recruited (upon a financial analysis) and they distribute them by S&T areas (24 in the evaluation procedure).

2. **Supply of Human Resources.** - PhD researchers apply at the MCYT, with indication of their preferences for the PRCs or universities (that should accept the candidate if he/she is finally selected).

3. **Evaluation and Selection.** - The Evaluation Commissions (24) select, establishing a “ranking”, the best candidates upon defined criteria.

4. The selected PhDs establish the final agreements with the PRCs of their preference. MCYT pays the annual amount of the subsidies to the institution hiring the PhDs selected.
Program Design Principles (I)

- Matching demand of PRCs with the supply of PhD researchers available as a mechanism for "allocation"

- "Competitive evaluation" of candidates at national level

- Evaluation based mainly on "scientific productivity", "potential of candidate" and "interest of the research proposal"
Program Design Principles (II)

- The PhD applicant needs the “ex ante acceptance” of PRCs in which he/she intends to go (“veto point for institutions”)

- If PRCs “pre-accepts” a researcher and the researcher is selected, the PRCs must hire him/her.

- But the final decision on where to go is in the hands of the “selected” candidates
Program Design Principles (III)

- “Reputation” of PRCs is an “attractor” of the best “candidates” requesting “acceptance”

- The “candidates’ ranking” in every field after the evaluation gives ex post information to the PRCs on the “relative” quality or merits of the researchers
  - Selection of the best researchers
  - Researchers select the PRCs demanding researchers
  - PRCs get the subsidies because they hire the best researchers
<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracts Approved</td>
<td>800</td>
<td>500</td>
</tr>
<tr>
<td>Researchers Finally Contracted</td>
<td>774</td>
<td>498</td>
</tr>
<tr>
<td>Demands from Research Centres</td>
<td>2,064</td>
<td>2,059</td>
</tr>
<tr>
<td>Number of Research Centres Apl.</td>
<td>151</td>
<td>155</td>
</tr>
<tr>
<td>Number of Research Centres Getting</td>
<td>84</td>
<td>74</td>
</tr>
<tr>
<td>Researchers Supply</td>
<td>2,807</td>
<td>3,025</td>
</tr>
<tr>
<td>Demand from Research Centres / Contr. Appro.</td>
<td>2,6</td>
<td>4,1</td>
</tr>
<tr>
<td>Researchers Supply / Contracts Appro.</td>
<td>3,5</td>
<td>6,0</td>
</tr>
</tbody>
</table>
### BALANCE: nationality, residence, age, sex

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. CONTRACTED CANDIDATES</td>
<td>774</td>
<td>498</td>
</tr>
<tr>
<td>N CONTRACTED FOREIGN CANDIDATES</td>
<td>105</td>
<td>99</td>
</tr>
<tr>
<td>N. CONTRACTED CANDIDATES BEING RESIDENTS OUTSIDE SPAIN</td>
<td>158</td>
<td></td>
</tr>
<tr>
<td>N. CONTRACTED SPANIARDS LIVING ABROAD</td>
<td>99</td>
<td>116</td>
</tr>
<tr>
<td>N CONTRACTED RETURNED CANDIDATES</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td><strong>AVERAGE AGE OF CONTRACTED CANDIDATES (years)</strong></td>
<td>35,7</td>
<td>35,6</td>
</tr>
<tr>
<td><strong>SEX DISTRIBUTION OF CONTRACTED CANDIDATES (%)</strong></td>
<td><strong>M</strong> - 63%</td>
<td>66%</td>
</tr>
<tr>
<td></td>
<td><strong>W</strong> - 37%</td>
<td>34%</td>
</tr>
</tbody>
</table>
## Balance of the different objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish coming back</td>
<td>13,0%</td>
<td>23,0%</td>
</tr>
<tr>
<td>Foreigners attraction</td>
<td>13,6%</td>
<td>19,9%</td>
</tr>
<tr>
<td>Improvement employment conditions and career prospects</td>
<td>73,4%</td>
<td>57,1%</td>
</tr>
</tbody>
</table>
## Contracted researcher by type of institution. Ramon y Cajal program

<table>
<thead>
<tr>
<th></th>
<th>2001 Call</th>
<th>2002 Call</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Universities</strong></td>
<td>445</td>
<td>57,5%</td>
<td>757</td>
</tr>
<tr>
<td><strong>Public Research Centres</strong></td>
<td>267</td>
<td>34,5%</td>
<td>411</td>
</tr>
<tr>
<td><strong>Other PRCs (3)</strong></td>
<td>62</td>
<td>8,0%</td>
<td>104</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>774</strong></td>
<td><strong>498</strong></td>
<td><strong>1272</strong></td>
</tr>
</tbody>
</table>

(1) CANDIDATOS EN PROPUESTA DE CONCESIÓN
(2) CSIC, CIEMAT, IAC, IGME, ISCIII, INIA, INTA, IEO
(3) HOSPITALES, SERVICIOS REGIONALES DE I+D, FUNDACIONES Y OTROS
CRITERIA USED FOR DISTRIBUTION OF SUBSIDIES BY S&T AREAS

- Relative quality of researchers among different S&T fields
- Thematic RTD priorities of the National R&D Plan
- The distribution of the aggregated demands of PRCs and universities by S&T areas
## Distribution by research fields

<table>
<thead>
<tr>
<th>Field</th>
<th>2001 Call</th>
<th>2002 Call</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Physic and Space Sciences</td>
<td>76 (9.8%)</td>
<td>40 (8.0%)</td>
<td>116 (9.1%)</td>
</tr>
<tr>
<td>2 Earth Sciences</td>
<td>42 (5.4%)</td>
<td>18 (3.6%)</td>
<td>60 (4.7%)</td>
</tr>
<tr>
<td>3 Materials Science and Technology</td>
<td>39 (5.0%)</td>
<td>30 (6.0%)</td>
<td>69 (5.4%)</td>
</tr>
<tr>
<td>4 Chemistry</td>
<td>74 (9.6%)</td>
<td>39 (7.8%)</td>
<td>113 (8.9%)</td>
</tr>
<tr>
<td>5 Chemical technology</td>
<td>19 (2.5%)</td>
<td>22 (4.4%)</td>
<td>41 (3.2%)</td>
</tr>
<tr>
<td>6 Vegetal and animal biology. Ecology</td>
<td>56 (7.2%)</td>
<td>34 (6.8%)</td>
<td>90 (7.1%)</td>
</tr>
<tr>
<td>7 Agriculture</td>
<td>42 (5.4%)</td>
<td>31 (6.2%)</td>
<td>73 (5.7%)</td>
</tr>
<tr>
<td>8 Ganadería y Pesca</td>
<td>28 (3.6%)</td>
<td>18 (3.6%)</td>
<td>46 (3.6%)</td>
</tr>
<tr>
<td>9 Food Science and technology</td>
<td>31 (4.0%)</td>
<td>14 (2.8%)</td>
<td>45 (3.5%)</td>
</tr>
<tr>
<td>10 Molecular and cellular Biology and genetics</td>
<td>139 (18.0%)</td>
<td>59 (11.8%)</td>
<td>198 (15.6%)</td>
</tr>
<tr>
<td>11 Phisiology and Pharmacology</td>
<td>40 (5.2%)</td>
<td>25 (5.0%)</td>
<td>65 (5.1%)</td>
</tr>
<tr>
<td>12 Medicine</td>
<td>50 (6.5%)</td>
<td>32 (6.4%)</td>
<td>82 (6.4%)</td>
</tr>
<tr>
<td>13 Mechanical, Ship and Aeronautical Engineering</td>
<td>8 (1.0%)</td>
<td>9 (1.8%)</td>
<td>17 (1.3%)</td>
</tr>
<tr>
<td>14 Electrical and Electronic Engenering and Rob</td>
<td>12 (1.6%)</td>
<td>11 (2.2%)</td>
<td>23 (1.8%)</td>
</tr>
<tr>
<td>15 Civil Engenering and architecture</td>
<td>5 (0.6%)</td>
<td>12 (2.4%)</td>
<td>17 (1.3%)</td>
</tr>
<tr>
<td>16 Mathematics</td>
<td>18 (2.3%)</td>
<td>14 (2.8%)</td>
<td>32 (2.5%)</td>
</tr>
<tr>
<td>17 Computer Sciences</td>
<td>11 (1.4%)</td>
<td>25 (5.0%)</td>
<td>36 (2.8%)</td>
</tr>
<tr>
<td>18 ICT</td>
<td>15 (1.9%)</td>
<td>20 (4.0%)</td>
<td>35 (2.8%)</td>
</tr>
<tr>
<td>19 Economy</td>
<td>17 (2.2%)</td>
<td>10 (2.0%)</td>
<td>27 (2.1%)</td>
</tr>
<tr>
<td>20 Law</td>
<td>3 (0.4%)</td>
<td>3 (0.6%)</td>
<td>6 (0.5%)</td>
</tr>
<tr>
<td>21 Social Sciences</td>
<td>5 (0.6%)</td>
<td>7 (1.4%)</td>
<td>12 (0.9%)</td>
</tr>
<tr>
<td>22 Psychology and Education Scinces</td>
<td>7 (0.9%)</td>
<td>4 (0.8%)</td>
<td>11 (0.9%)</td>
</tr>
<tr>
<td>23 Fillogy and Philosophy</td>
<td>18 (2.3%)</td>
<td>10 (2.0%)</td>
<td>28 (2.2%)</td>
</tr>
<tr>
<td>24 History and Art</td>
<td>19 (2.5%)</td>
<td>11 (2.2%)</td>
<td>30 (2.4%)</td>
</tr>
</tbody>
</table>

(1) CANDIDATOS EN PROPUESTA DE CONCESIÓN
### Regional distribution of contracted researchers. Ramon y Cajal Program

<table>
<thead>
<tr>
<th>Region</th>
<th>2001 Call</th>
<th>2002 Call (1)</th>
<th>TOTAL</th>
<th>%PRCs Res(FTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANDALUCIA</td>
<td>77</td>
<td>9,9%</td>
<td>64</td>
<td>12,9%</td>
</tr>
<tr>
<td>ARAGON</td>
<td>28</td>
<td>3,6%</td>
<td>10</td>
<td>2,0%</td>
</tr>
<tr>
<td>ASTURIAS</td>
<td>16</td>
<td>2,1%</td>
<td>10</td>
<td>2,0%</td>
</tr>
<tr>
<td>BALEARES</td>
<td>6</td>
<td>0,8%</td>
<td>2</td>
<td>0,4%</td>
</tr>
<tr>
<td>CANARIAS</td>
<td>8</td>
<td>1,0%</td>
<td>5</td>
<td>1,0%</td>
</tr>
<tr>
<td>CANTABRIA</td>
<td>11</td>
<td>1,4%</td>
<td>4</td>
<td>0,8%</td>
</tr>
<tr>
<td>CASTILLA-LA MANCHA</td>
<td>4</td>
<td>0,5%</td>
<td>2</td>
<td>0,4%</td>
</tr>
<tr>
<td>CASTILLA-LEÓN</td>
<td>35</td>
<td>4,5%</td>
<td>22</td>
<td>4,4%</td>
</tr>
<tr>
<td>CATALUÑA</td>
<td>199</td>
<td>25,7%</td>
<td>154</td>
<td>30,9%</td>
</tr>
<tr>
<td>COMUNIDAD VALENCIANA</td>
<td>88</td>
<td>11,4%</td>
<td>34</td>
<td>6,8%</td>
</tr>
<tr>
<td>EXTREMEADURA</td>
<td>1</td>
<td>0,1%</td>
<td>1</td>
<td>0,2%</td>
</tr>
<tr>
<td>GALICIA</td>
<td>21</td>
<td>2,7%</td>
<td>15</td>
<td>3,0%</td>
</tr>
<tr>
<td>LA RIOJA</td>
<td>0</td>
<td>0,0%</td>
<td>0</td>
<td>0,0%</td>
</tr>
<tr>
<td>MADRID</td>
<td>238</td>
<td>30,7%</td>
<td>159</td>
<td>31,9%</td>
</tr>
<tr>
<td>MURCIA</td>
<td>16</td>
<td>2,1%</td>
<td>8</td>
<td>1,6%</td>
</tr>
<tr>
<td>NAVARRA</td>
<td>9</td>
<td>1,2%</td>
<td>5</td>
<td>1,0%</td>
</tr>
<tr>
<td>PAIS VASCO</td>
<td>17</td>
<td>2,2%</td>
<td>3</td>
<td>0,6%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>774</strong></td>
<td></td>
<td><strong>498</strong></td>
<td></td>
</tr>
</tbody>
</table>

(1) CANDIDATOS EN PROPUESTA DE CONCESIÓN
Provisional balance (I)

- The program RyC has contributed significantly to solve the key problem in the Spanish system: The employment opportunities and conditions and the academic career prospects of the PhDs.
- However the “solution” of today's problems might be a “problem in the future”. The system will need a significant growth of the annual tenure employment.
- The RyC program contributes to the reinforcement of the institutions with the best reputation among researchers.
Provisional balance (II)

- The RyC program has created an information (reputation) system on the quality of the PhD researchers and the institutions.
- The RyC program has pressured the PRCs to develop strategic planning for human resources policies by fields and tenure strategies.
- The RyC program cannot solve the problem of “insufficient supply of PhDs in engineering and technological fields”.