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WOMEN IN INDUSTRIAL RESEARCH

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Foreword

It is my pleasure to present this study on statistical data and good practices on promoting women in industrial research in Europe. I am indebted to Prof. Danièle Meulders and to Maria Caprile, who managed this project. It is thanks to their efforts that today we know more about the real position of women in industrial research. Such work is essential for governments and enterprises for the development of appropriate strategies to promote women in research.

Although the study confirms that women are under-represented among industrial researchers, especially at hierarchical levels, it provides encouraging perspectives by showing that the private research sector has recently begun to recruit more highly qualified young women. The study stresses the need to improve the quality of statistics, and calls for a specific survey among European scientists and engineers with the aim to collect detailed information on the educational, labour and R&D trends of highly qualified women and men.

The data sources, case studies and good practices reiterate the need for a "transformative" approach to changing the working environment within industrial research. A similar conclusion was already reached in the report "Women in industrial research – A wake up call for European industry", published earlier this year and prepared by the high level expert group on Women in Industrial Research (WIR), chaired by Prof. Helga Rübsamen-Waigmann (Bayer) and Dr. Ragnhild Sohlberg (Norsk Hydro), both members of the European Research Advisory Board (EURAB).

I hope that this current study, together with the WIR report, will lead to fruitful discussions on how the situation of women researchers in private enterprises can be improved and how gender differentiated statistics for industrial research can be further developed.

Indeed, women will have to play an increasingly important role in the development of the European Research Area, which is the basis for the future competitiveness of Europe's industry and our common welfare.

Philippe Busquin

Commissioner for Research

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General Introduction

In 2003, the High Level Expert Group on Women in Industrial Research for strategic analysis of specific science and technology policy issues (STRATA) published the report *Women in Industrial Research: A wake up call for European industry*[1] in which the authors stressed the under-representation of women in industrial research in the European Union. They asked for concerted actions to attract, retain and promote women researchers in the industrial sector.

This under-representation of women in industrial research is not restricted to the Member States but also exists in other OECD countries such as the United States (US), Japan, New Zealand, Australia and Canada. In those countries, women scientists and engineers working in the industrial sector are under-represented and are also more likely to leave technical occupations, as well as the labour force, than women working in other sectors.

Several factors can explain why there are so few women in industrial research and why so many drop out. Firstly, there are barriers at entry level. Barriers to recruitment (biased hiring practices, for example), women's lack of self-confidence, lack of information on Science and Technology (S&T) careers, lack of career opportunities for women, lack of role models, a gender pay gap and gender stereotypes all play a role. Prejudices are particularly strong in the world of scientific research: *"Science is seen as an essentially masculine activity, not only because historically almost all scientists have been men, but also because the attributes of science itself are defined as the attributes of males . . . Both the scientific and the technological mind are viewed as active, rational and logical, whereas the feminine has traditionally been viewed as passive, emotional and intuitive. In this scenario, the traditional conceptions of femininity do not fit easily with science and technology. The cultural stereotype of science as linked with masculinity is crucial in explaining the small number of women in science. If science is seen as an activity appropriate for men, then it is hardly surprising that girls and young women usually do not want to develop the skills and behaviours considered necessary for success in science."*[2]

Secondly, industry is also a sector where the exit rate of women is higher than that of men, which might suggest that women perceive the climate in industry as inhospitable. This could be explained by the fact that most S&T fields are male-dominated, which means that women are subject to values and criteria that men have established for men, not for women. The consequences for women include discrimination, sexual harassment, isolation and exclusion from informal networks, problems linked to the different modes of communication between men and women and lack of opportunities for career development. There are also informal barriers: women are singled out, overlooked, ignored or discounted. Also, many

(1) *Rübsamen- Waigmann, Helga et al (2003), Women in industrial research: A wake up call for European industry, Office for Official Publications of the European Communities, Luxembourg*

(2) *Folguera, 2002, at http://leshumas.insa-lyon.fr/womeng2002/fr/Folguera.htm*

women feel they are judged by an entirely different set of standards. As a result, women develop a lack of self-confidence, low expectations or low aspirations, and have to work harder than men to prove themselves. This also contributes to stress and the creation of an unfriendly environment, in which it takes time and energy to ignore or to deal with these forms of behaviour.(3)

Thirdly, since women scientists are under-represented among senior managers in science and engineering, it leads to a lack of mentors and female role models.(4) However, mentors are valuable to women's career development. Researchers have shown that women with successful S&T careers had mentors who supported and encouraged them, particularly through the early phase of their career.(5)

Finally, there are difficulties in combining family and working life. While many women scientists and engineers cite the integration of family life and work as a primary concern, it seems that they often encounter difficulties in combining both activities because both are demanding in terms of time and personal investment. Moreover, the reconciliation problem is particularly harsh in scientific compared to other fields because women scientists are often married to men who pursue careers very similar to their own. This results in both partners being affected by the particularly demanding features of a technical career.

Regarding job satisfaction among women scientists and engineers, important issues for women working in the industrial sector are career development (promotion, salary increase, recognition), training, level of responsibility and trust, level of job interest, hospitable work environment, flexible working arrangements, job security and the existence of mentoring. Top managers can use these to attract more women to their firms.

Indeed, having more women in research is essential since a broadening of the recruitment base will facilitate a better match with the market and with clients. Moreover, women have different qualities than men, and therefore more women in research increases diversity, changes modes of communication and brings something new to the innovation process and thus improving the sector's competitiveness.

However, achieving equal presence and equal working conditions for men and women in industrial research involves both significant opportunities and significant constraints. At the Barcelona Summit, the European Council agreed that the proportion of the Gross Domestic Product (GDP) spent on Research and Development (R&D) in the European Union should increase from 1.9% in 2000 to 3% in 2010. Investment in industrial research is expected to double and the number

(3) *Mc Gregor and Harding, 2001, p.311; Committee on Women in Science and Engineering, 1994, p.24*
(4) *Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, 2000, p. 49*
(5) *The Committee on Women in Science and Engineering, 1994, p109*

General Introduction

of industrial researchers to increase significantly. However, this does not necessarily mean an increasing proportion of women in industrial research in the next few years. Indeed, currently, firms are not sufficiently aware of all the benefits that result from diversity. However, such a commitment by industry leaders to promote diversity in their companies is essential to achieve an increase in the number of women in S&T.
The aim of this report, therefore, is to provide a complete research project on the issue of women in industrial research, as well as on the obstacles they might encounter as their careers develop and how they can overcome them. Thanks to the efforts made by the Directorate-General (DG) Research Women and Science unit, this is the first time that a comprehensive official dataset has been issued on researchers by sex in the business enterprise sector. It should also be noted that it is more than just a report. Conducting the case studies involved close cooperation with national experts.

A literature review has been carried out at European and international levels, as well as two kinds of analysis: quantitative and qualitative. Good practices and recommendations have also been collected in order to help formulate actions for improving the current situation of women in industrial research.
The report consists of two major parts.

The first part is entitled *Quantitative analysis*, and presents the results of a statistical analysis of the situation of women in industrial research. Section one, entitled *Targeting women in research in the industrial sector: the method and its limits,* offers a critical inventory of existing harmonised data sources for the analysis of women in industrial research and explains the methodological approach of the statistical research. Section two, entitled *Women in research in the industrial sector: Analysis results,* draws a general picture of the situation of women in industrial research across Europe. Information is provided on the significance of the business enterprise sector for research, under-representation of women in industrial research, sectoral, occupational and educational segregation, as well as working conditions. The last chapter deals with the main findings regarding women researchers in other OECD countries such as the US, Canada, Japan, Australia and New Zealand. Finally, section three, entitled *Improving statistical sources and building gender indicators for industrial research* makes recommendations for the improvement of existing data sources and development complementary ones. Proposals for building gender-sensitive indicators and benchmarking women's participation in industrial research have also been put forward.

The second part of the report focuses on the qualitative study. The purpose of this qualitative study is to identify and describe good practices to promote increased female participation and improved career development in private sector research. A 'good practice' is a strategy used by companies to recruit, retain or promote women in research. Such policies might be used to broaden thinking or to improve the situation of women in private sector research. The aim is to share the experience of firms that have been successful in promoting female researchers. Twenty-nine case studies have been carried out in 11 Member States: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, the Netherlands, Portugal, Spain and the United Kingdom (UK).

After an explanation of two conceptual questions underlying the analysis of good practices in a first section – (i) How is industrial research different from academic sector research, and (ii) How should notions of good practice, mainstreaming and neutrality be understood – the second section (which is also the most important one) analyses different kinds of good practice: global integrated programmes favouring women, time management practices, management of pregnancy and maternity, recruitment and a mixed workforce, network-building, actions in the field of continuous training, actions in schools to raise girls' awareness of science, and reflections on the 'feminine management' mode. The conclusion of these case studies is based on a 'dream firm', which would exemplify some of the best practices encountered in the course of the case studies. These case studies present many ways of avoiding discrimination risks, and promoting women in industrial research.

Quantitative Analysis

1. Targeting women in industrial research: the method and its limits

The objective of this quantitative chapter is to analyse the situation of women in industrial research, drawing on data from two main sources: the European R&D Survey and the Community Labour Force Survey. As complementary sources of information, the study relies on the Eurostat Education database and the few available national studies on industrial researchers. The analysis focuses on the 15 EU Member States, but also includes data for other OECD countries.

The harmonised sources of information in Europe are still inadequate for the purpose of analysing women in research. This was the main conclusion of the study carried out by the Women and Science Unit at DG Research under the title *Women and Scientific Employment: Mapping the European Data*, also known as the Glover Directory(6). The main goal of this study was to make an inventory of all data that might enable an in-depth analysis of women's scientific employment in each EU Member State. The study pointed out that there was only one source of harmonised statistics on research in Europe, the European R&D Survey, which was inadequate as there was no systematic gender breakdown, even if at national level there were a rich variety of non-harmonised, specific data sources. Since this report was issued, Eurostat and OECD have started to request the gender breakdown for R&D personnel in every national R&D survey. However, sex-disaggregated data for industrial researchers are not available for all Member States yet.

R&D surveys are the most appropriate instrument for collecting data on R&D activities, expenditures, funds and personnel. Nevertheless, labour force surveys might be useful complementary data sources for the analysis of R&D personnel, as R&D surveys do not intend to provide a comprehensive insight into their living and working conditions. Consequently, this study draws also on data from the Community Labour Force Survey, even if this survey has not been designed specifically for the analysis of R&D personnel and does not allow for clear identification of the target group of women researchers in the industrial sector. Within the framework of this study, we have been able to use the Community Labour Force Survey to target scientists and engineers as the potential group of researchers. The analysis of scientist and engineer workforce trends, even if it cannot be simply extrapolated to researchers, has proved meaningful for the purpose of our research.

1.1 The European R&D Survey

Throughout Europe, the R&D Survey is conducted in coordination with Eurostat and according to the standards and guidelines of the Frascati Manual, adopted by the OECD as the terminological and methodological basis for the collection of statistical data on research and development (R&D)(7). Therefore, the target group of female researchers in industry can easily be identified through the European R&D survey:

- Researchers (RSEs) are defined as professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned(8). They are one of three categories of R&D personnel (i.e. researchers, technicians and other supporting staff).

- The business enterprise sector (BES) includes all firms, organisations and institutions whose primary activity is the market production of goods or services (other than higher education) for sale to the general public at an economically significant price, as well as the private non-profit institutions

(6) *European Commission, 2000*

(7) *The Frascati Manual was written by and for the national experts in OECD countries who collect and issue – inter alia – national R&D data, and who submit responses to OECD R&D surveys with the aid of the Secretariat of the OECD Economic Analysis and Statistics Division. This Manual deals exclusively with the measurement of human and financial resources devoted to research and experimental development (R&D), often referred to as R&D "input" data. The current edition of the Frascati Manual was issued in 2002 and is the fifth revision since the first edition in 1963.*

(8) *Frascati Manual, 2002, §§ 301-305*

mainly serving them[9]. It is one of four institutional sectors (i.e. business enterprise, government, higher education and private non-profit sectors). In this study the word 'industrial' sector is used as an equivalent term for Frascati's 'business enterprise' sector.

The thematic coverage of the European R&D Survey comprises a number of personal and employment-related variables of R&D personnel: sex, occupation, level of qualification, field of science, industry group and type of enterprise. However, the harmonisation of the survey design has not been fully achieved, imposing serious constraints on any analysis of the situation of women in industrial research:

- Not all national R&D surveys request a breakdown by sex for researchers in the industrial sector – for example, Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom[10].

- Not all national R&D surveys use both Head Count (HC) and Full Time Equivalent (FTE) as units for measuring R&D personnel. The HC unit expresses the total number of persons involved in R&D activities, while the FTE unit expresses the number of person-years and is used for identifying the whole time spent on R&D activities[11]. FTE is the most appropriate unit for measuring research employment, while HC is basic for analysing the volume and characteristics of R&D personnel, such as their sex[12]. Germany, the Netherlands and Sweden do not publish data in HC units whilst Finland, France and Ireland do not provide sex-disaggregated FTE data on industrial researchers.

- Survey coverage with respect to enterprises that carry out R&D activities is insufficient and varies significantly. There are important differences in survey and sampling design among Member States, but it is generally agreed that there is a lack of coverage of non-manufacturing and smaller enterprises, which gives rise to underestimation of total R&D personnel[13].

In addition, it is worth noting that, at present, the EU Member States are not obliged to carry out the European R&D Survey (Belgium, Denmark, Germany and Sweden carry out this survey only on a voluntary basis). Furthermore, the regularity with which it is performed varies significantly, so that for a large group of countries it is updated once a year, and for another, smaller group every two years, while in the case of Austria it is every five years.

In recent years, the European Commission has been examining ways of creating an information base in order to identify and fill the gaps in the available statistical information sources on women in industrial research across the European Union. After the Glover Directory study was carried out, the Commission proposed that the Helsinki Group participate in a project of the Women and Science Unit at DG Research in order to produce a global database of primary data on research and to develop a set of gender-sensitive indicators. This new database has become known as the Women in Science (WiS)

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(9) Frascati Manual, 2002, §§ 163-168

(10) The gender split on the UK Business Enterprise R&D survey was piloted during 2002. Gender will have been incorporated by the 2004 reference year under the new EU regulation on Science, Technology and Innovation. These data for Belgium, the Netherlands and Sweden will also become available before or during 2004.

(11) R&D may be the primary function of some people (e.g. workers in an R&D laboratory), a significant part-time activity (e.g. university teachers) or a secondary function (e.g. members of a design and testing establishment). One FTE may be thought of as one person-year. Thus, a person who normally spends 30% of his/her time on R&D is considered as 0.3 FTE. (Frascati Manual, 2002, §§331-333). Obviously, the relation between HC and FTE is not linear and varies greatly among sectors and countries, depending on the institutional framework and specific trends of R&D activities.

(12) Data on the total number of persons who are mainly or partially employed in R&D allow links to be made with other series of data: for example, education or employment data or the results of population censuses. This is particularly important when examining the role of R&D employment in total stocks and flows of scientific and technological personnel. HC data are also most appropriate for collecting additional information about R&D personnel, such as their sex, age or field of science.

(13) Eurostat, (1999). Most Member States use mixed procedures (census and sample) for R&D data collection in the industrial sector. The census of large enterprises, enterprises receiving R&D public funding or enterprises known to perform R&D is carried out together with a sample of other (smaller) companies. However, methods for establishing these censuses vary greatly and the same holds for sampling designs. As a result, survey coverage is different and in general insufficient (e.g. in Spain there is a clear lack of coverage for non-manufacturing enterprises and those that carry out R&D on their own).

database. Since its creation most efforts have been made to enrich and harmonise the data provided by the European R&D Survey, in particular by introducing sex breakdown into every R&D personnel variable (units, sectors, fields of science and occupation). However, while trying to improve the European R&D Survey, the WiS itself has not yet succeeded in establishing a complete and harmonised data set covering all European countries.

The last revision of the Frascati Manual is intended to overcome most of these drawbacks. For the first time the recommendation to report R&D personnel data by gender is issued. Secondly, the recommendation to collect HC data in addition to FTE data has been strengthened. Finally, several guidelines for improving the survey coverage of R&D activities in the services sector and in small enterprises are provided.

1.2 The Community Labour Force Survey

Experience shows that R&D surveys are the most appropriate instrument for collecting R&D personnel data. However, these kinds of surveys do not intend to provide information on a complete set of labour, personal and family variables. As the Frascati Manual points out(14), population censuses, population registers and labour force surveys might be useful complementary data sources for the analysis of R&D personnel. Following this statement, this study draws also on data from the Community Labour Force Survey (CLFS).

The CLFS is compulsory for all Member States and has a significant degree of harmonisation in respect of definitions used, survey design and survey timetable. All data are broken down by sex. The CLFS allows employment to be analysed in both HC and FTE units. CLFS occupation and education definitions are linked to the United Nations classifications – the International Standard Classification of Occupations (ISCO) (ILO, 1968; ILO, 1990) and the International Standard Classification of Education (ISCED) (UNESCO, 1976 and 1997) – while at sectoral level the Statistical Classification of Economic Activities in the European Community (NACE) (Eurostat 1990) is used. Moreover, the CLFS is a household survey and consequently covers all types of sectors and enterprises. Finally, the information it provides is very rich as its thematic coverage adds the most important personal, family and employment variables, although data on wages are not collected.

As with any sample survey, the results of the CLFS are subject to sampling error, the extent of which varies between countries since sample size and coverage vary. Table 1 details the sample size and survey rate in each of the Member States. In addition, the results of any sample survey are affected by non-sampling errors such as the inability or unwillingness of respondents to provide correct answers or even answer at all (non-response), mistakes by interviewers when filling in survey documents, miscoding, and so on. Experience shows that, at national level, survey information provides sufficiently accurate estimates for the levels and structures of the various aggregates into which the labour force is divided, provided that analyses of this type are kept within certain limits(15). Based upon the sample size and design in the various Member States, Eurostat has implemented basic guidelines intended to avoid publication of figures that are statistically unreliable(16).

In spite of reliability constraints, different studies carried out by Eurostat show that the Community Labour Force Survey (CLFS) is a valuable source of data for the analysis of scientific and technological employment and, in particular, the 'human resources in science and technology' (HRST)(17). The term HRST refers to the human resources actually or potentially devoted to the systematic generation, advancement diffusion and application of scientific and technological knowledge. At its widest, it

(14) *Frascati Manual, 2002, §328*

(15) *A basic analysis requires a minimum of seven variables: sex, year, country, working status, level of educational attainment, occupation and sector. More variables are required in proportion to the amount of information desired. As the data are already sampled, a more disaggregated analysis intensifies the risk of ultimately obtaining unreliable or even misleading data. So, while the CLFS provides plenty of scope for the analysis of working and living conditions, it needs to be underlined that it is in no way possible to cross-classify all of the available variables. An independent analysis is required for each indicator to test and to validate whether, for each country and year, it is reliable enough to be put forward for publication.*

(16) *Laafia, 2001*

(17) *Laafia, 2001*

Table 1: CLFS sampling information by country

	Sample population	Sample size	Survey coverage (%)
B	h	35 000	0.87
DK	p	15 600	0.40
D	h	150 000	0.45
EL	h	30 000	0.87
E	h	65 000	0.50
F	h	75 000	0.33
IRL	h	39 000	3.30
I	h	75 512	0.36
L	h	8 500	5.00
NL	a	60 000	1.00
A	a	31 500	1.00
P	h	20 000	0.68
FIN	p	19 717	0.40
S	p	17 000	0.30
UK	h	68 250	0.40

Note: h = households; p = persons; a = addresses. Source: Laafia, 2001.

extends to persons who have successfully completed a tertiary education (ISCED 97' 5 and 6) or work in a scientific and technological occupation (ISCO-88 major groups 2 and 3, 'professionals' and 'technicians' respectively)(18). The term HRST was first coined by the Canberra manual, which was prepared jointly by the OECD and the European Commission/Eurostat with the purpose of providing common guidelines for the definition, measurement and analysis of HRST.

Nevertheless, the CLFS has important drawbacks for the analysis of industrial researchers. The occupational and sectoral definitions and classifications used in this survey are general and were not designed for specific analysis of R&D personnel. As a result, it is not possible to identify clearly the group of industrial researchers. However, both the Frascati Manual and the Canberra Manual provide guidelines for bridging data on researchers and HRST and for using the CLFS as a complementary statistical source for the analysis of women in industrial research.

Targeting researchers

The Frascati Manual gives the more general correspondence between researchers and the ISCO classification. It is assumed that all researchers belong to the major group 'professionals' (ISCO-88 2)(19). Besides, the Canberra Manual splits HRST into two major categories: university-level HRST and technician-level HRST. The group of university-level HRST includes all people who have successfully completed a university education or who work in a scientific and technological occupation (ISCO-88 2 'professionals')(20). In spite of the obvious links between these two definitions, researchers are a much narrower group than university-level HRST. The group of researchers excludes suitably qualified people who are either working in non-R&D activities or are not employed (i.e. unemployed, retired or otherwise out of the labour force).

(18) *Plus the following subgroups: "Production and operational department managers" (ISCO-88 122); "Other department managers" (ISCO 88 123); "General managers" (ISCO-88 131) (Canberra Manual, 1995, §§ 48 and 89)*

(19) *Plus "Research and development department managers" (ISCO-88 1237). It also considers postgraduate students engaged in R&D as researchers, but proposes reporting this group separately (Frascati Manual, 2002, §§ 301-305)*

(20) *Plus the following subgroups: "Production and operational department managers" (ISCO-88 122); "Other department managers" (ISCO 88 123); "General managers" (ISCO-88 131) (Canberra Manual, 1995, §§ 62 and 89)*

Box 1.1

Eurostat's experience using CLFS for the analysis of scientific and technological employment

Human resources in science and technology (HRST), employment in high-technology sectors and, more recently, job-to-job mobility of highly qualified individuals are the three main areas of science-and-technology statistical analysis that Eurostat has sought to develop since the mid-nineties.

Building up official indicators on these employment-related domains is all the more important when concerns about meeting the demand for an ever more qualified workforce are high on the agenda. The policy importance of these human resource and mobility issues is reflected in the prominence of such matters in the European Commission's new 6th Framework Programme.

A common feature of the three Eurostat research projects described below is that they share the same primary data source – the CLFS – which is used to gather indicators on the 15 EU Member States, as well as Iceland, Norway and a host of candidate countries. The degree to which these are exploited for different countries and different years varies according to availability and reliability. Some of the most relevant findings were recently published in *Science and Technology in Europe – Statistical Pocketbook* (Eurostat, 2002b).

Human resources in science and technology

Research looks at the number and profile of HRST. One aspect of the project is to look at the cross-classification of education and occupation and how well skill demand and supply are matched. Whilst education data are analysed for the supply of HRST, proxies for the demand for highly qualified individuals are obtained by analysing various facets of the labour force survey data. The development of these HRST indicators follows a pilot study launched in 1995. The results showed that the national labour force surveys were natural sources of data, although there were comparability problems between countries. The harmonised nature of the CLFS supported its use as a possible solution in providing comparable HRST indicators.

Employment in high-technology sectors

Research on employment in high-technology sectors looks at the national and regional distribution of employment in high-technology manufacturing sectors and knowledge-intensive service sectors in the 15 EU Member States. The definition of high-technology manufacturing sectors is based on the OECD's classification (itself based on the ratio of R&D expenditure to GDP). A preliminary study of the use of the CLFS in certain countries concluded that reliable estimates of high-technology manufacturing employment at regional level could be derived from it. As a result, the methodology was applied to all countries and data extracted from the CLFS. Since then, research has been undertaken to develop indicators on high technology in services, though with the focus more on knowledge than on R&D intensity. This has resulted in two main Eurostat definitions: knowledge-intensive service sectors and the smaller, high-technology service sectors. These definitions follow a similar logic as for manufacturing. Research on this field does not include sex breakdown.

Job-to-job mobility

Research on job-to-job mobility focuses mainly on the mobility of HRST. This project follows a feasibility study carried out on behalf of Eurostat and the OECD, which concluded that it was possible to construct aggregate indicators on mobility for the whole population of highly qualified personnel and especially for broad industry groups in larger countries. By examining the length of time people have been in their current job, as well as their working situation one year before (both of which are questions in the CLFS), it is possible to build up a picture of job-to-job mobility rates in the European Union and beyond.

Source: Laafia, 2001

In this study, the level of educational attainment is used as the first criterion for targeting the potential group of researchers. The study is thus focused on the highly qualified population, i.e. those individuals who have successfully completed ISCED'97 levels 5A or 6 (ISCED'76 6, 7 or 8 for data up to 1997)(21). The criterion of qualification is the most useful when looking at the supply-side issues such as what the pool of people potentially available to work in R&D is. In that sense, data on the highly qualified population are analysed for the employed as well as for the unemployed and the inactive.

The second criterion is the type of occupation that highly qualified individuals are working in. The criterion of occupation is the most useful when looking at the demand-side issues such as how many people are actually working in R&D activities. Unfortunately, the CLFS does not allow for a clear distinction between R&D and non-R&D activities. Within the ISCO classification there is no 'researcher' occupation, this being included as an intrinsic capacity (that may or may not be a main or secondary activity) within the major group of 'professionals'. Furthermore, the CLFS does not include additional questions regarding the actual development of research activity. Nevertheless, within the framework of the ISCO classification, it seems possible to distinguish a number of 'core occupations' that are more R&D-oriented than the rest. If we look at the three-digit ISCO-88 classification – the most disaggregated level available for the CLFS dataset – we find that not all subgroups in the major group ISCO-88 2 are similarly R&D-oriented: for example, it is felt that engineers and life science professionals are more likely to work in research than business or primary and pre-primary education teaching professionals. The occupations included in this study's target group are the following(22):

- 211 – physicists, chemists and related professionals
- 212 – mathematicians, statisticians and related professionals
- 213 – computing professionals
- 214 – architects, engineers and related professionals
- 221 – life science professionals
- 222 – health professionals (except nursing)
- 231 – college, university and higher education teaching professionals
- 244 – social science and related professionals

Finally, in order to allow greater comparability between data sources, the target group of this study is restricted to employees, excluding self-employed workers who are only very slightly covered by the European R&D Survey.

People who fulfil these three criteria (qualification, education and working status) are referred to as scientists and engineers (S&E) in the framework of this study. They are seen as the most accurate proxy of researchers that CLFS dataset allows for, as they are both suitably qualified for research and are working in the most R&D-oriented occupations. However, not all professionals belonging to this group are actually researchers and the analysis of scientists and engineers (from the CLFS) must be distinguished clearly from the analysis of researchers (from the European R&D Survey)

Targeting the industrial sector

The Frascati Manual definition of institutional sectors is inspired by the System of National Accounts(23) and is based on a combination of different criteria (function, aim, economic behaviour, source of funds and legal status)(24). This sectoral breakdown does not correspond exactly to the CLFS

(21) *The ISCED classification was revised in 1997, which resulted in a break in the time series between 1997 and 1998. Tertiary or higher education now includes levels 5A, 5B and 6. 5A comprises bachelor's and master's degrees with a more theoretical basis than 5B, which has a more practical orientation. Doctoral degrees are placed exclusively in level 6. ISCED'76 did not distinguish between theoretical/practical orientation for bachelor degrees.*

(22) *The excluded occupations of ISCO-88 major group 2 in this study's target group are the following: 223- Nursing and midwifery professionals; 233- Primary and pre-primary education teaching professionals; 234- Special education teaching professionals; 235- Other teaching professionals; 241- Business professionals; 242- Legal professionals; 243- Archivists, librarians, related information professionals: 245- Writers and creative or performing artists; 246- Religious professionals*

(23) *With the difference that higher education has been established as a separate sector and households have, by convention, been merged with the private-non profit sector. See Annex 3 of the Frascati Manual (2002) for a detailed correspondence of institutional sectors of the Frascati Manual and the System of National Accounts sectors.*

(24) *Frascati Manual, 2002, § 160*

dataset, where only information on NACE economic activities is provided and even the distinction between public and private enterprises and institutions is not available for all Member States. However, an approximation to the Frascati Manual sectors may be achieved using the two-digit NACE classification, the most disaggregated level available.

According to the Canberra Manual, the business enterprise sector is mainly placed in NACE 1-74[25]. On the other hand, activities carried out by the business enterprise sector, which belong to NACE 75-99 ('Community, social and personal service activities') are expected to be almost negligible. Under this heading, the only activity that might have a relevant weight for the business enterprise sector is health (NACE 85). However, it would be misleading to include health within the industrial sector: as the Frascati Manual states[26], health institutions are a special category as they carry out R&D which may relate to any of the four institutional sectors. The best choice seems thus to consider health separately.

(25) Canberra Manual, 1995, Annex 6
(26) Frascati Manual, 2002, § 434

Consequently, the sectoral breakdown used in this study for the analysis of CLFS data is as follows:

- business enterprise (industry): NACE 1-74
- government: NACE 75 (public administration and defence; compulsory social security)
- health and social work: NACE 85 (health and social work)
- education: NACE 80 (education)
- private non-profit: NACE 91 and 95 (activities of membership organisations, private households with employed persons)

This sectoral breakdown can only be considered a proxy to the institutional sectors of the Frascati Manual. In particular, it should be noted that not all the activities carried out by the business enterprise sector are included within NACE 1-74 and, vice-versa, not all the activities belonging to NACE 1-74 are carried out by the business enterprise sector. In order to avoid any confusion that might arise when comparing results from different statistical sources, the term 'sector' will be used for the European R&D Survey data and the term 'domain' for the CLFS data.

Table 2: The target group for the Community Labour Force Survey data analysis: industrial scientists and engineers

	Level of education	*Highly qualified workforce (ISCED'97 5A or 6)*		*Rest of the workforce*
NACE	**ISCO-88 Working status**	*Scientists and engineers (ISCO-88 211, 212, 213, 214, 221, 222, 231, 244)*	*Rest of ISCO-88-2*	
Industrial domain (NACE 1-74)	*Employees*	**Industrial scientists and engineers (2% of workforce)**		
	Non-employees			
Rest of domains (NACE 75-99)				

1.3 Complementary Sources of Information

Wage information is completely absent from both the European R&D Survey and the CLFS. However, it is not yet possible to use other harmonised statistical sources. The European Structure of Earnings Survey (ESES) is the European database most suitable for an in-depth analysis of wages by personal and labour variables such as sex, education or occupation. However, the ESES does not provide sufficiently disaggregated information at European level on occupation and education to identify scientists and engineers, not to mention researchers. We can rely only on national statistics and specific studies in order to draw a general picture of the gender pay gap among scientists and engineers.

There is little literature on industrial researchers at European level. However, three interesting studies were identified which focus specifically on the situation of women researchers in Europe: *Women and Excellence in Research*(27), describing the situation of women researchers in Denmark; *Le Livre Blanc: Les femmes dans la recherche française*(28), regarding women researchers in France; and *La participation des femmes aux activités de recherche dans les entreprises du secteur privé. Eléments de réflexion*(29), for women researchers in Belgium. These studies have been used as additional sources of information. National studies have also been used in order to draw a picture of the situation of women scientists and researchers in non-European countries, namely the US, New Zealand, Australia, Japan and Canada(30).

Finally, our study has also drawn on the Eurostat Education database, which provides very rich information on the educational attainments and fields of study of both women and men.

(27) FSK, 2001
(28) Ministère de la Recherche, 2002
(29) Ouziel, 2001
(30) See Appendix 2 for a description of the literature review and references

Box 1.2

Targeting women in industrial research: the method and its limits

In spite of recent progress, statistical sources are still far from sufficient for analysing women in industrial research.

The study relies on two main sources: the European R&D Survey and the Community Labour Force Survey (CLFS). The Eurostat Education database and the few available national studies on industrial researchers (across the 15 EU Member States and some OECD countries) are also used as additional sources of information.

The European R&D Survey is the only harmonised survey on R&D activities and personnel at European level. Researchers in the business enterprise sector are the target group for the European R&D Survey dataset, according to the definitions and guidelines of the Frascati Manual.

The CLFS is used as a complementary source of information for analysing the living and working conditions of industrial researchers. The target group for the CLFS dataset is scientists and engineers in the industrial domain:

- Scientists and engineers are individuals holding ISCED'975A or 6 degrees who work as employees in ISCO-88 211, 212, 213, 214, 221, 222, 231, 244
- The industrial domain covers NACE 1-74

This target group can only be considered as the most accurate proxy to industrial researchers CLFS allows for. However, not all professionals belonging to this group are actually industrial researchers. Consequently, the analysis of the CLFS dataset must be distinguished clearly from the analysis of the European R&D Survey dataset.

2. Women in research in the industrial sector: analysis results

2.1 Main Figures and Trends

In the last decades, the educational level of women has risen significantly. Women account for more than half of bachelor and master's graduates in the European Union. The rising proportion of women in higher education and highly skilled employment in recent decades has been one of the major structural changes affecting labour markets and society, but this phenomenon has not yet been translated into the substantial participation of women in industrial research. While the industrial sector is playing an increasingly important role in R&D, women are still much more under-represented in industrial than in public research. As explained below, women make up 31% of scientists and engineers, the proportion of female researchers in the public sector is 30%, but women account for only 15% of industrial researchers(31).

This chapter draws a general picture of the situation of women in industrial research, presenting the most relevant figures and trends. Industrial researchers are a little studied group in comparison with researchers in the public sector, particularly from a gender-sensitive approach. This could be partly explained by the lower transparency of R&D in the industrial sector due to the lesser availability of statistical sources and the additional difficulties of carrying out fieldwork. European harmonised data on the situation of women in industrial research are analysed in depth here for the first time.

2.1.1 The significance of the industrial sector for research

Table 3 shows some of the most important indicators related to industrial research. Clearly, industry is already playing a leading role in R&D financing in most OECD countries. There is a strong correlation between overall R&D spending and the contribution of the industrial sector: the higher the percentage of GDP spent on R&D, the greater the share of R&D funding from the industrial sector. In Japan, 3% of GDP is spent on R&D, of which 73% comes from industry; these percentages are 2.7% and 67% in the US, and 1.9% and 56% in the EU. Both overall R&D spending and the industry contribution are considerably larger in Japan and the US than in the EU. As the European Council stated at the Barcelona Summit, the goal of allocating 3% of Gross Domestic Product (GDP) to R&D by 2010 will be achieved only if industry contributes two-thirds of the new investment, which means doubling current European industrial investment in research.

One of the most meaningful ways of benchmarking the R&D effort in the industrial sector is by comparing industry-financed research activities as a percentage of industrial output: the relative efforts of the business sector in financing R&D activities and its dynamics are important indicators of the profit-oriented creation of new scientific and technological knowledge and of efforts to absorb existing knowledge from other sources(32). As shown in table 3, the US industrial sector allocates considerably more to R&D than the EU industrial sector (2.3% compared to 1.5%). However, in Sweden, Finland, Japan and Germany, the industrial effort is even higher than in the US, while some other Member States – Denmark, Belgium and France – rank above the EU average. Nevertheless, R&D industrial effort is comparatively low in all other countries, particularly Spain, Italy, Greece and Portugal, where less than 0.6% of industrial output is allocated to research.

Industrial research's leading role is also confirmed by an analysis of human resources, particularly if one takes into account the fact that the European R&D Survey underestimates, to a certain extent, the number of researchers in the industrial sector. As table 3 shows, in 1999 the industrial sector employed about 50% of researchers (FTE) in the European Union, while only

(31) Part 2 of the report will try to identify and analyse good practices inside firms to demonstrate how firms can benefit from promoting women in research. The final aim is to increase the proportion of women in industrial research.

(32) European Commission, 2002a, p. 27

34% were employed in higher education and a mere 14% in the government sector.(33) Nevertheless, the European percentage of industrial researchers is very low compared to Japan (66%) and the US (83%). There are significant differences among Member States, ranging from Ireland and Austria at 64% to Portugal at 13%. However, national data confirm the significance of industry: industrial researchers are the largest FTE group in all European countries, with the exception of Spain, Greece and Portugal.

These percentages vary greatly when using HC instead of FTE figures. In this case, the most important sector by far at European level is higher education (52%), while the share of the industrial sector falls to 38%.(34) In other words, the higher education sector leads in terms of number of researchers, while industry is the leading sector in terms of number of person-years allocated to research. Only the large number of researchers doing part-time R&D activities at universities – that is, academics who are both teaching and researching – can explain the differences between HC and FTE figures. If the number of researchers is analysed in terms of HC, industrial researchers are the most significant group in four Member States: Sweden (57%), Finland (52%), Denmark (49%) and Ireland

(33) *Data on researchers exclude the private non-profit sector, due to the fact that very few countries provide data on researchers for this sector. However, this is a very small sector in human resource terms: fewer than 1% of researchers, where data are available.*

(34) *Data for 1999 from the European R&D Survey. Missing countries: Belgium, Luxembourg and the Netherlands. Exceptions to the reference year: BES: Austria and the United Kingdom (1998); France and Italy (2000); Ireland (2001); HES: Austria (1988); Germany (2000); GOV: Austria and the United Kingdom (1998). BES data in FTE for Germany and Sweden.*

Table 3: Indicators of industrial R&D intensity, 1999

	R&D financing			Researchers (FTE)		
	Percentage of GDP spent on R&D(a)	Percentage of R&D financing from the industrial sector(b)	Industry-financed R&D as percentage of industrial output(c)	Total number of researchers(1)	Percentage of researchers in the industrial sector(1)	Number of industrial researchers per thousand labour force(2)(d)
B	1.96	66.2	1.68	30 219	54.5	3.7
DK	2.06	58.0	2.03	18 438	46.5	3.0
D	2.48	66.9	2.10	255 260	58.8	3.8
EL	0.68	24.2	0.28	14 828	15.6	0.5
E	0.94	49.7	0.58	61 568	24.7	0.9
F	2.15	54.1	1.61	160 424	47.0	2.9
IRL	1.21	64.1	0.98	8 217	64.4	3.0
I	1.04	43.0	0.53	64 886	40.4	1.1
NL	2.02	49.7	1.40	40 623	47.7	2.4
A	1.80	40.1	0.96	20 222	64.4	3.4
P	0.76	21.3	0.26	15 752	12.7	0.4
FIN	3.37	70.3	3.17	25 398	41.6	4.1
S	3.78	67.8	4.27	39 921	57.2	5.3
UK	1.86	49.3	1.27	164 040	56.2	3.2
EU15	1.93	56.3	1.49	919 796	50.0	2.7
US	2.69	68.2	2.09	1 219 407	83.3	6.7
Japan	2.98	72.4	2.27	658 910	65.8	6.1

Notes: *(1) Excludes the PNP sector.*
(2) Calculations based on European Commission (2002a) and the CLFS.
EU15 is estimated and does not include Luxembourg.

Source: *DG Research (European Commission, 2002a).*
Exceptions to the reference year:
(a) Denmark, Germany, Spain, France, Austria, Finland, United Kingdom, EU15, United States and Japan (2000)
(b) Germany (2001); Spain, Finland, United Kingdom and Japan (2000); Italy (1996)
(c) Germany and Finland (2000)
(d) US (1997)

(44%). The proportion of industrial researchers is also very high in the three countries with the largest number of researchers (44% in France, 42% in Germany and 39% in the United Kingdom) and only in three countries is this percentage very low (again, Spain, Portugal and Greece, with fewer than 15%).

A useful indicator for benchmarking the intensity of industrial research is the number of industrial researchers in FTE per thousand labour force. This indicator reflects the share of industrial research work with regard to the overall labour force and allows for cross-national comparisons in terms of the involvement of human resources in industrial research. As table 3 shows, there are huge differences among OECD countries. The US leads, with almost seven researchers per thousand labour force, followed by Japan with six. The European average is far behind, at less than three. Member States vary greatly, with Sweden and Finland having more than four and Spain, Greece and Portugal with less than one.

In conclusion, at European level and in most European countries, industry is the leading sector in terms of R&D financing and working hours allocated to R&D, while industrial researchers are one of the most important researcher groups. The industrial sector is already playing a leading role in R&D and significant growth in both material and human resources is expected over the next few years. However, national differences are very marked and European performance is still far behind that of the US and Japan.

2.1.2 Under-representation of women in industrial research

The under-representation of women in research is far more pronounced in the industrial sector than elsewhere. Table 4 shows the most complete, harmonised data currently available on researchers by sex. Most of the data refer to 1999 (the year with the largest amount of data available); otherwise they are from the nearest year. The government sector has the highest proportion of female researchers (31%), followed very closely by the higher education sector (30%). Far behind is the industrial sector, with just 15%. In other words, only one in seven industrial researchers is a woman(35). In the 10 Member States that provide sex-disaggregated statistics, there are around 340,000 industrial researchers, of whom just over 50,000 are women.

Differences are very marked between the different European countries. The proportion of women in industrial research is extremely low in Austria and Germany (9-10%), intermediate in Italy, Spain, Denmark and France (18-21%), and relatively high in Portugal, Greece and Ireland (24-28%). In Austria and Germany, there is barely one woman researcher for every nine men. The European average is brought down particularly by the very low female participation in industrial research in Germany, the country with the largest number of industrial researchers. However, in all Member States the female proportion in the industrial sector is far behind that of the public sector. *[Graph 1]*

National studies show a similar situation in those countries where sex-disaggregated statistics are not reported in the European R&D Survey(36). While women overall made up 30% of researchers in Belgium in 1999, they represented only 26% of industrial researchers(37). In Sweden, women accounted for 25% of the total number of R&D personnel in the industrial sector in 1999(38).

(35) Part 2 of the report will devote some attention to the specific features that distinguish research in the industrial sector from public sector research.
(36) Data on industrial researchers for Belgium and Sweden are not directly comparable to the European R&D Survey data. However, these percentages clearly indicate that women are also seriously under-represented in industrial research in Belgium and Sweden
(37) Ouziel, 2001, p 2
(38) Swedish Institute of Statistics, 1999

Table 4: Industrial researchers by sex and proportion of female researchers by institutional sector (HC), 1999

	Industrial researchers		Proportion of female researchers (%)			
	Women	Men	BES	GOV	HES	Total
DK	2 218	9 074	19.6	31.1	27.3	23.9
D(1)	14 414	135 735	9.6	22.1	24.8	18.0
EL	940	2 991	23.9	37.5	44.3	40.9
E	3 353	13 957	19.4	37.5	34.5	32.6
F	17 787	68 428	20.6	28.6	31.7	26.5
IRL(2)	536	1 364	28.2	25.2	46.2	29.8
I	5 490	24 216	18.5	38.1	28.4	27.2
A	1 258	12 708	9.0	31.9	25.7	18.7
P	793	2 535	23.8	54.5	44.7	44.0
FIN	3 999	18 516	17.8	37.5	41.8	28.6
EU10	50 788	289 524	14.9	30.3	30.6	24.8

Notes: *(1) Germany: BES data in FTE; GOV data are estimated.*
(2) Ireland: GOV definition differs from that of the Frascati Manual; GOV data are estimated.

Source: *DG Research (European R&D Survey). GOV data for Germany and Ireland from European Commission, 2002b. Exceptions to the reference year: Austria (1998) and BES data in France (2000), Italy (2000) and Ireland (2001).*

The proportion of women in industrial research is probably somewhat higher than is indicated by the European R&D Survey due to the fact that this survey's coverage problems affect women more than men: women are more likely to be employed in the service sector and in small enterprises. But an analysis of the CLFS also demonstrates that the proportion of female scientists in the industrial domain is much lower than in other domains. Women account for around 50% of the scientists in health and social work and private non-profit domains. In an intermediate position are the education and government domains, with proportions of between 40% and 35%. Far behind comes the industrial domain, with the lowest rate, 20%. If these figures are compared with overall employment, the female proportion in the industrial domain is seen to be the lowest within scientific and engineering employment (31%), which in turn is far below the proportion for overall employment (47%). To sum up, there is a significant under-representation of women among scientists and engineers in the industrial domain and this under-representation is still more pronounced for female industrial researchers.

Overall, women and men tend to be concentrated in different sectors: 62% of female researchers are concentrated in higher education, whereas only 22% are in the industrial sector. In the case of men, the distribution between these two sectors is much more even (42% and 46%). For scientists and engineers, the trends are even more striking. The most significant feature is the concentration of men in the industrial domain (65%), while women are equally spread between the health and social work and the industrial domains (36%). As already mentioned, the proportion of men and women researchers in the industrial sector is probably somewhat higher than is indicated by the European R&D Survey, although not as high as that of scientists and engineers in the industrial domain. In any case, it should be emphasised that the ratio between the percentages of men and women is similar in both sources, so we may deduce that men's proportion of employment in the industrial sector is double that of women. *[Graphs 2, 3]*

National diversity is again very pronounced. The percentage of female researchers working in the industrial sector seems to be very low in Portugal, Greece and Spain (7-9%), similar to the European average in Italy, Austria and Germany (21-22%) and relatively high in Finland, France, Denmark and Ireland (32-41%). *[Graph 4]*

There are two indicators that make possible a more accurate cross-national comparison of industrial research from a gender-sensitive approach.

First, the gender gap in the FTE/HC ratio for industrial researchers. The number of FTE researchers per 100 HC researchers is calculated for both women and men, and the gender gap is expressed as the female/male ratio. The aim of this indicator is to analyse gender biases in part-time R&D work. Unfortunately, this indicator is only available for a few Member States, as only a minority provide data in both FTE and HC units.(39) Nevertheless, the results are quite interesting. First, as already mentioned, part-time research work is not very common in industrial research: for most European countries where information is available, the FTE/HC ratio for the industrial sector (both sexes) is far higher than the ratio for the higher education sector. Greece is the only Member State where the difference is not significant, mainly because the ratio in the industrial sector is comparatively low (57). Second, the gender gap is very small (in both senses) for all European countries with the sole exception of Austria, where the gender gap is larger (0.90). *[Graph 5]*

Second, the industrial research intensity rate by sex, calculated as the number of industrial researchers in HC per thousand labour force. The aim of this indicator is to measure the intensity of involvement in industrial research for women and men separately. In the whole of the European Union, there are only 0.9 women in industrial research for every thousand women in the labour force, while the proportion of men is significantly higher (4). National diversity is again pronounced. Finland stands out with a significantly higher female intensity rate than other countries (3.2) whereas in Portugal, Spain and Greece it is far below the European average (0.5-0.3). *[Graph 6]*

A central finding of our study is that the presence of women in industrial research does not bear any relation to the intensity of industrial R&D in terms of human or material resources. Countries such as Greece and Portugal have a high proportion of women in industrial research, while the volume of human and material resources devoted to industrial research is very low. In Germany and Austria the opposite is the case: the presence of women is very low among industrial researchers, although the intensity of industrial R&D is among the highest. Finland stands out as the best performer in terms of intensity of industrial R&D, while the proportion of female researchers is only intermediate. The same holds when the proportion of women in industrial research is compared to the female industrial research intensity rate. Ireland and Austria have similar female intensity rates (0.7) but their performance is completely different with regard to the proportion of women in industrial research: it is the highest in Ireland and the lowest in Austria. Finally, it is also worth noting that the proportion of women in industrial research bears no relation to the female employment rate. Again, countries such as Greece, Spain and Italy have high female proportions while their female employment rates are very low. *[Graphs 7, 8, 9]*

2.1.3 Employment growth and gender gaps

At present, the European R&D Survey does not have a sufficiently complete series of data over time for it to be used to analyse research employment trends by sex. However, such an analysis is possible for scientists and engineers by means of the CLFS. The findings are clear: the industrial domain has shown the greatest capacity to generate new jobs in scientific and engineering professions over the past five years (8%, as compared with 5% in other domains). In second place comes health and social work, followed very closely by the government domain, then education – which just about remains stable – and, lastly, private non-profit, with a significant relative loss of employment.

The increase in scientific and engineering employment is more accentuated for women than for men, particularly in the industrial domain. Between 1995 and 2000, the industrial domain experienced significant growth in female scientific and engineering

(39) Data in both FTE and HC are available only for Denmark, Greece, Spain, Italy, Austria and Portugal.

employment (33% as compared with just 4% for men). In other domains, employment growth was much less accentuated, although it was still more favourable for women (9% as compared with 1% for men). The employment trends in these domains are much more uneven: employment in health and social work and government rose significantly among women (11% and 10%) and to a lesser extent among men (5% and 6%); the growth in women's employment was somewhat more moderate in education (8%), while this domain suffered a falling-off among men; finally, employment has fallen for both sexes in the private non-profit domain. *[Graphs 10, 11]*

If we compare these trends to the growth in overall female employment over the period 1995-2000, we see that female employment in science and engineering has grown at a much higher rate, particularly in the industrial domain. Between 1995 and 2000, total female employment increased by 11%, female scientific and engineering employment by 17% and female scientific and engineering employment in the industrial domain by 33%. Male employment growth shows a different pattern, with rates of 7%, 3% and 4% respectively. This ties in with the fact that "in the period 1995-2000, more than 60% of all new jobs were created in high-skilled, non-manual occupations… Employment growth has been strongest for men and women in the same occupational categories, with employment growth for women generally being significantly stronger among professionals, technicians, sales workers and clerks than for men."(40)

However, these trends cannot be directly extrapolated to researchers in the industrial sector. Only a small number of scientists and engineers are working as researchers. Indeed, the ratio between researchers and scientists and engineers varies greatly across sectors: for the economy as a whole there are 26 researchers for every 100 scientists and engineers, but this ratio falls to 17 for industrial researchers. Relative growth in the number of scientists and engineers in the industrial domain does not necessarily entail similar growth in the number of industrial researchers. This is especially true when trends in employment are analysed by sex. At European level there are about 18 male industrial researchers for every 100 scientists and engineers but this proportion falls significantly in the case of women, to only 13(41). Furthermore, the sparse evidence on industrial researchers is by no way conclusive. At the European level, the number of industrial researchers has only slightly increased over the last decade and trends in the presence of women appear to be far more uneven(42).

What does appear to be clear is that gender gaps are still very pronounced among highly qualified individuals. Between 1995 and 2000, the strong growth in female scientific and engineering employment in the industrial domain has only led to a moderate growth in the presence of women (from 16% to 20%). In the public domain, trends were more uneven, though still moderately positive on the whole (from 42% to 44%). Besides, a significant number of highly qualified women are unemployed or inactive, in comparison with men. A very useful indicator for comparing the employment opportunities of women and men is the employment gender gap for highly qualified people by sex. It is calculated as the difference in percentage points (p.p.) between the employment rates for women and men holding 5A or 6 degrees(43). This gap is very big at European level (–9.9 p.p.): out of every 100 highly qualified women only 78 are employed, as compared to 87 men. Nevertheless, national diversity is particularly pronounced in this field. Sweden stands out as the only Member State where highly qualified

(40) *European Commission, 2001, p.35*

(41) *These data exclude the private non-profit sector and refer to the 10 Member States where sex-disaggregated statistics are provided for industrial researchers.*

(42) *On average for the EU15, the number of industrial researchers (FTE) from 1991 to 2001 has increased at a far lower rate than the number of researchers in higher education system (Frank, 2003). Besides, we learn from the European R&D Survey and some national studies that the percentage of women in industrial research is also growing in a few countries: from 10% to 19% in France (1984-1997) and from 17% to 19% in Spain (1997-1999). However, this percentage seems quite stable in Portugal and is even decreasing in Finland (from 23% to 21% in 1993-2000) and Belgium (from 29% to 26% in 1998-1999). Sources: Ministère de la Recherche, 2002, p. 7 (France); Ouziel, 2001, p. 4 (Belgium); European R&D Survey (Spain and Portugal). Only European R&D Survey data are strictly comparable.*

(43) *In turn, the employment rate for highly qualified women is calculated as the number of employed women holding 5A and 6 ISCED degrees multiplied per 100 and divided by the number of 15-64 women holding 5A and 6 ISCED degrees. The same holds for the male employment rate.*

women have a higher employment rate than men, while the employment gap is comparatively low in Portugal, the United Kingdom and Denmark (between –3 and –5 p.p.). On the other hand, differences in employment rates are very pronounced in Greece, Spain, Italy and Luxembourg (between –11 and –15 p.p.). *[Graph 12]*

It appears that scientific and engineering employment is growing much more quickly for women than for men and that this growth has been even more marked in the industrial sector. However, gender gaps are still very pronounced. Highly qualified women have far fewer employment opportunities than men and the proportion of women among scientists and engineers is still very low, especially in the industrial sector. For industrial researchers, employment trends seem more uneven while the proportion of women is far lower.

2.2 Sectoral, Occupational and Educational Segregation

Gender segregation means that women and men, to a certain extent, work in different occupations, in different sectors or under different contractual terms and conditions. *"While participation and employment rates of women and men are converging, some studies (Anker, 1998; Rubery and Fagan, 1993) have shown that the distribution of employment by occupation or sector is still very much gender-segmented(44)."* This chapter analyses the sectoral, occupational and educational segregation of industrial researchers.

Overall, segregation may be seen as the result of vertical and horizontal segregation(45). Vertical segregation measures gender inequality giving a single vertical dimension (i.e. level of study or managerial responsibility at work). Horizontal segregation measures differences that do not necessarily mean inequality between women and men (i.e. specific gender patterns across sectors, occupations of the same level or fields of study) and it is sometimes referred to as concentration. Strictly speaking, sectoral segregation has only one dimension (horizontal) while occupational and educational segregation have both a horizontal and a vertical dimension.

Does segregation really matter? As Rubery et al.(46) point out, *"in general there are two standpoints on whether segregation is really a problem for gender equality. The first sees gender segregation as indicative of real gender differences, related to discrimination towards women in the male dominated labour market and facilitating wage differences. The second does not see gender segregation as the central problem, and considers that the wage gap could and should be removed by other means than by creating a gender homogeneous labour market."*

From our point of view, segregation does matter for gender equality in industrial research insofar as it provides clear evidence of the persistence of sexist stereotypes and gender biases in science and technology. Analysis shows that higher education is still very much gender-segregated, both horizontally (field of study) and vertically (advanced research degrees). The different educational patterns of women and men appear to be one of the factors behind occupational and sectoral segregation among industrial researchers and the low presence of women in industrial research.

2.2.1 Sectoral segregation

Sectoral segregation among industrial scientists and engineers is very marked. The proportion of women is far higher in services (26%) than in other sectors (12%). Differences in the presence of women by economic activity are striking: from 64% in hotels and restaurants to 5% in mining. However, more than 80% of female industrial scientists are concentrated in two main sectors: real estate, renting and business activities (41%) and manufacturing (21%), where the proportion of women is comparatively low (23% and 13%). *[Graph13]*

(44) OECD, 2002, p. 86
(45) Blackburn et al, 2002, pp. 512-513
(46) Rubery et al., 2002, p. v
(47) This sector includes (a) Legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy; holdings, (b) Architectural and engineering activities and related technical consultancy, (c) Technical testing and analysis, (d) Advertising, (e) Labour recruitment and provision of personnel, (f) Investigation and security activities, (g) Industrial cleaning, and (h) Miscellaneous business activities n.e.c. (Photographic activities, Packaging activities, Secretarial and translation activities, etc.).

73% of female scientists work in service activities, as opposed to only 51% of men. The sector with the largest number of industrial scientists of both sexes is 'Other business activities',(47) with 19% of women and 15% of men. Other significant activities for scientists and engineers are computing (12% of women and 13% of men) and research and development (9% of women and 5% of men). Finally, chemical manufacture is the only industrial activity with a relatively high share of scientists of both sexes: 8% of women and 5% of men. In respect of other sectors, women and men follow completely different patterns. On the one hand, men have a larger presence in industrial economic activities (construction, machinery and equipment manufacture, motor vehicles), while women are located more in service activities (retail trade, financial activities). *[Graph 14]*

Sectoral segregation also presents highly marked national differences. Graph 15 shows the female proportions for two large sectoral groups: services (where the female presence is comparatively high) and non-services (where it is much lower). The results are presented in order, from lower to higher sectoral segregation, calculated as the ratio between both female proportions. As can be seen, the services/non-services split seems to be strongly characteristic of the large majority of Member States. Sectoral segregation is very high in Belgium and Germany, with very low female proportions in non-services, while it is much less pronounced in the United Kingdom, where both female proportions are very low, and Sweden, where both of them are very high. Furthermore, there seems to be a clear positive correlation between the female proportion in non-services sector and the overall female proportion. This positive correlation means that national differences in the female proportion of scientists and engineers in the whole industrial domain depend, on a large extent, on national differences in the female proportion in the non-services activities. *[Graphs 15, 16]*

Sectoral segregation patterns among scientists are highly relevant for the analysis of women in industrial research. Industrial activities are pre-eminent in terms of the quantity of economic and human resources dedicated to R&D. As we have seen, they are also the economic activities where the presence of women scientists is lowest. The existence of such gender-specific patterns across sectors among scientists and engineers is therefore an important factor hindering a greater participation of women in industrial research.

The vast majority of industrial researchers of both sexes are concentrated in the two sectors with the most intensive R&D activity: manufacturing (74% of women and 80% of men) and real state, renting and business (17% and 14%)(48). However, the female proportion in these two sectors is very low (14% and 18%). On the other hand, it is relatively high in sectors with little R&D effort, such as financial intermediation, agriculture and fishing or electricity, gas and water supply. A more disaggregated analysis confirms these trends. The only industry sector with a high employment volume and proportion of women is chemical manufacture, particularly the sub-sector of pharmaceutical manufacture, where around 12% of all female industrial researchers are working and the female proportion is nearly 50%. Female proportions are high in food, beverages and tobacco and in textiles and wood, but the relative weight of these sectors is very low. On the other hand, a large number of female researchers are to be found in the manufacture of electrical and optical equipment and the manufacture of transport equipment, where female proportions are very low. Finally, service sectors show intermediate female proportions: 24% in research and development and 17% in computer and related activities. *[Graphs 17, 18]*

National diversity is also very pronounced in the case of industrial researchers. Graph 19 shows female proportions for two large sectoral groups: services and other sectors. The results are presented in order, from the lowest to the highest sectoral segregation, calculated as the ratio between both proportions. As can be seen, three country-groups may be differentiated: i) Finland, France and Denmark, with low sectoral segregation and intermediate female proportions in both groups, somewhat higher for non-services; ii) Portugal,

(48) Sectoral data for industrial researchers refer to the nine Member States where sex-disaggregated statistics are available. See the notes to Graphs 12 and 13 for more detailed references.

Greece, Spain and Italy, with intermediate sectoral segregation and a relatively high presence of women in services; and finally, iii) Germany and Austria with high sectoral segregation and very low female proportions in both groups, but especially for non-services. A positive correlation between the female proportion in non-services and the overall female proportion is again confirmed for industrial researchers: national differences in women's presence in non-services R&D activities are of utmost importance for explaining the national differences in the overall proportion of women among industrial researchers. *[Graphs 19, 20]*

National studies give more information on sectoral segregation patterns in industrial activities for France and Germany, the countries with the highest number of industrial researchers(49). In France, in 1999, the proportion of female researchers is highest in the pharmaceutical industry (49%), followed by chemicals (32%) and the farm-produce industry (30%). On the other hand, women are under-represented in fields such as automobiles (15%), aeronautics (12%) and machine manufacturing (8%)(50). Sectoral segregation patterns are very similar for Germany in 1999, even if the proportion of female researchers in industrial activities in this country (9%) is much lower than in France (21%). The pharmaceutical industry is again the economic activity with the highest proportion of women researchers (37%). The presence of women is relatively high in the areas of food, tobacco processing, textiles and chemicals (around 30%), whereas it is very low in vehicle construction (6%), mechanical engineering (5%) and broadcasting, television and telecommunications technology (scarcely 3%)(51).

2.2.2 Occupational segregation

Occupational segregation is very important among industrial scientists and engineers. At one end, women make up only 12% of architects and engineers; at the other, women account for 70% of health professionals. The differences in the remaining occupations are also highly marked. The female proportion is relatively high among higher education teachers, social and life scientists (over 35%), whereas women are seriously under-represented among mathematicians, statisticians, physicists, chemists and computing professionals (under 25%). This picture conforms to the paradox stated by the OECD: *"The fact that high employment rates in the Nordic countries have not led to a better integration of women and men into occupations may be viewed as a paradox."(52)* Nevertheless, if we broaden our perspective to include trends over recent years, we see that *"in the period between 1995 and 2000, occupational segregation by gender was also marked in some high-skilled non-manual occupations. However, because of the stronger employment growth for women, occupational segregation by gender decreased in other occupational categories, especially among professionals."(53) [Graph 21]*

The strong occupational segregation is one of the main factors explaining the low participation of female scientists in the industrial sector. The professions where women are most under-represented are those that have greatest demand and greater weight in overall employment. Over 75% of employment is concentrated in the two professional groups with the lowest presence of women: architects and engineers (54%) and computing professionals (23%). Male employment is highly concentrated in these two groups (60% and 24%), whereas the concentration of female employment is far lower for architects (33%), even if quite similar for computers (20%). In the case of women, health professionals and social scientists also represent a very significant percentage of employment (15% and 14%).

Occupational segregation varies greatly across the Member States. Graph 22 shows the female proportions for two large occupational groups. The first groups together the professions where female presence is lowest: mathematicians, statisticians, physicists,

(49) The United Kingdom does not yet provide sex-disaggregated statistics.
(50) Ministère de la Recherche, 2002, p. 11
(51) Federal Ministry of Education and Research, 2002, p. 232
(52) OECD, 2002, p. 90
(53) European Commission, 2001, p. 35

chemists, computing professionals, architects and engineers. The second collates the remaining professions, which have a significantly higher female presence. The results are presented from the lowest to the highest occupational segregation, calculated from the ratio between both proportions. As can be seen, the diversity is very clear. Occupational segregation is very high in Finland, Austria, Belgium, Germany and Luxembourg, with very low female proportions in the more male-dominated occupations. On the other hand, it is much less marked in Greece, Sweden, Portugal and Ireland, with comparatively high rates of female participation in the most male-dominated professions (more than 20%). The Netherlands shows a different pattern, with again a low occupational segregation, but very low female proportions in both groups. In general, the female proportion in the most male-dominated occupations is again positively correlated with the overall female proportion. *[Graphs 22, 23]*

Laafia and Larson(54) show that the proportion of women researchers in the public sector in most Member States is far higher in medical and social sciences than in engineering and technology. The sparse evidence currently available shows a similar pattern for industrial research. Unfortunately, the European R&D Survey only provides information on industrial researchers and the field of science they are working in for two countries (France and Portugal). An analysis of occupational segregation in industrial research is therefore seriously limited. Notwithstanding this, it is interesting to note that industrial researchers seem to follow similar occupational segregation patterns to industrial scientists,

(54) Laafia and Larson, 2001.

Box 1.3

Vertical segregation and career development among scientists and engineers

Available data do not permit an analysis of vertical segregation. However, it should be stressed that the little available literature on the situation of women in management positions generally acknowledges that, regardless of sector of activity (public, private or academic), women's under-representation becomes even more pronounced as one moves up the hierarchical ladder. In Germany, according to the Federal Ministry of Education and Research (2001) women occupy 5% of leading positions in industrial research institutions, whereas the overall percentage of women in management positions in Germany's industrial sector is 11%. With reference to engineering, Le Pellec and Roux (2001, p. 3) reveal that only 3% of French women engineers perform higher hierarchical functions, as compared with 15% for their male colleagues.

However, things change and some employers are becoming aware of the significance of women's presence at the top level. In the report Doing-Gender in Industrial Organisations: An Example from a Research and Development Project at an Engineering Company (Rosell, 2002), the working atmosphere in a Swedish engineering company is described. Currently, only 6% of the 194 managers are women. The report shows that the managers of the firm consider this situation to be a problem and are determined to increase the proportion of women in managerial positions for the following reasons:

- *"The company wants to enlarge its recruitment base*
- *Greater diversity enhances a creative atmosphere*
- *An increase in the number of women managers will forge a change in management and [and bring it more into line with] the newly adopted leadership policy."* (Rosell, 2002, p. 2)

Finally, the Ministry of Research (2002, p. 24) in France has carried out research with respect to the creation of firms in scientific and technological activities. The results show that only one out of three founders of innovative firms is a woman (which is not that low if we compare this figure with the proportion of female researchers, about 25% in 1999). Moreover, in national tenders to obtain support for the creation of innovative technology enterprises, the proportion of female winners amounted to 10%. Their proportion was significantly higher among 'in creation–in development' projects: women accounted for one-fifth of these projects.

albeit even more marked. Only 18% of engineering and technology industrial researchers are women. However, this field of science concentrates an extremely high percentage of industrial researchers of both sexes: 57% of women and 66% of men. We can therefore confirm that occupational segregation among scientists is a factor of the utmost relevance when explaining the under-representation of women in industrial research. In the case of France, at least, it appears that this gender gap has been decreasing since 1995, when the proportion of female engineers was still as small as 13% for researchers. Moreover, the proportion of French women engineers is higher than that of men in computing, civil services and the food industry, but they are less present in industry, technical consultancy companies and civil works(55). *[Graph 24]*

2.2.3 Educational segregation(56)

In spite of the rising proportion of women in higher education, the educational patterns of women and men are very different and some fields of study are still predominantly male-dominated. A similar situation characterises access to the highest level of university education: the proportion of women among doctoral graduates is significantly lower than among first university graduates. In other words, university education shows marked segregation, both horizontal (fields of study) and vertical (levels of study)(57).

Horizontal segregation can clearly be seen when data on bachelor and master degrees by field of study are analysed(58). Overall, women account for 56% of 5A graduates but the proportion of women has highly marked differences depending on the field of study, ranging from 75% in educational sciences to just 24% in engineering. 47% of women graduate in the most female-dominated fields (educational sciences, health and social services, humanities and arts). In social and behavioural sciences, business and law (where the female proportion, 56%, is close to the average) the volume of female graduates is again very high (35%). On the other hand, the number of women graduating in the most male-dominated subjects is very low: 9% in science and just 6% in engineering. The contrast with men could not be clearer: 14% in science and 23% in engineering. *[Graph 25]*

A doctorate is still very much a minority option for both sexes but even more so for women. Out of every 100 women with a bachelor degree, only four graduate as doctors compared to seven men. Among master and bachelor graduates, women account for 56% while for doctoral graduates the figure is only 39%. In addition, horizontal segregation patterns are also very marked among doctoral graduates. *[Graph 26]*

When the situation is analysed at a national level, the first fact that catches the eye is that there are still highly marked differences in the presence of women among master and bachelor graduates, ranging from 65% in Portugal to 46% in Germany. The highest participation rate is to be found in southern (Portugal and Spain) and Nordic countries (Finland, Sweden and Denmark) and the lowest in central European countries, such as Belgium, Austria and Germany. These differences are, to a certain extent, connected to the different presence of women among doctoral graduates. The highest proportion is found in Italy (51%), followed by Portugal and Ireland, whereas in Germany, Belgium and the Netherlands it is very low (under 35%). *[Graph 27]*

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(55) Rodot and Moutaud, 2002, p. 1

(56) In part two of this report, good practices regarding partnerships between companies and schools in order to pull down this educational segregation will be presented.

(57) Educational data refer to 2000 and came from the Eurostat Education database. They cover ISCED 5A (bachelor and master degree) and ISCED 6 (doctoral degree). Missing countries: Greece and Luxembourg.

(58) The ISCED'97 fields of study are classified as follows:
- Educational Sciences (A02): Teacher training (ISC141); Education Science (ISC142);
- Humanities and arts (A05): Arts (ISC21); Humanities (ISC22);
- Social and behavioural sciences, business and law (A08); Social and behavioural sciences (ISC31); Journalism and information (ISC32); Business and administration (ISC34); A12-Law (ISC38)
- Engineering, manufacturing and construction (A18): Engineering and engineering trades (ISC52); Manufacturing and processing (ISC54); Architecture and building (ISC58)
- Science (A13): Life sciences (ISC42); Physical sciences (ISC44); Mathematics and statistics (ISC46); Computing (ISC48)
- Agriculture (A22): Agriculture, forestry and fishery (ISC62); Veterinary (ISC64);
- Health and social services (A25): Health (ISC72); Social services (ISC76)
- Services (A28): Personal services (ISC81); Transport (ISC84); Environmental protection (ISC85); Security Services (ISC86)

In order to analyse horizontal segregation, Graph 28 shows the proportions of female graduates for two large fields of study. The first collates the studies where female participation is lowest, namely science and engineering. The second brings together the remaining fields of study, which have a significantly higher presence of women. The results are presented from the lowest to the highest level of educational segregation, calculated from the ratio between both proportions. At one extreme there is Ireland, the country with the lowest educational segregation and a relatively high female proportion in the most male-dominated field of study. At the other extreme, educational segregation is very high in Finland (with the highest female proportion in traditionally female-dominated fields of study) and especially in the Netherlands (with the lowest female proportion in male-dominated fields of study). *[Graph 28]*

Clearly, the proportion of females in industrial research is closely linked to the female proportion among graduates in science and engineering, the most male-dominated fields of study and the degrees in greater demand in industrial research. Educational segregation therefore seems to be an important factor in occupational and sector segregation and, ultimately, the under-representation of women in industrial research. [Graph 29]

However, the number of female graduates in science and engineering varies greatly among Member States. An extremely useful indicator with which to analyse the most recent trends in this area and to compare the different performances of European countries is the number of science and engineering graduates by sex per thousand of population aged 20-29. This is one of the EU structural indicators currently in use in the area of Innovation and Research(59). National differences are highly marked, ranging from 10 female 5A graduates in Ireland to scarcely two in Austria. Differences are also highly significant with respect to doctoral graduates, with 0.8 female doctoral graduates in Sweden compared to just 0.2 in Italy. In general terms, three

(59) *We are referring to the 2003 set of Structural Indicators included in the statistical annex to the annual Report from the Commission to the Spring European Council. One of these indicators is the number of tertiary graduates in science and technology by sex per thousand of population aged 20-29 (for further details, see the Eurostat website on structural indicators: http://europa.eu.int/comm/eurostat/Public/datashop/print-product/EN?catalogue=Eurostat&product=1-structur-EN&mode=download). In this study we propose a similar indicator, but only for ISCED 5A or 6 degrees.*

Box 1.4

Industrial researchers and education in France

Le Livre Blanc: Les Femmes dans la Recherche Française was published by the French Ministry for Research in March 2002 (Ministère de la Recherche, 2002). This document was the outcome of a research project that not only focused on the industrial sector but also analysed the issue of women in research in the government and higher education sectors. Data on industrial researchers were collected by means of a survey. Of great importance is the fact that the questionnaire also asked for information on the researchers' level of education. The main findings are as follows:

- the educational background of female industrial researchers is very different from that of men. In 1999, 55% of female industrial researchers had a degree in engineering (as compared to 55% of men) and 27% a doctorate (15% of men).

- over the 15-year period between 1984 and 1999, the level of education of researchers starting work in industry rose, with more of them possessing a university degree. Over the same period, the number of women in industrial research increased for all educational levels while differences in education were reinforced. In activity sectors where the proportion of women researchers is high (such as the pharmaceutical sector, agriculture, the energy sector, chemicals, etc.), relatively more of them have a doctorate. For example, 80% of all doctors in medicine are concentrated in the pharmaceutical branch. Moreover, more than half of all industry researchers with a doctorate in medicine or pharmacy are women.

groups of countries may be distinguished: i) Ireland and France, with a relatively high ratio of women graduates in science and engineering, ii) the United Kingdom, the Netherlands and Austria, with very low ratios, and iii) the remaining European countries, with intermediate ratios. *[Graph 30]*

2.3. Working Conditions and Trends for Industrial Scientists and Engineers

The profile of female industrial scientists and engineers appears to be quite clear. They are younger than their male colleagues, fewer have children and their working conditions are different: more temporary employment, less job tenure and lower wages. This chapter draws mainly on CLFS data and presents the most significant trends and working conditions of female scientists and engineers in the industrial domain.

2.3.1 Age and patterns of change

Women scientists in the industrial domain are younger than other women in employment and significantly younger than their male colleagues. At European level, 59% of all women scientists and engineers in the industrial domain are under 35 years old, as compared to 42% of men(60). Female industrial scientists are also younger than women working as scientists in other domains (35% under 35) and non-scientist women working in the industrial domain (47%). National diversity is significant. In Ireland and Spain, more than 80% of female industrial scientists are under 35, while in Germany, Italy and Finland it is less than 50%. *[Graph 31]*

The proportion of women among young scientists is therefore significantly higher than among their older colleagues. At European level, 26% of scientists under 35 are women in the industrial domain, compared with barely 15% in the rest. In some European countries, the incorporation of young female scientists in recent years has had a clear impact on the increase in the proportion of women among those under 35. In Spain, women account for 46% of young scientists, while they account for just 9% of the older ones. The incorporation of young women has also been highly significant in other countries, such as Greece, Austria and Denmark (in all of these, women account for a third or more of young scientists in the industrial domain). However, this proportion is still relatively low in Germany (22%), the Netherlands (21%), the United Kingdom (19%), and especially Belgium, with the lowest proportion of all European countries (17%) – hardly differing from the figure for older scientists (14%).

One issue of utmost relevance is knowing to what extent the patterns of sectoral and occupational segregation are changing among the younger industrial scientists and engineers. The statistical tests carried out show quite a clear picture over the last five years. The patterns of sectoral segregation seem highly stable and there is insufficient evidence of any significant changes taking place. On the contrary, it may be stated that occupational segregation appears to be decreasing among young industrial scientists and engineers(61).

A relatively simple way of benchmarking patterns of change in this area is to compare the female proportions for scientific and technological occupations (the most male-dominated) for each of the two main age groups (under 35 and 35 or over). The difference in percentage points between these proportions provides highly relevant information on different national trends(62). In all Member States, young women have more presence in traditionally male-dominated professions than older women. At European level, the difference is as high as 11 p.p.: women under 35 account for 20%, an appreciably higher figure than the 9% for women of 35 or over. However, national differences are highly marked: in Spain, young female scientists have increased their presence in traditionally male-dominated professions by 20 p.p. with respect to their older colleagues, while in Belgium there has hardly been any

(60) No reliable data for Luxembourg and Sweden.

(61) The test of two proportions has been carried out in order to compare the female proportions among under 35 and older industrial scientists and engineers in the more male-dominated sectors and occupations over 1995-2000, drawing on CLFS data for the whole European Union. The result of the test was negative for sectors and positive for occupations at 95% of reliability.

(62) No reliable data for Luxembourg, Portugal and Sweden.

change at all. In some of the countries where the advances have been more marked, the initial starting point was very low: this is especially the case in Spain, where women aged 35 or more account for barely 5% of scientists in male-dominated professions, as well as Ireland, Italy, Austria, the Netherlands and Germany (around 7-10%). The situation is different in Greece, with a highly significant increase (19 p.p.), as well as a relatively high female proportion in the older age group (17%). *[Graph 32]*

2.3.2 The impact of parenthood[63]

Relatively few women scientists and engineers working in the industrial domain have dependent children, compared to their male colleagues. At European level, only 28% of female industrial scientists have at least one child under 16, compared to 35% of men.[64] The differences are also marked when comparing women non-scientists working in the industrial domain (34%) and women scientists working in other domains (34%). National differences are also highly marked. In Belgium, 52% of women scientists working in the industrial domain have children, whereas this figure is just 20% in the UK. Belgium is also quite an exceptional case because the percentage of female scientists having children is higher than that of men. In France, Italy and Austria, the situation is relatively balanced, with very similar rates for men and women, while in the other Member States, female percentages are significantly lower. This is especially the case for Spain and the United Kingdom, the countries with the lowest percentages and highest differences with respect to men, other female employees and female scientists in other domains. *[Graph 33]*

The fact that female scientists form a very young population, especially in some Member States, can probably partly explain these differences. Female scientists are also a highly educated part of the labour force and many studies have shown that highly qualified women tend to postpone maternity. Another important point is that the opportunity cost of staying at home to raise children is very high for highly qualified women. Therefore, if they decide to combine career and children, they are highly dependent on childcare infrastructures. These infrastructures still vary enormously across Europe in respect of both availability and quality of care. The lack of available childcare provisions might explain why some women, especially highly educated ones, decide not to have children[65][66].

One extremely useful indicator with which to analyse the impact of having children on employment opportunities for highly qualified women and men is the gender employment gap by family situation (that is, having at least one child under 16 or having no children). In each case, this indicator is the difference in percentage points between the female and male employment rates for people with ISCED 5A or 6. To adjust the analysis even further, this is carried out on the under-50 age group. Graph 34 shows the findings. Clearly, in all countries the gender employment gap is much wider among those who have dependent children than the rest[67]. The only outstanding exception is Portugal, where both gaps are very similar and also relatively small. At European level, the percentage of highly qualified women with children who are working is 79%, compared to 96% of men. Germany is the country with the widest gender employment gap among highly qualified people with children and also has the lowest employment rate in this group of women (74%). [*Graph 34]*

2.3.3 Working conditions

More than 13% of female scientists and engineers in the industrial domain have a temporary contract, as compared to 7% of males. Sweden and Ireland are the only European countries where the temporary rate among industrial scientists is somewhat lower

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(62) No reliable data for Luxembourg, Portugal and Sweden.
(63) In part two of the report, good practices regarding time management and management of pregnancy and maternity will be presented.
(64) No available data for Denmark, Ireland, Finland and Sweden; no reliable data for Luxembourg and Portugal.
(65) Gustafsson and Meulders, 2000; Gustafsson, 2002; Gornick et al., 1997
(66) Good practices regarding the management of pregnancy and maternity as well as time management practices inside firms will be presented in part two of the report. See also Appendixes.
(67) No available data for Denmark, Ireland, Finland and Sweden. No reliable data for Luxembourg.

for women than for men: in all other countries, the female rate is significantly higher (especially in Denmark, Belgium and Portugal). On the other hand, the differences between women scientists and other women employed in the industrial domain are very small at European level. The temporary rate is only 0.6 p.p. lower among women scientists. However, the size of the difference varies between countries: more temporary contracts are noted for women scientists in Portugal (the highest score, with 45% of women scientists having temporary contracts), Belgium, Italy, the United Kingdom and Luxembourg, while in other countries women scientists are less likely to have temporary contracts. Female scientists also appear to be much less subject to temporary work in the industrial domain than in other domains (25%). In 2000, temporary work accounted for 11% of all European employment, 10% of male employment and 13% of female employment(68). The situation of women scientists appears to be similar in the industrial domain and much more precarious in the remaining domains. Male scientists, on the other hand, are less subject to fixed-term contracts in the industrial domain, but much more in other domains (19%). *[Graph 35]*

In nearly all European countries, women scientists seem to have a low probability of staying more than five years in a job.(69) The percentage of female scientists in the industrial domain holding their jobs for more than five years is 41% at European level. Job tenure is significantly lower among female than among male scientists in the industrial domain (52%). The same holds for female scientists in other domains (56%). However, job tenure for female industrial scientists varies considerably across countries, from a high of 71% in Austria to a low of 21% in Ireland. *[Graph 36]*

In Europe, the percentage of women working in micro enterprises (10 or less employees) is higher than that of men. The picture is the same for scientists and engineers in the industrial domain, with 22% of women in micro enterprises compared to 9% of men . However, these percentages are lower than those observed for non-scientist employees in the industrial domain (30% for women, 23% for men). Even if female industrial scientists are less frequently employed in micro enterprises than other working women, their proportion in micro enterprises is significantly higher than the proportion of men. *[Graph 37]*

Finally, part-time work(71) is not a characteristic of women scientists: in all European countries and in all domains the share of part-time workers is lower for scientists than for other women in employment (23% compared to 36%). The share of part-time work is smallest in the industrial domain (16%). However, differences between countries are significant: the highest percentage is observed in the Netherlands (46%), in accordance with the importance of part-time work in this country. More surprising are the low percentages for the Nordic countries: Denmark with 4% (compared with 35% for other women in the industrial domain) and Sweden with 8% (33%). As different studies have stressed, the poor quality of part-time work in European countries is related to its strong concentration in particular sectors and occupations with low levels of qualifications and responsibilities. The above findings will therefore come as no surprise, but it appears that this mode of reconciliation between work and parental responsibilities is not chosen or available to women scientists in most countries, and especially for those working in the industrial domain(72). *[Graph 38]*

2.3.4 Gender pay gap

According to Straka(73), women's wages in scientific and technological professions are less than men's in most OECD countries and in recent years the gender pay gap appears to be widening instead of narrowing. As already mentioned, a cross-national analysis of the gender pay gap among industrial scientists and engineers is not possible because the European Structure of Earning Statistics (ESES) does not provide disaggregated data on occupation and education at the European level. However, it

(68) European Commission, 2001, p.110
(69) No reliable data for Luxembourg, Portugal and Sweden.
(70) No available data for Ireland. No reliable data for Denmark, the Netherlands, Luxembourg, Portugal and Sweden.
(71) Part-time as a good practice is discussed in the part two of the report.
(72) Maruani, 2000; Rubery et al., 1995, 2001; Meulders et al., 1993
(73) Straka, 2000, p. 2

seems meaningful to make reference to more aggregated European ESES data as well as the literature at national level in order to draw a basic picture of the gender pay gap among highly qualified employees.

Table 5 sets out the basic cross-national patterns in gender pay gap by educational attainment. The gender pay gap is calculated as the ratio between female and male average gross monthly earnings for full-time employees. These data are based on the ESES and thus exclude the public sector. As stated by Rubery et al(74), the general pattern across the EU is a slight widening of the gender pay gap between those workers with completed upper-secondary education compared to those with a first stage – or lower – of secondary education, and a significantly larger pay gap among workers with higher education. At European level, on average, women with higher education earn only 68% of their male colleagues' earnings. Either the ratio for individuals with upper-secondary education (76%) and first stage of secondary education or lower (77%) are far higher. This pattern holds for most Member States, although there are some exceptions (especially Finland, where the gender pay gap is the narrowest among the most highly educated group).

In all Member States, the rise in relative pay with education is higher (in terms of percentage points) among men than among women. However, differences are strongly marked across European countries. Rubery et al(75) have further explored the education-earnings profiles of EU Member States, which can differ both according to the size of the premium for education and the degree to which there is gender inequality in the premium. Table 6, based on this study, separates countries along these two dimensions: the relative size of the pay-off to education (defined as the percentage increase in relative pay between workers with low and high education); and whether these are similar or different for men and women. Additionally, the table breaks down countries depending on the extent to which highly qualified women are able to achieve earnings

(74) Rubery et al, 2002, p. 44-45
(75) Rubery et al, 2002, 46-47

Table 5: Gender pay gap by educational attainment in the private sector, EU 15

Ratio between women's and men's average monthly earnings for full-time employees multiplied by 100	First stage of secondary education or lower	Upper secondary education	Higher education
Belgium	81.20	82.90	71.50
Denmark	86.70	86.70	76.10
Germany	79.14	78.72	74.55
Greece	68.55	73.38	70.98
Spain	73.76	74.41	65.37
France	77.50	81.61	68.15
Italy	78.08	73.63	60.35
Luxembourg	81.58	80.77	74.49
The Netherlands	73.42	68.70	60.85
Austria	71.47	74.48	60.26
Portugal	70.75	73.06	72.92
Finland	80.85	81.59	82.72
Sweden	84.93	84.22	77.90
United Kingdom	71.01	70.67	71.25
EU15(1)	77.31	75.80	68.00

Notes: (1) EU15 average does not include Ireland. Source: Rubery et al, 2001, based on data from ESES, 1995 that exceed the average pay for men.

Overall, in eight countries highly qualified women earn more than the average male pay, and of these, seven provide relatively similar returns for both men and women: Luxembourg, Austria and Portugal, where returns to education are very high, and Germany, Denmark, Finland and Sweden, where they are comparatively low. Only Italy has a strong gender imbalance in returns. Of the six countries where even highly qualified women earn less than the male average, in two (Greece and the UK) the returns are low for both women and men. In the remaining countries, gender differences in return are strongly marked (they are high for men but low for women in the Netherlands, Spain and France, and low for men but very low for women in Belgium). As stated by Rubery et al, women in these four countries experience the double penalty of high inequity in returns and below male average pay for women workers with higher education.

For a number of Member States, more disaggregated information on the gender pay gap among industrial scientists and engineers is available. Based on the national Structure of Earnings Survey, the Belgian National Institute of Statistics computed the following table for 1999. Overall, women scientists in the industrial sector seem to perform worse in terms of wages than women in the economy as a whole. On average, female industrial scientists with a university degree or a degree from non-university higher education earn 80% of the wages of their male colleagues. In the private sector as a whole, this proportion is about 10 percentage points higher and in industry, in general, women earn up to 83% of men's wages. Another observation is that the gender pay gap varies significantly across occupations, from 28% among physicists and chemists to 14% among mathematicians and statisticians. When we consider scientists and engineers with a doctoral level of education, the table shows that although for physicists and chemists no significant difference in the wage gap is achieved by investing in such a high level of education (doctorate), female computing professionals do gain enormously from such an investment since the gender wage gap is reduced from 16% among computing professionals with higher education or university degrees to –4% amongst computing professionals with a doctorate. In other words, women PhDs in computing earn more than their male colleagues. It seems to be a fact that among scientists and engineers, women gain more (in wage terms) from obtaining a doctorate than men.

The gender pay gap among scientists and engineers

Table 6: Typology of education-earnings profiles by gender in the private sector, EU15 1995

	Relative size of education-earnings pay-off			
	High for all workers	Low for all workers	High for men, low for women	Low for men, very low for women
Highly qualified women earn more than average male full-time pay	Luxembourg Austria Portugal	Denmark Germany Finland Sweden	Italy	
Highly qualified women earn less than average male full-time pay		Greece United Kingdom	France The Netherlands Spain	Belgium

Source: Rubery et al, 2002, p.48. based on data from ESES, 1995

Table 7: Industrial S&E wages by sex, Belgium, 1999

		Gross monthly earnings						
ISCED[1]	ISCO	211	212	213	214	215	216	217
6	Women	16.31	21.14	16.35	16.22	16.07	17.92	18.87
	Men	22.65	24.68	19.50	21.32	19.74	21.47	24.35
	W/M	0.72	0.86	0.84	0.76	0.81	0.83	0.77
7	Women	-	-	-	-	-	-	-
	Men	28.66	-	25.76	27.74	-	-	-
	W/M	-	-	-	-	-	-	-
8	Women	18.98	-	22.38	-	-	-	-
	Men	25.48	-	21.42	19.75	-	37.24	-
	W/M	0.74	-	1.04	-	-	-	-

Notes: *(1) ISCED'76 levels: 6 covers university degrees and students enrolled in higher non-university education of an extended character; 7 covers all people with degrees from post-university education and 8 all people with a doctoral level of education.*

Source: *INS, Enquête sur la structure des salaires et la répartition des salaires (1999).*

has been widely confirmed across European countries. In Portugal, in 2001,[76] it was pointed out that, on average, for technological and scientific staff, the salary of women represented 73% of that of men in 1999. Nevertheless, this gap seems to be narrowing slowly (women's salaries have risen from 71% of men's earnings since 1997). However, those figures vary significantly according to the field women are working in: from 72.5% of men's wages (in a series of collective social and personal activities) to about 86% (in fishing). The business sectors in which the difference in pay turned out to be the smallest were, in descending order: fishing, extractive industries, electricity, gas and water companies. Furthermore, it has to be considered that research in Portugal is very poorly paid and does not offer particularly good prospects: men have either tended to shy away from it or have gone to conduct research abroad. As a result, women often take up this type of job[77].

In Sweden, this gap varies between 78% and 88%: it is less significant in physics, mathematics, technology, life sciences or health sciences than in medicine or social sciences[78]. In France, the salaries of women engineers are on average only 62.43% of those of their male colleagues. It also appears that married men are better paid than single men. The latter are in turn better paid than married women, who are better paid than single women. Moreover, this 'marital status-gender gap' has not decreased over the last 10 years[79]. A gender pay gap among scientists and engineers has also been confirmed in the Netherlands[80] and Germany[81].

2.4 Comparison with Non-European Countries

2.4.1 Under-representation of women in scientific and technological employment

In the United States, the National Science Foundation has published biannually, since 1982, a valuable source of information entitled *Women, Minorities, and Persons with Disabilities in Science and Engineering*[82]. Another useful annual publication is the *Science and Engineering Indicators*, published by the National Science Board. Women represented 24% of the science and engineering workforce in 1999, compared to 19% in 1991. However, their proportion varies across the different

(76) More references on the EIRO website (<www.eiro.eurofound.ie>).
(77) Eiro, 1999
(78) SCB, 2001
(79) Rodot and Moutaud, 2002, p. 2
(80) de Bruin, 2002, at http://www.wigsat.org/gasat/48.txt
(81) GKSLNW, 2000, p. 7
(82) The paper is available at <http://www.nsf.gov/sbe/srs/nsf00327/start.htm>.

professional fields: they are more present in psychology, social sciences or biology, but make up only 23% of physical scientists. Both in 1982 and in 2000 women were more likely than men to be employed on a part-time basis. Women also seemed more vulnerable to unemployment. Finally, in many occupational fields, women scientists have a lower level of education than men (16% of women and 20% of men hold doctoral degrees)(83).

As far as the industrial sector is concerned(84), US women scientists and engineers in industry are still a good stretch away from reaching parity (even in sectors widely thought of as woman-friendly, such as biotechnology): while women represent around 45% of the workforce in the United States, they occupy only 12% of S&T jobs in the business sector.

Another analysis of the proportion of women in industry compared to the public sector was published in the report *From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers*(85). This report shows that women are still more likely to work in the academic sector (where they outnumber men), although their growth rate in industry increased steadily from 7% in 1973 to 26% in 1995. The report also offers more precise information on the proportion of women and men by field and by work activity. For example, while men generally outnumber women in basic research, whatever the scientific field (except in social and life sciences), the opposite is true regarding applied research (except in social science).

On engineering, the report *A National Survey of Women and Men Engineers: A Study of the Members of 22 Engineering Societies* was published in 1993 by the Society of Women Engineers(86). This report gives information on demography, family issues, employment, salaries and education, motivations to become an engineer, job discrimination, and so on. While globally women represent 9% of engineers,(87) they *"are relatively unlikely to go into aerospace or civil engineering, and more likely than men to become chemical, computer, environmental, industrial or manufacturing engineers. They are less likely than men to work for consulting and engineering service firms (now the largest single industry sector for engineers) and more likely to work for manufacturers, especially the computer hardware and software industry."*(88)

In Canada, women represented 19% of the total workforce in science and technology in 1999 (compared to 17% in 1987). In line with what we observed in the United States, women were most present in life sciences (28%). They made up 24% of all physical scientists and 9% of engineers(89).

As far as engineering is concerned, Straka (2000) has pointed out the richness of the information available from the Professional Engineers of Ontario Survey. For example, women engineers are more likely to work in industry sectors such as utilities (19%), consulting (20%), education (21%) and government (25%) than in manufacturing (16%) and construction (10%)(90).

Again in respect of the industrial sector, Emerson et al. have analysed the presence of women scientists and engineers in the – typically very male-dominated – oil and gas sector. Based on previous studies, Emerson et al.(91) have shown that while women are over-represented in clerical services, sales and other service positions, they hold only 3% of all technical positions and 26% of all professional occupations, including scientists and engineers. For example, a survey of several large companies in the oil and gas sector in Newfoundland revealed that the proportion of engineering, professional or technical/trades positions held by women ranged from 1% to 7%.

Several data sources exist to help us to assess the presence of women in R&D in New Zealand. For example, Data and Statistical Tools for Gender, Science and Technology in the Asia-Pacific Economic Cooperation, prepared by Perpetua,(92)

(83) National Science Board, 2002
(84) Thom, 2001, http://www.ncrw.org/research/iqsci.htm http://www.ncrw.org/research/iqsci.htm
(85) National Academy of Science, 2001
(86) The paper is available on the website <www.swe.org/SWE/Publications/NationalSurvey.doc>.
(87) National Science Foundation, 2000, p. 51
(88) Society of Women Engineers, 1993, p. 2
(89) Emerson et al., 2000, p. 1
(90) Straka, 2002, p. 3
(91) 2000, p. 1

reviews existing data on the participation of women in science and technology education, employment, and R&D in the Asia-Pacific Economic Cooperation (APEC). The report also examines case studies where policy actions facilitate women's access to science and technology in order to identify the type of gender-disaggregated data needed to support such policies. Briefly, women comprised nearly 19% of scientists and engineers in 1996, a slight improvement over the 1991 figure of 17%. They were best represented among health professionals (35%) and mathematicians and statisticians (33%), and least represented among engineering (7%) and computing professionals (22%). They account for 24% of all scientists and engineers in the business sector(93).

Regarding Japan, the study *Female Researchers in Japan*(94) was conducted through interviews with female researchers and also made use of existing statistical material, such as the *Report on the Survey of Research and Development* by the Management and Coordination Agency and the *Report on the Basic Survey of Schools* by the Ministry of Education. The study was compiled to show the current status and future problems of female researchers in Japan. The author showed that in 1992 women represented 6% of researchers in natural science (compared to 4% in 1980). *"The ratio of females is highest in health-related areas at 16.4%, and lowest in engineering fields at 1.4%. Nonetheless, the growth in engineering is as large as that in university entrants."*(95)

Another study carried out by the Japanese National Institute for Science and Technology Policy (NISTEP) elucidates the need of private companies for researchers and engineers with high-flying academic careers. People from the personnel departments of 28 leading Japanese companies that actively invest in R&D were interviewed. Some information is specifically related to the problems of women. For example, the author states that the pharmaceutical and chemical industries seem to have discovered the value of employing more women. However, Wada(96) shows that the female share among technical recruits at chemical and pharmaceutical companies still corresponds to only around one-third of female graduates from the relevant university courses, the remaining two-thirds having moved into other sectors, become unemployed, and so on.

Finally, *"female recruitment rates at iron and steel, machinery manufacturing and service companies are very low at about 7% which corresponds to about half to a third of the female share of employed graduates from engineering courses (the main source of new recruits for these companies). Overall, even large companies engaged in sophisticated business operations are still dragging their feet as far as the recruitment of female technical personnel is concerned."*(97)

As far as Australian S&T women are concerned, the Australian Bureau of Statistics (ABS) has published a very valuable source of data in 1999, the *Report on Human Resources in Science and Technology* (**HRST**)(98). According to this report, women represented 54% of all those with S&T qualifications in 1996. Table 8 shows, among other things, that the proportion of women with a higher degree decreases in relation to age. This can be considered a first indicator of women's educational emancipation. However, the situation is far from ideal since the number of males with a higher degree (127,000) is still twice as high as the number of females (64,000). In S&T occupations, 47% of all those employed were women (33% in natural and physical sciences and only 7% of building and engineering professionals).

(92) *This paper was part of the background material for the Asia-Pacific Economic Cooperation Experts' Meeting on Gender, Science and Technology in 1998 in the Philippines.*
(93) *Ministry of Research, Science and Technology (MoRST), 1998*
(94) *Yokoo, 1992*
(95) *Yokoo, 1992, at http://www.nistep.go.jp/achiev/abs/eng/rep030e/rep030ae.html*
(96) *Wada, 1997, at http://www.nistep.go.jp/index-e.html*
(97) *adapted from Wada, 1997, at http://www.nistep.go.jp/index-e.html*
(98) *The data in this report were collected in the ABS's 1991 and 1996 Censuses of Population and Housing and the 1998 Labour Mobility Survey. All definitions of indicators and guidelines are in accordance with the Canberra Manual (OECD, 1995)*

Table 8: S&T qualifications and occupations, by age and sex, Australia, 1996

% – '000 women by age group (years)		15–24	25–34	35–44	45–54	55–64	65 & +	Total
HRSTQ(1)	Higher degree	50% – 1	44% – 16	36% – 2	30% – 16	23% – 5	21% – 3	34% – 64
	Postgraduate diploma	67% – 4	69% – 31	61% – 43	57% – 24	62% – 8	57% – 4	62% – 114
	Bachelor degree	60% – 81	53% – 184	49%–145	45% – 78	42% – 28	40% – 23	50% – 539
	Undergraduate diploma	69% – 18	71% – 70	70% – 98	62% – 68	61% – 36	60% – 32	66% – 322
HRSTO(1)	Specialist managers	50% – 7	37% – 26	28% – 28	25% – 21	21% – 5	33% – 1	30% – 88
	Natural and physical science	50% – 2	42% – 6	25% – 3	25% – 2	–	–	33% – 13
	Building and engineering	11% – 1	12% – 3	4% – 1	5% – 1	–	–	6.7% – 6
	Computing	22% – 2	24% – 8	23% – 6	18% – 2	–	–	22% – 18
	Health	84% – 16	76% – 55	75% – 67	74% – 44	–	–	74% – 197

Notes: *(1) HRST in terms of educational qualifications (HRSTQ) are persons who have completed post-school qualifications; HRST in terms of occupations (HRSTO) are persons employed in the most highly skilled occupations.*

Source: *1996 Census of Population and Housing.*

According to this report, given a more disaggregated classification, the proportion of women is particularly low among environmental and agricultural science professionals (17%), civil engineers (8%), and electrical and electronics engineers (7%). In contrast, they represent 33% of chemists and 60% of medical scientists.

Besides the Australian Bureau of Statistic, Australia has another useful source of information: the Association of Professional Engineers, Scientists and Managers (APESMA), which represents and protects the interests of Australian engineers, scientists, managers, architects, IT professionals, pharmacists, and veterinarians. The association plays a vital role in promoting career development for its members. For this purpose, it conducts surveys on employment behaviour and professional groups, with particular focus on discipline, age group, responsibility level, industry sector, and sex(99). Among other things, APESMA conducted the survey *Women in the Professions*(100) in 2002, which deals with several issues linked to women's wages and employment conditions, such as employment status, family life, earnings, mentoring and job function. Among other things, this report highlighted the fact that in all disciplines, except for architecture, fewer women than men have full-time status.

Finally, in 2001, the Institution of Engineers published a handbook *The Engineering Profession: A Statistical Overview* which is updated every year and is accessible online.(101) This statistical overview presents some instructive data on women. An example of the kind of data provided is given in table 9, which shows the gender split of engineers, by employment sector. The proportions dramatically favour males in both sectors, with a slightly more equitable division in the private sector.

(99) See www.apesma.asn.au/online_surveys/content.htm for a complete list of available surveys.

(100) APESMA (2002), Women in the Professions, Survey Report 2002 (www.apesma.asn.au/women).

(101) www.ieaust.org.au.

Table 9: Employment in engineering by sector and sex, Australia, 2000 (%)

	Private	Public	Other	Total
Male	91.9	96.5	96.7	93.4
Female	8.1	3.5	3.3	6.6

Source: Association of Professional Engineers, Scientists and Managers, Australia (2000), Professional Engineer Remuneration Survey Report 2000, Melbourne, p. 117, Fig. 10.3.

A glance at the different areas of engineering shows that women are least present among marine (6%), mechanical (8%), aeronautical (11%) and electrical engineers (14%). However, over a period of 10 years the share of women has increased by 138% in electrical and electronic engineering, while at the same time their share has grown by only 9% in aeronautical engineering. On the other hand, women represent 33% of chemical engineers and 19% of metallurgy engineers (the share of women in this field increased by 95% over the same 10-year period)(102).

2.4.2 Career development and management

In the US, women are about as likely as men to be in management or administration (43% of women and 47% of men cited management or administration as their primary or secondary work activity in 1997). It should be noted, however, that among younger scientists and engineers, percentages of men and women in management were similar, while among older scientists and engineers, a higher percentage of men than of women was in management. More specifically, among those aged 45 to 54, 50% of men and 42% of women were in management in 1997(103).

"Women who were supervisors had, on average, fewer total (direct plus indirect) subordinates than did men. The median number of total subordinates for women was seven compared to 10 for male supervisors. The disparity in number of subordinates is also most pronounced among older age groups." (104)

For the United States, Reeder et al. noted that, frustrated by the inflexible work environment and the prevalence of obstacles to their career development, US women engineers *"are leaving to start their own businesses, to work for smaller firms, and go to competitors that offer more of what they want. Women are starting new businesses at twice the rate of men. … The reasons they cite for taking this path are varied and numerous, including the desire to create something new or different and flexibility in work arrangements."* (Reeder et al., 2002, p. 2).

In Australia a gender gap in management positions in S&T professions has been observed and the distribution of responsibility level by gender for both professional engineers and scientists is skewed downwards towards lower levels for female workers. On the other hand, female workers in Australia feel that their career path differs substantially from that of men. The difference is most marked in physical and veterinary sciences and in pharmaceutical professions. In contrast, women discern almost no difference in respect of careers in architecture and general sciences(105).

2.4.3 Gender pay gap

In the US, in 1999, the median annual salary for women scientists and engineers was about 22% less than the median salary for men ($50,000 compared to $64,000). Between 1993 and 1999, salaries for women scientists and engineers increased by 25% compared with an increase of 28% for men(106). However, within younger age categories, the gap was weaker. *"For example, among physical scientists aged 20 to 29 with a bachelor's degree, the median salary for women was $27,000 and $29,000 for men. However,*

(102) Yates et al., 2001, p. 27
(103) National Science Foundation, 2000, p. 61
(104) National Science Foundation, 2000, p. 61
(105) APESMA, 2002, pp. 5,6,9
(106) Natioanal Science Board, 2002

the gap in salaries between male and female scientists widens with age in both the education and business sectors." (National Science Foundation, 2000, p. 62). Finally, *"salary differentials varied by broad fields. In computer science and mathematics occupations in 1999, women's salaries were approximately 12 percent less than men's salaries, whereas there was a 23 percent salary difference in life science occupations. In these respective occupations, women also reported the highest and lowest median salaries; their highest median salary was in computer science and mathematics occupations ($58,000) and their lowest was in life science occupations ($39,000)."* (National Science Board, 2002).

Finally, some studies have explored the factors that might explain this salary gap[108]. The principal factors are fewer years of experience and work-related employee characteristics (such as additional degree, enhanced job skills or professional licences). Other important factors are employer characteristics (for example, the private sector pays more than the public sector), the field in which the degree was obtained (the National Science Foundation shows that in computer and mathematical science occupations, women's salaries were approximately 12% lower than men's, compared to a gap of 24% in social science and life science occupations where women are disproportionately represented), type of work performed, region, and so on. The National Science Foundation[109] found that about 10% of the gap was 'unexplained'. According to the report, *"some or all of the 'unexplained' gender salary gap may be attributable to 'unequal pay for equal work.' Indeed, the size of the unexplained gap may even be underestimated."* (National Science Foundation, 1996, p. 73). In contrast, in the study of Lal et al., *"although statistically significant, the remaining difference [2%] is small compared to sources of errors and the possible effect of factors not covered by the survey."* (Lal et al., 1999, p. 2). The authors also found that the pay gap for female engineers was significantly lower than in other sectors.

Table 10: Average annual income of persons in S&T occupations, Australia, 1996 ($000)

HRSTO	HRSTQ			Other qualifications		
	Females	Males	Wage gap	Females	Males	Wage gap
Specialist managers	51	74	68.9%	36	52	69.2%
Natural and physical science	36	51	70.6%	27	35	77.1%
Building and engineering	38	55	69.1%	26	41	63.4%
Computing	47	55	85.5%	39	50	78%
Health	34	76	44.7%	24	48	50%
Other	34	51	66.7%	26	38	68.4%
All S&T occupations	**36**	**59**	**61.4%**	**29**	**45**	**64.4%**

Source: 1996 Census of Population and Housing.

In Canada, according to the Professional Engineers of Ontario Membership Salary Survey, the salary gap between male and female engineers was about 11% in 1999. This meant an increase of about 2.4% compared to 1997[107].

In Australia, women in S&T occupations earned only 63% of the average annual income of their male colleagues. The gap was especially high for health care professionals (45%) and for building and engineering professionals (69%) (see table 10). Female computing professionals with S&T qualifications earned the highest average annual income ($47,000), while female health care professionals without such qualifications earned the lowest income ($24,000).

(107) Straka, 2000, p. 8
(108) National Science Foundation, 1996, p. 72-75; Lal, Yoon and Carlson, 1999
(109) 1996, p. 73

Box 1.5

Women in research in the industrial sector: main conclusions

The rising proportion of women in higher education and highly qualified employment in recent decades has not yet been translated into the substantial participation of women in industrial research.

The industrial sector is increasingly playing a leading role in R&D, but women are still much more under-represented in industrial than in public research. The proportion of female researchers in the public sector is 30%, but women only account for 15% of industrial researchers.

The proportion of women in industrial research does not bear any relation to the intensity of industrial R&D in terms of human or material resources. The political implications are obvious: current policies to promote the development of industrial research are in no way sufficient to achieve a more equal presence of women in industrial research.

Women are seriously under-represented in science and engineering, the most male-dominated fields of study and the degrees in greatest demand in industrial research. Horizontal and vertical educational segregation appears to be an important factor, via occupational and sectoral segregation, hindering a great presence of women among industrial researchers.

Recent trends seem positive, but are still insufficient. The strong growth in the number of young female scientists in the industrial sector over the last few years is related to a certain reduction in occupational segregation.

Working conditions are different for female and male scientists and engineers. Women are more likely to have a temporary contract, to have lower seniority and to be significantly worse paid. The age differences between women and men only partially explain these gaps.

Unfortunately, statistical data on women's career development in industrial research are not yet available. However, national studies show that few women are occupying leading positions, even if some progress has been noted in recent years. The situation is similar in non-European countries.

Finally, relatively few women scientists and engineers working in the industrial sector have dependent children, compared to their male colleagues. In spite of age differences, it also seems clear that mothers, even highly educated ones, have fewer employment opportunities than fathers.

3. Improving statistical sources and building gender indicators for industrial research

3.1 Improving the European R&D Survey

The European R&D Survey is the only statistical operation that might make possible harmonised data on R&D activities, expenditure, funds and personnel across European and other OECD countries. In order to improve the usefulness of this source for analysing the situation of women in industrial research, the main priorities should be to provide a gender breakdown for every personnel variable and improve the harmonisation of the survey following the definitions and recommendations of the Frascati Manual.

3.1.1 Reporting sex-disaggregated data for industrial researchers

At present, only 10 EU Member States provide harmonised sex-disaggregated data for industrial researchers. These countries are Austria, Germany, Denmark, Greece, Spain, Finland, France, Ireland, Italy and Portugal. However, the European R&D Survey should try to provide information on all EU countries at least for the main variables: researchers by sex, in both HC and FTE. For two of the five other countries it should not pose too many problems. In Belgium and the UK, detailed R&D surveys are carried out at least every two years differentiating the category of researchers within total R&D personnel. However, for the remaining three countries, this aim might be more hazardous. In

Luxembourg, no R&D Survey has been conducted since 1994. In the Netherlands, the information provided by the R&D Survey is limited to expenditures and does not extend to personnel issues. For Sweden, the scope of the R&D Survey is also quite limited (data are available only for total R&D personnel and not for the subcategory of researchers), but it might be possible to obtain data from other sources.

3.1.2 Harmonising the survey design

Greater efforts should be made to achieve a more complete and harmonised coverage of the business enterprise sector by national R&D Surveys, especially for the services sector, firms that carry out R&D either irregularly or on their own, and for small enterprises. The efforts to improve coverage of R&D in the services sector could be of the utmost importance for gender analysis, as the percentage of women is higher in services sectors than in industry.

Attaining greater regularity over time is another basic aim. At present, some countries provide data on R&D every year, but there are countries where data are collected only every two or even five years. If it does not prove possible for all European countries to provide data on an annual basis, an agreement on a two-year survey would significantly improve the usefulness of the European R&D Survey.

3.1.3 Mapping the research population

The Frascati Manual distinguishes three R&D personnel categories: researchers, technicians and support staff. These three main categories are distinguished clearly in the national R&D Surveys of only seven Member States (Belgium, Austria, Germany, Spain, United Kingdom, Italy and Portugal). A clearer mapping of R&D personnel in the remaining national R&D Surveys might be an interesting way of improving the European R&D Survey.

3.1.4 Collecting data on every Frascati variable

The efforts made by the Women's Unit at DG Research have proved successful in collecting NACE information for R&D business enterprises. A similar effort should be made to collect data on other variables that are already included in the guidelines of the Frascati Manual, despite the fact that data are available only for a few European countries: level of qualification, field of science and type of enterprise.

For a more in-depth analysis of the situation of women in industrial research a more complete and harmonised data set on levels of qualification and fields of science is of the utmost importance. At present this information is almost absent from the European R&D Survey. A significant source of information is thus being neglected and one recommendation for future improvement is to try to add such education and employment data concerning all categories of R&D personnel. For some countries such an exercise should not be too difficult since their R&D Survey already offers information on these variables.

3.2 Further Potential Uses of the CLFS

The CLFS allows for a wide variety of interesting and pertinent indicators relating to scientific and technological employment and activities. As a household survey, it can provide richer information with respect to quality of employment, as well as personal and family trends than an enterprise/institution survey like the European R&D Survey. A few improvements in the CLFS – some of them presently under review[110] – would significantly promote the analytical study of the situation of female industrial researchers and, therefore, the information available for the development of a more thorough science and technology policy.

3.2.1 A research activity variable

The most significant improvement would be the inclusion of a research activity variable. At present, it is not possible to know whether scientists and engineers are developing R&D activities. Such a variable might be included as an ad-hoc survey to be carried out every four or five years. This variable would allow for the complementary estimation of HC researchers and, especially, for a broad analysis of the labour, personal and family trends of R&D

(110) Laafia, 2001

personnel, which is simply not possible on the basis of current statistical sources. Unfortunately, a variable of this kind does not seem to be on the agenda for improving CLFS data in the next few years.

3.2.2 A field of study variable

The second improvement would be a variable providing information on field of study, when the survey respondent has completed a tertiary education. At the moment, regular information on field of study is available on persons undertaking tertiary education and graduates, but only using education data. The link between education and the labour market is lost when using CLFS data, even if it is one of the main aims of research on scientific and technological employment. Without the field of study variable in the CLFS questionnaire, it is impossible to get a regular insight into how highly qualified people develop their professional careers.

However, this and other pertinent questions were included in an ad hoc survey for CLFS 2000 data, followed by Eurostat's call for a tender for a quality analysis of the reliability of the data thus obtained. Another ad hoc survey containing this question is anticipated for 2004. Should the analysis of the quality of the data prove positive, it will at least be possible to provide some form of international survey-based labour force analysis on the matching or mismatching of skills, even if only twice in a five to six year period.

3.2.3 Three-digit NACE sector information

The third potential area of information concerns the NACE sector of economic activity at the three-digit level. At the moment, this is restricted to NACE at the two-digit level. With three-digit NACE sector information, research could be much more focused on high tech sectors of particular importance. There are three obvious examples:

1. Aerospace (NACE 35.3): at the moment, we can only consider the whole NACE 35, which includes all other transport equipment (for example, bicycles). Aerospace is the most R&D intensive sector of all.
2. Telecommunications (NACE 64.2): again, we can only consider NACE 64, which covers post and telecommunications. The large number of persons employed under post and courier activities (NACE 64.1) thus hides the significant developments in telecommunications.
3. Another example is pharmaceuticals (NACE 24.4), though it is less problematic in the sense that it is included in chemicals (NACE 24), in itself a medium-high tech sector.

In 2001, for the first time, three-digit NACE sector information was provided to Eurostat, at least for a minority of countries. The information was optional and so results for all countries cannot be expected. Eurostat will carry out an analysis of the quality of the data during 2003.

3.2.4 Other analytical possibilities

By using the question on working status one year before and by selecting students, it is theoretically possible to build up indicators on the transition from school to work and gain further insight into the demand for recent graduates. Sample sizes and degree of non-response may prove a practical impediment to continuing this research, but it is nevertheless something Eurostat intends to explore.

Currently, data by ISCED in the CLFS prior to 1998 are grouped together so that no differentiation can be made between those people that have a first university degree and those that have a PhD. With the introduction of the ISCED'97, it may be that data can be presented reliably at a more disaggregated level. Eurostat intends to investigate the quality and reliability of these disaggregated results.

3.3 Using the ESES for Collecting Information on Wages

The ESES is a valuable source of information on wages at European level. However, two main problems have been identified with this database. First, a precise identification of the research population is not possible since the survey is not based on the definitions provided by the Frascati Manual. However, if three-digit ISCO-88 and disaggregated ISCED information were available (as it is for CLFS) it would be possible to at least identify the group of industrial scientists and engineers. Second, at present such information is not available at European level even if it is collected at national level. Making this information available would mean a huge improvement for an accurate description of the wage conditions and the gender pay gap among scientists and engineers. If this statistical operation proved to be successful, a second step could be to include (as proposed for the CLFS) an additional question on research activities.

3.4 Implementing a specific survey among scientists and engineers

Exploring the possibility of implementing a specific survey among scientists and engineers at European level is our last recommendation(111). Such a survey might provide far richer information on the educational, labour and R&D trends of highly qualified women and men than is currently available from other sources: i.e. personal characteristics (sex, children, household, citizenship), education (complete degree inventory including level, field, year, institution), employment (labour force status, employer, rank, tenure, wage, working time, work-family arrangements) and R&D activities (field, career, funds, publications, patenting).

3.5 Developing Gender Indicators and Benchmarking Women's Participation in Industrial Research

As well as better statistics, indicators are needed for benchmarking women's participation in industrial research and monitoring the impact of national and industrial policies. The statistical analysis made in chapter two shows that there is room for developing gender indicators, even if statistics are still clearly insufficient. In this chapter several indicators have already been defined and analysed: here we just select those that we consider more meaningful for benchmarking equal presence of men and women in industrial research.

(111) The US National Science Foundation's biennial Scientists and Engineers Statistical Data System (SESTAT) might serve as an example.

Benchmarking indicators

Target group	Indicator	Definition	Source
Industrial researchers	**1. Female proportion among industrial researchers**		
		Number of female industrial researchers divided by the number of industrial researchers of both sexes, multiplied by 100	European R&D Survey
	2. Number of industrial researchers per thousand labour force by sex		
		2a. Number of female industrial researchers divided by the female labour force, multiplied by 1,000	European R&D Survey CLFS
		2b. Number of male industrial researchers divided by the male labour force, multiplied by 1,000	
	3. Gender gap in the FTE/HC ratio for industrial researchers		
		Ratio between 1) the number of FTE female industrial researchers divided by the number of HC female industrial researchers and 2) the number of FTE male industrial researchers divided by the number of HC male industrial researchers	European R&D Survey
	4. Female proportion among industrial researchers in non-service sectors		
		Number of female industrial researchers in non-service sectors divided by the number of industrial researchers of both sexes in non-service sectors, multiplied by 100 (Non-service sectors are NACE A–F)	European R&D Survey
Highly qualified population (population holding ISCED 5A or 6 degree)	**5. Gender employment gap for highly qualified population**		
		Difference in percentage points between 1) employment rate of highly qualified women 15-64 and 2) employment rate of highly qualified men 15-64	CLFS
	6. Gender employment gap for highly qualified population by family situation		
		6a. Difference in percentage points between 1) employment rate of highly qualified women 15-49 having at least one child under 15 and 2) employment rate of highly qualified men 15-49 having at least one child under 15	CLFS
		6b. Difference in percentage points between 1) employment rate of highly qualified women 15-49 without children under 15 2) employment rate of highly qualified men 15-49 without children under 15	CLFS
Industrial scientists and engineers (Employees holding ISCED 5A or 6 degree; working as ISCO-88 211, 212, 213, 214, 221, 222, 231, 244 in NACE 1-74)	**7. Female proportion of industrial scientists and engineers in scientific and technological occupations**		
		Number of female industrial scientists and engineers in scientific and technological occupations divided by the number of industrial scientists and engineers in scientific and technological occupations of both sexes, multiplied by 100 (Scientific and technological occupations are ISCO-88 211, 212, 213, 214)	CLFS
	8. Age differential in the female proportion of industrial scientists and engineers in scientific and technological occupations		
		Difference in percentage points between 1) female proportion of industrial scientists and engineers under 35 years of age in scientific and technological occupations	CLFS

Part 1

Target group	Indicator	Definition	Source
		and 2) female proportion of industrial scientists and engineers of 35 or more years of age in scientific and technological occupations (Scientific and technological occupations are ISCO-88 211, 212, 213, 214)	
ISCED 5A graduates	**9. Female proportion among ISCED 5A graduates**		
		Number of female ISCED 5A graduates divided by the number of ISCED 5A graduates of both sexes, multipliedby 100	Education database
	10. Female proportion among ISCED 5A graduates in science and engineering		
		Number of female ISCED 5A graduates in science and engineering divided by the number of ISCED 5A graduates in science and engineering of both sexes, multiplied by 100 (Science and engineering are ISC 42, 44, 46, 48, 52, 54, 58)	Education database
	11. New ISCED 5A graduates in science and engineering per thousand 20-29 population by sex		
		11a. Number of female ISCED 5A graduates in science and engineering divided by female population 20-29, multiplied by 1,000	Education database CLFS
		11b. Number of male ISCED 5A graduates in science and engineering divided by male population 20–29, multiplied by 1,000	
ISCED 6 graduates	**12. Female proportion among ISCED 6 graduates**		
		Number of female ISCED 6 graduates divided by the number of ISCED 6 graduates of both sexes, multiplied by 100	Education database
	13. Female proportion among ISCED 6 graduates in science and engineering		
		Number of female ISCED 6 graduates in science and engineering divided by the number of ISCED 6 graduates in science and engineering of both sexes, multiplied by 100 (Science and engineering are ISC 42, 44, 46, 48, 52, 54, 58)	Education database
	14. New ISCED 6 graduates in science and engineering per thousand 20-29 population by sex		
		14a. Number of female ISCED 6 graduates in science and engineering divided by female population 20-29, multiplied by 1,000	Education database CLF
		14b. Number of male ISCED 6 graduates in science and engineering divided by male population 20–29, multiplied by 1,000	

Box 1.6

Improving statistical sources and building gender indicators for industrial research

Both better statistics and gender indicators are needed for benchmarking women's presence in industrial research.

Greater efforts should be addressed at European level and in most Member States in order to report gender breakdown for every R&D personnel variable and improve the harmonisation of the European R&D survey.

The inclusion of new variables (namely research activity and field of study) and more disaggregated NACE information would significantly further the analytical possibilities of using the CLFS for studying the situation of women in industrial research..

A more ESES disaggregated breakdown by education and occupation at European level would constitute a huge improvement for the analysis of wages and gender pay gap among highly qualified individuals.

A specific survey among scientists and engineers at European level might provide far richer information on the personal, educational, labour and R&D trends of highly qualified women and men than is currently available from other sources.

However, there is also room for developing gender-sensitive indicators from available statistical sources. A set of 14 benchmarking indicators has thus been selected.

Qualitative Analysis: Case Studies

1. Introduction

This part of the report presents the results of the case studies based on meetings at 29 firms(112): on average, three firms were studied in each of 11 Member States.(113) Two series of meetings were organised: one meeting with either the chairperson or managing director of the company or the director of human resources (or head of the research department), and, when possible, two or three meetings with female researchers in each of the companies examined.

The aim of this case-study based analysis was to identify and analyse good practices and to demonstrate how firms have benefited from promoting women in research. A good practice is a strategy used by companies to attract, recruit, retain or promote women in research. Collecting a series of good practices, together with a description and critical analysis, in a single report will be of great use to policymakers and other actors concerned with women's advancement in industrial research: it is hoped that a synthetic but also critical overview of good practices will broaden the scope of their reflections on how to improve the situation of women in industrial research. However, the purpose is also to spread the positive experiences of firms that have been successful in promoting female researchers over a wider range of enterprises. The role of the firms analysed is thus to serve as examples. Their human resource practices that have succeeded in promoting and maintaining women in research will hopefully inspire many others.

Indeed, all of the measures presented in this report clearly illustrate the wide variety of actions that firms can take to promote women in research. What is still lacking is motivation. In order to encourage firms to invest in the cause of women's careers in science, it is important to show them how they and their employees can benefit. Indeed, when the differences between men and women are made visible and when all policy measures are analysed from this angle, one gets a different view of practices which favour women, a view which is an asset for everyone. For example, actions to raise awareness of science among young people open up professions, drawing young people into them, benefiting firms and indeed the whole sector. Similarly, in-depth reflection on the different types of management makes possible the accumulation of different but also complementary working modes and know-how. Put differently, failure to promote women in research means depriving one's enterprise of professional and scientific capabilities and expertise that would benefit it. After all, one's competitors might turn out to be more open.

The task of showing firms why adopting a pro-women stance is in their interest and the importance of gender-differentiated analyses must be carried out at enterprise level, but also – and this may be of even greater importance – at the level of female researchers themselves, whose personal professional success and conditions of neutrality often mask a blindness to the indirect dangers of discrimination.

However, the implementation of good practices means following certain 'rules'. First, it is absolutely necessary that top management is committed to promote diversity in the firm. Second, while it is feasible to generalise some good practices across all types of firms, others need to be adapted to the organisation's specific environment. Therefore, initial needs assessment, adaptation of good practices, evaluation of the effectiveness of the programme and updating are required(114). Finally, for a policy to be implemented, it needs first to be accepted by and integrated in corporate culture(115).

This part of the report is organised into two main sections.

(112) Companies involved in the Women in Industrial Research group are not included in this study. This study is complementary to the activities of the WIR group. We would like to thank the European Industrial Research Management Association (EIRMA) for its help in finding appropriate firms.

(113) These Member States are: Belgium, France, Spain, Portugal, Austria, the United Kingdom, Ireland, Germany, Finland, Denmark and the Netherlands. An expert in each country (see Appendix 4.1) prepared a national report in which firms' practices are described. Also in this part is a synthesis of the different national reports and enterprise meetings (see the methodology in the Appendix (Appendix 4.3).

(114) Brainard, at http://www.globalalliancesmet.org/best_pubpriv.htm

(115) Emerson et al., 2000, p. 7

Section 1 discusses some conceptual questions underlying the analysis of good practices. Some attention has been devoted to the specific features that distinguish research in the industrial sector from public sector research, and notions of 'good practice', 'mainstreaming' and 'neutrality' are discussed.

Section 2 is the most important one. In this section the different kinds of good practice are analysed: global integrated programmes favouring women, time management (reduction of working time, part-time work and flexibility of work organisation), management of pregnancies and maternity, recruitment and a mixed workforce, network-building, continuous training, initiatives in schools to raise girls' awareness of science, and reflections on the 'feminine management' mode.

At the end we allow ourselves to get carried away a little. A perfect but unfortunately imaginary firm is presented where women are treated just as they should be. For this purpose the best practices encountered in the course of the case studies are gathered together.

2. Conceptual and theoretical discussion

In this section, the aim is i) to focus on the specific features that distinguish industrial research from public sector research and ii) to discuss the notions of 'good practice', 'mainstreaming' and 'neutrality', which may be said to constitute the general standpoint of the present study.

2.1 Specific characteristics of industrial research in comparison with public sector research

The quantitative analysis(116) acknowledged the low representation of women researchers in the industrial sector. Indeed, they only represent 15% of the 500,000 researchers in the industrial sector in the European Union, compared to 31% in the government sector and 30% in the higher education sector. Moreover, women seem to prefer working in higher education: 62% of female researchers are concentrated in higher education, whereas only 22% are in the industrial sector.(117)

Meetings with female researchers have shown that there is a clear difference between research in industry and research in the public sector. When female researchers explain why they opted for a position in industrial research they often stress features such as the different work organisation, the different purpose of research in each sector, the different status and pace of work, all of which do not seem to be neutral in terms of gender. The female researchers seem to think that the choice between private and public sector is of more concern to women.

A first difference suggested by the female researchers interviewed has already been mentioned and relates to the purpose of the research. The public sector focuses mainly on basic research, while industry tends to invest in applied research. This observation is based only on the statements of the female researchers interviewed and does not pretend to offer a comparative and objective analysis of both spheres of research. However, the statement clearly illustrates the image female researchers have of research in the public and industrial sectors.

Many women put forward this work-related element to justify their choice. Intellectual freedom can be a very important factor in the choice between a public career and one in industrial research. Female researchers active in industry have confirmed the dichotomy 'public basic research – industrial applied research'.

A second difference to which female researchers drew our attention is related to work organisation. Some researchers share the opinion that research in industry is mainly teamwork, in contrast to research in the public sector, which seems to be much more of an individual endeavour focused on the person of the researcher and the number of his or her publications. This difference in perspective is necessarily

(116) See section 2.1.

(117) However, those figures have to be interpreted with some caution because the European R&D Survey underestimates the number of researchers in the industrial sector.

translated into the criteria used for evaluation, which are different in the two sectors. The public sector seems to focus on the person and his or her publications, while the private sector values a team's success more highly.(118)

A third feature put forward by female researchers as distinguishing the private and the public sectors is work rhythm. As already mentioned, the profit-oriented and commercial character of industrial research demands very applied and 'useful' research in contrast to the public sector where research is mainly basic. This difference seems to be reflected in the work rhythm in both environments, industrial research being more stressful and developing at a faster pace, unlike the much more relaxed way of working characteristic of university research. However, this fast pace does not discriminate against women.

When a female researcher was asked why she had opted for industrial research, she explained that she wanted to rise to the challenge of entering a more difficult work environment but one which at the same time is much more dynamic, 'moves' and develops, and offers real opportunities to make a difference, to change things.(119) For example, in some firms,(120) the majority of entrants develop their careers outside the research department. This kind of remark seems to be widespread but should not be taken as representative, given the size of the sample. Moreover, other 'economic' arguments can explain the choice of industrial research: for example the desire for a more permanent work contract.

The difference in status between researchers working in industry and those in the public sector is the fourth point raised by the female researchers interviewed. The dynamism of industrial research is in no way reflected in researchers' employment contracts, which seem to be characterised by far more stability in the private than in the public sector. The status of university researchers can be very uncertain, often for a considerable period of time, until they receive tenure. Tenure is a crucial watershed in a researcher's career, after which their status becomes far more stable. However, many researchers do not have the patience to wait so long and leave the public sector for the private one. As a result, industry benefits from the inflow of highly qualified people trained in the public sector.

Concerning the difference in status, one female researcher explained that being engaged by a firm involved in industrial research can be considered as initial recognition of one's capabilities. As a result, one's status is much clearer and acknowledged by everyone. By contrast, the situation is completely different in the public sector where the image of the 'eternal student' persists. A researcher's educational past is known and only very seldom are capabilities and development explicitly appreciated; whereas in the private sector the researcher is no longer someone's student.(121)

Many female researchers think that the most decisive factors in women's choice of the public sector are the flexible working hours and the high degree of intellectual freedom. The dynamic character of research in industry and the high degree of responsibility entrusted to researchers are the main factors attracting women to it.

2.2 Three key concepts: 'good practices', 'mainstreaming' and 'neutrality'

A 'good practice' is defined as a strategy used by companies to attract, recruit, retain or promote women in research. Although the primary aim of good practices seems to be the explicit promotion of women, there are many other initiatives in favour of women and with the purpose of rebalancing pre-existing inequalities. As a result, a wide range of practices should be included in the notion of good practices.

In this study, most, if not all firms claim to be 'neutral' in their human resource practices. They justify this logic of neutrality by showing that women and

(118) Danish firm 1, Denmark report, p. 7.
(119) Remark by a female researcher at Thalès, France report.
(120) Philips, Netherlands report, p. 2.
(121) Remarks made by female researchers in the public sector who interact with a private research unit in Belgium.

Box 2.1

Notion of researchers in the case studies

Researchers in the statistical part are defined as scientists or engineers engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the management of the projects concerned (Frascati Manual, 1993, p. 279). This definition is more restrictive and operational than the one used by firms and in the case studies. In fact, no single definition of the job of researcher exists. In a number of firms, for example, some categories of technician are also considered to be researchers. However, if the job of researcher covers 'all those involved in research work', then the notion becomes extremely broad, encompassing a very wide range of different professional situations. The exclusion of administrative employees from the definition of researcher is generally accepted, but the borderline remains doubtful in the case of two categories in particular, managers and technicians. Managers are often former researchers or are often still considered as researchers by their superiors. However, a lot of women managers claim that they no longer see themselves as researchers. Whether a technician might be defined as a researcher depends on his/her autonomy and responsibility. If the technician is not only an operator, he or she is considered a researcher. However, this judgement is personal and subjective, and depends on the firm, the firm's culture, the individual, their status, and so on.

Despite these specific characteristics and blurred frontiers, it is possible to distinguish two features that are typical of the job of researcher:

1) Researchers are characterised by a high level of education.

2) Research work is intellectual or reflective work and often appears to be a vocation in one way or another. This inherent feature of research work distinguishes the job of researcher from other, more regular, less flexible or personal occupations. Research seems to be a form of personal engagement.

This perception is somewhat different with respect to industrial research because it is more closely tied to time schedules and planning (for clients it is important that deadlines and planned schedules are adhered to). Industrial research may also be said to be more operational and designed to provide answers to clients' needs, the main purpose being a saleable product. The latter aspect is important for our study concerning women in industrial research because it shows that research in industry follows a different logic compared with research in the public sector; it has specific characteristics and requires other skills, other kinds of management, and so on, none of which are neutral from a gender point of view. Indeed, the gender issue cannot be understood in the same way in the research sector as in the labour market in general. The research sector is very specific and women in this sector do not always encounter the same problems and difficulties faced by other women in the labour market.

men have no wish to be treated in a differentiated way. For these firms, the logical result of this policy of neutrality is to treat women and men in exactly the same way, fostering a belief that there is no discrimination at all. Such reasoning, however, is in clear conflict with the notion of 'mainstreaming'. Neutrality ignores the specific employment characteristics of women and men. Moreover, while it is true that discrimination and other obstacles holding women back are not found in these firms, it is no less true that there are no practices which favour them. Neutrality means that although the firm is not reluctant to engage women, at the same time it does not try to promote them either.

To justify this logic of neutrality firms, but also female researchers themselves, often point to the percentage of women in the firm. However, in our opinion, even if committed to their female employees' cause, these firms are in this way not trying to prove that their policies are gender-neutral but rather to justify their adherence to a policy of neutrality. Some firms also 'prove' their neutrality by showing that the rate of feminisation of research jobs within the firm corresponds to the rate of feminisation in the areas of education that underlie their sector's activity. Another argument used to prove the neutrality of human resource practices and, more particularly, of promotion opportunities is the presence of women in managerial positions.

Firms tend to present this desire for neutrality as a policy of non-discrimination towards women. They insist that they do not discriminate against women. This shows that firms understand discrimination only in its legal form or in terms of direct discrimination. The European Court of Justice defines direct discrimination as "discrimination that is susceptible to being observed through the sole criteria of identical work and equal pay". Preventing direct discrimination consists of accounting for illicit criteria, such as discrimination by sex, in all decisions by public or private authorities. However, the understanding of discrimination has moved on from its direct form, overt and more or less intentional, to encompass also indirect discrimination.(122)

Indirect discrimination(123) results from an apparently neutral measure taken by an employer that turns out to have a disproportionate effect on different categories of people.(124) In other words, indirect discrimination results from an apparently neutral measure that leads to the same result as an act of direct discrimination. Indirect discrimination occurs, for example, when a rule put into practice for both men and women turns out to be more harmful to one sex than to the other. Such rules are prohibited except when they can be justified on the basis of criteria completely free of sexual discrimination.

This legal concept of indirect discrimination is interesting because it puts into perspective the arguments for neutrality often presented by firms in the case studies. Indeed, this concept underlines that a measure or practice that is apparently neutral might nevertheless in some cases have a different effect on men than on women and thus become a source of discrimination. The legal concept of indirect discrimination (encompassing the concept of gender-blindness) will be used as a discussion thread in the case study analyses.

When the logic of neutrality is pushed to an extreme, gender differences risk being totally negated. Such a situation emerges when a firm implements practices that are so neutral gender-wise that it no longer seems necessary to systematically break down workforce statistics by sex.

The enterprise examples analysed here bear witness to the lack of acknowledgement of the gender aspect, or what is often called 'gender-blindness'. Notwithstanding their professed neutrality, these firms are unaware of the risks of indirect discrimination. Furthermore, women are the main advocates of this logic of neutrality and convey an attitude of gender-blindness. The problem of gender-blindness was clearly laid out in the Massachusetts Institute of Technology (MIT) report (1999) on the status of women science faculty members at MIT.(125) Such gender-blindness blocks every claim made by women, who find themselves facing specific circumstances that justify differential treatment. In order to counter this attitude, it is necessary to make visible and acknowledge the specific features of women compared to men, and vice versa.

With regard to these objectives of neutrality, female researchers themselves desire identical treatment of women and men and certainly do not want to benefit from special measures. Thus, they are apparently satisfied with the neutral policies pursued by their employers. The female researchers met shared the same – false – belief as their managers that neutrality equals equality, disproved by mainstreaming. It may be that a minority of female researchers can justify this belief. Moreover, some women researchers even experience these policies of absolute neutrality, as well as the absence of overt obstacles, as elements that actively

(122) Here we quote arguments analysed by S. Lemière (2001), Wage discrimination between men and women : an analysis of firm's wage practices , PhD in economics, University Paris I.

(123) The notion of indirect discrimination is also related to that of systemic discrimination used in the Anglo-Saxon and French-Canadian literature.

(124) This notion of indirect discrimination first emerged in the context of discrimination against migrant workers (the Sotgiu ruling) and was then applied to capture discrimination on the grounds of sex or family situation in the judgments Jenkins and Bilka.

(125) MIT – Massachusetts Institute of Technology (1999), A Study on the Status of Women Faculty in Science at MIT.

contribute to their career development. Pregnancy and children are the issues that most often create difficulties for women. Indeed, although the general feeling of most women is that they have not been subject to discrimination, they do notice that the existence of children can change their career development in ways that even men with children do not experience.

Caution and critical analysis are needed to correctly interpret the women interviewees' statements, which often totally discount discrimination. It should be kept in mind that most of the researchers interviewed were very young women.(126) This explains many of the reactions encountered: a lot of female researchers claim not to experience any inequalities or discrimination – they do not have the feeling that discriminatory practices are present in the firms they work in. The MIT report shows that opinions, ideas and statements differ considerably according to the age of the female researcher, with every new generation of young women being convinced that the problem of discrimination was solved by the previous generation and therefore is no longer of concern to them. Moreover, the few older women researchers who were interviewed turned out to be more sensitive to the gender question and to male–female differences.

The French webpage of the Paris Professional Women's Network(127) explains why it is important to promote gender diversity and family friendly programmes. It also illustrates different arguments such as 'women are a significant part of the talent pool', 'women are the main decision-makers for most household purchases but they are very few on the boards of firms producing these articles', as well as the fact that some problems exist in the retention of women or in reward systems, that new laws exist, that the next generation has certain expectations, etc. Good practices in human resource management are very important, regardless of the fact that the Paris Professional Women's Network concludes that *"the impetus for change will have to come from the chief executive officer (CEO). The changes involved are such that human resource departments or department heads cannot make them alone."* Good practices are important because they can change mentalities about the place and role of men and women in the firm and in society. Diversity management(128) gathers all good practices to facilitate the integration and retention of women in firms. In this sense, diversity management deviates from a policy of neutrality because diversity management wants to promote gender diversity. The aim is not just to establish neutrality but rather to value diversity.

Behind this logic of neutrality, or in the worst case gender-blindness, lurks the danger of laissez-faire, to the benefit of men. Two biases are likely to surface in a laissez-faire policy.(129) On the one hand, nothing changes and the same problems persist: for example, the glass ceiling or the hold put on a woman's career by pregnancy. On the other hand, women might feel encouraged to adopt male-type behaviour at work and, as a result, refrain from developing normal female careers. A laissez-faire logic may reinforce rather than alleviate the differences between men and women. During one enterprise visit, it was explained to us that the risk of neutrality masking a laissez-faire attitude was enhanced by society much more than by private companies.(130) In the same way, and concerning the link between promotion and family obligations, according to one of the women interviewed,(131) if any restrictions do exist they are due to the organisation of society rather than to the company's policies.

Moreover, the logic of neutrality risks hiding differences between men and women in attitudes, choices and work behaviour. Nevertheless, the existence of such differences is a fact and they can enrich work organisation and efficiency.

Differences in work organisation, managing responsibility, types of management, perception of rules

(126) As shown in the qualitative part, S&T women in the industrial sector are younger than other women in employment and significantly younger than S&T men.

(127) http://www.pwn.link.be/tht_corporate/p_tht_corp_bcase_whyceos.html. On this notion of gender diversity, it is also interesting to analyse the reflexions of Felice N. Schwartz and Laura Ricci.

(128) Diversity management is focused here only on women even if the notion normally includes all minorities.

(129) Remarks based on discussions during meetings.

(130) Philips, Netherlands, p. 5.

(131) PT Inovaçao, Portugal.

and so on, between men and women, were often stated by the female interviewees and are discussed in more detail later in this report, with examples of enterprise reflections on 'feminine management'.

The analysis of good practices is closely linked to the mainstreaming approach, of which good practices provide concrete real-life examples.(132) The report Equality between Women and Men in the European Union – Examples of Good Practices (1996–2000)(133) is itself an example of the importance of analysing good practices in order to visualise the mainstreaming approach in a more concrete manner.

The Council of Europe defines mainstreaming as *"the (re-)organisation, improvement, development and evaluation of decision-making processes for the purpose of letting all agents generally involved in policy implementation incorporate a perspective of equality between men and women in all domains and at all levels."* (Council of Europe, 1998).

In other words, the concept of mainstreaming, which was largely developed by T. Rees (1998),(134) suggests a new conception of equality between men and women that should no longer be treated separately from decision-making, but simultaneously as an integrated part of the decision-making process and in a permanent fashion.

The thought underlying the mainstreaming approach is that if a standpoint of equality between the sexes is integrated in each action or measure from the very beginning, it will become less necessary to introduce supplementary measures later on to compensate for unpredicted negative effects.

In this report a number of human resource practices implemented by firms to promote women in research are presented. These practices have different aims: to rebalance the work situation for mothers, to efficiently link family and working life, time flexibility and work organisation, training, network-building, recruitment, the pursuit of a mixed workforce, and so on. Despite their different purposes, all the human resource practices presented make it possible to favour female employment in industrial research and show that this is possible for all firms.

(132) Global integrated programmes and equality management constitute a major strategy favouring women. These important examples of good practices correspond to the mainstreaming approach, but they are still rare in firms (these integrated programmes are presented in the next section).

(133) European Commission, Employment and Social Affairs (May 2000).

(134) T. Rees (1998), Mainstreaming Equality in the European Union, London: Routledge.

Box 2.2

Conceptual issues

Despite the fact that female researchers don't feel discriminated against and enterprises claim a policy of neutrality, gender in the enterprise must be analysed in terms of indirect discrimination and gender blindness in order to make visible specific male and female features. In this way the indirect and prejudicial effects on women of apparently neutral measures become clear. Diversity management seeks to promote women in firms. In this sense all good practices can be interesting to show (and increase) the value of diversity both in and for the organisation.

The thought underlying the mainstreaming approach is that if a standpoint of equality between the sexes is integrated in each action or measure from the very beginning, it will become less necessary to introduce supplementary measures later on to compensate for unpredicted negative effects.

3. Good practices

Female-friendly companies that implement policies supporting family life, mentoring and career development allow the development of an environment in which women feel respected and valued within the company. Therefore, they are more likely to be successful in recruiting and retaining women scientists and engineers.(135) Furthermore, policies established to diversify the corporate workforce have generally had positive effects on the recruitment and retention of both men and women in those companies.

The literature on women and science is full of examples of good practices at the company level. Many good practices exist at recruitment level and also to change the workplace structure. Some firms have implemented diversity training as a company-wide initiative, and this has resulted in a change in the workplace structure. Good practices also seek to challenge existing stereotypes (such as the setting up of an Advisory Council for Diversity, staff surveys and exit interviews) and to reduce the attrition rate (surveys on job satisfaction, use of statistics and exit interviews to identify problems). Examples of good practices to help women's career development are identifying women with a high potential and considering giving them new responsibilities or promotion, continuous training and development opportunities. Examples of good practices to promote equal pay are wage studies. Many good practices exist in the field of the work/family balance. Examples are maternity/paternity leave provisions, dependent care assistance, flexible work schedules, enhanced internal publicity and information about family friendly policies in order to enable and encourage more employees, especially men, to take advantage of them, etc.

Human resource practices differ in terms of purpose and effect. In this section a list of good practices(136) is presented and described. Those good practices are analysed in terms of aim and result in respect of promoting women in research. At the beginning of this section, the idea that good practices must be integrated programmes of measures favouring women is explained and a few examples of such integrated programmes are presented, followed by analysis of a list of separate measures to promote women in industrial research.

Those case studies present a range of possible actions or of examples of practices that favour women in research. The case studies as real-life examples illustrate and clarify the mainstreaming approach as set out by the European Commission. Some of the actions of case study firms can be interpreted as positive towards women, even if the firms themselves do not describe them in that way.

3.1 Global Integrated Programmes Favouring Women

This section deals with firms at which global programmes have been implemented favouring women's employment in research.

3.1.1 Procter & Gamble

Procter & Gamble is an example of a general diversity programme.(137) Each part of the company is responsible for its own diversity programme. These programmes are similar in respect of content but differ according to date put into practice. This is due to the way the programme was developed in the R&D department at the European Technical Centre. At the outset, efforts were concentrated on managers, but now the programme has been extended to include administrative and technical personnel.

Originally, the diversity programme was developed to tackle the perceived problem of retention of women at managerial level; many women left, especially at the beginning of their careers. Possible explanations include family priorities and slow promotion. It proved very difficult to identify the real reasons for this retention problem: even the notes from the exit meetings did not clearly state the reason for departure. The employees in question are highly qualified and desire career advancement. It is

(135) CAWMSET, 2000, p. 50

(136) Rübsamen-Waigmann, H. et al (2003) "Women in industrial research – A wake up call for European Industry" (The report contains first exemples of good practises, witch have been supplemend by the good practises in this project.)

(137) Belgium report.

therefore important to reduce to a minimum the barriers and other constraints they face. Furthermore, awareness raising with respect to the differences between men and women in terms of working style is important for an understanding of why men sometimes seem to advance more rapidly.

The programme is constructed around three important axes: i) awareness of different working styles, ii) network meetings and iii) flexible work arrangements.

The first step, taken in 1997, involved a real effort to offer flexible work arrangements to all employees: reduced work schedules, family care leave (unpaid leave of absence over and above the legally mandated maternity/parental leave to care for each newly born or adopted child, available to both men and women), personal unpaid leave of absence (sabbatical, up to three months every seven years), care for dependants while travelling (when an employee has to stay away from home overnight on a non-routine or unexpected trip the company will pay a contribution to the cost of care for a child or other dependant), flexible work schedules (flexible start and finishing times), job sharing (two people work part-time), working from home (making it possible to spend up to 50% of work time at home).

The second stage of the diversity programme started in 2001 and has thus only been in place for one year (at the time of writing). This stage is being worked on and requires a lot of effort and time. Nevertheless, already women feel more free to talk openly about male/female problems and as a result the programme may already have begun to persuade women to stay on. However, it is too early to present real results from the second stage of the programme, which involves networks and working-style awareness.

It is important to stress that Procter & Gamble's top management is totally committed to the diversity programme, which is fully integrated and considered a real 'company programme'.

The most important aspects of the R&D department's diversity programme in Procter & Gamble are:

- Top management must provide leadership and develop a vision
- Be clear about the business benefits (building the business case)
- Explain the objective of the programme to the whole organisation, emphasising the business objective and the fact that this is not positive discrimination, but rather about creating a level playing field
- Convince the sceptics
- Interview Procter & Gamble R&D employees at all levels and listen to their views on diversity
- Develop appropriate policies and tools, for example, to help work/life balance (flexiwork, shopping facilities at work, banking, post office, insurance office, breakfast/restaurant facilities, and so on)
- Introduction of quarterly diversity network meetings for all
- The diversity network is voluntary and its purpose is to support people, share information and diffuse understanding of grassroots issues. As a result of network input, teams have been formed to develop specific plans to tackle key issues
- Beyond policies and tools, there is a need to change the organisational culture to become more inclusive of a diverse range of styles
- A 'style workshop' has been developed to provide training in understanding and working with others with diverse working styles
- Introduction of mentoring programmes
- Review of assignment-planning process to ensure everyone gets an assignment in which they can demonstrate their potential, irrespective of style
- Include in the appraisal process a review of diversity programme achievements

This programme (R&D activities exclusively) is not exclusively targeted at gender issues, but rather at the larger concept of diversity that includes cultural differences, for example across countries, even if the primary purpose is to increase the number of women in management positions (but without resorting to positive discrimination).(138) This focus on diversity has made it possible to broaden the programme's scope. The programme is also considered to be a way of achieving better management.

(138) Similarly, with the accent on diversity, IBM in Spain (Spain report) is trying to diversify its workforce and to employ people from different groups, such as women, ethnic minorities, people with disabilities, gays and lesbians.

Furthermore, Procter & Gamble produces many goods targeted at women and therefore it is considered a good business move to increase the number of women within the company since this allows for better decision-making. Taking into account different management styles enhances innovation and creativity, especially in R&D.

The programme is supported at all hierarchical levels and is part of the company's general objectives. Employees take care of the practical side of the programme on a voluntary basis and spend time on this task on top of their usual work. It represents a very long journey. At the outset, the programme contributed to a higher degree of flexibility at work. However, the company soon realised that flexibility measures were not sufficient. It is equally important to understand and incorporate differences in management style between men and women. This last aspect relies heavily on a change in mentality and work attitude, and time is required to allow this change to take place.

3.1.2 Pfizer

Pfizer represents another example of an integrated programme with good practices in a number of areas,(139) specifically: flexible working, childcare support, a Women's Network Group, a Gender Planning Group, academic liaison, awareness training, environmental planning and reflective employment practice. Pfizer carries out numerous analyses and studies to shed light on the obstacles women face (with respect to retention and progression, or linked to the nature of the job, the firm's culture, working conditions, work organisation, and so on) and to form work groups charged with follow-up and evaluation of the measures adopted in favour of women.

As a result of the second gender report, the company set up a Gender Planning Group to examine the results and recommendations from the gender research to investigate why there was a gender imbalance within the company. This group is also required to produce an action plan for change. The group consists of a mix of very senior and relatively junior people, women and men, from different parts of the company. They are committed to the aims and objectives of the group, and contribute to its work 'in addition to their day job'.

The company has embraced a number of practices to support and encourage women. These include part-time work, maternity provisions and accommodation of the particular needs of women with childcare responsibilities, a childcare support programme, a Women's Network Group, training to counter the negative effects of the organisational culture, academic liaison, creation of a working environment that is conducive to women, and so on.

One example of the training support mentioned in the previous paragraph to counter the negative effects of some aspects of the organisational culture concerns what is considered to be 'good supervisor's behaviour', particularly with regard to the particular career needs of pregnant women. A reluctance – on the part of both supervisors and women themselves – to raise the issue of careful career planning at an early stage of pregnancy often leads to avoidable problems. In response, a website has recently been developed by the human resources department, containing practical advice and guidance to support supervisors facing this particular challenge. A broad programme of cultural awareness – 'respect for the individual' – is also being rolled out at present.

While it would be justified by the considerable progress the company had made and the actions under way to contribute to more positive change, no complacency was detectable at Pfizer, but rather something akin to impatience with the rate of change: "There's more pressure to take more active steps. Personally, I'm a bit concerned about the rate at which those active steps are coming. We clearly don't want positive discrimination. I use the term 'positive action'."

3.1.3 Others examples: OMV Aktiengesellschaft and Thalès

At OMV Aktiengesellschaft, an Equal Opportunities Guideline has been implemented and recently a working group on equality of treatment

(139) UK report.

was established.(140) This working group will focus on training, equal opportunities, security of employment, a parental leave guarantee and flexible working hours. During parental leave, close contact is maintained: people receive information on current developments and have the possibility to work a few hours from home. Within the framework of the equal opportunities working group the workers' council is looking for solutions to improve the position of those who need to care for children.

Another, more recent example is Thalès.(141) The Thalès group has launched an initiative on equality between men and women at European level in order to harmonise the different internal practices in the group's operations in different European countries. This initiative is new and still incomplete. The provisions emerging from this initiative must be determined at national level and implemented locally. These initiatives are linked to the recent obligation to engage in bargaining on this issue (equality of women and men) annually in France.

These programmes combine different aspects of human resource practices with the aim of increasing the participation of women in research. They can be specific to R&D departments or concern the firm as a whole. For women such programmes constitute very good practices. When implementing such programmes, firms should encourage real communication and discussion of their motivation, means and benefits so that women do not feel compromised by the suggestion of positive discrimination.

3.2 Time management practices

Besides catering to the needs of both women and men, these measures are also very well adapted to the specific characteristics of research. One might mention working time: for example, flexible working time, working hours and work organisation; but also teleworking (working from home).

3.2.1 Flexibility of work organisation

Most firms implement flexibility in work organisation (in particular, flexibility of working hours, compressed working weeks and teleworking or working from home) for all their personnel, both female and male. These practices are well developed and point to an evolution in the way work is organised. This is all the more true in R&D activities since they are particularly sensitive to such developments. Work flexibility practices, although they apply to all workers, are considered to be particularly favourable to women's employment because they make possible the easier reconciliation of professional and family life.

Nevertheless, these practices also respond to a need for more flexibility and adaptability increasingly being experienced by firms. In order to keep pace with clients' demands, firms require their employees to be more and more flexible. As a result, flexibility can also be interpreted as an availability constraint imposed on employees (they no longer have fixed working hours). In some cases, it is an illusion to think that an increase in flexibility leads to a higher degree of freedom. The gain in freedom risks being offset by the required degree of availability.

Case studies also include a number of firms where working hours are relatively fixed, although most firms, even those with very flexible working hours, state firmly that they do not allow overtime. This statement can be explained by the fact that R&D workers are not paid by the hour but in a 'lump sum', the only consideration being the final result of one's work.

Flexibility in work organisation is particularly suited to R&D work. Indeed, from all interviews we got the impression that the only thing that really matters is the result of one's work, rather than the number of hours worked or the way in which work is organised.(141)

It is also recognised that productive outputs can be satisfactorily achieved in all types of places, and for scientists it appears to be especially important that they have time just to think. Scientific research is so important to a business that it is accepted that scientists cannot be constrained by traditional work models.(142)

(140) Austrian report, pp. 8–9.
(141) French report.

While the freedom provided by flexible working hours is positively valued for its contribution to the better reconciliation of professional and family life, it is also important to keep in mind that R&D activities also require periods of irregular working hours: night or weekend work might be necessary, not on a regular basis but just to keep track of the development of an experiment or to finish an important project.

Research activities do not lend themselves to a restriction to rigid working hours (duration of scientific experiments, uninterrupted mental and intellectual reflection, and so on). This real-life perception of research work underlines the idea that research is a 'vocation'. The often- stated argument that researchers have a high degree of freedom to reconcile their professional, personal and family lives should be reconsidered in these terms. Such freedom is subordinate to the particularities of research and the constraints it puts upon researchers. In other words, providing flexible working hours in industrial research is not just a beneficial policy but also a measure that companies are forced to implement due to the characteristics of research work.

Most firms offer flexible hours at the beginning and end of the working day. Similarly, all firms are open to accommodation as regards the working time of individual employees. Individual requests are treated on a case-by-case basis. Female researchers seem to benefit significantly from flexible work organisation.

Another form of flexible work organisation is teleworking (working at home). The development of new information and communication technologies allows for more flexible work options or even work from home, making it possible to cope with such unexpected emergencies as a sick child, as well as to opt for more radical solutions, such as the decision of one female employee to relocate her family further away from her employer, which was made possible by her ability to work from home and go into the office only several days a month.(143) This arrangement works well because she is well integrated in the firm's IT systems.

Many firms offer this possibility, which is made much easier by the new communication technologies and is well adapted to some aspects of a researcher's work. For example, some employees may work one day per week from home, where they have their own laptop and Internet access.(144)

One organisation, a private non-profit institute,(145) offers its entire staff the option of working part-time or from outside the office via telecommuting. Female researchers tend to see many benefits in this way of working. The possibility to work from home while their children are at kindergarten/school or sleeping allows them continuously to follow the progress of projects and to retrieve the relevant information at any time. Access to internal data and documents via the computer and home e-mail, for example, allows female researchers to concentrate on the core of their work while they are at the office.

Homework is not reconcilable with all of a researcher's work activities. Laboratory work can clearly only take place on-site. Also, people who work partly at home want to come to the office regularly to maintain personal contact with their colleagues, a wish that is often endorsed by the firm: for example at Philips, working from home is allowed for one day a week at the most because they want employees to be present for a minimum number of hours in order to maintain contact with colleagues. Nonetheless, aspects of a researcher's workload, such as the editing of reports or projects, can just as well be accomplished at home.

Telework is a good practice that facilitates the reconciliation of family and working life. Nevertheless, some guidelines must be followed because this form of work risks allowing work to invade the home. The frontier between work and privacy may become blurred. For example, not all women appreciate telework as a way of combining family and working life. The argument against telework is that an environment with children, for example, is not con-

(142) UK report, Borax, p. 27.
(143) UK report, Pfizer.
(144) Austria report, Eli Lilly, p. 11.

ducive to high performance. Women may prefer a separate work environment.[146] There are other problems, for example even if telework allows a more flexible and more family friendly organisation of working life, it can isolate women in their professional environment and put them in an atypical professional situation.

3.2.2 Reduction of working time; part-time work

Practices related to the reduction of working time differ substantially across the firms in the analysis. Indeed, in some firms part-time work was not even an option for people in research positions. In these firms, it was said that the research activity itself is not compatible with part-time employment.[147]

In other firms, part-time work is possible for parents of very young children. For example,[148] on request employees can work reduced hours (part-time) until their children are 10–12 years old. At another firm,[149] a provision allowing women to return to work on a part-time basis after giving birth was introduced well before it was enshrined in law. Since this possibility was made available, a significant difference has been observed in the number of women who return to work and also in the number of women who eventually return to full-time positions. Both numbers have increased.

Some of the firms and female researchers in the study claimed that part-time work does not hinder one's career. This is an important argument in the discourse of women researchers themselves and it is always illustrated by examples of female researchers having been promoted although they were working part-time.

Such examples are advanced to show that it is indeed possible to pursue a career in part-time employment. To quote Maruani (1995):[150] *"In return for the 'convenience' of short and predictable working hours these labour market adjustments impose high penalties in the form of low pay and poor promotion prospects and limited pension entitlements."*

Nonetheless, it is interesting to draw attention to one case that puts the previous examples in a different light: part-time careers may exist for women but not for men! For example, a section head (woman) works 32 hours a week (a reduction of five hours); this is no hindrance in her work and is accepted. In the same firm, some men have also expressed a desire to reduce their working time, but were told that they were not serious about their work. Obtaining reduced working time is a privilege to be bestowed by the employer; it is not automatic.[151]

The opportunity to pursue a real career whilst working part-time is a good practice because the tendency is for part-time work to form an obstacle to the promotion of women and to access to jobs involving greater responsibilities. These sample-experiences of part-time careers are very important as proof that it is possible, that part-time does not preclude pursuing a real career. Nevertheless, this possibility again seems reserved for women.

Given the law on the 35-hour working week in France, French firms are quite open to different practices of working time reduction, which can be either individual or collective. One French firm offers a "forfait en jours réduits" (reduction of working time expressed on a yearly basis) to its employees. This measure allows for a reduction in total annual working time by a fixed number of days to be taken freely throughout the year. The "forfait en jours réduits" allows an employee to organise his or her work on a yearly basis, choosing the (reduced) number of days worked. This measure allows for a greater degree of work flexibility. It is an option open to managers only, however, and can be taken up on a full-time as well as on a part-time annual basis. The advantage of the part-time "forfait en jours réduits" is that it allows for non-rigid part-time work (a part-time job that is not constrained to

(145) *Austria report, Austrian institute for SME Research, p. 8.*
(146) *Spain report, IBM, p.41.*
(147) *As stressed in part one, part-time work is not a characteristic of S&T women in all European countries and in all sectors the share of part-time workers is lower for S&T women than for other women in employment (23% compared to 36%).*
(148) *Denmark report, Haldor Topsøe, p. 2.*
(149) *Pfizer, UK report.*
(150) *M. Maruani (1995), "Inequalities and flexibility", in Equal*
(151) *Opportunities for Women and Men: Follow-up to the White Paper on Growth, Competitiveness and Employment, Report to the European Commission's Employment Task Force (DG V). V/5538/95-EN, Brussels.*

fixed days or hours of work). This measure may appeal to female engineers because it could contribute to the smoother reconciliation of professional and family life even if it was not specifically designed for this purpose in the first place.(152)

Other measures are negotiated collectively. At GDF,(153) for example, it is possible to work 32 hours (four days a week) either individually or collectively, or even at the level of the work team or department. At GDF, one-third of those employed in research work part-time. One-third of men work 32 hours compared to one-half of women.

Given that the collective arrangement of a 32-hour working week concerns the whole department, the threat to one's career is limited. Such risks are more likely to arise in a situation where the choice to work part-time is purely individual.

3.3 Management of pregnancy and maternity (154)

Human resource practices with respect to the management of pregnancies and maternity may encompass the above-mentioned practices of flexible working time and work organisation. In a narrower perspective, they are limited to practices specifically targeted at mothers and parents, such as care options or maternity leave, and do not affect the whole workforce.

Part 1 of the report showed that relatively few women scientists and engineers working in the industrial sector have dependent children, compared to their male colleagues. The fact that women form a very young population and are also a highly educated part of the labour can probably partly explain these differences.

Pregnancy is thought to have a restrictive effect on women's careers. While in many studies women scientists and engineers put forward the integration of family and working life as of primary concern, it seems that they often encounter difficulties in combining both activities because both are so demanding in terms of time and personal investment.(155)

Furthermore, motherhood often occurs at a crucial point in a woman's career. Motherhood is often considered to limit a woman's availability to her firm. A number of studies show that some women have the feeling that it is difficult for them to compete on an equal basis with men in promotion matters because the age at which they are most likely to be promoted is also the age at which they are most likely to give birth and consequently take a career interruption. One of the main consequences is that fewer women than men hold management positions because prolonged breaks or part-time work slow down the accumulation of seniority.(156)

Another part of the problem is on the employers' side. Employers often assume that the commitment of women who are married or who have children will be less sustained than that of male employees. Such assumptions influence their decision to hire women scientists as well as the type of work assigned to women.(157)

Maternity legislation and its implementation(158) differ across the EU: length and payment of maternity leave, paternity leave, parental leave, collective childcare, and so on. These national differences may explain differences in women's reactions and expectations. Despite this legally differentiated landscape, some firms develop good practices to promote mothers' employment and careers. Two reactions, one of a female researcher and the other from a firm, are particularly interesting on this point because they explain the 'comparative advantage' of mothers/housewives in terms of work organisation and efficiency. The researcher in question is a development manager who did not consider maternity leave as a disadvantage, but rather as the opposite: on maternity leave a woman often experiences a positive form of growth, in the course of which priorities change and work is done

(152) France report, Thalès, p. 1.
(153) France report, p. 5.
(154) In the appendix, national regulations on childcare and parental leave are to be found (Appendix 5)
(155) Lewis, 1995, at http://www.the-scientist.com/yr1995/jan/prof_950109.html
(156) McGregor and Harding, 2001, p. 311; Straka, 2000, p. 4; Van Nieuwenhuyse et al., 2002, p. 3
(157) Gender, Science and Technology Gateway at http://gstgateway.wigsat.org/TA/careers/whycareers.html
(158) In the appendix, national regulations on childcare and parental leave are to be found (Appendix 5)

even more efficiently than before.(159) The firm broadens this argument, explaining that women who manage both family commitments and a career tend to develop better time management skills all round and are better able to take on board problems, making them a valued asset to the company.(160) Even more positively, after a woman has had her children, she tends to be an excellent employee – better than most men.(161) Women learn good organising skills during maternity leave.

The management of maternity poses more or fewer problems depending on the firm.(162) For example, some large firms have stated that maternity and pregnancies are not a problem because the size of the firm makes it easy to find solutions (temporary replacement, anticipation and organisation of returns).

Women who do not have children are more likely to express concerns, fearing they will encounter difficulties in the future. At the same time, most of the women interviewed were confident of their employer's openness of mind as regards pregnancy and maternity.

Women tended to formulate the problems they have in trying to reconcile their family lives and professional lives in terms of their own personal and familial ability to cope as working mothers. Some female researchers explicitly oppose intervention by their employers in such matters.

At Biotecnol,(163) one interviewee thought that the ideal solution for women with young children would be for the company to let them work part-time; another solution is related to a national policy measure: to increase the period of maternity leave from the current four months to a full year.

According to the women interviewed at PT Inovaçao,(164) although the company acknowledges the reconciliation of women's work and family life, an improvement in women's situation depends on changes within the family – such as the sharing of household tasks – and in society, through the reduction of work schedules, particularly for those with children under the age of 12.

One wish frequently mentioned in the debate about the reconciliation of work and family life is that the mother alone be given the choice concerning how to go about it. As already mentioned, some women stress that they do not want any intervention from the firm in gender-related matters. For example, when it comes to travel or assignments, colleagues or superiors tend to consider the specific constraints of mothers and limit their options because they have children. Of course, these constraints exist, but at least women would like to be offered the alternatives in order to make their own decision, whether positive or negative.(165) A good example was provided by a Spanish female researcher,(166) who explained that the firm had offered her a special childcare service so that when she participated in a meeting in other countries she could take her recently born child with her. At Hovione,(167) assuming that motherhood is the main cause of employer/manager reluctance in hiring women, female absenteeism is not an issue here. Company management believes it is not a matter of favouring women, but rather of giving them the opportunity to prove that they are competent, irrespective of their family responsibilities.

Some women do not wish their employer to intervene in family/work reconciliation by providing childcare amenities, interpreting such measures as a return to paternalist management, as well as fearing an increase in working hours, meetings scheduled later and later in the evening, and so on. The general view is that it is up to the government to manage the reconciliation of work and family life (point of view essentially of French and Belgian female researchers).

The average age of female researchers is quite low.(168) Therefore, firms anticipate that they will have to cope with future pregnancies.

(159) Finland report, Outokumpu, remarks made by a female researcher, p. 12.
(160) Ireland report, Arup Ireland, p. 30.
(161) Finland report, Orion Pharma, p. 13.
(162) In the literature review, it was found that some employers still assume that the commitment of married women with families will be less sustained than that of male colleagues.
(163) Portugal report, p. 14.
(164) Portugal report, p. 16.
(165) Finland report, Outokumpu, p. 10, researcher's response concerning mobility.
(166) Spain report, p. 46.
(167) Portugal report.

In fact, the question of how to manage maternity and pregnancies should not be considered as a problem. Indeed, whether pregnancies are well or badly managed depends only on the goodwill of the firm. An open outlook results in prescient management and communication between pregnant women and the firm. In this case, pregnancies are not considered a problem. In contrast, a firm that does not anticipate such questions and prefers to close its eyes to the specific characteristics of working women will more frequently report pregnancies as management problems.

Human resource practices in the area of pregnancy management are of two main types: opportunities for maternity and parental leave on the one hand, and care options on the other. With respect to maternity and parental leave, some firms offer more generous provisions than are required by law. They either offer a higher replacement income during the leave, prolong the duration of the leave or adopt a very open and flexible policy as to possible extensions of the leave.

At Borax,(169) the maternity provision represents a "slight improvement on the legal requirement". It was acknowledged that this could be strengthened. Part-time work is available as an option after return from maternity leave, as is job-sharing (where practically possible).

Paternity leave exists at Pfizer.(170)

Acambis provides enhanced maternity pay to cover the statutory 18 weeks' maternity leave,(171) along with five days' paid paternity leave and five days' compassionate leave. Atofina is remarkably open to career breaks.(172) Both men and women take career breaks for different reasons (children, launch of own business). The firm's only complaint with respect to career breaks is that they can be prolonged and when people finally decide to come back they have often lost most of their previous skills and operational knowledge.

Problems caused by career breaks exist in all firms but have particularly severe effects in R&D activities where researchers must keep continuously informed about the latest developments. For example, a women researcher at Philips(173) explained that career breaks are less popular than part-time work because one completely loses touch with what is happening at work. Changes take place so quickly in research that one cannot afford to become totally disconnected for a period of time. IBM in Germany(174) offers telework, also in research, for parental leave or interruptions for caring. Employees who opt to deactivate their employment contract can keep in touch with work and the company by substituting for others during vacation or illness. In addition, they can attend training schemes during their leave to keep their skills up-to-date. At the same firm, attempts are made to employ highly qualified women at least part-time after a maximum of one year of parental leave in order to keep them up-to- date. However, at Repsol YPF,(175) the speed of knowledge change in its specific research area is not considered an impediment to researchers taking leave periods longer than one or two years. The professional basis of the researchers is considered so well founded that updating will be easy. At Orion Pharma,(176) maternity breaks do not really affect a person's career prospects: for example, just recently a female employee who had been on parental leave for two years was called in to see whether she would be interested in taking a high-level post which had become vacant.

The case of Eli Lilly is particularly interesting here.(177) The company tries to maintain contact with those (basically women) on parental leave, offering them the possibility to work a number of hours a week as freelancers (although this could also be interpreted as creating the risk of work impinging upon family life). At the same time, because Eli Lilly is a high performing company, returning after a long parental leave can be difficult.

(168) The statistic part of this report has shown that women scientists in the industrial sector are younger than other women in employment and significantly younger than their male colleagues.

(169) UK report, p. 28.
(170) UK report.
(171) UK report, p. 37.
(172) Belgium report, p. 4.
(173) Netherlands report, p. 7.

With respect to care options, both the practices and the reactions they provoke among women differ a great deal from one firm to another. These reactions are discussed in some detail when we looked at firms' attitudes towards the care question.

Biovail does not currently offer childcare facilities for its employees,[178] but is planning to start a crèche at its new plant if there is a demand for it. Given the (low) average age of its employees, the location of the new plant is being carefully considered in terms of access to schools and other amenities for young families.

Instead of a crèche, Acambis[179] offers childcare vouchers to the value of £40 per child per week. Philips has two different strategies:[180] childcare costs are (partially) reimbursed (leaving parents completely free to organise childcare as they please) and Philips supports childcare centres in Eindhoven in the sense that it guarantees a certain number of places at the centres.

Pfizer is proud of its childcare support programme.[181] Support is provided in the form of help in finding quality childcare in the area, as well as the arrangement of four holiday clubs per year. However, difficulties with this scheme were acknowledged: shortage of day care, difficulties in finding nannies and providing for night care. The need for an on-site company crèche, as part of an expanded 'cradle to teenage car' programme, was accepted and is being actively pursued.[182]

While some female researchers are opposed to crèches being organised within the firm, others favour such provisions, at least when the crèche's opening hours correspond to the usual working hours in the firm (until 5.15 pm). The question of what happens when a person loses his or her job is yet another important issue to be settled: one female researcher explained that women certainly have more to gain from such a policy measure.[183]

At GDF, the idea of a crèche was first raised a long time ago but was rejected by the unions out of fear that such a measure, which would be presented as a positive effort on the part of the firm, would only prolong the working day.[184]

To sum up, women's opinions tend to differ widely on the subject of care provisions.

In Germany, Aventis[185] is cooperating with the city of Frankfurt to make a childcare centre available; some Aventis plants have their own day nursery and, if not, the firm helps with an external family service (placement agent for day nurseries). IBM is cooperating with an external 'family service' that provides employees, free of charge, with individual support and advice when looking for suitable carers for their children or other relatives.[186]

In conclusion, Eli Lilly merits particular attention. The report on Austria states that, for the seventh consecutive year,[187] the US magazine Working Mother has chosen Eli Lilly as one of the nation's 100 best companies for working mothers – the company has been recognised by the magazine every year since 1995 and has made the top 10 four times.

While the magazine uses a range of criteria for selection, Working Mother specifically noted Lilly's innovations, such as the addition of a 'quiet room' to its childcare centres, which allows children to recover from illness or injury before returning to their regular schedules.

The magazine also noted Lilly's outreach programme for parents, including a course on prevention of pre-teen drug, alcohol and tobacco abuse. Working Mother also praised Lilly's training programmes that help to put women on a management fast-track. Entrants' work/life programmes were evaluated along with these criteria: percentage of women in the workforce, childcare support, flexible work schedules, leave for new parents, a culture sup-

(174) Germany report, p. 6.
(175) Spain report, p. 31.
(176) Finland report, p. 8.
(177) Austria report, p. 8.

(178) Ireland report, p. 21.
(179) UK report, p. 37.
(180) Netherlands report, p. 3.
(181) UK report.
(182) UK report.

porting work/life balance and opportunities for women to advance.

If these practices more clearly concern women (and men in their role as fathers) they do not necessarily fulfil the objective of promoting women. Indeed, the practices surrounding pregnancies and maternity can equally well be interpreted as forms of compensation or as measures to restore equity. Consequently, although these practices are presented as a sub-group of the general category of practices favouring women, first, they do not involve all women but only mothers, and second, they compensate for differences in situation which stem from the 'natural' fact of being a man or a woman. They thus aim at restoring equal opportunities, an equality which is 'disturbed' by the fact that only women can bear children.

These provisions are to be interpreted as good practices since they facilitate women's employment but also as logical and essential measures to re-balance women's and men's opportunities. In this sense, these actions are crucial in facilitating women's professional careers.

3.4 Recruitment, Promotion, Wages and a Mixed Workforce

In the literature review it was found that some employers still have a negative attitude towards the employment of female staff and often fall back on traditional recruiting and hiring practices, using well-established and often exclusive networks. However, the false assumptions about gender-roles will disappear as companies hire capable women who, through commitment and experience, will eventually succeed in dispelling such damaging views.(188)

Some firms clearly attempt to create a diversified workforce to facilitate cooperation and to minimise conflicts. Their policy is to achieve and maintain a balance between women and men in the workforce as a whole,(189) for reasons such as good teamwork and smooth functioning. In order to avoid management problems resulting from either purely male or purely female teams, firms monitor this balance carefully.(190) The ultimate goal is that a balance, as well as equality, is attained over time. A work situation is only considered balanced when it is mixed. In mixed teams, the risk of conflict is thought to be minimal because everyone finds his or her place more easily; a mixed team is more in line with nature, in conformity with the usual order of things.

At IBM in Germany,(191) although most recruiting events and activities at universities are presented in a gender-neutral way – for example, within the framework of university relations – IBM has committed itself to increase the proportion of female employees by about 10%. To this end female students are addressed directly but no gender quota has been laid down.

Efforts to recruit women may be made in order to restore a gender balance in the workforce: at the SME research institute,(192) whenever it became apparent that there were significantly more male than female staff, efforts were made to recruit more women and women were preferred to men when candidates had equal qualifications. As men and women are represented equally at the SME research institute at the moment, no strategies to attract women explicitly are being pursued.

To help female promotion, every woman at IBM selected for top management (High Management Potential) is assigned a personal mentor.(193) Regarding promotion opportunities and timing, the vice-president of product development at Orion Pharma explained that a crucial moment for the employer is when a woman returns to work after her second maternity leave.(194) This is when a woman should be given the right kind of sufficiently interesting and challenging tasks. At this point in their lives, many women start to think about what they

(183) France report, GDF, p. 4.
(184) France report, remark by a female researcher at GDF, p. 8.
(185) Germany report, p. 8.
(186)Germany report, p. 8.
(187) Germany report, p. 6.
(188) The Committee on Women in Science and Engineering, 1994, p. 18
(189) Belgium report, pp. 2, 5.
(190) Even if the policy of the firm is opposed to quotas (50/50).
(191) Germany report, p. 4.
(192) Austria report, pp. 6–7.
(193) Germany report, p. 6.
(194) Finland report, p. 4.

really want. The employer has to be ready to react in order to retain the best employees. Nevertheless, at the same firm, one big problem concerning promotion to superior posts is that women do not want to apply for them for family reasons. They are simply not inclined to work longer hours and to take on more responsibility.

A number of firms are careful to give due attention to the gender aspect in their recruitment process. However, these efforts often maintain a very informal character within the firm and are hardly ever translated into an explicit policy.

Despite the fact that concern about equality between women and men at the time of recruitment is usually of an informal nature, some firms make a special effort to recruit women in research. This is the case at OMV Aktiengesellschaft,(195) for example, where one female employee with some degree of responsibility and aware of gender issues drew the firm's attention to these questions.

A neutrality policy is often applied in recruitment and wages. Indeed, firms declare that in both of these fields of human resource management they do not practise discrimination. However, although similar at first sight, not practising discrimination is by no means the same as being truly neutral as regards gender.

With respect to recruitment, firms tend to stress the importance of criteria such as qualifications and experience, regardless of the sex of the candidate. Depending on the sector of activity, job applications are more or less feminised.

OMV Aktiengesellschaft(196) does not apply special recruitment strategies in order to attract women; the company tries to attract excellent, dedicated and motivated people in general and applies modern means to reach the best qualified. To assure equal opportunities for male and female candidates, the OMV Aktiengesellschaft staff member that carries out the interview is specially trained and objectivity criteria have been established. More than one person interviews the candidate, to ensure the most objective result possible.

Female researchers confirm and defend this identical treatment at the time of recruitment. Some female researchers state that they are opposed to quota policies, which may reinforce discrimination. They fear stigmatisation. Most women interviewed, particularly in Belgium and France, do not want to highlight their 'femininity' at work. The scientific environment should encourage people to seek recognition of their abilities: in contrast, measures targeted specifically at women risk undermining their credibility. They are first and foremost scientists.

Some women researchers admit nevertheless that despite developments in the position of women and despite the neutrality policies pursued by their employers, real change might require at least some degree of positive discrimination. Remarkably, they tend to believe that this applies only to the labour market as a whole, not to their own firm.

Neutrality also prevails in respect of wages: no wage gap was revealed by the case studies. Wages depend above all on the position one occupies within the firm and on individual performance evaluation. The women interviewed confirmed enterprises' declarations of a lack of wage discrimination, as well as of biased evaluation criteria concerning technical, organisational and interpersonal skills.

In this context Atofina is an interesting case. The company pursues a policy of wage neutrality between women and men.(197) The company's explicit wish to reduce the male/female wage gap can be considered a good practice. However, the attainment of wage equality will take time and is easier to achieve for younger employees. In the past the company's policy was more male-oriented. This explains the current management attachment to neutrality and equal opportunities.

In the same if not more active way, Forschungszentrum Jülich GmbH has included a

(195) Austria report, p. 13.
(196) Austria report, p. 7.
(197) Belgium report, p. 5.

bonus system in the collective wage agreement. Theoretically, this means the absence of all gender-specific differences. However, significant differences still exist between men and women. To tackle these differences the company implemented an action programme Bonus Equality and Motivation in 2001. Within the framework of this programme, by the end of 2005 bonuses should be awarded in strict accordance with the proportion of male and female employees.

Some female researchers, for example at Metso Paper,(198) insist on the importance of a good superior and development discussions. Development discussions with a superior present a good opportunity to discuss all possible problems, personal plans and indeed everything concerning work and promotion. For example, one female researcher at this firm underlined the importance of her previous superior, who had made an effort to get her wage rises.

3.5 Network-Building

The absence of a women's network is often put forward to explain, on the one hand, the under-representation of women in certain positions and, on the other, the far greater difficulty women encounter in obtaining promotion to positions of high responsibility. The absence of networks is one factor, among many others, that explains differences between male and female management often put forward by female researchers themselves.(199)

The kinds of network maintained more by men than by women include networks of former students, but above all networks within the firm itself, such as football teams, people who tend to go to the pub together, or, to cite the Finnish report, to the sauna.

The typically Finnish example of collective visits to the sauna gives a fairly good idea of the difficulties women face in joining male networks.(200) In Finland, the sauna is traditionally a place where important issues are negotiated informally. At the firm, there are relatively few sauna-evenings, and even then, women and men sauna separately. In such circumstances, it can be disadvantageous to be a woman in a male-dominated field: if there are only one or two women in the group, a sauna may not even be reserved for them; and in any case the men go to their own. Since they are all colleagues, they naturally also discuss work. The more common this culture, the more disadvantaged women are. One development manager puts it quite clearly: she found it difficult to imagine that she would be promoted to higher levels of responsibility, because at those levels sauna-evenings and the like are even more prevalent. She also put forward the example of a different company. A friend of hers applied for a post, for which she was slightly better qualified than the male candidate in terms of education, work experience, and so on. Nevertheless, the man was chosen because "it's so much fun to organise sauna-evenings". Another interviewee felt that one of the reasons why women are absent from top management is the fact that "traditionally people move in very small circles where everybody has known everybody else since their student years". There were far fewer female university students when the current top managers were studying. The number of women students has clearly increased in recent decades, so time will tell, she said. Nevertheless, again in Finland but at a different firm, Orion Pharma, where the research department is very female, sauna-evenings and golf are not a barrier for women's promotion. This kind of culture is not very common in the company, and it is rather the women who have made their own cliques, organising sauna-evenings for women and for female managers.

Women's network-building is often difficult and sometimes these networks remain quite hermetic. One woman researcher at Haldor Topsøe stated:(202) *"One of the female researchers tried to join a network of female engineers; however, it was a very closed circle and not very welcoming. She then tried to set up her own network, but this demanded too much of an effort. They all agree that women do not have the same networks as men, and that networks are necessary to have a career."*

(198) Finland report.
(199) The importance of networks for women in private sector research can be put in perspective in terms of the notion of 'cultural discomfort', found in the literature review.

(200) Finland report, remark by a female researcher at Outokumpu, p. 9.
(201) Finland report, p. 6.
(202) Denmark report, p. 6.
(203) UK report.

Pfizer recently approved the establishment of a Women's Network Group.(203) This network resulted from a group of relatively senior to middle women managers meeting together at the instigation of one senior woman manager. The purpose is to facilitate effective networking for women in the company and create effective support structures for those feeling 'isolated and lonely'. The group has developed informally, with regular meetings and social events. Requests for a separate budget have not yet been successful, though financial means for activities are invariably extracted from the HR budget. Small amounts from the global budget also support such groups across the globe.

At Outokumpo there is an important women's network in the form of the NICE organisation:

Box 2.3

Outokumpu: NICE, a women's organisation(204)

NICE (pronounced nais, the Finnish word for 'woman') is a group of women engineers (about 15 in all) at Outokumpu Research Oy. Management entirely approves of this association and has encouraged, even supported their excursions or seminars financially.

The group was formed in September 1989. An older senior research metallurgist was the Grand Old Lady behind NICE. She had the idea that women researchers in OCR needed to get together to exchange opinions and experiences. Another aim was to organise excursions, which at that time were limited to management only. Since then NICE has on average organised one excursion per year and arranged several more informal meetings. Excursions have been organised to other Outokumpu Group companies, as well as to other industrial companies in the region. The latest excursion was to Finland's second nuclear power plant (located in nearby Olkiluoto), hosted by one of Finland's leading experts in nuclear technology. The unofficial meetings have included sauna-evenings, museum visits, beauty and recreation evenings, as well as traditional Christmas lunches. Most of these events have been sponsored by the company, which in this way has acknowledged the network's existence. A particular highlight came in 2001 when NICE invited all women engineers in the Outokumpu Group (54 at that time) to participate in a two-day internal NICE seminar. Women researchers got to know each other and received information about Outokumpu and its environmental policy, patenting and legal activities, quality certification, and so on.

Participation in these activities has increased knowledge of local industry, the information being presented by experts and in more detail than would ordinarily be the case. NICE members have enjoyed a number of events and have formed a network of women engineers within the company that helps them to cope with everyday work, and even life itself.

The women in NICE have been allowed to meet or organise their events during working hours. Among their male colleagues, this can arouse some grumbling ("Why don't we have anything like this?", "How come they can use working hours for such activity?") or banter: "So, the women are off on their travels again!"

It seems that the women in NICE are divided: on the one hand, there are seniors who accept things as they are and, on the other, juniors who "still believe that the world is different from what it is", as one younger researcher puts it. Anyway, all the women interviewed agreed that if real problems connected to gender arose, NICE would serve as a good channel of expression. So far, however, there have been no problems big enough to justify the use of NICE in such a manner. Furthermore, most women in NICE did not seem so interested in NICE becoming 'politically active'. The elder senior research metallurgist who founded it stresses heavily that NICE is not a 'women's movement', but instead that womanhood is merely one thing all participants share.

The organisation is not politically active; it is more like a women's network, perhaps comparable to male networks getting together on sauna-evenings or on the golf course. It is a forum in which to share ideas and experiences from a woman's point of view and in an informal context.

(204) Finland report, pp. 15–16.

Box 2.3

NICE's seminars and excursions can be analysed as concrete results or benefits because when NICE was founded such excursions were only available to bosses, not to ordinary personnel. Women were very enthusiastic about the new possibilities provided by NICE.

The example of NICE is interesting because it also sheds light on the biases and limits of this kind of structure. Indeed, the absence of in-depth and serious discussions on the different forms of inequality between women and men shows that, even if not intentionally avoided, the problem is not analysed, but rather reduced to a few humorous remarks. This observation refers particularly to the fact that the women themselves do not wish to transform this network into something more active. The network may be used whenever a specific problem arises but it is not its purpose to bring out difficulties or problems related to gender inequality.

At Procter & Gamble,(205) participation in the network is voluntary and both men and women attend. Discussions within the network touch on different subjects, such as the work and family life balance, mentoring, management styles, and so on. Since the network has started to focus on general diversity issues rather than the problems experienced by women, participants are equally divided between men and women. In parallel to the network, a mentoring programme exists which is composed of two strategies:

1) mentoring up: in which younger managers help more senior managers on male/female issues, allowing for an exchange of ideas and discussion
2) mentoring down: this corresponds to the usual mentoring programme (with no particular attention to male/female issues). This classical mentoring policy did not exist previously, or only very informally. There was and still is a system of 'godmothers' for young admins 'coming aboard', and later on.

Another interesting case is Haldor Topsøe.(206) It is presented here not as an example of successful network-building, but rather of the role and influence of women's networks in the promotion of women in research.

Haldor Topsøe was approached by around 10 female engineers from the professional association of engineers about 15 years ago. They put pressure on the company to start hiring female engineers, an encounter which broke the ice. Female scientists started to arrive at Haldor Topsøe in substantial numbers eight to ten years ago. They have a good professional reputation and are considered no differently from their male counterparts. They always come back after maternity and parental leave. Although there are some efforts to promote women they do not always accept help. This is especially true higher up the promotional ladder.

The contribution of such networks was emphasised by several women, for example the current chair of the Pfizer Women's Network Group. Elsewhere, the company sees this as important from a 'business point of view', because women were previously largely excluded from such networks.

At IBM in Germany,(207) the annual conference Women and Technology, which was held for the first time in 1999, has proved to be particularly helpful in network-building for women in research. Women in executive and management positions from 24 countries meet during these conferences in which top management is also involved. The conference has proved to be a platform for information,

(205) Belgium report.
(206) Denmark report.
(207) Germany report, p. 9.

motivation, and support for women from IBM's different business segments. At the conference, qualified women from technical and research fields discuss their opportunities for development within IBM and their working environments for the future in different workshops. They establish contacts and build or extend networks. Among other things, the conference serves to encourage the participants to work on their own personal and career development.

On the one hand, the experience of female researchers from other countries serves as a benchmark for the promotion of equal opportunities within the group of national affiliates. On the other hand, female researchers are given the incentive to advance their personal and career situation. Such incentives derive especially from very successful women reporting their own positive and negative experiences, their strategies and activities. Above all, role models generate additional motivation.

As one female researcher explained, the conferences help to establish women's networks. The corporate support for the establishment and maintenance of permanent corporate women's networks allows a more intense exchange of information about both career opportunities and possibilities to combine family and work better. Although women's networks are private initiatives, they can only be established with the company's support (for example, information and dialogue via the Internet). In addition, the international IBM comparisons showed that Germany was bottom of the league regarding the number of executive positions held by women. This German deficiency became especially obvious in exchanges with female directors from the US corporate divisions. Their many years of experience helped to define model benchmarks for Germany (at national level). The international group statistics that showed the catching-up required in Germany strengthened their value and provided additional motivation to management and research staff.

New communication technologies facilitate the networks' functioning: for example, IBM in Spain formed a Global Women Leaders' Task Force and organised a series of Global Women's Leadership Conferences, and the IBM Intranet has a specific page to discuss gender items.

Network-building is a good practice but once again time is a problem. Indeed, women already divide their time between their work and family responsibilities and now network time needs to be added! NICE(208) is a very interesting case because women have been allowed to meet or organise during working hours.

A female researcher(209) who was a little sceptical made another important point: no matter how much women organise into networks, they will not go far if the management does not provide them with opportunities. She expressed her hope in the female vice-president of human resources and the wish that this woman would promote equality issues in management. She said that the management seemed to approve of the network activity and had paid for courses. This last remark indicates the importance of the participation and will of the top management and the role of a high-ranking woman open to gender issues.(210)

It should also be noted that many regional, national and even international networks exist to represent, protect and promote women in science and technology. These networks support women at all stages of their educational and professional careers. They help in the construction of good practices, inform public bodies on the participation of women in S&T, develop education, industry, and women's group liaison, offer mentoring and support to women embarking on a career in or returning to science and engineering, and so on. Such networks are particularly present in English-speaking countries (United States, Canada, UK, New Zealand and Australia). More than 60 organisations with an interest in women in S&T have evolved in the UK.

For example, in Australia, the Institution of Engineers (IEAust), besides publishing a statistical

(208) Finland report, Outokumpu Research Oy.
(209) Finland report, remarks made by a female researcher at Metso Paper.

(210) Even if in other cases a woman in top management may only be a token appointment or even be 'worse' than a man because she doesn't want to hear about gender issues.

overview with a section on gender issues, has created a *Women in Engineering Group*. The group aims at providing advice on policy changes needed to encourage women's full participation in the Institution. The Group also tries to improve public and government awareness of ways to enhance the participation of women in engineering. The Institution has promoted a Gender Equity Policy that guarantees equal opportunities, which are necessary for a successful career in engineering. Since 1990, IEAust has organised a series of interactive workshops with private companies to promote effective management of diversity and of work and family policies. Moreover, the Institution initiated the Annual Engineering 2000 Award to encourage industry policies that increase the participation of women in engineering. Finally, the Institution has developed a childcare system for IEAust employees.

At the international level, the Global Alliance for Diversifying the Science and Engineering Workforce should also be mentioned. The association is a collaborative initiative of the American Association for the Advancement of Science (AAAS), Women in Engineering Programs and Advocates Network (WEPAN) and the Association for Women in Science (AWIS)(211). One of its activities concerns collaboration with higher education institutions, corporations, non-governmental organisations and governments in order to support efforts to diversify the SMET (science, mathematics, engineering and technology) workforce. The website illustrates interesting good practices at the firm's level.

3.6 Actions in the Field of Continuous Training

Actions in the field of continuous training seem to meet the particular expectations of female researchers. Indeed, several women researchers have shown their interest in training courses focused on management methods, work organisation, team management, and so on. These choices are not surprising, given female researchers' views on the differences in management style between men and women. One woman at GDF stated more particularly:(212) *"Maybe the firm has to assume its share of responsibility in trying to raise the confidence of women. For example, it might be interesting to organise 'trainings in management' to encourage and even push women to fulfil executive functions in areas where they are not traditionally present, such as on building sites."*

It is a fact that in firms that offer significant opportunities for technical training, foreign language training and also interpersonal-skills training, women seem to be particularly at ease and satisfied about training in such skills as time management, team work, and so on, not so as to work more but to be more efficient during working time.(213)

At this stage, it is interesting to draw attention to the Kerry Group, which has developed a major training programme. One of its goals is to promote women in managerial positions in the research branch in order to 'smash the glass ceiling'.

The case of Pfizer is somewhat different from the examples presented so far.(215) Pfizer largely invests in both continuous training and awareness in order to encourage a change in the firm's culture with respect to women. Indeed, at Pfizer, training support has been introduced to counter the negative effects of some aspects of the organisational culture. One example is that of support for 'good supervisor behaviour' with regard to the career needs of pregnant women. The website developed by the human resources department contains practical advice and guidance to assist supervisors with this particular issue. A broad cultural awareness programme entitled Respect for the Individual is currently under way.

Offering training opportunities to women is a good practice that is often much appreciated by women themselves. Nevertheless, why do women need more training? Don't they have enough skills? Weren't they selected on recruitment in the same way as men? If these questions seem provocative because training involves not only women, they illustrate the

(211) More information can be found on their website http://www.globalalliancesmet.org/about.htm.

(212) France report, p. 10.

(213) Remark made by a female researcher at Atofina, Belgium report, p. 10.

Box 2.4

The experience of the Kerry Group[214]

The Kerry Group has a vast training programme for all employees and has recently been involved in training schemes targeted specifically at women. A major contribution to women's training has been via the WITS NOW project which was set up in 1995 to address career development for women scientists, technologists and engineers working in Irish industry. Over its five years of operation, it broadened its scope to implementing procedures to promote equal opportunities and diversity at work.

The project involved WITS and three of Ireland's largest food companies, Golden Vale, Greencore Group and the Kerry Group. (Kerry Group acquired Golden Vale this year and is in the process of merging both companies' policies.) The main aim of the project was to promote management development training for women. Kerry Group and WITS devised and delivered three Management Diploma programmes, with a total of 52 graduates at University College, Cork and the University of Limerick. The Diploma course was designed for women who wished to complement their technical expertise with general management skills. It combined knowledge, theories and concepts of management with practical skills development. All participants reported an increase in their confidence and competence in their jobs, and this was reflected in promotion and increased responsibility for 80% of them. Over 100 women also benefited from short career-development workshops, some run exclusively for WITS. This included a Stress Management seminar in 2000. During the second project, Kerry Group helped to organise career planning workshops for tertiary level students, to make them more aware before they entered industry. Entitled Horizons, the programme was piloted at the University of Limerick and at the Limerick Institute of Technology. It encouraged participants to look objectively at their skills and to match them to careers, rather than just following peers into gender segregated areas by default. It also urged them to take charge of their careers, rather than expecting an employer to do so for them. (…)

The company has a graded system in place for recruitment based around regular review of performance measures. Again it has an explicit policy that prevents discrimination based on gender or any other form of discrimination. Particularly since training schemes such as the NOW project have been implemented more women are seeking and being awarded higher positions in the company: *"Many of the female researchers are more ambitious with regard to promotion than their male counterparts . . . the only reason there are more men in management is the age structure of the company. As there has been a greater influx of female graduates in the last five years, this will be reflected in a higher proportion of female managers in the future . . . we have a very simple strategy for 'smashing the glass ceiling' and if an employee is good at his/her job he/she will never be held back on the basis of gender, etc."* The company maintains several internal programmes aimed at encouraging women with high potential into senior positions in the firm and at assisting women to retrain after career breaks or other leaves from the company.

(214) Ireland report, pp. 37–38.

recurrent problem of women thinking they need more training or thinking their management skills are lacking. This demand for continuous improvement is consistent with technical progress and the need to perform, but it is also a good illustration of the difference in self-confidence between men and women. One female researcher at Orion Pharma confirmed that more women tend to seek training than men.[216] Sometimes men consider it as mere 'messing about'.

Nevertheless, this is not always the case. For example, in the past, Aventis offered training options especially to women – Women in Management, Women Go Ahead – but a lack of female demand brought this to a halt.

(214) Ireland report, pp. 37–38
(215) UK report.
(216) Finland report, p. 6.
(217) Germany report, p. 6.

3.7 Partnerships between companies and schools

As emphasised in the first part of the report (see part 1, section 2.2.3), while the proportion of female university graduates has risen significantly, some fields of study (such as engineering and mathematics) are still mostly male-oriented and the proportion of women doctorates is very low compared to men. Consequently, among the actions aimed at promoting a greater presence of women in industrial research, measures should be implemented to attract more girls into science courses in secondary and higher education.

Many good practices addressing girls at school already exist and are developed at different levels (government, industry, network and education system). Some of them are attempts to revitalise the image of S&T and to challenge stereotypes.(218) Others enable girls to experience the world of work because girls in higher education tend to be badly informed about the different opportunities offered by the industrial sector. For example, the German government organises Girls' Days. On these occasions, girls can visit companies to get acquainted with the world of work and to gather information on working, training and earning opportunities in different companies.(219) While only a pilot project in 2001, the Girls' Day was held on a national scale in 2002 and has been a great success: more then 42,000 girls and 1.200 companies took part. In 2003, some 100,000 girls and more than 3,500 research centres, universities, companies and government offices participated.

A number of firms, but mostly female researchers themselves, share the opinion that a crucial step in promoting women in industrial research would be to raise the awareness of schoolgirls with respect to science and technical education opportunities. Often in biology, pharmacology and chemistry, as in the case of a particular Spanish firm,(220) the reason for the high proportion of female research employees lies in the gender structure of students. The desire to increase the number of girls in science, and not only biology, is seen as a good way of attracting them into private sector research.

Some female researchers talk of a system of study grants for girls in science, for example. In other words, it is important to try to achieve two goals in particular even before entry into the labour market: i) reduce the concentration of girls in some disciplines and increase their presence in others, and ii) make efforts to change the sexual stereotypes attached to some scientific occupations.

Philips has a number of initiatives to promote women in technical studies,(221) and not only its research department: the importance of reaching a very large group at an early stage, even at preparatory school level, is stressed. In parallel, a Dutch government initiative entitled Meisjes en Techniek stresses the importance of such initiatives not only for Philips but for society as a whole. Philips receives classes from preparatory schools on a regular basis.

In Germany, IBM cooperates as a partner with a number of different schools and universities.(224) Within the framework of this cooperation, attempts are made to attract women to courses in the technical and natural science fields or to encourage female students to opt for IT careers and overcome their fear of technical and natural science courses. Also, in Spain, IBM in Barcelona has established a programme of collaboration with the Polytechnic University to promote technical careers among girls in schools(223).

(218) See for example the website Tapping the Talent for the UK or Future Opportunities Generated by Diversity in Higher Education and Training (Impulze Nutzen, 2002) which presents good practices by the German government to encourage girls and young women to take an interest in technical and scientific studies.

(219) Impulse Nutzen, 2002, p. 4. In the UK, a series of Taster Days, launched by the Office of Science and Technology, "give girls experience of jobs in S&T. The aim is to ensure that girls have an increased choice, a wider experience and a better knowledge of the careers open to them. Many companies including BT, IBM and Microsoft took part in the project. There were positive results: 98% of girls participating in Taster Days said that their experience had changed their perception of the industry they had chosen to engage with. In particular, they discovered more women, more opportunity and more diversity than they anticipated." (Promoting SET for Women Unit website).

(220) Spain report.

(221) Netherlands report, p. 5.

(222) Germany report, p. 3.

(223) Spain report, p. 42.

(224) France report, pp. 4–5.

The case of one female researcher at Thalès is extremely interesting. This female researcher (a member of the Women and Science association) observes that very few girls take the courses that logically lead to her area of work (about 10% of the students) and that about the same proportion of women are present in her firm. According to her, initiatives should be taken at school level. She emphasises the need to change mentalities. As a result, she thinks it necessary to go to schools and present examples of women who have succeeded in scientific jobs in industry in order to prove that "it is possible, it exists". She has chosen to present her project to promote jobs in research without putting forward the gender aspect. However, the presentation is made solely by female researchers and scientists. The idea is that by proceeding in such a way it will become more natural that women are associated with scientific jobs. Following the same logic, she is trying to set up a network (database) of professional female scientists and technicians who are willing to visit schools, holding meetings where all professions are present. She thinks that to achieve her goal the presentation of professions should not focus on women's issues. However, in practice it is of the utmost importance that all professionals in the network are women in order to cause the image of scientific jobs and of women in these jobs to change in people's minds, a change enhanced by examples (not by the presentation of facts or under pressure of militant action). For the moment, this network is still under construction and the female researcher trying to get it started has encountered some serious problems in mobilising women to participate.

This policy of awareness raising about sciences among schoolgirls in scientific disciplines with a very small proportion of females is in the first instance the personal initiative of one female researcher, but it has already drawn a positive reaction from the human resource director (also a woman).

For the moment, Thalès plays a role in supporting PhDs in a sort of partnership with different universities. The director of human resources explains that a special effort is made to favour women in recruitment for PhDs, but that this is more of a personal initiative than company policy.[225]

In a different dimension and in the context of a real and clearly stated policy of equality between men and women, Pfizer runs a school liaison scheme in the local community in an attempt to 'reposition science', and address the problems of supply by presenting science as a gender-non-specific subject[226]. Approximately 150 schools, both primary and secondary, are currently involved. It reports a high success rate, with large numbers of pupils visiting the company as a result. An associated activity is the Science Jamboree Week, when the social club is turned into a huge laboratory with experiments filmed and placed on the website. Over 60,000 hits from schools all over the country have been recorded. Much emphasis is on smashing the stereotypical view of scientists as men, which indeed seems to be changing in the target group.

One example of the importance of gender diversity in schools indirectly derives from the case study of Repsol YPF.[227] Repsol YPF is a Spanish enterprise in which the proportion of female researchers is increasing. Nevertheless, this tendency is not the result of a human resource strategy to increase female participation, but rather seems to derive from a general transformation of Spanish society, where the proportion of women in university education has generally increased and specifically in the knowledge domains underlying Repsol YPF's activities. These socio-educational changes have led to a major penetration by women of some research areas.

Nevertheless, gender diversity and equality in number in schools are not sufficiently adequate to address problems of career development, promotion and work/family balance. Good practices are not restricted to the school dimension, before entry into the labour market. Firms certainly need to take on some responsibility to promote women in research.

(225) France report, Thalès, p. 2.
(226) UK report.
(227) Spain report, p. 31.

3.8 Reflections on the 'Feminine Management' Mode

The first part of this report acknowledges that women's under-representation becomes even more pronounced as one moves up the hierarchical ladder, although some employers are becoming aware of the significance of women's presence at the top level.

This example shows the importance of networking and style awareness. These are especially important in cases such as the one described by a German female researcher:(229) dealing with and promoting women in research is particularly unusual for older supervisors. Based on their own experience they are much more oriented towards male newcomers and provide them with support much more readily than women.

At Procter & Gamble,(230) a workshop was created to explain the differences between men and women, particularly the differences in management style. The participation target is 100% of R&D employees. This workshop examines both the positive and the negative features of a more masculine management style (more hierarchical, closer to a military opera-

(229) Germany report, IBM, p. 3.
(230) Belgium report.

Box 2.5

The male work environment inhibits women moving up the ladder: extract from a discussion between two female researchers in Philips(228)

At the Natlab, there are currently no women in research leadership positions, so it is too early to discuss the glass ceiling phenomenon. When Ingrid arrived at the Natlab, there were seven women. Since the time she started working there men have arrived and have risen to the position of group leader. The same development should have been possible for women but nonetheless management has remained a man's world. According to Sima, people are still judged according to 'male' characteristics. Managers mainly listen to hard facts and do not seem to realise that other ways to approach and do things exist. Decisions do not necessarily have to be made on the basis of hard facts; sometimes they can also be made based on intuition. However, both Ingrid and Sima think that things are improving. Time is needed because traditionally Philips and the Natlab have always been male-oriented. Recently, Ingrid was asked to become a group leader but she is still hesitating whether to accept this promotion. She is not convinced that most of the male group members will easily accept her more intuitive way of taking decisions. Moreover, she is not attracted by the fact that she will be the only female group leader and she doesn't want to be asked just because she is a woman. Sima thinks Ingrid should accept. Someone needs to be the first. Ingrid could set a very positive example and could become an important role model for others.

Behaviour encountered in the daily work environment indicates that men do not seem to know how to treat women as colleagues. They know women as wives, as dates, in positions in which they provide services for them or in other social contexts but not as equals and certainly not as superiors. The few women at the Natlab are mainly bothered by subtle signs in men's behaviour. Men have to learn how to treat women as equal colleagues. Colleagues have always been men with whom they could go out for a drink and chat in a particular way. The presence of women confuses them and they feel uncomfortable. Men tend to treat women as being more 'delicate'. As a result, they remain in the background when it comes to leadership and high responsibility positions and hence they do not climb up to such positions as easily, because at the top you have to be really accountable for what you do. To change things, women should consolidate their presence and see to it that their voices are heard. In men's eyes, women are not technical. Women should keep proving differently. They might see this as a challenge. Sima feels supported by the fact that Philips seems to really want more women. As women become more numerous, it becomes harder to neglect them. If one woman says something, it becomes more likely that she will be backed up by other women and her point be discussed as a real option instead of being treated as some deviation from the general point of view.

(228) Netherlands report, Philips, pp. 7–8.

tion, allowing for quicker reactions and initiatives) as compared to a more female style (targeted more towards agreement, consultation, collaboration, often allowing for a higher degree of creativity).

Behavioural differences between men and women are revealed and can serve the analysis of differences in management style. For example, men are more focused on the ultimate goal, while for women the way in which this final outcome is reached is just as important; men prefer to concentrate on one task at a time, which allows them to stay focused, and women are more capable of dealing with different tasks at the same time.

Two female researchers at Philips explain that women sometimes act more on intuition than on hard facts.(231) Men do not always know how to judge or evaluate this way of acting because they have nothing to compare it with. They do not want to over- or underestimate a woman's work but are simply not capable of evaluating it properly.

The workshop's studies, and the differences that were put forward as a result, led to the implementation of a compulsory training programme for all managers in order to raise their awareness of these differences in management style. Already, half of all managers have completed this training programme and the rest will follow. A similar training programme is being developed for technicians and administrative staff. This training programme also aims at changing attitudes, for example, by getting women to speak up during meetings instead of men monopolising proceedings, so that women's ideas and views are heard alongside the men's. The workshop has also shown the importance of how a result is reached rather than focusing solely on the final outcome.

Reflections concerning style awareness at Procter & Gamble have also led to the establishment of an assignment-planning project . This ensures that everyone gets an assignment in which they can demonstrate their potential, irrespective of style. The acknowledgement of differences in management style is considered by Procter & Gamble as the most important pillar of the R&D department's diversity programme.

As one female German researcher explained,(233) it is important to implement more objective assessment and selection criteria from the top down. This requires making supervisors more sensitive to the diversity approach and its implementation in operational development plans, as well as to more objective performance criteria. Moreover, it has been shown that wherever performance criteria can be measured more easily and precisely, such as for technical services, women are more successful.

The high value put on female-type management, scientific skills, and ability to combine family and professional spheres, and so on, makes it possible to favour women's promotion in order to 'smash the glass ceiling'. Such initiatives pursue a double goal. A first and very concrete purpose is to advance the situation of women in research. A second and more subtle one is to gradually change the general mentality with respect to scientific employment for women. Similarly, openness towards different kinds of management or, in other words, towards specifically female assets in relational terms, with respect to team management or in decision-making matters, is to the benefit of the firm.(234)

(231) Netherlands report, p. 9.
(232) Belgium report.
(233) Germany report, IBM, p. 4.

(234) It is interesting to note here that some gender stereotypes could be analysed as positive aspects and could serve as the foundation of good practices.

Box 2.6

A look at some firms' good practices

All the firms encountered in this study help to bring to light the wide diversity of good practices to promote women in industrial research. Even if global integrated programmes account for the lion's share of investment in favour of women, all the practices presented here declare *"improving the situation of women in industrial research is possible, easy, and not expensive: it is enough to want it!"* The good practices concern the whole range of human resource management: time management (particularly the possibility to pursue a real career whilst working part-time), management of pregnancies and maternity, recruitment, promotion, wages and diversity, network-building, initiatives in continuous training, initiatives in schools to raise the awareness of girls towards science, and finally, reflections on 'feminine management'. In all these examples, the risk of discrimination between men and women exists. However, these good practices also present many possible actions to limit such risk, to restore equality and to promote women in industrial research.

Box 2.7

I have a dream…

Starting out from the set of case studies, we thought it would be interesting to set up a dream case, an 'ideal type' firm where everything is perfect for women. Unfortunately, we have not encountered such a firm in the course of the study, but we were able to construct an ideal type firm by putting together all the best practices that observed in the different firms in the study: the firm E-Research.

E-Research is a firm that is very much aware of the fact that women are an important economic, scientific and human resource for its performance and growth. The job of researcher allows for time flexibility and the activity of research particularly gains from networks and training programmes. E-Research encourages the creation of networks where women can discuss professional, scientific and human issues. On the one hand, networks are a locus of real exchange of ideas regarding not just professional and scientific but also gender aspects. On the other hand, women's networks clarify the role and place of men's networks in the professional sphere and in decision-making.

Some specific training programmes exist to pool and increase the acknowledgement of and openness towards female-type management. Such training programmes are designed to cater for needs that are more typically female, such as how to organise one's time, how to become and remain self-confident, as well as training on management and team-leading aspects, and so on.

E-Research knows that maternity constitutes an important turning-point in women's careers. The firm has developed a set of measures aimed at facilitating the combination of professional and family life: access to a crèche on the premises or help with the costs of externally provided childcare, parental leave provisions, and so on.

Recruitment time at E-Research is a time of direct action in favour of women's employment in research: attention is focused on the relationship between the number of applicants and the number of actual recruits from each sex and this results in recruiters being very aware of the gender aspect. In parallel to such efforts, E-Research develops and encourages real communication and discussion on the reasons, means and advantages of these efforts favouring women in order to avoid a lack of respect and acknowledgement in terms of the female recruits' merits. Therefore it is extremely important to the firm that the focus is on recruiting women with equal capabilities in order to ensure the proper integration of new recruits. The department of human resources has an important role to play in terms of communicating with the whole of the firm's workforce, women and men.

General Conclusion

Industry is the leading sector in terms of R&D financing and working hours allocated to R&D. It has also experienced the most significant growth in the number of scientists and engineers in recent years. However, in Europe, women represent only 15% of industrial researchers, which is clearly less than in the remaining institutional sectors. Moreover, women's under-representation becomes even more pronounced as one moves up the hierarchical ladder and they are more likely to have temporary contract and to be significantly worse paid. This is clearly an intolerable waste of resources and action is needed to recruit a more diverse workforce of researchers.

The female participation rate in industrial research is in no way related to the female employment rate or to the level of intensity of industrial R&D in terms of human or material resources involved. Therefore, policies should be adapted or developed to address seriously the division that exists between patterns of female access to employment according to qualifications. Furthermore, because policies to promote the development of industrial research are by no means sufficient to achieve a greater presence of women among industrial researchers, a coherent gender mainstreaming approach is required.

The first part of the report also stresses that the female participation rate in industrial research is closely linked to the female participation rate among university graduates, and that science and engineering are the most male-oriented fields of study. Educational segregation (both horizontal [type of studies] and vertical [doctorates]) is therefore a cause of women's under-representation in industrial research, via occupational and sectoral segregation.

Therefore, it is important to take action to raise the awareness of girls about science and technical education opportunities, as well as to contribute to changing the sexual stereotypes of some scientific occupations. Consequently, the image of S&E needs to be redefined and refreshed. It is also important to inform girls about the different opportunities offered by the industrial sector. Initiatives that allow girls to experience the world of work are therefore very useful. However, it is important to note that educational segregation is only a part of the problem and it is therefore not sufficient to undertake actions only in this sector. Industry also has a big role to play.

Industry is also a sector where the exit rate of women is higher than that of men, which might suggest that women perceive the climate in industry as inhospitable. This could be explained by the fact that most S&E fields are male-dominated, which can lead to discrimination, gender stereotyping, sexual harassment, problems regarding acceptance in the workplace, problems linked to the different modes of communication between men and women, and so on.

It is commonly held that the most decisive factors in women's choice of the public sector are the flexible working hours and the high degree of intellectual freedom. By contrast, the faster pace and more diverse career paths, greater job stability and the high responsibility entrusted to researchers are the main factors attracting (another group of) women to the industrial sector.

Regarding those results, it is possible to find good practices implemented in the different European countries to pull down the remaining obstacles and to improve the working atmosphere for women.

Part 2 of this report presents the wide diversity of such good practices in firms. It assesses some interesting examples of human resource practices from a gender perspective and shows how they have very often evolved from a logic or culture that grew historically and socially in the different firms. These practices have different aims: to rebalance the work situation for mothers, to link family and working life efficiently, to improve time flexibility and work organisation, training, network-building, efforts in the field of recruitment, attaining a mixed workforce, and so on. However, the most interesting ones are integrated programmes of measures favouring women.

In this sense, the purpose today should be to ensure that the gender perspective gradually becomes a central and integrated axis of all human resource practices. It was observed that many firms emphasise the logic of neutrality. However, this focus on neutrality is risky and biased: only once inequalities are corrected and initiatives favouring women are implemented can neutrality turn out to be a just and equitable policy logic for firms. Indeed, a policy of neutrality must always rest on a foundation that is unbiased in terms of gender. At present this is not always the case. A good policy can be first to implement measures to correct differences between men and women and then to manifest a desire for neutrality.

Analysis of the set of case studies provides examples of the wide range of possible actions open to firms willing to favour the employment of women in research and for research. All parties can win from this aim of promoting women in private sector research. Women can access the best careers, incorporating measures to facilitate professional and family life, practices to promote other modes of management, flexible work, and so on. Young women have broader vistas open to them at schools and universities due to the actions of firms and female researchers to raise young women's awareness of science and industry. Employers get to recruit and retain highly qualified female researchers as a consequence of initiatives favouring women in recruitment and promotion, to keep good researchers even after maternity, to acknowledge the value of other ways of working or managing, to enlarge women's recruitment possibilities, and so on.

It is hoped that the analysis of a series of good practices will broaden the scope of reflection of policymakers and other actors involved in advancing the cause of women in industrial research. These good practices are also intended to serve as examples to a wide range of enterprises. However, to encourage firms to undertake these actions and to invest in the cause of women's careers in science, it is important to show how firms and their employees can benefit. Moreover, a company cannot just pick a couple of likely-looking programmes and implement them. Success is subject to certain conditions, such as the commitment of top management to promote diversity in the firm, an initial needs assessment, customisation of good practices, evaluation of the effectiveness of the programmes, and their updating.

Finally, the report makes recommendations aimed at increasing the number of women in industrial research, as well as improving their current work environment.

Part 1 analyses the available statistics on women in industrial research in Europe, both their good points and drawbacks. It underlines the lack of harmonised and sex-disaggregated data, as well as the difficulty of identifying women researchers in industry. However, statistics are important because they make it possible to identify the problems, as well as to suggest where improvements can be made. Therefore, there is a need

General Conclusion

to enlarge national coverage and to improve the quality of these statistics (to identify better the specific group of researchers and to harmonise the different national databases, as well as to collect gender-disaggregated statistics) and to disseminate them more widely. Exploring the possibility of implementing a specific survey among scientists and engineers at European level is the best advice that can be given because it could provide far richer information on the educational, labour and R&D trends of highly qualified women and men than is currently available from other sources.

As far as private firms are concerned, a strong commitment at all levels in the enterprise, but particularly from top management, to promote numerical equality and diversity is of prime importance. There is also a need for a more hospitable work environment, which implies challenging discrimination and stereotypes about women and improving women's position in high management. Firms need to pay special attention to the hiring and placement of young women scientists and engineers and must stop recruitment policies based on old boys' networks, as well as practices that set a double standard in measuring men's and women's achievements. Personnel managers and recruiters have to be trained to eliminate all discrimination and they have to develop robust recruitment initiatives for the best talent available. Employers also have to promote equal pay. To fight the risk of isolation, they have to encourage women's networks within the company and provide strong role models and mentors for younger female employees. Employers must also establish and promote family friendly policies and flexible work schedules and encourage male and female employees to take advantage of those policies. Finally, they should participate in educational activities and in projects aimed at improving the situation of women in S&T employment (in association with public institutions or networks, for example).

Some recommendations to women that can be found in the literature are: display strength of character, be aware of your market value, learn to be more assertive and self-confident, get a mentor, keep your sense of humour – which includes the ability to take criticism in a good spirit – do not take things personally, be professionally visible: let managers know what you have accomplished and that you are ready for promotion.

Finally, no recommendations for men seem to exist. While women are encouraged, even pushed, to adapt their behaviour in order to avoid or overcome obstacles to their career advancement (such as discrimination), we wonder why men are never asked to adapt their behaviour so that women may feel better accepted in their work environment. However, men have an important role to play in removing the different barriers and making women feel more accepted at work. Also, in order to make it easier for women to combine their work and family lives, a more equal sharing of household tasks between men and women is required. Men also have to be aware that differences exist between men and women in terms of work behaviour and organisation, as well as in management approaches, and that such differences can enrich the organisation and efficiency of work.

Not promoting the presence of women in research activities means depriving firms of professional and scientific capabilities and expertise that would certainly be of great benefit to them. A lot remains to be done before parity is achieved and the remaining obstacles removed. However, if governments and policymakers, as well as companies and networks, are able to work together and build strong partnerships, matters will undoubtedly improve more quickly.

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- BELGIUM (ATOFINA, UNIBIOSCREEN AND PROCTER & GAMBLE), report written by Séverine Lemière, MATISSE-Université Paris I and DULBEA and Síle O'Dorchai, DULBEA, Free University of Brussels (ULB)
- DENMARK (A DANISH ANONYMOUS FIRM AND HALDOR TOPSOE), report written by Maria Jepsen, ETUI
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APPENDIX

APPENDIX 1: List of abbreviations

AAAS	American Association for the Advancement of Science
ABS	Australian Bureau of Statistics
AISES	The American Indian Science & Engineering Society
ANTA	Australian National Training Authority
APEC	Asia-Pacific Economic Co-operation
APESMA	The Association of Professional Engineers, Scientists and Managers
BE	Business Enterprise
BES	Business Enterprise Sector
BE-D	Business Enterprise Domain
BMBF	Bundesministerium für Bildung und Forschung, Germany
BT	British Telecom
CAWMSET	Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development
CEO	Chief Executive Officer
CIREM	Foundation Centre for European Initiatives and Research in the Mediterranean, Barcelona
CLFS	Community Labour Force Survey
DG	Directorate-General
DULBEA	Département d'Economie Appliquée de l'Université Libre de Bruxelles
EIRO	European Industrial Relations Observatory
ESES	European Structure of Earnings Survey
EST	Engineering, science and technology
ETAN	European Technology Assessment Network
EU	European Union
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GOV	Government Sector
GOV-D	Government Domain
H&SW-D	Health & Social Work-Domain
HC	Head Count
HES	Higher Education Sector
HE-D	Higher Education Domain
HR	Human Resources
HRST	Human resources in science and technology
IEAust	The Institution of Engineers, Australia
IfGH	Institut für Gewerbe-und Handelsforschung (Austrian Institute for Small Business Research)
ILO	International Labour Office
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
IT	Information Technology
JSAP	Japanese Society of Applied Physics
MIT	Massachusetts Institute of Technology
MoRST	Ministry of Research, Science and Technology (New Zealand)
NACE	Statistical Classification of Economic Activities in the European Community
NAMEPA	The National Association of Minority Engineering Program Administrators
NCR	National Cash Register Company
NISTEP	Institute for Science and Technology Policy (Japan)
NSBE	The National Society of Black Engineers
OECD	Organisation for Economic Co-operation and Development
OMCV	Cape Verdean Women's Organisation
PhD	Doctor
PNP	Private non-profit Sector
PNP-D	Private non-profit Domain
R&D	Research and Development
S&E	Science and Engineering
S&T	Science and Technology
SESTAT	Scientists and Engineers Statistical Data System
SET	Science, Engineering and Technology
SHPE	Society of Hispanic Professional Engineers
SMET	Science Mathematics Engineering and Technology
SWE	Society of Women Engineers
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US	United States
WEPAN	Women in Engineering Programs and Advocates Network
WI TS	Women in Technology and Science
WiS	Women in Science

APPENDIX 2: The literature review

The literature review ranges widely over national studies at European level, as well as papers describing the situation of women scientists and engineers in the United States, Canada, New Zealand, Australia and Japan for purposes of comparison.

However, information regarding the participation of women scientists in the industrial sector and, more specifically, studies devoted to the description of their situation are very scarce and fragmented.(1) In fact, across the European countries almost no studies exist on the specific conditions of women in industrial research and their personal feelings about their situation(2).

In this annex, it is possible to find the list of national studies used for the literature review as well as a list of web-sites

Appendix 2.1.: References

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(2) *Researchers in the industrial sector are a group which has barely been studied in comparison with researchers in the public sector.*

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Appendix 2.2.: List of web-sites

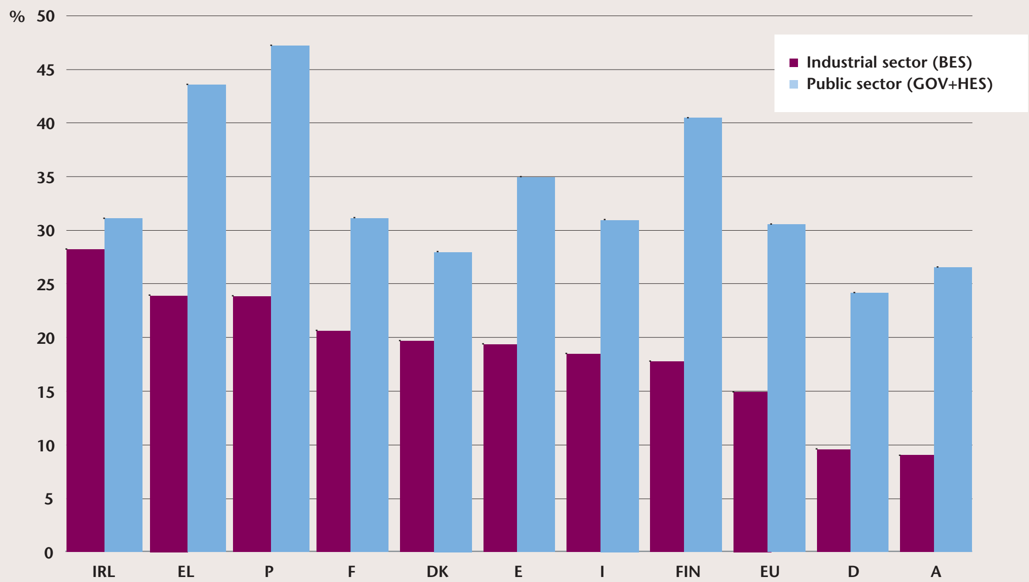
- Asia-Pacific Economic Cooperation (APEC), http://www.apec.org.sg/
- APEC Science and Technology web site, http://www.apecst.org/
- Association for Women in Science & Engineering (AwiSE), www.awise.org
- Association of Professional Engineers, Scientists and Managers (AU), www.apesma.asn.au
- Australian Bureau of Statistics, www.abs.gov.au
- Belgian Women in Science and engineering (BeWISE), http://bewise.naturalsciences.be/
- Canadian Coalition of Women in Engineering, Science and Technology (CCWEST), http://www.ccwest.org/english/ccwest.html
- Coalition for Equal Value Equal Pay (CEVEP) (NZ), http://www.cevep.org.nz/
- Daphne Jackson Trust (UK), http://www.daphnejackson.org/
- Federal Ministry of Education and Research (G), http://www.bmbf.de/
- Gender, Science and Technology Gateway, http://gstgateway.wigsat.org/TA/careers/whycareers.html
- Global Alliance, http://www.globalalliancesmet.org
- Ministry of Research, Science, and Technology (MoRST) (NZ), http://www.morst.govt.nz/
- Ministry of Women's Affairs (NZ), http://www.mwa.govt.nz/
- National Advisory Council on the Employment of Women (NACEW) (NZ), http://www.nacew.govt.nz/publications.htm
- National Association of Women Pharmacists (NAWP) (UK), www.nawp.org.uk/
- National Institute of Science and Technology (NISTEP) (JP), http://www.nistep.go.jp/achiev/ftx/eng/rep024e/text/rep024e.txt
- National Science Foundation (U.S.), http://www.nsf.gov/sbe/srs/seind00/start.htm
- New Zealand Association for Women in the Sciences (AWIS), http://www.awis.org.nz/
- New Zealand Council of Trade Unions (CTU), http://www.union.org.nz/
- New Zealand Government Online, http://www.govt.nz/
- Opportunity 2000/Education Steering Group, Tapping the Talent, http://www.lboro.ac.uk/orgs/opp2000/
- Participatory Research and Gender Analysis for Technology Development and Institutional Innovation (NZ), PRGA Program, http://www.prgaprogram.org/prga/
- Portia Project : Internet Gateway into SET for all women (UK), www.portia.ic.ac.uk
- Promoting SET for Women Unit, Department of Trade and Industry (UK), http://www.set4women.gov.uk
- Statistics Bureau & Statistics Center (JP), http://www.stat.go.jp/english/data/kagaku/1530.htm
- Statistics New Zealand, http://www.stats.govt.nz/
- Statistics of Chemistry Education, http://www.chemsoc.org/
- The Association for Science Education (UK), http://www.ase.org.uk/
- The Division for Advancement of Women in Engineering and Geoscience (DAWEG) (CA), http://tetra.mech.ubc.ca/daweg
- The Institution of Engineers (AU), www.ieaust.org.au
- The Society for Canadian Women in Science and Technology (SCWIST), http://www.harbour.sfu.ca/scwist/
- The Society of Women Engineers (U.S.), www.swe.org
- WISE Ottawa (http://www.wise-ottawa.ca/), WISE Newfoundland and Labrador (http://www.stemnet.nf.ca/WISE/), WISE Niagara, (Women in Science and Engineering)
- Women Chemists Network, www.rsc.org/lap/rsccom/wcc/wccindex.htm
- Women Education and Employment in Science and Technology (WEEST), http://www.cittadel-lascienza.it/weest/choice.htm
- Women in Physics Group, www.iop.org/IOP/Groups/WP
- Women in Science and Technology * Frauen in Naturwissenschaft und Technik (NUT) http://www.nut.de/
- Women in Science, Engineering and Technology (WiTEC) (UK), www.shu.ac.uk/witec
- Women in Technology and Science (WITS), http://www.witsireland.com/
- Women into Science and Engineering (WISE) (UK), www.wisecampaign.org.uk
- Women's Business Network (NZ), http://www.womens-business.org.nz/
- Women's Engineering Society (WES) (UK), www.wes.org.uk

A summary of the findings coming from de literature review has been written in which barriers that women encounter at the entry level but also during their career development as well as recommendations and good practices can be found.

APPENDIX 3: The quantitative part

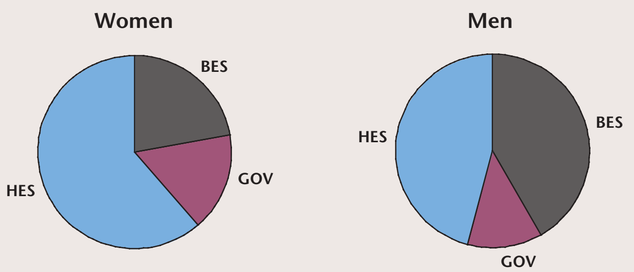
Appendix 3.1.: Graphs

GRAPH 1. Female proportion among RSEs by institutional sector and country, 1999



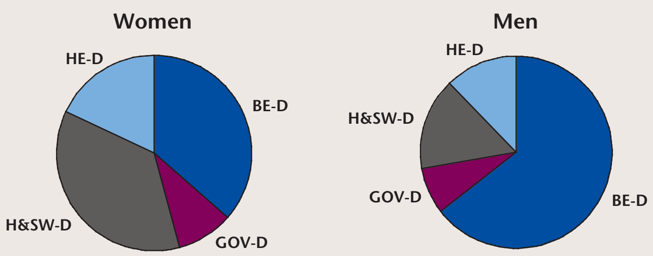
Source: DG Research, European R&D Survey; GOV data for Germany and Ireland from European Commission, 2002b
Notes: 1) Germany: BES data in FTE; GOV data in HC are estimated;
2) Ireland: GOV's definition differs from Frascati Manual's, GOV data in HC are estimated
Missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom
Exceptions to the reference year: Austria (1998) and BES data in France (2000), Italy (2000) and Ireland (2001)

GRAPH 2. Breakdown of RSEs by institutional sector and sex, EU10, 1999



Source: DG Research, European R&D Survey; GOV data for Germany and Ireland from European Commission, 2002b
Notes: 1) Germany: BES data in FTE; GOV data in HC are estimated; 2) Ireland: GOV's definition differs from Frascati Manual's, GOV data in HC are estimated
Missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom
Exceptions to the reference year: Austria (1998) and BES data in France (2000), Italy (2000) and Ireland (2001)

GRAPH 3. Breakdown of S&E by institutional sector and sex, EU15, 2000

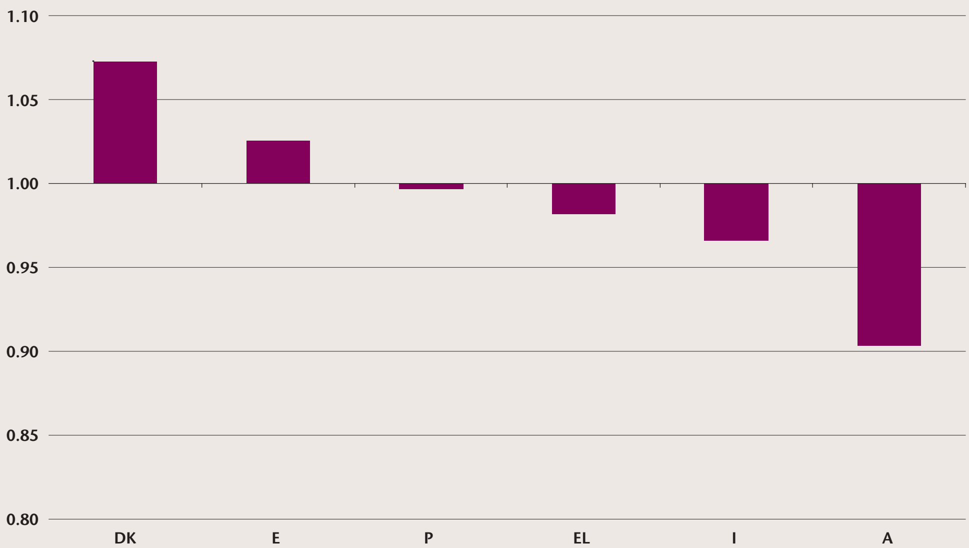


Source: Eurostat, Community Labour Force Survey (CLFS)

GRAPH 4. Percentage of industrial RSEs among all RSEs by sex and country, 1999

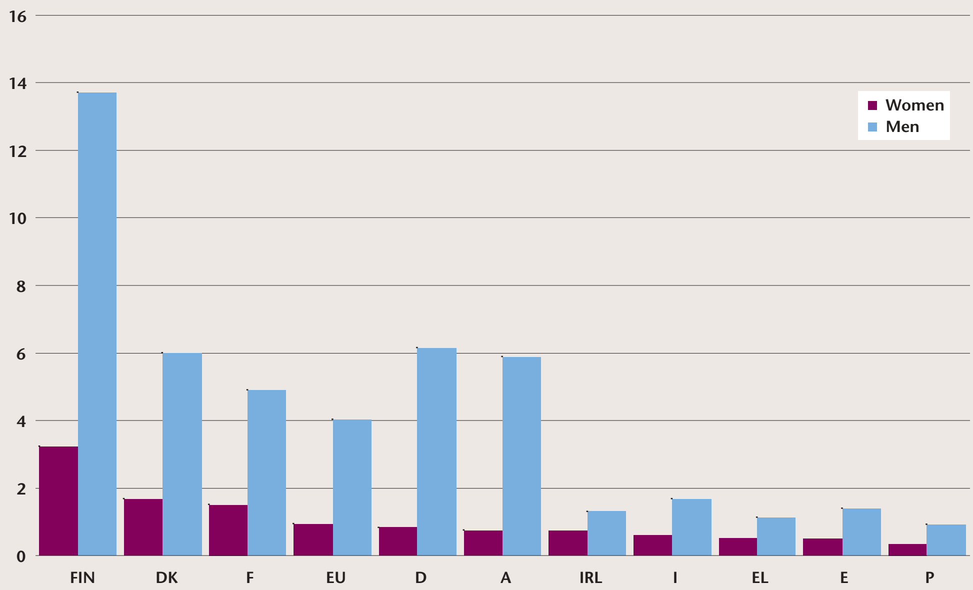
Source: DG Research, European R&D Survey ;GOV data for Germany and Ireland from European Commission, 2002b
Notes: 1) Germany: BES data in FTE; GOV data in HC are estimated;
2) Ireland: GOV's definition differs from Frascati Manual's, GOV data in HC are estimated
Missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom
Exceptions to the reference year: Austria (1998) and BES data in France (2000), Italy (2000) and Ireland (2001)

GRAPH 5. Gender gap in the FTE/HC ratio for industrial RSEs by country (ratio between female and male ratios), 1999



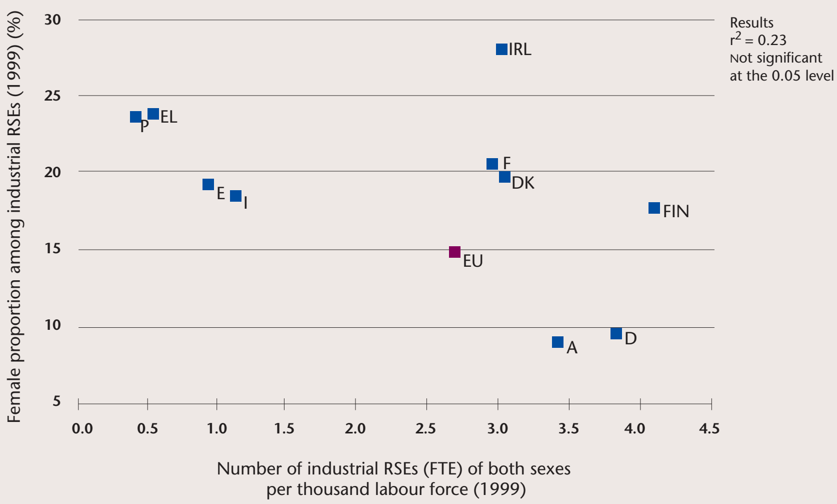
Source: DG Research, European R&D Survey
Missing countries: Belgium, Germany, France, Ireland, Luxembourg, the Netherlands, Finland, Sweden and the United Kingdom
Exceptions to the reference year: Austria (1998) and Italy (2000)

GRAPH 6. Number of industrial RSEs per thousand labour force by sex and country, 1999



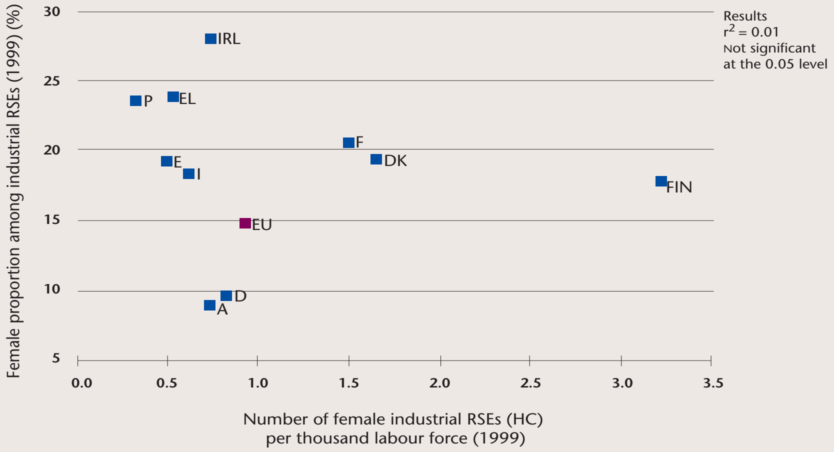
Source: DG Research, European R&D Survey; Eurostat, Community Labour Force Survey (CLFS)
Notes: Germany data in FTE
Missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom
Exceptions to the reference year: Austria (1998), France (2000), Italy (2000) and Ireland (2001)

GRAPH 7. Female proportion among industrial RSEs and number of industrial RSEs in FTE per thousand labour force by country, 1999



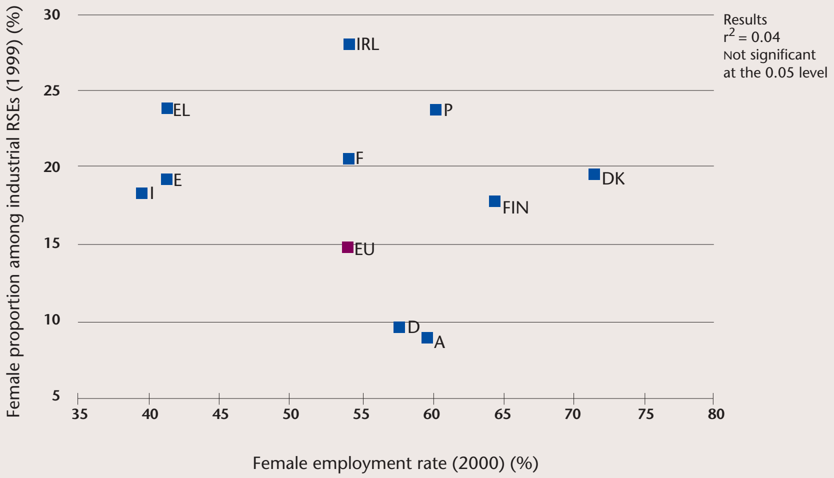
Source and notes:
i) Female proportion among industrial RSEs. Source: DG Research, European R&D Survey; Eurostat, Community Labour Force Survey (CLFS);
Notes: Germany data in FTE; Missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom;
Exceptions to the reference year: Austria (1998), France (2000), Italy (2000) and Ireland (2001)
ii) Number of industrial RSEs (FTE) of both sexes per thousand labour force. Source: own calculations based on European Commission 2002a and Eurostat, Community Labour Force Survey (CLFS)

GRAPH 8. Female proportion among industrial RSEs and number of female industrial RSE per thousand labour force by country, 1999



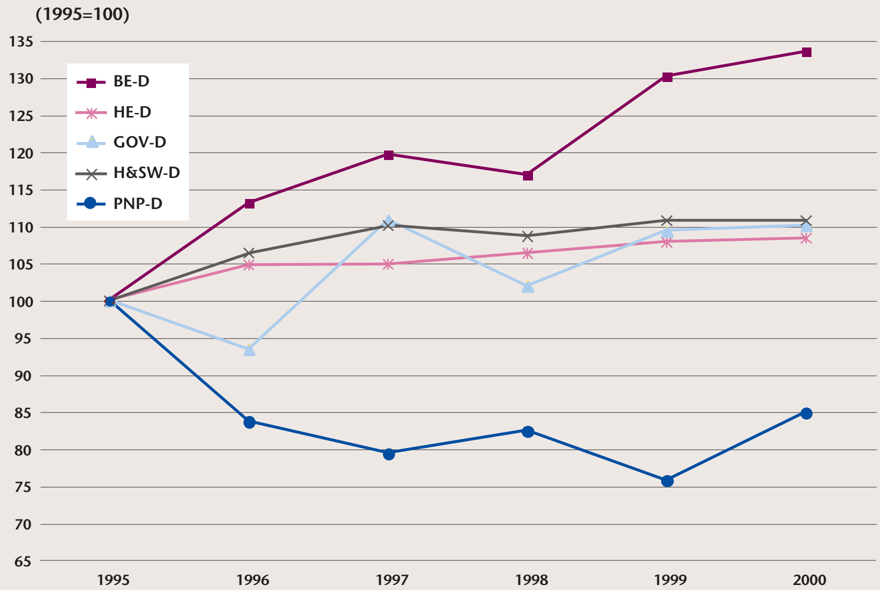
Source: DG Research, European R&D Survey; Eurostat, Community Labour Force Survey (CLFS)
Notes: Germany: data in FTE; Missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom
Exceptions to the reference year: Austria (1998), France (2000), Italy (2000) and Ireland (2001)

GRAPH 9. Female proportion among industrial RSEs and female employment rate, 1999/2000



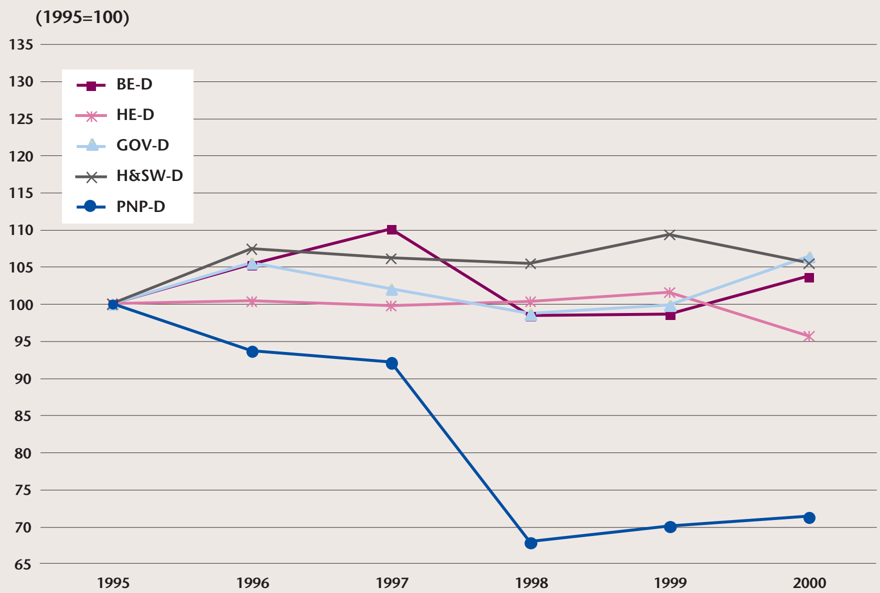
Source: DG Research, European R&D Survey; Eurostat, Community Labour Force Survey (CLFS)
Notes on RSEs data: Germany data in FTE; Missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom;
Exceptions to the reference year: Austria (1998), France (2000), Italy (2000) and Ireland (2001)

GRAPH 10. Trends in female S&E employment by institutional sector, EU15 (1995-2000)



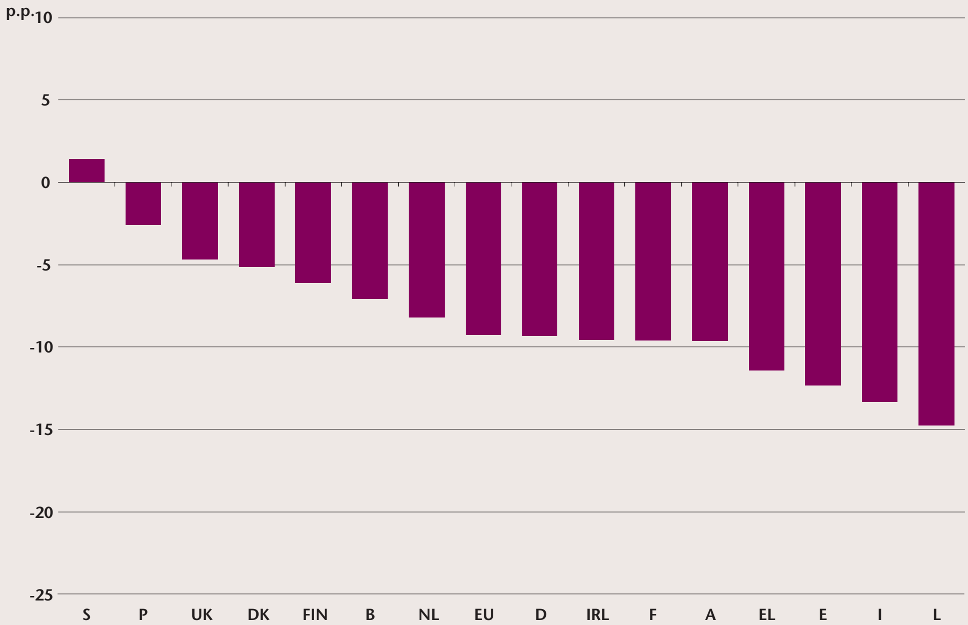
Source: Eurostat, Community Labour Force Survey (CLFS)
Notes: Data from 1995 to 1997 refer to ISCED76 6, 7 and 8 degrees; data from 1998 to 2000 refer to ISCED97 5A and 6 degrees; estimated values: Germany (1998); Ireland (1998, 1999); Luxembourg (1998); the Netherlands (1995); Finland (1995, 1996); Sweden (1995, 1996, 1997); the United Kingdom (1998)

GRAPH 11. Trends in male S&E employment by institutional sector, EU15 (1995-2000)



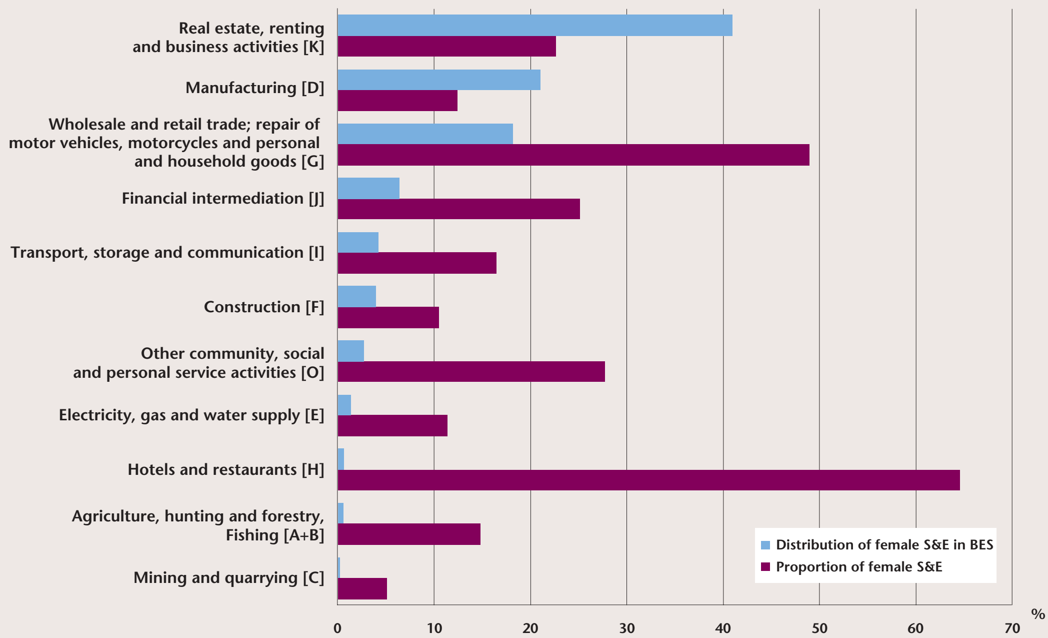
Source: Eurostat, Community Labour Force Survey (CLFS)
Notes: Data from 1995 to 1997 refer to ISCED76 6, 7 and 8 degrees; data from 1998 to 2000 refer to ISCED97 5A and 6 degrees; estimated values: Germany (1998); Ireland (1998, 1999); Luxembourg (1998); the Netherlands (1995); Finland (1995, 1996); Sweden (1995, 1996, 1997); the United Kingdom (1998)

GRAPH 12. Employment gender gap for highly qualified persons by country, 2000



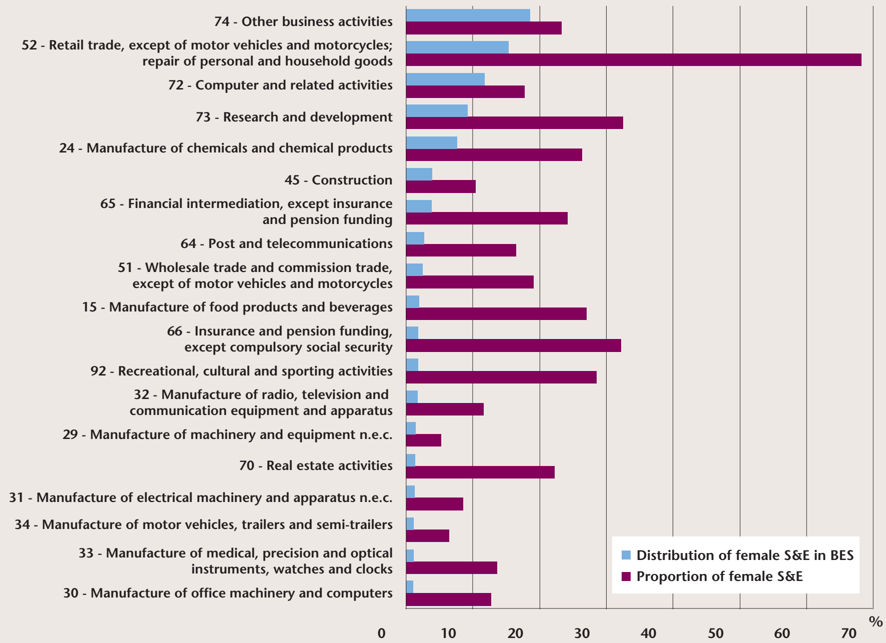
Source: Eurostat, Community Labour Force Survey (CLFS)

GRAPH 13. Female proportion and employment share of female industrial S&E by economic activity (NACE-1), EU15, 2000



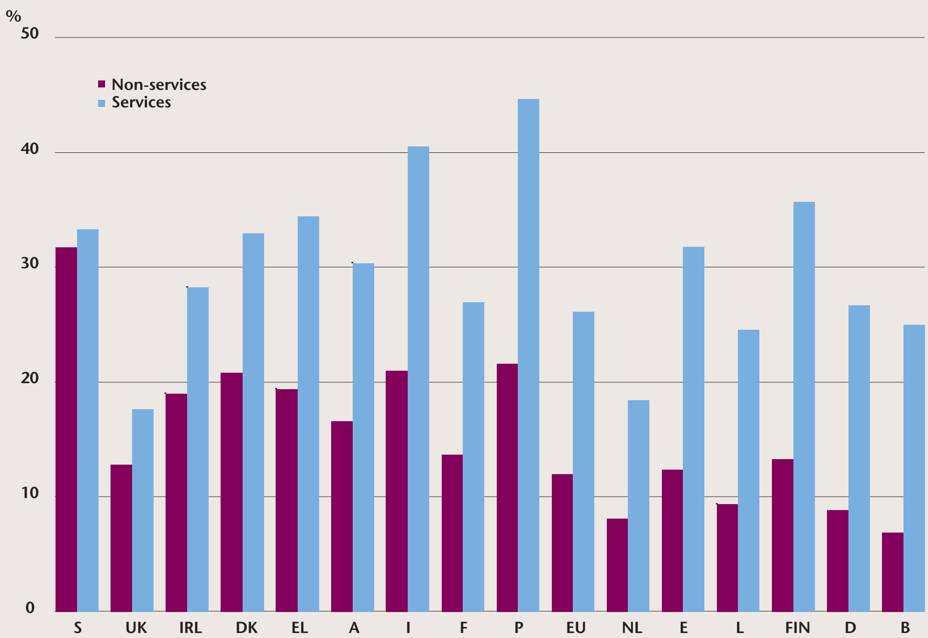
Source: Eurostat, Community Labour Force Survey (CLFS)

GRAPH 14. Female proportion and employment share of female industrial S&E by economic activity (NACE-2), EU15, 2000



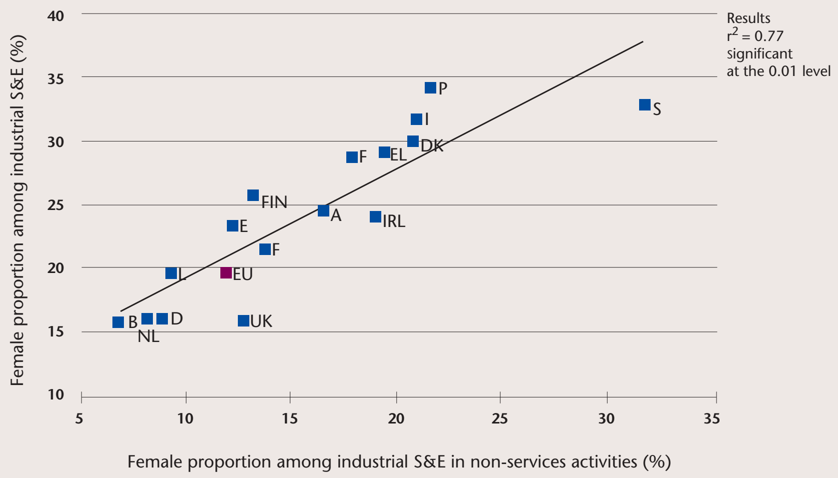
Source: Eurostat, Community Labour Force Survey (CLFS)

GRAPH 15. Female proportion among industrial S&E by economic activity and country, 2000



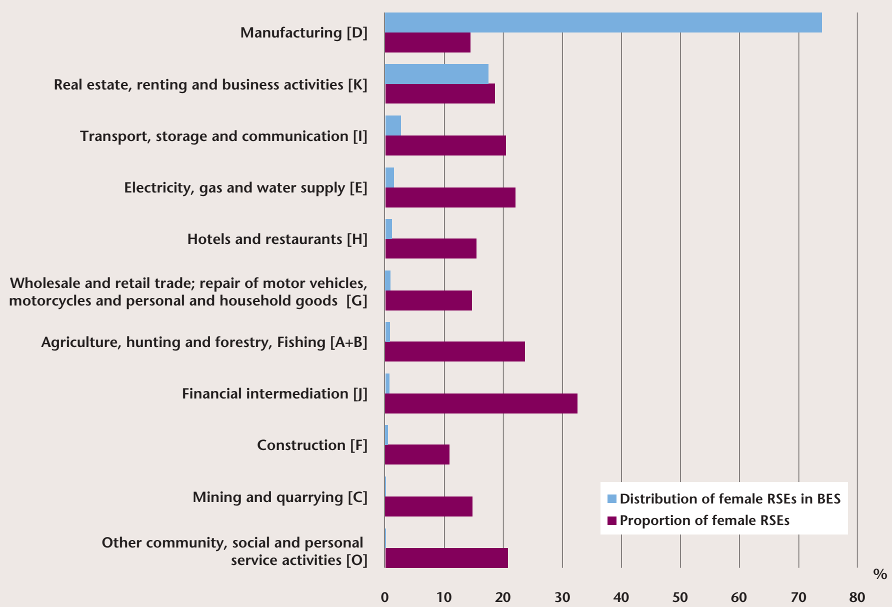
Source: Eurostat, Community Labour Force Survey (CLFS)

GRAPH 16. Female proportions among industrial S&E in the overall industrial domain and in nonservices activities by country, 2000



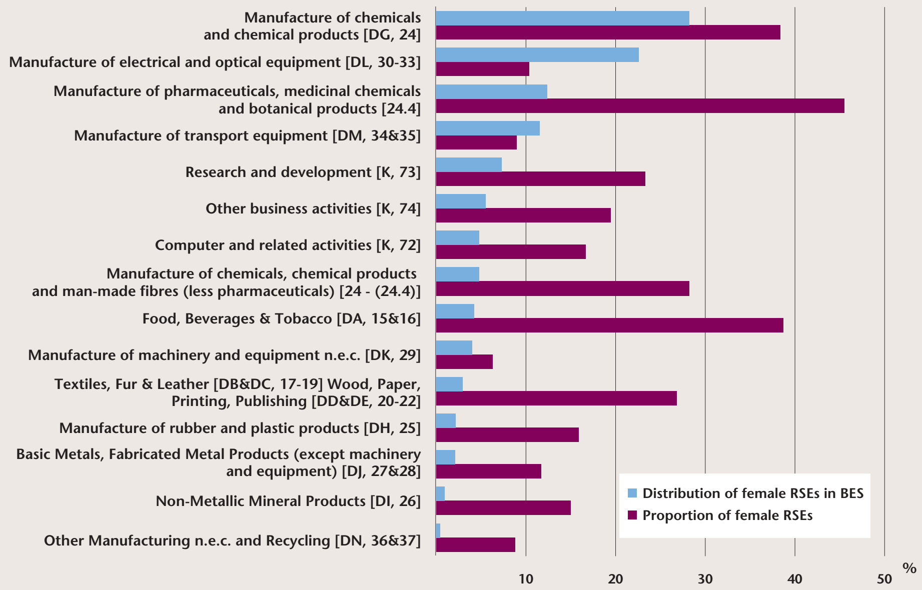
Source: Eurostat, Comunity Labour Force Survey (CLFS)

GRAPH 17. Female proportion and employment share of female industrial RSEs by economic activity (NACE-1), EU15, 1999



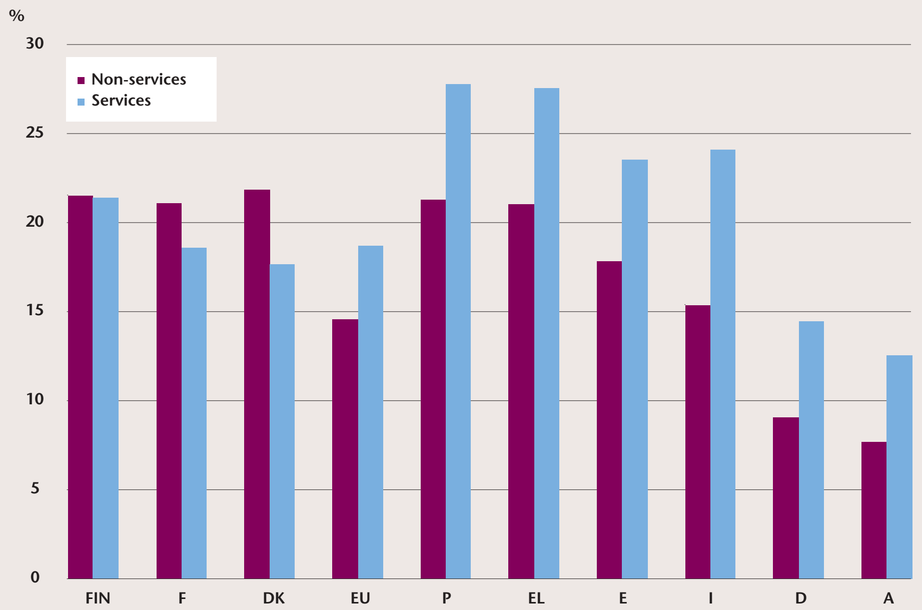
Source: DG Research, European R&D Survey
Missing countries: Belgium, Ireland, Luxembourg, the Netherlands, Sweden, the United Kingdom. Germany data in FTE
Exceptions to the reference year: Austria (1998); France and Finland (2000)

GRAPH 18. Female proportion and employment share of female industrial RSEs by economic activity (NACE-2), EU15, 1999



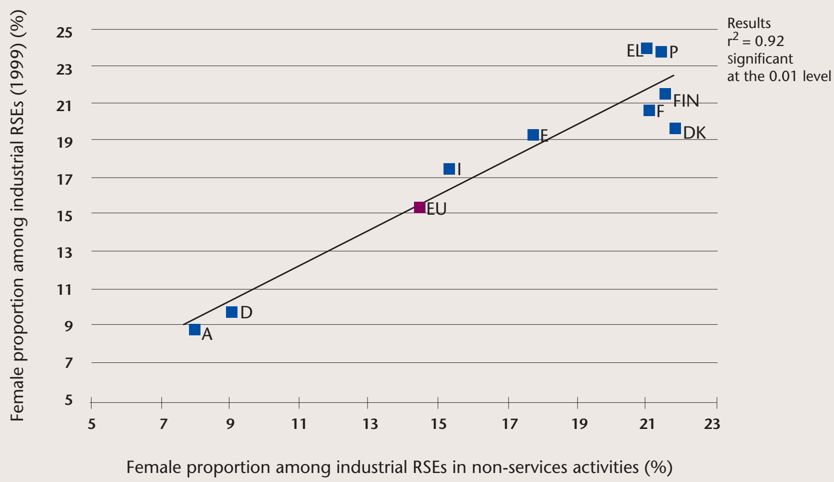
Source: DG Research, European R&D Survey
Missing countries: Belgium, Ireland, Luxembourg, the Netherlands, Sweden, the United Kingdom. Germany data in FTE
Missing NACE data: 72 (Germany); 24.4 (Germany and France)
Exceptions to the reference year: Austria (1998); France and Finland (2000)

GRAPH 19. Female proportion among industrial RSEs by economic activity and country, 2000



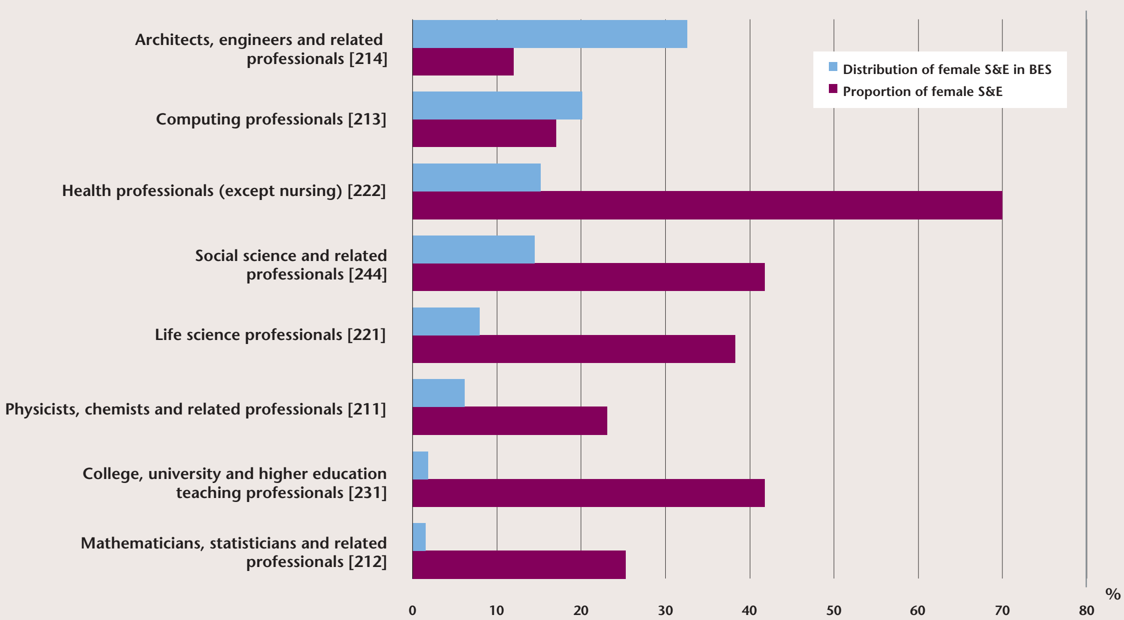
Source: DG Research, European R&D Survey
Missing countries: Belgium, Ireland, Luxembourg, the Netherlands, Sweden, the United Kingdom. Germany data in FTE
Missing NACE data: 72 (Germany); 24.4 (Germany and France)
Exceptions to the reference year: Austria (1998); France and Finland (2000)

GRAPH 20. Female proportions among industrial RSEs in the overall industrial sector and in non-services activities by country, 1999



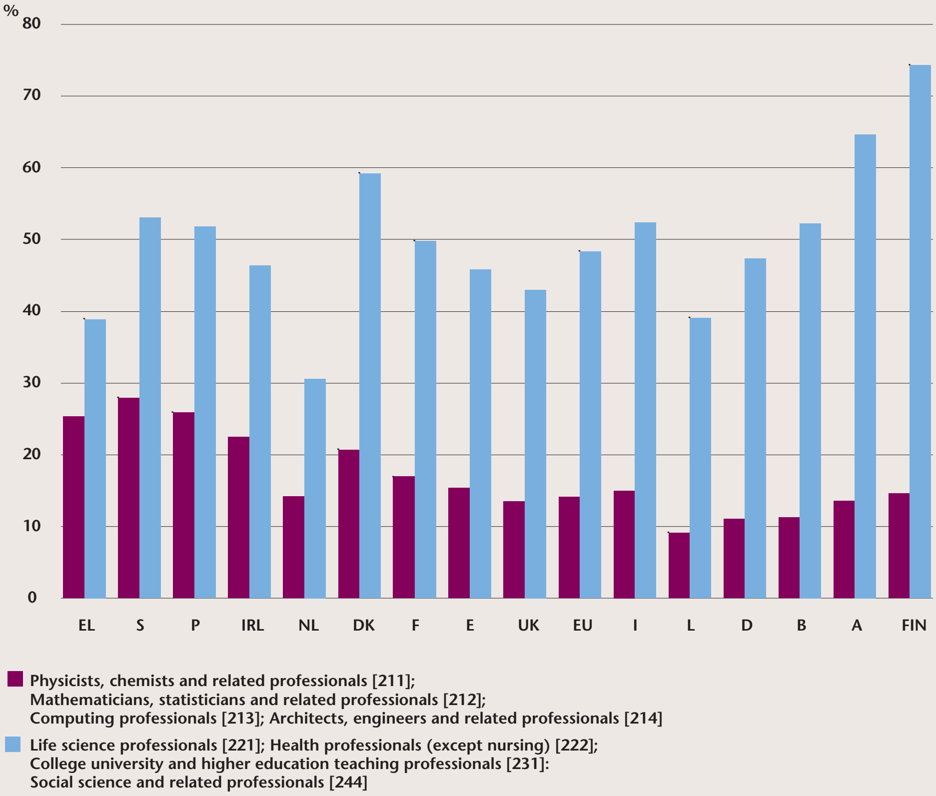
Source: DG Research, European R&D Survey
Missing countries: Belgium, Ireland, Luxembourg, the Netherlands, Sweden and the United Kingdom; Germany data in FTE
Exceptions to the reference year: Austria (1998), France and Finland (2000)

GRAPH 21. Female proportion and employment share of female industrial S&E by occupation, EU15, 2000



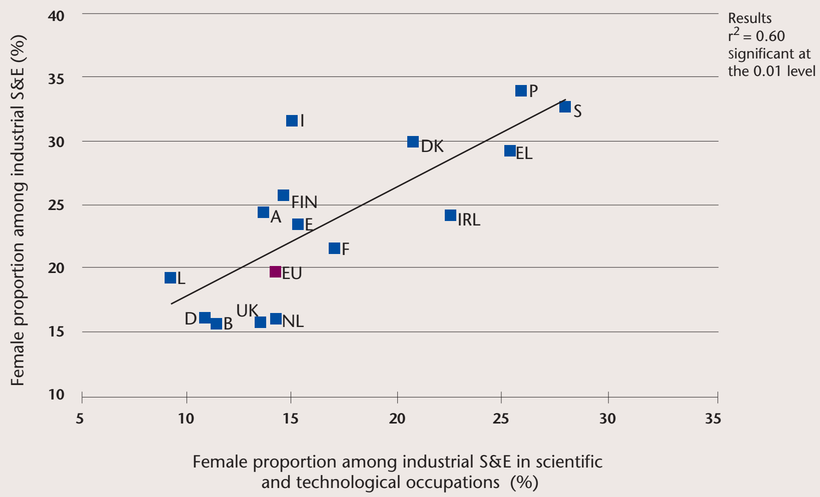
Source: Eurostat, Community Labour Force Survey (CLFS)

GRAPH 22. Female proportion among industrial S&E by occupation and country, 2000



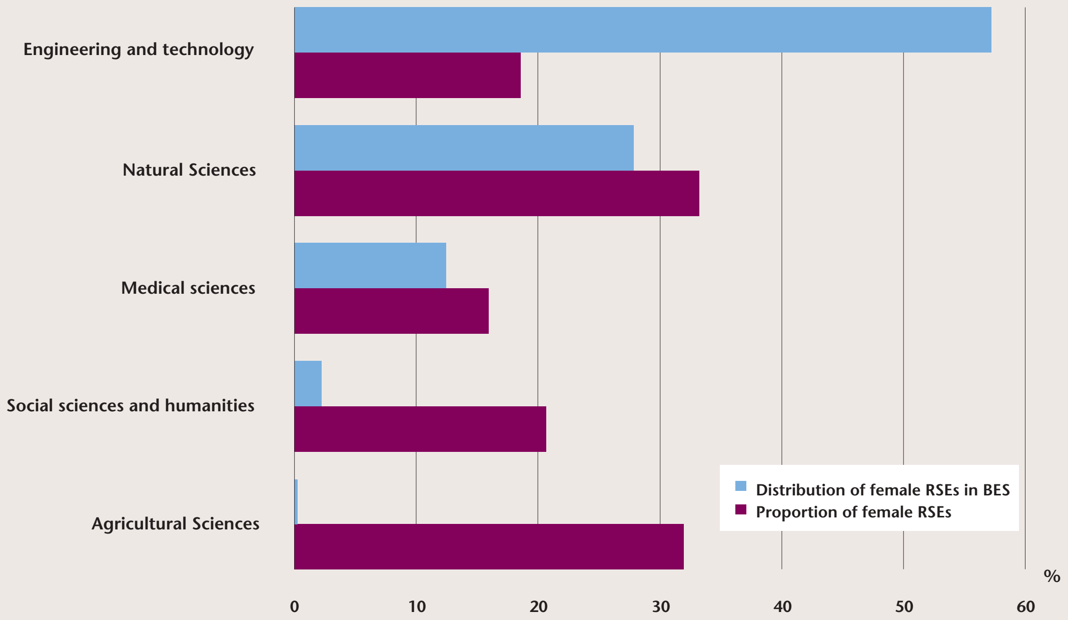
Source: Eurostat, Community Labour Force Survey (CLFS)

GRAPH 23. Female proportions among industrial S&E in the overall industrial domain and in scientific and technological occupations by country, 2000



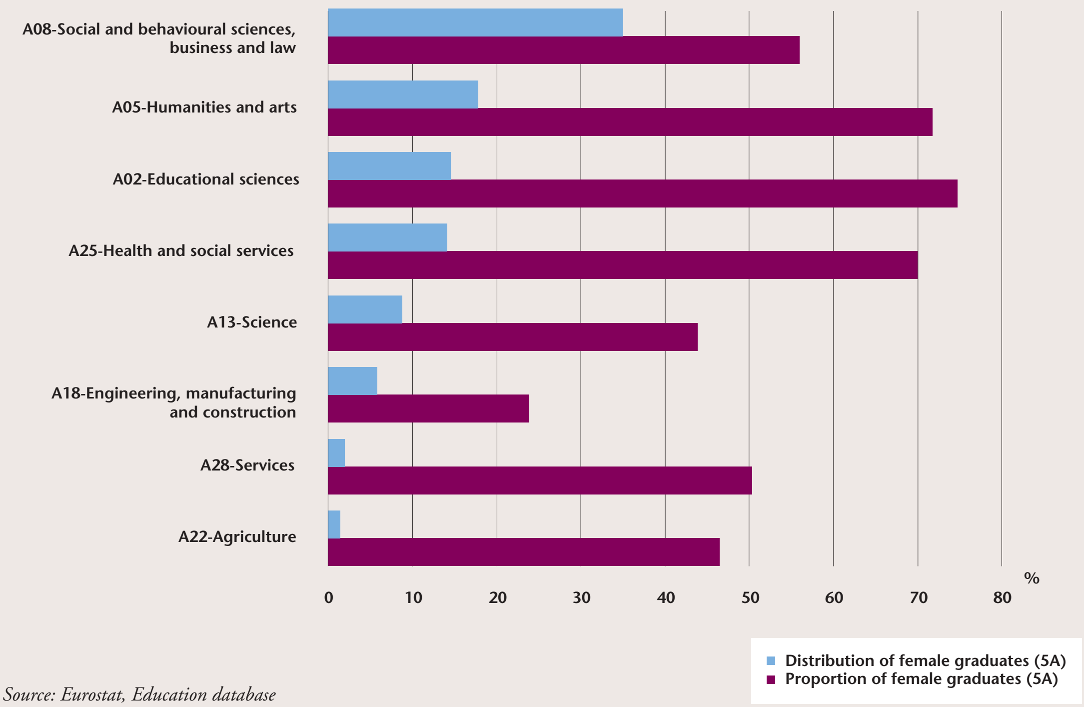
Source: Eurostat, Comunity Labour Force Survey (CLFS)

GRAPH 24. Female proportion and employment share of female industrial RSEs by field of science (Data from France and Portugal), 1999



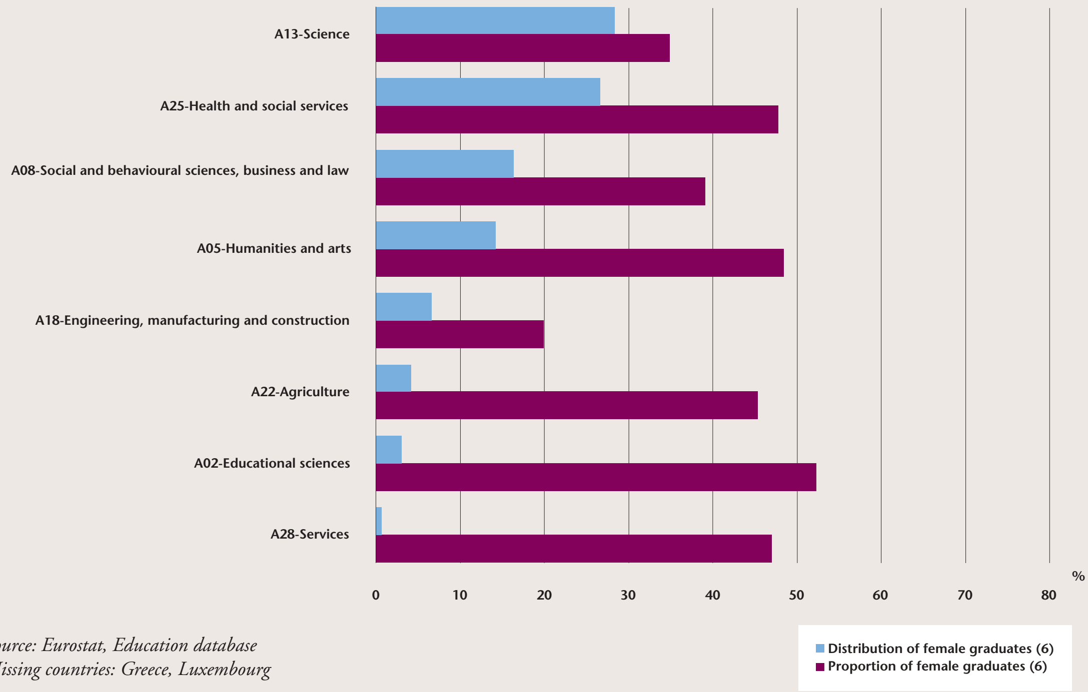
Source: DG Research, European R&D Survey

GRAPH 25. Female proportion and share of female graduates (ISCED 5A) by main field of study, 2000



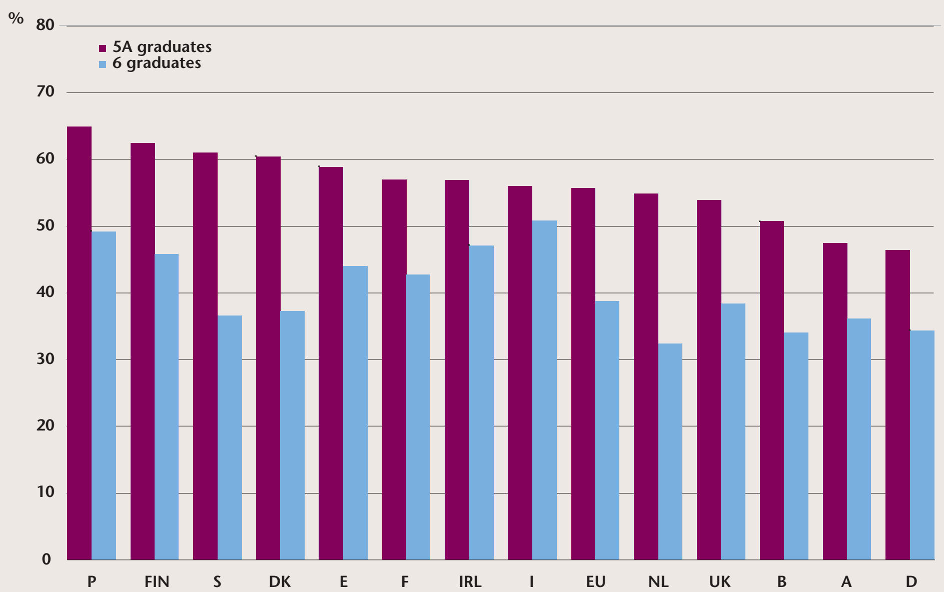
Source: Eurostat, Education database
Missing countries: Greece, Luxembourg

GRAPH 26. Female proportion and share of female graduates (ISCED 6) by main field of study, 2000



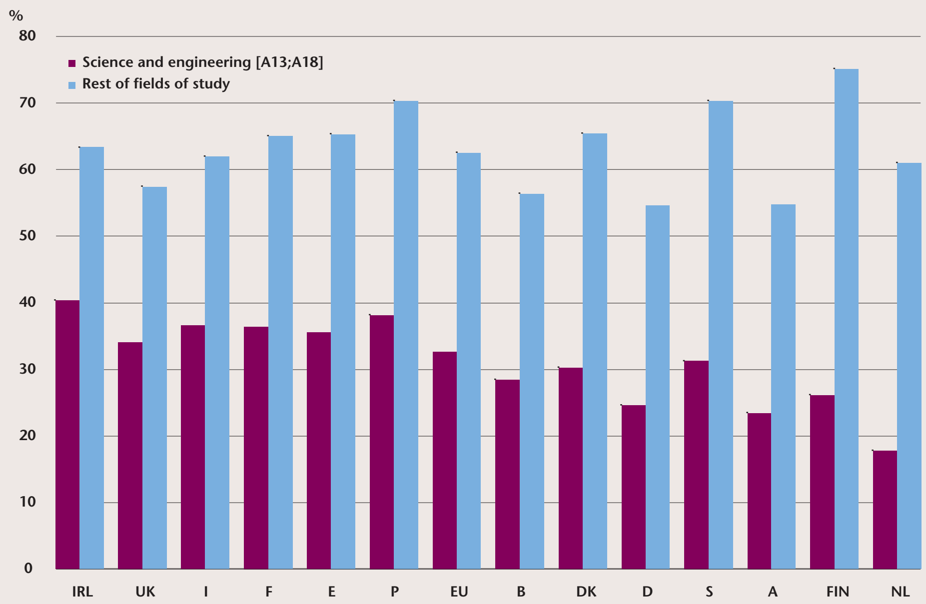
Source: Eurostat, Education database
Missing countries: Greece, Luxembourg

GRAPH 27. Female proportions among graduates by ISCED degree (5A and 6) and country, 2000



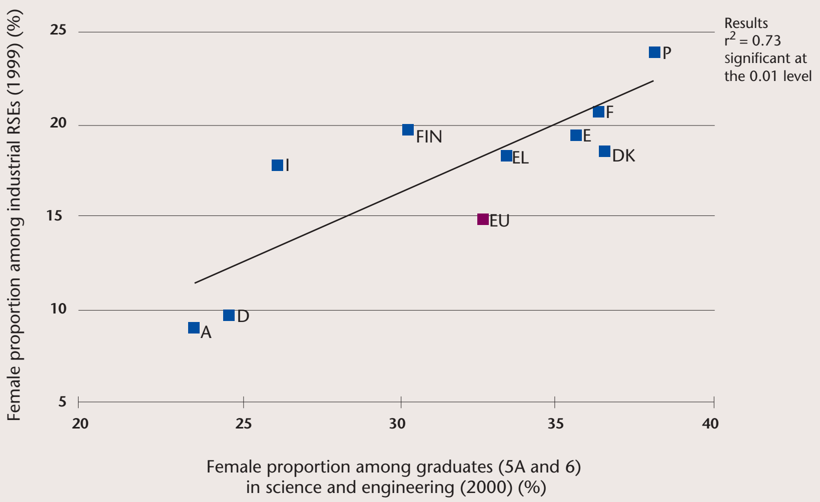
Source: Eurostat, Education database
Missing countries: Greece, Luxembourg

GRAPH 28. Female proportion among graduates (ISCED 5A and 6) by field of study and country, 2000



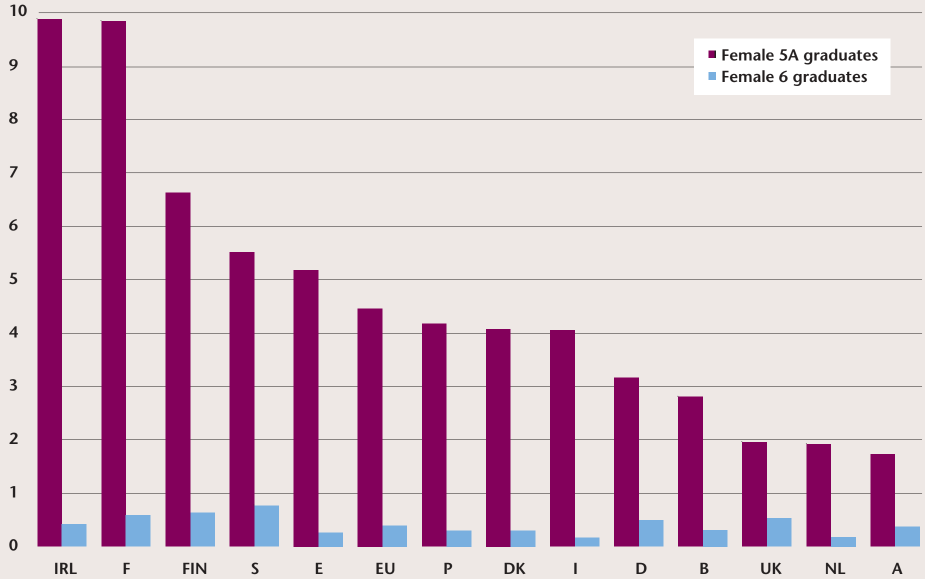
Source: Eurostat ,Education database
Missing countries: Greece, Luxembourg

GRAPH 29. Female proportions among industrial RSEs and among graduates (ISCED 5A and 6) in science and engineering, 2000



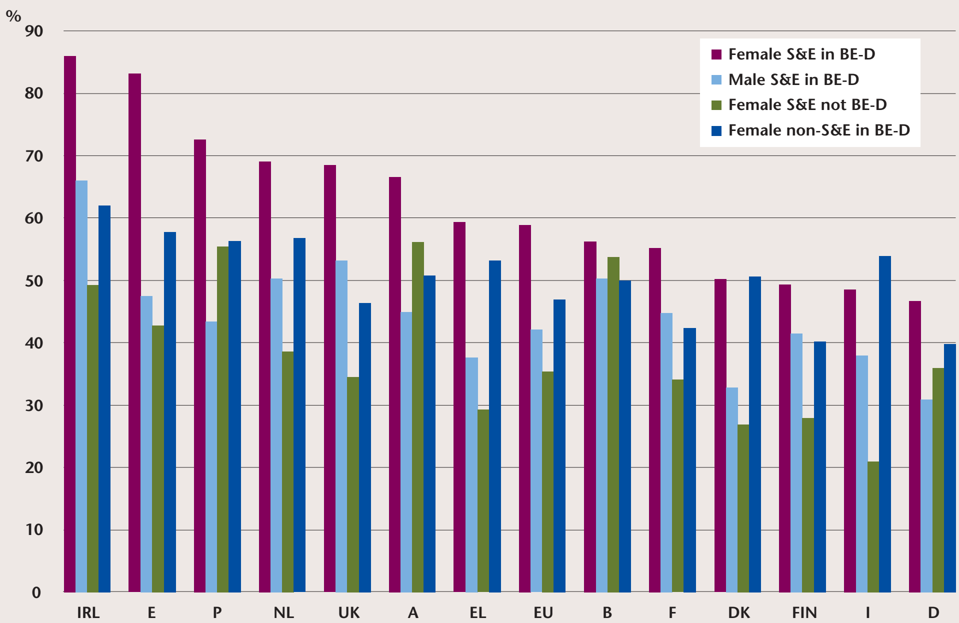
Source: DG Research, European R&D Survey and Eurostat, Education database
Missing countries: Belgium, Greece, Ireland, Luxembourg, the Netherlands, Sweden and the United Kingdom. Germany data in FTE
Exceptions to the reference year for RSEs data: Austria (1998), France and Finland (2000)

GRAPH 30. Number of female graduates (ISCED 5A and 6) in science and engineering per thousand 20-29 population by country, 2000



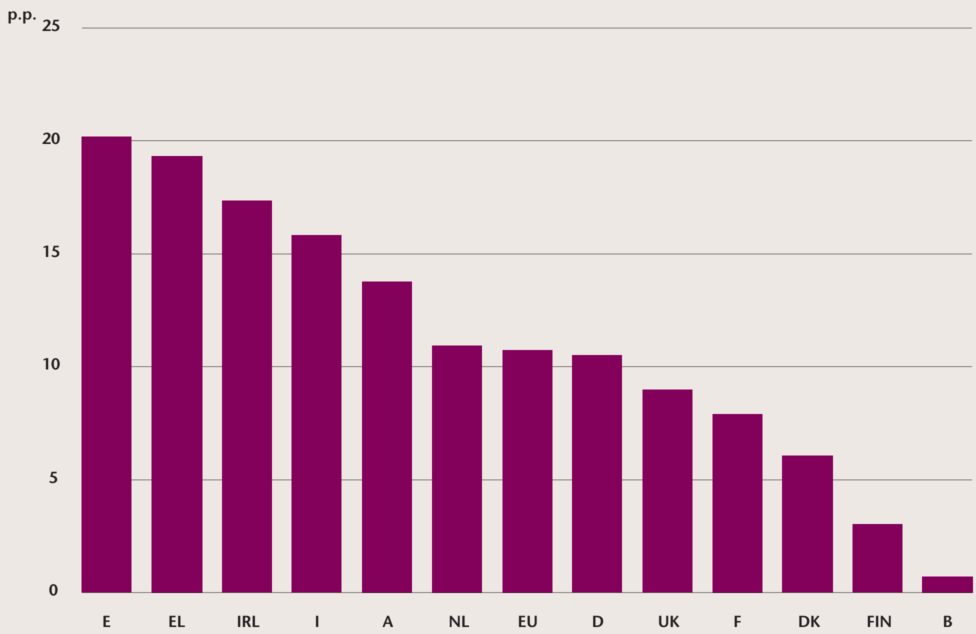
Source: Eurostat, Education database and Community Labour Force Survey (CLFS)
Missing countries: Greece, Luxembourg

GRAPH 31. Percentage of under 35 years old: Female and male S&E in the industrial domain; Female S&E not in the industrial domain; Female non-S&E in the industrial domain; 2000



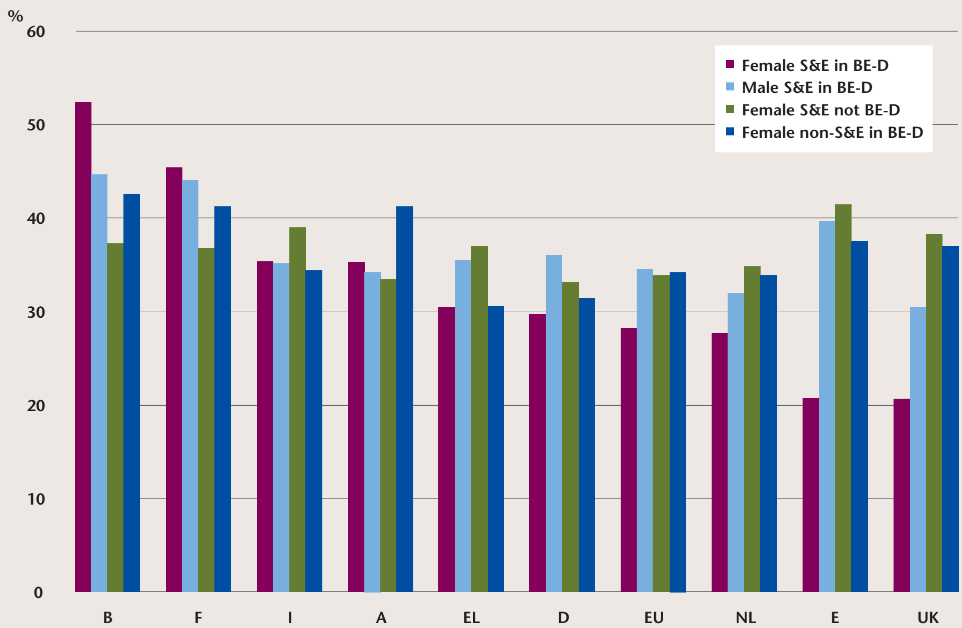
Source: Eurostat, Community Labour Force Survey (CLFS)
No reliable data for Luxembourg and Sweden

GRAPH 32. Age differential in the female proportion among industrial S&E in scientific and technological occupations (under 35 years old and 35 or more), 2000



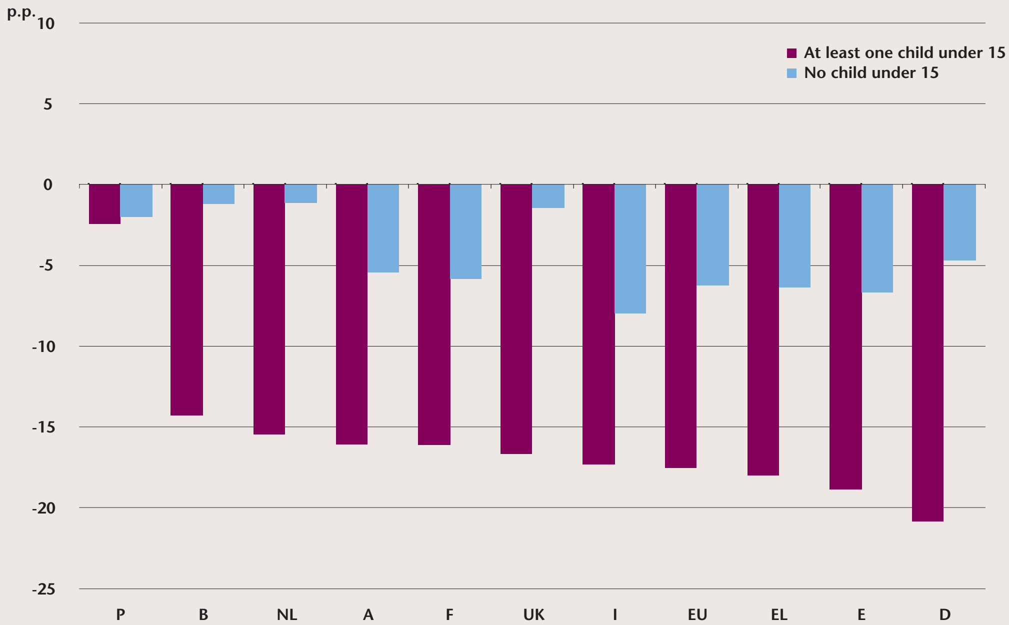
Source: Eurostat, Community Labour Force Survey (CLFS)
No reliable data for Luxembourg, Portugal and Sweden

GRAPH 33. Percentage with at least one child under 15: Female and male S&E in the industrial domain; Female S&E not in the industrial domain; Female non-S&E in the industrial domain; 2000



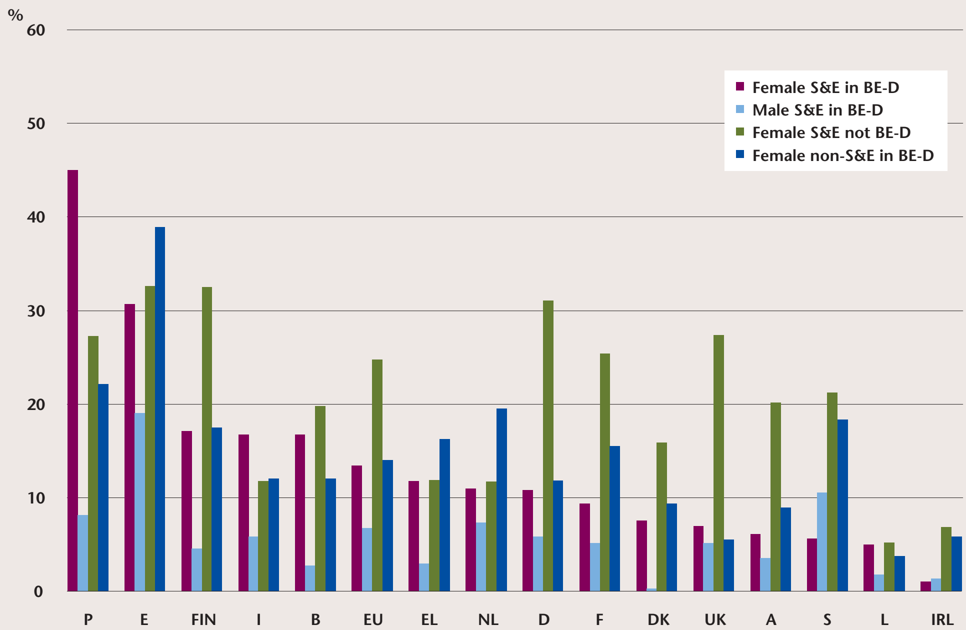
Source: Eurostat, Community Labour Force Survey (CLFS)
No available data for Denmark, Ireland, Finland and Sweden; no reliable data for Luxembourg and Portugal

GRAPH 34. Gender employment gap for highly qualified population by family situation, 2000



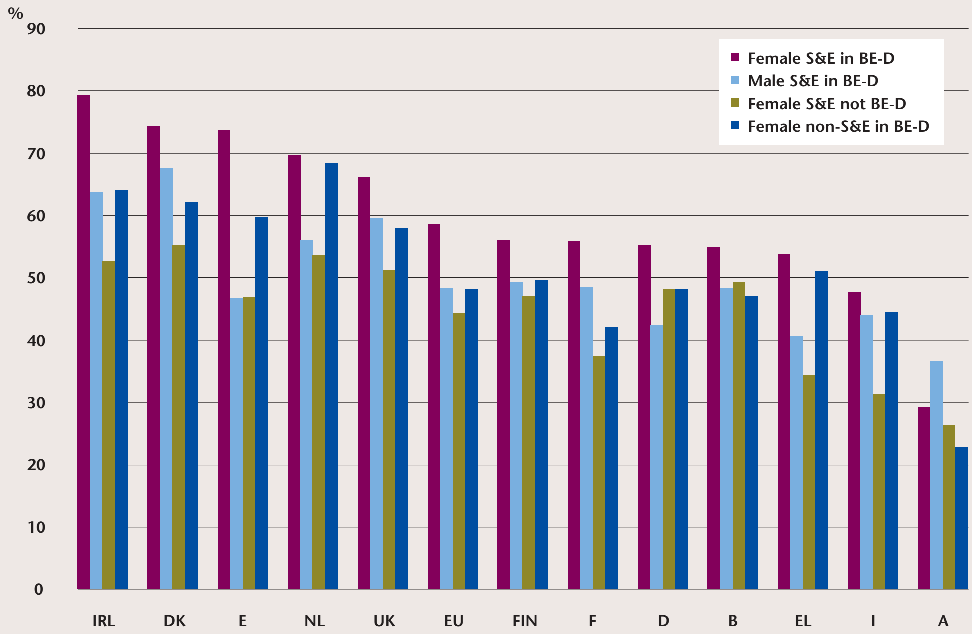
Source: Eurostat, Community Labour Force Survey (CLFS)
No available data for Denmark, Ireland, Finland and Sweden; no reliable data for Luxembourg

GRAPH 35. Percentage with a temporary contract: Female and male S&E in the industrial domain; Female S&E not in the industrial domain; Female non-S&E in the industrial domain; 2000



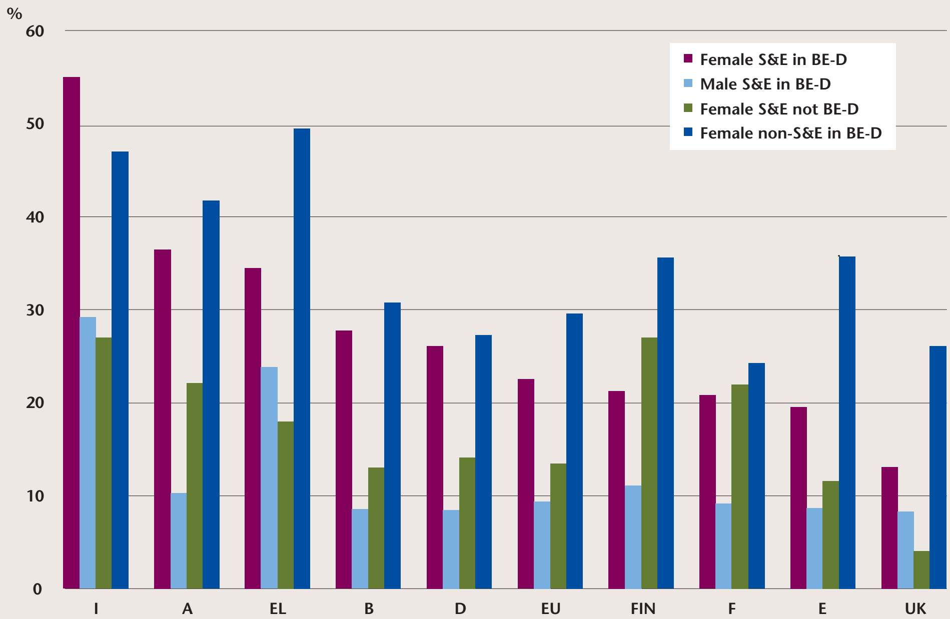
Suorce: Eurostat, Community Labour Force Survey (CLFS)

GRAPH 36. Percentage in current job less than 5 years: Female and male S&E in the industrial domain; Female S&E not in the industrial domain; Female non-S&E in the industrial domain; 2000



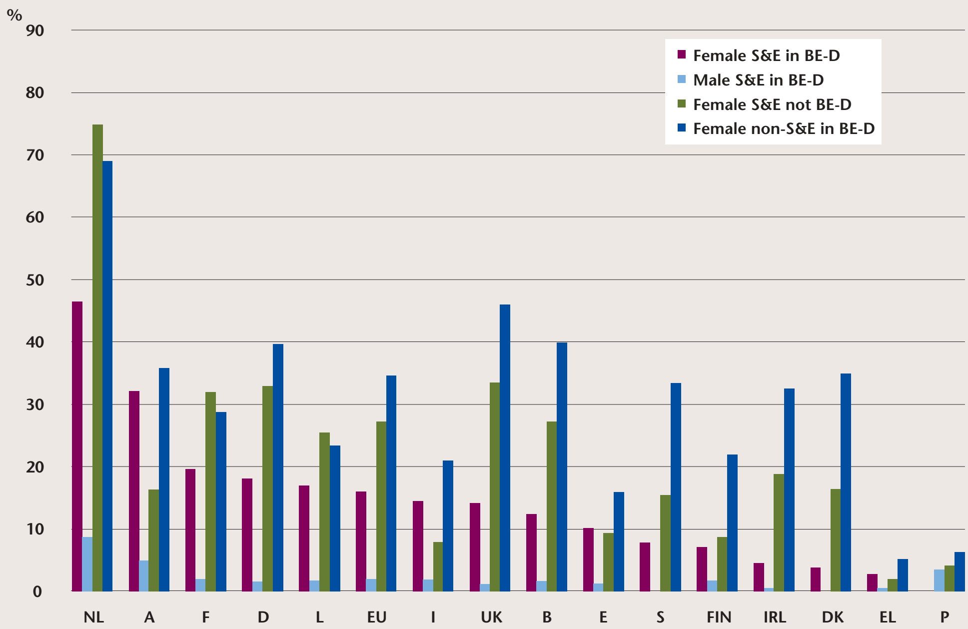
Source: Eurostat, Community Labour Force Survey (CLFS)
No reliable data for Luxembourg, Portugal and Sweden

GRAPH 37. Percentage working in 10 or less persons establishment: Female and male S&E in the industrial domain; Female S&E not in the industrial domain; Female non-S&E in the industrial domain; 2000



Source: Eurostat, Community Labour Force Survey (CLFS)
No available data for Ireland; no reliable data for Denmark, Luxembourg , the Netherlands, Portugal

GRAPH 38. Percentage working part-time: Female and male S&E in the industrial domain; Female S&E not in the industrial domain; Female non-S&E in the industrial domain; 2000



Source: Eurostat, Community Labour Force Survey (CLFS)

Appendix 3.2.: Benchmarking indicators and national profiles on women's participation in industrial research

This Annex presents i) the selected set of benchmarking indicators on women's participation in industrial research for the 15 EU Member States and ii) the national profiles on women's participation in industrial research for every EU Member State.

3.2.1. Benchmarking indicators on women's participation in industrial research

The benchmarking indicators on women's participation in industrial research are the following:

Target group	Indicator	Definition	Source
Industrial researchers	**1. Female proportion among industrial researchers**		
		Number of female industrial researchers divided by the number of industrial researchers of both sexes, multiplied by 100	European R&D Survey
	2. Number of industrial researchers per thousand labour force by sex		
		2a. Number of female industrial researchers divided by the female labour force, multiplied by 1,000	European R&D Survey CLFS
		2a. Number of male industrial researchers divided by the male labour force, multiplied by 1,000	
	3. Gender gap in the FTE/HC ratio for industrial researchers		
		Ratio between 1) the number of FTE female industrial researchers divided by the number of HC female industrial researchers and 2) the number of FTE male industrial researchers divided by the number of HC male industrial researchers	European R&D Survey
	4. Female proportion among industrial researchers in non-service sectors		
		Number of female industrial researchers in non-service sectors divided by the number of industrial researchers of both sexes in non-service sectors, multiplied by 100 (Non-service sectors are NACE A–F)	European R&D Survey
Highly qualified population (population holding ISCED 5A or 6 degree)	**5. Gender employment gap for highly qualified population**		
		Difference in percentage points between 1) employment rate of highly qualified women 15-64 and 2) employment rate of highly qualified men 15-64	CLFS
	6. Gender employment gap for highly qualified population by family situation		
		6a. Difference in percentage points between 1) employment rate of highly qualified women 15-49 having at least one child under 15 and 2) employment rate of highly qualified men 15-49 having at least one child under 15	CLFS
		6b. Difference in percentage points between 1) employment rate of highly qualified women 15-49 without children under 15 2) employment rate of highly qualified men 15-49 without children under 15	CLFS

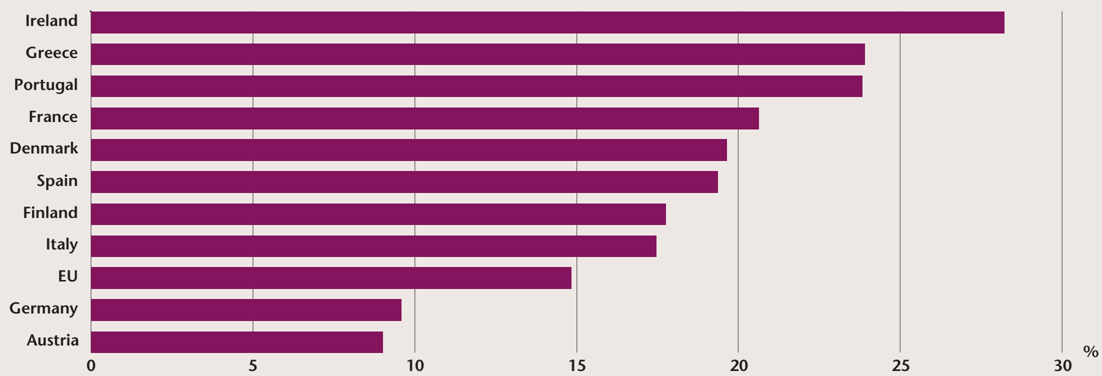
Target group	Indicator	Definition	Source
Industrial scientists and engineers (Employees holding ISCED 5A or 6 degree; working as ISCO-88 211, 212, 213, 214, 221, 222, 231, 244 in NACE 1-74)	**7. Female proportion of industrial scientists and engineers in scientific and technological occupations**		
		Number of female industrial scientists and engineers in scientific and technological occupations divided by the number of industrial scientists and engineers in scientific and technological occupations of both sexes, multiplied by 100 (Scientific and technological occupations are ISCO-88 211, 212, 213, 214)	CLFS
	8. Age differential in the female proportion of industrial scientists and engineers in scientific and technological occupations		
		Difference in percentage points between 1) female proportion of industrial scientists and engineers under 35 years of age in scientific and technological occupations and 2) female proportion of industrial scientists and engineers of 35 or more years of age in scientific and technological occupations (Scientific and technological occupations are ISCO-88 211, 212, 213, 214)	CLFS
ISCED 5A graduates	**9. Female proportion among ISCED 5A graduates**		
		Number of female ISCED 5A graduates divided by the number of ISCED 5A graduates of both sexes, multipliedby 100	Education database
	10. Female proportion among ISCED 5A graduates in science and engineering		
		Number of female ISCED 5A graduates in science and engineering divided by the number of ISCED 5A graduates in science and engineering of both sexes, multiplied by 100 (Science and engineering are ISC 42, 44, 46, 48, 52, 54, 58)	Education database
	11. New ISCED 5A graduates in science and engineering per thousand 20-29 population by sex		
		11a. Number of female ISCED 5A graduates in science and engineering divided by female population 20-29, multiplied by 1,000	Education database CLFS
		11b. Number of male ISCED 5A graduates in science and engineering divided by male population 20–29, multiplied by 1,000	
ISCED 6 graduates	**12. Female proportion among ISCED 6 graduates**		
		Number of female ISCED 6 graduates divided by the number of ISCED 6 graduates of both sexes, multiplied by 100	Education database
	13. Female proportion among ISCED 6 graduates in science and engineering		
		Number of female ISCED 6 graduates in science and engineering divided by the number of ISCED 6 graduates in science and engineering of both sexes, multiplied by 100 (Science and engineering are ISC 42, 44, 46, 48, 52, 54, 58)	Education database
	14. New ISCED 6 graduates in science and engineering per thousand 20-29 population by sex		
		14a. Number of female ISCED 6 graduates in science and engineering divided by female population 20-29, multiplied by 1,000	Education database CLF
		14b. Number of male ISCED 6 graduates in science and engineering divided by male population 20–29, multiplied by 1,000	

Each national profile on women's participation in industrial research shows the values of the benchmarking indicators and gives additional information grouped into four charts:

• the "bar chart", which gives an overview of the presence of women in industrial research as compared to their presence among 5A and 6 graduates and the highly qualified workforce
• the "distribution of graduates chart", which shows the distribution of female and male 5A and 6 graduates by field of study
• the "scientists and engineers profile chart", which shows the main trends and working conditions of female and male industrial scientists and engineers
• the "industrial R&D intensity chart", which shows the values of some meaningful indicators on R&D intensity in the industrial sector.

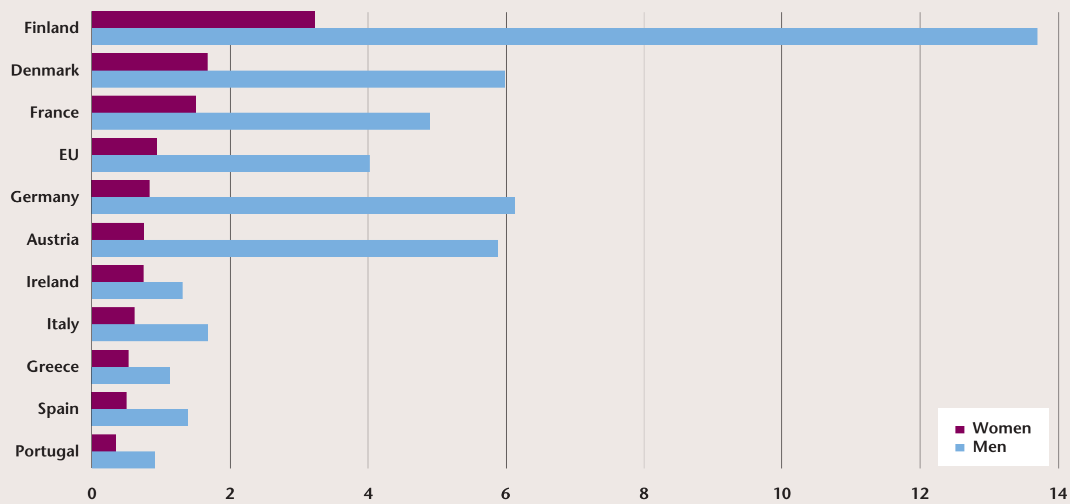
3.2.2. National profiles on women's participation in industrial research

1. Female proportion among industrial researchers, 1999



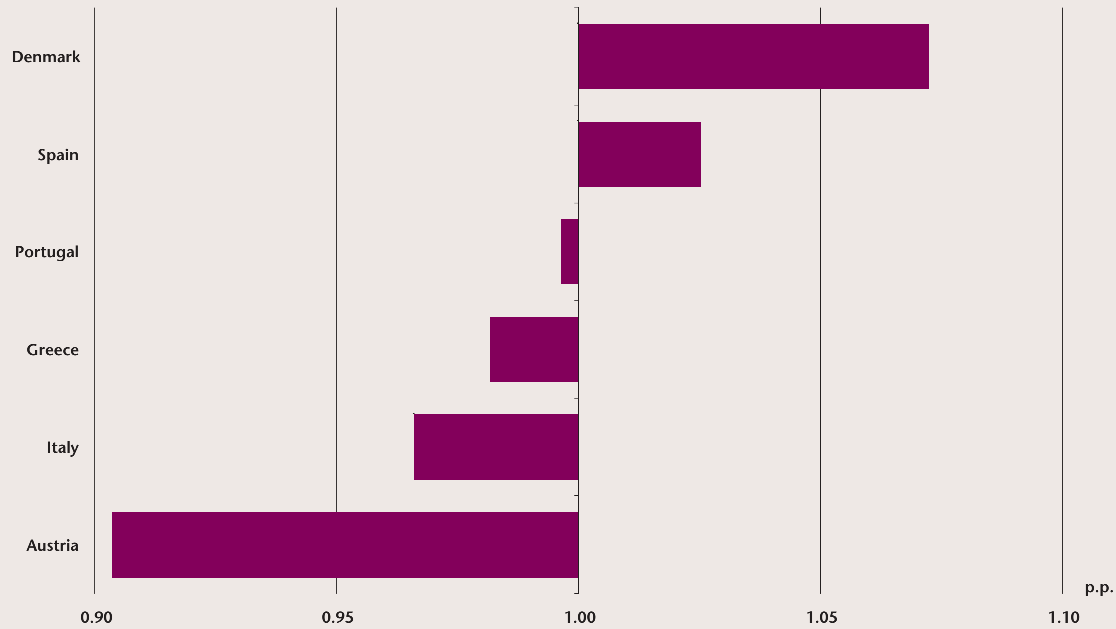
Source: DG Research, European R&D Survey
Notes: 1) FTE data for Germany; 2) Exceptions to the reference year: Austria (1998); France and Finland (2000); Ireland (2001);
3) EU average does not include the following missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom

2. Number of industrial researchers per thousand labour force by sex, 1999



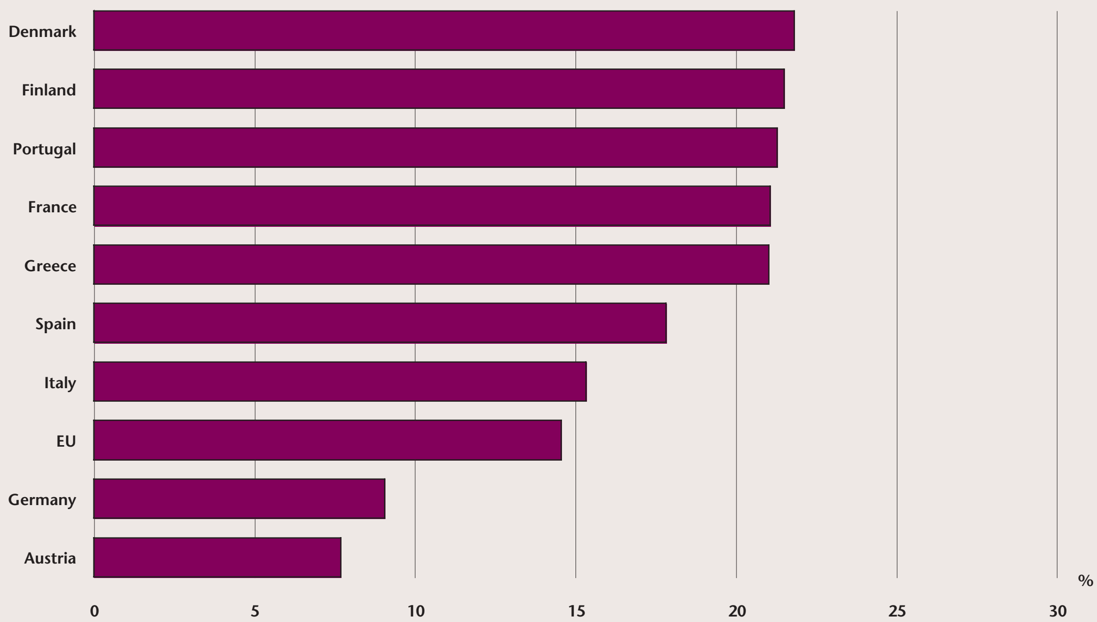
Source: DG Research, European R&D Survey
Notes: 1) FTE data for Germany; 2) Exceptions to the reference year: Austria (1998); France and Finland (2000); Ireland (2001);
3) EU average does not include the following missing countries: Belgium, Luxembourg, the Netherlands, Sweden and the United Kingdom

3. Gender gap in the FTE/HC ratio for industrial researchers, 1999



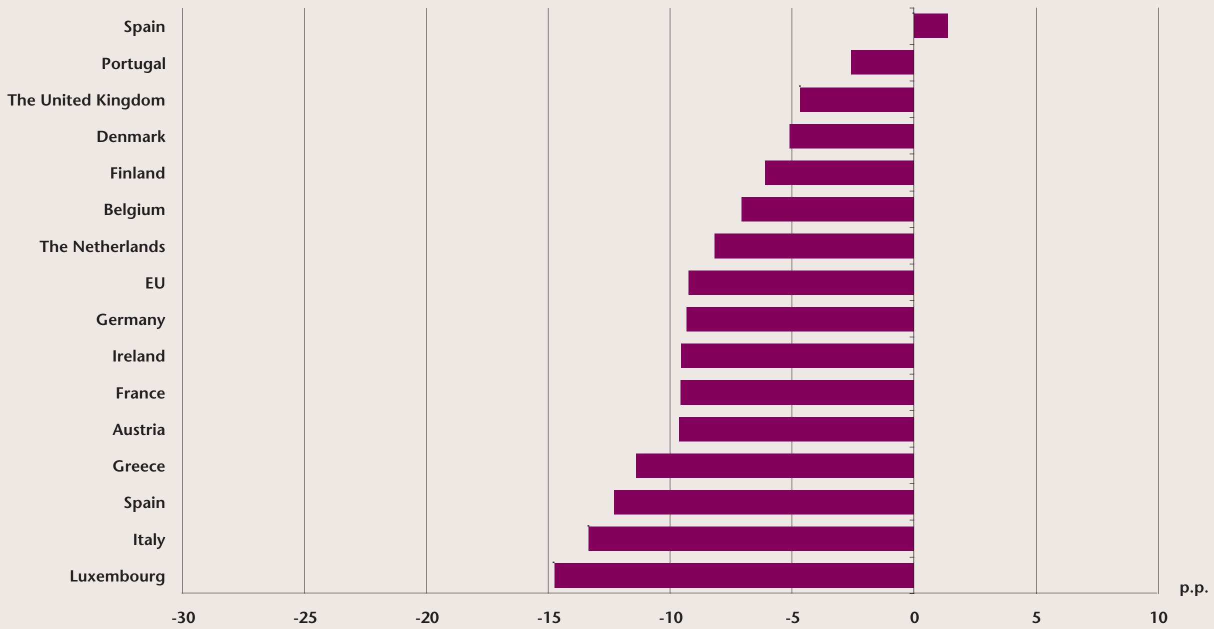
Source: DG Research, European R&D Survey
Notes: 1) Exceptions to the reference year: Austria (1998); 2) Missing countries: Belgium, Germany, France, Ireland, Luxembourg, the Netherlands, Finland, Sweden and the United Kingdom

4. Female proportion among industrial researchers in non-service sectors, 1999



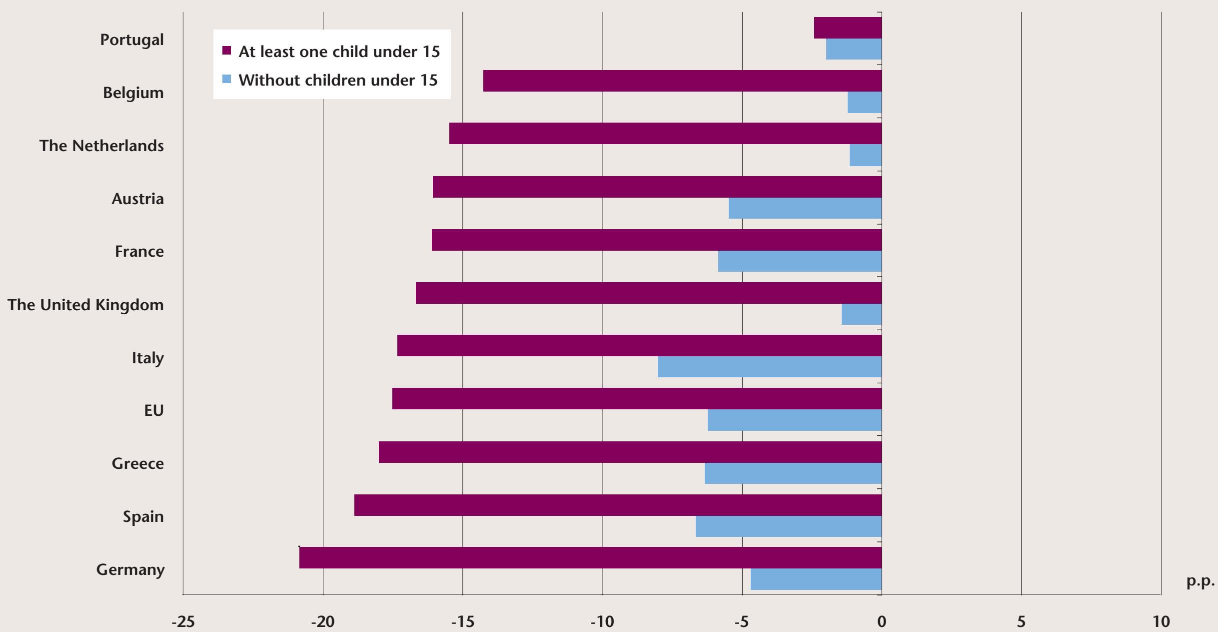
Source: DG Research, European R&D Survey
Notes: 1) FTE data for Germany; 2) Missing NACE data: 72 (Germany); 24.4 (Germany and France); 3) Exceptions to the reference year: Austria (1998); France and Finland (2000); 4) EU average does not include the following missing countries: Belgium, Ireland, Luxembourg, the Netherlands, Sweden and the United Kingdom

5. Gender employment gap for highly qualified population, 2000



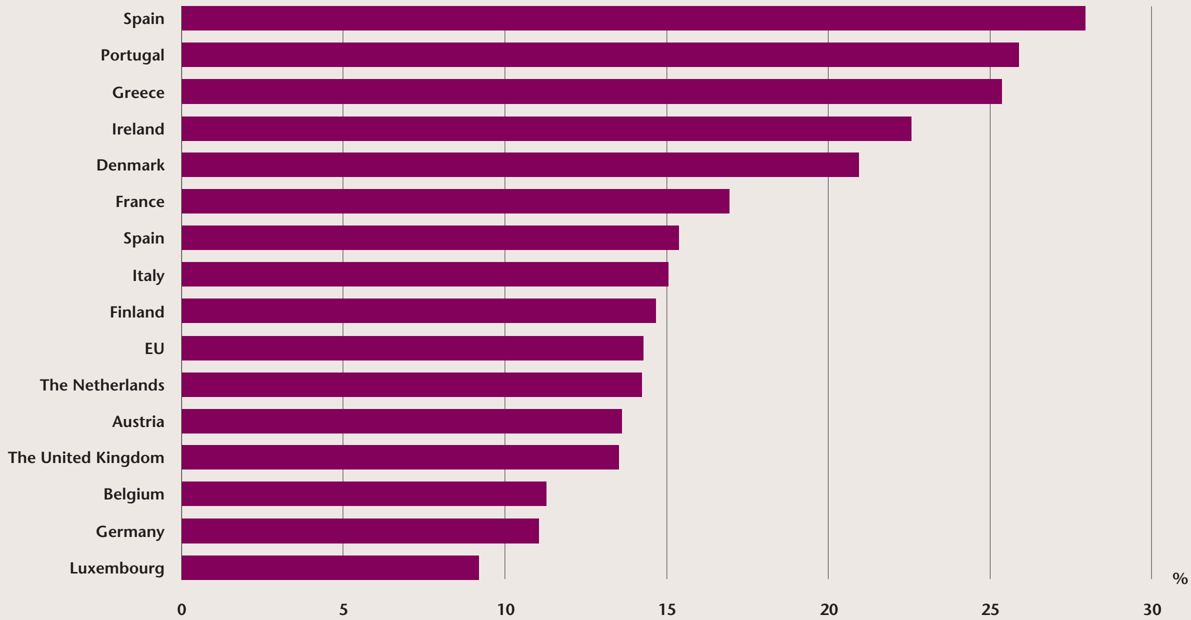
Source: Eurostat, Community Labour Force Survey

6. Gender employment gap for highly qualified population by family situation, 2000



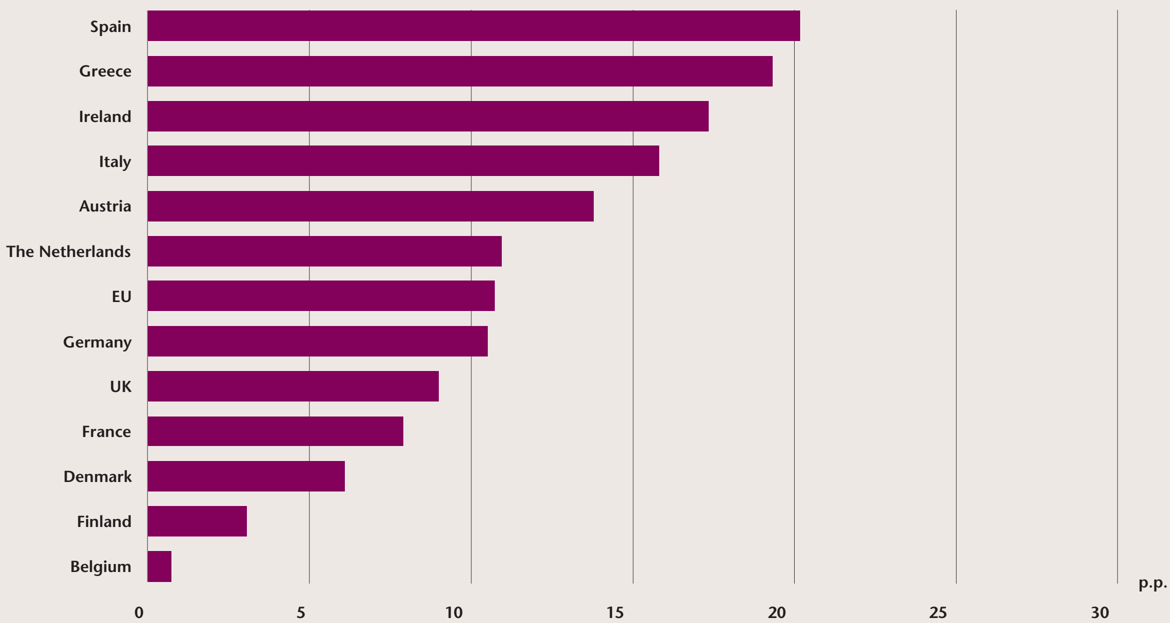
Source: Eurostat, Community Labour Force Survey
Notes: 1) No reliable data for Luxembourg; 2) EU average does not include the following missing countries: Denmark, Finland, Ireland and Sweden

7. Female proportion of industrial scientists and engineers in scientific and technological occupations, 2000



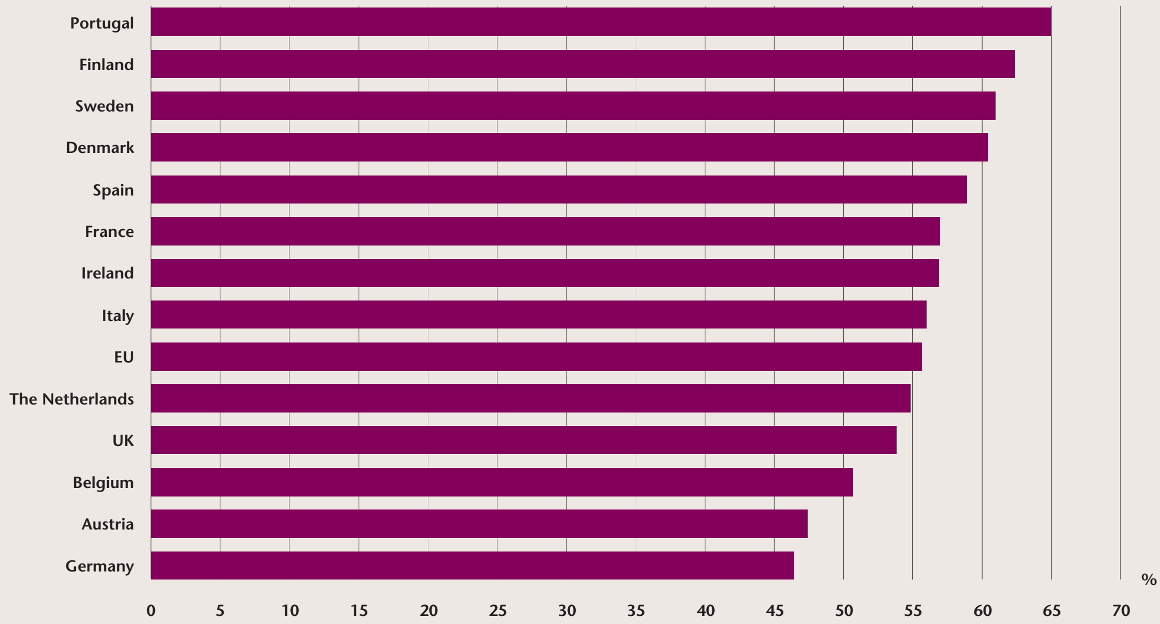
Source: Eurostat, Community Labour Force Survey

8. Age differential in the female proportion of industrial scientists and engineers in scientific and technological occupations, 2000



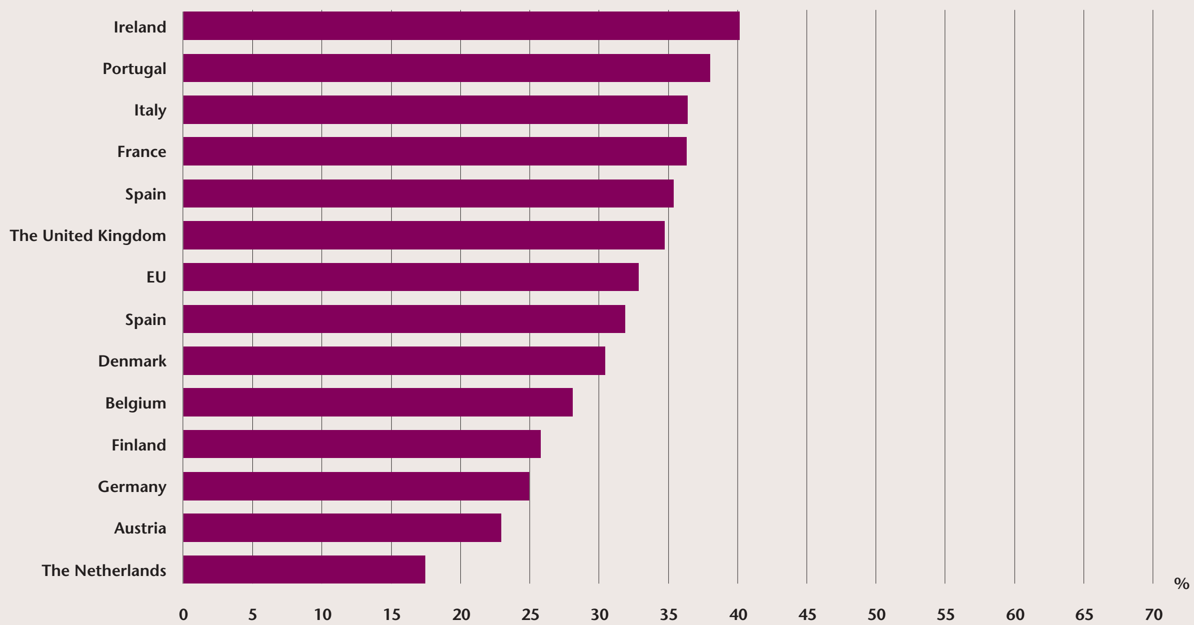
Source: Eurostat, Community Labour Force Survey
Note: no reliable data for Luxembourg, Portugal and Sweden

9. Female proportion among ISCED 5A graduates, 2000



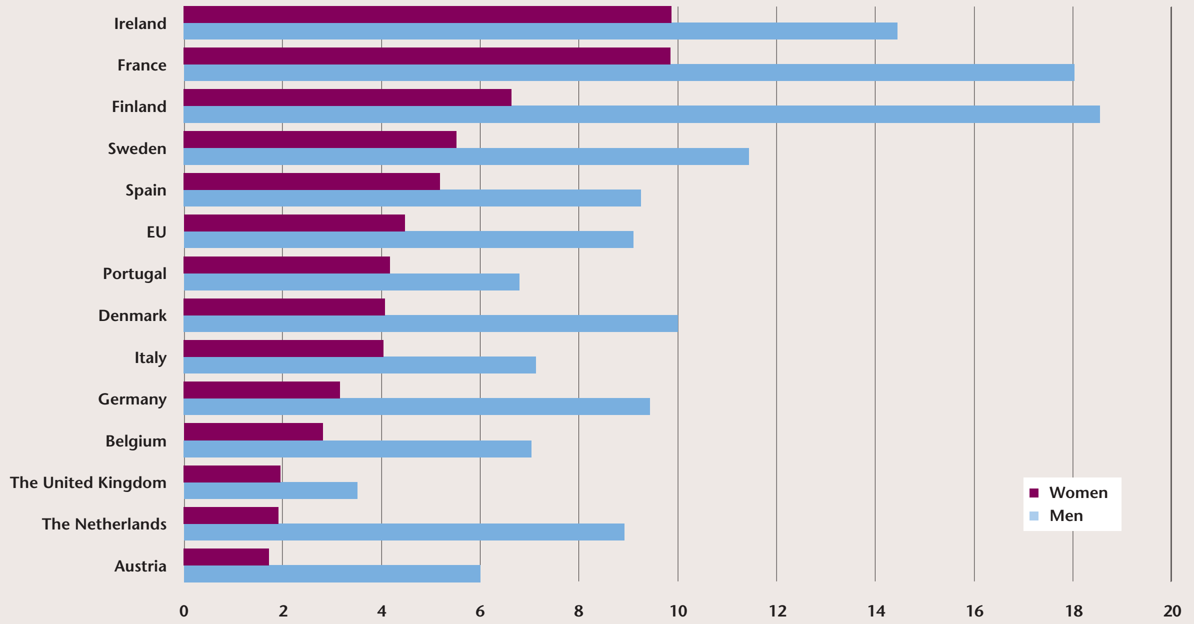
Source: Eurostat, Education database
Note: EU average does not include the following missing countries: Greece and Luxembourg

10. Female proportion among ISCED 5A graduates in science and engineering, 2000



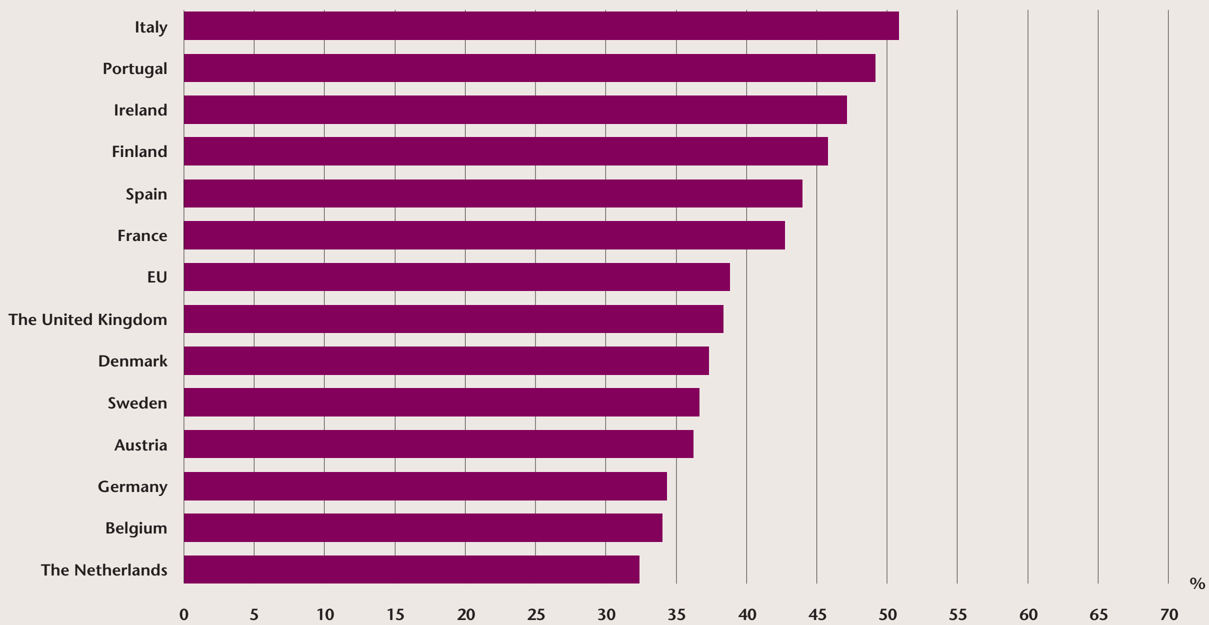
Source: Eurostat, Education database
Note: EU average does not include the following missing countries: Greece and Luxembourg

11. New ISCED 5A graduates in science and engineering per thousand 20–29 population by sex, 2000



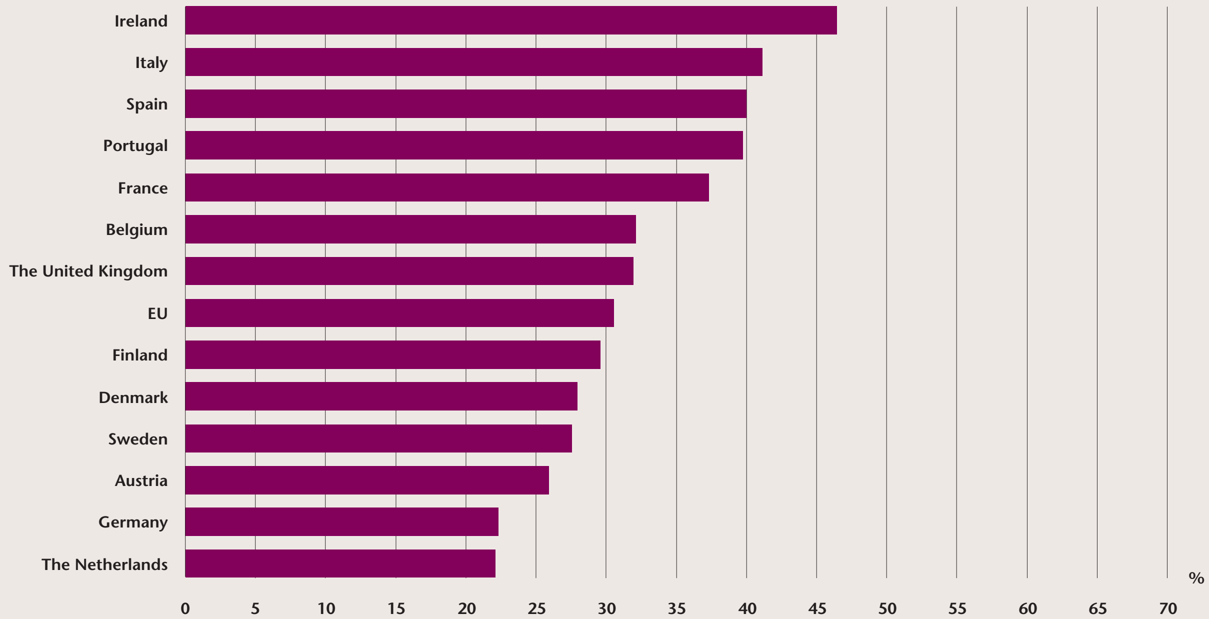
Source: Eurostat, Education database
Note: EU average does not include the following missing countries: Greece and Luxembourg

12. Female proportion among ISCED 6 graduates, 2000



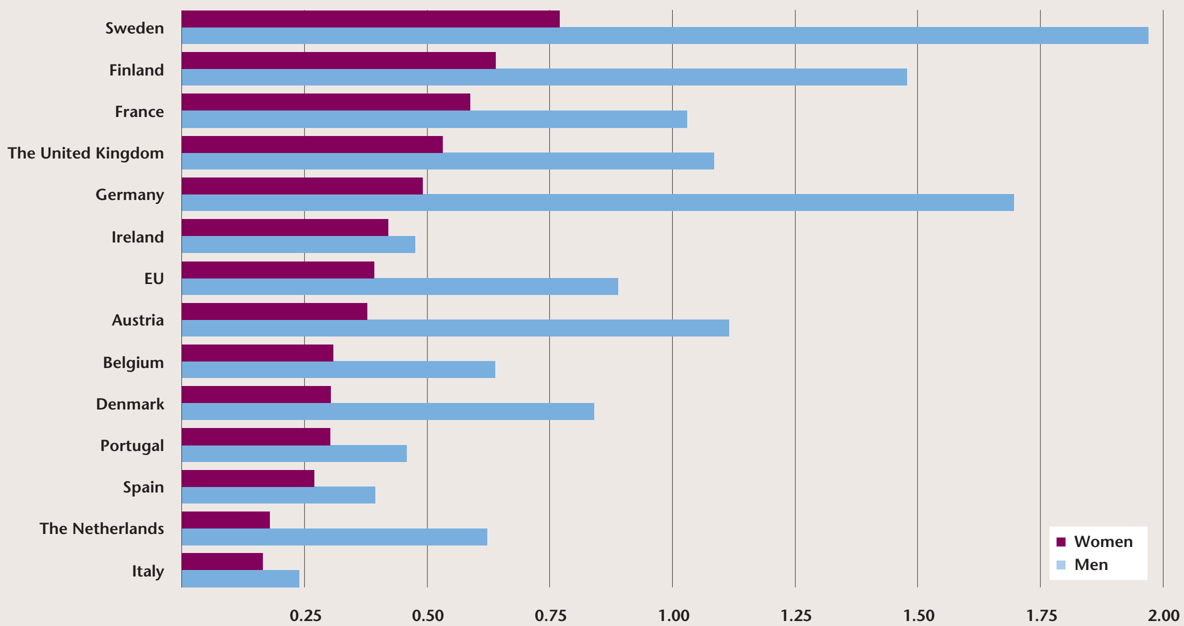
Source: Eurostat, Education database
Note: EU average does not include the following missing countries: Greece and Luxembourg

13. Female proportion among ISCED 6 graduates in science and engineering, 2000



Source: Eurostat, Education database
Note: EU average does not include the following missing countries: Greece and Luxembourg

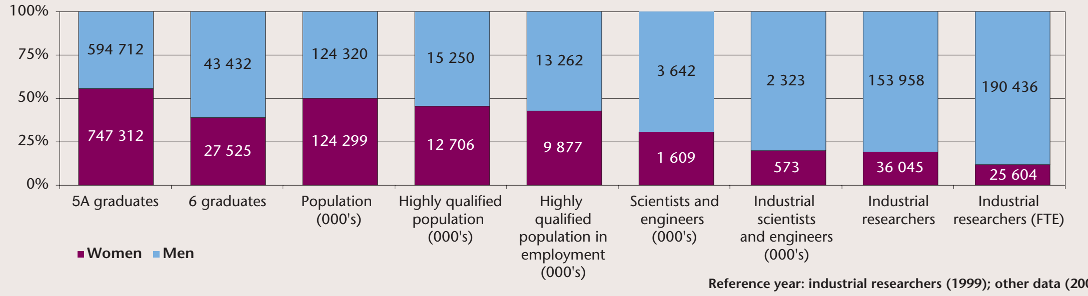
14. New ISCED 6 graduates in science and engineering per thousand 20–29 population by sex, 2000



Source: Eurostat, Education database
Note: EU average does not include the following missing countries: Greece and Luxembourg

EU-15

Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 1999/2000



Reference year: industrial researchers (1999); other data (2000)

Notes: 1) EU average does not include the following missing countries: i) Graduates: EL, L; ii) Industrial researchers; B, L, NL, S, UK; 2) Exceptions to the reference year: Industrial researchers in A (1998); F and FIN (2000); IRL (2001)

Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	14,83	1999
2a. Number of female industrial researchers per thousand labour force	0,94	1999
2b. Number of male industrial researchers per thousand labour force	4,01	1999
3. Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4. Female proportion among industrial researchers in non-services sectors (%)	14,56	1999
5. Gender employment gap for highly qualified population (p.p.)	-9,24	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-17,52	2000
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	-6,23	2000
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	14,27	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	10,74	2000
9. Female proportion among 5A bachelor graduates (%)	55,69	2000
10. Female proportion among 5A graduates in science and engineering (%)	32,86	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	4,47	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	9,09	2000
12. Female proportion among 6 graduates (%)	38,79	2000
13. Female proportion among 6 graduates in science and engineering (%)	30,55	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,39	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	0,89	2000

Notes: 1) EU average does not include the following missing countries: B, L, NL, S, UK; 2) FTE data in Germany; 3) Exceptions to the reference year: A (1998); F and FIN (2000); IRL (2001)

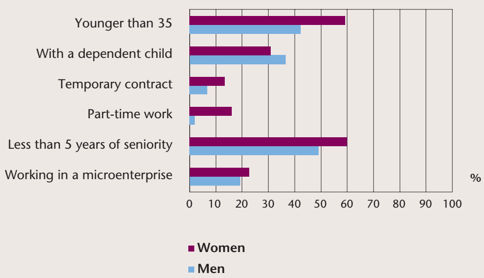
Note: 1) EU average does not include the following missing countries: D, IRL, FIN, S

Note: 1) EU average does not include the following missing countries: EL, L

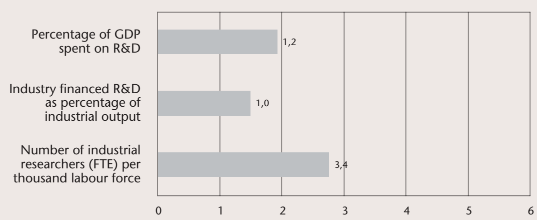
Distribution by field of study

Note: 1) EU average does not include the following missing countries: EL, L

Industrial S&E profile, 2000



Industrial R&D intensity, 1999

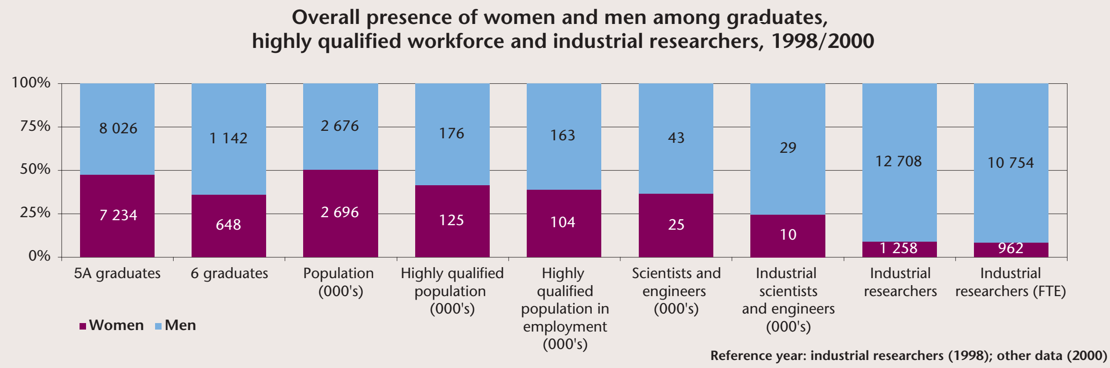


Exceptions to the reference year: Percentage of GDP spent on R&D (2000)

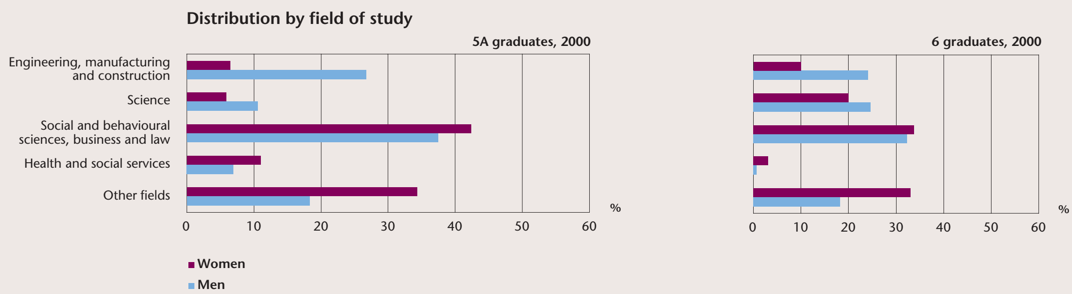
Notes on S&E Industrial profile: 1) EU average on "with a dependent child" does not include the following missing countries: DK, IRL, FIN, S; 2) EU average on "working in a microentreprise" does not include IRL

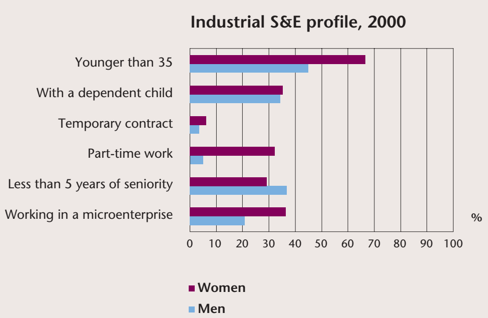
Notes on industrial R&D intensity: 1) EU average does not include L; 2) Exceptions to the reference year: i) Percentage of R&D spent on R&D: DK, D, ES, F, A, FIN, UK (2000); ii) Industry-financed R&D as percentage of industrial output: D and FIN (2000)

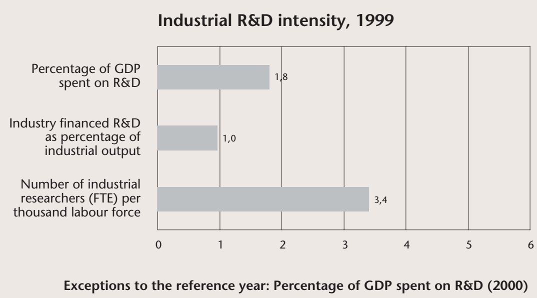
Austria



Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	9,01	1998
2a. Number of female industrial researchers per thousand labour force	0,75	1998
2b. Number of male industrial researchers per thousand labour force	5,88	1998
3. Gender gap in the FTE/HC ratio for industrial researchers	0,90	1998
4. Female proportion among industrial researchers in non-services sectors (%)	7,70	1998
5. Gender employment gap for highly qualified population (p.p.)	-9,63	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-16,07	2000
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	-5,47	2000
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	13,63	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	13,78	2000
9. Female proportion among 5A bachelor graduates (%)	47,40	2000
10. Female proportion among 5A graduates in science and engineering (%)	22,93	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	1,73	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	6,00	2000
12. Female proportion among 6 graduates (%)	36,20	2000
13. Female proportion among 6 graduates in science and engineering (%)	25,93	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,38	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	1,12	2000

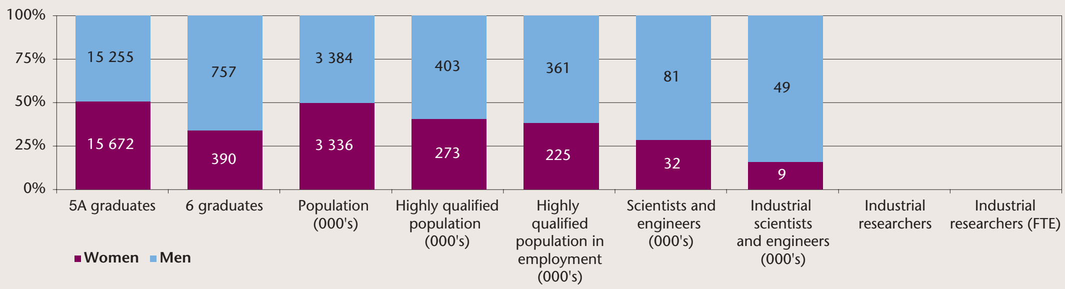






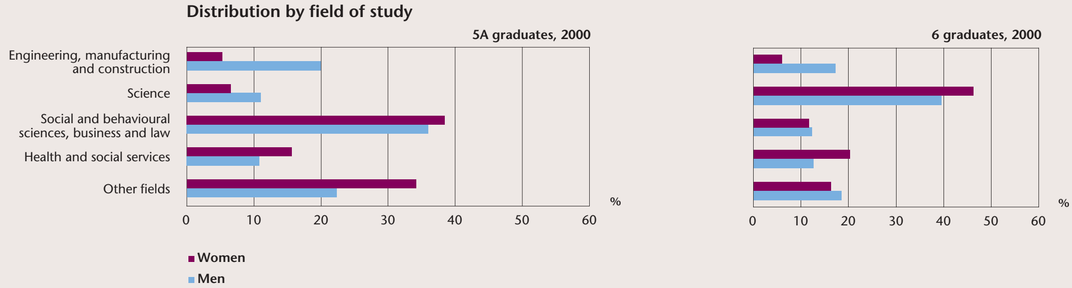
Belgium

Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 2000

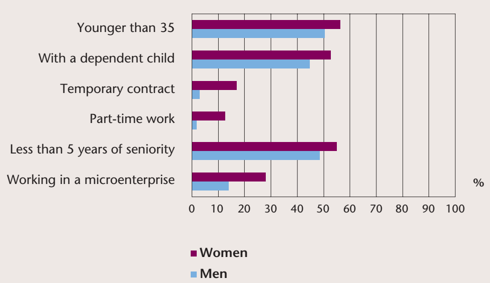


Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	n.a.	
2a. Number of female industrial researchers per thousand labour force	n.a.	
2b. Number of male industrial researchers per thousand labour force	n.a.	
3. Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4. Female proportion among industrial researchers in non-services sectors (%)	n.a.	
5. Gender employment gap for highly qualified population (p.p.)	-7,06	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-14,27	2000
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	-1,21	2000
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	11,30	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	0,72	2000
9. Female proportion among 5A bachelor graduates (%)	50,67	2000
10. Female proportion among 5A graduates in science and engineering (%)	28,08	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	2,81	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	7,04	2000
12. Female proportion among 6 graduates (%)	34,00	2000
13. Female proportion among 6 graduates in science and engineering (%)	32,12	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,31	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	0,64	2000

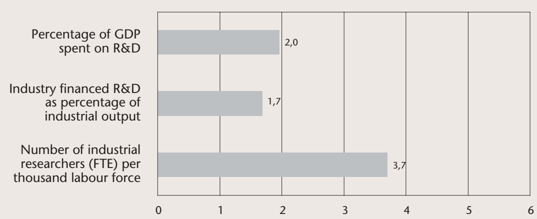
Distribution by field of study



Industrial S&E profile, 2000

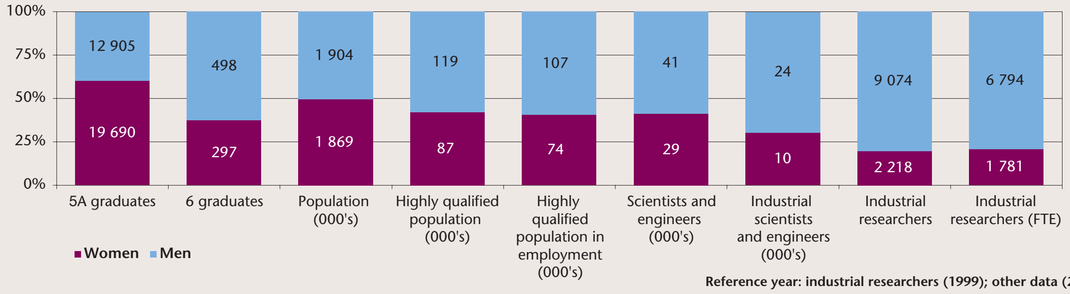


Industrial R&D intensity, 1999



Denmark

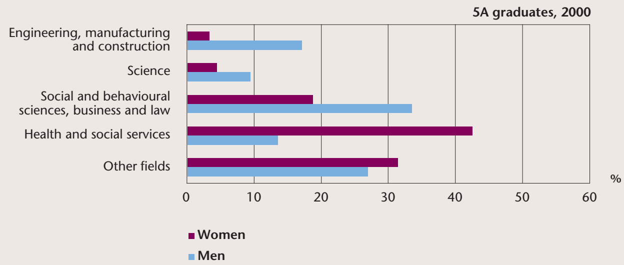
Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 1999/2000

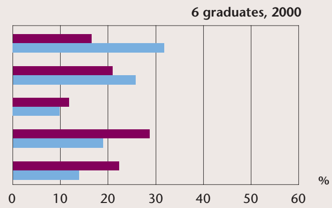


Reference year: industrial researchers (1999); other data (2000)

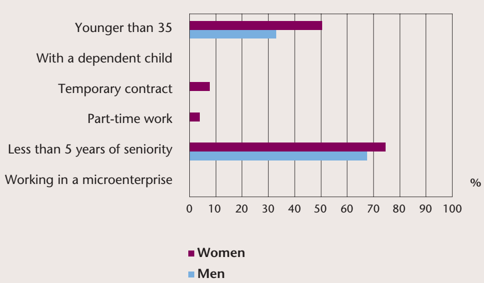
Benchmarking indicators		Value	Year
1.	Female proportion among industrial researchers (%)	19,64	1999
2a.	Number of female industrial researchers per thousand labour force	1,67	1999
2b.	Number of male industrial researchers per thousand labour force	5,99	1999
3.	Gender gap in the FTE/HC ratio for industrial researchers	1,07	1999
4.	Female proportion among industrial researchers in non-services sectors (%)	21,83	1999
5.	Gender employment gap for highly qualified population (p.p.)	-5,11	2000
6a.	Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	n.a.	
6b.	Gender employment gap for highly qualified population without children under 15 (p.p.)	n.a.	
7.	Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	20,95	2000
8.	Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	6,08	2000
9.	Female proportion among 5A bachelor graduates (%)	60,41	2000
10.	Female proportion among 5A graduates in science and engineering (%)	30,46	2000
11a.	New female 5A graduates in science and engineering per thousand 20-29 population	4,07	2000
11b.	New male 5A graduates in science and engineering per thousand 20-29 population	10,00	2000
12.	Female proportion among 6 graduates (%)	37,36	2000
13.	Female proportion among 6 graduates in science and engineering (%)	27,96	2000
14a.	New female 6 graduates in science and engineering per thousand 20-29 population	0,30	2000
14b.	New male 6 graduates in science and engineering per thousand 20-29 population	0,84	2000

Distribution by field of study

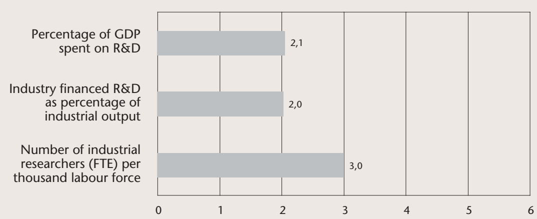




Industrial S&E profile, 2000



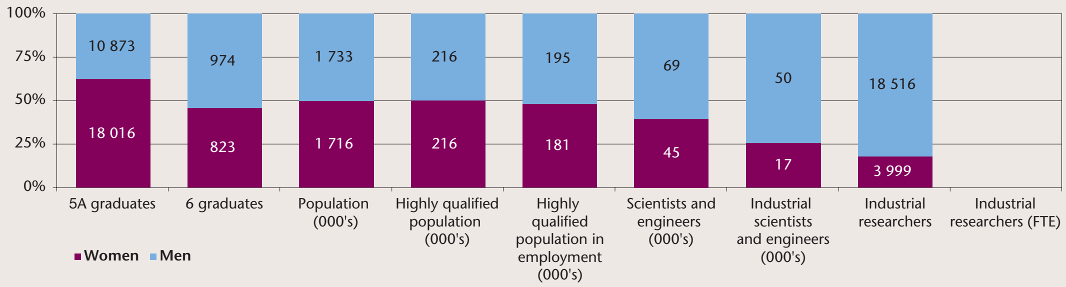
Industrial R&D intensity, 1999



Exceptions to the reference year: Percentage of GDP spent on R&D (2000)

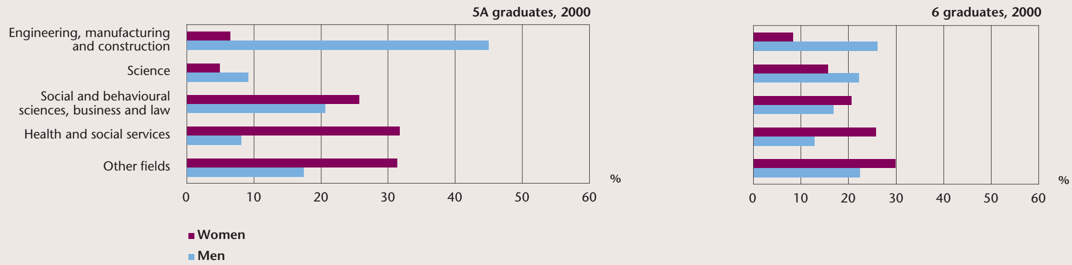
Finland

Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 2000

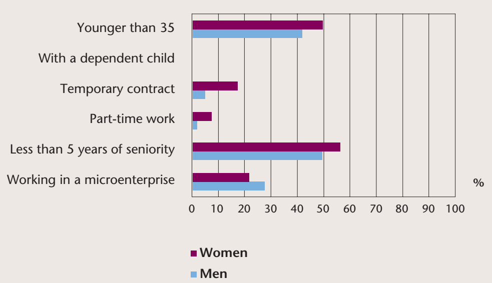


Benchmarking indicators		Value	Year
1.	Female proportion among industrial researchers (%)	17,76	2000
2a.	Number of female industrial researchers per thousand labour force	3,23	2000
2b.	Number of male industrial researchers per thousand labour force	13,70	2000
3.	Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4.	Female proportion among industrial researchers in non-services sectors (%)	21,52	2000
5.	Gender employment gap for highly qualified population (p.p.)	-6,11	2000
6a.	Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	n.a.	
6b.	Gender employment gap for highly qualified population without children under 15 (p.p.)	n.a.	
7.	Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	14,66	2000
8.	Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	3,05	2000
9.	Female proportion among 5A bachelor graduates (%)	62,36	2000
10.	Female proportion among 5A graduates in science and engineering (%)	25,79	2000
11a.	New female 5A graduates in science and engineering per thousand 20-29 population	6,63	2000
11b.	New male 5A graduates in science and engineering per thousand 20-29 population	18,54	2000
12.	Female proportion among 6 graduates (%)	45,80	2000
13.	Female proportion among 6 graduates in science and engineering (%)	29,58	2000
14a.	New female 6 graduates in science and engineering per thousand 20-29 population	0,64	2000
14b.	New male 6 graduates in science and engineering per thousand 20-29 population	1,48	2000

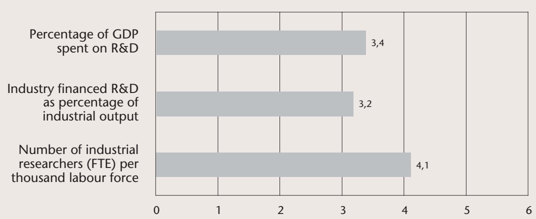
Distribution by field of study



Industrial S&E profile, 2000



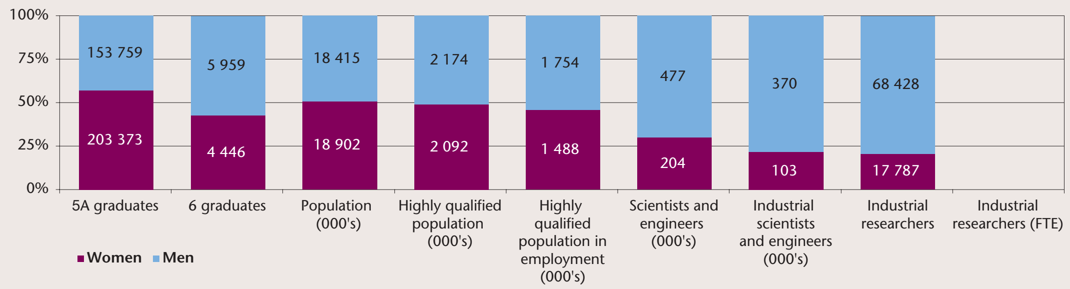
Industrial R&D intensity, 1999



Exceptions to the reference year: Percentage of GDP spent on R&D and industry financed R&D as percentage of industrial output (2000)

France

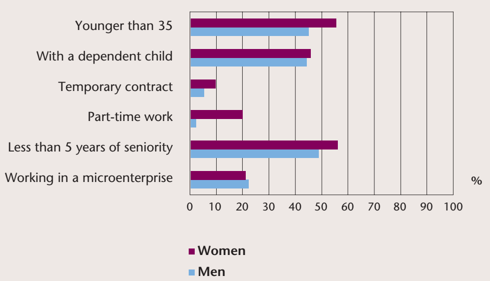
Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 2000



Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	20,63	2000
2a. Number of female industrial researchers per thousand labour force	1,50	2000
2b. Number of male industrial researchers per thousand labour force	4,90	2000
3. Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4. Female proportion among industrial researchers in non-services sectors (%)	21,08	2000
5. Gender employment gap for highly qualified population (p.p.)	-9,58	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-16,10	2000
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	-5,87	2000
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	16,94	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	7,91	2000
9. Female proportion among 5A bachelor graduates (%)	56,95	2000
10. Female proportion among 5A graduates in science and engineering (%)	36,30	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	9,85	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	18,03	2000
12. Female proportion among 6 graduates (%)	42,73	2000
13. Female proportion among 6 graduates in science and engineering (%)	37,32	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,59	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	1,03	2000

Distribution by field of study

Industrial S&E profile, 2000

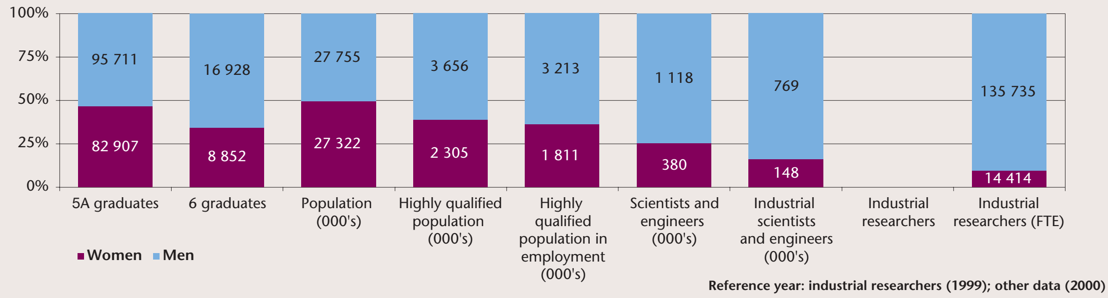


Industrial R&D intensity, 1999

Exceptions to the reference year: Percentage of GDP spent on R&D (2000)

Germany

Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 1999/2000

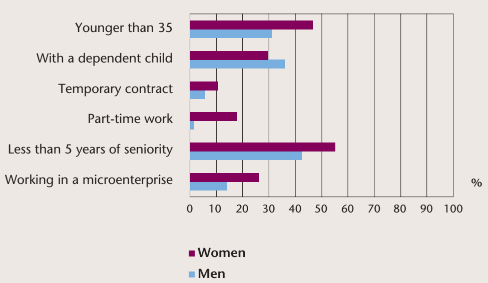


Reference year: industrial researchers (1999); other data (2000)

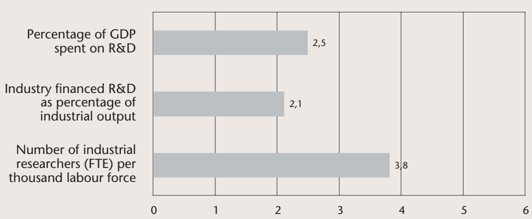
Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	9,60	1999
2a. Number of female industrial researchers per thousand labour force	0,83	1999
2b. Number of male industrial researchers per thousand labour force	6,14	1999
3. Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4. Female proportion among industrial researchers in non-services sectors (%)	9,06	1999
5. Gender employment gap for highly qualified population (p.p.)	-9,33	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-20,84	2000
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	-4,70	2000
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	11,06	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	10,51	2000
9. Female proportion among 5A bachelor graduates (%)	46,42	2000
10. Female proportion among 5A graduates in science and engineering (%)	24,96	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	3,16	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	9,44	2000
12. Female proportion among 6 graduates (%)	34,34	2000
13. Female proportion among 6 graduates in science and engineering (%)	22,33	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,49	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	1,70	2000

Distribution by field of study

Industrial S&E profile, 2000



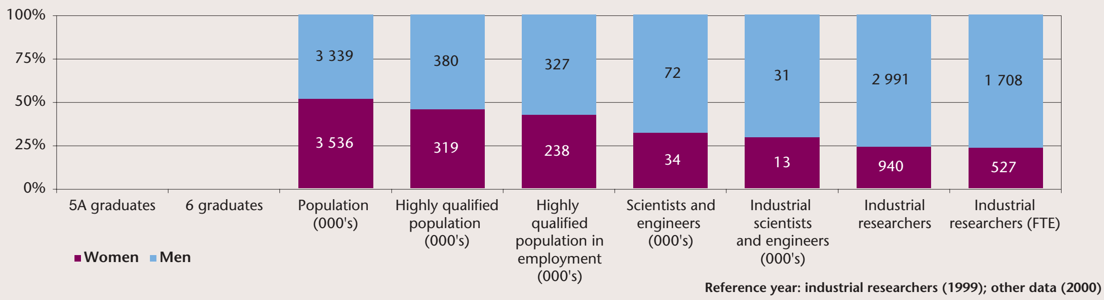
Industrial R&D intensity, 1999



Exceptions to the reference year: Percentage of GDP spent on R&D and industry financed R&D as percentage of industrial output (2000)

Greece

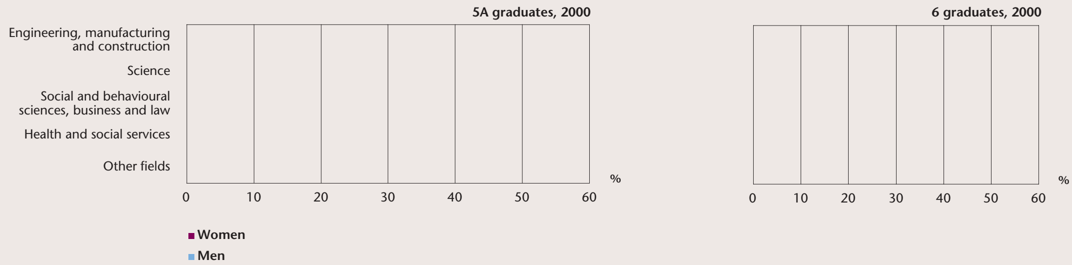
Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 1999/2000



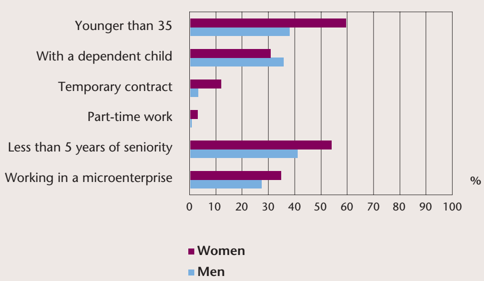
Reference year: industrial researchers (1999); other data (2000)

Benchmarking indicators		Value	Year
1.	Female proportion among industrial researchers (%)	23,91	1999
2a.	Number of female industrial researchers per thousand labour force	0,53	1999
2b.	Number of male industrial researchers per thousand labour force	1,13	1999
3.	Gender gap in the FTE/HC ratio for industrial researchers	0,98	1999
4.	Female proportion among industrial researchers in non-services sectors (%)	21,03	1999
5.	Gender employment gap for highly qualified population (p.p.)	-11,41	2000
6a.	Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-18,00	2000
6b.	Gender employment gap for highly qualified population without children under 15 (p.p.)	-6,35	2000
7.	Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	25,36	2000
8.	Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	19,32	2000
9.	Female proportion among 5A bachelor graduates (%)	n.a.	
10.	Female proportion among 5A graduates in science and engineering (%)	n.a.	
11a.	New female 5A graduates in science and engineering per thousand 20-29 population	n.a.	
11b.	New male 5A graduates in science and engineering per thousand 20-29 population	n.a.	
12.	Female proportion among 6 graduates (%)	n.a.	
13.	Female proportion among 6 graduates in science and engineering (%)	n.a.	
14a.	New female 6 graduates in science and engineering per thousand 20-29 population	n.a.	
14b.	New male 6 graduates in science and engineering per thousand 20-29 population	n.a.	

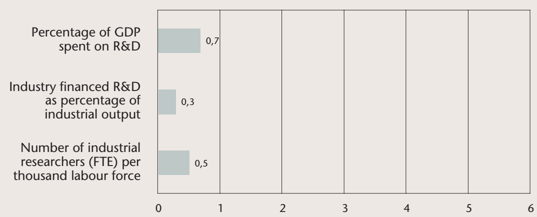
Distribution by field of study



Industrial S&E profile, 2000

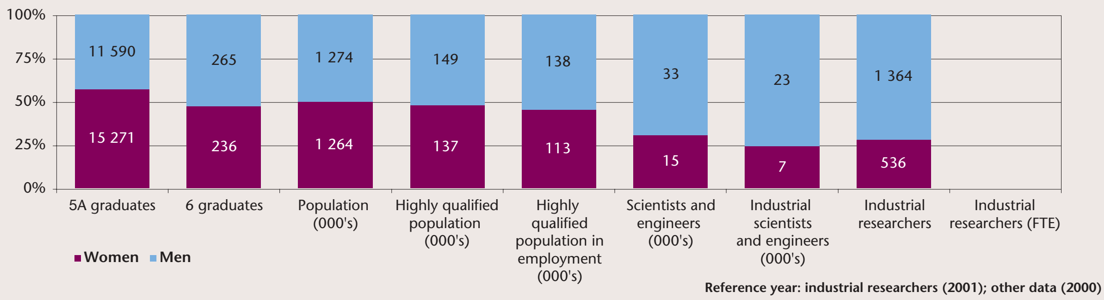


Industrial R&D intensity, 1999



Ireland

Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 2000/2002



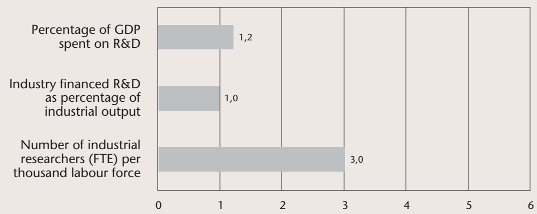
Reference year: industrial researchers (2001); other data (2000)

Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	28,21	2001
2a. Number of female industrial researchers per thousand labour force	0,74	2001
2b. Number of male industrial researchers per thousand labour force	1,30	2001
3. Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4. Female proportion among industrial researchers in non-services sectors (%)	n.a.	
5. Gender employment gap for highly qualified population (p.p.)	-9,56	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	n.a.	
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	n.a.	
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	22,57	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	17,35	2000
9. Female proportion among 5A bachelor graduates (%)	56,85	2000
10. Female proportion among 5A graduates in science and engineering (%)	40,15	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	9,88	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	14,44	2000
12. Female proportion among 6 graduates (%)	47,11	2000
13. Female proportion among 6 graduates in science and engineering (%)	46,45	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,42	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	0,48	2000

Distribution by field of study

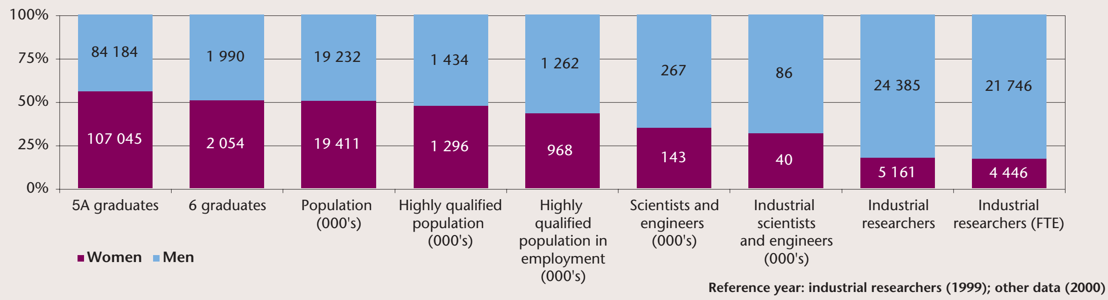
Industrial S&E profile, 2000

Industrial R&D intensity, 1999



Italy

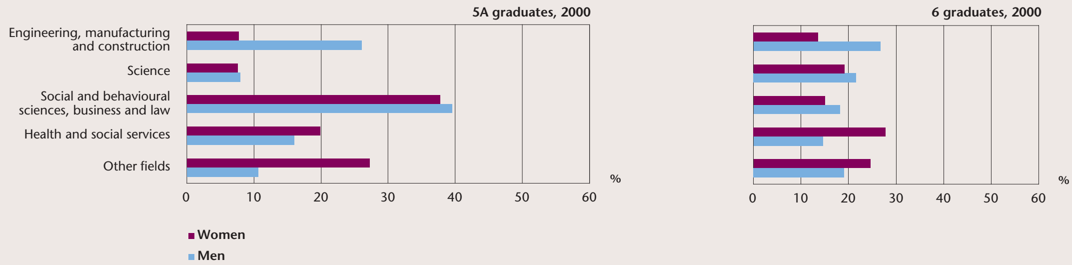
Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 1999/2000



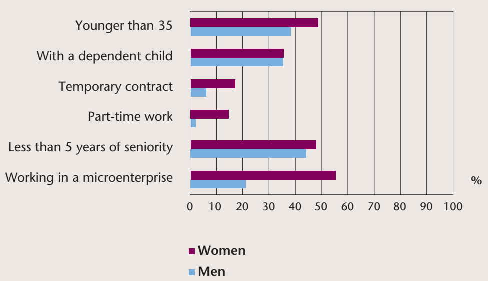
Reference year: industrial researchers (1999); other data (2000)

Benchmarking indicators		Value	Year
1.	Female proportion among industrial researchers (%)	17,47	1999
2a.	Number of female industrial researchers per thousand labour force	0,60	1999
2b.	Number of male industrial researchers per thousand labour force	1,67	1999
3.	Gender gap in the FTE/HC ratio for industrial researchers	0,97	1999
4.	Female proportion among industrial researchers in non-services sectors (%)	15,34	1999
5.	Gender employment gap for highly qualified population (p.p.)	-13,33	2000
6a.	Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-17,33	2000
6b.	Gender employment gap for highly qualified population without children under 15 (p.p.)	-8,01	2000
7.	Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	15,05	2000
8.	Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	15,81	2000
9.	Female proportion among 5A bachelor graduates (%)	55,98	2000
10.	Female proportion among 5A graduates in science and engineering (%)	36,40	2000
11a.	New female 5A graduates in science and engineering per thousand 20-29 population	4,05	2000
11b.	New male 5A graduates in science and engineering per thousand 20-29 population	7,13	2000
12.	Female proportion among 6 graduates (%)	50,79	2000
13.	Female proportion among 6 graduates in science and engineering (%)	41,13	2000
14a.	New female 6 graduates in science and engineering per thousand 20-29 population	0,17	2000
14b.	New male 6 graduates in science and engineering per thousand 20-29 population	0,24	2000

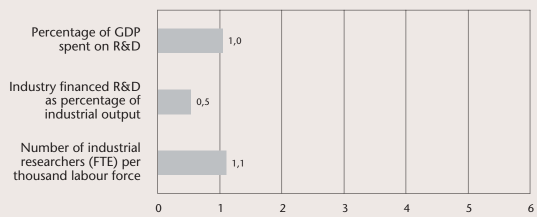
Distribution by field of study



Industrial S&E profile, 2000

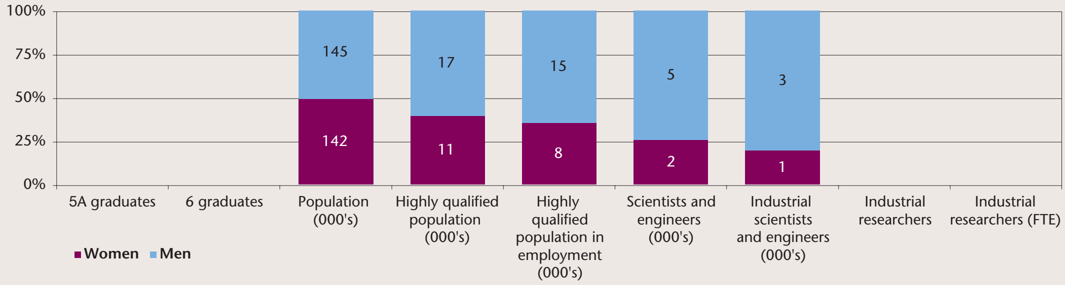


Industrial R&D intensity, 1999



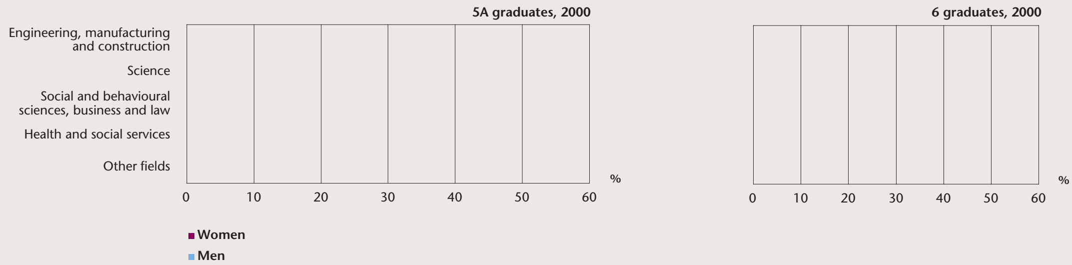
Luxembourg

Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 2000

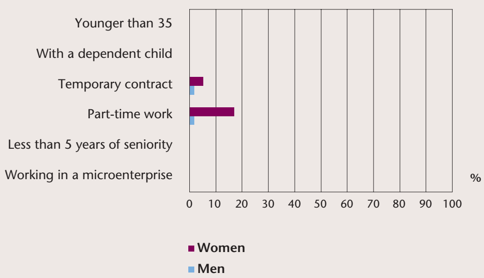


Benchmarking indicators		Value	Year
1.	Female proportion among industrial researchers (%)	n.a.	
2a.	Number of female industrial researchers per thousand labour force	n.a.	
2b.	Number of male industrial researchers per thousand labour force	n.a.	
3.	Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4.	Female proportion among industrial researchers in non-services sectors (%)	n.a.	
5.	Gender employment gap for highly qualified population (p.p.)	-14,75	2000
6a.	Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	n.r	
6b.	Gender employment gap for highly qualified population without children under 15 (p.p.)	n.r	
7.	Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	9,19	2000
8.	Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	n.r.	
9.	Female proportion among 5A bachelor graduates (%)	n.a.	
10.	Female proportion among 5A graduates in science and engineering (%)	n.a.	
11a.	New female 5A graduates in science and engineering per thousand 20-29 population	n.a.	
11b.	New male 5A graduates in science and engineering per thousand 20-29 population	n.a.	
12.	Female proportion among 6 graduates (%)	n.a.	
13.	Female proportion among 6 graduates in science and engineering (%)	n.a.	
14a.	New female 6 graduates in science and engineering per thousand 20-29 population	n.a.	
14b.	New male 6 graduates in science and engineering per thousand 20-29 population	n.a.	

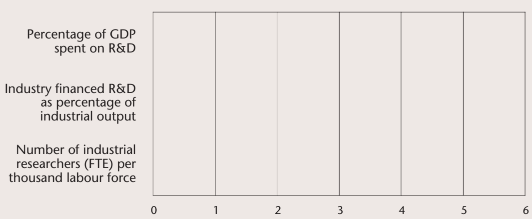
Distribution by field of study



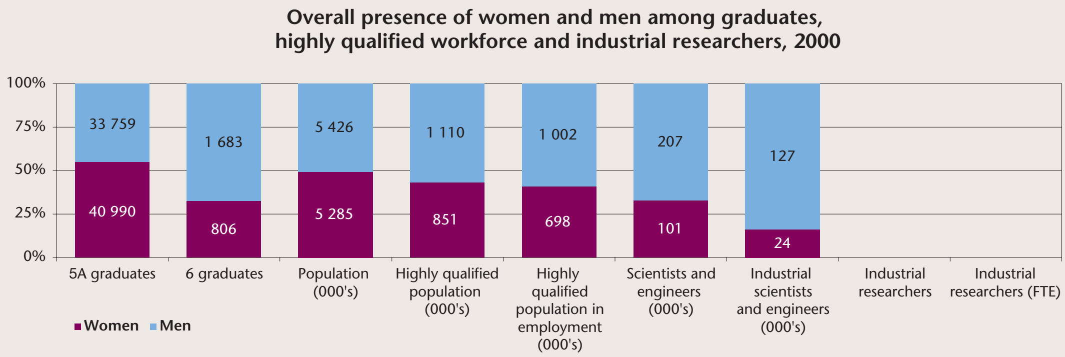
Industrial S&E profile, 2000



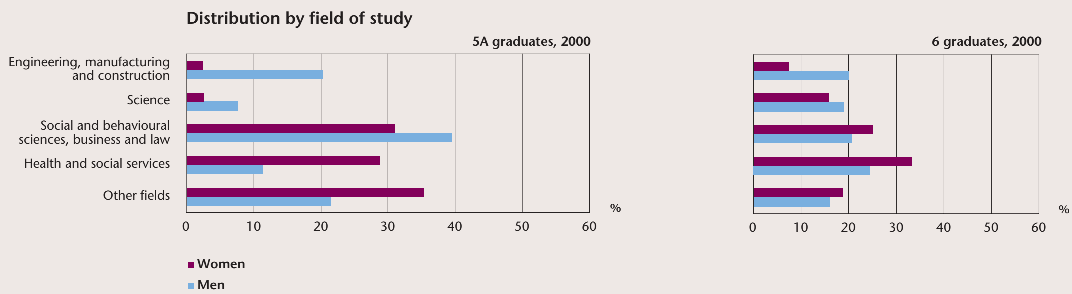
Industrial R&D intensity, 1999

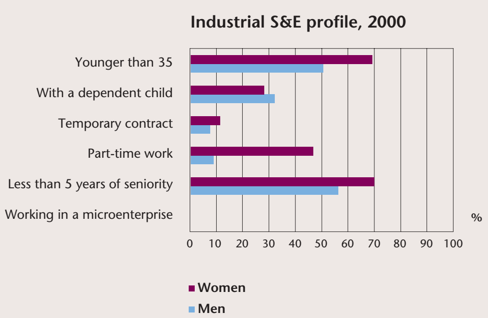


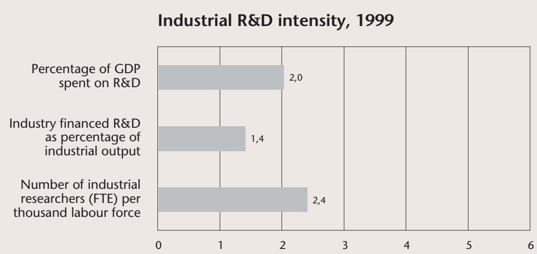
The Netherlands



Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	n.a.	
2a. Number of female industrial researchers per thousand labour force	n.a.	
2b. Number of male industrial researchers per thousand labour force	n.a.	
3. Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4. Female proportion among industrial researchers in non-services sectors (%)	n.a.	
5. Gender employment gap for highly qualified population (p.p.)	-8,18	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-15,48	2000
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	-1,14	2000
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	14,24	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	10,94	2000
9. Female proportion among 5A bachelor graduates (%)	54,84	2000
10. Female proportion among 5A graduates in science and engineering (%)	17,46	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	1,92	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	8,92	2000
12. Female proportion among 6 graduates (%)	32,38	2000
13. Female proportion among 6 graduates in science and engineering (%)	22,09	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,18	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	0,62	2000

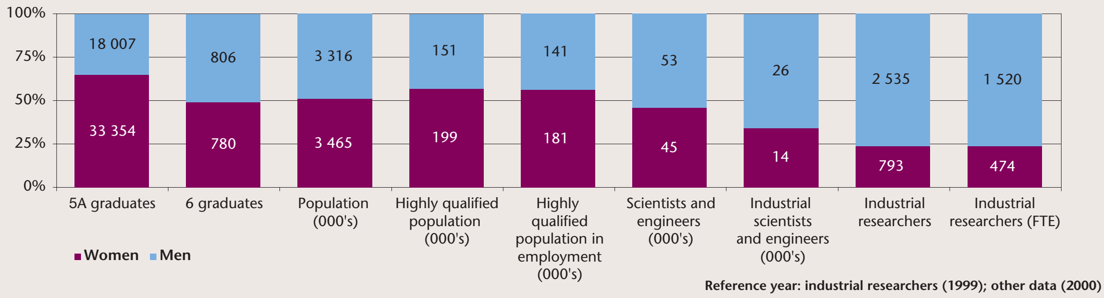






Portugal

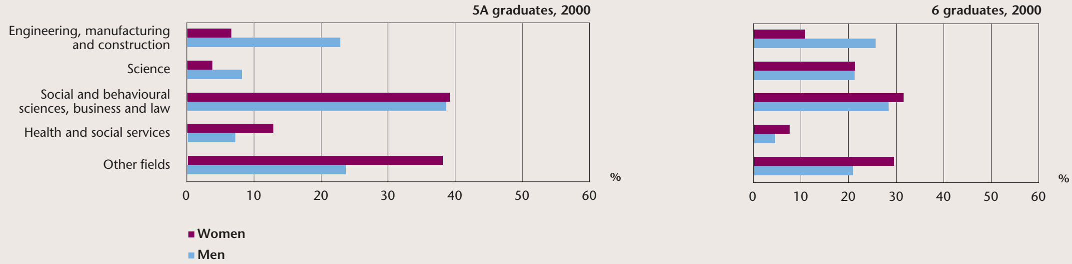
Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 1999/2000



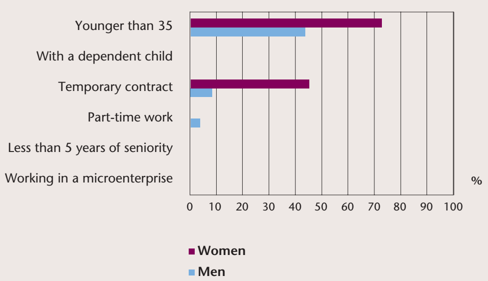
Reference year: industrial researchers (1999); other data (2000)

Benchmarking indicators		Value	Year
1.	Female proportion among industrial researchers (%)	23,83	1999
2a.	Number of female industrial researchers per thousand labour force	0,34	1999
2b.	Number of male industrial researchers per thousand labour force	0,91	1999
3.	Gender gap in the FTE/HC ratio for industrial researchers	1,00	1999
4.	Female proportion among industrial researchers in non-services sectors (%)	21,29	1999
5.	Gender employment gap for highly qualified population (p.p.)	-2,57	2000
6a.	Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-2,43	2000
6b.	Gender employment gap for highly qualified population without children under 15 (p.p.)	-1,99	2000
7.	Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	25,89	2000
8.	Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	n.r.	
9.	Female proportion among 5A bachelor graduates (%)	64,94	2000
10.	Female proportion among 5A graduates in science and engineering (%)	38,02	2000
11a.	New female 5A graduates in science and engineering per thousand 20-29 population	4,17	2000
11b.	New male 5A graduates in science and engineering per thousand 20-29 population	6,79	2000
12.	Female proportion among 6 graduates (%)	49,18	2000
13.	Female proportion among 6 graduates in science and engineering (%)	39,74	2000
14a.	New female 6 graduates in science and engineering per thousand 20-29 population	0,30	2000
14b.	New male 6 graduates in science and engineering per thousand 20-29 population	0,46	2000

Distribution by field of study



Industrial S&E profile, 2000



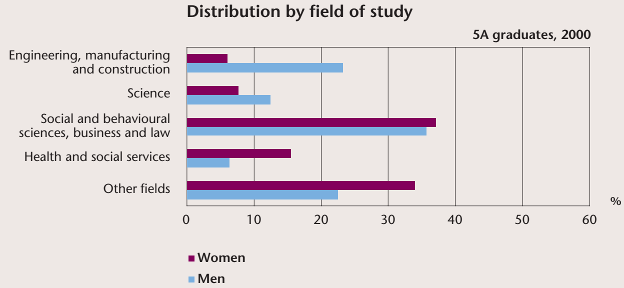
Industrial R&D intensity, 1999

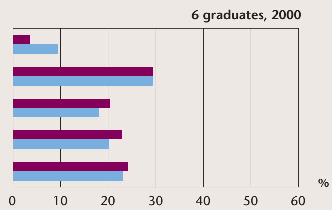
Spain

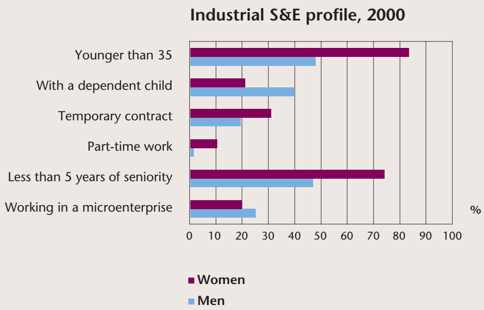
Reference year: industrial researchers (1999); other data (2000)

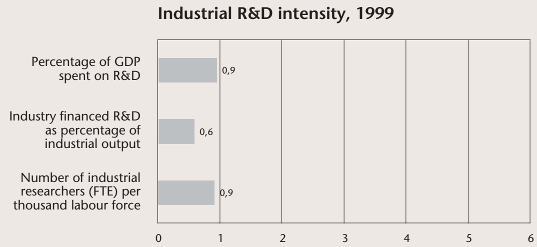
Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	19,37	1999
2a. Number of female industrial researchers per thousand labour force	0,49	1999
2b. Number of male industrial researchers per thousand labour force	1,39	1999
3. Gender gap in the FTE/HC ratio for industrial researchers	1,03	1999
4. Female proportion among industrial researchers in non-services sectors (%)	17,82	1999
5. Gender employment gap for highly qualified population (p.p.)	-12,30	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-18,87	2000
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	-6,67	2000
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	15,37	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	20,18	2000
9. Female proportion among 5A bachelor graduates (%)	58,88	2000
10. Female proportion among 5A graduates in science and engineering (%)	35,37	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	5,18	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	9,25	2000
12. Female proportion among 6 graduates (%)	44,00	2000
13. Female proportion among 6 graduates in science and engineering (%)	40,02	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,27	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	0,40	2000

Distribution by field of study





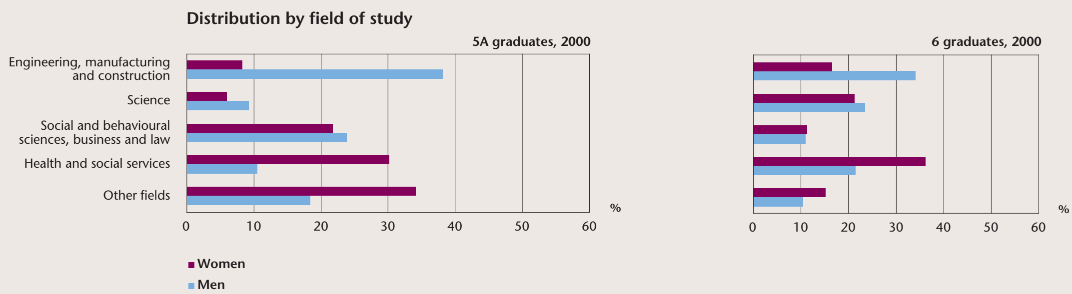


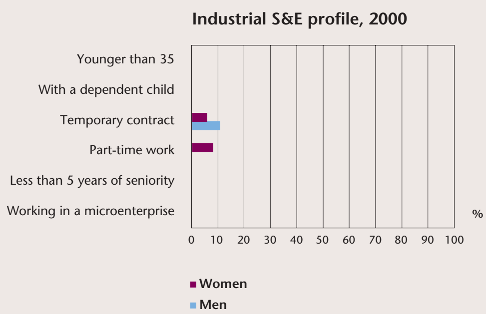


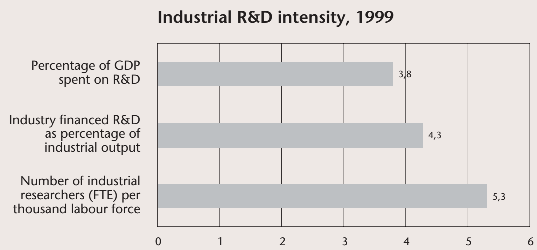
Exceptions to the reference year: Percentage of GDP spent on R&D (2000)

Sweden

Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	n.a.	
2a. Number of female industrial researchers per thousand labour force	n.a.	
2b. Number of male industrial researchers per thousand labour force	n.a.	
3. Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4. Female proportion among industrial researchers in non-services sectors (%)	n.a.	
5. Gender employment gap for highly qualified population (p.p.)	1,39	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	n.a.	
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	n.a.	
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	27,96	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	n.r.	
9. Female proportion among 5A bachelor graduates (%)	60,96	2000
10. Female proportion among 5A graduates in science and engineering (%)	31,87	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	5,52	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	11,44	2000
12. Female proportion among 6 graduates (%)	36,63	2000
13. Female proportion among 6 graduates in science and engineering (%)	27,52	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,77	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	1,97	2000

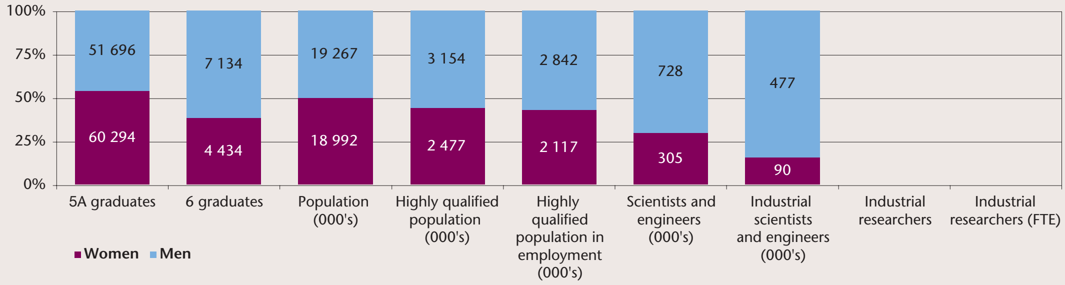






The United Kingdom

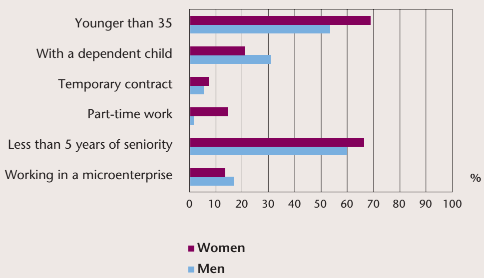
Overall presence of women and men among graduates, highly qualified workforce and industrial researchers, 2000



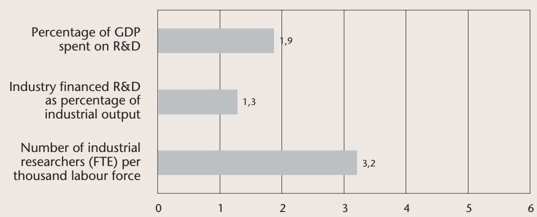
Benchmarking indicators	Value	Year
1. Female proportion among industrial researchers (%)	n.a.	
2a. Number of female industrial researchers per thousand labour force	n.a.	
2b. Number of male industrial researchers per thousand labour force	n.a.	
3. Gender gap in the FTE/HC ratio for industrial researchers	n.a.	
4. Female proportion among industrial researchers in non-services sectors (%)	n.a.	
5. Gender employment gap for highly qualified population (p.p.)	-4,66	2000
6a. Gender employment gap for highly qualified population having at least one child under 15 (p.p.)	-16,67	2000
6b. Gender employment gap for highly qualified population without children under 15 (p.p.)	-1,44	2000
7. Female proportion among industrial scientists and engineers in scientific and technological occupations (%)	13,53	2000
8. Age differential in the female proportion among industrial scientists and engineers in scientific and technological occupations (p.p.)	8,98	2000
9. Female proportion among 5A bachelor graduates (%)	53,84	2000
10. Female proportion among 5A graduates in science and engineering (%)	34,76	2000
11a. New female 5A graduates in science and engineering per thousand 20-29 population	1,96	2000
11b. New male 5A graduates in science and engineering per thousand 20-29 population	3,52	2000
12. Female proportion among 6 graduates (%)	38,33	2000
13. Female proportion among 6 graduates in science and engineering (%)	31,91	2000
14a. New female 6 graduates in science and engineering per thousand 20-29 population	0,53	2000
14b. New male 6 graduates in science and engineering per thousand 20-29 population	1,08	2000

Distribution by field of study

Industrial S&E profile, 2000



Industrial R&D intensity, 1999



Exceptions to the reference year: Percentage of GDP spent on R&D (2000)

Appendix 3.3.: Methodological Notes

The following codes have been used:

B	Belgium
DK	Denmark
D	Germany
EL	Greece
E	Spain
F	France
IRL	Ireland
I	Italy
LU	Luxembourg
NL	The Netherlands
A	Austria
P	Portugal
FIN	Finland
S	Sweden
UK	The United Kingdom

Definitions and statistical classifications

Frascati Manual (The Measurement of Scientific and Technological Activities. Proposed Standard Practice for Surveys of Research and Experimental Development – Frascati Manual 2002)

The Frascati Manual gives the following definitions:

i) Researchers (RSEs) are defined as professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned (Frascati Manual, 2002, §§ 301-305)

ii) The industrial sector (business enterprise sector; BES) includes all firms, organisations and institutions whose primary activity is the market production of goods or services (other than higher education) for sale to the general public at an economically significant price, as well as the private non-profit institutions mainly serving them (Frascati Manual, 2002, §§ 163-168)

Industrial researchers are those researchers working in the industrial sector

Researchers are counted as Head Count (HC) unless specified otherwise, in which case they are Full Time Equivalent (FTE). The HC unit expresses the total number of persons involved in R&D activities, while the FTE unit expresses the number of persons.years and is used for identifying the whole time spent on R&D activities

International Standard Classification of Education (ISCED'97)

The ISCED'97 classification defines the activities of students and graduates by level of education and field of study.

A 5A degree is defined as a basic university degree (first stage of tertiary education based on theory-based tertiary programmes to qualify for entry to advanced research programmes). A 6 degree is defined as a university degree at PhD level (second stage of tertiary education leading to an advanced research qualification).

In this annex, the ISCED'97 fields of study are grouped as follows:

- Engineering, manufacturing and construction: Engineering and engineering trades (ISC52); Manufacturing and processing (ISC54); Architecture and building (ISC58)

- Science: Life sciences (ISC42); Physical sciences (ISC44); Mathematics and statistics (ISC46); Computing (ISC48)

- Social and behavioural sciences, business and law: Social and behavioural sciences (ISC31); Journalism and information (ISC32); Business and administration (ISC34); A12-Law (ISC38)

- Health and social services: Health (ISC72); Social services (ISC76)

- Other fields of study: Teacher training (ISC141); Education Science (ISC142); Arts (ISC21); Humanities (ISC22); Agriculture, forestry and fishery (ISC62); Veterinary (ISC64); Personal services (ISC81); Transport (ISC84);

Environmental protection (ISC85); Security Services (ISC86)

The main “Science and engineering” field groups together the above mentioned fields“Science” and “Engineering, manufacturing and construction”.

The number of graduates refers to those graduating in the reference year and not to the number of graduates in the population.

Other definitions used in this study

This study uses other definitions for the analysis of Community Labour Force Survey data, drawing on the following statistical classifications: the above mentioned ISECD’97, the International Standard Classification of Occupations (ISCO-88) and the Statistical Classification of Economic Activities in the European Community (NACE):

- Highly qualified population: 15-64 years population holding ISCED 5A or 6 degree
- Scientists and engineers (S&E): Employees holding ISCED 5A or 6 degree; working as ISCO-88 211, 212, 213, 214, 221, 222, 231
- Industrial scientists and engineers (industrial S&E): Employees holding ISCED 5A or 6 degree; working as ISCO-88 211, 212, 213, 214, 221, 222, 231, 244 in NACE 1-74
- Non-service sectors: NACE A–F
- Scientific and technological occupations: ISCO-88 211, 212, 213, 214

The ISCO-88 occupational groups above mentioned are the following:
- 211 – physicists, chemists and related professionals
- 212 – mathematicians, statisticians and related professionals
- 213 – computing professionals
- 214 – architects, engineers and related professionals
- 221 – life science professionals
- 222 – health professionals (except nursing)
- 231 – college, university and higher education teaching professionals
- 244 – social science and related professionals

Data sources

Data on industrial researchers are taken from the European R&D Survey.

Data on 5A and 6 graduates are taken from the Education database (New Cronos, Eurostat).

Data of the chart “Industrial R&D intensity” are based on European Commission (2002) *Towards a European Research Area. Science, Technology and Innovation. Key Figures 2002,* European Commission Research Directorate General, Luxembourg: Office for Official Publications of the European Communities. The indicator “number of industrial researchers (FTE) per thousand labour force” has been calculated using data on industrial researchers (FTE) from this source and data on the labour force from the Community Labour Force Survey.

The other data (highly qualified population and scientists and engineers) are taken from the Community Labour Force Survey.

Flags

The following flags have been used:

n.r. not reliable

n.a. not available

APPENDIX 4: Case studies

Appendix 4.1: National experts

Country	Expert team
Belgium	Séverine Lemière, slemiere@univ-paris1.fr Sile O'Dorchai, sile.odorchai@ulb.ac.be DULBEA
France	Séverine Lemière, slemiere@univ-paris1.fr Sile O'Dorchai, sile.odorchai@ulb.ac.be DULBEA
Spain	Karsten Krüger, albakarsten@yahoo.de CIREM
Portugal	Ilona Kovacs, ilona@iseg.utl.pt, ilona.kovacs@moniz.jazznet.pt Sara Falcao Casaca, sarafc@clix.pt, sarafc@iseg.utl.pt Departamento de Ciências Sociais - ISEG - UTL
Austria	Ingrid Pecher, i.pecher@ifgh.ac.at Sonja Sheikh, s.sheikh@ifgh.ac.at Austrian Institute for SME Research
United Kingdom	Jenny Bimrose Fiona Scheibl Robert Lindley, R.M.Lindley@warwick.ac.uk Warwick Institute for Employment Research
Ireland	Clare Mc Andrew Trinity College Dublin (Robert Lindley (Warwick institute for employment research) R.M.Lindley@warwick.ac.uk)
Germany	Gerhard Engelbrech, gerhard.engelbrech@iab.de Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbeit
Finland	Hanna Sutela, Hanna.Sutela@stat.fi Statistics Finland – Work Research Unit
Denmark	Maria Jepsen, mjepsen@etuc.org ETUI
Netherlands	Séverine Lemière, slemiere@univ-paris1.fr Sile O'Dorchai, sile.odorchai@ulb.ac.be DULBEA

Appendix 4.2: Caracteristics of firms

Name	Country	Sector of Activity	Proportion of women	Women in top positions	size	Inter national
Austrian Institute for SME Research	Austria	Independent, private, non profit association. Economic research.	50% (close to the sector's activity: 48% of women with a master degree Vienna university of economics and business administration)	1 woman executive board since 2002	30	Co-operation and partnership
OMV Aktiengesellschaft	Austria	Exploration of crude oil and natural gas	17% of total (female staff)	Department R&D is headed by a woman since 1999	5659 (group) 95 R&D	Yes
Danish firm 1 (anonymous)	DK	R&D of optical and life science components	10% in R&D, « not bad taken into consideration the field of research »	No female directors, nor project managers	150 researchers 6000 people in the holding company	Yes
Haldor Topsoe	DK	Development and production of heterogeneous catalyst and the design of process plants on catalyst processes	30 % of the scientists	No woman department manager and 1(of 3) woman on R&D planning.	100 scientists at the site	Yes
Unibioscreen(1)	Belgium	Research to prevent cancer: experimental R&D pharmaceutics, cellular and molecular biology. Start-up of the Université Libre de Bruxelles	47% of total	1/3 of heads of department and soon 2/4.	19 total	Partnership

(1) We exposed here only the firm (and not the part of academic laboratory which work with Unibioscreen).

Name	Country	Sector of Activity	Proportion of women	Women in top positions	size	Inter national
PT Inovaçao	Portugal	Telecommunication Established in 1999 : beginning of Portugal's telecom privatisation process. Innovation process throughout Portugal telecom group's companies.	27.4% total 14.5% of researchers 36.6% in the activity sector 14% of the students in the discipline.	Few. 1 woman used to belong to the executive council (comprising 3 people) but she left the company recently.	347 group : 20000	interna-tionalisa-tion
Hovione	Portugal	Pharmaceutical	In general (not in the firm): 70% in pharmaceutical sciences (but less qualified) 55% in the activity sector (in jobs requiring less qualifications). 34% in the firm. 44% in the R&D department	1 woman (of 5) project manager 7.1% of senior staff in the firm (against 4.9% in the sector).	68 in R&D department 448 total	Yes
Biotecnol	Portugal	Biotechnology	In general : female rate in courses related to biotechnology is 65.5%, and 48% in R&D sector. 59% in the firm 75% of trainees	50% of the staff in charge of co-ordination	17 permanent contracts + 8 trainees	partnership
Outokumpu Research Oy (ORC)	Finland	Metals production, stainless steel, copper products and technology	21% of the scientific staff 22% of research metallurgist 29% of senior research metallurgist	1 women (of 5) in the management group of ORC (financial manager) 25% of development manager	175 R&D 67 scientific staff	Yes

Name	Country	Sector of Activity	Proportion of women	Women in top positions	size	Inter national
Metso Paper	Finland	Pulp and paper industry processes, machinery and equipment.	13% of the RTD personnel 24% of technological staff	1 woman in the management of RTD In the service business several of these product development managers are women but in the other strategic businesses lines the product development managers are all men.	10 300 persons in over 30 countries. 620 in Research, Technology and Development department (60% in R&D and 40% in technological staff, laboratory workers and workers on pilot machines)	Yes
Pfizer	UK	Pharmaceutical	27% female researchers (48% of researchers recruited in 2001) Biologist : 14% of all researchers and 30% of women Chemists : 13% of all researchers and 47% of women Analytical chemists : 11% of all researchers and 41% of women	4% of program manager 15%of department head 22% of technology centre manager	Around 2658 in R&D 1676 researchers	Yes
Borax	UK	Supplier of borate (minerals)	3 (of 7) scientists (1 scientist and 2 assistant scientists) 3 female researchers recruited in 2001 against 1 male.	No woman in leading positions in research	56 total 7 in scientific research	Yes

Name	Country	Sector of Activity	Proportion of women	Women in top positions	size	Inter national
Acambis	UK	Pharmaceutical (biotech business taking novel vaccines)	58% in research services. 50% of research scientist	3 directors are female.	In the UK Site : 52 in research services 21 research scientist	Yes
Biovail ireland	Ireland	Pharmaceutical	60% in Biovail Ireland 56% of the research department 58% for first year university students taking scientific courses.	2 (of 3) most senior management positions are filled by women. Middle management : 3 (of 4) women.	Ireland : 22 total	Yes
ARUP	Ireland	Consultant industrial engineering	21% of total of the site of Dublin. 34% in the civil environmental and transportation group (CET). 16% in the building engineers (BE) 21% for first year university students taking engineering courses, 50% in environmental engineering.	In the CET team, the bulk of women are at the senior project level and also include 2 senior directors in each group a senior director. There are 4 women senior directors as opposed to 33 men.	6500 in 32 countries. 350 in Ireland (3 sites). The site of Dublin : 223	Yes

Name	Country	Sector of Activity	Proportion of women	Women in top positions	size	Inter national
Kerry Group	Ireland	Food industry	50% of total in the site of Ireland 2/3 of people in research are women (in the new product development section: 50% women, in the IT department : 73% female). In 2002, the enrolment for food science and technology was 76% female, for agricultural and food engineering was 18%, and was 55% for business and commerce degrees (higher education authority, 2002)	1 woman in senior management in the IT and 13 middle managers. In R&D, 58 female managers (10% of all employees in research are female managers).	17000 employees in 17 countries 3000 people in Ireland 776 in research	Yes
Gaz de France	France	Gas (exploration-production, transport, distribution, trade and services). Nationalised undertaking.	26% of women in research jobs (without support functions) (30% of women on the 61 people recruited in 2001) among executives : 31% women among female researchers: 86% executives, and 14% technicians. (agents de maitrise)	1/7 project directors _ heads of pools	Research Department Saint-Denis : 684 and 482 scientists and engineers.	
Thalès	France	Electronic and defence	16% of engineers.(near of the percentage in school in the specialities) 30% of recently recruited	12% of managers (with the support positions). Director of the R&D Centre Orsay: a woman		Yes

Name	Country	Sector of Activity	Proportion of women	Women in top positions	size	Inter national
Atofina Research)	Belgium (Feluy)	Chemical activities of TotalFinaElf Group.	30% of the managerial staff (researchers, project managers…)	2 out of 20 department are headed by women. However, women are more present among heads of division.	410 at the site : _ has a university degree (scientist and engineer) and _ labo-ratory technicians or administrative staff.	Yes
Eli Lilly	Austria	Pharmaceutical	2/3 of the staff is female. 9/12 researchers are women (75%) (in the medical / research department) 13.5% of the total research personnel in the sector students who have finished in medicine : 58% are women, 81% in pharmacy, 61% in biology,, 89% in nutrition sciences, 50% in nutrition and biotechnology,	Head of department and registration manager : men. 3 persons at the next level are women.	41000 people in 70 countries. 90 in Vienna : 12 researchers (in the medical / research department)	
Repsol YPF	Spain	Petrochemical	29% of the researchers in the different Spanish centres. In 2000-2001,contract of 37 researchers : 56% are women.	No woman director. 1 woman programme co-ordinator and 2 more with senior consultant degree. 18% of all programme co-ordinators or similar charges. 11% of the consultants responsible for the co-ordination of some more specific research areas and project management. 50% of the researchers, with project management functions.	37393 persons world-wide. 276 researchers in the different Spanish research centres.	Yes

Name	Country	Sector of Activity	Proportion of women	Women in top positions	size	Inter national
Spanish firm (anonymous)	Spain	Pharmaceutical	51% of the whole employees. 60% of the employees in the research field.	No woman in the board of the enterprise. 1 woman (of 15) advisor. From the 10 directors, 3 are women(support areas) (managing director is a woman).	270 total. 160 in Research field.	Yes
Orion Pharma	Finland	Products for healthcare, pharmaceutical company.	83% in pharmaceutical product development. Nearly 90%of laboratory assistants. 60-70%of scientific staff. About 75% of the personnel working in the R&D.	Many female superiors. The vice president of product development is a woman.	900 in the R&D. 300 in pharmaceutical product development.	Yes
IBM	Spain	Computer technologies and information systems	In spain, 34% of all employees, 34% in the technological functions and around 20% among the executives	The president of IBM Spain Portugal is a woman	3889 in IBM Spain	Yes
Philips	The Netherlands (Natlab – Eindhoven)	Electronic	about 60 women in Natlab : around one tenth of the scientific staff. Share of women among new recruits is increasing.	No woman in the 30-35 managerial research functions (today there are some women among potential group leaders). Women present at level of specialist ladder.	2700 in all research laboratories across the world, about 1000 are researchers (university graduates). More half of Philips'total activities in Natlab.	Yes

Name	Country	Sector of Activity	Proportion of women	Women in top positions	size	Inter national
Aventis Pharma Detschland GmbH	Germany	Prescription medicaments	36% of the employees in the firm. 44.9% in R & D	0 female manager in research in higher grade and 6.3% of female manager in total in higher grade.	7238	Yes
IBM	Germany (deutschland entwicklung GmbH in Böblingen)	Computer technologies and information systems	27% in total (firm in Germany). 17% in entire research department and overall among executives in research.	The overall share of women in top positions amounts to 10%. Although women are over represented in top positions in R&D at 17%, the number of female executives in Germany remains at a low level compared to the worldwide situation in IBM.	26000 in more than 40 branches IBM deutschland GmbH. 1700 (compuetr science specialists, engineers, technicians) in IBM deutschland entwicklung GmbH in Böblingen	Yes
Procter & Gamble	Belgium	Fabric & Home care, baby, feminine and family care, snacks and beverages, beauty care, health care, pet health and nutrition.	Overall R&D at ETC : 48 % women	Top Management (Senior Scientist level and up) at ETC : 28 % women	R&D employees worldwide : 7250 and in Europe :2020.	Yes

Appendix 4.3: Methodology: Work organisation and choice of firms

An expert in each country has been contacted to conduct the national case studies with the help of an interview guide and a series of previously designed guidelines for the case studies.

The list of countries with the names of their national experts can be found in the appendix 4.1.

The underlying logic of this qualitative study was to visit firms that belong to different industrial fields and to cover a large panorama of good practices. The study is based on a purely qualitative approach. Its purpose is to present some "pictures" of the situation of firms and especially of female researchers in industry.

The case studies of each country cover three companies, where possible of different sizes (one small, one medium-size and one big company).

Two points were vital to the choice of the firms:
- Firms needed to have important R&D expenditures and research departments
- Firms preferably needed to be concerned with the promotion of women in research. In other words, the culture of the company was thought to be very important.(2)

A summarising table of the chosen firms' characteristics can be consulted in the appendix 4.2.

Appendix 4.4: Guidelines for meetings

The purpose of this note is to propose some guidelines for this qualitative study.

Outline of the case studies :

The case studies of each country needs to englobe three undertakings, preferably of different size (one small, one medium-size and one big undertaking).

(2) We would like to thank the European Industrial Research Management Association (EIRMA) for its help in finding appropriate firms.

Two points are vital to the choice of firms :
- firms with important R&D expenditures and the enterprises must have important research departments
- firms concerning by the promotion of women in research. So, the culture of the company is very important. Criteria for good practice is, for example, that gender differentiated statistics are collected, and for different years, or if there is a commitment of the top management interested in these questions and if men are co-operating or if promoting of women or closing the gender gap is a success criteria for the management…

Firms must belong to different sectors to cover a large panorama of good practices, it would be very interesting too to expose good practices in the PNP sector.

The study is focussing on researchers and engineers and their careers not so much on technicians or secretaries.

With Helga Ebeling and the European Industrial Research Management Association (EIRMA), we will propose the name of different firms willing to take part in the project in each country to help the country's expert to ensure that relevant areas of industrial research in Europe are covered.

Two series of meetings are organised :
- One with each employer (the chairperson and managing director of the undertaking or the director of human resources or head of the research department)
- Two or three meetings with female researchers in each of the undertakings examined.

GUIDE FOR THE MEETINGS AT THE LEVEL OF THE UNDERTAKINGS :

To context the firm in its sector and country, a short description of the sector and the research activities of the sector can be necessary, with, for example :
- Academic disciplines of the research activities of the sector

- Employment in research by gender
- Proportion of women by employment categories, by degree, by type of employment contract, by age categories, by categories of working hours: statistical data covering the research activities and the whole of the economic sector.
- R&D intensity, R&D expenditures
- Proportion of women in the initial training course which is the most common in the sector.

General information :
- Name of the undertaking
- Name of the person interviewed and his/her professional duties
- Distinctive characteristics of the undertaking within the economic sector
- Size by gender
- Member of a larger group, if yes: distinctive features (specialization) and size of the group
- R&D intensity, R&D expenditures

Department of Research

1. Description of the Department of Research and position of women within this department

Short descriptive summary of the research activities, principal academic discipline. If, within the Department of Research, different services exist, they should be distinguished.
Proportion of women in researchers (and if different categories of researchers exist, the proportion of women in each category).
Proportion of female researchers by degree, by type of employment contract, by age categories, by categories of working hours.
Same data for women in the firm in general.
How many women are in top-positions, high potentials…? Definition of levels.
Unionization rate by gender and, if possible, for the researchers and by gender.
Collection of internal statistics and documents of the undertaking, for example: social balance sheet…if possible for the last 5 years (these data the company might send later if not available for the interview).

2. Human resource management

The different items mentioned below correspond to the main branches of human resource management. They should be addressed in a more specific way accounting for **gender and male-female differences in the job of researcher**. The aim is to expose the good practices to improve the situation of women in research in the firm.

a) Recruitment
- Type of employment contract
- Training period
- Pursued degree
- Recruitment path (school, network of graduates, …), co-operation with universities and schools
- Ratio candidates/recruits by gender
- How many women/ which disciplines/absolut/percentages/yearly (if possible for the last 5 years)
- Age of recruitment
- Parity policy or measures encouraging female employment, recruitment strategies, how do they try to be attractive for women.
- Are there targets to increase female participation ? development in the last years ? have been studies undertaken to identify barriers, which ? Strategies ?
- Availability criterion, assessment of the family burden
- Role of gender in recruitment
- Resorting to head-hunters, hiring away at the competitors and consequently, are there staff flights observable?

b) Continuous training – promotions – mobility

Training
- Specific training for researchers : differences in accessibility, in demand, in specialization, in successful outcome between men and women
- Actions in favour of women
- Does the company know which are the needs of their high qualified staff ?

Promotions and skills evaluations
- Frequency and male-female differences
- Features of the promotional mechanisms: evaluation system, importance of seniority, penalty

associated with career breaks, …

- Promotions within the career of researchers, differences between men and women, reasons ?
- Actions in favour of women
- Mentoring

Mobility

- Frequency and male-female differences
- Link between professional and geographical mobility
- Reasons for the factors curbing mobility
- Accompanying conditions for families in the case of geographical mobility
- Actions in favour of women

c) *Wages – bonuses*

Wage gap between male and female researchers, and in the different categories of researchers if different categories exist.

Bonuses which are specific for the researchers : male-female differences

d) *Availability – working time – linking of family life and professional life*

- Atypical working hours – flexible time / work organisation
- Availability / over-time
- Particular attention to child care
- Management of maternities
- Leaves for dependent persons which are typical for the researchers
- Measures destined to ease the reconciliation between family life and professional life which are typical for the researchers

3. Good practices

- Which practice in your undertaking would you consider effective in favouring female researchers?
- Why?
- What are the positive and negative effects of this practice?
- Are you intending to undertake actions that will be specifically targeted at women, within your undertaking in general or within the occupation of researcher? What are these actions?

Request authorization to have personal meetings with some of the female researchers, ask for contact persons.

Request authorization to diffuse the name of the firm and their experience of good practice.

GUIDE FOR THE MEETINGS AT THE INDIVIDUAL LEVEL: WITH A FEMALE RESEARCHER

The purpose of organizing personal meetings with female researchers is to test how the policy stated by the undertaking can or cannot be retrieved in the personal feelings of the female researchers on the relevant issues as well as to confront the stated policy with the difficulties these women have experienced in practice.

Gathering of the personal opinion of the female researcher:

In her opinion, are there measures encouraging the promotion of women in the research activities of the undertaking?

If yes, which measures? Are they effective? What are the negative effects of these measures?

If no, in her opinion, then why? Should such measures be taken to combat certain existing inequalities?

In her opinion, are there obstacles or factors curbing the promotion of female researchers in the undertaking?

If yes, what are these brakes? How can they be fought against?

If no, does the female salary feel her situation is fair with regard to her male counterparts?

Retrieve the principal arguments that were advanced with regard to the different aspects of Human Resource Management (HRM) during the meeting that was held at the level of the undertaking in order to present those arguments to the female salary and get her opinion on them.

APPENDIX 5: Regulations on child-care and

Appendix 5.1: Child–care coverage

Proportion of young children using formal child-care arrangements

	Aged under 3	Aged 3 to mandatory school age	Year
France	29	99	1998
Netherlands	6	98	1998
Belgium	30	97	2000
Italy	6	95	1998
Denmark	64	91	1998
Spain	5	84	1998
Norway	40	80	2000
Sweden	48	80	1999
Germany	10	78	1998
Portugal	12	75	2000
Austria	4	68	1998
Finland	22	66	2000
United kingdom	34	60	1997
Ireland	38	56	2000
Greece	3	46	1997

Source: OECD Employment Outlook, provided by national sources, 2001

Appendix 5.2 : Child-care allowance

France	**Child Home Care Allowance** (allocation de garde d'enfant à domicile, AGED) is paid if the child concerned is under the age of 3. The maximum allowance amounts to FRF 9,840 (€ 1,500) per quarter on the condition that family income does not exceed net FRF 220,784 (€ 33,658) per year. For higher income, the maximum amount is FRF 6,561 (€ 1,000). For children aged between 3 and 6, it amounts to FRF 3,279 (€ 500) per quarter. **Private child care allowance** (aide à la famille pour l'emploi d'une assistante maternelle agréée AFEAMA): in case of employment of an approved maternal assistant for a child aged less than 6, all social costs are paid provided the gross salary does not exceed a certain limit. **Supplement to AFEAMA:** amount varies according to the age of the children and the family resources. Care for a child under 3 years of age: FRF 1,290 (€ 197) maximum, FRF 845 (€ 129) minimum. Care for a child aged more than 3 and less than 6: FRF 645 (€ 98) max., FRF 423 (€ 64) minimum. **Allowance for parent presence** (Allocation de présence parentale, APP): allows a parent with a seriously sick child to stop or reduce the professional activity. The amount of the allowance depends on the remaining activity and is supplemented when the person taking care of the child is alone.
Netherlands	No special benefit.
Belgium	No special allowance.
Italy	No special allowance.
Denmark	Reduction for brothers and sisters in the same institute.

parental leave

Spain	No special allowance.
Norway	**Monthly Cash Benefit for Parents with Small Children** (kontantstøtte) to parents with children between 1 and 3 years. Conditions of residence in Norway (child and recipient) and of non-use or limited use of State subsidised day care centres (barnehage). 5 different rates of benefit varying according to the child's number of weekly hours in such a day care centre. Maximum rate (0 hours) NOK 3,000 (€ 361), minimum rate (25-32 hours) NOK 600 (€ 72). **For single parent:** Child Care Benefit (stønad til barnetilsyn) when the child must be looked after by someone else during working hours or training courses. Maximum for one child NOK 2,496 (€ 300), for two NOK 3,256 (€ 392), for three or more NOK 3,690 (€ 444). Can be drawn in addition to the Cash Benefit for Parents with Small Children (kontantstøtte) for parents with children between 1 and 3 years.
Sweden	No special allowance.
Germany	No special allowances.
Portugal	No special allowance.
Austria	No special allowance.
Finland	**Child home care allowances** (lasten kotihoidon tuki) for families who care for their children under the age of 3 at home or by other arrangement instead of using day care provided by municipalities. The allowance consists of: basic part FIM 1,500 (€ 252), sibling increase FIM 500 (€ 84) (if sibling under 3 years) or FIM 300 (v 50) (sibling 3-6 years) and means-tested supplement, maximum FIM 1,000 (€ 168) per month. **Private child care allowance** (lasten yksityisen hoidon tuki) is paid when a family arranges the care of the child privately. The allowance is paid to the provider of care directly. The basic amount is FIM 700 (€ 118) per month and per child. In addition a means-tested supplement can be paid of maximum of FIM 800 (€ 135) per month and child. **Partial child care allowance** (osittainen hoitoraha) of FIM 375 (€ 63) per month is paid to a parent who has a child under the age of 3 and who reduces working hours to maximum 30 hours a week.
United Kingdom	Help can be given with childcare as part of the Working Families' Tax Credit (WFTC). This is an allowance paid to workers with low wages to top up their wages. In order to qualify for WFTC the claimant must: - normally work at least 16 hours a week; - have at least one dependent child for whom they are responsible; - not be claiming Disabled Person's Tax Credit; - have an income under GBP 91.45 (€ 145); - have savings and capital of under GBP 8,000 (€ 12,668); - be present and 'ordinarily resident' in GB; - not be 'subject to immigration control'.
Ireland	Not applicable
Luxembourg	No child care allowance.
Greece	No child care allowance.

Source: Mutual Information System on the Social System in the EU Member States and the European Economic Area, Situation on January 1st 2001 and Evolution, http://europa.eu.int/comm/employment_social/missoc2001/index_en.htm

Appendix 5.3: Allowance for single parent

France	**Single Parent Allowance** (allocation de parent isolé, API): Guarantee of minimum family income for single persons with at least 1 child or in case of pregnancy without other dependant children. Monthly amount: FRF 3,295 (€ 502) plus FRF 1,098 (€ 167) per child. The allowance is equal to the difference between this amount and the beneficiary's income. **Maintenance allowance** (allocation de soutien familial): Children who are not acknowledged by either parent or whose father or mother do not fulfil the obligation to pay maintenance, based on income. FRF 494 (€ 75) per month per child.
Netherlands	No special benefit.
Belgium	No special allowance.
Italy	Increased family allowance if lone parent with a child.
Denmark	The general benefits are supplemented by DKK 953 (€ 128) per quarter = DKK 317.66 (€ 43) per month and per child and by an additional allowance of DKK 969 (€ 130) per quarter = DKK 323 (€ 43) per month and per household. Condition: Proof of single-parent situation once a year.
Spain	No special allowance.
Norway	- Child benefit for one more child than the single parent actually has. - One extra infant supplement if child or children between 1 and 3 - Transitional benefit (overgangsstønad) of 1.85 times the Basic Amount (Grunnbeløpet) i.e. NOK 90,816 (€ 10,933) for 3 years, or for up to 5 when under training to qualify for work. The transitional benefit is reduced by 40% of income from work exceeding _ of the Basic Amount (Grunnbeløpet). Recovery of the transitional benefit in child support payments exceeding the rate of advance maintenance payment (bidragsforskott). The recovery is limited to 70% of the exceeding. - Education benefit (utdanningsstønad) when general education or vocational training courses are needed to qualify for the job market.
Sweden	Single parents are guaranteed SEK 1,173 (€ 132) monthly either from child support payments from the other parent or advanced maintenance allowance from the state.
Germany	No special allowances
Portugal	No special allowance.
Austria	**Child benefit** (Kindergeld):No special benefit. **Child-raising allowance** (Karenzgeld):Isolated parents are granted some additional ATS 83.40 (€ 6.06) per day, amount that must be refunded by the other parent (the father). Tax reduction for isolated parents (Alleinerzieherabsetzbetrag): annual tax reduction of ATS 5,000 (€ 363).
Finland	The Child Allowance (lapsilisä) is supplemented by FIM 200 (€ 34) for each child of a single parent
United Kingdom	The higher rate of benefit for lone parents was withdrawn for new claims from June 1998 but a few residual claims remain in payment.
Ireland	One Parent Family Payment is available as a separate and specific means-tested scheme Claimant:IEP 77.50 (€ 98) max. per week. Supplement:IEP 15.20 (€ 19) per week for each child.
Luxembourg	No special benefit.
Greece	Increase of the family allowances of GRD 1,250 (€ 3.67) for each child if parent is widow/er, invalid or soldier as long as survivor's pension does not exceed a certain amount. This benefit is paid without regard to sex of the single parent.

Source: Mutual Information System on the Social System in the EU Member States and the European Economic Area, Situation on January 1st 2001 and Evolution, http://europa.eu.int/comm/employment_social/missoc2001/index_en.htm

Appendix 5.4: Lenght of parental leave and how it is taken (full or part-time, block or piecemeal)

The Member States have to implement parental leave that last for at least three months. They can decide whether parental leave is granted on a full-time or part-time basis, in a piecemeal way or in the form of a time-credit system.

Country	Maximum length of leave	Form of leave	Comment
Austria	Private sector: 22 months	Full-time until child's second birthday (minimum length: 3 months; maximum length: 22 months)	For children born before 31/12/1999: Parents may alternate once; no simultaneous use; any combinations meeting those requirements are possible
		Full time	For children born since 1/1/2000: • Parents may alternate twice; when alternating for the first time, simultaneous use for 1 month is possible until the child is maximum 23 months old • parental leave full time + 3 months "postponed" at latest to the child's 7th birthday (or entry into school) (one parent: until child is 21 months old; both parents "postpone": first block at maximum until child is 18 months old + 3 months + 3 months) subsidiary/additional parental leave in case of prevention of the other parent; :parental leave sui generis in cases of force majeure; maximum length of 23 months and 3 weeks, when begun at the earliest possible time during maternity leave; symmetrical construction in case the other parent is not in the same household as the child anymore; gender specific difference: common household with the child required of father only.
	46 weeks	Part time (block)	For children born before 31/12/99: one parent until child's 4th birthday; both parents simultaneously until child's 2nd birthday (maximum)
		Part-time	For children born after 1/1/2000 one parent or both parents alternatively until child's 4th birthday ; both parents simultaneously until child's 2nd birthday
		Full time then part time	For children born before 31/12/99. Until child's 1st birthday (by one parent or by both parents alternatively), then part-time (one parent or both parents alternatively until child's 3rd birthday; or both parents simultaneously until child's 2nd birthday- minimum length of part-time required: 3 months
		Full time combined with part time	For children born since 1/1/2000. In case part-time is consumed before the child's 1st birthday, the period of part-time is extended accordingly over full-time block (no protection from dismissal after the 2nd birthday)

Country	Maximum length of leave	Form of leave	Comment
		Adoption: If child adopted between 18 months and 2 years old: 6 months. If child adopted after 2 years of age, 6 months but may be used until the child is 7 years old. Applies also foster-parents.	Exception for Länder officials - special leave until child starts at kindergarten (4 years old) Principles described for the private sector apply.
	Public sector: 2 years 4 years	Full-time Part-time	Provisions on "postponed" parental leave apply to certain groups of federal employees (university and other teachers, judges) in a modified form. Additional leave until child enters school for federal civil servants and federal contractual employees.
		Public Sector: The Federal State as employer may reject part time work only for that reason, that the employee, due to part time work, could be employed neither at her former workplace nor at an equivalent workplace. The employer's decision can be revoked up to the Higher Administrative Court (Verwaltungsgerichtshof). or Constitutional Court (Verfassungsgerichtshof).	
Belgium	3 months	Full-time. Alternatively, in private sector, leave may be split with employer's agreement, or used in form of a reduction of working time (e.g. six months half time). In federal public sector, leave may be split, but must be taken in complete working days. Similar, but more rigid provisions in other public services. But Parental leave or career break can be used in a part-time format (since 1.05.1999).	
Denmark	• 52 weeks (between the parents) • 4 weeks before expected confinement until 14 weeks after birth of child.	Full-time, as a single block	Employer and employee may agree further period of leave (paid by the State) but total leave must not exceed 52 weeks. Full benefit which for most workers is considerably lower than full pay. By collective agreement or otherwise the employer may agree to pay full pay for the whole or part of the period of parental leave. It is possible to prolong parental leave by accepting reduced benefit and also the possibility of postponing the leave period until later.
Finland	158 consecutive calendar days after end of maternity leave (known as family leave). Additionally, at least 2 months childcare leave in respect of child under 3 years old. (Alternatively, partial childcare leave i.e. reduction in working hours, but not below 30 hours per week)		
France	In private sector : 3 years ie. 12 months (renewable twice). In public sector : 3 years by periods of 6 months renewable	Full-time or by reducing working hours by at least a fifth, or a combination	

Country	Maximum length of leave	Form of leave	Comment
Germany	3 years	Full or part-time whole or piecemeal with employer's agreement.	Part-time restricted to employees in establishments employing more than 15 people
Greece	3.5 months	Full-time (part-time, with employer's agreement), whole or piece-meal.	In addition, single parents (widows, widowers or unmarried parents) are entitled to an annual parental leave of 6 days if they have up to 2 children, and of 8 days, if they have 3 or more children. After maternity leave, women employed in banks and public corporations are entitled to a reduced working day by 2 hours if they have children up to 2 years old and by 1 hour if they have children up to 4 years old . Instead of the reduced day, they may take a continuous leave of 9 months subsequent to maternity leave. In private sector, after maternity leave, mothers are entitled to a reduced day by 1 hour, for 30 months, or, if their employer agrees, by 2 hours for the first 12 months and one hour for another 6 months; if mother do not use this, fathers are entitled to the reduced day.
Ireland	2 years in civil service 14 working weeks	In civil service, 2 years full-time, whole or piecemeal Full-time, as a single block. Alternatively, as separate blocks of time or by reduced hours to maximum of 14 weeks, with employer's consent.	Even where more than one child, parent only entitled to 14 weeks in a 12 month period unless employer agrees to grant more
Italy	Parents (or a single parent) entitled to total of 10 months leave, with the mother and father each allowed maximum of 6 months	Whole or piecemeal	If father takes more than 3 months, his maximum entitlement increases to 7 months and the maximum total time per child is increased from 10 to 11 months
Luxembourg	6 months 12 months	Full-time, as single block Part-time, with agreement of employer	
Netherlands	6 months 13 weeks	Part-time (50% of contractual working hours). Leave can be taken in a flexible form with a maximum of three leave periods of each at least 1 month. Full-time, available on request. Employer can refuse if important reasons for doing so.	

Country	Maximum length of leave	Form of leave	Comment
Portugal	3 months 6 months	Full time Part time	
	Alternative Schemes Additional, 6 months special leave renewable for up to 2 years (3 years where third child and 4 years where child is disabled)	Full-time	
	1) Schemes for care reasons that can go up to 2 (or 3) years - either parent has the right to work part-time for caring for a child under 12 years old (Maternity Law, article 19, n. 1). This right can go up to 2 years length, or up to 3 years, in case of third child, or more.	Part-time	
	2) Other schemes for care reasons, depending on the agreement between the employer and the employee working father or mother can always agree with the employer in other part-time schemes for reasons of care of a natural or adopted child aged under 12.	Part-time	

Country	Maximum length of leave	Form of leave	Comment
Spain	16 weeks (extendable for two weeks for multiple birth for every child born after the second one)	Full-time	1. Suspension of the work contract (leave after birth):
	10 weeks	Part-time	(The 6 weeks after childbirth are compulsory, to be taken on a full time basis, the rest up to 16 weeks, i.e., 10 weeks can be taken part-time).
			Right exists to remuneration at the expense of the Social Security Service as long as a minimal period of 180 insured days is justified within the 5 years immediately previous to the date of childbirth or to the date of the administrative or judicial decision in case of adoption.
			2. Childcare leave(3) no right to be remunerated during this time.
	3 years from childbirth	Full-time	3. Reduction of the work-day schedule for minors' care under 6 years(4). Reduction in working hours of between a half and a third, with the corresponding and proportional reduction of the remuneration(salary): Applicable to all categories of workers.
Sweden	18 months from birth or the point at which parent takes custody of adopted child or whenever there is a right to statutory parental benefits.	Full-time: Reduction of normal working time where parent in receipt of parental cash benefit. Reduction of normal working time by one quarter until, in most cases, child reaches 8 years or until end of first school year if later. Leave for employee's temporary care of child	
United Kingdom	13 weeks: Part-time: pro-rata entitlement (13 times employee's normal working week) 18 weeks in case of child entitled to disability living allowance.	Full-time. As general rule, may not be taken in periods other than a week or multiple of a week	Employee may not take more than 4 weeks leave in respect of any one child in a 12 month period

Source: COMMISSION OF THE EUROPEAN COMMUNITIES (2003), REPORT FROM THE COMMISSION on the Implementation of Council Directive 96/34/EC of 3rd June 1996 on the framework agreement on parental leave concluded by UNICE, CEEP and the ETUC

(4) Art. 46.3 del Estatuto de los Trabajadores, en su redacción dada por la Ley 39/1999 de 5 de noviembre (BOE 6.11.1999).

(5) Art. 37.5 del Estatuto de los Trabajadores, en su redacción dada por la Ley 39/1999 de 5 de noviembre (BOE 6.11.1999).

Appendix 5.5: Maternity Leave: Prior and after confinement

France	Maternity benefit (indemnités journalières de maternité) only for employees interrupting their work: - 16 weeks (6 before confinement and 10 after). - 2 additional weeks before birth in case of pathological pregnancy. - 26 weeks (8 before confinement) in case of a 3rd child. - 34 weeks (12 before confinement) in case of twins. - 46 weeks (24 before confinement) for multiple births (except twins). In case of adoption: Maternity leave. This leave can be divided between the father and the mother, on condition that both are entitled to it. If mother dies during childbirth: Father entitled to paternity leave
Netherlands	In general, there is a maternity leave of 16 weeks. Prior to confinement, a leave between six and four weeks is compulsory; ten to twelve weeks remain for leave after confinement. If the baby comes early, one is still entitled to a leave of 16 weeks. The number of days that the baby is premature will be added to the leave after confinement.If the baby comes late, the number of 'late' days will be added to the total period of leave. In this case, the leave will be longer than 16 weeks.
Belgium	**Prenatal leave:** 7 weeks (9 weeks in case of multiple birth) before the expected date of delivery. The week immediately preceding delivery is compulsory, the other weeks are optional. **Postnatal leave:** 8 mandatory weeks after delivery. The part of the optional prenatal leave that has not been used up before delivery can be taken after the postnatal leave or at the time when the child comes home after a long period of hospitalisation. In the case of death of the mother, part of the postnatal leave may be changed into a paternity leave under certain conditions.
Italy	Maternity benefit (indennità di maternità), only if wage is discontinued: 1 or 2 months before the presumed confinement date and 3 or 4 months (in case of one month of abstention before delivery) after (optionally 6 supplementary months). The optional supplementary parental leave (astensione facoltativa dal lavoro) may be requested by the father if the mother does not claim, or if the father has sole charge.
Denmark	- For employed or self-employed women or women pursuing training/education under the anti-unemployment measures enacted: Weekly payments during 4 weeks before expected confinement and for 24 weeks after (the last 10 weeks of 24 weeks may be in favour of the father). - Male employed or self-employed: Weekly payments for 2 weeks within the 14 weeks following birth and for 2 weeks after expiry of the 24 weeks period. - Employed or self-employed in case of adoption: Weekly payments for 24 weeks from the date when the parent actually takes charge of the child of which 2 weeks are for the two adopting parents and for 2 weeks as prolongation of the 24 weeks for the adopting father.
Spain	Maternity benefit (prestación por maternidad) for a maximum of 16 weeks (2 weeks more in the case of multiple birth for each child). If employee in receipt of benefit continues to require medical care beyond this 16-week period, she will be treated as temporarily unfit for work. In the case of multiple births, a special allowance is paid for 6 weeks. In the case of adopted and foster-children, allowance is paid for 16 weeks, 2 weeks more in the case of multiple adoption or prior fostering (child under 6 years or more if she/he is handicapped). If both parents work, 10 weeks (leave and allowance) may be in favour of the father. In the event that the mother dies during childbirth, the father has the right to post-natal maternity leave.

	Benefit for risk during pregnancy (riesgo durante el embarazo): paid to expectant mothers, who are unable to continue with their normal task during their pregnancy. The National Social Security Office (Instituto Nacional de la Seguridad Social, I.N.S.S.). manages this allowance.
Norway	- Where both parents have earned a right to Parental Benefit (fødselspenger), the maximum benefit period is 42 weeks at the full rate or 52 weeks at an 80% rate. - Parental Benefit may be drawn from 12 weeks before confinement at the earliest, and 3 weeks of benefit must be taken out before confinement and by the mother. - 4 weeks are reserved the father, and cannot be taken out by the mother. Apart from the 6 weeks after confinement reserved for the mother, the benefit can be taken out by the father on the basis of his own earnings, provided he has worked for at least 6 of the last 10 months immediately before he started his leave. - The father can also take out benefit when a non-active mother is a student or prevented from taking care of the child because of illness. The maximum period of benefit for the father is in these cases 29 weeks at the full rate or 39 weeks at the 80% rate. - Parental Benefit can also be spread out in a time account arrangement (avtale om tidskonto) permitting part-time work in a variety of combinations with reduced benefit over a period of up to 2 years. Employees must enter a written arrangement to this end with the employer, freelancers and self-employed with the local national insurance office. - Corresponding benefits in the case of adoption of children under 15, with periods adjusted for there being no confinement on the part of the adoptive parents.
Sweden	Pregnancy cash benefit (havandeskapspenning) is payable for a maximum of 50 days during the last 60 days before the expected confinement. Parent's cash benefit (föräldrapenning) is payable for a total of 450 days per child. 360 days are paid according to the sickness cash benefit rate, the minimum being SEK 60 (6.75) per day (guarantee amount, garantibelopp). The remaining 90 days are paid according to the guarantee amount. The days may be taken out earliest 60 days before expected confinement by the woman, and by either of the parents until the child is 8 years old. Parents sharing custody are entitled to half of the total number of benefit days each. This right can be transferred to the other parent with the exception of 30 benefit days each, that are reserved for the mother respectively the father (father/mother month, pappa/mammamånad). Temporary parent's cash benefit (tillfällig föräldrapenning) may be taken out for a maximum of 60 days per year until the child is 12 years old (the benefit can be extended in certain cases). Fathers are entitled to 10 benefit days (father days, pappadagar) in connection with child
Germany	6 weeks prior to and 8 weeks after confinement (12 weeks in cases of premature or multiple birth).
Portugal	Maternity benefit (subsídio de maternidade): During maternity leave for 120 days (90 of which have to be after confinement; the mother must necessarily take 6 weeks); 14 to 30 days after miscarriage or delivery of a stillborn child. In case of multiple birth, the leave is extended 30 days per child, since the first one. Paternity benefit (subsídio de paternidade): 5 days, consecutive or not, during the first month after the child birth and: - In case of physical or mental incapacity of the mother; - in case of the mother's death; - based on a joint decision made by both parents. The period the benefit is granted in these last situations, is in relation to the time the mother would have a right to the benefit. In the event of the mother's death, however, the period is a minimum of 14 days.

	Adoption grant (subsídio por adopção): 100 days. Parental leave benefit (subsídio por licença parental): Father or mother can benefit from a 3 months parental leave to take care of their child aged less than 6. This period is taken into account for pension calculation. The father can benefit from an allowance during 15 days, if these follow the paternity of maternity leave. Benefit for a special leave for grand-parents (subsídio por faltas especiais dos avós): 30 days following the grand-children birth. Granted to the working grand-father or grand-mother, when the child parents are at their charge and are aged 16 or less. Benefit in case of particular risks during pregnancy (subsídio por riscos específicos): granted during pregnancy if the woman works in dangerous health/ security conditions or in the case of night-shifts. Parental benefit for the care of ill or disabled children (subsídio para assistência na doença a descentes menores ou deficientes): granted to the father or the mother of an ill child aged less than 10 years or of a disabled child (without age condition) during a maximum period of 30 days for each child and per calendar year. Parental benefit for the care of severely disabled or chronically ill children (subsídio para assistência a deficientes profundos e a doentes crónicos): granted to the father or the mother during a maximum period of 6 months.
Austria	Maternity benefit (Wochengeld) (if there is no continued payment of wages and salaries): 8 weeks before and after confinement (12 weeks in case of premature and multiple birth or Caesarean sections) and for the duration of an individual employment prohibition.
Finland	- Special maternity allowance (erityisäitiysraha) paid during pregnancy, if the mother is exposed to chemical substance, radiation or an infectious disease at her work. - Maternity allowance (äitiysraha) paid to the mother for 105 consecutive calendar days except Sundays, 30-50 of which before expected date of confinement. - Paternity allowance (isyysraha): can be paid to a father for a maximum of 18 days. - Parents' allowance (vanhempainraha) paid immediately after the maternity allowance to either the mother or father for 158 days (excluding Sundays). In case of multiple births 60 days are added to this period for each additional child. In case of adoption of a child under the age of 7 the parents' allowance is paid for a minimum of 180 days.
United Kingdom	All employees are entitled to 18 weeks statutory maternity leave. In addition, employees who have worked for the same employer for at least one year are entitled to additional maternity leave lasting from the end of their maternity leave up to the end of the 28th day after the week their baby is born.
Ireland	Maternity benefit:14 weeks - at least 4 must be taken before and 4 weeks after confinement.
Luxembourg	Maternity Benefit (Prestations en espèces de maternité): Only if wage is discontinued. 8 weeks before presumed date of confinement and 8 weeks after effective date of confinement; 4 weeks supplement for nursing mothers and in case of premature birth or multiple births. Additional exemption from work if a change of assignment for health reasons is not possible (advice from the occupational medical officer required). Maternity Allowance (allocation de maternité): 16 weeks. Non-cumulative with similar maternity benefits or with earnings.
Greece	Maternity benefit payable to insured women 56 days before and 56 days after confinement.

Source: Mutual Information System on the Social System in the EU Member States and the European Economic Area, Situation on January 1st 2001 and Evolution, http://europa.eu.int/comm/employment_social/missoc2001/index_en.htm

Appendix 5.6: Maternity: Cash Benefit

France	Net salary with ceiling. Maximum: FRF 399.71 (€ 61) per day. Minimum: FRF 49.37 (€ 7.53) per day.
Netherlands	Sickness Benefits Act (Ziektewet, ZW):100% of the daily wage. Maximum daily wage considered: NLG 337.33 (€ 153). Self-employed Persons Disablement Insurance Act (Wet arbeidsongeschiktheidsverzekering zelfstandigen, WAZ):100% of the minimum wage (at least if that was earned) or less.
Belgium	Maternity benefit (indemnité de maternité/moederschapsuitkering):82% of wages (without ceiling) in the first 30 days, and 75% or 60% of wages up to ceiling respectively, for period from 31st day, and for period exceeding the 15 weeks. Special regulations for unemployed workers and for disabled. Birth grant (allocation de naissance/ kraamgeld): BEF 38,141 (€ 945) for first birth; BEF 28,697 (€ 711) for second and each subsequent birth. May be obtained in advance two months before the probable date of birth. Adoption grant (prime d'adoption/ adoptiepremie):BEF 38,141 (€ 945) per adopted child.
Italy	80% of earnings for the compulsory period, and 30% for the supplementary period.
Denmark	**Salaried workers:** Maternity cash benefit (dagpenge ved fødsel) calculated upon the basis of the hourly wage of the worker (contributions to Labour Market Fund (Arbejdsmarkedsfonden) deducted), with a maximum of DKK 2,937 (€ 394) per week or DKK 79.38 (€ 11) per hour (37 hours per week), and upon the number of hours of work. **Self-employed:** The maternity cash benefit are calculated on the basis of the earnings from the occupational activity of the self-employed person, with the same maximum as mentioned above. Hours or days during pregnancy where work was interrupted for preventive medical examinations (covered by the employer).
Spain	100% of the contribution basis. 75% of the contribution basis for risk during pregnancy allowance from the day after the risk starts. Contribution basis: daily salary subject to contributions of the month preceding the termination of work.
Norway	The compensation level of the full rate Parental Benefit (fødselspenger) is the same as that of sickness cash benefits (sykepenger), 100% of the income from work up to an annual 6 times the Basic Amount (Grunnbeløpet) i.e. NOK 294,540 (€ 35,459). The Maternity Grant (engangsstønad ved fødsel) for the non active is paid as a lump sum of NOK 32,138 (€ 3,869). Should the Parental Benefit for the full period be lower than the Maternity Grant, the Parental Benefit will be topped with the differential.
Sweden	The compensation level is the same as for sickness cash benefit (sjukpenning), 80% of the income qualifying for sickness cash benefit.
Germany	**Maternity Benefit** (Mutterschaftsgeld):Average net wage of insured person, reduced with legal contributions, with maximum of DEM 25 (€ 13) per day. Difference covered by supplement paid by employer (in case of suppression of this supplement, complement paid by the State). Women employees who are not insured receive a maximum of DEM 400 (€ 205). **Maternity Allowance** (Entbindungsgeld):Fixed grant of DEM 150 (€ 77) to insured persons not entitled to Maternity Benefit (Mutterschaftsgeld).

Portugal	Maternity benefit (subsídio de maternidade), paternity benefit (subsídio de paternidade), adoption grant (subsídio por adopção), parental leave benefit (subsídio por licença parental), benefit for a special leave for grand-parents (aubsídio por faltas especiais dos avós): Daily allowances of 100% of the average daily wages (payments at Christmas and holiday allowances included). Minimum amount: 50% of the minimum wage. Benefit in case of particular risks during pregnancy (subsídio por riscos específicos), parental benefit for the care of ill or disabled children (subsídio para assistência na doença a descentes menores ou deficientes), parental benefit for the care of severely disabled or chronically ill children (subsídio para assistência a deficientes profundos e a doentes crónicos): Daily benefit of 65% of the average daily wage. Minimum amount: 30% of the minimum wage.
Austria	Maternity benefit (Wochengeld):To the amount of the average net income of the last 13 weeks or 3 months. For voluntary insured persons with earnings below the threshold for compulsory insurance and persons having a free service contract, the support amounts to ATS 94 (€ 6.83) per day.
Finland	Minimum cash benefit is FIM 60 (€ 10) per day.
United Kingdom	Statutory Maternity Pay: 90 per cent of earnings for the first 6 weeks of the maternity pay period; GBP 60.20 (€ 95) for the remaining weeks (up to 12). Maternity Allowance:GBP 60.20 (€ 95) per week for up to 18 weeks if average earnings are at least equal to the lower earnings limit for contributions which applies at the beginning of the test period (26 weeks in the 66 week period before the baby is due). For 2000/2001, this is GBP 67 (€ 106) per week. Otherwise, the woman may claim 90% of her average earnings if her earnings are at least GBP 30 (€ 48) a week but less than the lower earnings limit which applies at the beginning of the test period.
Ireland	Maternity benefit: - 70% of average weekly earnings in the relevant tax year. Minimum IEP 90.70 (€ 115), maximum IEP 172.80 (€ 219) per week) or - the amount of Disability Benefit including increases for adult and child dependants which the person would be entitled to if absent from work through illness, whichever amount is greater.
Luxembourg	**Maternity Benefit** (Prestations en espèces de maternité): 100% of the salary the insured received during the maternity leave. **Maternity Allowance** (allocation de maternité): LUF 6,917 (€ 171) per week, payable over a period of 16 weeks.
Greece	Maximum (no dependants): GRD 12,110 (€ 36) per day. Maximum (4 dependants): GRD 16,954 (€ 50) per day.

Source: Mutual Information System on the Social System in the EU Member States and the European Economic Area, Situation on January 1st 2001 and Evolution, http://europa.eu.int/comm/employment_social/missoc2001/index_en.htm

More information:

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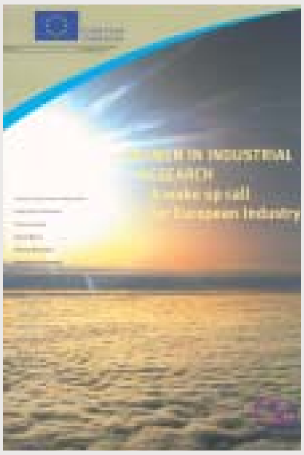

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How will industrial research companies in the European Union find the talent they need to meet the competitive and technological challenges of the 21st Century? How will they enlarge R&D capacity when there are already shortages of highly qualified industrial researchers?

This study is part of the new EU initiative to promote Women in Industrial Research (WIR).

Based on statistical data and examples of good practice in Europe it gives information about the real situation of women in industrial research. For the first time official data from the European R&D survey and the European Labour Force Survey have been examined. Although the study confirms that women are under-represented among industrial researchers, especially at senior levels, it provides encouraging perspectives by showing that the private research sector has recently begun to recruit more highly qualified young women.

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