Net ReAct

The role of networking in research activities

Deliverable D3.2

Post-Docs in the life sciences

by

empirica, Gesellschaft für Kommunikations- und Technologieforschung mbH

Deliverable Version:	netreact d3.2.doc, draft
Delivery Date:	21.11.2005
Contract:	The role of networking in research activities EU Contract No. 22540-2004-12 F1ED SEV DE
Issued by:	Institute for Prospective Technological Studies, Commission of the European Communities
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Preface and acknowledgement

This deliverable was mainly written by Alexander Mentrup, empirica. Parts of this work are based on deliverable D1.3, which was written by Franz Barjak, University of Applied Sciences Solothurn Northwestern Switzerland (FHSO):

- The overall structure of the report, since both are of the same nature and similar research questions are to be answered;
- The first three sections of the report, which were in part or completely repeated from D1.3. This was necessary to give the reader a complete overview of the project and the NetReAct survey to obtain a correct understanding of the results of the post-docs analysis.

Executive Summary

General purpose and approach of the project

The “The role of Networking in research activities” (NetReAct) project is designed to capture, describe and analyse the strategies, patterns, dynamics and impact of networking in research activities in the life sciences in 10 European countries. The objectives are as in the Tender Specifications, specifically to develop and apply methods to shed light on current research collaboration behaviour of European universities, in particular in respect of the mobility of ideas and of personnel (brains) and in doing so:

- to assess the dynamics of universities' networking activities in respect of other universities, of public and private research bodies and
- to measure the capacity of universities and their laboratories to attract doctoral students and post-doctoral staff from other geographical areas.

The main unit of analysis in NetReAct is the research team or research group. We understand as a research team a group of people, scientists and non-scientists, which work in the same location for a longer time period to produce new scientific knowledge. The group of people is part of one or several larger organisations (university, department, school etc.), but at least some of its members are employed by a university. Also, the team is recognized from the outside as a separate entity.

The project uses an empirical approach that rest on three main pillars: a questionnaire-based survey targeted principally at heads of research teams to collect data on the doctoral students and post-docs at these institutions as well as further covariates which are supposed to influence research productivity; bibliometric data (publication and citation statistics) taken from the Thomson-ISI database to assess the levels of collaboration and output produced by these institutions, and webometric data (hyperlinks) collected from the internet to evaluate the position of these institutions in the life sciences networks.

The present deliverable D3.2 provides a first descriptive analysis of the responses to the survey of life sciences research teams focussing on two issues:

- a very brief description of the distribution of the dataset by country, scientific discipline, age and size of the responding teams,
- a more detailed analysis of the survey responses on post-docs.

The NetReAct Survey

The identified research population consists of more than 7,700 teams from 359 universities (see Table 2-1). We found more than nearly 1,600 teams in the UK and more than 1,300 teams in France and Germany. Relatively few teams – between 170 and 230 – were found in the smaller countries Portugal, the Czech Republic, Norway, and Hungary. Sweden has a relatively large life sciences sector with 650 teams. The average number of life sciences teams per university varies from more than 30 in the

Nordic countries to only 15 in Portugal and the Czech Republic. Overall 1,773 teams or 23% of the research population were selected for the sample and addressed in the survey.

Concerning the purpose of the NetReAct project to test the feasibility of the chosen approach to collect data on young researchers in science, D1.3 has already assumed the lessons learned from the preparation and realisation of the survey. At this point, we only want to summarise these findings:

1. The identification and retrieval of research teams was only possible through time consuming searches of web pages in the university domain and manual copying-and-pasting of the relevant names and URLs. Moreover, sometimes links tended to be broken and the provided information was frequently outdated, incomplete or simply false.
2. In spite of these weaknesses, the approach proved to be successful. Nearly half of the teams included in the sample showed a measurable response to the survey and 26% of the teams entered the dataset with a usable questionnaire. The dataset can be assumed to constitute a representative selection of the much larger research population.
3. A comparison of the staff data collected from the World Wide Web with the survey-based staff data indicated that the data from both sources is similar.
4. It remains uncertain, whether all respondents really filled in the questionnaire for the target-date 2003, more than 2 years before the survey. It was frequently repeated in the questionnaire, but we have no way of verifying this.
5. The tables about PhD students and post-docs were not always filled out entirely and the respondents, i.e. the research team leaders, left open the questions they did not know for sure. But, for instance more than 90% of all teams provided information on the countries of origin of their PhD students and more than 70 % of all teams provided the same information for their post-docs. In general, data on more than 1,500 PhD students and 800 post-docs working in the teams in 2003 were provided by the team leaders.
6. These results also confirm the choice of the level of analysis, namely the lowest possible level (above individuals) of research teams. Not only were the team leaders able to fill in the questionnaires and provide the required answers, but the analysis of the results produced a plausible and meaningful picture of life sciences teams.

All countries are sufficiently represented in the dataset. The largest share of teams in the dataset comes from the UK, namely 17% of the teams; more than 10% of the teams are from Germany, France, and Italy and each of the other six countries contributes between 6 and 9% of the teams. In regard to the main scientific discipline of the team we find an emphasis on biosciences. Approximately half of the teams are younger than 10 years and half of them are older. The average size of the teams in the dataset is 11 members, and three quarters of the teams have less than 20 members.

Post-docs working in the teams in 2003

How can post-docs in the European life sciences research teams be characterised?

The typical post-doc in the life sciences in the study period was around 32 years old, not implicitly male, but to a slightly larger extent, and also not implicitly from within the country of the team (ca. 40% of post-docs have lived or worked in another country before). He or she worked in a team of – on average – about 16 people, of which about 2.4 were professors or other principal investigators at a higher hierarchy level and 2.2 were at the post-doc level (i.e. on average a post-doc has one fellow post-doc in the team).

Research teams are highly international with regard to post-doc researchers. A large minority of post-docs are non-domestic: 43% by country of origin and 41% by the country in which the PhD was obtained. The EU is the main origin of these foreign researchers, with about 20% of post-doc researchers' origins. 5-6% come from non-EU Europe, while about 16-18 % come from non-European countries.

Furthermore, post-docs mostly had work experiences abroad, more than three out of five post-docs worked in another country before being employed as post-doc in a research team.

Few post-doc researchers can rely on university financing, but have to (rely on their research teams to) raise other research funds. The typical post-doc researcher was mainly funded through public sources other than the university for the duration of 2 to 3 years.

Post-docs leaving the teams

What are the directions of post-docs after having finalised their first post-doc position?

After leaving the team, post-docs mainly assumed other post-doc (temporary), or faculty (permanent) position in a university. They did not implicitly stay in the country when assuming this new position: one out of five post-docs went to another EU member state, fewer to another country worldwide and still less to North-America.

In the UK and Norway more post-docs have assumed temporary post-doc positions; in Spain, France and Hungary more have assumed permanent faculty positions. Less university positions were obviously available in the Czech Republic, Norway, Italy and Germany; to assume non-university research & development positions was most important for post-docs in the Czech Republic and Norway. Other employment played an important role in the Czech Republic, Germany and Italy. The share of post-docs being unemployed after leaving the team was the highest in Germany and France (about 8%).

Recruitment of post-docs

What are the main factors with regard to the attractiveness of research teams and the characteristics of post-docs?

Research team leaders in life sciences in Europe were asked to assess factors of attractiveness for post-doctoral recruitment. They ranked the scientific reputation of their team and the quality of their post-doctoral training highest in this regard. Other factors, including factors such as industry contacts, played a minor or even negligible role. No significant variation across countries can be found here. Notably, industry contacts were an important factor for biomedicine teams, however.

On the other hand, research team leaders demanded of new post-docs as the most important recruitment characteristic a very high motivation. Only second important were characteristics like the specific knowledge a post-doc should have, an adequate behaviour, publications the post-docs has written or has been involved in and whether the post-doc fits socially or not.

1 Introduction to the NetReAct project and the deliverable

1.1 Overall aim and structure of the project

The "The role of Networking in research activities" (NetReAct) project is designed to capture, describe and analyse the strategies, patterns, dynamics and impact of networking in research activities in the life sciences in 10 European countries. The objectives are as in the Tender Specifications, specifically to develop and apply methods to shed light on current research collaboration behaviour of European universities, in particular in respect of the mobility of ideas and of personnel (brains) and in doing so:

- to assess the dynamics of universities' networking activities in respect of other universities, of public and private research bodies and
- to measure the capacity of universities and their laboratories to attract doctoral students and post-doctoral staff from other geographical areas.

The work is structured along four work-packages:

- Work-package 1: Characterisation of doctoral students
- Work-package 2: Bibliometric measures of networking activities and of their impact
- Work-package 3: Characterisation of post-doctoral training
- Work-package 4: Analysis of the datasets

The research objectives are pursued with different methodological approaches of data collection (and interpretation):

- a *questionnaire-based survey* targeted principally at heads of research teams to collect data on the doctoral students and post-docs at these institutions as well as further covariates which are supposed to influence research productivity,
- *bibliometric data* (publication and citation statistics) taken from the Thomson-ISI database to assess the levels of collaboration and output produced by these institutions, and
- *webometric data* (hyperlinks) collected from the internet to evaluate the position of these institutions in the virtual life sciences networks.

The different datasets will be combined in work-package 4 to develop profiles of life sciences research teams and analyse their research productivity. Work-packages 1 and 3 mainly rest on the data gathered in the survey which will be described subsequently. Bibliometric and webometric methods are described in the deliverables of work-package 2.

The data collections and analyses of the NetReAct project are carried out for 10 countries as required according to the tender specifications: France, Germany, the UK, Italy, Spain, Portugal, Sweden, Norway, Hungary, and Czech Republic.

The life sciences disciplines included in the analysis were originally based on two different classifications: (1) the ISCED97 classification and (2) the K.U. Leuven-IRO Subject Classification. In line with the tender specifications, the ISCED97 classification was used to identify the scientific disciplines of research teams and their members (heads of the teams, PhD students, post-docs) from an education-related point of view. The exploratory interviews taught us that the ISCED 1997 classification is not really in line with the self-perception of team leaders in the life sciences (see NetReAct deliverable 1.1, p. 60). Hence, we chose to use the K.U. Leuven-IRO classification for identifying the research fields of the research teams in the survey and the bibliometric analysis. The K.U. Leuven-IRO classification uses a broader concept of the life sciences and accounts for the fact that life scientists do not publish only in journals of their core fields, but also in journals of related and neighbouring fields. Three major fields – Biology (Z1-Z5), Biosciences (B) and Biomedical research (R) – cover the life sciences as defined in ISCED97.

1.2 Research teams as the basic unit of analysis

The main unit of analysis in NetReAct is the research team or research group. We understand as a research team a group of people, scientists and non-scientists, which work in the same location for a longer time period to produce new scientific knowledge.[1] The group of people is part of one or several larger organisations (university, department, school etc.), but at least some of its members are employed by a university. Also, the team is recognized from the outside as a separate entity.

The definition uses different restrictions in regard to location, time, and people. The geographical restriction may be somewhat counterintuitive and against the growing tendency to virtual collaboration facilitated by the internet and other computer networks. It was nevertheless necessary in order to clearly meet one of the main objectives of the study which lies in juxtaposing the effects of group features and inter-group collaboration on research productivity. The inclusion of non-collocated and virtual members in the groups would have made it difficult if not impossible to distinguish clearly between external group members and collaborators. For the same reason, visiting scientists and guest workers were not included in the research teams if they stayed less than six months.

We do not limit the research group to people that are employed by the same organisation or to publishing authors only. Limiting the teams to scientists employed by one institution would force us to ignore the open organisational approach to research groups taken in some countries. However, to limit the overall scope of the analysis and in line with the Tender Specifications we only selected teams which were affiliated to a university. As one of our main purposes is the evaluation of the role of doctoral students and post-docs in research groups, we could not limit the groups to co-authors.

[1] See on other possible ways of defining research groups: NetReAct deliverable D1.1, pp. 15-16.

Research teams as we understand them might but need not coincide with what Joly and Mangematin (1996), Laredo and others (1999, 2001) defined as laboratories. Bigger labs which consist of several units or teams are not included entirely, but only with one or several of their teams. This selection of the smaller unit was mainly due to our topic and empirical approach: as we requested detailed information on doctoral students, post-docs and collaboration activities, we had to address informants with sufficient knowledge on these issues. Furthermore, Joly and Mangematin (1996, p. 916) point out that the logic which governs the relationships between science and industry varies between research teams. This should also apply to the relationships between research teams from science – it would be daring to assume that all teams within a lab have the same collaboration relationships and degree of integration into scientific networks. Therefore, the team level is essentially the more appropriate one for our type of analysis.

Research teams are not isolates, however, but they are linked to other groups through research networks, i.e. the informal and loose interactions and relationships which exist between the heads and principal investigators of research teams (see NetReAct deliverable D1.1, pp. 16-18).

1.3 Contents of this deliverable

The present report is partly based on the deliverable D1.3. We adopted the same structure and also parts of the document which were considered to be important for the analyses of post-doctoral training. This approach was deemed to be useful since both reports are of the same nature: the D1.3 mainly deals with an analyses of the characteristics of PhD students whereas this report is focussed on post-docs. Furthermore, the underlying questions in the survey questionnaire were mainly the same for doctoral students and post-docs.

The deliverable D3.2 provides a first descriptive analysis of the responses to the survey of life sciences research teams focussing on two issues:

- a brief description of the distribution of the dataset by country, scientific discipline, age and size of the responding teams,
- a more detailed analysis of the survey responses on post-docs.

Though several of the issues discussed in the NetReAct deliverable D1.1 are revisited in this deliverable, it is not an exploration of the 22 hypotheses formulated there (see D1.1. pp. 6-8 for a summary). This is not yet possible, as the bibliometric data collected in WP 2 are a necessary ingredient to this. This final step will be carried out in work-package 4. The present deliverable rests mainly on the survey results and in particular on the responses to the questions on post-docs.

Chapter 2 recalls the work done within WP 1 to generate the research population and sample of life sciences research teams and shows some basic survey statistics. Furthermore, the survey results are analysed in order to assess the representativeness of the survey responses. Since D1.3 already made this in detail we here only summarise the findings.

In chapter 3 we provide a general overview of the survey results. In particular, we show the distribution of teams by country, scientific discipline, age and size. These variables are used in the remainder of the deliverable for structuring the responses and comparing different subgroups of teams. A comparison for the numbers of post-docs and their shares among the total team personnel between different groups of teams is included in the second part of chapter 3.

Chapter 4 carries out a more detailed description of several variables for post-docs built on the basis of the survey results. These variables refer to post-docs working in the life sciences teams at the beginning of 2003, the post-docs leaving the teams, the factors influencing the attractiveness of life sciences teams for post-docs and desired characteristics of applicants for post-doctoral research positions. For each set of variables we show the responses for the entire dataset and we differentiate by country, main discipline, age and size of the team. These descriptions are necessary to obtain a good understanding of the structures of the dataset (for post-docs).

At this stage of the research it does not make much sense to draw conclusions and a summary has been provided at the beginning of the deliverable. The last chapter therefore summarises the analysis of the data.

2 NetReAct survey on life sciences research teams

2.1 Research population and sample of the project

2.1.1 The research population

The primary statistical unit of analysis is the university-based research team. The identification of the population of life sciences research teams drew heavily on the International Handbook of Universities (International Association of Universities [IAU], 2003) and the internet as sources of information. The research population was assembled in three major steps of work:

1) The International Handbook of Universities was used to identify universities with teams in the life sciences.
2) From the websites of these universities we collected the names and URLs (WWW addresses) of the life sciences teams, searching for groups mentioned by the IAU and also navigating the university faculty/department structure to look for additional groups. The name and URL collection produced "hierarchical trees" which included the information on the faculties, departments, institutes and research teams.
3) The web pages of the sample teams (see below on the sampling) were submitted to a closer review when their addresses were collected. This led to the identification of further research teams which were subsequently added to the research population.

A particular challenge was the distinction of university research teams from teams of non-university research organisations and other tertiary education institutions (colleges). In most countries the exclusion of the non-university research sector was easy to implement, because the organisations appear as separate entities. For instance the institutes of the Czech Academy of Sciences, the German Max-Planck-, Fraunhofer and Leibnitz-Societies, the Spanish and Italian Research Councils (CSIC and CNR) are in most cases not included on university websites; and if they are included, they are clearly denoted as extra-university. Things are different in France: 85% of the CNRS research teams are in cooperation with universities and other research institutions and 45% of the INSERM laboratories are located in universities; many of these labs are run under cooperation agreements or they are actually mixed laboratories, so called "Unités mixtes de recherche (UMR)". Moreover, the temporary nature of the labs in France made the identification via the internet difficult, in particular if they were discontinued after the latest funding period. We opted to include these mixed teams, if a participation of university personnel was clearly discernible. This was applied in particular to the French case but also to other countries, when non-university and university personnel formed together a research team.

Other tertiary education institutions – in particular teaching-oriented colleges in the UK, university colleges in Sweden, and the *Fachhochschulen* in Germany – were generally not included in the research population.

The research population thus identified consists of more than 7,700 teams from 359 universities (see Table 2-1). We found more than nearly 1,600 teams in the UK and more than 1,300 teams in France and Germany. Relatively few teams – between 170 and 230 – were found in the smaller countries Portugal, the Czech Republic, Norway, and Hungary. Sweden has a relatively large life sciences sector with 650 teams. The average number of life sciences teams per university varies from more than 30 in the Nordic countries to only 15 in Portugal and the Czech Republic.

Table 2-1: Research population of life sciences research teams by country

Country	No. of universities with life sciences research teams	No. of life sciences teams identified	Life sciences teams per university
CZ	11	173	15.7
DE	61	1,447	23.7
ES	48	896	18.7
FR	57	1,384	24.3
HU	10	214	21.4
IT	47	952	20.3
NO	6	199	33.2
PT	15	229	15.3
SE	15	650	43.3
UK	89	1,588	17.8
Total	**359**	**7,732**	**21.5**

Source: NetReAct (FHSO).

2.1.2 Sampling and sample characteristics

For the statistical analyses of work-package 4 an overall dataset of at least 300 research teams was considered desirable to secure sufficient variation. On the basis of a country sample of 10 countries this would consist of on average 30 research teams per country. Response rates of newer postal surveys in an academic environment measured between 25% and 50% (Barjak & Harabi, 2004; Bozeman & Corley, 2004; Fritsch & Schwirten, 2002; Laredo, 1999; Walsh, Kucker, Maloney, & Gabbay, 2000). As the questionnaire was quite long, asked for rather detailed and not always readily available information on doctoral students and post-docs, and the survey period fell into the holiday season, we expected a low overall response rate of 25-30%. We further assumed 5% of the returned questionnaires to be only partially filled and unusable and a rate of usable questionnaires of 20%. This required a sample of at least 1,500 research teams in order to obtain the minimum number of 300 usable datasets.

We employed a stratified, random sampling to obtain these 1,500 research teams which is briefly described in D1.3, p. 18 (for a more detailed description see deliverable D1.1, p. 51-55).

This resulted in the sample as shown in Table 2-2. Overall 1,773 teams or 23% of the research population were selected for the sample. The coverage varies notably across countries, however. For the countries with the smaller life science systems more than 50% – in Czech Republic and Norway more than 60% – of the research population are included. This percentage goes down to only 16.3% for France and 18-19% for Spain, Germany, UK, and Italy. University coverage is generally higher, of course. However, the average number of teams in the sample per university is only 5.8.

Table 2-2: Sample of life sciences research teams per country

Country	Universities included		Teams included		Teams per university
	No.	In % of population	No.	In % of population	
CZ	11	100.0%	119	68.8	10.8
DE	56	91.8%	271	18.7	4.8
ES	39	81.3%	164	18.3	4.2
FR	49	86.0%	225	16.3	4.6
HU	10	100.0%	108	50.5	10.8
IT	39	83.0%	186	19.5	4.8
NO	6	100.0%	122	61.3	20.3
PT	15	100.0%	123	53.7	8.2
SE	14	93.3%	148	22.8	10.6
UK	65	73.0%	307	19.3	4.7
Total	**304**	**84.7%**	**1,773**	**22.9**	**5.8**

Source: NetReAct (FHSO).

Table 2-3: Inlinks to the life sciences research teams in the sample by country

Country	Inlinks per team	No website	Percentage of teams per inlink class					
			0	1-2	3-5	6-10	> 10	Total
CZ	2.0	3.4%	52.1%	25.2%	11.8%	6.7%	4.2%	100.0%
DE	10.7	1.1%	11.8%	15.9%	19.2%	21.0%	32.1%	100.0%
ES	3.0	17.1%	57.9%	18.9%	8.5%	9.8%	4.9%	100.0%
FR	4.3	3.6%	41.8%	28.0%	12.0%	9.8%	8.4%	100.0%
HU	4.1	3.7%	44.4%	27.8%	9.3%	6.5%	12.0%	100.0%
IT	2.1	12.9%	53.2%	21.5%	14.5%	8.1%	2.7%	100.0%
NO	6.0	0.0%	23.8%	32.8%	13.9%	9.8%	19.7%	100.0%
PT	9.1	15.4%	51.2%	13.8%	6.5%	7.3%	21.1%	100.0%
SE	8.0	3.4%	31.1%	27.0%	15.5%	7.4%	18.9%	100.0%
UK	7.6	3.3%	21.2%	24.4%	24.8%	14.7%	15.0%	100.0%
Total	**6.2**	**5.9%**	**35.7%**	**23.1%**	**15.1%**	**11.4%**	**14.7%**	**100.0%**

Source: NetReAct (FHSO & SCIT).

In Table 2-3 we provide the link statistics for the teams in the sample. The average inlink figure per team was higher in the sample than in the research population (see deliverable D1.1, p. 55) which served the purpose of having the top performers in life sciences research overrepresented. On average, 6.2 hyperlinks pointed to the homepages of the teams in the sample – high average link numbers can be found in Germany, Portugal, the UK and the Nordic countries.[2] They are considerably lower in the other countries in the sample. For 6% of the teams in the sample we could not find a homepage. In particular in the Southern European countries these percentages are higher with 17% in Spain, 15% in Portugal and 13% in the case of Italy. The distribution over the five inlink classes shows again the North-South divide that can also be seen in the average link data.

When the addresses for the research teams in the sample were collected from the WWW, additional information on the personnel was added. This serves the purpose of comparing the respondents to the survey with the overall sample and checking for any bias in the responses (see chapter 2.2.3). The results are shown in Table 2-4. The average size of the research team according to the WWW is 14.7 scientific and non-scientific workers, ranging from 10.2 in Portugal to 22 in Hungary. Across all countries each life sciences team trains 5 PhD students. According to these figures sourced from the internet, PhD students approximately represent 30-35% of the total scientific and non-scientific staff. For nearly 700 or close to 40% of all teams in the sample the homepages also provided information on the post-docs working in these teams. We found 2.6 post-docs per team across the entire 10 country sample. However, it has to be noted that the figures on PhD students and post-docs are very much preliminary and only suitable for getting a vague overview of the sample structure. They were gathered from the World Wide Web, and even for those teams which provided them, we do not know, whether they are up-to-date and complete (probably in many cases they are not).

[2] The high average link number for Portuguese life sciences research teams is due to 21 teams from one university. The links to these websites are mainly internal links for navigational purposes. If these teams are excluded, the average inlink figure per team is reduced to 2.6.

Table 2-4: Average number of staff of sample teams by country (according to the WWW)

Country	Total scientific and non-scientific staff	PhD students[a]	Post-docs[b]
CZ	15.1	6.2	1.7
DE	16.8	5.5	3.2
ES	12.2	4.6	1.8
FR	17.8	5.0	1.9
HU	21.7	4.3	2.8
IT	10.2	3.2	1.5
NO	12.5	4.0	2.8
PT	11.0	4.6	2.2
SE	13.4	5.8	2.2
UK	13.0	5.9	3.9
Total	**14.7**	**5.0**	**2.6**
Valid N (% of sample)	**1,374 (77.5%)**	**954 (53.8%)**	**697 (39.3%)**

Source: NetReAct (FHSO).

2.2 Survey methodology, responses and representativeness

2.2.1 Survey methodology

NetReAct implemented a questionnaire-based survey to collect information on doctoral students and post-docs. This survey is also used to gather further information at research team level critical for progressing understanding of key hypotheses in the analysis and modelling of WP4. This information will help resolve spurious correlations and dismiss some important rival hypotheses when it comes to assessing the impact of collaboration and other networking activities on scientific output (WP4).

The questionnaire was developed in order to collect information on doctoral students and post-docs in the life sciences as specified in the tender, as well as some additional control variables. In particular it contained questions on (see annex 2 on the full questionnaire):

- The research group, its affiliation(s), research fields, overall personnel numbers and development since 2003;
- Factors that determine the attractiveness of research teams and PhD students and post-docs in the recruitment process;
- Characteristics of doctoral students and post-docs, including demographic and education-related information;
- Profiles of the heads of the research teams;
- Number of collaborating teams and motivations to engage in research collaborations;
- Publication lists or publishing scientists in a team as input to the bibliometric analyses of WP2;

- The questionnaire itself as a test of the methodological approach.

Overall, the questionnaire was rather long, with 31 separate questions and many of them in the form of complex tables. In particular the respondents had to fill in some rather detailed information on doctoral students and post-docs with which not all of them were familiar (see NetReAct D1.1, p. 70). The questionnaire was drawn up in English. We assumed that this would not have any significant negative impact on the response rate, as English is the lingua franca of science and most scientists read and understand it well enough. Also, a recent survey among scientists in five disciplines conducted by one of the NetReAct partners did not show any major influence of the mother tongue on the response rates to an English language questionnaire (see Barjak & Harabi, 2004).

The data collection was carried out in two different ways:

1) A Word on screen version of the questionnaire was e-mailed to part of the sample with a request to return the completed questionnaire by e-mail.
2) An e-mail with a personalised hyperlink leading to an html (internet) version of the questionnaire was sent to the other part of the sample. The respondents were asked to fill in the questionnaire on screen and save it at the end.

In order to reduce non-responses an additional Word for print version was produced and offered to be sent out on request.

The survey approach was evaluated through a pre-test with 69 teams from UK, DE, and FR. The responses proofed the general feasibility of the approach and after minor corrections and changes of the questionnaire, the mailing started in the first week of July. Because of the holiday season the overall response period was extended to the beginning of September. From July to September the teams received up to three reminders asking for completion of the questionnaire.

2.2.2 Responses to the survey

Overall, out of 1,773 teams in the sample 773 (43.6%) showed a measurable response (see Table 2-5). 962 teams had not responded till the closing of the survey (September 12, 2005). Of these 962 teams 34 (1.9%) had not received the questionnaire, because a correct e-mail address for the team leader could not be found through the internet.[3] Particularly high response rates of more than 50% appear for Portuguese, Italian, Norwegian, and Hungarian teams. Rather low are the rates for France, Germany, Spain and the UK.

[3] This number is quite small. However, in each of the mailings e-mails to previously seemingly working mail addresses were returned as undeliverable and errors could be corrected. Thus we assume that some additional delivery failure notes may have been suppressed by the sending or receiving mail servers and that the actual number of undelivered mails might be higher.

Table 2-5: Responses to the survey by country

Country	No response		Not deliverable		Response		Total N
	N	in %	N	in %	N	in %	
CZ	62	52.1%	2	1.7%	57	47.9%	119
DE	162	59.6%	4	1.5%	110	40.4%	272
ES	100	61.0%	1	0.6%	64	39.0%	164
FR	138	61.3%	8	3.6%	87	38.7%	225
HU	49	45.4%	2	1.9%	59	54.6%	108
IT	85	45.7%	3	1.6%	101	54.3%	186
NO	54	44.6%	0	0.0%	67	55.4%	121
PT	53	43.1%	1	0.8%	70	56.9%	123
SE	75	50.3%	0	0.0%	74	49.7%	149
UK	184	60.1%	13	4.2%	122	39.9%	306
Total	**962**	**54.3%**	**34**	**1.9%**	**811**	**45.7%**	**1,773**

Source: NetReAct survey 2005.

Around six percent of the respondents stated, that they did not have responsibility for a life sciences research team at the beginning of 2003 and that our questions were therefore not applicable to them (see Table 2-6). In most cases these were young team leaders who had obtained this position within the previous two years, and in some instances we had contacted retired scientists. For Norway this share is notably higher than for the other countries which points to a considerable fluctuation of team leaders. In addition, 4.3% of the respondents refused to participate in the survey usually stating time constraints. Across all countries 60% of the responses could be included in the NetReAct analyses. In other words, 26.4% of the respondents included in the original sample provided usable questionnaires.

Table 2-6: Usable responses to the survey by country

Country	All responses		Not applicable		Participation refused		Usable questionnaires	
	N	in %	N	in %	N	in %	N	in %
CZ	57	100.0%	4	7.0%	2	3.5%	30	56.6%
DE	110	100.0%	8	7.3%	9	8.2%	60	60.0%
ES	64	100.0%	2	3.1%	0	0.0%	37	57.8%
FR	87	100.0%	6	6.9%	3	3.4%	56	69.1%
HU	59	100.0%	3	5.1%	1	1.7%	34	61.8%
IT	101	100.0%	2	2.0%	0	0.0%	52	51.5%
NO	67	100.0%	10	14.9%	6	9.0%	37	58.7%
PT	70	100.0%	6	8.6%	1	1.4%	44	64.7%
SE	74	100.0%	3	4.1%	5	6.8%	41	60.3%
UK	122	100.0%	6	4.9%	8	6.6%	77	64.2%
Total	**811**	**100.0%**	**50**	**6.2%**	**35**	**4.3%**	**468**	**60.5%**

Source: NetReAct survey 2005.

2.2.3 Representativeness of the responses

The detailed analyses of the representativeness of the received responses is given in deliverable D1.3, section 2.2.3, p. 23 and the following. At this point, we only repeat and summarise the main outcomes.

According to the information available for the sample the responses constitute a representative selection of this sample and – as the sampling was randomised – therefore a representative part of the entire population of life sciences research teams in the 10 NetReAct countries. Minor limitations to representativeness appear:

- For the inlink numbers of Italian teams: As the link figures are presumed to be related to the performance of the teams (see deliverable D1.1, p. 52), we might have a slight underrepresentation of outperforming Italian teams in the sample.
- For the post-docs in Portuguese and Swedish teams, the former having more post-docs per team in the responding teams than in the entire population and the latter having fewer post-docs in the dataset teams.
- In regard to gender in Germany and Spain: In Germany teams led by females are slightly overrepresented and in Spain they are underrepresented among the responding teams.

These particularities should be kept in mind in the analysis of the survey results. However, they are all of minor extent and do not affect the validity of the results.

2.2.4 Time needed to complete the questionnaire

For obtaining a satisfactory response rate it was crucial to keep the effort of responding as low as possible. The NetReAct survey tried to reduce the effort for the team leaders by animating them to delegate some of the responses to assistants. However, only 18 respondents stated that they had delegated questions to assistants or asked colleagues to provide some of the answers for them.

Given the information the respondents have provided, the average time needed to fill in the questionnaire was 20 minutes (median) which matches quite well with the projected time of 15 minutes.

A more detailed view on the time needed could be found in D1.3, p. 27.

3 General distribution of the survey responses and role of the post-docs

This chapter provides a general overview of the survey results. In particular, we show the distribution of teams by country, scientific discipline, age and size. These variables are used in the remainder of the deliverable for structuring the responses and comparing different subgroups of the teams. A comparison for the numbers of post-docs and their shares among the total team personnel between different groups of teams is included in the second part of the chapter.

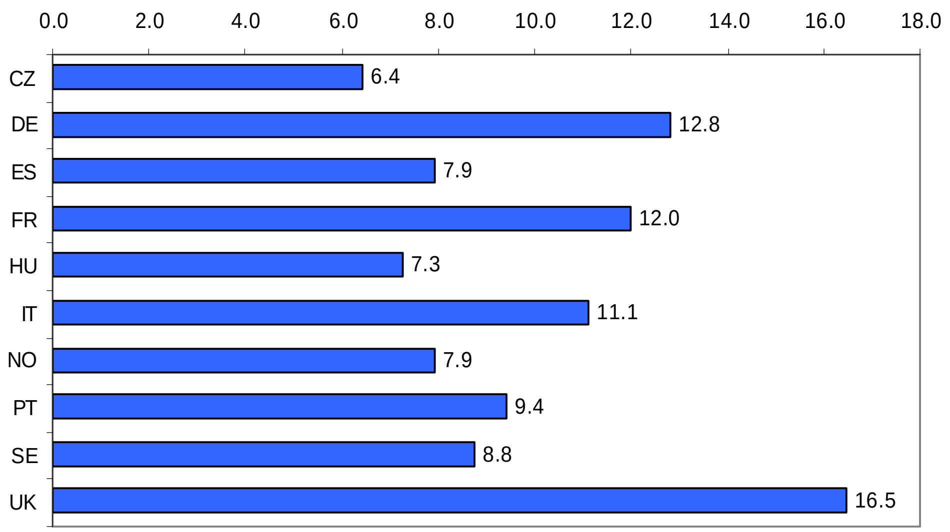
3.1 Distribution of the responses

Distribution by country

The country information is available for all 468 teams which provided usable responses to the survey. Very few team leaders (2 in total) had changed the country between the beginning of 2003 and the realisation of the survey in summer 2005.

As Figure 3-1 shows, the largest share of valid responses comes from the UK (17%). The other big countries in the sample, Germany, France and Italy, also contribute with more than 11% each. Each of the other six, smaller countries make up between 6% and 10% of the total. Even for the country with the smallest number of usable responses, the Czech Republic, we reached the threshold of 30 responses (see Table A-3 in the annex).

Figure 3-1: Share of teams by country (percentages)



Source: NetReAct survey 2005.

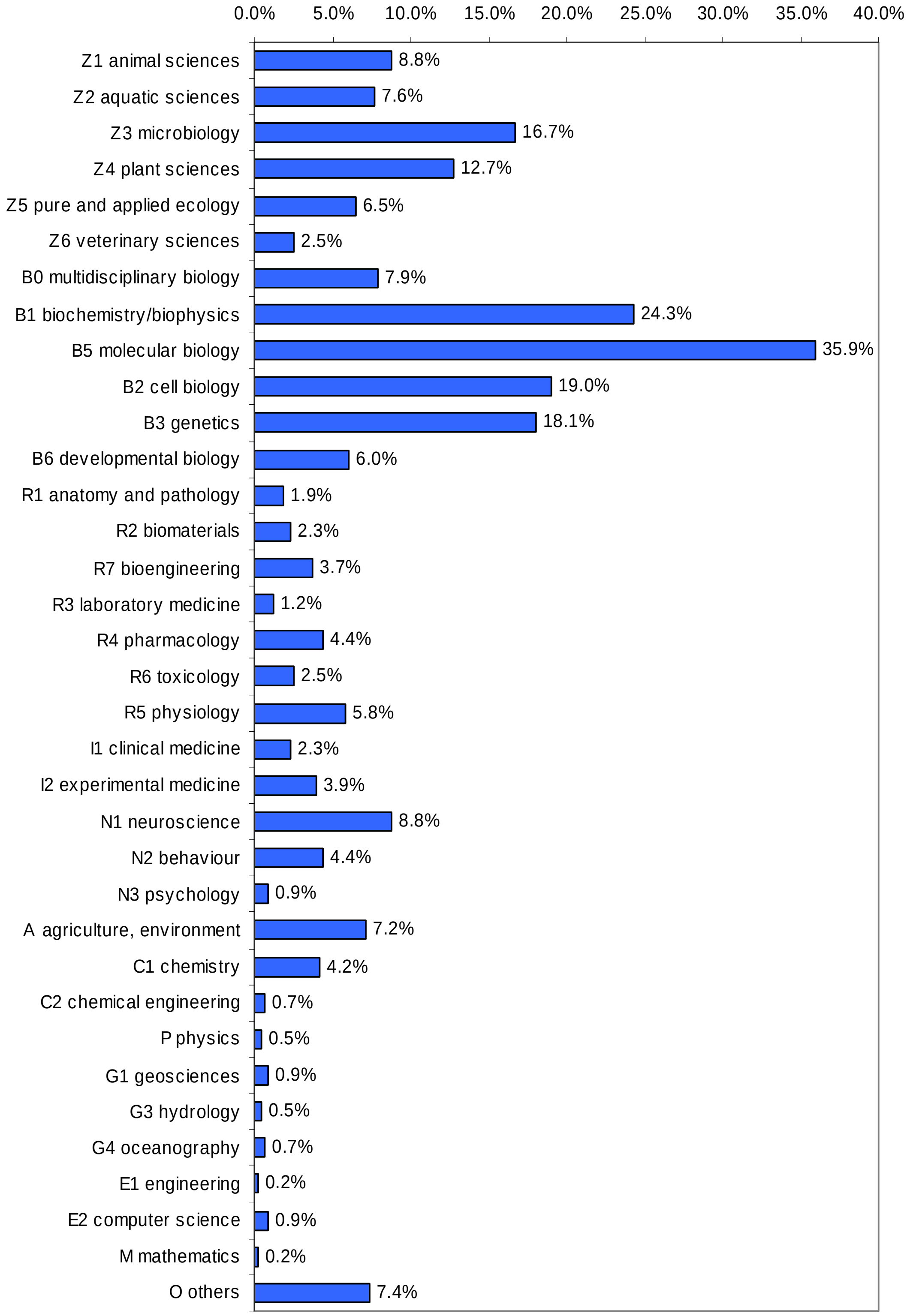
Distribution by field and discipline

In order to assess the academic disciplines of the research groups the questionnaire included a question on the most important fields covered by PhD research at the beginning of 2003. According to the exploratory interviews conducted in advance to the survey, it was decided to use the research-oriented K.U. Leuven – IRO Subject Classification, as some interviewees (team leaders in the life sciences) had problems to match their research activities with the rather education-oriented ISCED 1997 classification (see D1.1, p. 60). Annex Table A-4 shows the classification that was included in the questionnaire as drop-down lists. The respondents were asked to select a maximum of three fields from this list.

Out of 468 usable responses 36 (7.7%) had missing values for this question. This might be due to the focus on "PhD research": If the respondents did not have any PhD students in their team, they might not have known how to answer the question.

The distribution of the valid responses by field is shown in Figure 3-2. The largest share of 36% of the teams carried out PhD research in molecular biology; next comes biochemistry/biophysics in which nearly one fourth of the teams were active. Further big fields present in 15-20% of the teams are cell biology, genetics, and microbiology.

Figure 3-2: Share of teams by discipline (percentages)



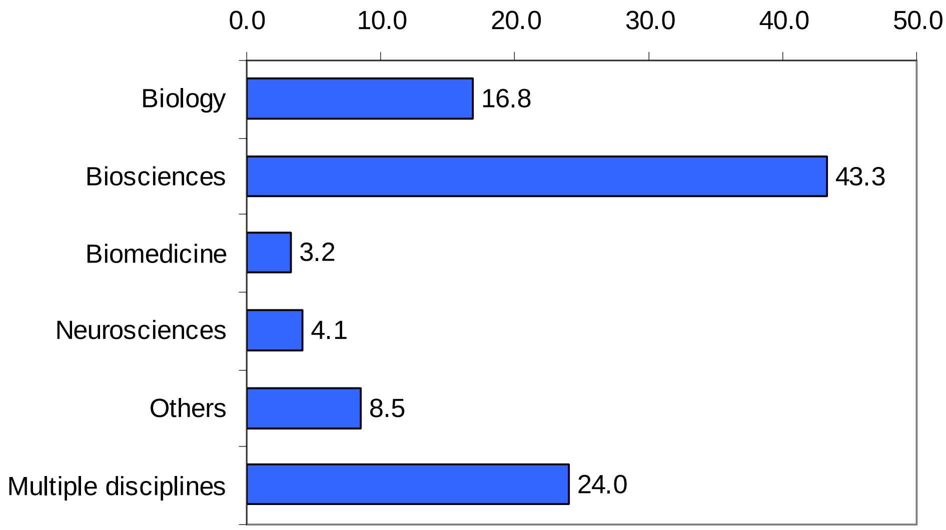
a Percentages exceed 100% as up to three answers were possible.

Source: NetReAct survey 2005.

As a next analytical step the fields were added to academic disciplines. We proceeded as follows: all fields were added to the disciplines biology (Z-fields), biosciences (B-fields), biomedicine (R-fields), neurosciences (N-fields), and other disciplines (I-, A-, C-, P-, G-, E-, M-, and O-fields). The main discipline was selected as the one to which the majority of fields could be attributed, e.g. if the respondent gave three fields B5 molecular biology, B2 cell biology, and Z3 microbiology the main discipline B biosciences was selected. If two or three fields in different disciplines were chosen by the respondent and a clear majority could not be found the case was labelled as multidisciplinary.

Figure 3-3 shows the results according to the IRO - K.U. Leuven Subject Classification. Again, the figure shows that biosciences are the most important discipline in the dataset. More than 40% of the teams belong primarily to this discipline. Nearly one fourth of the teams were classified as multidisciplinary and 17% facilitate PhD research in biology. Biomedicine, neurosciences and other disciplines are less important.

Figure 3-3: Share of teams by main academic discipline (K.U. Leuven – IRO Subject Classification, percentages)



Source: NetReAct survey 2005.

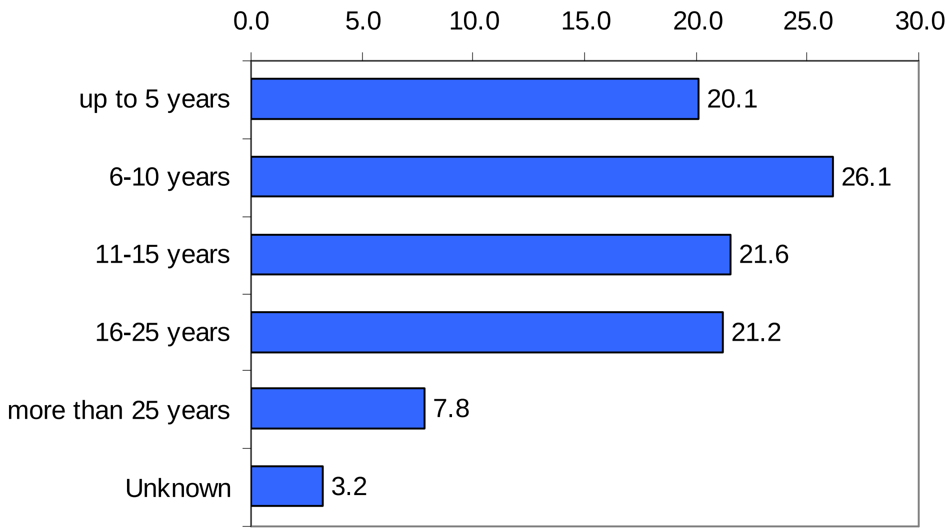
Distribution by age of the team

In order to assess the age of the teams, a question was included in the questionnaire that asked for the year in which the group had started to do research. This specification was preferred to the year of founding or official recognition of a team which may differ from the year in which the research started, as the exploratory interviews had shown (see D1.1, pp. 59-60).

Figure 3-4 provides the grouped responses to this question converted to the age of the team. Accordingly, nearly half of the teams are up to 10 years old and almost 90% are not more than 25 years old. Only a small percentage of 8% is more than 25 years old.

For few teams the actual starting year of research was not known by the respondent – we can assume that these are older teams, too, which were founded before the current leader had taken over.

Figure 3-4: Share of teams by age of the team (percentages)



Source: NetReAct survey 2005.

Distribution by team size

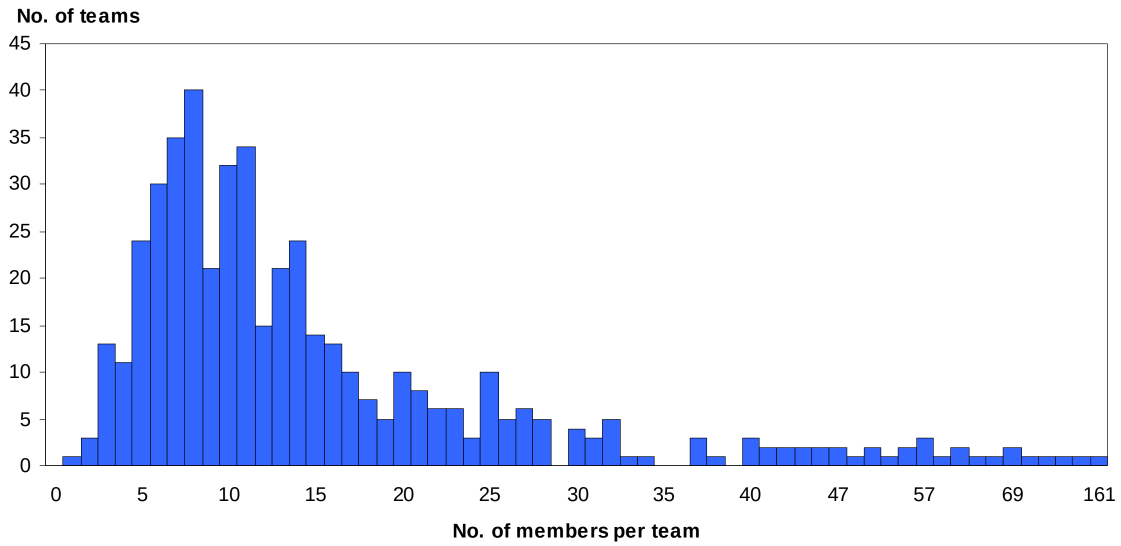
Seven different personnel categories were assessed for each team:

- Principal investigators (e.g. team leaders, professors)
- Post-doctoral researchers (usually PhD under 5 years ago i.e. 1998 or after)
- Other researchers (with PhD before 1998)
- PhD students
- Other research students (e.g. Masters students)
- Technical Staff (posts not requiring PhD or equivalent)
- Other staff (e.g. administrative)

The respondents were asked to include in this numbering all personnel on leave for less than 6 months and guests or visitors staying for more than 6 months. The responses were summed up to obtain the total size of each team. The range of team size is from 1 (1 case) to 161 members (Figure 3-5) and the histogram shows a peak in the range of 7-11 members (sizes with 0 cases are not shown for team sizes larger than 40). The 3 cases with more than a hundred team members (161, 137, and 132) should probably be considered as outliers. But even among the other 16 teams with more than fifty members a majority are probably not teams according to our definition (see chapter 1.2) but entire institutes or departments.

Average team size is 11 members (median). The median is the better mean value in this case because of the outliers. The arithmetic mean of 16.2 team members is slightly larger than the team size as obtained from the WWW (14.3 persons, see D1.3, p.25). However, the data from the WWW has two weaknesses compared to the survey data: it includes all people listed on the website, except for research students at master level, provided that they were labelled as such and could be excluded. They were excluded from the web staff data, because we had not been able to identify a common practice of counting them as team members or not. Moreover, for the larger units in the survey no figures on team members were available on the web.

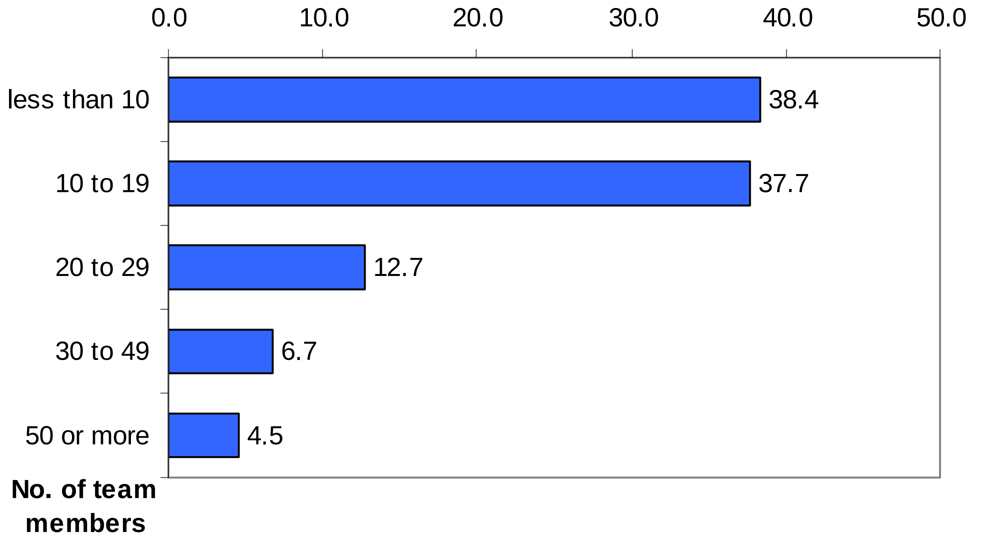
Figure 3-5: Histogram of team sizes[a]



a Sizes with 0 cases are not shown for team sizes larger than 40.

Source: NetReAct survey 2005.

Figure 3-6: Share of teams by team size group (percentages)



Source: NetReAct survey 2005.

Nearly 40% of the teams are small teams with less than 10 members and another 40% of the teams are medium-sized with 10 to 19 members (cf. Figure 3-6). Only 13% of the teams have 20 to 29 members. We assume that among the very big teams with 30 to 50 or even 50 and more members a number of departments or institutes are included – however, they add up to roughly 11% of the total only and therefore they will play a negligible role in the overall analysis.

3.2 Post-docs by teams

3.2.1 Detailed team structures

From the deliverable D1.3 we already know the basic structure of the research teams in life sciences. According to this, on average 2.2 post-docs, 4.6 PhD students and 2.4 principal investigators worked in the teams. The share of post-docs was only a half of the share of doctoral students (see D1.3, p. 35).

A somewhat higher percentage can be calculated from the data on the labs at the University of Louis Pasteur Strasbourg provided by Carayol and Matt (2004): 18.6% of their scientists are post-docs. Laredo (1999, pp. 30-33) obtains a similar share for labs in human genetics in six different European countries. If junior researchers are included and the overall lab size is calculated, still 20% of the human genetics personnel are post-docs.

Furthermore, between two and three other research students and technical staff worked on average in a team. Other researchers and other staff were less important. Looked at it from a different perspective, around two third of the team members were scientists and one third were assistants (other research students, technicians, administrative and other staff).

In the following a detailed analysis of the team structures is given. We look at the distribution of personnel groups by country, main discipline, age and size of the team.

Team structure by country of the team

Table 3-1 and Figure 3-7 show, that there are some noticeable differences with regard to the personnel structures of life sciences research teams across the ten countries. The highest average number of principal investigators was found in France, Portugal and Spain, whereas Swedish and Norwegian teams had less persons in this category. For the group of post-docs, above all British teams had the highest number. On the other hand, only 1.4 and 1.5 post-docs were on average in the teams in Sweden and Norway. A quite huge number of other researchers was employed in teams in ES and CZ; less were employed in DE and SE. The number of average PhD students per team is the highest in the Czech Republic (6.0), followed by the figure for Portugal (5.7). In contrast to this, in Italy only half as much doctoral students were employed in the teams. Other research students seemed to play an more important role in research teams in CZ, where 5.9 persons of this group were employed on average. Considerably less other research students were found in British and Swedish research teams. Taken together the technical and other administrative staff, we can observe a high average number of personnel in this group in French teams (6.2) and a low number in Sweden and Spain (1.0 and 1.1). The total group sizes were also different when analysing them by country: seemingly the biggest teams were found in France and Czech Republic, where an averaged team was constituted by more than 22 persons. The smallest teams were found in Sweden: only a few more than 10 persons per team.

Table 3-1: Personnel structure of the life sciences teams by country of the team

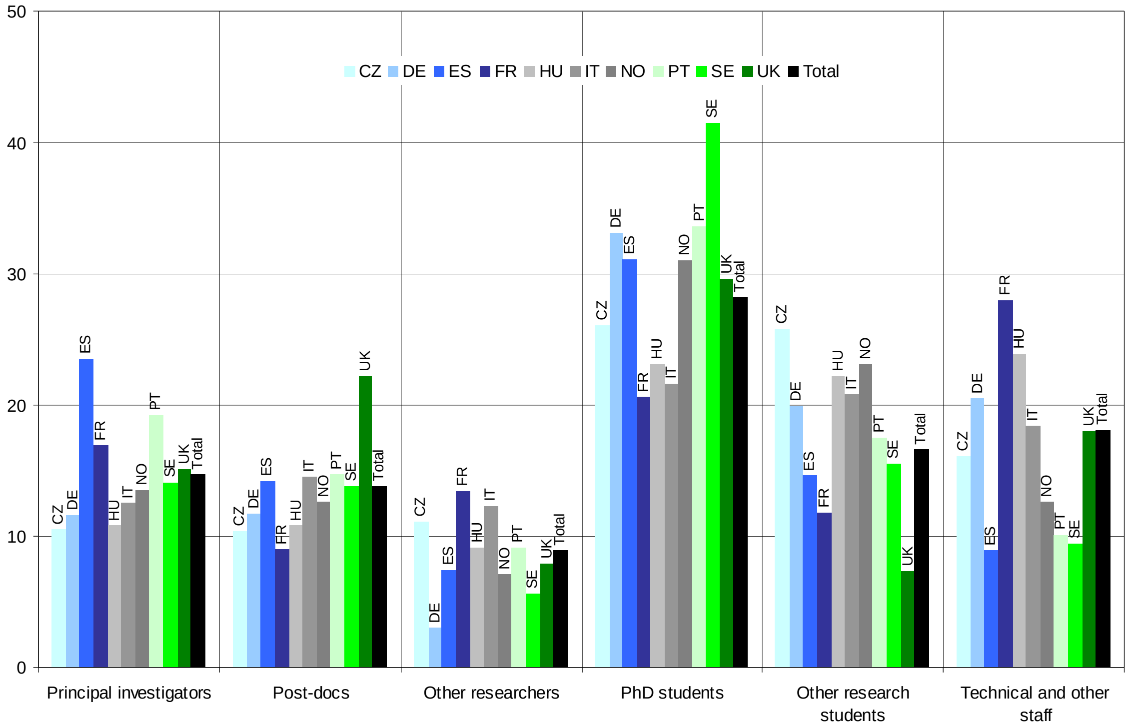
	Principal invest-igators		**Post-docs**		**Other researchers**		**PhD students**		**Other research students**		**Technical staff**		**Other staff**		**Total group size**	
	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*
CZ	2.4	*0.4*	2.4	*0.5*	2.5	*0.8*	6.0	*1.1*	5.9	*1.5*	2.7	*0.7*	0.9	*0.3*	22.8	*4.7*
DE	1.9	*0.3*	1.9	*0.3*	0.5	*0.1*	5.3	*0.5*	3.2	*0.5*	2.5	*0.4*	0.8	*0.1*	16.1	*1.4*
ES	3.0	*0.4*	1.8	*0.2*	0.9	*0.3*	4.0	*0.5*	1.9	*0.6*	0.8	*0.2*	0.3	*0.1*	12.8	*1.3*
FR	3.7	*0.5*	2.0	*0.3*	3.0	*0.5*	4.6	*0.6*	2.6	*0.3*	3.4	*0.5*	2.8	*2.1*	22.1	*3.0*
HU	1.7	*0.2*	1.7	*0.3*	1.4	*0.5*	3.6	*0.5*	3.4	*0.7*	2.8	*0.6*	0.9	*0.2*	15.5	*2.0*
IT	1.9	*0.2*	2.2	*0.4*	1.9	*0.6*	3.3	*0.5*	3.2	*0.9*	1.7	*0.6*	1.1	*0.6*	15.3	*3.3*
NO	1.6	*0.2*	1.5	*0.3*	0.9	*0.3*	3.8	*0.6*	2.8	*0.4*	1.4	*0.2*	0.1	*0.1*	12.2	*1.5*
PT	3.3	*0.5*	2.5	*0.3*	1.5	*0.8*	5.7	*0.6*	3.0	*0.5*	1.4	*0.3*	0.4	*0.2*	16.9	*1.7*
SE	1.5	*0.2*	1.4	*0.2*	0.6	*0.2*	4.3	*0.4*	1.6	*0.2*	0.8	*0.2*	0.2	*0.1*	10.4	*0.9*
UK	2.5	*0.4*	3.6	*0.5*	1.3	*0.3*	4.9	*0.7*	1.2	*0.2*	2.4	*0.7*	0.5	*0.2*	16.5	*2.0*
Total	**2.4**	***0.1***	**2.2**	***0.1***	**1.4**	***0.2***	**4.6**	***0.2***	**2.7**	***0.2***	**2.1**	***0.2***	**0.9**	***0.3***	**16.2**	***0.8***

Note: N=465.

Source: NetReAct survey 2005.

However, the more meaningful figures are the percentages of personnel group by country of the team (see Figure 3-7). Here, again the share of the principal investigators at the total group is the highest in Spain, France and Portugal, whereas the share of research team leaders etc. in Spanish teams is by far the highest: nearly every fourth person is a principal investigator. The picture for the distribution of the shares of post-docs at the teams is similar to the average numbers. Again, the highest share could be found in British teams. A very low share was observed for France, where less than every tenth person was a post-doctoral researcher. Seemingly unimportant was the group of other researchers in German teams (3%), whereas at least every tenth person in Czech, French and Italian teams was an other researcher. Swedish life sciences teams were constituted to a high share of PhD students: more than 40% of the total average Swedish team were doctoral students. In Germany, Spain, Norway, Portugal and the UK there are after all still around or more than 30% PhDs. Different the situation in French, Hungarian and Italian teams, where only 20% or a little more than this were doctoral students. The group of other research students played a more important role in CZ and was negligible for teams in the UK. Other administrative and technical personnel in research teams were strongly represented in French and Hungarian teams. In contrast to this teams in ES, PT and SE had only 10% maximum of this staff group.

Figure 3-7: Personnel structure by country of the team in % of total staff size



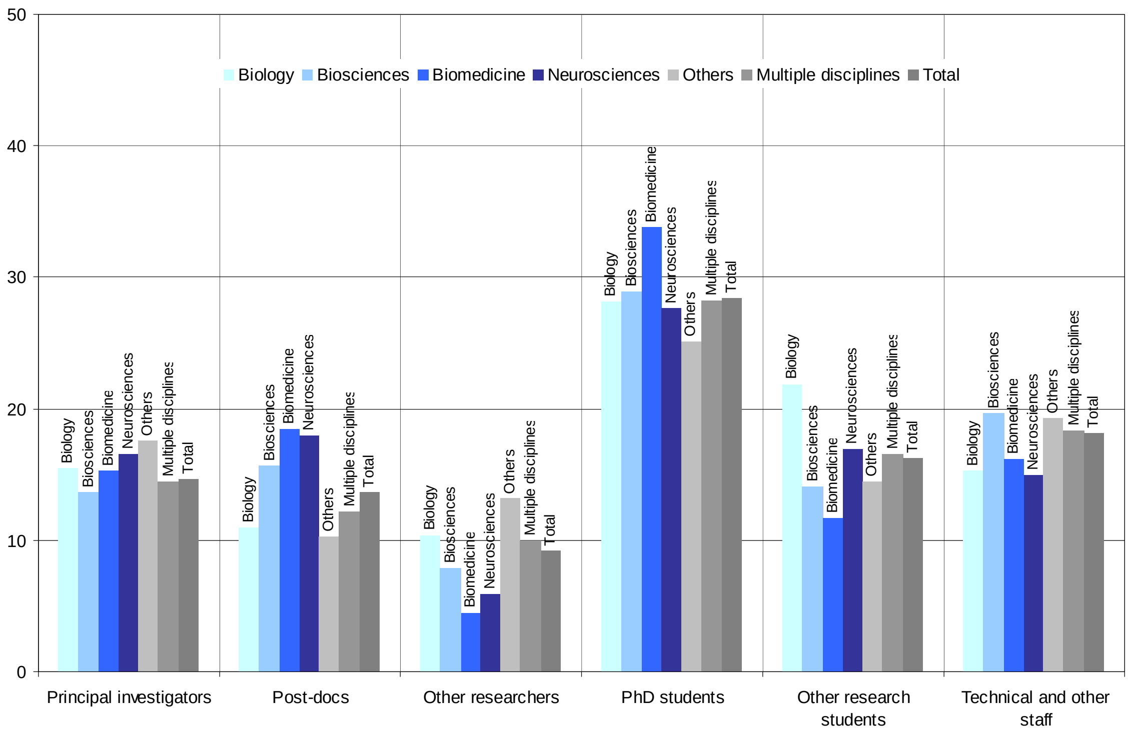
Note: N=465.

Source: NetReAct survey 2005.

Team structure by main discipline of the team

The distribution of average team numbers according to different personnel groups by the main discipline of the team is shown in Table A-30 in the annex. Total group sizes differ slightly: while biology and neurosciences group were constituted by more than 17 persons per team, biosciences and biomedicine teams had on average 2 to 3 persons less in their teams. Analysing the shares of personnel groups by the main discipline of the research teams, we see that the shares of principal investigators is in all disciplines nearly the same (see Figure 3-8). Different the situation for post-docs: biology teams had only 10% post-docs, teams in biosciences, biomedicine and neurosciences had at least 15%. In contrast to this biology teams were constituted to a higher share of other researchers than biosciences, biomedicine and neurosciences teams. More than 30% of personnel in biomedicine teams were PhD students, whereas in the other three disciplines this group was always represented less than 30%. Again, other research students – same as for other researchers – were most important in biology teams. According to other administrative and technical staff, seemingly biomedicine teams had the highest share.

Figure 3-8: Personnel structure by main discipline of the team in % of total staff size



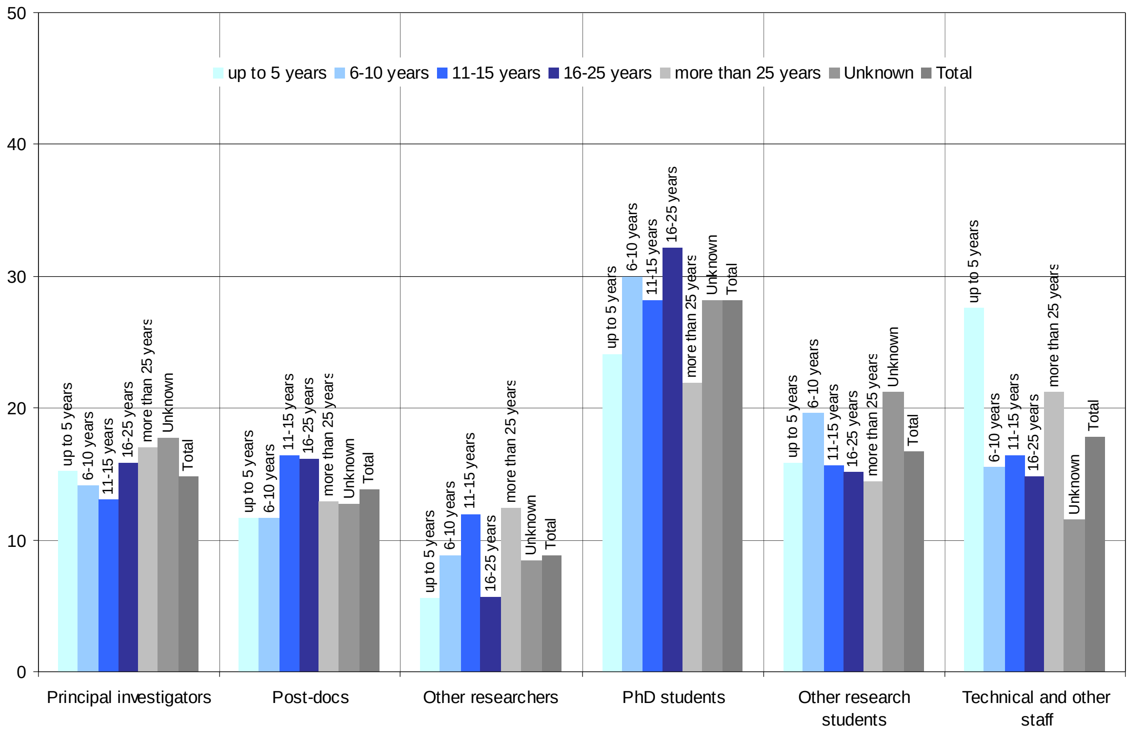
Note: N=432.

Source: NetReAct survey 2005.

Team structure by age of the team

It appeared to be that in particular young teams were quite small with only around 12 persons per team (see Table A-31 in the annex). The biggest teams were more than 25 years old and were constituted of about 23 persons. But, analysing the share of the different personnel groups by age of the teams, there were no striking differences observed (see Figure 3-9) – despite of the share of post-docs and PhD students: while in young and old teams there seemed to be less post-docs and PhDs, there were more employed in middle-aged teams. Also the relatively large share of technical and administrative staff in young and old teams was conspicuous.

Figure 3-9: Personnel structure by age of the team in % of total staff size



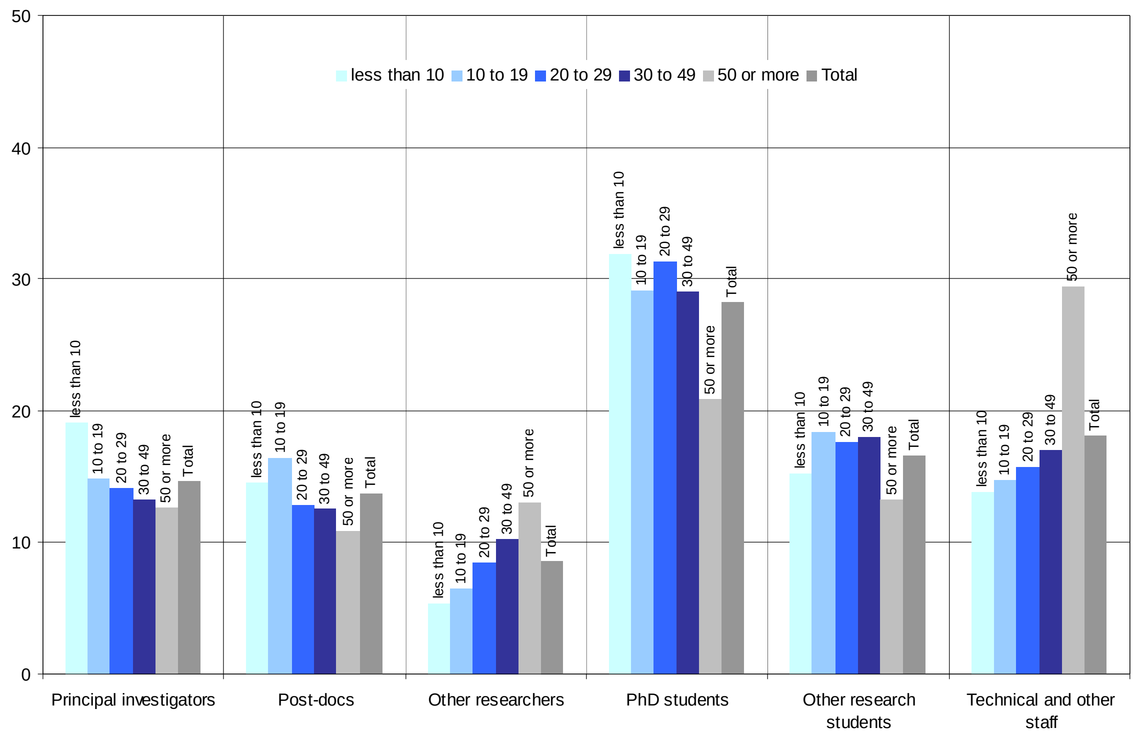
Note: N=461.

Source: NetReAct survey 2005.

Team structure by size of the team

Certainly, the distribution of personnel was linear to the size of the teams (see Table A-32 in the annex). The smallest size class had on average 6.4 team members; the size class 10-19 had 13 persons employed; teams with 20 to 29 staff members had 23.6 persons working in their team; 37 researchers and other staff were employed in teams of 30 to 49 persons; and in the biggest size class 73 staff members on average were found. The shares of the personnel groups by team sizes show some noticeable differences (see Figure 3-10). Smaller teams had more principal investigators, post-docs and PhDs. In contrast to this, bigger teams, in particular the biggest of more than 50 persons, had a higher share of other researchers and above all technical and administrative staff. This confirms the assumption we made in section 3.1 (see p. 29) that among the biggest teams a number of departments or institutes are included, where in general more other staff is employed than in pure research teams.

Figure 3-10: Personnel structure by size of the team in % of total staff size



Note: N=465.

Source: NetReAct survey 2005.

3.2.2 Role of post-docs in different groups of life sciences teams

The present chapter further looks at the total number of post-docs and investigates, whether their role differs between different groups of teams. The analysis distinguishes between the countries, academic disciplines, ages and sizes of the teams.

Post-docs by country of the team

If the number and percentages of post-docs are differentiated by the country of the team (cf. Table 3-2), four groups of countries appear:

- In German, French, Hungarian and Norwegian teams, there were comparatively few post-docs. The average number of post-docs (1.9, 2.0, 1.7, and 1.5 respectively) in each of these countries was lower than the country average (2.2). Also, the average share of post-doc researchers within the teams was lower than average for each of these countries.

- Portuguese[4] and British teams had relatively high numbers of post-docs (2.5 and 3.6) and the share of post-docs compared to other personnel was above the average of all countries. It seems that the importance of post-docs in British teams was clearly higher than in other countries. The share of post-docs at research teams in the UK was by far the highest: 22.2. Also the mean number of post-docs in British teams was higher than in every other country.
- Life sciences teams in Spain, Italy and Sweden[5] had fewer post-docs than average, but regarding the ratio of post-docs to total personnel, the group of post-docs was more important than in Germany, France, Hungary and Norway.
- For the Czech teams we count more post-docs than average. However, post-docs here made up only one out of ten of the total personnel which was a lower share than the average of all countries.

Table 3-2: Post-docs by country of the team

Country	Median	Arithmetic mean	95 % Confidence interval of the mean: lower bound	95 % Confidence interval of the mean: upper bound	In % of total staff	No. of teams
CZ	2.0	2.4	1.3	3.4	10.4	30
DE	1.0	1.9	1.3	2.4	11.7	60
ES	2.0	1.8	1.3	2.3	14.2	37
FR	1.0	2.0	1.4	2.6	9.0	55
HU	1.5	1.7	1.1	2.3	10.8	34
IT	1.0	2.2	1.3	3.1	14.5	51
NO	1.0	1.5	1.0	2.1	12.6	37
PT	2.0	2.5	1.8	3.1	14.7	44
SE	1.0	1.4	1.1	1.8	13.8	41
UK	3.0	3.6	2.7	4.6	22.2	77
Total	**2.0**	**2.2**	**2.0**	**2.5**	**13.8**	**466**

F-Test on the congruence of means: F-value 3.817, significant at $p<0.01$
Levene-Test on the homogeneity of variances: 2.709, significant at $p <0.01$
Robust tests on the congruence of means: Welch-Test: 3.056, significant at $p<0.01$, Brown-Forsythe-Test: 4.504, significant at $p<0.01$

Source: NetReAct survey 2005.

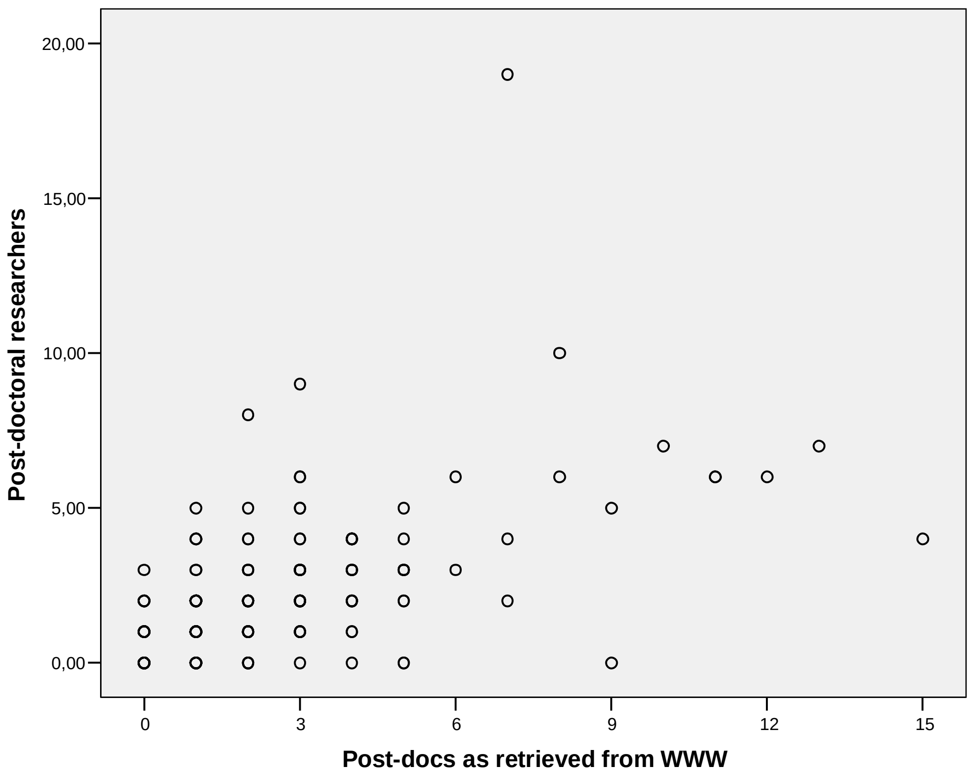
The results do not lend themselves to an easy explanation. New and old EU member states, northern and southern countries and eastern and western countries showed similarities. Beyond the UK results, variation across countries was rather small. As already mentioned above, life sciences research teams in the UK conspicuously seem to have relied more heavily on post-docs than teams elsewhere in Europe.

The validity of the survey data on post-docs can be checked by comparing it to data retrieved from the WWW. This is, however, limited to a tentative comparison, for only for 40% of the teams data can be found on the web, and web data are not necessarily

[4] The results for Portugal should be read carefully since there could be a selection bias, see section 2.2.3.
[5] The results for Sweden should be read carefully since there could be a selection bias, see section 2.2.3.

referring to the same reference time period as the surveyed data. However, the similarity is strikingly high on an European aggregate level (see Table 2-1 in comparison to Table A-2 in the annex, p. 85): according to the web research, the teams have an average number of 2.5 post-docs while the figure was 2.2 according to the survey. However, single country figures obtained from the web in part only weakly resemble the survey results. While figures concerning Spain, Sweden and the UK are similar to the respective survey information, other countries show partially larger deviations. However, the Pearson correlation coefficient between both data series is 0.55 and significant. The scatter plot shows this relationship (see Figure 3-11). This finding together with the according analyses in Deliverable 1.3 about doctoral students reinforces the validity of both sources of information on post-docs in the life sciences.

Figure 3-11: Number of post-docs according to the survey responses and teams' web presentations



Note: N=202, dots overlaying
Source: NetReAct survey 2005 and data collection from the WWW (FHSO).

Post-docs by main academic discipline of the team

The average number of post doc researchers in biology, biosciences, other disciplines and multiple disciplines all were around the average of the total, cross-disciplinary average. Biomedicine and neurosciences were clearly different (see Table 3-3). The mean values with 2.9 and 3.1 post-docs per team were much higher than the total average and than all the other disciplines. Furthermore, the share of post-docs in the total staff was clearly higher in these two than in other disciplines or than the total average. However, the figures for biomedicine should be read carefully. The confidence interval was quite large and the median much lower and far away from the mean, which both points to a statistical error.

All disciplines analysed were conspicuously similar with regard to the average number of post-docs employed in the corresponding teams: the mean number of post-docs was around 2 and the share at the total personnel was a little more than a tenth. Only the neurosciences teams seemed to consist of a higher number of post-docs. While the share of post-docs was higher than in any other discipline, this "anomaly" can not be found with regard to PhD students whose share in teams was as high in neurosciences as it was in the other research fields.

Table 3-3: Post-docs by main academic discipline of the team

Main discipline	Median	Arithmetic mean	95 % Confidence interval of the mean		In % of total staff	No. of teams
			lower bound	upper bound		
Biology	1.0	2.0	1.5	2.4	11.0	73
Biosciences	2.0	2.3	1.9	2.7	15.7	187
Biomedicine	1.0	2.9	-0.8	6.7	18.5	14
Neurosciences	3.0	3.1	2.1	4.1	17.9	18
Others	2.0	1.7	1.2	2.1	10.3	37
Multiple disciplines	2.0	2.3	1.8	2.8	12.2	104
Total	**2.0**	**2.3**	**2.0**	**2.5**	**13.6**	**433**

F-Test on the congruence of means: F-value 1.091, insignificant at $p<0.1$
Levene-Test on the homogeneity of variances: 2.276, significant at $p<0.05$
Robust tests on the congruence of means: Welch-Test: 1.919, insignificant at $p<0.1$, Brown-Forsythe-Test: 0.673, insignificant at $p<0.1$

Source: NetReAct survey 2005.

Post-docs by age of the team

The team age exerted some influence on the number of post-docs, but a clear difference to the rest was only obvious for younger teams, which had started research less than ten years before in the period 1995-2003 (cf. Table 3-4). These clearly had fewer post-doc positions than older teams (the mean was 1.4 for the youngest and 2.0 for 5-10 years old teams, which was lower than the total average of 2.2), both in numbers and as shares of the teams (only a little more than a tenth). For the very young teams this might be due to the fact that they were still in the process of being established, or in a process of expansion, respectively, and that in the beginning of 2003 some of the positions for post-docs still had to be filled. Moreover, younger teams still might have had to earn a reputation and get sufficient visibility through well regarded publications, before they become sought targets of post-docs. For the other groups of older teams a clear-cut trend cannot be seen.

Table 3-4: Post-docs by age of the team

Age of the team	Median	Arithmetic mean	95 % Confidence interval of the mean		In % of total staff	No. of teams
			lower bound	upper bound		
up to 5 years	1.0	1.4	0.9	1.9	11.6	92
6-10 years	2.0	2.0	1.6	2.3	11.7	121
11-15 years	2.0	2.8	2.2	3.5	16.4	100
16-25 years	2.0	2.4	1.8	3.0	16.1	98
more than 25 years	2.0	2.9	1.9	3.9	12.9	36
Unknown	2.0	2.2	1.0	3.4	12.7	15
Total	**2.0**	**2.2**	**2.0**	**2.5**	**13.8**	**462**

F-Test on the congruence of means: F-value 3.882, significant at p<0.01
Levene-Test on the homogeneity of variances: 2.707, significant at p<0.05
Robust tests on the congruence of means: Welch-Test: 3.617, significant at p<0.01, Brown-Forsythe-Test: 3.949, significant at p<0.01

Source: NetReAct survey 2005.

Post-docs by size of the team

Similar to the analyses of doctoral students by size of the team (see D1.3, p.39), it is somewhat trivial to state that smaller teams had fewer post-docs than larger teams. The important column in Table 3-5 is the one that shows the ratio of post-docs to total staff of the teams. Above all it shows that large units with 50 or more members had a somewhat smaller percentage of post-docs than teams with fewer personnel. However, this might be caused by the fact that these large teams were not always research teams according to our definition, but departments or institutes which also employed a larger share of overhead staff.

Table 3-5: Post-docs by total size of the team

Total team members	Median	Arithmetic mean	95% Confidence interval of the mean		In % of total staff	No. of teams
			lower bound	upper bound		
less than 10	1.0	0.9	0.8	1.1	14.5	179
10 to 19	2.0	2.1	1.9	2.4	16.4	175
20 to 29	3.0	3.0	2.4	3.6	12.8	59
30 to 49	4.0	4.6	3.7	5.6	12.5	31
50 or more	5.0	8.0	4.7	11.2	10.9	21
Total	**2.0**	**2.2**	**2.0**	**2.5**	**13.7**	**465**

F-Test on the congruence of means: F-value 67.762, significant at p<0.001
Levene-Test on the homogeneity of variances: 80.839, significant at p<0.01
Robust tests on the congruence of means: Welch-Test: 45.969, significant at p<0.01, Brown-Forsythe-Test: 19.657, significant at p<0.01

Source: NetReAct survey 2005.

Summary

From a quantitative perspective, post-docs were equally important in life sciences research teams as principal investigators, research students and technical staff. One out of seven team members were post-docs and the teams in the sample employed on average 2.2 post-doctoral researchers.

The numbers of post-docs per team varied across countries in the sample, but there were no clear divides visible – such as North-South, old-new member state, big-small country etc.. However, the result for the UK was surely notable: shares of post-docs by team and also the average number of post-docs were by far the highest compared to the other countries. The comparison of data on post-docs from two different sources (the WWW and the survey) showed similarities between both data series even though there were major structural differences between them. This supported the general validity of both methods for obtaining information on the number of post-doctoral researchers in research teams, at country level but also at the level of the individual research team.

A significant result of the comparison of the number of post-docs between teams which had their major research focus in different life sciences disciplines was that teams which undertook research in the neurosciences employed more post-docs than teams in other disciplines. Regarding the age of the team, we found that teams younger than 10 years tended to have fewer post-docs than older teams. In addition, large teams with 50 or more team members had fewer post-docs than smaller teams. However, this might be due to a misunderstanding on the side of the respondents who provided information for entire departments or institutes and not teams, as requested. Departments usually employ overhead staff (e.g. administration, library, joint laboratories etc.) which would inflate the denominator in the ratio of post-docs to total team members.

The following chapter provides a more detailed analysis of the post-docs in the life sciences research teams.

4 Characterisation of the post-docs in life sciences teams

The present section is based on questions asked in table format in which the survey respondents, the heads of the life sciences research teams, were asked to provide information on a selection of post-docs. The questions asked for a maximum of five post-docs who most recently (but before 2003) had joined the team or who most recently had left the team. The threshold of five students was deemed necessary to keep the effort of responding to the survey as low as possible. However, as we saw above the average number of post-docs per team is 2.2 (cf. Table 3-1, p. 29). More than 93% of all teams had 5 or fewer post-docs and only 7% had more than 5. Therefore, the information obtained covers all post-docs in a large part of the dataset and is still meaningful for the majority of the rest – even more than this is the case for the doctoral students (75% had fewer than 5 PhD students and 8% more than 8, see D1.3, p. 41).

For most variables we obtained information on more than 800 post-docs working in the teams in 2003 and more than 700 post-docs who left the teams since 2003.

4.1 Post-docs working in the teams in 2003

This section describes patterns of post-doc researchers' age, gender, discipline of research, country of origin and last degree, source and duration of funding, and work experience abroad and compares these patterns by the country, main discipline, age and size of their team.

4.1.1 Age

The mean age of the post-docs across the entire sample was 32.2 years. The youngest post-docs were to be found in the Czech Republic (30.1) and the UK (30.6). Post-docs in Germany and Spain were relatively old (33.3 and 33.9). These findings are somewhat in contrast to the distribution of the mean age of doctoral students across countries. Norwegian and Swedish PhD students were 2-3 years older, British were 2 years younger than on average (see D1.3, p.41). While the picture that we got of the doctoral students in the UK was corresponding to the figures of the British post-docs, (i.e. that seemingly researchers in life sciences in the UK were younger) this could not be observed for Czech post-docs. Also, the same trend could not be seen for the older doctoral students and post-docs, i.e. doctoral students in Norway and in Sweden were relatively old, but post-docs in these two countries were of an average age. Vice versa post-docs in Germany and Spain were quite old, but the age of the PhD students was around the average.

Table 4-1: Mean age of post-docs by country of the team

Country of the team	Arithmetic mean	95% Confidence interval of the mean lower bound	upper bound	Valid cases
CZ	30.1	28.8	31.4	19
DE	33.3	32.2	34.5	35
ES	33.9	32.0	35.9	28
FR	32.5	31.3	33.7	37
HU	32.6	29.6	35.5	19
IT	31.8	30.4	33.2	28
NO	32.7	31.6	33.8	21
PT	32.9	31.7	34.2	28
SE	32.9	31.7	34.2	31
UK	30.6	29.6	31.6	62
Total	**32.2**	**31.8**	**32.7**	**308**

F-Test on the congruence of means: F-value 3.106, significant at $p<0.01$
Levene-Test on the homogeneity of variances: 2.458, significant at $p<0.01$
Robust tests on the congruence of means: Welch-Test: 3.540, significant at $p<0.01$, Brown-Forsythe-Test: 3.023, significant at $p<0.01$

Source: NetReAct survey 2005.

Differentiating post-docs' age by the main discipline (according to IRO-K.U.L.) returns a slightly higher average age of post-docs in biology research teams and a slightly lower average age of post-docs in teams in the neurosciences (cf. Table 4-2). However, the variation across the disciplines was quite low and post-docs in different research fields were roughly the same age.

Table 4-2: Mean age of post-docs by main academic discipline of the team

Main discipline of the team	Arithmetic mean	95% Confidence interval of the mean lower bound	upper bound	Valid cases
Biology	33.7	32.4	35.0	48
Biosciences	31.3	30.7	32.0	123
Biomedicine	32.3	28.7	35.9	9
Neurosciences	31.1	29.0	33.2	12
Others	33.3	32.0	34.5	19
Multiple disciplines	32.4	31.4	33.4	73
Total	**32.2**	**31.7**	**32.6**	**284**

F-Test on the congruence of means: F-value 3.250, significant at $p<0.1$
Levene-Test on the homogeneity of variances: 1.181, insignificant at $p<0.1$
Robust tests on the congruence of means: Welch-Test: 3.241, significant at $p<0.01$, Brown-Forsythe-Test: 3.300, significant at $p<0.01$

Source: NetReAct survey 2005.

Looking at the distribution of the average age of post-docs by the size of the research groups, to some extent there were differences between teams of different sizes. While no clear discrepancies were found regarding doctoral students, in general, smaller teams tended to consist of younger post-docs than bigger ones (cf. Table 4-3). However, the biggest size class (i.e., teams that consisted of more than 50 persons) seemed to employ younger post-docs (30.9 in contrast to an average of 32.2 across the whole dataset).

Table 4-3: Mean age of post-docs by team size

Main discipline of the team	Arithmetic mean	95% Confidence interval of the mean lower bound	upper bound	Valid cases
less than 10	31.9	31.2	32.7	**108**
10 to 19	32.0	31.4	32.6	**115**
20 to 29	33.5	31.9	35.0	**39**
30 to 49	33.6	31.7	35.6	**26**
50 or more	30.9	28.9	32.9	**18**
Total	**32.2**	**31.8**	**32.7**	**306**

F-Test on the congruence of means: F-value 2.630, significant at $p<0.05$
Levene-Test on the homogeneity of variances: 2.554, significant at $p<0.05$
Robust tests on the congruence of means: Welch-Test: 1.909, insignificant $p<0.1$, Brown-Forsythe-Test: 2.210, significant at $p<0.1$

Source: NetReAct survey 2005.

The figures for the mean age of post-docs differentiated by the team age did not include any clear patterns or significant differences and therefore they were not reproduced in this report.

4.1.2 Gender

In contrast to the findings about gender distribution of doctoral students, there were slightly more male than female post-docs in the analysed life sciences research teams (cf. Table 4-4). This finding applies to the majority of countries in the dataset. It was particularly pronounced for Spanish and British research teams, in which around six out of ten post-docs were male. French and Norwegian life sciences research teams had a gender distribution with nearly balanced male and female post-doc shares. In general, no strong dominance of male post-docs was observed, but with roughly 71% female post-docs in Italian research teams there was one outlier. It seemed that young Italian life sciences researchers were more likely to be female than male, which is proved by the figures for PhD students (61.0 % female and 39.0 % male, see D1.3, p.43).

Table 4-4: Percentages of post-docs by gender and country of the team

Country of the team	Gender of the post-docs					
	Male post-docs		Female post-docs		All post-docs	
	N	In %	N	In %	N	In %
CZ	19	57.6	14	42.4	33	100.0
DE	62	54.4	52	45.6	114	100.0
ES	35	60.3	23	39.7	58	100.0
FR	49	52.7	44	47.3	93	100.0
HU	18	58.1	13	41.9	31	100.0
IT	19	29.2	46	70.8	65	100.0
NO	21	47.7	23	52.3	44	100.0
PT	32	45.1	39	54.9	71	100.0
SE	52	55.9	41	44.1	93	100.0
UK	124	59.9	83	40.1	207	100.0
Total	**431**	**53.3%**	**378**	**46.7%**	**809**	**100.0%**

Source: NetReAct survey 2005.

The gender distribution of post-docs also varied between the academic disciplines (cf. Table 4-5): with a share of 66.7 % in biomedicine research teams there was a clear male dominance. Only in biosciences, which at the same time was the discipline with the highest share of female researchers (50.1 %), the distribution between female and male post-docs was balanced. These findings are a bit contrary to the analysis of doctoral students. The dominance of female PhD students in the neurosciences (68.6 %, see D1.3, p.43) was not mirrored by a female post-docs overrepresentation. This probably reflects the well known gender bias, that is observed in many scientific disciplines: the shares of women increasingly diminish at higher hierarchy levels of the academic ladder.

Table 4-5: Percentages of post-docs by gender and main discipline (IRO-K.U.L.)

Main discipline of the team	Gender of the post-docs					
	Male post-docs		Female post-docs		All post-docs	
	N	In %	N	In %	N	In %
Biology	67	55.8	53	44.2	120	100.0
Biosciences	184	49.9	185	50.1	369	100.0
Biomedicine	14	66.7	7	33.3	21	100.0
Neurosciences	13	54.2	11	45.8	24	100.0
Others	30	63.8	17	36.2	47	100.0
Multiple disciplines	108	54.8	89	45.2	197	100.0
Total	**416**	**53.3%**	**362**	**46.5%**	**778**	**100.0%**

Source: NetReAct survey 2005.

No clear relationship between the team age and the distribution of post-docs by gender for the survey period 2003 and the two years before appeared (cf. Table A-5).

Furthermore, no obvious relation regarding the gender distribution of post-docs and team size could be found. In contrast to the doctoral students, where smaller teams more often employed male and larger teams more often employed female PhD students (see D1.3, p. 44), the distribution of post-docs across team sizes was nearly the same in each team size class (cf. Table A-28). Only in the second smallest group (i.e. team size from 10 to 19 persons) the share of male post-docs was a little lower, meaning that these teams had a balanced gender structure.

4.1.3 Main discipline of doctoral research

The overall distribution of the post-docs by their main discipline of doctoral research is shown in Table 4-6. Some of the most remarkable variations between countries were:

- Biology post-docs were overrepresented in Germany, Norway and Portugal and they are of low significance in Hungary and Italy;
- Post-docs in the biosciences were overrepresented in Italy, the Czech Republic, and Hungary. In Germany, Portugal and Norway we found an underrepresentation of post-docs in biosciences;
- Czech, Norwegian and British teams employed many biomedical post-docs, whereas German, French and Swedish teams had only relatively few post-docs in biomedicine;
- Post-docs in the neurosciences were very important in French and Hungarian teams, and apparently inexistent in Sweden and of low importance in Spanish teams.

These findings confirm to a major part the analysis of doctoral students. Under- and overrepresentations were found in almost all the same countries for the distribution of doctoral students as well as for the post-docs.

Table 4-6: Percentages of post-docs by their discipline of doctoral research and country of the team

Country of the team	Discipline of the post-docs					All post-docs (N)
	Biology	Bio-sciences	Bio-medicine	Neuro-sciences	Other disciplines	
CZ	18.2	57.6	18.2	3.0	3.0	33
DE	38.8	37.1	2.6	3.4	18.1	116
ES	30.5	44.1	6.8	1.7	16.9	59
FR	23.7	50.5	2.2	14.0	9.7	93
HU	3.2	54.8	3.2	16.1	22.6	31
IT	13.6	71.2	4.5	4.5	6.1	66
NO	44.2	37.2	11.6	4.7	2.3	43
PT	41.1	24.7	8.2	8.2	17.8	73
SE	32.6	46.1	1.1	0.0	20.2	89
UK	28.2	48.0	9.4	4.0	10.4	202
Total	**29.3**	**46.1**	**6.2**	**5.3**	**13.0**	**805**

Note: the distribution of post-docs across their main disciplines is dependent on the sample structure, i.e. biosciences teams are overrepresented in the sample.

Source: NetReAct survey 2005.

Comparing the disciplines of the up to five post-docs for which individual information was listed with the main discipline of the team (which was also defined on the basis of the most important fields of PhD research in the group in 2003) we see, as we should expect, that the largest values are generally to be found on the diagonal. For instance, nearly 75% of the post-docs who worked in a biology team did this in a biology field. We find this overrepresentation in all disciplines. Biomedical teams, however, were not too much focussed on purely biomedical scientists: more than half of their post-docs researched in other fields, many times even in other sciences outside of the life sciences. In other words, biomedical teams seemed to be more multidisciplinary than the other teams. These figures correspond to the findings which we got about the distribution of the disciplines of doctoral students across the main discipline of the research team (see D1.3, p.45).

Table 4-7: Percentages of post-docs by their discipline of doctoral research and the main discipline of the team

Main discipline of the team	Discipline of the post-docs					All post-docs (N)
	Biology	Bio-sciences	Bio-medicine	Neuro-sciences	Other disciplines	
Biology	74.8	11.8	3.4	0.8	9.2	119
Biosciences	17.7	72.2	1.6	1.4	7.1	367
Biomedicine	14.3	14.3	42.9	0.0	28.6	21
Neurosciences	0.0	7.7	7.7	76.9	7.7	26
Others	22.2	17.8	2.2	0.0	57.8	45
Multiple disciplines	33.2	31.6	13.8	6.1	15.3	196
Total	**30.0**	**45.7**	**6.3**	**4.9**	**13.0**	**774**

Source: NetReAct survey 2005.

While the distribution of post-docs in biology and biosciences across the team age classes showed no strong differences, there were some variations concerning post-docs in biomedicine and neurosciences (see annex Table A-6). However, these variations showed no clear pattern: biology post-docs were underrepresented in very young and old teams and overrepresented in middle-aged teams; neurosciences post-docs were underrepresented in middle-aged teams and overrepresented in old teams.

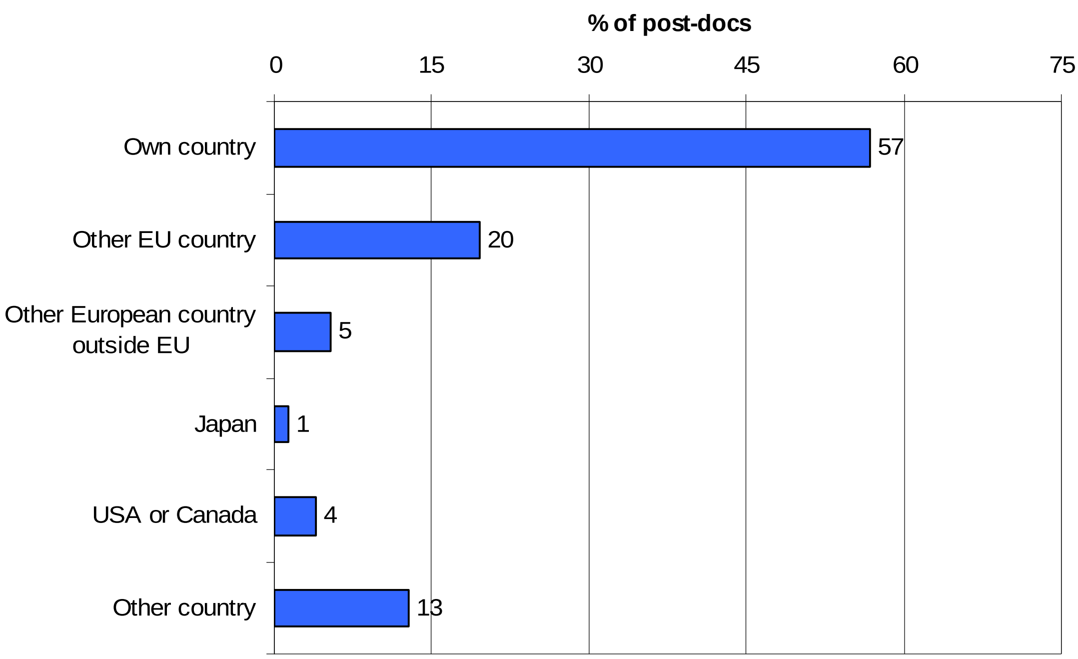
Also, the number of post-docs by team size varied (see annex Table A-7). Biologists were overrepresented in bigger teams while bioscientists were underrepresented in this size class. Post-docs in biomedicine and neuroscience were explicitly fewer represented in small teams.

4.1.4 Countries of origin and last degree

Those post-docs for whom information is available in the dataset came from 69 different countries, which is a little less than the number of countries of origin of the doctoral students (87). More than every second post-doc the team leaders provided this information for lived or worked in the same country before in which they were employed as post-doc (see Figure 4-1). Roughly 20% came from another EU member state, about 5% came from another European country outside the EU (including Romania, Turkey, Russia and the other states formerly part of the Soviet Union), 1% came from Japan, 4% from USA or Canada and the remainder (13%) from other countries worldwide outside of Europe, North America or Japan. A separate analysis of the distribution of Japanese post-docs was therefore not justified and they were added to the "other country" category. This group included a large number of countries worldwide, with China (2.4% post-docs), Australia (1.6%), Argentina (1.3%), India (1.1%) and Brazil (0.8%) as the most important countries of origin. However, lots of other countries from Africa, Asia, or South America were also represented in the dataset.

The overall trend described by the figures corresponds to the analysis about PhD students, where also the biggest share of doctoral students came from within the same country, and where also other EU countries as well as other countries worldwide were major countries of origin. However, the share of post-docs coming from these two categories was higher and therefore the share of post-docs which came from the same country as the country of the team was lower than this was the case for PhDs. This might be due to a greater willingness to work abroad on the side of post-docs.

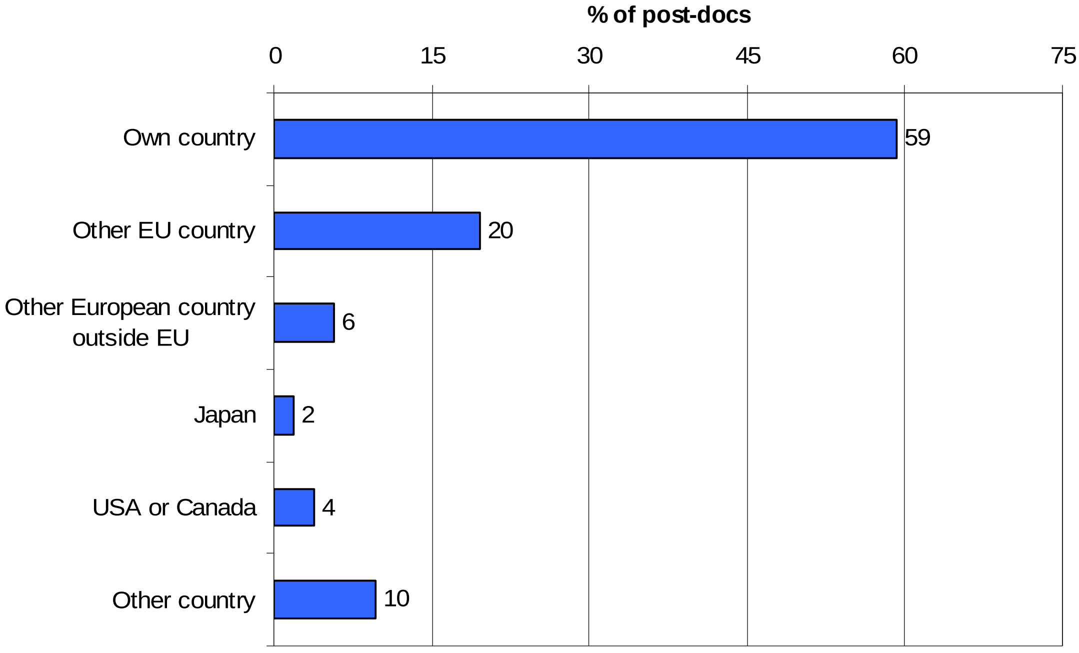
Figure 4-1: Percentages of post-docs by their country of origin



Source: NetReAct survey 2005.

About as many post-docs as were born in the country(57%) had written their PhD in the country (59%) in which they were employed as post-doc (see Figure 4-2).

Figure 4-2: Percentages of post-docs by their country of PhD (last degree)



Source: NetReAct survey 2005.

Table 4-8: Percentages of post-docs by their country of origin and the country of the team

Country of the team	Country of origin of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
CZ	89.2	8.1	2.7	0.0	0.0	37
DE	65.8	10.8	5.4	5.4	12.6	111
ES	61.4	18.6	0.0	1.4	18.6	70
FR	40.4	21.3	7.4	11.7	19.1	94
HU	74.3	2.9	8.6	2.9	11.4	35
IT	79.7	12.7	3.8	0.0	3.8	79
NO	60.4	25.0	2.1	6.3	6.3	48
PT	61.4	22.9	3.6	1.2	10.8	83
SE	27.5	34.1	16.5	1.1	20.9	91
UK	50.9	22.3	3.6	4.9	18.3	224
Total	**56.8**	**19.6**	**5.4**	**4.0**	**14.2**	**872**

Source: NetReAct survey 2005.

Analysing the share of post-docs' country of origin by country of the team significant variations become apparent (see Table 4-8). The share of Swedish and of French post-docs having lived or worked in the same country before taking on a post-doc position was relatively low. On the other hand, research teams in the Czech Republic, Hungary and Italy consisted to a larger part of national post-docs. Consistently with the described findings, research teams in France and Sweden also had a quite large share of post-docs from other EU countries, but so did teams in Norway, Portugal and the UK. Again, the share of post-docs from other European countries outside the EU was high in Sweden. Looking at the distribution of post-docs from the USA or Canada indicates a high share in French and Norwegian research teams – and interestingly not in the UK. The category "other country" seemingly did not play an important role in Czech and Italian life sciences teams, but were of relatively great importance in Sweden and France, and to a lower extent also in Spain and the UK.

From the analyses about the doctoral students' country of origin we know that research team structures were most international in the UK. This could not be observed for the figures the post-docs analysis has delivered. Here, Swedish and French teams were the most international ones.

The results for the country of last degree were basically similar and need not be discussed separately (see Table A-8 in the annex). It should only be mentioned that post-docs in Portuguese research teams had earned their doctorate to a larger extent abroad.

Simple diversity indices can be calculated with the information on the whole range of countries of origin of the post-docs. The Shannon Diversity Index uses this information and shows the diversity of countries in a team by means of the following formula:

$$D_S = \sum_{i=1}^{C} (p_i * \ln p_i)$$

with D_s Shannon's Diversity Index
C Total number of different countries *i* of origin in a team (max. 5)
p_i Proportion of C made up of the *i*th country

Table 4-9 shows that the largest diversities (i.e. more than 0.6) were found in Sweden and the UK (for the PhD students also Germany had such a large value, see D1.3, p.48). Germany, France, and Portugal had lower diversities in the range of 0.4 – 0.5. The other countries from Southern Europe and the new member states had the lowest diversities of 0.04 to 0.29. The total averages were nearly the same as for the doctoral students, however the variation across the countries was not that strong, in spite of the figures for Czech and Hungarian research teams. These results only partly corroborate the results obtained from the analysis of country groups. For instance, while the share of "domestic" Norwegian post-docs was quite low (60%) and therefore it seemed that teams in Norway showed a high diversity with regard to the constitution of post-docs, the value for the diversity index was very low (0.24, which was the third lowest). Different in the UK: the share of domestic post-docs was also quite low (51%), but far away from the lowest. However, the diversity index was the highest compared to the other countries.

Table 4-9: Shannon's Diversity Index for the countries of origin of the post-docs by country of the team

Country	Arithmetic mean	95% Confidence interval of the mean		No. of teams
		lower bound	upper bound	
CZ	0.04	-0.04	0.11	19
DE	0.40	0.27	0.53	43
ES	0.29	0.10	0.47	29
FR	0.46	0.29	0.62	41
HU	0.14	0.01	0.27	20
IT	0.27	0.11	0.42	30
NO	0.24	0.06	0.41	22
PT	0.44	0.26	0.63	31
SE	0.63	0.45	0.81	35
UK	0.65	0.52	0.78	66
Total	**0.42**	**0.36**	**0.47**	**336**

F-Test on the congruence of means: F-value 5.870, significant at $p<0.01$
Levene-Test on the homogeneity of variances: 6.861, significant at $p<0.01$
Robust tests on the congruence of means: Welch-Test: 11.563, significant at $p<0.01$, Brown-Forsythe-Test: 6.692, significant at $p<0.01$

Source: NetReAct survey 2005.

The Shannon Diversity Indices for the countries of last degree of the post-doc differentiated by the country of the team were in most cases very similar to the above results (see Table A-9 in the annex). However, there were two remarkable differences: for Italian and British teams the diversity index was connotatively lower for the country of last degree than for the country of origin.

Differentiating post-docs by their country of origin and the main discipline of the team we see that above all in biology teams – and not in biosciences teams as it was the case for doctoral students – post-docs from foreign countries were recruited (see Table 4-10, the same result was obtained if the country of last degree (PhD) is used, see Table A-10). Post-docs from other European countries (outside the EU) played an important role in the research team constitution in the area of biosciences. Interestingly high was the share of post-docs coming from North America in neurosciences teams.

Table 4-10: Percentages of post-docs by their country of origin and the main discipline of the team

Main discipline of the team	Country of origin of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
Biology	48.9	20.0	3.7	3.7	23.7	135
Biosciences	59.6	20.6	6.5	4.9	8.3	384
Biomedicine	52.4	19.0	4.8	0.0	23.8	21
Neurosciences	51.5	18.2	0.0	12.1	18.2	33
Others	54.2	18.8	6.3	2.1	18.8	48
Multiple disciplines	59.9	16.7	4.7	2.1	16.7	192
Total	**57.1**	**19.3**	**5.3**	**4.1**	**14.3**	**813**

Source: NetReAct survey 2005.

Older teams employed fewer domestic post-docs and more from abroad than teams that were only up to 15 years old (see Table 4-11). In particular, post-docs from the US, other EU countries, and other countries worldwide rather worked in the older teams. The percentages for the country of last degree were generally similar (see annex Table A-11). Team size and the country of origin of the post-docs showed no clear interrelation. It could only be stated, that smaller teams are composed more internationally than larger teams. (see annex Tables A-12 and A-13).

Table 4-11: Percentages of post-docs by their country of origin and the age of the team

Age of the team	Country of origin of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
up to 5 years	60.7	22.2	5.1	3.4	8.5	117
6-10 years	62.9	17.6	5.9	2.3	11.3	221
11-15 years	58.0	21.5	4.1	2.7	13.7	219
16-25 years	51.6	18.6	5.6	7.9	16.3	215
more than 25 years	36.1	22.2	6.9	2.8	31.9	72
Unknown	68.8	12.5	12.5	0.0	6.3	16
Total	**56.4**	**19.8**	**5.5**	**4.0**	**14.4**	**860**

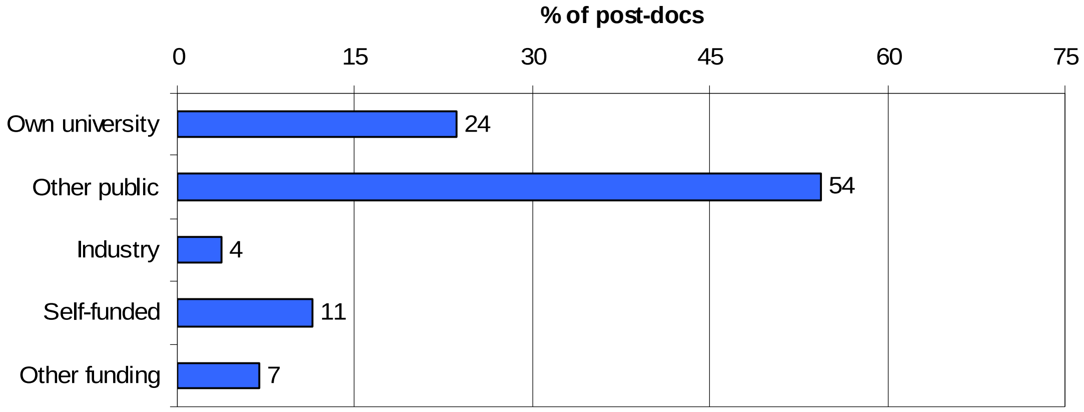
Source: NetReAct survey 2005.

The statistical tests for the Shannon Diversity Index (see above on the formula) for the team ages were not significant. Therefore, an interpretation is not possible. The complete table can be found in the annex, Table A-29.

4.1.5 Sources and duration of funding

The sources and the duration of funding of the post-docs were assessed, too. More than half of the post-docs, similar to the funding of the PhD students, obtained funding from other public sources (cf. Figure 4-3). University funding was given to 24% of the post-doctoral researchers. Other sources, industry funding and self-funding were only relevant for 4-11% of the post-docs.

Figure 4-3: Percentages of post-docs by their source of funding



Source: NetReAct survey 2005.

Funding structures differed notably across countries (cf. Table 4-12):

- Funding through the own university was central in Italy, the Czech Republic, and Hungary where other public sources were a lot less important (this was the same for PhD students);
- In all countries except for the three listed in the previous bullet point other public sources were the main source of post-doc funding. In Norway and Portugal it was nearly the only source of funds for post-docs;
- Significant industry funding of post-docs was only given in France, but it should also be mentioned that the share of post-docs funded by the industry is the second highest in Hungary and therefore also higher than in the UK;
- Self-funding appeared in particular in the UK and France; other funding sources were also available in the UK, France, and Italy.

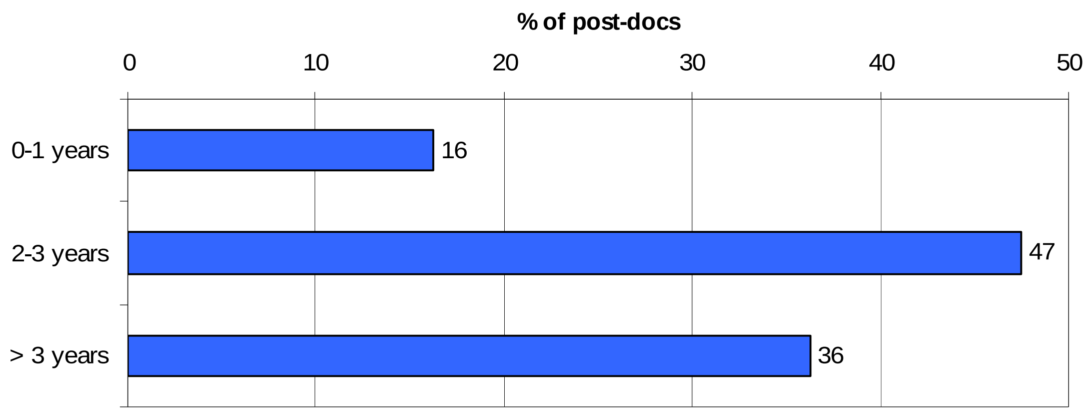
Taken together, it seems that the largest variety of funding sources was provided to post-docs in Great Britain and France. However, the large share of post-docs funding themselves in FR suggests a possible problem in obtaining other sources, in particular public sources. The same applies to a lesser extent to post-docs in the UK. The analysis of the PhD students mostly correspond to the findings observed for post-docs, despite of the category “self-funded”, for which the values were conspicuously lower.

Table 4-12: Percentages of post-docs by their source of funding and country of the team

Country of the team	Source of funding of the post-docs					All post-docs (N)
	Own university	Other public	Industry	Self-funded	Other funding	
CZ	75.8	21.2	0.0	3.0	0.0	33
DE	38.5	49.6	2.6	7.7	1.7	117
ES	13.3	71.7	0.0	6.7	8.3	60
FR	7.3	45.8	10.4	25.0	11.5	96
HU	66.7	20.0	6.7	6.7	0.0	30
IT	52.2	33.3	1.4	1.4	11.6	69
NO	14.0	76.7	2.3	4.7	2.3	43
PT	14.7	74.7	0.0	10.7	0.0	75
SE	16.5	61.5	2.2	11.0	8.8	91
UK	9.4	58.4	5.4	15.8	10.9	202
Total	**23.5**	**54.4**	**3.7**	**11.4**	**7.0**	**816**

Source: NetReAct survey 2005.

Figure 4-4: Percentages of post-docs by their duration of funding



Source: NetReAct survey 2005.

The main duration of funding for post-doctoral research was 2-3 years (cf. Figure 4-4). Short term funding of up to one year was less important, and funding periods of three years and more were likewise common as for the period of 2-3 years.

The variance of the duration of funding variable was rather low (cf. Table 4-13). The funding for post-docs was usually acquired for a minimum period of two years. The shares for short-term funding in France, Spain and Sweden were relatively high. Table 4-13 reveals that in France, Hungary, Italy, Norway, Sweden and the UK shorter funding periods of 2-3 years were more common than in the other countries. The more than 3 years funding period played above all a major role in Czech Republic, and to a lesser extent in Germany and Portugal.

Table 4-13: Percentages of post-docs by their duration of funding and country of the team

Country of the team	Duration of funding of the post-docs			All post-docs (N)
	0-1 years	2-3 years	> 3 years	
CZ	0.0	26.7	73.3	30
DE	19.8	28.4	51.7	116
ES	28.8	33.9	37.3	59
FR	31.1	54.4	14.4	90
HU	3.4	51.7	44.8	29
IT	14.5	58.0	27.5	69
NO	13.5	54.1	32.4	37
PT	8.0	37.3	54.7	75
SE	25.6	60.0	14.4	90
UK	8.1	55.3	36.5	197
Total	**16.3**	**47.5**	**36.2**	**792**

Source: NetReAct survey 2005.

Table 4-14: Percentages of post-docs by their source of funding and main discipline of the team

Main discipline of the team	Source of funding of the post-docs					All post-docs (N)
	Own university	Other public	Industry	Self-funded	Other funding	
Biology	23.0	50.0	3.3	15.6	8.2	122
Biosciences	25.7	51.3	4.0	10.7	8.3	374
Biomedicine	9.5	76.2	9.5	0.0	4.8	21
Neurosciences	30.8	57.7	3.8	3.8	3.8	26
Others	28.9	51.1	0.0	15.6	4.4	45
Multiple disciplines	18.8	60.4	3.6	11.2	6.1	197
Total	**23.4**	**54.3**	**3.7**	**11.3**	**7.3**	**785**

Source: NetReAct survey 2005.

Own university funding was slightly more often obtained in neurosciences and biosciences teams and other public funding in the biomedicine and multiple discipline teams (cf. Table 4-14). Industry funding was overrepresented in biomedicine, but it was still at a low level. With regard to the duration of funding, no clear pattern could be found for the main disciplines of the team (see Table A-14 in the annex).

The importance of own university funding for post-docs was higher for younger teams than for older teams (cf. Table 4-15). Older teams fare better in obtaining funding from other public sources or industry. The results on funding sources and team size appear to be in contrast to this (cf. Table 4-16): own university funding was slightly more common in large teams and other public sources were important for the funding of post-docs in small teams. The results on the duration of funding are reproduced in the annex (see Tables A-15 and A-16).

Table 4-15: Percentages of post-docs by their source of funding and age of the team

Age of the team	Source of funding of the post-docs: Own university	Other public	Industry	Self-funded	Other funding	All post-docs (N)
up to 5 years	28.8	49.0	0.0	16.3	5.8	104
6-10 years	26.8	51.2	3.8	9.4	8.9	213
11-15 years	17.9	57.7	4.0	13.9	6.5	201
16-25 years	22.4	57.3	3.1	8.9	8.3	192
more than 25 years	21.1	59.2	9.2	9.2	1.3	76
Unknown	37.5	62.5	0.0	0.0	0.0	16
Total	**23.4**	**55.0**	**3.6**	**11.1**	**6.9**	**802**

Source: NetReAct survey 2005.

Table 4-16: Percentages of post-docs by their source of funding and size of the team

Total staff of the team	Source of funding of the post-docs: Own university	Other public	Industry	Self-funded	Other funding	All post-docs (N)
less than 10	15.1	60.4	3.6	13.3	7.6	225
10 to 19	24.6	56.0	1.5	11.1	6.8	325
20 to 29	28.8	54.2	5.1	5.1	6.8	118
30 to 49	31.7	46.3	2.4	13.4	6.1	82
50 or more	32.1	32.1	14.3	12.5	8.9	56
Total	**23.8**	**54.3**	**3.6**	**11.2**	**7.1**	**806**

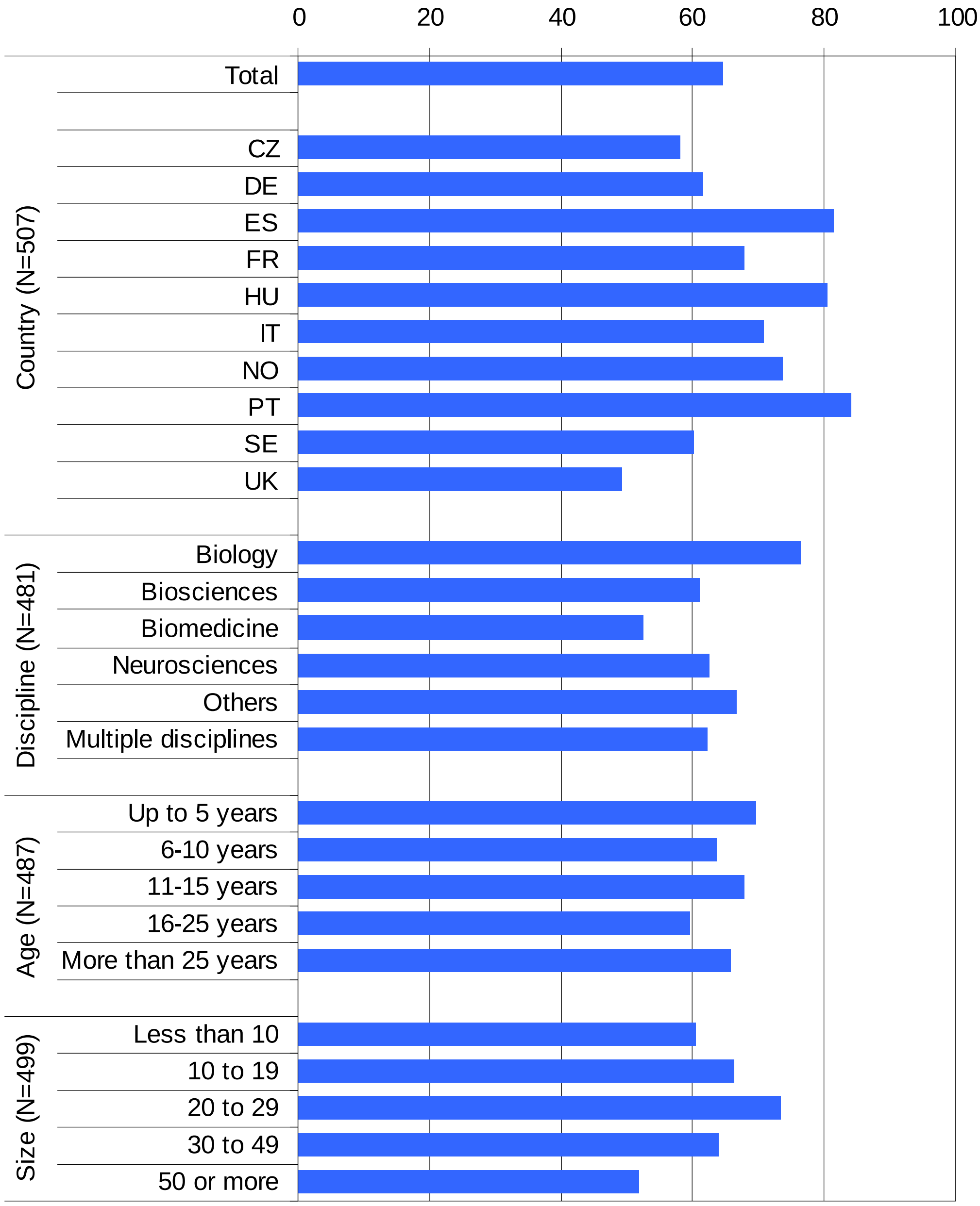
Source: NetReAct survey 2005.

4.1.6 Work experience abroad

In the NetReAct survey team leaders were also asked whether the post-docs working with the team have work experiences in other countries than that of the research team. More than half of all post-docs, for which the respondents have given information, had work experience abroad. But, if closer looked into and analysed by country, main discipline, team age and size, some interesting variations appear. Figure 4-5 shows these differences: considerably higher shares of post-docs with foreign experience were employed in research teams in Spain, Hungary and Portugal. On the other hand, rather few British post-docs seemed to have work experiences outside the UK. The share of post-docs with international work know-how was higher in biology research teams and lower in biomedicine teams. While the distribution across age of the team shows no striking differences or pattern, we can assume that middle-sized teams consisted of more post-docs with work experience abroad than young or old teams.

A detailed overview of the corresponding figures could be found in the annex, Table A-27.

Figure 4-5: Percentages of post-docs with international work experience by country, main research discipline, age and size of the team



Source: NetReAct survey 2005.

4.1.7 Summary

The section analysed the characteristics that were requested for up to five post-docs per team. The available characteristics of the post-docs are:

- age,
- gender,
- main discipline of doctoral research,
- country of origin and last degree (PhD), and

- sources and duration of funding.

Each of these characteristics was cross-tabulated with the following team characteristics:

- country,
- main discipline of research,
- age, and
- size (total staff members).

The most notable results of this exercise are the following:

1) Post-docs in the life sciences in the ten sample countries were on average 32.2 years old. The age was higher in Spain and Germany and lower in the UK and the Czech Republic. It was also higher in biology and lower in the neurosciences.

2) The majority of post-docs for which information was provided were male: 431 out of 809 (53.3 %). In Spanish and British research teams around 60% of the post-docs were males, whereas in Italian teams there were strongly more females than males. Males were also overrepresented in biomedical teams and teams with a major focus in other sciences. Females were overrepresented in the biosciences.

3) A lot of post-doc research in the sample countries was done in biology and the biosciences. Nearly every country – apart from Hungary – is well represented in both disciplines. Biomedical research was also present in every country, but more than 18% of the post-docs worked in this discipline in the Czech Republic. Post-docs in biology worked more often in multi-disciplinary teams. Post-doctoral research in the neurosciences was important in France and Hungary.

4) Around six out of ten post-docs were employed in their country of origin, and also around 60% in the same country in which they earned their doctorate. In general, the figures for country of origin and country of last degree hardly differ. The majority of foreign born (or educated) post-docs in the sample countries came from another EU country or another country outside of Europe to the country of the team. More post-docs from China (2.4% of all post-docs) or Australia (1.6%) worked in the ten countries than from the United States. Post-docs from abroad could be found particularly in Sweden, France and the UK. The "sending countries" differed: foreign life sciences post-docs were mainly coming from EU Member States – with the exception of research teams in Hungary, where more post-docs were coming from non-EU European countries and other countries worldwide. Especially in Sweden and the UK, the group of foreign post-docs was a diverse international mixture. The country-related diversity of post-docs was lowest in the Czech Republic and in some of the other New Member States and Southern European countries. Foreign post-docs were recruited especially by teams in biology. As a rule, they worked more in older – and presumably in more established – teams.

5) Post-doc research was to 24% funded through university budgets and to more than 50% through other public sources. The importance of university versus other public funding was reversed in Italy, the Czech Republic, and Hungary. University funding

was more important for younger and bigger teams. Industry funding, self-funding (by the post-doc) and other sources were generally of low importance. Only in France and the UK industry funding of post-docs was a little bit more common. Funding periods were usually longer than two years, and short term funding of less than one year was also quite common, in particular in France, Spain, and Sweden.

6) More than half of all post-docs in the sample already had work experience abroad. In Portugal, Hungary and Spain, the shares of post-docs with foreign work experiences was quite high, against this fewer post-docs in teams in the UK had such experiences. In the biology research field, a large share of post-docs had know-how on working in other countries; in biomedicine considerably fewer post-docs have had this experience.

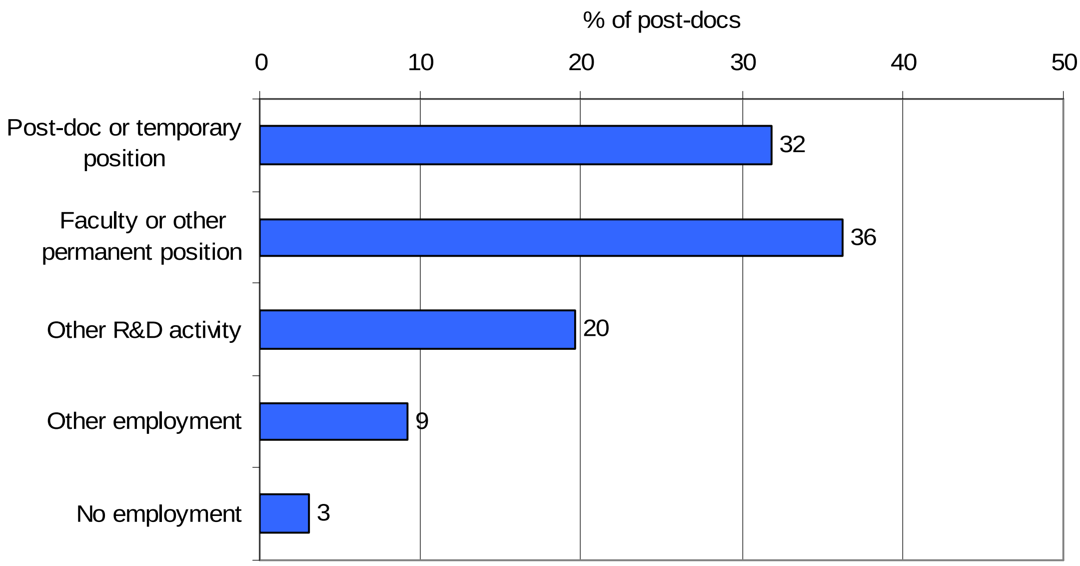
4.2 Post-docs who have left the teams since 2003

In the survey information on the new positions of five post-docs who most recently had left the team was collected, too. We asked the respondents to include all who had left. The exploratory interviews showed that the respondents usually knew quite well where their former students or post-docs had gone and what they were doing (see D1.1, p. 69).

4.2.1 New activities

According to the knowledge of the respondents, the team leaders of the life sciences teams, more than 80% of their former post-docs continued to work in R&D (cf. Figure 4-6). One third had continued a post-doc or other temporary position, another third had obtained a faculty or other permanent position and 20% have engaged in another R&D activity. Only 9% had taken a different kind of employment outside of R&D and merely 3% had had no employment after leaving the team. The figures observed are nearly the same as for the doctoral students, but the dominance of the possibility to get a post-doc or temporary position is – of course – not existent. Also, other employment was not that important as it was for PhD students after earning a doctorate.

Figure 4-6: Percentages of post-docs by their new activity



Source: NetReAct survey 2005.

However, as Table 4-17 shows, this varies across countries. Temporary positions were less common for graduates from Czech, Spanish or Hungarian teams and more common in Norway and the UK. Permanent positions were most often obtained in Spain and Hungary, and still important in France and Portugal, whereas they played a smaller role in Norway and the Czech Republic. The category “Other R&D activity” was of high importance in Norway and CZ and less important in France and Germany. Other employment positions were important for post-docs in CZ, DE and IT. The highest shares of post-docs with no employment after leaving the team were found in France, Germany, and to smaller extent in Norway.

Table 4-17: Percentages of post-docs by their new activity and country of the team

Country of the team	New activity of the post-docs: Post-doc or temporary position	Faculty or other permanent position	Other R&D activity	Other employment	No employment	All post-docs (N)
CZ	22.9	22.9	34.3	17.1	2.9	35
DE	30.6	34.7	10.2	17.3	7.1	98
ES	22.7	54.5	18.2	4.5	0.0	44
FR	31.1	47.3	9.5	4.1	8.1	74
HU	22.2	51.9	14.8	11.1	0.0	27
IT	34.7	27.8	19.4	16.7	1.4	72
NO	40.0	17.1	37.1	0.0	5.7	35
PT	31.1	40.0	24.4	2.2	2.2	45
SE	25.0	36.3	30.0	6.3	2.5	80
UK	38.2	34.7	18.1	8.0	1.0	199
Total	**31.9**	**36.2**	**19.6**	**9.2**	**3.1**	**709**

Source: NetReAct survey 2005.

Differentiating the post-docs by their new activity and the main discipline of their team also produces some interesting insights (cf. Table 4-18). Second or third post-docs were less common in biomedicine. Post-docs from these teams most often obtained faculty or other permanent positions. More post-docs from biosciences teams took up a position in another employment area than R&D than post-docs from other teams. The results on team age and team size for this variable are shown in the annex (Tables A-17 and A-18).

Table 4-18: Percentages of post-docs by their new activity and the main discipline of the team

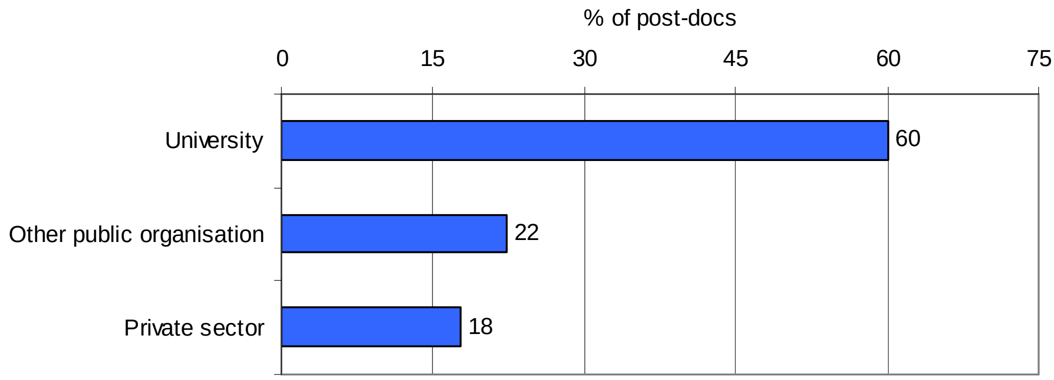
Main discipline of the team	New activity of the post-docs: Post-doc or temporary position	Faculty or other permanent position	Other R&D activity	Other employ ment	No employment	All post-docs (N)
Biology	25.3	44.0	20.9	7.7	2.2	91
Biosciences	32.4	30.9	22.4	10.3	3.9	330
Biomedicine	18.2	50.0	27.3	0.0	4.5	22
Neurosciences	33.3	44.4	14.8	7.4	0.0	27
Others	28.6	42.9	19.0	7.1	2.4	42
Multiple disciplines	34.9	37.9	14.8	10.1	2.4	169
Total	**31.4**	**36.6**	**20.0**	**9.3**	**3.1**	**681**

Source: NetReAct survey 2005.

4.2.2 New organisations

In addition to the new activities of the post-docs another question asked for the new organisations in which they continue to work after leaving the team of their post-doctoral research. As also observed for the doctoral students, nearly six out of ten continued to work in a university, and around 20% have moved on to other public organisations or the private sector, respectively (cf. Figure 4-7).

Figure 4-7: Percentages of post-docs by their new organisation



Source: NetReAct survey 2005.

There are some country differences for this variable, too (Table 4-19): in Hungary and Spain more post-docs than on average joined universities often obtaining faculty positions (see also Table 4-17 above). Hence, it seems that in both countries life sciences research at the universities is expanding. In France post-docs particularly often joined other research organisations in the public sector, which was also figured out for PhD students. Among those who were gone to the private sector we found above all post-docs from Germany, whereas this transition after leaving the team was very low in Hungary and Portugal.

Table 4-19: Percentages of post-docs by their new organisation and country of the team

Country of the team	New activity of the post-doc			All post-docs (N)
	University	Other public organisation	Private sector	
CZ	54.5	30.3	15.2	33
DE	54.4	21.1	24.4	90
ES	69.8	16.3	14.0	43
FR	40.3	40.3	19.4	62
HU	70.4	22.2	7.4	27
IT	62.3	17.4	20.3	69
NO	68.8	15.6	15.6	32
PT	63.4	26.8	9.8	41
SE	65.4	14.1	20.5	78
UK	61.1	22.2	16.8	185
Total	**60.0**	**22.3**	**17.7**	**660**

Source: NetReAct survey 2005.

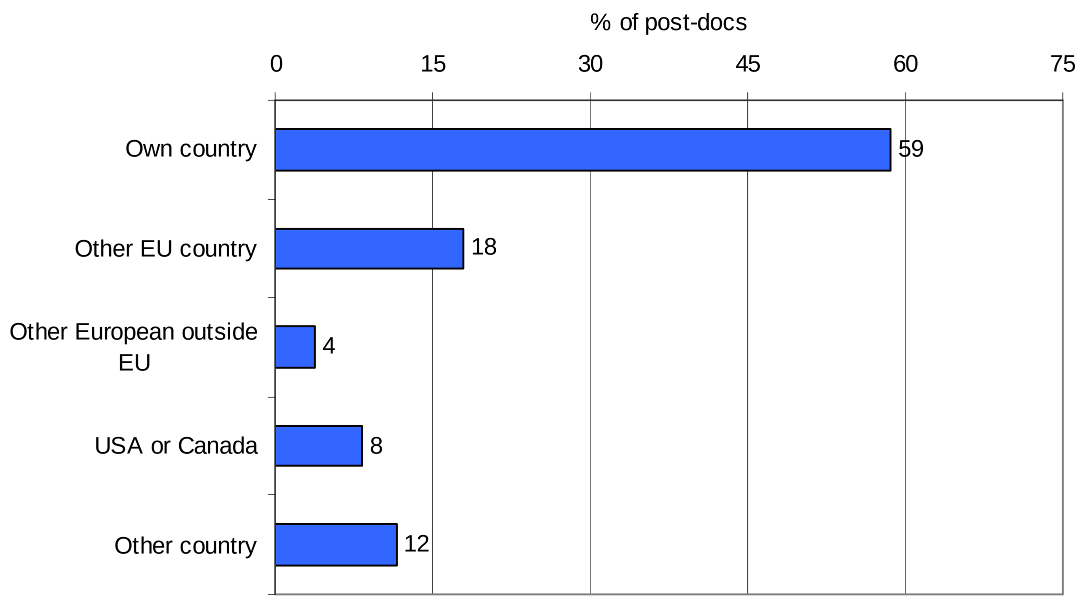
The results for the main academic discipline, the age and size of the teams were not particularly striking (see annex Tables A-19 to A-21). But, it should be noted that seemingly more post-docs coming from biomedicine and neurosciences teams stayed at the university than post-docs from other disciplines. This confirms the good perspectives of post-docs from biomedical teams found above. The observation that PhD graduates moving on to the private sector have studied rather in older than in younger teams (see D1.3, Table A-20, p. 92) could not be made for the post-docs.

4.2.3 Countries of destination

Approximately two thirds of the post-docs continued to work in the same country in which they had worked before, 18% went to another EU member state, 12% to another country worldwide and 8% to the US or Canada. Other European countries outside of the EU are hardly chosen at all as new work places (4%).

Comparing the countries of destination with the source countries of post-docs (cf. Figure 4-1, p. 46) corroborates that the USA are a "net importer" of life science post-docs from the EU – the number of European post-docs going to the US is considerably higher (see Figure 4-8) than the number of American post-docs coming to Europe for a research position.

Figure 4-8: Percentages of post-docs by their new country of work



Source: NetReAct survey 2005.

The number of post-docs leaving the country where the former post-doctoral research position was, was remarkably high in France and Sweden (see Table 4-20): together with Spain these were the only countries where more post-docs leave than stay, whereas the share for Spain was only slightly lower than 50%. Many “leavers” could also be found in the UK, Germany and Portugal. French and Swedish post-docs were overrepresented in all other country categories. Like the Swedish, German and British post-docs also often chose the USA or Canada as a new destination. Spanish, French and Swedish post-docs frequently moved on to other countries at global level.

Table 4-20: Percentages of post-docs by their new country of work and the country of the research team

Country of PhD research	Country of destination of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
CZ	88.9	2.8	0.0	8.3	0.0	36
DE	58.5	13.4	3.7	11.0	13.4	82
ES	48.1	27.8	1.9	1.9	20.4	54
FR	38.6	24.3	10.0	8.6	18.6	70
HU	68.8	15.6	9.4	3.1	3.1	32
IT	83.3	11.5	1.3	2.6	1.3	78
NO	82.9	8.6	0.0	2.9	5.7	35
PT	56.9	25.5	3.9	2.0	11.8	51
SE	32.1	34.5	4.8	10.7	17.9	84
UK	58.8	13.2	2.9	13.2	11.8	204
Total	**58.5**	**17.9**	**3.7**	**8.3**	**11.6**	**726**

Source: NetReAct survey 2005.

According to Table 4-21 the post-docs of biomedical teams (and not of the biosciences teams as observed for the PhD students) were particularly mobile: they mostly did not stay in the country of the former post-doc position, but left to another country worldwide, outside Europe and North-America. Noticeable was the distribution of destinations across post-docs from neurosciences: European and other international countries were not relevant, but USA or Canada as destination were of major importance.

Table 4-21: Percentages of post-docs by new country of work and the main discipline of the team

Main discipline of the team	Country of destination of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
Biology	53.3	16.2	1.9	8.6	20.0	105
Biosciences	61.7	20.1	4.2	8.6	5.4	313
Biomedicine	47.6	9.5	4.8	9.5	28.6	21
Neurosciences	57.7	3.8	3.8	26.9	7.7	26
Others	53.5	16.3	9.3	4.7	16.3	43
Multiple disciplines	59.9	17.4	2.3	5.2	15.1	172
Total	**58.8**	**17.6**	**3.7**	**8.2**	**11.6**	**680**

Source: NetReAct survey 2005.

It seems that the long distance relationships to foreign countries take some time to be established. Among the teams that were five years old or younger we found comparatively few post-docs who went to destinations outside the country of the former post-doc position than among the older teams (see Table 4-22). This could be confirmed by the figures for post-docs leaving older teams (16 years and more) and choosing USA or Canada or another country worldwide, which were considerably high. The outbound mobility of post-docs did not seemed to be related to team size (see Table A-22 in the annex).

Table 4-22: Percentages of post-docs by new country of work and the age of the team

Age of the team	Country of destination of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
up to 5 years	66.7	19.0	3.6	1.2	9.5	84
6-10 years	56.3	23.8	3.8	6.9	9.4	160
11-15 years	63.1	16.7	3.9	6.4	9.9	203
16-25 years	52.9	16.0	2.1	15.5	13.4	187
more than 25 years	52.6	14.5	6.6	7.9	18.4	76
Unknown	62.5	12.5	12.5	0.0	12.5	8
Total	**58.2**	**18.1**	**3.8**	**8.4**	**11.6**	**718**

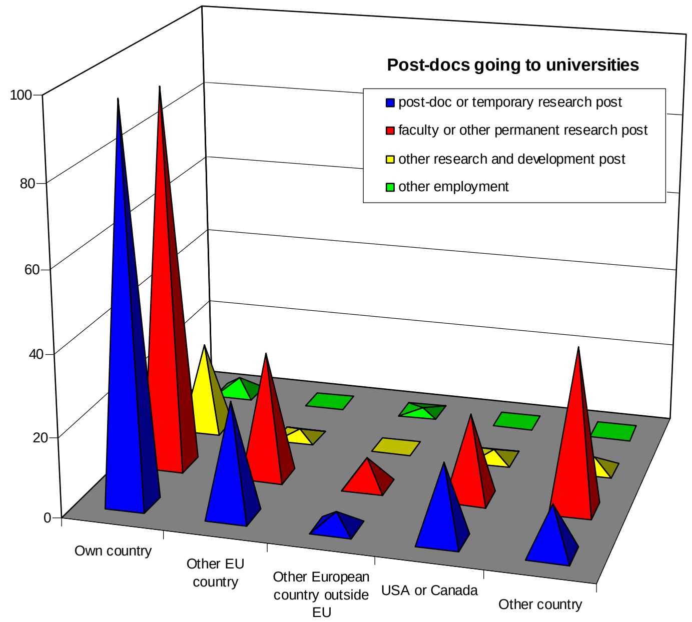
Source: NetReAct survey 2005.

4.2.4 Combinations of activity, organisation and country

There are certain typical combinations of these variables on the destinations of post-docs. The variations across the different categories were rather similar for post-docs who have gone to universities and non-university public research organisations – for the latter the values are of course substantially lower and there were surely more post-docs taking other R&D or other employment positions (see Figure 4-9 and Figure A-1 in the annex). But the figures for post-docs who have gone to the private sector were different (see Figure 4-10).

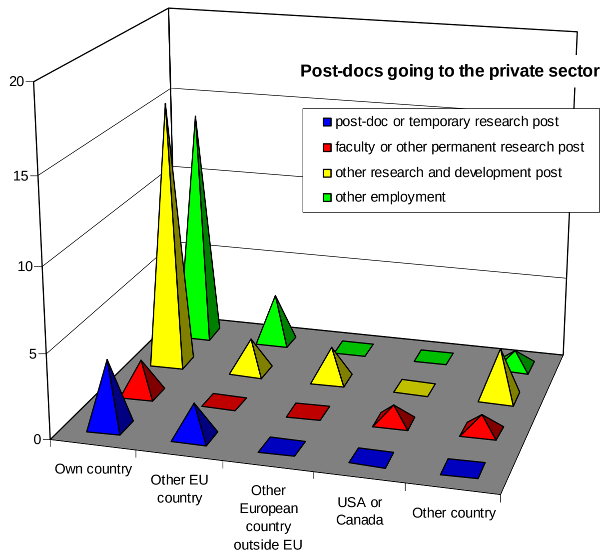
Post-docs who stayed in universities or went to non-university public research organisations often continued with a post-doctoral or temporary research position in their home country. The USA, Canada and other EU member states were also preferred destinations for post-docs. A similar percentage of the post-docs obtained a faculty or other permanent position, usually in their home countries; some of the post-docs got these permanent positions in other countries outside of Europe – we suppose that these were often post-docs returning to their home countries, though we don't have any real proof for this (it would require a more detailed biographical analysis). Post-docs who obtained another research and development position or employment outside of R&D often leaved academia and moved to the private sector, but mostly stayed in the country of the former research team (see Figure 4-10).

Figure 4-9: Number of post-docs going to universities by their new activity and destination country



Source: NetReAct survey 2005.

Figure 4-10: Number of post-docs going to the private sector by their new activity and destination country



Source: NetReAct survey 2005.

4.2.5 Summary

Around one third each of the post-docs continued to work in science on temporary or permanent positions. Fewer obtained positions in another R&D activity or in the private sector. According to the knowledge of the team leaders 3% did not find any employment after leaving the team. Across all ten countries two third of the post-docs remained in the same country in which they worked before. The USA were a much more important destination for post-docs than source. In particular high percentages of Swedish and French post-docs have obtained new positions overseas.

The trajectories of post-docs clearly differed across countries. Whereas the typical Hungarian post-doc has obtained a faculty or post-doc position at a Hungarian university, French post-docs more often have joined a non-university research organisation or left the country and sought a new job abroad – which was exactly the same for the doctoral students. A sizable fraction of German post-docs has moved on to research or other employment in the private sector in Germany.

We found that German, Swedish and Italian post-docs often have left science. They have taken jobs in the private sector and outside of research instead. This might indicate that public science cannot absorb all the post-docs and meet the career expectations of the post-docs in these countries. The comparatively large percentages of non employed graduates in Germany support this reading. However, a different explanation would be that conventions in regard to the role and value of a post-doc might differ across Europe and that in the mentioned countries a PhD degree and post-doctoral research position is often considered as the ticket to a career in industry. We cannot definitely answer this question, as a closer inspection of the motivations of post-docs would be required.

4.3 Recruitment of post-docs

In order to get some more background information on the recruitment of post-docs the NetReAct questionnaire (see annex 2) also included questions on the factors that helped the groups to attract the right type and number of applicants for a post-doctoral position and the sought characteristics of these applicants.

4.3.1 Factors determining the attractiveness of teams

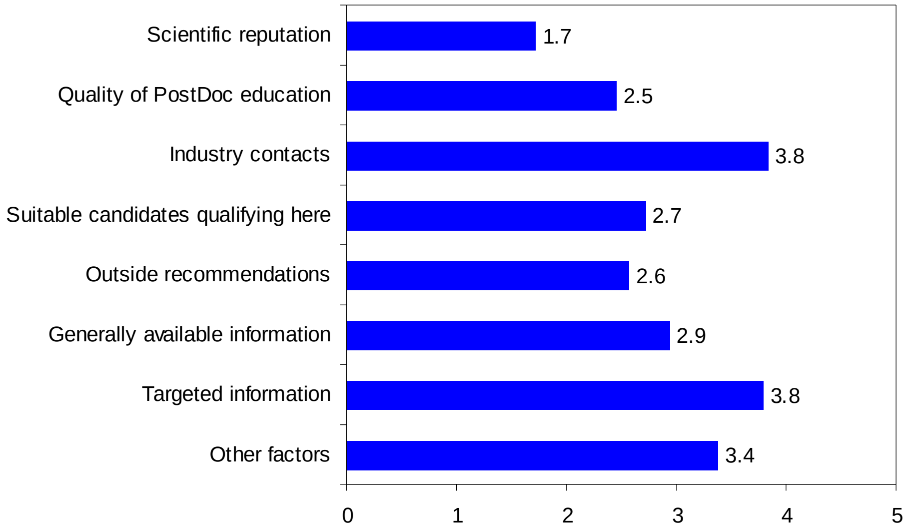
According to the opinion of our respondents, i.e. the heads of the research teams, the attractiveness of their team for new post-docs as well as for doctoral students (see D1.3, p.63) was mainly determined by the team's scientific reputation: the higher the reputation, the easier it was to attract good post-docs (see Table 4-23 and Figure 4-11). The quality of the post-doctoral training, the availability of suitable candidates from within the university and recommendations from outside were also deemed as at least very important by the majority of respondents. Rather unimportant were the mailing of targeted information to other schools, organisations or individuals as well as contacts to the industry. The same trends were found for the PhD students (see D1.3, p. 63).

Table 4-23: Factors determining the attractiveness of groups for post-docs (percentages)

	essential	very important	Important	low importance	no importance	no answer	Total responses (N)
Scientific reputation	43.6	33.5	12.4	1.5	0.6	8.3	468
Quality of post-doctoral training	13.5	35.0	26.1	9.6	2.8	13.0	468
Industry contacts	1.9	9.0	15.6	31.4	26.1	16.0	468
Suitable candidates qualifying here	9.4	27.6	32.3	10.7	6.0	14.1	468
Outside recommendations	11.8	32.5	31.0	12.2	2.6	10.0	468
Generally available information	8.8	22.2	29.1	22.4	5.8	11.8	468
Targeted information	1.9	8.3	19.0	32.3	23.5	15.0	468
Other factors	5.3	4.3	2.1	2.1	11.1	75.0	468

Source: NetReAct survey 2005.

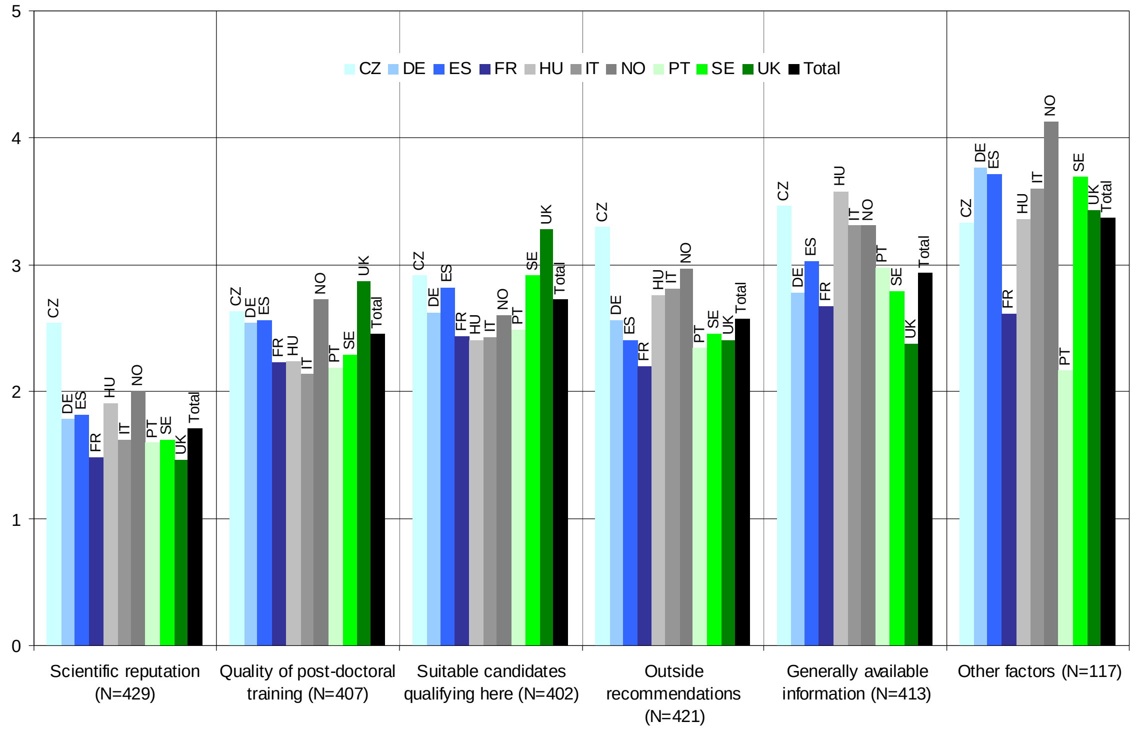
Figure 4-11: Arithmetic means of factors determining the attractiveness of groups



Note: 1 = essential to 5 = no importance, n.a. excl.

Source: NetReAct survey 2005.

Figure 4-12: Arithmetic means of the six main important factors of the attractiveness of groups for post-docs by country of the team



Note: 1 = essential to 5 = no importance, excl. n.a., most unimportant factors “industry contacts” and “targeted information” excl.

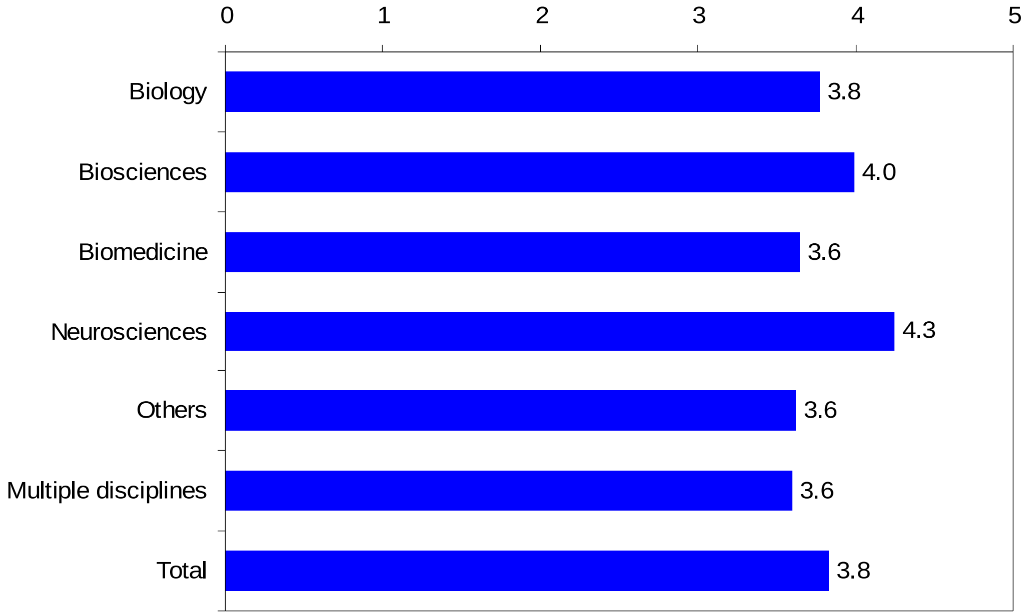
Source: NetReAct survey 2005.

Although the rankings of these factors differed between the countries in the dataset for the period of 2003, the main important factor in every country was the scientific reputation (see Figure 4-12 and Table A-23 in the annex). The second important factor in nearly all countries was the quality of the post-doctoral training and education. For Spanish, French and British research team leaders, the second important factor were recommendations from outside the own university – however in France the quality of the training and in UK the generally available information sources like the internet, newsletters, newspapers and journals were just as important. In Norway, suitable candidates from the own university was deemed to be the second important factor. Other factors, which were not listed in the question, are mainly not important, despite of the information received from respondents from France and Portugal. The corresponding question in the survey gave the team leaders the opportunity to mention what else could be an important factor. These other factors were mainly related to the availability of funding sources for post-docs. Furthermore, the attractiveness of the team with regard to the available infrastructure (labs and technical equipment), the location and the surroundings or the quality of the team, the projects or themes which the teams deal with and the released publications were referred to other factors.

In addition, we also differentiated the attractiveness factors by the main scientific discipline, the age and the size of the team. In most cases, these variables did not relate to the attractiveness factors. Some interesting relationships are shown in Figure 4-13, and Figure 4-15 (the selected categories always showed the highest standard deviation across the corresponding break variable).

As we have already found out for PhD students (see D1.3, p. 65), industry contacts were of higher importance for biomedical and multidisciplinary research teams when recruiting new post-docs than for teams from the other disciplines (Figure 4-13). The generally available information were more important for young teams (Figure 4-14). For both PhD students as well as post-docs the ratings for industry contacts were increasing with team size – except for the largest team size category (which might be somewhat special, as we have stated several times above, see e.g. p. 29).

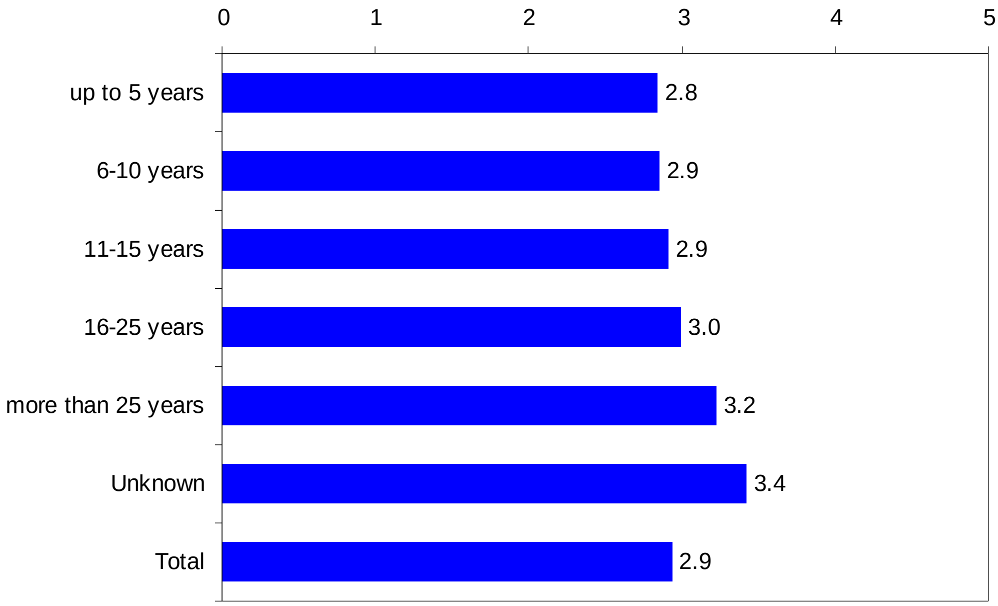
Figure 4-13: Industry contacts as a determinant of the attractiveness of groups for post-docs by main discipline of the team (arithmetic mean)



Note: 1 = essential to 5 = no importance, n.a. excl., standard deviation: 0.26

Source: NetReAct survey 2005.

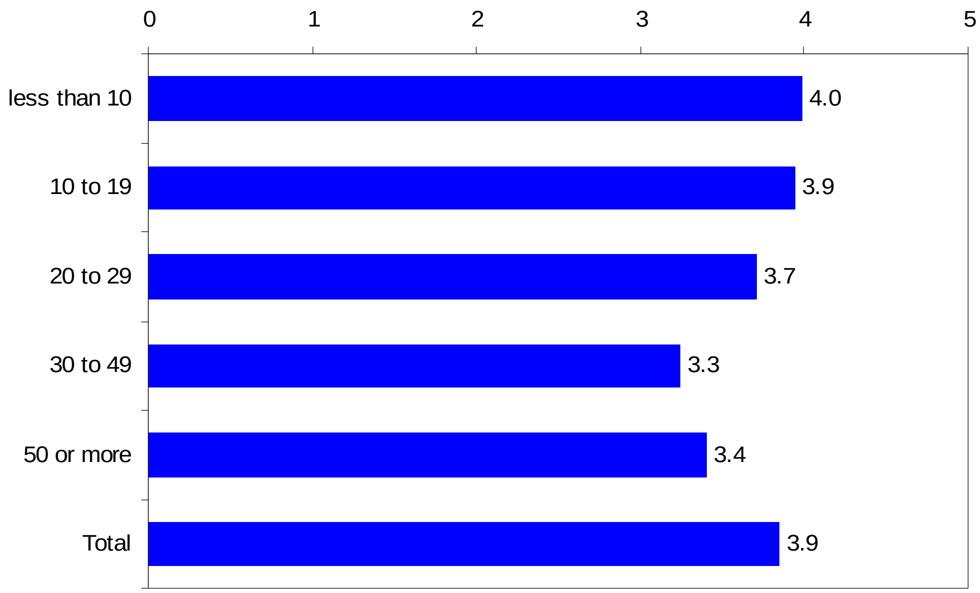
Figure 4-14: Generally available information as a determinant of the attractiveness of groups for post-docs by age of the team (arithmetic mean)



Note: 1 = essential to 5 = no importance, n.a. excl., standard deviation: 0.23

Source: NetReAct survey 2005.

Figure 4-15: Industry contacts as determinant of the attractiveness of groups for post-docs by size of the team (arithmetic mean)



Note: 1 = essential to 5 = no importance, n.a. excl., standard deviation: 0.33

Source: NetReAct survey 2005.

4.3.2 Desired characteristics of applicants

The exploratory interviews carried out before the survey had shown that qualifications, skills, motivation, and how well applicants seemed to fit into the team were important issues considered in the filling of open PhD positions (see NetReAct deliverable 1.1, p. 66). We assume, that these factors were also important for the recruitment of post-doctoral researchers. In the questionnaire, eleven different characteristics were listed plus an open-ended question to capture additional issues (see D1.3, annex 2). In this last category respondents mentioned in particular factors such as possibilities for a self-organised funding, language and scientific writing skills, innovative – either technical, theoretical or conceptual – and logical thought.

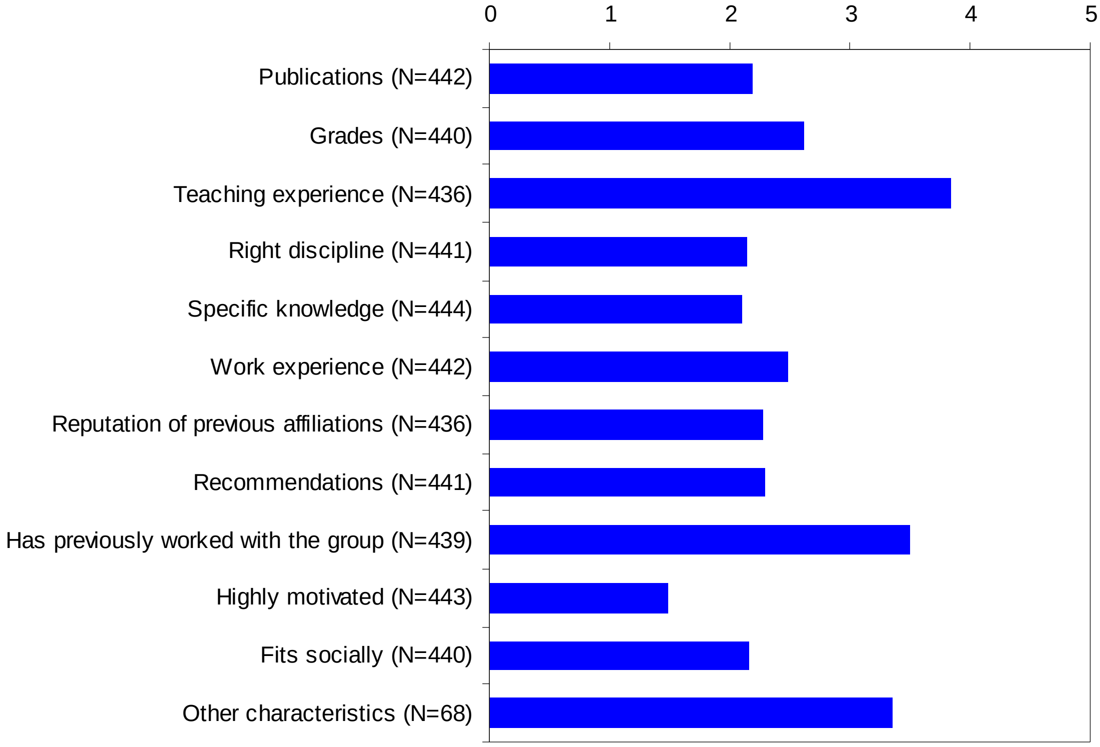
The responses for the entire set of teams are reproduced in Table 4-24 and Figure 4-16. We see that by far the most influential criterion in the selection of applicants was their motivation to work with the group and on the topics it covers: adding up the parameter values for "essential" and "very important" delivers a value of 87%. In contrast, the second important factor, specific knowledge, receives only just under 70% (cf. Table 4-24). The factors "publications", "right discipline", "reputation of previous affiliation", "recommendations" and "fits socially" were all considered as at least very important by around 60% of the respondents. The most dispensable factor (besides the "others" category) for the respondents, i.e. the research team leaders, was the experience post-docs have made with their teaching activities. Nearly all these findings were also delivered from the analyses of the desired characteristics of PhD studentship applicants (see D1.3, p. 67). But, there are some interesting differing facts: while the publications – and also, but to a lesser extent, the specific knowledge – did not play an important role for the PhD students, this was exactly the opposite for the post-docs (publications were deemed to be third important). On the other side, grades were quite important for doctoral students and were less important for post-doc applicants.

Table 4-24: Desired characteristics of applicants for a post-doctoral research post (percentages)

	essen-tial	very import-ant	Import-ant	low import-ance	no import-ance	no answer	Total respons es (N)
Publications	19.9	43.2	26.3	4.3	0.9	5.6	468
Grades	11.1	29.5	38.5	13.7	1.3	6.0	468
Teaching experience	0.9	6.6	20.3	44.0	21.4	6.8	468
Right discipline	23.9	37.0	28.8	3.8	0.6	5.8	468
Specific knowledge	22.2	46.4	21.8	3.6	0.9	5.1	468
Work experience	9.8	40.2	33.5	10.0	0.9	5.6	468
Reputation of previous affiliations	14.7	44.0	28.4	5.3	0.6	6.8	468
Recommendations	15.8	43.4	26.7	7.7	0.6	5.8	468
Has previously worked with the group	4.5	15.0	21.4	35.0	17.9	6.2	468
Highly motivated	57.5	29.1	8.1	0.0	0.0	5.3	468
Fits socially	23.1	39.3	25.6	4.9	1.1	6.0	468
Other characteristics	3.0	3.0	1.3	0.4	6.8	85.5	468

Source: NetReAct survey 2005.

Figure 4-16: Desired characteristics of applicants for a post-doctoral research post (arithmetic mean)

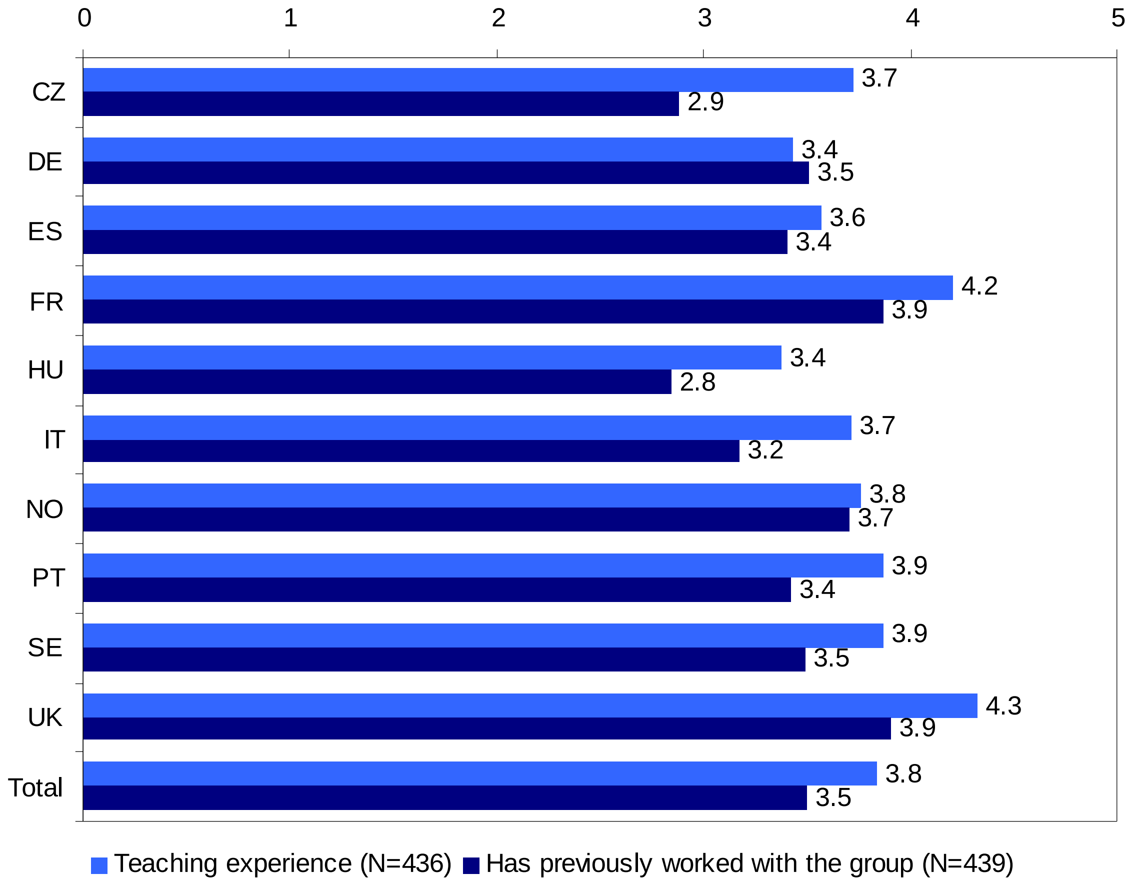


Note: 1 = essential to 5 = no importance, n.a. excl.

Source: NetReAct survey 2005.

There are also notable variations between the countries in the sample (see Table A-24 in the annex). While motivation was always the most important factor for team leaders in the different countries, the second and third important factors differed. In the Czech Republic, Norway and Portugal publications the candidate for the post-doc position has written, or has been involved in, were mentioned as the second important factor; in Spain and the UK this was the “right discipline”; specific knowledge was the second important in Hungary and Italy; in Sweden, it was reputation through previous work; and the socially fitness was second important in Germany and France. Most differences between the ratings were found for the two characteristics shown in Figure 4-17. In the UK and France, just as the results from the analyses of the PhD students have shown (see D1.3, p.68), it was considered of low importance whether an applicant has previously worked with the team, whereas it was deemed a lot more important in Hungary and the Czech Republic. Applicants for post-doctoral research posts had to be slightly more experienced with teaching in Germany and Hungary, but there was quasi no importance for this in France and the UK.

Figure 4-17: Having worked with the team previously and teaching experiences by country of the team (arithmetic mean)



Note: 1 = essential to 5 = no importance, n.a. excl., standard deviation: having worked with the team previously 0.37, teaching experience 0.30.

Source: NetReAct survey 2005.

Further on, we investigated whether the main scientific discipline of the team also played a role in the recruitment decisions and influenced at which characteristics of the applicants the team leaders looked for. In Table 4-25 the two main characteristics for each of the different research team disciplines are highlighted. Again, the main factor was the motivation, but the second important factor differed between the disciplines. While in biology, biomedicine and in the multiple disciplines the characteristics “right discipline” and “specific knowledge” were secondly important, in biosciences it was the social fitness and in neurosciences it was the record and quality of publications (together with the specific knowledge). The most recognisable differences were to be found in the characteristics “teaching experience” (standard deviation: 0.28) and “specific knowledge” (standard deviation: 0.24). The former played a more important role in the biomedicines and a less important role in the neurosciences teams. The latter was more important in biomedicine and neurosciences – which corresponds, especially for biomedicine, to the figures from the doctoral students research (see D1.3, p.69) – and less important in the other disciplines (see Figure 4-18).

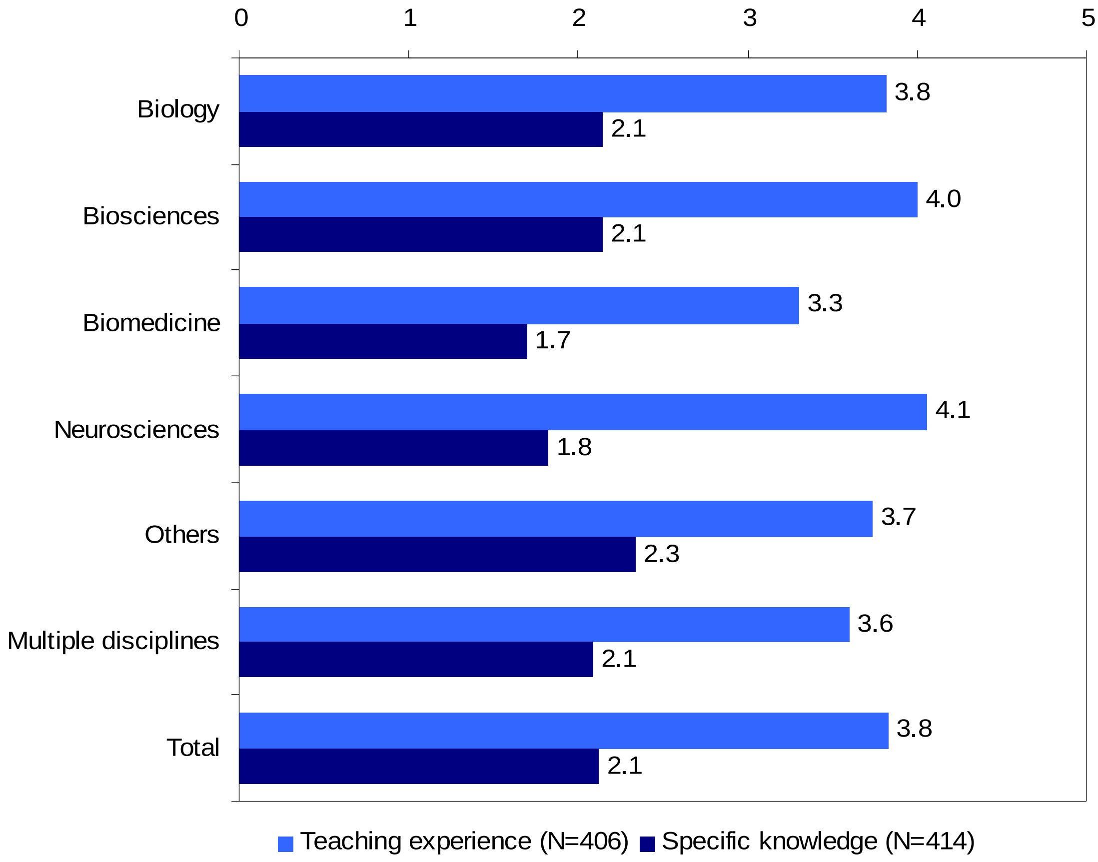
Table 4-25: Mean values for the desired characteristics of applicants for a post-doctoral research position by main discipline of the team

Main discipline of the team	Publications (N=411)	Grades (N=409)	Teaching experience (N=406)	Right discipline (N=410)	Specific knowledge (N=414)	Work experience (N=412)	Reputation of previous affiliations (N=404)	Recommendations (N=409)	Has previously worked with the group (N=408)	Highly motivated (N=411)	Fits socially (N=409)	Other characteristics (N=64)
Biology	2.2	2.5	3.8	2.1	2.1	2.5	2.4	2.5	3.6	1.6	2.2	4.2
Biosciences	2.3	2.6	4.0	2.3	2.1	2.5	2.2	2.2	3.6	1.5	2.1	3.4
Biomedicine	2.2	2.8	3.3	1.7	1.7	2.3	2.5	2.5	3.0	1.3	1.8	3.5
Neurosciences	1.8	2.8	4.1	2.0	1.8	2.4	2.1	2.1	3.3	1.6	2.4	1.0
Others	2.1	2.5	3.7	2.2	2.3	2.7	2.4	2.5	3.3	1.7	2.3	3.7
Multiple disciplines	2.1	2.7	3.6	2.1	2.1	2.4	2.3	2.3	3.5	1.4	2.2	3.1
Total	2.2	2.6	3.8	2.2	2.1	2.5	2.3	2.3	3.5	1.5	2.2	3.4
Standard deviation	*0.16*	*0.11*	*0.28*	*0.21*	*0.24*	*0.13*	*0.14*	*0.18*	*0.24*	*0.13*	*0.19*	*1.12*

Note: 1 = essential to 5 = no importance, n.a. excl., main two factors highlighted.

Source: NetReAct survey 2005.

Figure 4-18: Importance of teaching experience and specific knowledge for recruiting by main discipline of the team (arithmetic mean)

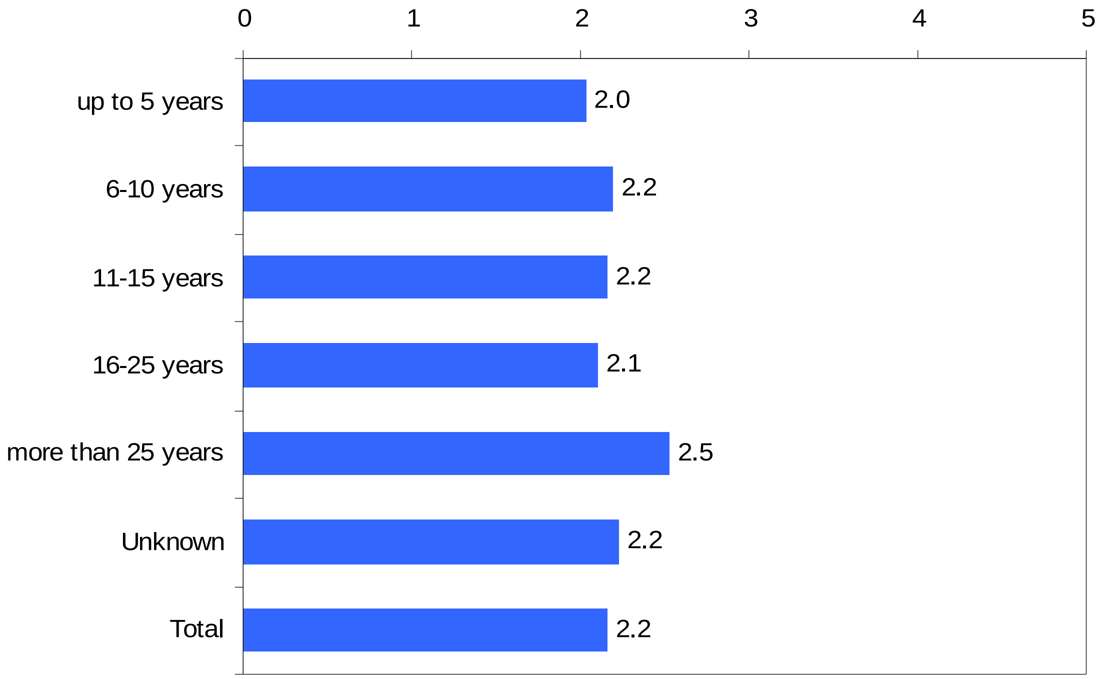


Note: 1 = essential to 5 = no importance, n.a. excl., standard deviation: teaching experience 0.28, specific knowledge 0.24.

Source: NetReAct survey 2005.

Analysing the influence of the team age and size delivers no striking pattern (see Table A-25 and A-26 in the annex). Again, the motivation of the applicant for a post-doctoral research post was of major importance. Nothing else seemed to affect the decisions of team leaders to such a large extent. The second important factors were again different, by team age as well as by team size. Recapitulating, we can say that it was important to have specific knowledge and be in the right discipline for young (10 years and younger) and small (up to 20 persons) teams. For middle aged and middle sized teams the characteristic "publications" was important, which was also detected for PhD studentship applicants (see D1.3, p.67). The older and the bigger the team the more important the correct behaviour became. Figure 4-19 and Figure 4-20 show the differences within the age and size categories for the characteristics with the highest standard deviation and therefore the most interesting factors. When neglecting the age group "unknown" for the characteristics and the calculation of the standard deviation, the factor "socially fit" receives the highest standard deviation for team age groups. It could be assumed that it was more important for smaller than for bigger teams that the applicant fits socially. Differentiating by team sizes, the most interesting characteristic was the “grade” of the applicant. If we disregard the last category “50 and more”, we could assume that the grade of the applicant was more important in bigger teams than in smaller ones.

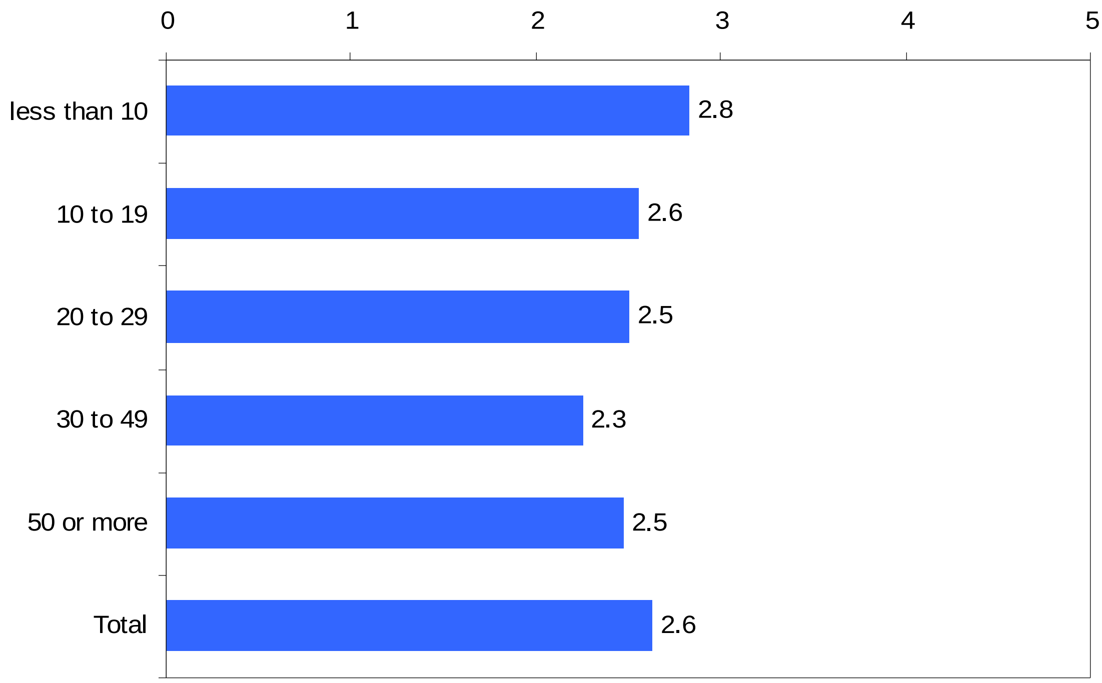
Figure 4-19: Importance of the social fitness for recruiting of post-docs by age of the team (arithmetic mean)



Note: 1 = essential to 5 = no importance, n.a. excl., standard deviation: 0.17, N= 435.

Source: NetReAct survey 2005.

Figure 4-20: Importance of grades for recruiting by size of the team (arithmetic mean)



Note: 1 = essential to 5 = no importance, n.a. excl., standard deviation: 0.20, N=437.

Source: NetReAct survey 2005.

4.3.3 Summary

The present chapter investigated the factors influencing the recruitment of post-docs from two perspectives: the attractiveness of the teams for post-docs and the attractiveness of applicants for open post-doctoral research positions.

In regard to the attractiveness of life sciences teams the team leaders highlighted the role of the team's scientific reputation for obtaining highly qualified post-docs – as well as PhD candidates. Although it would have been better to ask the post-docs themselves, what they judge important, we think that the responses were trustworthy as the team leaders once were PhD students and post-docs, too. In addition to the scientific reputation the quality of the post-doctoral training, the availability of applicants from within the own university and recommendations from outside played a major role, whereas industry contacts and targeted information were hardly rated as important.

The most desired property of applicants was a high degree of motivation and commitment – both for PhD students and post-docs. All other characteristics were considered to be less important, though some still received a high importance ranking, like whether applicants are expected to fit into the team, discipline, previous affiliation or recommendations from colleagues. In contrast to the desired characteristics of PhD students, applicants for a post-doctoral research post had to exhibit a list of publications they wrote or were involved in. This factor was more important for post-docs than for PhDs – which is most probably founded in the nature of these different research positions. While a PhD student was more engaged in expanding his knowledge before taking on the doctoral student education, a post-doc already has produced new knowledge in his or her antecedent PhD education and surely has published research results in this context (for instance the doctoral thesis).

The appraisals of team and applicant characteristics differed by country. For instance, publications played a more pronounced role in the Czech Republic, Norway and Portugal than in the other countries; previous knowledge of the applicants was less important in the UK and France, where post-docs were more mobile and more international than in the other countries (see section 4.1.4). Some of the appraisals also tended to vary between young and old teams as well as between small and large teams.

5 Summary of findings

Post-docs in life sciences research teams in Europe

The NetReAct survey shows what the characteristics of post-docs in life sciences research teams in ten European countries in 2003 were. We were able to analyse the number of post-docs per team, the age, the gender, the main research discipline, the country of origin and the funding structures. Furthermore, we have analysed whether post-docs had work experience abroad and what their new activities, their new organisation and country of residence after leaving the team were.

In detail, we have found 2.2 post-docs per team on average, with quite big teams in the Czech Republic and France (22 persons mean). The constitution of research teams were different in the different countries. A relatively high share of principal investigators was found in Spanish teams, while the share of post-docs was highest in the UK (22% of total staff) and the share of PhD students was highest in Sweden. Furthermore, the group of technical and other administrative staff was strongest represented in French teams. Analysing the composition of research teams by the main discipline of the team revealed that there were slightly more post-docs in biomedicine and neurosciences (each around 18% of total staff) and most PhD students in biomedicine. The age of the teams did not have a strong impact on the composition of the teams, but we could assume that post-docs and doctoral students were slightly higher represented in middle-aged teams and that there were relatively many technical and other administrative staff employed in young and old teams. According to the size of the team, we found that the smaller the team, the higher the shares of principal investigators, post-docs and PhD students and that other researchers and students, in particular technical and administrative staff, were overrepresented in bigger teams.

The second factor of post-docs that we have analysed was age. We found out that post-docs in life sciences research teams were around 32 years old. By country, we observed that post-docs in the UK and the Czech Republic were younger (around 30) and post-docs in Spanish and German teams were relatively old (around 33). Differences were also found in the different research fields: younger post-docs were employed in bio- and neurosciences teams, whereas older were employed in biology teams. The distribution of post-docs' ages by size of the teams revealed that younger post-docs were found in very big and very small teams.

The gender distribution of post-docs was 53% male to 47% female. But, there were differences by country: a relatively high share of male post-docs was found in Spanish, Hungarian and British teams while quite a lot of females were found in particular in Italian teams (70%) and also – but to a lesser extent – in Norwegian and Portuguese teams. Differentiating the gender distribution by the main discipline of the team we saw that there were more males in biomedicine and more females in biosciences.

Post-docs who had biology as their main research discipline were overrepresented in German, Norwegian and Portuguese teams, whereas only a few biology post-docs were found in Hungarian and Italian teams. For the biosciences as the main research field of post-docs, we observed an overrepresentation in Italy, the Czech Republic and Hungary, and an underrepresentation in Germany, Portugal and Norway. Czech, Norwegian and British teams employed many biomedical post-docs and French and Hungarian employed many neurosciences post-docs.

Analysing the country of origin and the country of last degree, i.e. the country where the post-doc has earned his or her doctorate, revealed similar trends, so that we here focus on the country of origin. Although most post-docs in the research teams for which team leaders have provided us with information were coming from the same country as the country of the team, we observed a relatively high share of post-docs coming from abroad. Two out of five post-docs were foreign and from other EU member states or from other countries worldwide (not other European, not North-America and as well not Japan). Country differences appeared for this analysis, too: the highest share of foreign post-docs were found in Sweden, where only 28% of the post-docs were coming from within the same country. The same applied for France and the UK, but to a lesser extent. On the other side, we found low shares of foreign post-docs in the Czech Republic, Italy and Hungary, where less than a third of post-docs were foreign. High shares of foreign post-docs in Sweden, Norway and Portugal were coming from another EU member state. Non-EU European countries were common origins for post-docs in Sweden, where 16.5% of post-docs (in contrast to the overall average of 5.4%) were coming from these countries. In France, the North-American states were common as countries of origin. To analyse the diversity of the life sciences research teams, we have calculated the Shannon Diversity Index. The corresponding values showed high diversities for the country of origin of post-docs in Swedish and British teams and low diversities in Czech and Hungarian teams. With regard to the main discipline of the team, we observed that there were more foreign post-docs in biology and fewer in biosciences and multi-discipline teams. Thereby, notably many post-docs coming from the USA or Canada were found in neurosciences teams (12% in contrast to 4% on average). The analysis of post-docs' country of origin by the age of the team revealed that seemingly a high share of foreign post-docs (more than 60%) were employed in old teams.

As a next step we have examined the funding structures of post-docs, i.e. what were the sources and what the duration of funding. The NetReAct survey showed that the main funding sources for post-docs in the life sciences were "other public sources" with more than 50% of post-docs funded by this type of source. The second important source was the university funding possibility. That there were different funding structures in the different countries was revealed by the analysis of funding sources by country of the team. We observed that university funding played a major role in the Czech Republic, Hungary and Italy. Further, other public funding was important for post-docs in Spain, Portugal, Norway, Sweden and the UK (around 50% and more post-docs had such a funding). Industry and self-funding was most important for post-docs in France, the latter also for post-docs in the UK. The relatively high shares of self-funded post-docs in France suggests a possible problem in obtaining funding sources in the French life sciences research area. The same applied to a lesser extent to post-docs in the UK. The analysis of funding sources by the main research field of the team showed that own university funding was most important for post-docs in neurosciences; other public and industry funding sources were most important in biomedicine; self-funding played an important role in biology. By team sizes, we found that own university funding became more important the bigger the team was and that other public funding became more important the smaller the team was. Furthermore, industry funding was important above all for post-docs in big teams. Concerning the duration of funding, the responses showed that most post-docs were funded for a period of 2 to 3 years. Whereas short-term funding (below one year) was more important for post-docs in France, Spain and Sweden, middle-term funding (two to three years) was more important again in Sweden, but also in Italy and long-term funding (three years and more) played a major role in the Czech Republic, Portugal and Germany.

Post-docs having had foreign work experience in research teams in Europe constituted more than half of all post-docs, i.e. every other post-doc has worked in another country than the country of the team before. We found more post-docs with work experience abroad in Spanish, Hungarian and Portuguese teams and, interestingly, fewer in British teams. The share of post-docs having worked abroad is highest in biology research teams. In addition, middle-sized teams seemed to have more post-docs with work experience abroad.

In the survey, we also found out what the new activities post-docs had taken, the new organisations post-docs had changed to and the new countries post-docs had gone to after leaving the research team were. Concerning the new activity, post-docs have mainly taken another post-doc/ temporary or a faculty/ permanent position (in each case one third). In the UK and Norway more post-docs have taken another post-doc/ temporary position; in Spain, France and Hungary more have taken a faculty/ permanent position. To take another research & development position was most important for post-docs in the Czech Republic and Norway. Other employment played an important role in CZ, DE and IT. The share of post-docs being unemployed after leaving the team was the highest in Germany and France (ca. 8%). Post-docs leaving from biology, biomedicine and neurosciences teams were thereafter mainly employed in a permanent position, whereas post-docs from biosciences teams took another post-doc/ temporary position. According to the new organisation to which the post-docs have changed, a university was the main destination, i.e. they have stayed at the university. This was in particular the case for post-docs leaving from teams in Spain, Hungary and Norway, whereas other public research organisation were important new employers for post-docs in France. In addition, the private sector was most important for post-docs from German, Italian or Swedish research teams, where more than 20% have changed to. The new country remained mostly the same, i.e. 60% of the post-docs stayed in the country of the team after leaving it. Following destinations were to 18% other EU member states, other countries worldwide (12%) and USA or Canada (8%). Post-docs who have stayed in the same country were mainly found in Czech, Italian and Norwegian teams (more than 80%). Notably high shares of post-docs from teams in France and Sweden have left the country. The destinations varied across the country of the team: another

EU member state was a common destination for post-docs from Spanish and Swedish teams; other non-EU but European countries were popular among post-docs from French teams; USA/Canada was strikingly important for post-docs from Germany, Sweden and the UK; other countries worldwide were an important destination for post-docs from Spanish and French teams. For the latter we can assume that possibly these researchers once came to Spain and France from one of the many Spanish or French speaking countries worldwide and return after they have finished their education. Analysing the new countries by the main discipline of the team, we observed that in particular post-docs from neurosciences have gone to the USA or Canada, whereas post-docs from biomedicine teams left the teams to another country worldwide.

To sum all this information up, the question

How can post-docs in the European life sciences research teams be characterised?

could be answered as follows:

The typical post-doc in the life sciences in the study period was around 32 years old, not implicitly male, but to a slightly larger extent, and also not implicitly from within the country of the team (ca. 40% of post-docs have lived or worked in another country before). He or she has earned his or her doctorate probably in the same country and was funded through non-university public sources for a duration of 2 to 3 years. Furthermore, the typical post-doc had work experience abroad, and – after leaving the team – he or she took another post-doc/ temporary or faculty/ permanent position in an university, but did not stay implicitly in the country.

Further to the details about the characteristics of post-docs, the NetReAct survey delivered information about the attractiveness of life sciences research teams and about the desired characteristics post-docs should have. Both were provided from the point of view of the team leaders.

Concerning the attractiveness of teams, we observed that the main factors were the scientific reputation as well as the quality of the post-doctoral education. Considerably less important were the availability of industry contacts and generally available information sources such as the internet, newsletters, newspapers and journals. The analysis across the different countries revealed no striking differences, the scientific reputation was always the most important category. However, while analysing the factors by the main discipline of the team, we found that industry contacts were an important factor for biomedicine teams. This was also the case for bigger teams. The team age showed only variations for the factor "generally available information", which was more important for young than for old teams.

Team leaders in the European life sciences mentioned above all the motivation post-docs should have as the most important and desired characteristic. Also important, but to a lesser extent was the specific knowledge, the right discipline, publications post-docs have written or have been involved in, and the social fitness. There were not many differences across countries, but we have further analysed the characteristics "having worked with the team previously" and "teaching experience", since these two showed the highest variations. The former was more important in Hungary and the Czech Republic, the latter in Hungary and Germany. While the motivation was also most important when differentiating by main discipline of the team, we observed that the second important factor in neurosciences were the publications, in biosciences this was the social fitness. In the other disciplines, the correct behaviour, as well as the specific knowledge, were second important. Teaching experiences were found more important in biomedicine than in other disciplines and the specific knowledge was more important for biomedical and neurosciences teams. According to the age and size of the team, we observed that the social fitness seemed to be more important in younger teams and that grades played a more important role in bigger teams.

To sum all this information up, the question

What were the main factors the team leaders saw with regard to the attractiveness of research teams and the characteristics of post-docs?

could be answered as follows:

Research teams in life sciences in Europe ranked their scientific reputation and their quality of post-doctoral training highest with regard to the attractiveness of the team for post-docs. Other factors played a more or less negligible role.

The most important characteristic the team leaders in life sciences research teams demanded from new post-docs was very high motivation. Only second important were characteristics like the specific knowledge a post-doc has, adequate behaviour, publications post-docs have written or have been involved in, and whether the post-doc fits socially or not.

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Annex 1: Tables

Table A-1: Mean number of PhD students (from WWW) by response status and country[a]

Country	Non responses and unusable responses		Usable responses		Results of the statistical tests		
	Mean	S.E.	Mean	S.E.	ANOVA F-value	Levene-Test	Welch-Test
CZ	6.3	0.8	5.9	0.9	0.08	0.81	0.11
DE	5.5	0.4	5.4	0.6	0.05	0.11	0.05
ES	4.6	0.5	4.7	1.0	0.02	0.15	0.02
FR	5.0	0.5	4.9	0.9	0.02	0.16	0.02
HU	4.7	0.9	3.5	0.5	0.83	2.27	1.29
IT	3.0	0.4	3.6	0.7	0.62	0.50	0.59
NO	3.9	0.5	4.2	0.7	0.10	0.17	0.10
PT	3.9	0.4	5.3	0.9	2.32	4.72*	2.14
SE	5.9	0.5	5.6	0.8	0.12	0.20	0.12
UK	5.9	0.6	5.7	0.9	0.04	0.20	0.04
Total	**5.1**	**0.2**	**5.0**	**0.3**	**0.09**	**0.55**	**0.10**

a Based on data for 954 teams (53.8% of the sample).

F-Test on the congruence of means, Levene-Test on the homogeneity of variances, Welch-Test: robust test on the congruence of means for inhomogeneous variances.

Significance levels: ** p < 0.01, * p < 0.05, + p < 0.1.

Source: NetReAct (FHSO).

Table A-2: Mean number of post-docs (from WWW) by response status and country[a]

Country	Non responses and unusable responses		Usable responses		Results of the statistical tests		
	Mean	S.E.	Mean	S.E.	ANOVA F-value	Levene-Test	Welch-Test
CZ	2.0	0.4	1.1	0.5	1.77	0.03	1.77
DE	3.1	0.3	3.1	0.5	0.00	0.23	0.00
ES	1.8	0.2	2.0	0.4	0.15	0.85	0.21
FR	2.0	0.3	1.7	0.3	0.43	0.87	0.55
HU	3.1	0.4	2.4	0.6	0.96	0.15	0.84
IT	1.4	0.3	1.7	0.3	0.35	0.00	0.42
NO	2.8	0.5	2.8	0.5	0.00	0.42	0.00
PT	1.4	0.3	3.0	0.7	4.45*	3.39+	4.73*
SE	2.5	0.4	1.4	0.2	3.08+	8.50**	6.00*
UK	4.0	0.3	3.7	0.6	0.29	0.19	0.27
Total	**2.7**	**0.1**	**2.5**	**0.2**	**0.90**	**1.83**	**1.00**

a Based on data for 697 teams (39.3% of the sample).
F-Test on the congruence of means, Levene-Test on the homogeneity of variances, Welch-Test: robust test on the congruence of means for inhomogeneous variances.
Significance levels: ** p < 0.01, * p < 0.05, + p < 0.1.

Source: NetReAct (FHSO).

Table A-3: Usable responses to the survey by country

Country	Non responses and unusable responses		Usable responses		Total sample size
	N	in %	N	in %	N
CZ	89	74.8%	30	25.2%	119
DE	212	77.9%	60	22.1%	272
ES	127	77.4%	37	22.6%	164
FR	169	75.1%	56	24.9%	225
HU	74	68.5%	34	31.5%	108
IT	134	72.0%	52	28.0%	186
NO	84	69.4%	37	30.6%	121
PT	79	64.2%	44	35.8%	123
SE	108	72.5%	41	27.5%	149
UK	229	74.8%	77	25.2%	306
Total	**1,305**	**73.6%**	**468**	**26.4%**	**1,773**

Chi-square = 12.886, insignificant at $p < 0.1$

Source: NetReAct survey 2005.

Table A-4: Academic disciplines based on K.U. Leuven – IRO Subject Classification

Code	Discipline	Code	Discipline
1	Z1 animal sciences	19	R5 physiology
2	Z2 aquatic sciences	20	I1 clinical medicine
3	Z3 microbiology	21	I2 experimental medicine
4	Z4 plant sciences	22	N1 neuroscience
5	Z5 pure and applied ecology	23	A agriculture, environment
6	Z6 veterinary sciences	24	N2 behaviour
7	B0 multidisciplinary biology	25	N3 psychology
8	B1 biochemistry/biophysics	26	C1 chemistry
9	B5 molecular biology	27	C2 chemical engineering
10	B2 cell biology	28	P physics
11	B3 genetics	29	G1 geosciences
12	B6 developmental biology	30	G2 space sciences
13	R1 anatomy and pathology	31	G3 hydrology
14	R2 biomaterials	32	G4 oceanography
15	R7 bioengineering	33	E1 engineering
16	R3 laboratory medicine	34	E2 computer science
17	R4 pharmacology	35	M mathematics
18	R6 toxicology	36	O others

Source: K.U. Leuven – IRO (NetReAct modifications).

Table A-5: Percentages of post-docs by their gender and the age of the team

Team age	Gender of the post-docs					
	Male		Female		All psot-docs	
	N	In %	N	In %	N	In %
up to 5 years	58	55.8	46	44.2	104	100
6-10 years	103	50.7	100	49.3	203	100
11-15 years	115	57.8	84	42.2	199	100
16-25 years	108	54.3	91	45.7	199	100
more than 25 years	41	55.4	33	44.6	74	100
Unknown	5	31.3	11	68.8	16	100
Total	**430**	**54.1**	**365**	**45.9**	**795**	**100**

Source: NetReAct survey 2005.

Table A-6: Percentages of post-docs by their discipline of doctoral research and the age of the team

Age of the team	Discipline of the post-docs					All post-docs (N)
	Biology	Bio-sciences	Bio-medicine	Neuro-sciences	Other disciplines	
up to 5 years	26.0	52.9	1.9	5.8	13.5	104
6-10 years	28.0	47.8	7.2	6.3	10.6	207
11-15 years	28.1	45.7	7.5	3.5	15.1	199
16-25 years	29.2	39.1	8.9	5.7	17.2	192
more than 25 years	35.6	47.9	1.4	8.2	6.8	73
Unknown	62.5	31.3	0.0	0.0	6.3	16
Total	**29.5**	**45.5**	**6.3**	**5.4**	**13.3**	**791**

Source: NetReAct survey 2005.

Table A-7: Percentages of post-docs by their discipline of doctoral research and the size of the team

Size of the team (no. of total staff)	Discipline of the post-doc					All post-docs (N)
	Biology	Bio-sciences	Bio-medicine	Neuro-sciences	Other disciplines	
less than 10	31.1	52.0	4.0	2.2	10.7	225
10 to 19	24.2	49.7	5.3	6.5	14.3	322
20 to 29	33.0	33.0	6.1	9.6	18.3	115
30 to 49	45.7	29.6	6.2	6.2	12.3	81
50 or more	19.2	50.0	23.1	1.9	5.8	52
Total	**29.3**	**45.9**	**6.3**	**5.4**	**13.1**	**795**

Source: NetReAct survey 2005.

Table A-8: Percentages of post-docs by their country of last degree (PhD) and the country of the team

Country of the team	Country of last degree of the post-doc					
	Own country	**Other EU country**	**Other European country outside EU**	**USA or Canada**	**Other country**	**All post-docs (N)**
CZ	86.5	8.1	2.7	0.0	2.7	37
DE	66.4	11.5	5.7	4.1	12.3	122
ES	65.7	18.6	0.0	2.9	12.9	70
FR	44.1	21.5	10.8	7.5	16.1	93
HU	82.4	2.9	5.9	5.9	2.9	34
IT	82.9	7.9	1.3	1.3	6.6	76
NO	59.6	29.8	4.3	2.1	4.3	47
PT	46.3	34.1	6.1	3.7	9.8	82
SE	34.0	31.9	14.9	2.1	17.0	94
UK	59.1	19.1	3.6	4.9	13.3	225
Total	**59.3**	**19.5**	**5.7**	**3.9**	**11.6**	**880**

Source: NetReAct survey 2005.

Table A-9: Shannon's Diversity Index for the countries of last degree (PhD) of the post-docs by country of the team

Country	Arithmetic mean	95% Confidence interval of the mean		No. of teams
		lower bound	**upper bound**	
CZ	0.06	-0.03	0.15	19
DE	0.37	0.24	0.50	45
ES	0.28	0.11	0.45	29
FR	0.43	0.27	0.59	40
HU	0.07	-0.03	0.17	19
IT	0.18	0.04	0.31	30
NO	0.20	0.05	0.35	21
PT	0.50	0.30	0.70	31
SE	0.64	0.45	0.83	34
UK	0.55	0.41	0.68	65
Total	**0.38**	**0.33**	**0.43**	**333**

F-Test on the congruence of means: F-value 5.546, $p<0.01$
Levene-Test on the homogeneity of variances: 9.762, $p<0.01$
Robust tests on the congruence of means: Welch-Test: 9.218, $p<0.01$, Brown-Forsythe-Test: 6.472, $p<0.01$

Source: NetReAct survey 2005.

Table A-10: Percentages of post-docs by their country of last degree (PhD) and the main discipline of the team

Main discipline of the team	Country of last degree of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
Biology	51.1	23.7	**4.4**	5.2	15.6	135
Biosciences	60.8	19.0	**6.8**	4.4	9.1	385
Biomedicine	60.0	25.0	**5.0**	0.0	10.0	20
Neurosciences	52.9	23.5	**0.0**	8.8	14.7	34
Others	60.9	13.0	**6.5**	2.2	17.4	46
Multiple disciplines	65.0	16.7	**4.9**	1.5	11.8	203
Total	**59.9**	**19.2**	**5.6**	**3.8**	**11.5**	**823**

Source: NetReAct survey 2005.

Table A-11: Percentages of post-docs by their country of last degree (PhD) and the age of the team

Age of the team	Country of last degree of the post-docs					All post-docs
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
up to 5 years	63.2	21.9	5.3	2.6	7.0	114
6-10 years	64.2	17.7	6.6	2.7	8.8	226
11-15 years	59.3	21.3	5.4	3.6	10.4	221
16-25 years	54.9	19.5	5.1	6.5	14.0	215
more than 25 years	45.3	18.7	6.7	2.7	26.7	75
Unknown	68.8	18.8	6.3	0.0	6.3	16
Total	**58.9**	**19.7**	**5.8**	**3.8**	**11.8**	**867**

Source: NetReAct survey 2005.

Table A-12: Percentages of post-docs by their country of origin and the size of the team

Size of the team (no. of total staff)	Country of origin of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
less than 10	49.4	22.8	7.5	4.1	16.2	241
10 to 19	57.9	18.4	5.5	4.3	13.8	347
20 to 29	56.3	20.6	4.0	4.0	15.1	126
30 to 49	61.6	20.9	3.5	3.5	10.5	86
50 or more	71.0	9.7	3.2	1.6	14.5	62
Total	**56.6**	**19.6**	**5.5**	**3.9**	**14.4%**	**862**

Source: NetReAct survey 2005.

Table A-13: Percentages of post-docs by their country of last degree (PhD) and the size of the team

Size of the team (no. of total staff)	Country of last degree of the post-doc					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	

less than 10	54.1	21.5	7.9	4.1	12.4	242
10 to 19	61.2	18.4	5.7	2.8	11.9	353
20 to 29	56.6	22.5	3.9	6.2	10.9	129
30 to 49	64.4	20.7	4.6	2.3	8.0	87
50 or more	69.5	10.2	3.4	1.7	15.3	59
Total	**59.4**	**19.5**	**5.7**	**3.6**	**11.7**	**870**

Source: NetReAct survey 2005.

Table A-14: Percentages of post-docs by their duration of funding and main discipline of the team

Main discipline of the team	Duration of funding of the post-docs			All post-docs (N)
	0-1 years	2-3 years	> 3 years	
Biology	21.4	41.9	36.8	117
Biosciences	13.4	49.7	36.9	358
Biomedicine	19.0	52.4	28.6	21
Neurosciences	19.2	46.2	34.6	26
Others	31.1	42.2	26.7	45
Multiple disciplines	16.6	45.1	38.3	193
Total	**16.8**	**46.8**	**36.3**	**760**

Source: NetReAct survey 2005.

Table A-15: Percentages of post-docs by their duration of funding and age of the team

Age of the team	Duration of funding of the post-docs			All post-docs (N)
	0-1 years	2-3 years	> 3 years	
up to 5 years	12.6	36.9	50.5	103
6-10 years	15.4	54.8	29.8	208
11-15 years	22.0	43.5	34.6	191
16-25 years	15.0	49.2	35.8	187
more than 25 years	16.4	49.3	34.2	73
Unknown	12.5	25.0	62.5	16
Total	**16.6**	**47.2**	**36.2**	**778**

Source: NetReAct survey 2005.

Table A-16: Percentages of post-docs by their duration of funding and size of the team

Total staff of the team	Duration of funding of the post-docs			All post-docs (N)
	0-1 years	2-3 years	> 3 years	
less than 10	22.3	53.1	24.6	224
10 to 19	13.8	50.5	35.7	311
20 to 29	14.7	31.9	53.4	116
30 to 49	12.0	48.0	40.0	75
50 or more	17.9	39.3	42.9	56
Total	**16.5**	**47.4**	**36.1**	**782**

Source: NetReAct survey 2005.

Table A-17: Percentages of post-docs by their new activity and the age of the team

Age of the team	New activity of the post-docs					All post-docs (N)
	Post-doc or temporary position	Faculty or other permanent position	Other R&D activity	Other employ ment	No employment	
up to 5 years	27.8	35.4	22.8	11.4	2.5	79
6-10 years	39.3	30.1	19.0	6.7	4.9	163
11-15 years	32.3	37.4	18.2	9.6	2.5	198
16-25 years	26.3	38.3	23.4	9.7	2.3	175
more than 25 #years	36.8	44.7	10.5	6.6	1.3	76
Unknown	10.0	10.0	40.0	30.0	10.0	10
Total	**32.1**	**36.1**	**19.7**	**9.1**	**3.0**	**701**

Source: NetReAct survey 2005.

Table A-18: Percentages of post-docs by their new activity and the size of the team

Size of the team	New activity of the post-docs					All post-docs (N)
	Post-doc or temporary position	Faculty or other permanent position	Other R&D activity	Other employ ment	No employment	
less than 10	32.3	37.0	21.4	5.7	3.6	192
10 to 19	32.2	31.9	21.1	11.7	3.0	298
20 to 29	26.6	43.6	19.1	8.5	2.1	94
30 to 49	37.8	40.5	12.2	5.4	4.1	74
50 or more	30.4	37.0	17.4	15.2	0.0	46
Total	**32.0**	**36.1**	**19.7**	**9.2**	**3.0**	**704**

Source: NetReAct survey 2005.

Table A-19: Percentages of post-docs by their new organisation and the main discipline of the team

Main discipline of the team	New organisation of the post-docs			All post-docs (N)
	University	Other public organisation	Private sector	
Biology	65.2	23.6	11.2	89
Biosciences	53.9	24.9	21.2	297
Biomedicine	71.4	0.0	28.6	21
Neurosciences	80.0	12.0	8.0	25
Others	67.5	20.0	12.5	40
Multiple disciplines	64.0	19.9	16.1	161
Total	**60.5**	**21.8**	**17.7**	**633**

Source: NetReAct survey 2005.

Table A-20: Percentages of post-docs by their new organisation and the age of the team

Age of the team	New organisation of the post-docs			All post-docs (N)
	University	Other public organisation	Private sector	
up to 5 years	58.3	19.4	22.2	72
6-10 years	60.1	26.4	13.5	148
11-15 years	61.3	21.0	17.7	186
16-25 years	59.1	23.2	17.7	164
more than 25 years	66.2	16.2	17.6	74
Unknown	22.2	44.4	33.3	9
Total	**60.2**	**22.4**	**17.5**	**653**

Source: NetReAct survey 2005.

Table A-21: Percentages of post-docs by their new organisation and the size of the team

Size of the team	New organisation of the post-docs			All post-docs (N)
	University	Other public organisation	Private sector	
less than 10	62.4	20.4	17.1	181
10 to 19	56.2	23.0	20.8	274
20 to 29	62.8	23.3	14.0	86
30 to 49	72.9	15.7	11.4	70
50 or more	48.9	35.6	15.6	45
Total	**60.1**	**22.4**	**17.5**	**656**

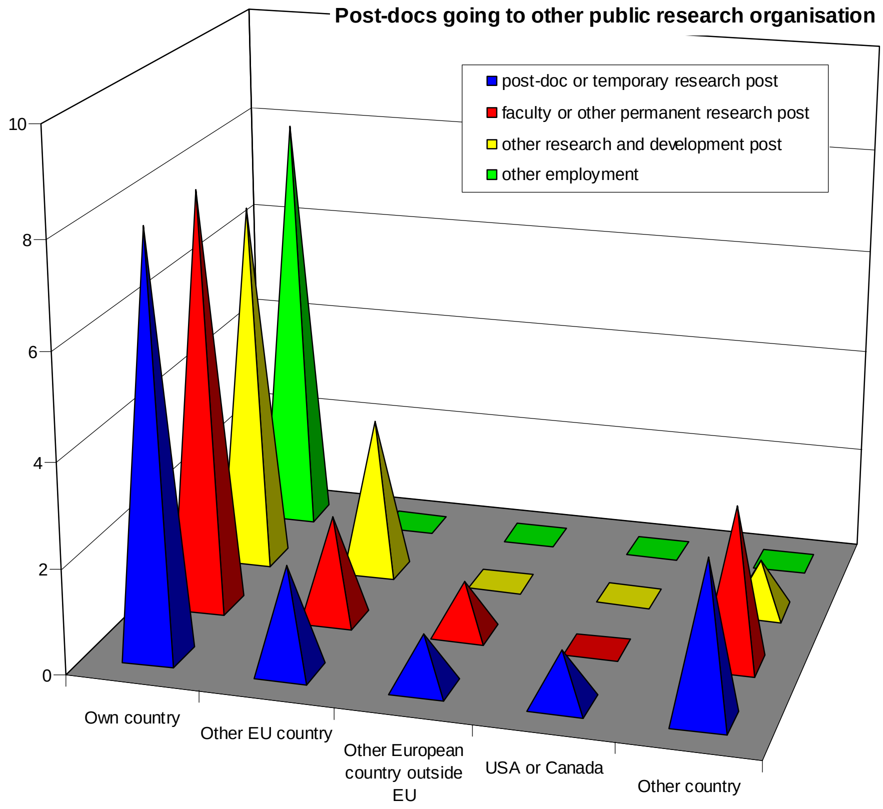
Source: NetReAct survey 2005.

Table A-22: Percentages of post-docs by new country of work and the size of the team

Size of the team (no. of total staff)	Country of destination of the post-docs					All post-docs (N)
	Own country	Other EU country	Other European country outside EU	USA or Canada	Other country	
less than 10	51.0	21.6	5.7	8.8	12.9	194
10 to 19	59.5	17.1	3.3	9.0	11.0	299
20 to 29	55.0	21.0	2.0	8.0	14.0	100
30 to 49	67.1	14.5	3.9	6.6	7.9	76
50 or more	73.1	9.6	1.9	5.8	9.6	52
Total	**58.4**	**18.0**	**3.7**	**8.3**	**11.5**	**721**

Source: NetReAct survey 2005.

Figure A-1: Number of post-docs by their new organisation of work, activity and destination country



Source: NetReAct survey 2005.

Table A-23: Factors determining the attractiveness of groups for post-docs by country of the team

Country of the team	Scientific reputation	Quality of post-doctoral training	Industry contacts	Suitable candidates	Outside recommendations	Generally available information	Targeted information	Other factors
				Median, n.a. excl.				
CZ	2.5	2	5	3	3	3.5	4	4
DE	2	2	4	3	2.5	3	4	5
ES	2	3	4	3	2	3	4	5
FR	1	2	4	2	2	3	4	2
HU	2	2	4	2	3	4	4	4.5
IT	2	2	4	2	3	3	4	4
NO	2	3	4	2.5	3	4	4	4.5
PT	1.5	2	4	2	2	3	3	2
SE	2	2	4	3	2	3	4	5
UK	1	3	4	3	2	2	4	4
Total	**2**	**2**	**4**	**3**	**3**	**3**	**4**	**4**
				Arithmetic mean, n.a. excl.				
CZ	2.5	2.6	4.2	2.9	3.3	3.5	3.8	3.3
DE	1.8	2.5	4.0	2.6	2.6	2.8	3.9	3.8
ES	1.8	2.6	3.9	2.8	2.4	3.0	4.0	3.7
FR	1.5	2.2	3.7	2.4	2.2	2.7	3.5	2.6
HU	1.9	2.2	3.7	2.4	2.8	3.6	3.6	3.4
IT	1.6	2.1	3.5	2.4	2.8	3.3	3.6	3.6
NO	2.0	2.7	3.9	2.6	3.0	3.3	4.2	4.1
PT	1.6	2.2	3.8	2.5	2.3	3.0	3.4	2.2
SE	1.6	2.3	4.1	2.9	2.5	2.8	4.0	3.7
UK	1.5	2.9	3.8	3.3	2.4	2.4	3.9	3.4
Total	**1.7**	**2.5**	**3.8**	**2.7**	**2.6**	**2.9**	**3.8**	**3.4**

Source: NetReAct survey 2005.

Table A-24: Desired characteristics of applicants for post-doctoral research posts by country of the team

Country of the team	Publications (N=442)	Grades (N=440)	Teaching experience (N=436)	Right discipline (N=441)	Specific knowledge (N=444)	Work experience (N=442)	Reputation of previous aff. (N=436)	Recommenda tions (N=441)	Has previously worked with the group (N=439)	Highly motivated (N=443)	Fits socially (N=440)
					Median, n.a. excl.						
CZ	2	3	4	3	3	2.5	2	2	3	1	2.5
DE	2	2	4	2	2	2	2	2	4	1	2
ES	2	3	4	2	2	2	2	2	3	2	2
FR	2	3	4	2	2	3	2	2	4	1	2
HU	2	3	3	2	2	2	2	3	3	1	2
IT	2	3	4	2	2	2	2	3	3	1	2
NO	2	2.5	4	2	2	3	2	2	4	2	2.5
PT	2	2	4	2	2	2	2	2	3	1	2
SE	2	3	4	2	2	2	2	2	4	1	2
UK	2	3	4	2	2	3	2	2	4	1	2
Total	**3**	**2**	**4**	**2**	**3**	**3**	**2**	**2**	**3**	**1**	**2**
					Arithmetic mean, n.a. excl.						
CZ	2.1	2.8	3.7	2.5	2.4	2.6	2.3	2.4	2.9	1.6	2.5
DE	2.2	2.5	3.4	2.3	2.2	2.4	2.4	2.3	3.5	1.3	1.8
ES	2.2	3.0	3.6	2.1	2.1	2.5	2.3	2.4	3.4	1.7	2.3
FR	2.2	2.8	4.2	2.1	2.2	2.8	2.3	1.9	3.9	1.4	1.9
HU	2.2	2.5	3.4	2.0	1.9	2.3	2.3	2.5	2.8	1.5	2.4
IT	2.3	2.6	3.7	2.2	2.1	2.3	2.3	2.8	3.2	1.5	2.2
NO	2.0	2.5	3.8	2.1	2.1	2.5	2.4	2.5	3.7	1.6	2.5
PT	1.8	2.2	3.9	2.2	1.9	2.4	2.1	2.3	3.4	1.5	2.0
SE	2.3	2.8	3.9	2.1	1.9	2.5	1.9	2.0	3.5	1.4	1.9
UK	2.3	2.6	4.3	2.0	2.1	2.5	2.4	2.1	3.9	1.4	2.4
Total	**2.2**	**2.6**	**3.8**	**2.2**	**2.1**	**2.5**	**2.3**	**2.3**	**3.5**	**1.5**	**2.2**

Source: NetReAct survey 2005.

Table A-25: Mean values for the desired characteristics of applicants for post-doctoral research posts by age of the team

Team age - grouped	Publications (N=437)	Grades (N=435)	Teaching experience (N=431)	Right discipline (N=436)	Specific knowledge (N=439)	Work experience (N=437)	Reputation of previous affiliations (N=431)	Recommendations (N=436)	Has previously worked with the group (N=434)	Highly motivated (N=438)	Fits socially (N=435)	Other characteristics (N=67)
up to 5 years	2.2	2.7	4.0	2.3	2.0	2.5	2.3	2.2	3.5	1.4	2.0	3.0
6-10 years	2.2	2.7	3.9	2.1	2.1	2.5	2.3	2.3	3.5	1.5	2.2	3.1
11-15 years	2.1	2.5	3.7	2.1	2.1	2.5	2.2	2.3	3.6	1.4	2.2	3.5
16-25 years	2.3	2.6	3.9	2.1	2.1	2.4	2.2	2.2	3.3	1.6	2.1	3.6
more than 25 years	2.4	2.6	3.9	2.2	2.2	2.6	2.6	2.6	3.6	1.7	2.5	3.7
Unknown	1.9	2.6	3.8	1.9	2.3	2.2	2.2	2.4	2.9	1.4	2.2	5.0
Total	2.2	2.6	3.8	2.2	2.1	2.5	2.3	2.3	3.5	1.5	2.2	3.4
Standard deviation	*0.17*	*0.08*	*0.08*	*0.13*	*0.11*	*0.14*	*0.16*	*0.13*	*0.27*	*0.11*	*0.17*	*0.72*

Note: 1 = essential to 5 = no importance, excl. n.a., main two factors highlighted.

Source: NetReAct survey 2005.

Table A-26: Mean values for the desired characteristics of applicants for post-doctoral research posts by size of the team

Total group size - grouped	**Publications (N=440)**	**Grades (N=437)**	**Teaching experience (N=434)**	**Right discipline (N=439)**	**Specific knowledge (N=441)**	**Work experience (N=439)**	**Reputation of previous affiliations (N=433)**	**Recommendations (N=439)**	**Has previously worked with the group (N=437)**	**Highly motivated (N=440)**	**Fits socially (N=437)**	**Other characteristics (N=66)**
less than 10	2.3	2.8	4.0	2.4	2.1	2.5	2.4	2.3	3.6	1.5	2.3	3.7
10 to 19	2.2	2.6	3.8	2.0	2.1	2.5	2.3	2.3	3.5	1.4	2.1	3.3
20 to 29	1.9	2.5	3.7	2.1	2.1	2.4	2.2	2.3	3.3	1.5	2.1	3.0
30 to 49	1.9	2.3	3.6	1.9	1.9	2.3	2.2	2.1	3.3	1.4	2.3	4.0
50 or more	2.2	2.5	3.8	2.2	2.1	2.4	2.3	2.5	3.3	1.6	2.1	3.0
Total	2.2	2.6	3.8	2.2	2.1	2.5	2.3	2.3	3.5	1.5	2.2	3.4
Standard deviation	*0.18*	*0.20*	*0.17*	*0.19*	*0.09*	*0.11*	*0.08*	*0.13*	*0.18*	*0.06*	*0.09*	*0.45*

Note: 1 = essential to 5 = no importance, excl. n.a., main two factors highlighted.

Source: NetReAct survey 2005.

Table A-27: Percentages of post-docs with work experience abroad by country, discipline, age and size of the team

		Post-docs with work experience abroad	Post-docs without work experience abroad
	Total	64.6	35.4
Country (N=507)	**CZ**	58.1	41.9
	DE	61.5	38.5
	ES	81.4	18.6
	FR	67.9	32.1
	HU	80.6	19.4
	IT	70.8	29.2
	NO	73.7	26.3
	PT	84.0	16.0
	SE	60.2	39.8
	UK	49.2	50.8
Discipline (N=481)	**Biology**	76.5	23.5
	Biosciences	61.0	39.0
	Biomedicine	52.4	47.6
	Neurosciences	62.5	37.5
	Others	66.7	33.3
	Multiple disciplines	62.1	37.9
Age (N=487)	**Up to 5 years**	69.7	30.3
	6-10 years	63.6	36.4
	11-15 years	67.7	32.3
	16-25 years	59.7	40.3
	More than 25 years	65.8	34.2
	unknown	87.5	12.5
Size (N=499)	**Less than 10**	60.4	39.6
	10 to 19	66.3	33.7
	20 to 29	73.5	26.5
	30 to 49	64.1	35.9
	50 or more	51.8	48.2

Source: NetReAct survey 2005.

Table A-28: Male and female post-docs by team size

Total team members	Gender of the post-docs					
	Male post-docs		Female post-docs		All post-docs	
	N	In %	N	In %	N	In %
less than 10	58	55.8	46	44.2	104	100.0
10 to 19	103	50.7	100	49.3	203	100.0
20 to 29	115	57.8	84	42.2	199	100.0
30 to 49	108	54.3	91	45.7	199	100.0
50 or more	41	55.4	33	44.6	74	100.0
Total	**430**	**54.1%**	**365**	**45.9%**	**795**	**100.0%**

Source: NetReAct survey 2005.

Table A-29: Shannon's Diversity Index for the countries of origin of the post-docs by age of the team

Age of the team	Arithmetic mean	95% Confidence interval of the mean		No. of teams
		lower bound	upper bound	
up to 5 years	**0.38**	**0.24**	**0.51**	**52**
6-10 years	**0.34**	**0.24**	**0.44**	**89**
11-15 years	**0.49**	**0.38**	**0.60**	**77**
16-25 years	**0.43**	**0.31**	**0.54**	**81**
more than 25 years	**0.55**	**0.34**	**0.76**	**27**
Unknown	**0.35**	**-0.05**	**0.74**	**6**
Total	**0.42**	**0.37**	**0.47**	**332**

F-Test on the congruence of means: F-value 1.303, insignificant at $p<0.1$
Levene-Test on the homogeneity of variances: 0.936, insignificant at $p<0.1$
Robust tests on the congruence of means: Welch-Test: 1.252, insignificant at $p<0.1$, Brown-Forsythe-Test: 1.383, insignificant at $p<0.1$

Source: NetReAct survey 2005.

Table A-30: Personnel structure of the life sciences teams by main discipline of the team

	Principal investigators		Post-docs		Other researchers		PhD students		Other research students		Technical staff		Other staff		Total grou size	
	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std Err*
Biology	2.7	0.3	1.9	0.2	1.8	0.5	5.0	0.6	3.9	0.6	2.2	0.3	0.5	0.2	17.6	[illegible]
Biosciences	2.0	0.2	2.3	0.2	1.2	0.2	4.3	0.3	2.1	0.3	1.8	0.2	1.1	0.6	14.8	[illegible]
Biomedicine	2.4	0.4	2.9	1.7	0.7	0.3	5.4	1.7	1.9	0.5	2.0	0.3	0.6	0.2	15.9	[illegible]
Neuro-sciences	2.8	0.5	3.1	0.5	1.0	0.5	4.7	0.8	2.9	0.7	2.1	0.5	0.4	0.2	17.1	[illegible]
Others	2.8	0.5	1.6	0.2	2.1	0.8	4.0	0.6	2.3	0.5	2.4	0.7	0.6	0.2	16.0	[illegible]
Multiple disciplines	2.8	0.3	2.3	0.3	1.9	0.4	5.4	0.4	3.1	0.5	2.6	0.6	0.9	0.3	19.0	[illegible]
Total	**2.4**	**0.1**	**2.2**	**0.1**	**1.5**	**0.2**	**4.7**	**0.2**	**2.7**	**0.2**	**2.1**	**0.2**	**0.9**	**0.3**	**16.5**	[illegible]

Note: N=432.

Source: NetReAct survey 2005.

Table A-31: Personnel structure of the life sciences teams by age of the team

	Principal investigators		Post-docs		Other researchers		PhD students		Other research students		Technical staff		Other staff		Total grou size	
	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std Err*
up to 5 years	1.8	0.2	1.4	0.2	0.7	0.1	2.8	0.3	1.9	0.2	1.5	0.3	1.7	1.3	11.8	[illegible]
6-10 years	2.4	0.2	2.0	0.2	1.5	0.3	5.1	0.5	3.3	0.5	2.0	0.3	0.6	0.1	16.9	[illegible]
11-15 years	2.3	0.2	2.8	0.3	2.1	0.4	4.9	0.4	2.7	0.4	2.1	0.4	0.8	0.3	17.3	[illegible]
16-25 years	2.4	0.2	2.4	0.3	0.8	0.2	4.8	0.4	2.3	0.3	1.7	0.2	0.5	0.1	14.9	[illegible]
more than 25 years	3.8	0.8	2.9	0.5	2.8	0.9	4.9	0.8	3.3	0.8	4.1	1.3	0.7	0.2	22.6	[illegible]
Unknown	3.1	0.8	2.2	0.5	1.5	0.4	4.9	0.7	3.7	0.8	1.8	0.4	0.2	0.1	17.3	[illegible]
Total	**2.4**	**0.1**	**2.2**	**0.1**	**1.4**	**0.1**	**4.5**	**0.2**	**2.7**	**0.2**	**2.0**	**0.2**	**0.8**	**0.3**	**16.0**	[illegible]

Note: N=461.

Source: NetReAct survey 2005.

Table A-32: Personnel structure of the life sciences teams by size of the team

	Principal investigators		Post-docs		Other researchers		PhD students		Other research students		Technical staff		Other staff		Total grou size	
	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std. Error*	Mean	*Std Err*
less than 10	1.2	0.0	0.9	0.1	0.3	0.0	2.0	0.1	1.0	0.1	0.7	0.1	0.1	0.0	6.4	[illegible]
10 to 19	1.9	0.1	2.1	0.1	0.8	0.1	3.8	0.1	2.4	0.1	1.5	0.1	0.4	0.0	13.1	[illegible]
20 to 29	3.3	0.3	3.0	0.3	2.0	0.3	7.4	0.4	4.2	0.4	2.8	0.4	0.9	0.1	23.6	[illegible]
30 to 49	4.9	0.6	4.6	0.5	3.8	0.7	10.8	0.9	6.7	1.0	5.1	0.7	1.3	0.2	37.1	[illegible]
50 or more	9.2	1.2	8.0	1.6	9.5	1.8	15.2	1.7	9.7	2.7	11.6	2.4	10.0	5.5	73.1	[illegible]
less than 10	1.2	0.0	0.9	0.1	0.3	0.0	2.0	0.1	1.0	0.1	0.7	0.1	0.1	0.0	6.4	[illegible]
Total	**2.4**	**0.1**	**2.2**	**0.1**	**1.4**	**0.1**	**4.6**	**0.2**	**2.7**	**0.2**	**2.1**	**0.2**	**0.9**	**0.3**	**16.2**	[illegible]

Note: N=465.

Source: NetReAct survey 2005.