Meta-analysis of gender and science research

Topic report
Gender Wage Gap and Funding

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General introduction

Over the past decade, the European Comission has strived towards attracting and retaining more women in science and research as part of its strategy to become a competitive and knowledge-based society. Equally crucial to achieving a gender balance in science is mainstreaming gender in scientific research in order for a gender balance to be reached at all levels of the hierarchical scientific career. The Gender and Excellence expert group was set up to improve transparency in the procedures used in selection committees for the award of grants and fellowships and in access to research funding in general. However, not only should more women be able to reach higher seniority grades, they should also be paid equally to men in identical positions. The gender pay gap in science and research constitutes a summary indicator of all existing gender inequalities in these occupational categories.

This report is structured around these two issues: the gender pay gap in science and research and gender differences in application for and obtention of research funding. The first part focuses on the gender pay gap, the second part on research funding.

In a first section of the first part, we present the methodological and conceptual framework for an analysis of the gender pay gap in general. An outline of the general definition of the gender pay gap is followed by a discussion of existing indicators and measures of the gender pay gap. The gender pay gap in the labour market as a whole is analysed both at the European level and within the different countries. Finally, an attempt to evaluate the evolution of the gender pay gap over time is made.

The second section of the first part narrows the focus to the gender pay gap in scientific and research professions. We first present the results of existing European comparisons. We also look into the evolution of the gender wage gap in these occupations and try to establish European comparisons over time.

Finally, in the first part, we present the results of those studies in the Gender and Science database that deal with the gender pay gap. We start with a short statistical synthesis of the publications and we filter out what can be learned from a global assessment of this research on the gender pay gap. Second, we present the main research questions that are addressed by the publications on the gender pay gap in the Gender and Science database. Three types of research questions are identified: the description of the gender pay gap in scientific and research occupations; the causes and consequences of the pay gap; and finally, the measures to tackle the gender pay gap in science and research. Third, we present the main methodologies used to analyse the gender pay gap in science and research professions. Fourth, we present the main results put forth by the publications in the Gender and Science database. Results are grouped into three categories: international comparisons, the determinants of the gender pay gap, and country specificities. To conclude, we discuss the statistical gaps in existing research and we formulate policy recommendations.

The second part of this report focuses on the gender bias in access to research funding. It has a similar structure to the first part. First, we present the methodological and conceptual framework of access to funding (general definition and measures). In a second section, we present the results of European comparisons that allow to draw a general picture of the problem. Third, we present the results of those publications in the Gender and Science database that address the topic of research funding. In this section we first briefly present these publications from a statistical point of view. Then we retrieve the main research questions addressed in these publications and we synthetise the methodologies used and results obtained. Finally, we discuss the main gaps in existing research on funding and we propose policy recommendations.

Part I: Gender Wage Gap

1. Concept and methodology

1.1. General definition

The gender pay gap refers to the difference between the wages earned by women and by men. At EU level, the gender pay gap is defined as the relative difference in the average gross hourly earnings of women and men within the economy as a whole. This definition is restrictive in that it captures only part of gender pay differences given that there are differences in working hours between women and men and that women benefit less than men from non-wage forms of pay. As a result, gender inequality in earnings from an economic activity is expected to be much higher than gender differences in hourly pay.

In all countries, all domains, sectors and professions men earn more than women. These gender pay gaps persist despite the fact that women's employment, labour supply and level of education has increased, caught up or even surpassed men's in all countries. Moreover, there is no link between the gender pay gap and women's employment rate. In the Scandinavian countries, the gender pay gap is close to the EU average and higher than that observed in some Southern European countries.

However, any form of wage discrimination based on sex is prohibited in all EU member states. The 1975 Equal Pay Directive bans discrimination on grounds of sex with regard to all aspects and conditions of pay. In particular, where a job classification system is used for determining pay, it must be based on the same criteria for both men and women and so drawn up as to exclude any discrimination on grounds of sex. The 2002 Directive on equal treatment for men and women as regards access to employment, vocational training and promotion, and working conditions also applies to pay and it introduces definitions of direct and indirect discrimination requiring Member States to set up Equality Bodies to promote and support equal treatment between women and men. Seven Directives concerning equal treatment between women and men (including the 1975 and 2002 Directives) were incorporated in a single Directive adopted in 2006. It brings more clarity to Community law on the field of equal treatment between women and men. All of these

instruments mean that it is illegal to discriminate against women in the labour market and pay women lower wages than men when doing the same work or work that is of an equal value. The transposition of these Directives into national legislation has provided each member state with the necessary legislative framework to reduce the gender pay gap. However, available data do not prove this to be the case. The gender pay gap exists everywhere and more importantly, it does not decrease over time.

Other factors besides direct discrimination deepen the gender pay gap. The literature has identified a huge number of these factors:

- Human capital, including level of education and professional experience
- Differences between men and women in educational orientations
- Horizontal/vertical segregation
- The size of the public sector and the relative level of public wages
- The definition of "equal value": job classification and evaluation schemes
- Working time: full-time, part-time, overtime
- Different forms of flexible work
- The wage structure: overtime, seniority, performance-related pay, individually-negotiated pay
- Level and coverage of wage bargaining
- Existence and level of the minimum wage
- Access to internal training and to publicly-financed lifelong learning programmes, organisation of training time
- Industrial organisation and structure: size of firms, outsourcing, ...
- Women's underrepresentation in unions, employer associations, other bargaining or representative bodies
- …

The problem of the gender wage gap is thus an extremely complex one on which policies have yet had just a minor impact.

1.2. Measurement and indicators

With respect to the measure of the gender pay gap, Plantenga and Remery (2006) explain: "*In order to take into account differences in working hours and the impact of the income tax system most estimates are based on differences in gross hourly wages. The most common method is to calculate the gender pay gap as the ratio of women's average gross hourly wage to men's average gross hourly wage, or as the difference between men's and women's gross hourly wage as a percentage of men's average gross hourly wage. In this case the gender pay gap indicates how many percentage points the earnings of men have to decrease in order to be equal to those of women* » (p.11). However, a better measure would have the earnings of women in the denominator in which case the gender pay gap would indicates by how many percentage points the earnings of women have to increase in order to be equal to those of men.

If the EU measure neutralizes the differences in working hours between men and women given that it looks at hourly wages, it remains a gross measure that reflects direct discrimination but also a whole series of more subtle forms of discrimination that are conveyed by individual, firm and other characteristics, observed or not.

Numerous empirical studies have applied decomposition techniques such as that developed by Oaxaca and Blinder (1973) to split the gender pay gap into two or more parts, a part that can be attributed to observed differences in characteristics between men and women and one that is due to differences in the returns to identical characteristics. The adjusted wage gap corresponds to this residual gap that remains after controlling for all observable differences in male and female characteristics.

Economists have been numerous to carry out such wage gap decompositions. However, these techniques suffer a number of flaws which one need always keep in mind. Indeed, although part of the total gender pay gap can be attributed to differences in men's and women's characteristics and is as such "explained" by these differences, this does not mean that these differences in characteristics justify resulting pay differences. Differences in characteristics result from more subtle discriminatory processes such as segregation across sectors, occupations, study fields, firms, and so forth.
This explains why the indicator retained at the EU level to measure the gender pay gap is the unadjusted gap between men's and women's hourly wages.

There are two data sets at the EU level that allow to estimate the gender pay gap, the Structure of Earnings Survey (SES) and the Statistics on Income and Living Conditions (SILC). There is a fundamental difference in design between both of these datasets. The SES data are individual but provided by establishments' management, whereas SILC data are collected from responses to the survey questions by the sampled individuals. This conceptual difference between both data sets has important implications in terms of data quality. Data on wages and working hours are far more reliable when reported by employers than by workers. The SES and SILC also differ in terms of sectoral coverage. Whereas SILC covers the entire economy, the SES has traditionally excluded the public sector. However, as of 2006, the SES partly covers the public sector as well. Indeed, as of 2006, education (Nace Rev. 1.1 M), health and social work (Nace Rev. 1.1 N) and other community, social and personal service activities (Nace Rev. 1.1 O) are included. Public administration and defence and compulsory social security (Nace Rev. 1.1 L) is still left out. This

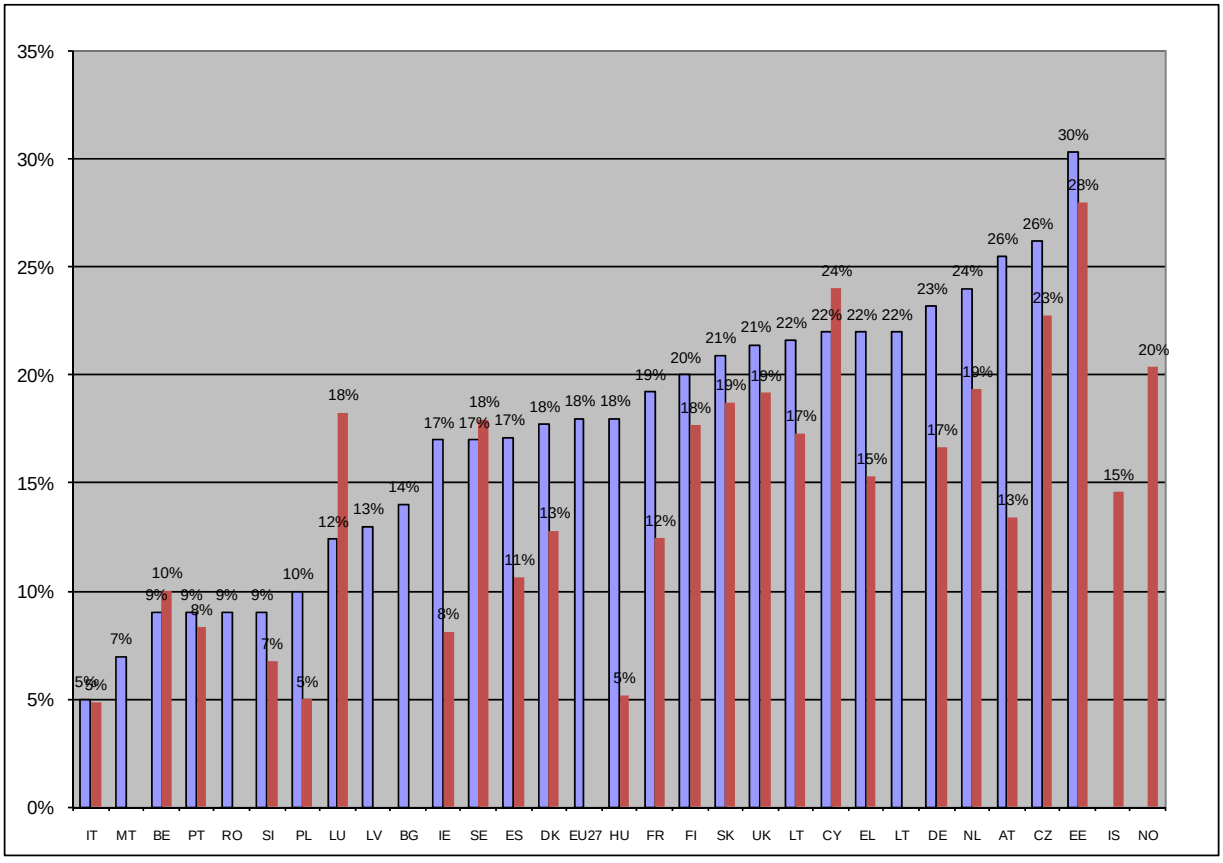
partial coverage of the economy by the SES data may affect wage estimations and calculations of the gender wage gap if it is indeed true that women's wages are higher in the public sector. Thridly, it should be noted that the SES covers only firms with more than 10 workers. A fourth difference between both data sets derives from their different objectives. The SES concentrates on wages and as such offers very detailed information on all elements of wages, jobs and firms. It provides only limited information on the individual and household characteristics of individuals. On the contrary, SILC is the successor of the European Community Household Panel (ECHP) and is considered the reference source of statistics on income and social exclusion in the European Union. It provides ample information on living conditions (household composition, housing, etc.), income situation and perception, employment situation and background, and health and social life of households and individuals. Finally, a relative advantage of SILC compared with the SES is that SILC has a panel dimension allowing for dynamic analyses of wages whereas the SES is purely cross-sectional.

2. Results of International comparisons

2.1. European comparative statistics

On average for the EU27, the most recent data provided by the European Commission show that the gender pay gap stood at 18% in 2006 meaning that women on average earn 18% less than men.

Graph 1: (Unadjusted) gender pay gap in the EU, 2006



Source: Smith (2010) and SILC 2007, own calculations
Note: SES: provisional data for EU27, FR, ES and CY

Graph 1 presents the gender pay gap throughout the EU calculated on the basis of the SES (blue bars) and EU-SILC (red bars). The differences between the two series of gaps illustrate the difficulty to accurately measure the gender pay gap and its evolution over time. When different data sets are used the country ranking changes and the size of the gender pay gap too.

The first finding is that a gender pay gap exists in all European countries. Women on average earn less per hour than men.

The second finding is that the ranking of countries is surprising. Indeed, based on SES data, the following countries have gender pay gaps below 10%: Italy, Malta, Slovenia, Belgium, Romania, Portugal and Poland. The gap exceeds 20% in Finland, Slovakia, the UK, Cyprus, Lithuania, Greece, Germany, the Netherlands, Austria, the Czech Republic and Estonia. The ranking is surprising in the sense that those countries with the lowest gender pay gap are not necessarily those known for their gender equality policies. The Scandinavian countries, for example, always put forth as good examples of countries where gender equality is promoted, are not found among countries with the smallest gender pay gap.

According to Carley (2009), the gender pay gap is on average wider in the 12 new EU Member States than in the former EU15 in 2008. However, according to Graph 1 the new entrants are just as well present among those countries with the lowest gender pay gap, e.g. Malta, Slovenia and Romania, as among those where the gender pay gap is largest, e.g. the Czech Republic, Estonia and Lithuania. When the gender pay gap is analysed, we do not find the traditional welfare state typologies, such as the one established by Esping Andersen (1990).

Numerous studies have identified the factors that influence the size of the gender pay gap. Individual factors such as age and education are positively correlated with the size of the gender pay gap (Blau and Kahn 2000). According to Plantenga and Remery (2006), in comparison to a representative sample of the total population, the gender pay gap is lower if only a sample of new entrants in the labour market is investigated. This means that the gender pay gap tends to widen with age. Another constant observation is that the gender pay gap is higher for married employees and significantly lower for singles. Age is often used as a proxy for labour market experience given the lack of data on real experience in most data sets. However, it can be questioned whether age is a good proxy for women's labour market experience given that they are numerous to interrupt their careers at child-bearing ages.

According to Barth et al. (2002), in Denmark, the Netherlands and Germany the pay gap among the highest educated is substantially wider than among the least educated, after controlling for differences in work experience. This suggests that women hit a 'glass ceiling' in the pay structure.

The hypothesis of the glass ceiling is confirmed by Arulampalam et al. (2007). These authors analyse the evolution of the gender pay gap along the wage distribution using quantile regressions. They provide evidence for the workings of a glass ceiling at the top of the wage distribution. "*The gender pay gap typically widened toward the top of the wage distribution (the "glass ceiling" effect) and in a few cases it also widened at the bottom (the "sticky floor" effect)*" (Arulampalam et al. 2007, p.163).

The widening of the gender pay gap at the top of the wage structure and its increase with level of education are of huge concern for women in science as far as these results suggest that the gender pay gap would be larger for women scientists and researchers than on average for all female workers.

Segregation also appears to be highly correlated with gender wage inequality. Women's over-representation in low-paid industries, occupations and establishments explain a part of the gender wage gap in the decomposition model. Bayard *et al.* (2003) attribute roughly 50% of the gender

pay gap in the United States to women's overrepresentation in low-paid occupations. Gannon et al. (2005) show that sectoral segregation (horizontal) explains 29% of the gender pay gap in Ireland, between 14% and 16% in Denmark and Italy and roughly 7% in the UK. However, sectoral segregation does not contribute to explaining the gender pay gap in Belgium and Spain. Such matched employer-employee data have also served as the basis for the analyses by Groshen (1991), Meyersson et al. (2001) and Amuedo-Dorantes and De la Rica (206). The first two studies find that the gender wage gap at the job-cell level contributes very little to the aggregate wage gap. On the contrary, the third study shows that the within job cell component of segregation accounted for 22% of the aggregate gender wage gap in Spain in 1995 and for 53% in 2002. Grimshaw and Rubery (2002) also found a correlation between sector of activity and the gender pay gap. By means of a simulation of what the distribution of female employment across occupations and industries would look like in case it were equal to that of men's employment, and controlling for gender differences in education, labour market experience and seniority, Plasman and Sissoko (2005) show that the part of the gender wage gap that is due to professional segregation amounts to 5.27% in Italy, 13% in Belgium, 20.2% in Denmark and 26.7% in Spain. Gender differences in the human capital variables explain the entire gender wage gap in Italy but only half of it or less in Denmark, Belgium and Spain. In the latter three countries, women's wages are subject to the combined effects of discrimination in the access to occupations and wage discrimination. Dolton et al. (2008) pool the 8 waves of the ECHP to study a sample of salaried public and private sector workers (excluding the self-employed) aged 16-64 over the period 1994-2001. The authors find that in some countries those occupations that employ the largest shares of women are also those with the largest gender wage gap whereas in others, the opposite holds true. Dolado *et al.* (2002) study the sign and the magnitude of the correlation between segregation (by age and level of education) and the 'net' wage gap (the unexplained part in the Oaxaca-Blinder decomposition) in the EU15 (based on ECHP data) and the US (based on data from the Current Population Survey). They find a positive but small and not statistically significant relationship between both elements. However, when the Scandinavian countries, where segregation is high and the gender pay gap small, are left out, significance increases. A positive, non-significant correlation was also found by Blau and Kahn (2001) in their analysis of 22 countries over the period 1985-1994. On the contrary, Pissarides *et al.* (2005) obtain a negative but not statistically significant sign when testing the correlation between segregation and the net gender wage gap in 11 European countries between 1980 and 1998. To sum up, we agree with Bettio (2008: 184): "*Uncertainty about the estimated order of magnitude on the one hand, and about the precise link [of segregation] with discrimination on the other hand, continues to thwart any attempt to draw precise conclusions from existing evidence on this point*".

The gender pay gap appears to be smaller in the public sector than in the private sector (Plantenga and Remery 2006). Policy developments such as cuts in public sector expenditure in pursuit of the Maastricht convergence criteria and the emphasis on economic performance through flexibility therefore have negative implications for gender pay equality (Rubery et al 1999).

Other studies address the wage structure and wage formation process as a determinant of the gender pay gap. Differences between countries in terms of wage structure and wage formation are shown to explain differences in the level of the gender pay gap. Studies generally put forth, despite strong cross-country differences, a negative relation between the wage distribution and the gender pay gap. Blau and Kahn (2003), based on microdata for the period 1985-1994, show

that a more compressed male wage structure and lower female net supply are both associated with a lower gender pay gap.

On the contrary, the formal coverage of the collective bargaining system, a more coordinated and articulated bargaining system and a centralized system of pay and wage formation tend to decrease the gender wage gap. Plantenga and Remery (2006) state: "*As wages are increasingly set at local or company level, inter-firm and inter-industry wage differences may increase, thereby potentially increasing the gender pay gap. In addition, the rise of a variable and performance-based pay system may increase the overall wage difference between men and women. In fact women seem to be swimming upstream: women with an improved educational background, fewer children and shorter periods of employment interruption are confronted with a labour market with growing wage differentials and a reduced share of collectively agreed wages and wage components"* (p. 5).

According to Blau and Kahn (2003), the high wage floors that are associated with highly centralized, unionized wage setting raise women's relative pay since women are systematically overrepresented at the bottom of the wage distribution. When a minimum wage exists it also decreases gender wage disparity (Rubery and Grimshaw, 2009). Trade union density is also negatively correlated with the gender pay gap. However, Sap (1993) indicates that female bargaining power follows women's share of union leadership.

The gender pay gap is also correlated with the gendered impact of family responsibilities. The presence of young children in the household not only has a depressing impact on female labour market participation rates but it also affects wages through a reduction of working hours. The inverse generally holds true for men as fathers tend to work and earn more than men without children. Besides affecting participation and working hours, parenthood status in itself is usually associated with a pay penalty for mothers and a wage bonus for fathers thus deepening the gender wage gap. The effects of maternity on women's wages were analysed by O'Dorchai (2009). She finds that the motherhood wage is much smaller than the gender wage gap, indicating that discrimination is more sex- than maternity-related and thus concerns all women as they are all potential mothers. Not only is the motherhood gap smaller in size, it is even negative in six of the twenty countries studied pointing towards a wage bonus for mothers as compared with non-mothers. However, only in Belgium and Cyprus is this bonus worth mentioning (7% in Belgium and 18% in Cyprus). In the thirteen of the remaining countries, motherhood strengthens the gender wage gap and women's wages suffer downward pressure from the accumulated effects of their sex and motherhood status. The wage disadvantage for mothers (as compared with non-mothers) ranges from 1% of an average mother's wage in Hungary to 21% in the UK. There is one country where mothers and non-mothers earn roughly identical wages, Italy.

2.2. Evolution

Comparing the gender pay gap over time is a complicated affair, principally because of data problems (quality of the data and comparability, provisional character of data, breaks in the series). The SES provides the most reliable data on wages but data are collected only once every four years. The European Community Household Panel (ECHP) may be used until it was ended in 2002 and replaced by the EU-SILC as of 2003 (cfr. Plantenga and Remery 2006).

Table 1 attempts to present the evolution of the gender pay gap between 1995 and 2005. The EU-27 average shows a decrease of 2 percentage points over the period. However, the SES for 2006 which are used to compute the European indicator on the gender wage gap show that the gender pay gap is still at 18% in 2006 compared with 15% in Table 1 for 2005.

There is no clear general trend towards a decrease of the gender pay gap over time. A communication by the European Commission (2007)[1] states that there is nothing to indicate that this gap is narrowing in any significant way. This contrasts with the marked increase in the female employment rate and with the evolution of the legal framework on gender equality in pay. The gap between men's and women's earnings persists and in general, there is little evidence of progress in closing the gap (She Figures, 2009).

[1] European Commission (2007) *Communication from the Commission to the European Parliament, the Council, The European economic and social Committee and the Committee of the Regions. Tackling the pay gap between women and men*, Brussels, COM (2007) 424 final.

Table 1: Gender pay gap[1] (%) in the EU from 1995 to 2005

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
EU-27 (1)	17	17	16	17	16	16	16	16	15	15	15
BE	12	10	10	9	11	13	12	:	:	6 (2)	7
BG	:	:	:	:	:	:	22	21	18	16	16
CZ	:	21	21	25	22	22	20	19	19	19	19
DK	15	15	13	12	14	15	15	18 (2)	18	17	18
DE	21	21	21	22	19	21	21	22 (2)	23	23	22
EE	27	27	28	26	26	25	24	24	24	24	25
EL	17	15	13	12	13	15	18	17	11 (2)	10	9 (3)
ES	13	14	14	16	14	15	17	21 (2)	18	15	13 (3)
FR	13	13	12	12	12	13	14	13	12 (2)	12	12
IE	20	21	19	20	22	19	17	:	14 (2)	11(3)	9 (3)
IT	8	8	7	7	8	6	6	:	:	7 (3)	9
CY	29	28	27	26	27	26	26	25	25	25	25
LV	:	:	:	20	20	20	16	16	16	15	17
LT	27	22	23	22	16	16	16	16	17	16	15
LU	19	19	19	18	17	15	16	17	15	14	14
HU	22	23	24	23	21	21	20	16	12	14	11
MT	:	:	:	:	:	11	9	6 (2)	4	4	4
NL	23	23	22	21	21	21	19	19	18	19	18
AT	22	20	22	21	21	20	20	:	17 (2)	18	18 (3)
PL	:	:	:	:	15	:	12	11	11	10	10
PT	5	6	7	6	5	8	10	8	9	5 (2)	9
RO	21	24	24	20	17	17	18	17	18	14 (2)	13
SI	14	15	14	11	14	12	11	9	:	8 (3)	8 (3)
SK	:	:	:	:	23	22	23	27	23	24	24
FI	:	17	18	19	19	17	17	20 (2)	20	20	20
SE	15	17	17	18	17	18	18	17	16	17	16
UK	26	24	21	24	22	21	21	23 (2)	22	22	20 (3)

Source: Eurostat, Structural Indicators; In European Commission, 2007, p. 19.

(1) Estimate.
(2) Break in series.
(3) Provisional value.

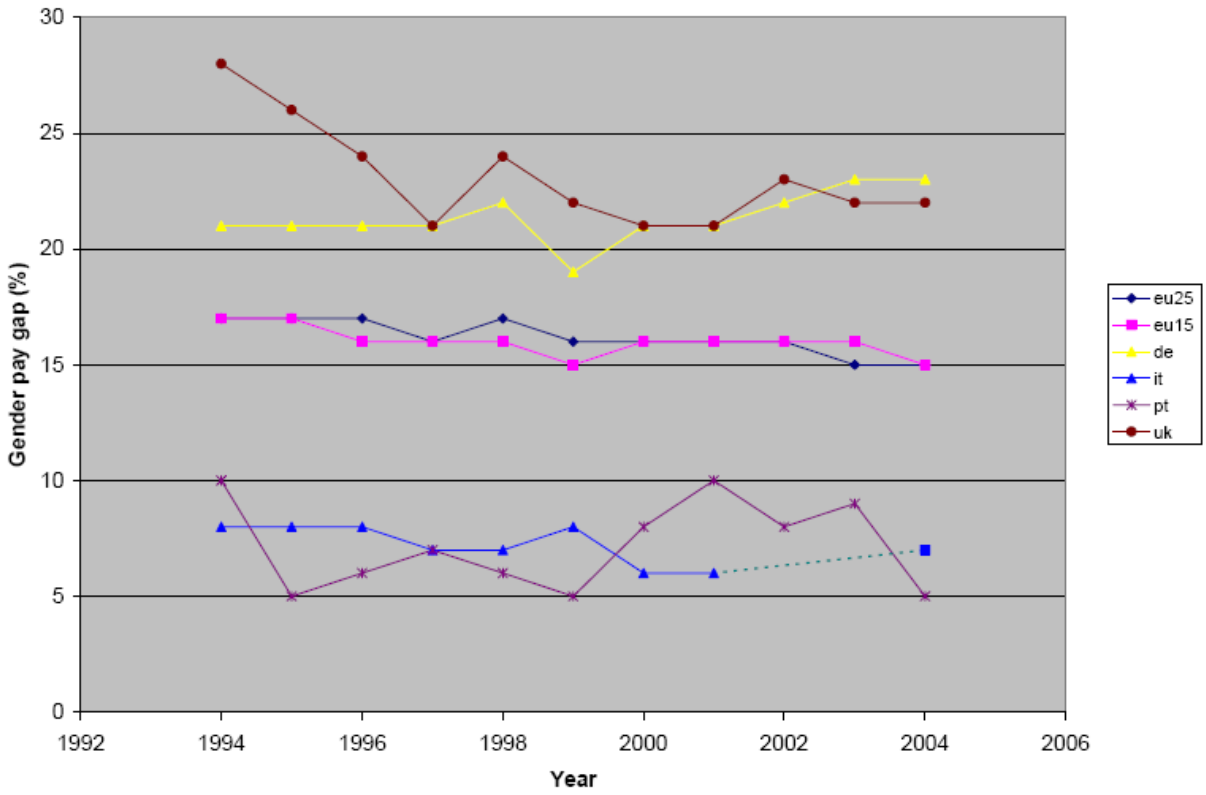
Plantenga and Remery (2006) have also attempted to evaluate the evolution of the gender pay gap over time. They observe that countries may show unexpectedly strong swings in pay ratios from one year to another which suggests problems of survey quality. Their conclusions are that the gender pay gap at the level of the EU-25 seems to have been fairly stable over the last decade.

[1] The gender pay gap is defined as the difference between average gross hourly earnings of male paid employees and of female paid employees as a percentage of average gross hourly earnings of male paid employees. The population consists of all paid employees aged 16-64 that are at work 15+ hours per week.

However, variation has been large within some countries, some showing a decrease and others an increase. The authors present a graph drawing the evolution of the pay gap between 1994 and 2004. They explain: "*The target population consists of all paid employees aged 16-64 who work at least 15 hours per week. The data are, however, not based on the SES but on several other sources such as the European Community Household Panel (ECHP), the EU survey on Income and Living conditions (EU-SILC) and national sources. This hampers the comparability considerably. Moreover, for several countries there is a break in series and/or not all years are available. Data on the development of the gender pay gap should therefore be treated with more than the usual caution."* (p. 13)

Graph 2 yields the evolution of the gender pay gap in two countries with a higher than average pay gap (Germany and UK) and in two countries with a lower than average pay gap (Portugal and Italy). In the middle we find the European average. It shows that the gender pay gap is fairly stable over time and that there are quite substantial differences between individual European countries. The UK shows a decrease. The German gender pay gap, although large, is rather stable. Italy, on the contrary, has a small gender gap that is also relatively stable while in Portugal the gender pay gap is marked by large swings over the period, with a clear drop in 2004 (which is likely to be related to the break in the series).

Graph 2: Development of the gender pay gap in EU25, EU15, Germany, Italy, Portugal and UK, 1994-2004.



Source: Plantenga and Remery, 2006, p. 14. Based on Eurostat: ECHP and SILC

Notes: EU25 and EU15: Eurostat estimates
Germany: break in series in 2002

The European Foundation's review of pay developments in 2008 (EuroFound 2009) provides further evidence for these national patterns in the evolution of the gender pay gap. It shows that there has been a decrease in the gender pay gap in Austria, Denmark, Latvia, Lithuania, Luxembourg and Malta. On the contrary, the gap has increased in Bulgaria, the Czech Republic and the UK. According to Smith (2010) "*the rising gaps demonstrate that although the gender pay gap has been resistant to downward pressure there remains the real risk of an increasing gap as many trends on European labour markets – rising inequality, increased part-time work, new pay systems, etc. – could enlarge gender inequalities*" (p. 8).

Besides these studies for the European Commission, the literature advances other comparisons of the gender pay gap in Europe over time. Cholezas and Tsakloglou (2003) analyse the trend over time of each component of the gender pay gap. The waves relative to the years 1994 and 2001 of the ECHP are compared. The authors show that the gender pay gap widened between 1994 and 2001 in Belgium, Greece, and Luxembourg and narrowed in the remaining countries. The share of discrimination (the non-explained part of the gender pay gap or the price effect) decreased in Belgium, France, Germany, Greece, Ireland and Spain and increased in Denmark, Italy, Luxembourg, Portugal and the UK. If selectivity is not accounted for, the discrimination component of the gender pay gap is underestimated.

Olivetti and Petrongolo (2005) also use the ECHP to study the importance of selection in Sourthern Europe. They show that in Southern Europe (but also in Ireland), women with lower labour market attachment have a higher wage penalty with respect to men because they have relatively poorer characteristics than women with higher labour market attachment and because they receive a lower remuneration for a given set of characteristics.They further show that differences in characteristics explain a much larger share of the gender pay gap relative to that explained by the wage structure in southern Europe than elsewhere.

A number of comparative studies have tried to locate the part of the wage distribution where the gender gap is largest using quantile regressions. Arulampalam *et al.* (2007) have studied 11 countries over the period 1995-2001 using ECHP data. Results suggest that for some of the countries, in both the public and private sectors, the mean gender pay gap can be broken up into a gap that is typically wider at the top of the wage distribution (existence of a glass ceiling) and occasionally also wider at the bottom of the wage distribution (the workings of a sticky floor). Differences in returns tend to account for a huge share of the variation in the gender pay gap along the conditional wage distribution. A glass ceiling is found to operate both in the public and private sectors in Denmark, Finland, Italy, France and the Netherlands. A sticky floor is observed in both sectors in Austria and France but also in the private sector in Italy and in the public sector in Belgium, Germany, Ireland, and Denmark. Alternative explanations of these sticky floors and glass ceilings are discussed, such as the taste-based explanation, parental leave and day-care policies, the negative relationship between the magnitude of the glass ceiling and the dispersion of the wage distribution (the fact that high wages at the bottom of the wage distribution might make it very difficult for career-oriented women to hire household help or help with childcare so that women are forced into less-demanding jobs and thus substantially fall behind men towards the top of the distribution), gender-biased promotion procedures, the lesser bargaining power of women or the fact that they are more subject to firms' market power, gender inequality in

minimum wage compliance at the bottom of the wage distribution, the differential interest representation of women by their trade union representatives at the bottom of the distribution, and so forth.

Pissarides *et al.* (2005) uses 1998 ECHP data to investigate how adjusting for cross-country differences in female participation affects the gender wage gap but also how responsive the wage gap is to country-specific institutional settings such as employment protection policies, parental leave policies and product market regulations. Results show that the gender wage gap is smaller in Europe than in the US because of lesser wage inequality and higher unionization levels in Europe. The relatively small size of the gender wage gap in Spain, Italy, and Greece can be explained by the lower female participation rate in these countries. Indeed, correction for the fact that female participation is lower and mostly concerns more skilled women raises the gender wage gap in the Mediterranean countries to the European average.

Gannon *et al.* (2005) have analysed the interactions between the gender wage gap and the inter-industry wage gap based on matched employer-employee data that are harmonized across 6 EU countries (Belgium, Ireland, Italy, Denmark, Spain and the UK). The authors show that gender wage differentials are significant in 80% of the industries but across countries, the sectors with the highest and lowest gender wage gaps vary. They also show that the industry effect explains 29% of the gender wage gap in Ireland, between 14% and 16% of the gap in Denmark and Italy, and roughly 7% of the gap in the UK. The industry effect does not contribute to explaining the gender wage gap in Belgium and Spain.

By means of a simulation of what the distribution of female employment across occupations and industries would look like in case it were equal to that of men's employment, and controlling for gender differences in education, labour market experience and seniority, Plasman and Sissoko (2005) show that the part of the gender wage gap that is due to professional segregation amounts to 5.27% in Italy, 13% in Belgium, 20.2% in Denmark and 26.7% in Spain. Gender differences in the human capital variables explain the entire gender wage gap in Italy but only half of it or less in Denmark, Belgium and Spain. In the latter three countries, women's wages are subject to the combined effects of discrimination in the access to occupations and wage discrimination.

Dolton et al. (2008) pool the 8 waves of the ECHP to study a sample of salaried public and private sector workers (excluding the self-employed) aged 16-64 over the period 1994-2001. The authors find significant differences in the extent as well as in the structure of the gender wage gap across EU member countries. As a result, policies to tackle the gender wage gap need to be country-specific. First, in some countries, the gender wage gap increases with age so that policies should first target old rather than young workers. Second, depending on the country, wage discrimination leads to either underpaying women or overpaying men and policies should thus be conceived according to the country-specific mechanisms at work. Third, policies should account for the fact that in some countries those occupations that employ the largest shares of women are also those with the largest gender wage gap whereas in others, the opposite holds true. Fourth, part-time work is generally associated with a wage penalty so that in countries with a large share of female part-timers policies should be more targeted towards this group of workers. Finally, wage discrimination is not everywhere negatively related to education: in some countries the gender wage gap is highest among the low-educated whereas in others, the inverse is true.

Finally, Rubery *et al.* (2005) argue that the wage structure is largely institutionally determined (wage bargaining and wage setting mechanisms). Therefore, in order to tackle the gender wage gap, policies should focus on low pay and the effective implementation of the minimum wage. "Gender audits" and "gender mainstreaming" are thus important tools to reduce gender wage disparity.

To conclude, the level and the evolution of the gender pay gap vary strongly across countries. One thing is clear, however, there is no significant trend towards a reduction in the gender pay gap.

3. Gender pay gap in Science

As we saw in the previous chapter, the gender pay gap is the result of several factors: individual factors, combination between work and private life, direct discrimination. It is also the result of occupational factors (occupational segregation).

Over the last decades, the rising proportion of women in higher education and highly skilled employment has triggered a major structural change on the labour market. However, this phenomenon has not translated into a similar participation of women in traditionally male-dominated scientific and professional fields. Science and research are still characterised by vertical and horizontal gender segregation. Gender inequalities persist in education (the gender ratio differs across fields of study). This is called horizontal segregation. Vertical segregation refers to the fact that women work in lower hierarchical positions than men even if they have equal qualifications. The existence of the "glass ceiling" or the "sticky floor" affects women trying to progress to senior positions. It affects all occupational sectors even those which are dominated by women. The absence of women in leadership positions tends to be more acute in science and technology occupations than in other fields (Osborn et al. 2000).

The gender pay gap among scientists can be seen as partly a consequence of these two types of gender segregation. Vertical segregation has a direct impact on the gender pay gap because of the fact that women are under-represented in leadership positions. Horizontal segregation also has an impact on the gender wage gap since women are under-represented in the most prestigious and well paid occupations and sectors.

In the first part of this chapter we will present the results of the last publication of She Figures (2009) that has the advantage to provide harmonized data on the gender pay gap in scientific occupations among European countries. The second part will be based on the results from the Gender and Science Database in order to see what the publications on gender and science are revealing about the gender pay gap in these occupations.

3.1. Data from She Figures

3.1.1. Descriptive overview of the gender pay gap in science and research

In the first part of this report we have discussed the gender pay gap for the labour market as a whole (all occupations). In this part, we will present data from She Figures 2009 and focus on scientific and research professions. We will first present data on the gender pay gap by selected occupations for employees in private enterprise for the years 2002 and 2006, for public enterprises and for both sectors. Then, we will analyse the gender pay gap by age group for employees in private and public enterprise. No data are available for full-time and part-time working scientific professionals. Data on the gender pay gap by educational attainment are also missing.

It is important to note that these data approximate the gender pay gap in scientific and research professions since it is very difficult to identify these professions in the available data sources. Occupations that request a high level of education are assimilated with scientific and research professions.

Table 2: Gender Pay-Gap in % by selected occupations for employees in private enterprise, EU-27, 2002 and 2006

				2002	2006
		ISCO CODES			
EU-27	100		Legislators, senior officials and managers	29	30
		110	Legislators, senior officials and managers	u	u
		120	Corporate managers	28	30
		130	Managers of small enterprises	32	28
	200		Professionals	31	29
		210	Physical, mathematical and engineering science professionals	22	22
		220, 230,240	Life science, health, teaching and other professionals	36	33
	300		Technicians and associate professionals	28	26
		310	Physical and engineering science associate professionals	26	25
		320, 330,340	Life science, health associate, teaching associate professionals and other associates professionals	30	28

Source: She Figures 2009 (p. 88), on the basis of the Structure of Earnings Surveys 2002 and 2006 (Eurostat)
'u': unreliable due to small sample size
GPG (unadjusted) = The unadjusted Gender Pay Gap (GPG) represents the difference between average gross hourly earnings of male paid employees and of female paid employees as a percentage of average gross hourly earnings of male paid employees

Table 2 focuses on the gender pay gap for a selection of occupations in private enterprise. Three groups of occupations are considered relevant. The first one relates to decision making occupations (ISCO 100 – Legislators, senior officials and managers). For this category, the gender pay gap rose from 29% in 2002 to 30% in 2006. However, within the sub-category "managers of small enterprises", the pay gap decreased significantly, by 4 percentage points, over the period. The second group includes professional occupations (ISCO 200 - physical, mathematical and engineering science professionals and life science, health, teaching and other professionals). Between 2002 and 2006, the pay gap in this category decreased from 31% to 29%. Finally, the gender pay gap for the last category of occupations, "technicians and associate professionals" (ISCO 300) decreased from 28% in 2002 to 26% in 2006.

Table 3 presents the gender pay gap for the same occupational categories but in the public sector. The results differ from the private sector. For the first category (ISCO 100) a significant increase in the gender pay gap is observed in the public sector over the period (from 22% in 2002 to 28% in 2006). For this category, the pay gap is higher in the public sector than in the private sector in 2006. Concerning the second category of occupations, an important decrease of the pay gap is observed: from 46% in 2002 to 38% in 2006. This reduction in the pay gap mainly concerned the

subcategory "physical, mathematical and engineering science professionals", where the pay gap decreased by 13 percentage points over the period! Finally, the last professional category also put forth by a significant reduction in the pay gap which passed from 36% in 2002 to 27% in 2006. For these two categories of occupation also, the gap appears to be wider in the public than in the private sector. These results are surprising "*given that it is generally believed that the stronger regulation in the public sector better protects women against discrimination. This is thus not certified by our data which could tentatively lead towards a different explanation: Could it be that private enterprise is more efficient than the public sector and as such cannot go without recruiting bright women and appreciate their true worth in their pay?* " (She Figures 2009, p.72)

Table 3: Gender pay gap in % by selected occupations for employees in public sector, EU-27, 2002 and 2006

				2002	2006
		ISCO CODES			
EU-27	100		Legislators, senior officials and managers	22	28
	200		Professionals	46	38
		210	Physical, mathematical and engineering science professionals	42	29
		220, 230,240	Life science, health, teaching and other professionals	42	40
	300		Technicians and associate professionals	36	27
		310	Physical and engineering science associate professionals	35	25
		320, 330,340	Life science, health associate, teaching associate professionals and other associates professionals	40	32

Source: She Figures 2009 (p.89), on the basis of the Structure of Earnings Surveys 2002 and 2006 (Eurostat)
GPG (unadjusted) = The unadjusted Gender Pay Gap (GPG) represents the difference between average gross hourly earnings of male paid employees and of female paid employees as a percentage of average gross hourly earnings of male paid employees

Table 4: Gender pay gap in % by selected occupations in private and public sector, EU-27, 2002 and 2006

				2002	2006
		ISCO CODES			
EU-27	100		Legislators, senior officials and managers	29	30
		110	Legislators, senior officials and managers	u	u
		120	Corporate managers	28	30
		130	Managers of small enterprises	u	u
	200		Professionals	34	31
		210	Physical, mathematical and engineering science professionals	25	23
		220, 230,240	Life science, health, teaching and other professionals	38	34
	300		Technicians and associate professionals	28	26
		310	Physical and engineering science associate professionals	27	25
		320, 330,340	Life science, health associate, teaching associate professionals and other associates professionals	31	28

Source: She Figures 2009 (p.90), on the basis of the Structure of Earnings Surveys 2002 and 2006 (Eurostat)
'u': unreliable due to small sample size
GPG (unadjusted) = The unadjusted Gender Pay Gap (GPG) represents the difference between average gross hourly earnings of male paid employees and of female paid employees as a percentage of average gross hourly earnings of male paid employees

The previous table provides average figures for public and private enterprise (Table 4). It shows similar results and no new observations are put forward.

Table 5: Gender pay gap in % by age group for employees in private and public sector for the total of occupations 100, 200 and 300, EU-27 and EU-25, 2002 and 2006

		2002	2006
EU-27	15-34	19	17
	35-44	32	28
	45-54	43	38
	55-64	38	37
EU-25			
	15-34	18	17
	35-44	30	26
	45-54	41	36
	55-64	37	37

Source: She Figures 2009 (p.91), on the basis of the Structure of Earnings Surveys 2002 and 2006 (Eurostat)
GPG (unadjusted) = The unadjusted Gender Pay Gap (GPG) represents the difference between average gross hourly earnings of male paid employees and of female paid employees as a percentage of average gross hourly earnings of male paid employees.

Table 5 breaks down the gender pay gap by 4 different age groups for employees in private and public enterprise for the total of occupations 100, 200 and 300. It appears that "*in the EU-27, in 2006, the gender pay gap was greatest amongst 45-54 year-olds at 38%, closely followed by the group of 55-64 year-olds where the gap stood at 37%. The pay difference was roughly 10*

percentage points lower amongst 35-44 year-olds at 28% and it further drops to 17% for the 15-34 year-olds. For all age groups, particularly for 35-44 year-olds and for 45-54 year-olds, there is an improvement of the gap as compared with 2002" (p.72). The general tendency is similar that the one observed for the whole labour market: the pay gap widens with the age of researchers.

To conclude, from these results from She Figures 2009, it appears that the gender pay gap is higher for high qualified professions. The gender pay gap increases with the level of education. This is important for this meta-analysis on women in science. If the pay gap increases with level of education, it will be larger in science and research occupations than in the labour market as a whole. Moreover, the She Figures 2009 results show that the gender pay gap is higher in occupations where highly qualified female professionals are better represented.

3.1.2. Evolution

Is the pay gap in science and research careers increasing or decreasing? We have seen that for the labour market as a whole, we cannot conclude on a clear deepening nor on a widening of the gender pay gap. On the basis of "She Figures 2009", we observe different evolutions of the gender pay gap over time.

In the private sector, there seems to be a trend towards a decrease of the pay gap on average for the EU27, except in the category of legislators, senior officials and managers, where the pay gap increased by 1 percentage point between 2002 and 2006. It is in the category of "managers of small enterprises" that the pay gap decreased most significantly over the period (-4 percentage points). In the two other categories, "professionals" and "technicians and associated professionals", the pay gap decreased by 2 percentage points over the period.

In the public sector, the gender pay gap has considerably widened between 2002 and 2006 for the first category of "legislators, senior officials and managers" (+ 6 percentage points). For the two other categories, the pay gap significantly decreased over the period (-8 percentage points for professionals and -9 points for technicians and associated professionals).

With respect to the evolution of the pay gap in the different age groups, in all age groups, particularly among 35-44 year-olds and 45-54 year-olds, an improvement of the gap is observed as compared with 2002.

Even if we observe small signs of a reduction of the gender pay gap in some cases, the overall picture drawn by the data fails to put forth a clear trend towards a reduction of the gap. The gender pay gap is not likely to close spontaneously.

3.2. The gender pay gap in the Gender and Science database

3.2.1. Synthesis and statistical analysis of the Gender and Science Database

3.2.1.1. General overview

Out of 4549 entries in the Gender and Science Database, only 571 are dealing with the topic "gender pay gap and funding", 354 deal with the gender pay gap in science and research and 287 address the issue of access to research funding. This illustrates the limited research in this area compared with other topics such as "stereotypes and identity" with 2458 entries or "vertical segregation" with 2035 entries.
One fifth of the publications (20%) on the gender pay gap in science also deal with the topic of access to research funding whereas 24% of the publications on access to funding also deal with the gender pay gap in science (Table 6).

Table 6: Key issues

Presence of key issues in publications	GPG	ARF
Gender pay gap	100,0	24,4
Access to research funding	19,8	100,0

3.2.1.2. Cross-topical coverage

Table 7 informs on the other topics that are dealt with in the publications on the gender pay gap. Indeed, most publications on the gender pay gap also investigate other topics. A large majority of the publications on the gender pay gap also address the topic of vertical segregation (85%), 67% are related to horizontal segregation and 64%, to science as a labour activity.

Table 7: The topics dealt with in the publications in the Gender and Science database

Presence of topics in publications	GPG
Horizontal segregation	66,7
Vertical segregation	85,0
Stereotypes and identity	52,5
Science as a labour activity	63,6
Scientific excellence	29,4
Gender in research contents	29,9
Policies towards gender equality in research	46,6

3.2.1.3. Institutional sector coverage

Table 8 analyses the institutional coverage of the studies on the gender pay gap. The higher education sector is much more studied than the other institutional sectors: 71.5% of all

publications on the gender pay gap concern the higher education sector. The gender pay gap in the government sector is dealt with in 33% of the publications. 30% of the publications on the gender pay gap look at the business enterprise sector. Finally, the least well covered institutional sector is the private non-profit sector which is addressed by just 10% of the publications.

Table 8: Institutional sector

Institutional sector - Other	GPG
Business enterprise sector	29,7
Government sector	32,9
Higher education sector	71,5
Private non-profit sector	10,1

3.2.1.4. Coverage of scientific fields of science

Table 9 presents the coverage in terms of fields of science of the publications dealing with the gender pay gap. The most investigated scientific field is that of the social sciences, business and law: 44% of all publications study the gender pay gap in this field. Other fields in which the gender pay gap has been thoroughly investigated are science, mathematics and computing (36.6%), engineering, manufacturing and construction (28.6%), health and social services (22.9%), and education (22.9%). The gender pay gap in services and agriculture and veterinary has received much less research attention.

Table 9: Publications by fields of science covered

Scientific field - Other	GPG
Education	22,9
Humanities and arts	12,0
Science, mathematics and computing	36,6
Agriculture and veterinary	8,0
Health and social services	22,9
Engineering, manufacturing and construction	28,6
Social sciences, business and law	44,0
Services	1,7
Other	24,6

3.2.1.5. Life-course stage coverage

The gender pay gap can be studied at different stages of the life course. Table 10 shows that analyses of the gender pay gap mostly concern early-career scientists (84%), followed by mid-career scientists (81%) and late-career scientists (76%). As far as publications on the gender pay gap also deal with other topics, Table 10 presents publications dealing with very early life course stages even though these stages do not directly concern the gender pay gap but treat, for example, of segregation rooted in early childhood education. Tertiary education is also often approached in the publications on the gender pay gap (30% at the first stage of tertiary education and 36% at the

second stage). In general, these studies investigate the "choice" of study or aptitudes at school and their implications on future earnings. Lower stages of the life course are mainly analysed in publications that deal with all levels of the life course in general or in publications that focus on other topics besides the gender pay gap.

Table 10: Life course stages

Life course stage	GPG
ISCED 0	1,2
ISCED 1	3,2
ISCED 2	4,4
ISCED 3	8,0
ISCED 4	8,8
ISCED 5	29,6
ISCED 6	36,0
Early-career scientists	84,0
Mid-career scientists	80,8
Late-career scientists	76,0
Other	12,8

3.2.1.6. Methodological approach

The methodological approach that is most used is the conceptual approach, in 42% of the publications (Table 11). 39% of the publications relative to the gender pay gap are state-of-the-art studies. About 36% are compilations of statistics. Empirical research on the topic using quantitative techniques is carried out in 33% of the publications whereas qualitative methods are applied in 28%. Finally, merely 8% of the publications build gender indicators relative to the gender pay gap in science.

Table 11: Methodological approach

Methodological approach	GPG
Conceptual	42,1
State-of-the-art	39,3
Compilation of statistics	36,2
Building gender indicators	7,6
Empirical research. Quantitative techniques	33,3
Empirical research. Qualitative techniques	27,7

Table 12 presents the type of empirical research that has been carried out by researchers to investigate the gender pay gap in science. Nearly half of the publications on the gender pay gap are non-empirical (49%). In the case of empirical studies, the gender pay gap in science has been analysed with quantitative techniques more so than with qualitative techniques (respectively 24% and 18%). Only 10% of the publications use both quantitative and qualitative research methods.

Table 12: Types of empirical research

Empirical research	GPG
No empirical research	48,6
Quantitative techniques	23,7
Qualitative techniques	18,1
Quantitative and qualitative techniques	9,6
Total	*100,0*

Among the use of quantitative techniques (Table 13), a representative sample is used in 64% of all publications on the gender pay gap in science. Micro-data are used in 42% of the publications. Roughly one third (36%) of the studies uses multivariate analysis to examine the gender pay gap. Finally, few studies conduct longitudinal analyses (12%).

Table 13: Methodological approach: Quantitative techniques

Quantitative techniques	GPG
Representative sample	64,4
Micro-data	41,5
Longitudinal/cohort	11,9
Multivariate analysis	36,4

Concerning the use of qualitative techniques (Table 14), interviews are conducted in an important share of the publications (79%). Case studies constitute about 20% of the research on the gender pay gap in science. An observation-based method was applied in 18% of the studies. Bibliographical research is used in 12% of the publications and the method of content analysis is applied in 5% of the entries.

Table 14: Methodological approach: Qualitative techniques

Qualitative techniques	GPG
Biographical research	12,2
Case studies	20,4
Content analysis	5,1
Interviews	78,6
Observations	18,4

3.2.1.7. Evolution of the number of publications between 1980 and 2009

One can observe that the number of entries was very low during the 80s (Table 15). This number starts to rise during the 90s and more significantly in the early 2000s when the number of publications dealing with the topic of the gender pay gap in science has become more than 9 times higher than at the beginning of the period. In general, one can say that the study of this topic is rather recent.

Table 15: Number of publications on the pay gap between 1980 and 2009

Publication year (mean per year)	GPG
1980-1984	2,8
1985-1989	1,6
1990-1994	5,0
1995-1999	11,0
2000-2004	26,2
2005-2007	31,0
2008-2009	14,0

The majority of the publications (55.6%) address the gender pay gap in science since 2000 (Table 16). When we go back in time, the share of publications on the topic steadily decreases. Whereas 50% deal with the topic in the 90s, 29% cover the 80s, 20% the 70s and 15% the post-World War II period. The gender pay gap in science during the first half of the 20th century is studied in 11% of the publications, 5% deal with the topic in the 19th century. Almost no studies go back further in time.

Table 16: Time coverage of the publications on the pay gap

Time coverage	GPG
General / Not specified	3,1
Before the 18th century	0,8
18th century	1,4
19th century	5,4
1900-1945	10,5
1946-1970	15,3
1970s	19,8
1980s	29,1
1990s	50,3
2000s / Present-day	55,6

3.2.1.8. The pay gap by country group

Table 17 presents the proportion of all publications that deal with the gender pay gap by country. It is in the United Kingdom that the topic has been studied most relative to the other topics: 38.7% of all publications deal with pay and funding. Other countries with a relatively large proportion of publications (more than 10%) on the topic are Austria, Germany, Italy, and Sweden. The countries where the gender pay gap in science has received the least research attention (less than 1%) compared with the other topics are Croatia, the German Democratic Republic, Israel, the Soviet Union, Switzerland, and Yugoslavia.

Table 17: Number of publications on the gender pay gap by country

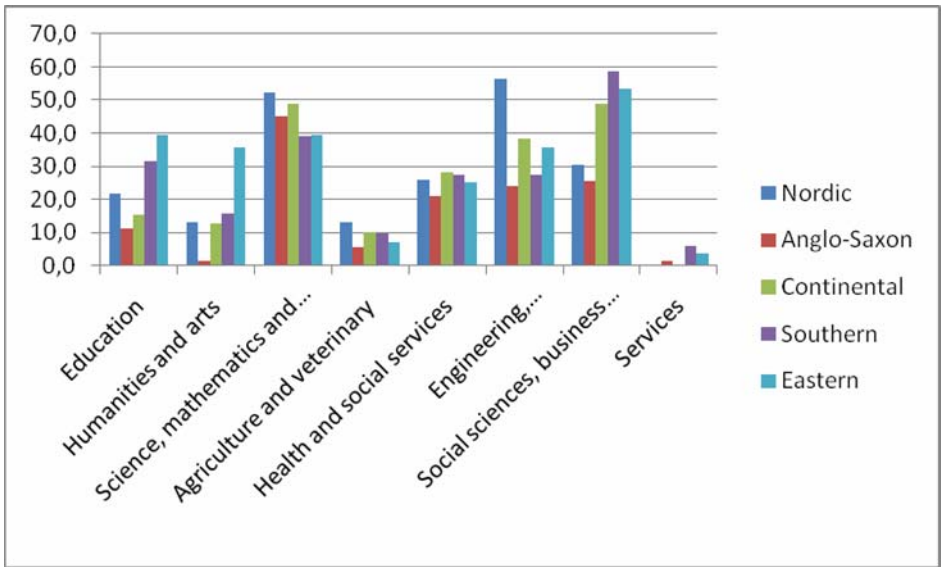
	GPG	
	n	**%**
Austria	39	11,0
Belgium	28	7,9
Bulgaria	13	3,7
Croatia	3	0,8
Cyprus	12	3,4
Czech Republic	27	7,6
Czechoslovakia	6	1,7
Denmark	26	7,3
Estonia	19	5,4
Finland	25	7,1
France	32	9,0
German Democratic Republic	1	0,3
Germany	50	14,1
Greece	32	9,0
Hungary	33	9,3
Iceland	8	2,3
Ireland	21	5,9
Israel	3	0,8
Italy	38	10,7
Latvia	19	5,4
Lithuania	20	5,6
Luxembourg	20	5,6
Malta	27	7,6
Netherlands	27	7,6
Norway	7	2,0
Poland	22	6,2
Portugal	24	6,8
Romania	24	6,8
Slovakia	28	7,9
Slovenia	21	5,9
Soviet Union	2	0,6
Spain	25	7,1
Sweden	45	12,7
Switzerland	2	0,6
Turkey	20	5,6
United Kingdom	137	38,7
Yugoslavia	2	0,6
(Other)	23	6,5

3.2.1.8.1. Scientific fields by country group

The most investigated scientific field in the studies on the gender pay gap in science is that of the social sciences, business and law in three country groups: the Southern countries, the Eastern countries and the Continental countries. In this latter group the field of science, mathematics and computing is equally well documented upon in the literature. In the Nordic countries,

engineeruing, manufacturing and construction is the field that has received most research attention and in the Anglo-Saxon countries, the gender pay gap in science, mathematics and computing has been most investigated. Services and agriculture and veterinary remain almost unexplored in all country groups. The field of health and social services shows the highest degree of equality between the country groups: between 21% and 28% of all publications on the gender pay gap in science cover this field of science in all country groups. Education has been subject to relatively more research in the Eastern and Southern countries than in the other groups. Finally, humanities and arts are noticeably more studied in the Eastern countries than in the other groups.

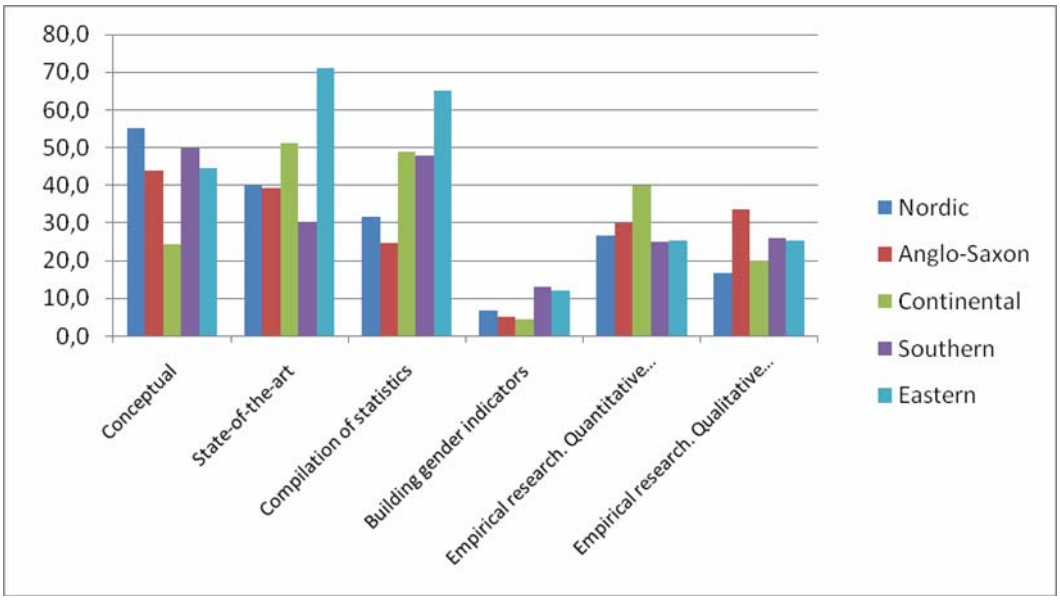
Graph 3: The gender pay gap: scientific fields by country group



3.2.1.8.2. Methodological approach by country group

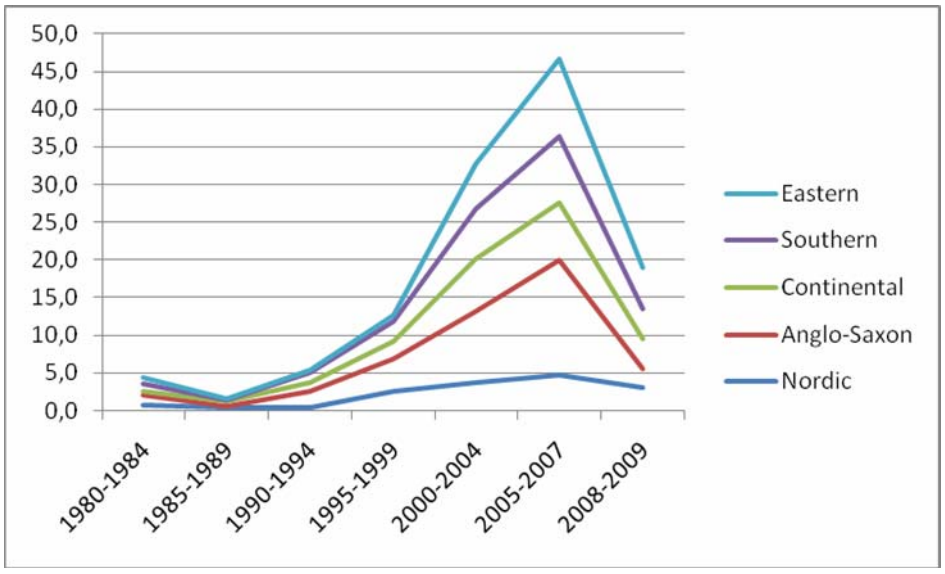
The conceptual approach is more widespread in the Nordic countries, compilations of statistics and state of the art reports are more used in the Eastern countries. The continental countries make a wider use of empirical research based on quantitative techniques, whereas qualitative methods are most used in the Anglo-Saxon countries. Finally, the construction of gender indicators is underdeveloped in all country groups.

Graph 4: The gender pay gap: methodological approach by country group



3.2.1.8.3. Years of publication by country group

Graph 5: The gender pay gap: years of publication by country group



The turn of the century has marked a sharp increase in the number of publications on the topic of pay and funding in all country groups except for the Nordic countries.

3.2.2. Research questions

Research on the gender pay gap in scientific professions is scarcely developed. It is a rather new topic of study. Research took off as of the end of the 90s, except for the Nordic countries. The topic is thus very recent and this for two reasons. First, there is a lack of available official data on gender income differences. Second, in an important number of research institutions are entirely determined by rank and seniority.

In some countries, in some cultures, earned wages are a taboo (Palasik 2009 (country report Hungary), de Cheveigné and Muscinési 2009 (country report France)). If such is the case, the question of pay (or of the pay gap) is hidden and has not generated much research.

1) Description of the gender pay gap in scientific and research professions

Publications on the gender pay gap reveal that there is a difference in the average wage of men and women in scientific and research professions. This difference is sometimes presented by comparing it with the situation in the labour market as a whole (Granqvist and Regnér 2003).

International comparisons are carried out mainly among European countries (European Commission 2007, Meulders and Caprile 2003, Machin and Puhani 2003, Kreetz 2004).

The research questions are also related to the observed differences in wages that women and men receive in different sectors, or professions/fields. The sector of higher education has been most studied. Research concerning the gender pay gap in the private or the government sector is more scarce (Ministère délégué à la recherche et aux nouvelles technologies 2004, Wilson-Kovacs et al. 2006, Novak 2006, Lewis 2009). Daune-Richard et al. (2004) analyse the proportions of women and men in different functions and disciplinary sectors.

In other cases, research focuses on a specific field of study. The study fields that are most addressed are: engineering (Kolmos 1996, Evetts 1996, Marry 2001, Faulkner 2005, 2006, 2007, Minks 2001, Ercoli Finzi 2001, Hart 2007), science and technology (Palasik 2006, Palasik and Papp 2008, Brynin 2005, Singh and Vinnicombe 2002, Hassi 1986, Vámos 1997), medicine (Holdcroft 2007, Hohner et al., 2003, Maurer 1993, Fitzgerald 2001, Kilminster et al. 2006, Silcox 2007, Mixa 2000), economic and business (Stein 1995, Maier et al. 2003, Carabelli et al. 1999, Dawid 2002, Palasik 2008).

Box 1: What next?

Árnadóttir (2004) discusses networks as a means to career advancement in relation to women in the engineering profession and the status of female engineers in Iceland. Engineers in Iceland are usually involved on a large scale in R&D in their specific field (construction-hydropower-high tech) The importance of networking for female engineers is undisputed since research has shown that a lot of recruitment occurs through informal networks. As a minority in the engineering profession, women need to rely especially on their work-related networks for their career advancement. In Iceland, women are only around 6% of members in the Engineers Association of Iceland. The EA was founded in 1912 and the first woman to graduate as an engineer and become a member joined in 1945. For 21 years, no other Icelandic women graduated as an engineer. When female engineers enter the labour market, they often find themselves as the only woman at work and therefore are excluded from certain activities and spaces as e.g. the changing room, where a lot of informal discussion takes place and vital information is exchanged. The author calls for a new analysis of the status of female engineers in Iceland since the only available data is nearly two decades old. She refers to information available from 2003 on earnings within the engineering profession which shows that male engineers have, on average, 24.3% higher total wages than female engineers. Fixed monthly wages are 15.2% higher among male engineers than female engineers. Several factors may contribute to this situation and the pay gap is not likely to disappear without further inquiry.

Árnadóttir, J. H. 2004, 'Hvað tekur við?', *Vélabrögð*, vol. 25, pp. 4-6.

A particular concern for the group of Eastern countries is the issue of the transformation process from a previously unified, only governmental system for science and education into a more versatile system (including private sectors).

In a second stage, after this descriptive part, the question of the causes and factors that determine the gender pay gap is raised (section 2). Why are women more represented in low-paid occupations? What is the status of women in these sectors/occupations?

2) Identifying the causes of the gender pay gap

a) Individual factors

The gender pay gap is partly linked with individual characteristics. One major determinant of the pay gap that has been studied is educational background. The following box provides an example of an analysis on the impact of education on wages.

Box 2: Two sexes – two educational systems

A document based on a presentation given at a conference at the University of Iceland in 2000 addresses the topic of gendered education, gendered job selection and traditional stereotypical ideas about the roles of women and men. Until 1909 and 1911, there were two educational systems in Iceland; one for women and one for men, preparing the sexes for different roles in life. Women's roles were constrained to the home while men's roles were to enter the labour market. In 1909, secondary schools were opened up to women and in 1911 a law was passed granting women the right to seek education at the University of Iceland. The passing of this law meant the abolishment of a gender segregated educational system in Iceland and the creation of a gender neutral educational system as concerns formal rights. However, research shows that university education does not enhance women's earnings in the same way as it does for men. A reason identified by the author is the large concentration of female students in traditional female disciplines, such as nursing and social sciences. The completion of these disciplines in most cases leads to jobs in the public sector whereas the completion of male-dominated disciplines such as engineering leads to jobs in the private sector resulting in higher wages and more freedom to bargain for individual wages. The author points out that gendered disciplinary "choices" do not need to be criticized if their consequences would be the same regarding earnings and working conditions. However, this is not the case and indicators from the Institution of Social Sciences at the University of Iceland show that women who obtain a university degree can expect to increase their earnings by 42% whereas men can expect to gain 104% in earnings by obtaining a university degree. The author concludes that although two educational systems for the two sexes have been abolished in Iceland, women and men now have an unequal status within a unified educational system.

Kristmundsdóttir, S. D. 2000, *Tvö kyn, tvö menntakerfi*, Downloaded on 29/08/2008, Available at: http://www.menntamalaraduneyti.is/media/MRN-pdf_Annad/SDTvomenntakerfi.pdf.

One can also mention research on the impact on the gender pay gap of language proficiency and computer skills and of planning, coordinating, organising, and problem-solving abilities (Garcia-Aracil 2007), the impact of productivity (Euwals and Ward 2000) and of professional mobility (Mousourou 1983). Mathematic skills and their impact on the pay gap were also investigated, e.g. by Mitra (2002).

The analysis of pay as a factor of stress was studied by Tytherleigh et al. (2007).

Women's income expectations have been studied by Need and De Jong (2008).

Finally, study choices, career choices and life expectations (that are also factors related to horizontal segregation) have been investigated in research on the wage gap (Granqvist and Regnér 2003, Machin and Puhani 2003).

b) Organisational factors

Besides individual factors, organisational and structural factors have a significant influence on the gender pay gap. However, with respect to wage formation, in many cases, wages in the higher education and government sectors are fixed based on seniority and not subject to negotiations. As a result, there is no pay discrimination. However, premiums or other advantages added as a supplement to fixed wages (Einarsdóttir 1999, 2004) often generate gender differences. On the contrary, in the business and enterprise sector, there is more room for gender differences because wages are more likely to be individually negotiated.

Allmendinger and Hinz (2007) investigated the link between occupational segregation and the wage gap.

Box 3: Gender Segregation in Organisations and the Pay Gap among Men and Women

On the basis of official employment statistics and an operating survey by the Institute for Job Market and Employment Research (IAB) [German: Institut für Arbeitsmarkt- und Berufsforschung], the extent, forms and consequences of organisationally bounded segregation of occupations and jobs in the 1990s are identified. The authors aim to describe and explain occupational segregation as well as gender pay differences in organisations. The key issues are, to what extent organisations as (corporate) market players contribute to the development and reproduction of separate professional worlds for men and women and to gender-specific pay differences. Thereby it should also be clarified whether gender segregation in occupations within organisations - and in the workplace – is 'sharper' than in the labour market as a whole. Segregation values that are usually reported for employees do not take into account the (action and interaction) level on which the separation of professional activities in work organisations is actually experienced.

Allmendinger, J. & Hinz, T. 2007, 'Geschlechtersegregation in Organisationen und die Lohndifferenz zwischen Männern und Frauen' in R. Gildemeister & A. Wetterer, eds. *Erosion oder Reproduktion geschlechtlicher Differenzierungen?: widersprüchliche Entwicklungen in professionalisierten Berufsfeldern und Organisationen*, Westfälisches Dampfboot, Münster, pp. 172-188.

Saportah and Elvira (2001) analyse the effect of unionisation on gender wage differentials for production workers in manufacturing industries.

Concerning organisational culture, the inference of stereotypes on the position of women and their earnings has been studied (Palasik 2006, Van Doorne-Huiskes 1983, STEM 2006, Usluer 2000). Brynin (2005) analyses how technology influences gender stereotypes and how assumptions about men’s and women's relationship with technology reinforce social stereotypes and inequalities.

Many scholars investigated the question of why women's earnings are lower than men's even when they have the same educational level or seniority. Indeed the level of education of girls increased significantly over the last decades but no proportional reduction of the pay gap is observed.

Another subject of concern is why, despite the increased participation of women in paid employment, their position remains subordinate to men's (Bútorová 2007). The impact of the feminisation of certain professions on the wage gap constitutes an important research topic (Árnadóttir 2004, Šporer 1987, Marry 2001, Paiva and Lobo 2007, Bottero 1980). Scholars also analysed the impact of feminisation on workforce planning and employment practices (Marry 2001).

Box 4: Women doing men's work and women doing women's work: Female work and pay in British wartime engineering.

Extreme demand pressures coupled with acute skill shortages in the run up to World War II caused British engineering companies to break down existing production processes into smaller constituent parts. This allowed the employment of persons trained over narrower ranges of skills and helped to create an exponential growth of female jobs, from 10.5% of total engineering employment in 1939 to 35.2% by 1943. Women were officially classified into those doing men's work and those doing women's work. Using a unique data set provided by the Engineering Employers' Federation, this paper examines female work and pay from 1935 (the first year of rearmament) to 1942 (the peak of production activity) in more detail than has been previously undertaken. It features the pay and hours of piece- and time-rated women, female-male wage ratios, and an assessment of the war's longer term impact on the female labour market. Why is this important? This research enables learning from historical cases when it was possible to engage women in engineering with considerable success, something that is very difficult to do now.

Hart, R. A. 2007, 'Women doing men's work and women doing women's work: Female work and pay in British wartime engineering.' *Explorations in Economic History*, vol. 44, no. 1, pp. 114-130.

c) Vertical segregation

The gender pay gap is also caused by vertical segregation. Indeed, the fact that women's progress is slower than men's leads to a situation where women are underrepresented in (higher paid) top positions. Women are also less rewarded in the highest wage scales. This is the case for the labour market in general but also for scientific and research professions in particular.

Pay differences between men and women within the same sector or occupation raise the question of women's career and promotion opportunities. Do gender differences exist in selection, hiring and promotions? Is the principle of equal opportunities really applied? Do women scientists win competitions at the same rate as men, and if not, why? The way in which the work evaluation system awards people has been studied in many countries. It questions the gender pay gap as a

consequence of the difficulties women experience with career progression and access to top positions.

Several authors analysed the evaluation and promotion systems in academia with regard to their gender neutrality (Booth, et al. 2003, Einarsdóttir 1999). The perception of women of the evaluation and promotion system was also investigated (Adam et al. 2004, Booth et al. 2002, Sağlamer et al. 2006).

Finally, it is worth mentioning a study that analyses the impact of outside employment offers on the earnings of men and women in academia (Blackaby et al. 2005).

d) Conciliation of work and private life

The impact of women's family responsibilities on their pay and promotions is also an area of research. Lewis (2009) analyses the impact of motherhood on the "choice" between sacrificing time for the family and sacrificing pay. French et al. (2006) explore gender differences in contractual commitments, job satisfaction and spouses' occupation among general practitioners in Scotland. The reproduction of the traditional division of labour, where women are economically dependent on their partner, was studied in Turkey (Sağlamer et al. 2009 (country report Turkey)). Glover (2002) investigated employment mobility and the balance between commodified (paid) work and uncommodified (unpaid) domestic work. Finally, the study by Brynin and Schupp (2000) deserves attention. It focuses on the transfers of the benefits of human capital within the home, that occur between partners and family, and how they affect wages.

e) Discrimination

Discrimination has been studied as a determinant factor of the gender pay gap. Direct or indirect (subtle) discrimination can result from employer attitudes but also from an organisational culture that is shows resistance towards integrating women. Another element is that the reference model for certain occupations is defined in terms of masculine attributes. Women are consequently employed at lower levels and in lower pay jobs.

Pay discrimination has been investigated by Novak (2006), Chevalier (2007), Addis (1997), Daune-Richard et al. (2004), Corominas et al. (1999, 2008), Granqvist and Regnér (2003), Ljunglöf et al. (1998).

Women's experience and perception of discrimination in wage formation have been investigated in the higher education sector (de Henau and Meulders 2003, Booth et al. 2002). Adam et al. (2004) studied the formation of individualised pay packages in ICT as well as women's experiences and views of pay and reward systems in this sector.

Box 5: Directing Equal Pay in ICT

The objectives of this research are: to improve understanding of the data gathered on women's pay and progression in the ICT sector; to investigate organisational (large and SMEs) pay structures and reward systems; to collect and analyse data from women about their experiences and views of pay and reward systems; to identify 'good practice' and provide a basis for offering solutions to the gender pay gap in the ICT industry. This will impact on UK Government and UK employer policies and procedures of women in the ICT labour market who "choose" flexible working to achieve a work-life balance and provide advice for organisations and their employees so that fair work-life balance solutions may be implemented and the retention of those with ICT industry skills can be achieved. The researchers have conducted primary research using two approaches, quantitative and qualitative. They have also conducted case studies from a sample of women in the ICT labour market from all regions throughout England. Data are collected about women's experiences and views of pay and reward systems. These accounts are then investigated using in-depth interviewing techniques. A survey method was used to capture supporting data from women. Additionally, questionnaires (on-line and postal) are administered to a sample of employers throughout England in order to capture data about organisational pay and reward systems. This variety of methods provides an overview of the overt and covert barriers within pay and reward systems as well as an in-depth exploration of particular women's views and experiences.

Adam, A., Richardson, H., Keogh, C. & Tattersall, A. 2004, *Directing Equal Pay in ICT*, Downloaded on 24/05/2004, Available at: **http://www.isi.salford.ac.uk/gris/depict/GenderPayGap.html** .

f) Multivariate analysis

Several studies tend to evaluate the relative weight of the previous factors in the formation of the pay gap and the degree to which each of these factors influences the gap. These studies generally apply econometrical techniques.

Alon and Haberfeld (2007) analyse women's wage profiles taking into account race, ethnicity and education. Стоянова (2007) measures the relative shares of objective factors, human capital factors, and discrimination factors in the pay gap in Bulgaria. Chevalier (2002) examines the role of "choice" variables (subject of study and occupation) as well as career expectations and aspirations on the variation of the gender wage gap. Machin and Puhani (2003) measured the contribution of educational degree to the gender wage differential in the UK and Germany. Finally, human capital, job search, and career attitudes and their influence on the wage gap were analysed by Reimer and Schröder (2006).

3) Measures to tackle the gender pay gap in science and research

The sociology of organisations and the management culture have been analysed and questioned in terms of equal opportunities. For example, a reflection on the establishment of an accurate and comprehensive methodology for the assessment of jobs in academia and private business, eliminating gender bias in payment has been started (Corominas et al. 1999, 2008, Schömer 1999, Caldicott 2007).

Box 6: Gender Equality Scheme

Within the University of Oxford, a University's Gender Equality Scheme and Action Plan has been established by the authorities. One of the objectives of the plan is to address the causes of any gender pay gap. The Gender Equality Code of Practice issued by the government identifies three main factors which contribute to the existence of a gender pay gap: pay discrimination (which is often inadvertent, but nonetheless unlawful); the impact of women's disproportionate share of caring responsibilities (which often results in women taking up part-time work which is often poorly paid and restricts career continuity and progression); the concentration of women in particular occupations, usually characterised by lower levels of pay than in those numerically dominated by men. Since 2002, the University has undertaken equal pay audits to review the pay of women and men doing equal work and to identify any pay gaps.

Caldicott, F. (ed.), University of Oxford 2007, *Gender Equality Scheme*, University of Oxford, Oxford.

In Iceland, the incentive system used within the university, the work evaluation system designed to pay academics for research work conducted outside their required working hours and the question of encouraging staff to actively engage in research were studied (Einarsdóttir 1999, 2004).

3.2.3. Methodology

Various types of methods are used to study the gender pay gap. There is no unique approach in this area of research. The measures chosen for the gender pay gap as well as the data sets used for its calculation are at the discretion of authors. Some publications concern the gender pay gap for the labour market in general while only few deal more precisely with scientific occupations, special fields of occupations or particular sectors.

State-of-the-art publications exist but always concern the gender pay gap for the labour market as a whole and the various explicative theories that are related to it.

Box 7: Pay differences between women and men. What can we learn from economic research?

This is a report from SACO, the organisation of academics in Sweden. Most academics are registered in SACO and their individual work conditions, such as pay, have been monitored for a long time. Although pay is an important economic factor, it can vary seemingly inexplicably between groups of individuals. In the current debate, such differences are often characterised as discriminating. Research in political economy has, for a long time, studied the occurrence of discrimination from a theoretical as well as an empirical perspective. The aim of this report is to give an overview of the political economic research on differences in pay and especially discuss the research results that concern the situation of highly educated men and women. The objective is to account for what research has achieved, as well as finding knowledge usable to address future differences in pay at Saco and in other organisations. The Swedish labour market seems to be gender-segregated to a higher degree than the labour market in many other countries. Since the "choice" of occupation seems to be the most important cause of differences in pay, it is necessary to investigate which factors influence this "choice". Especially, it is crucial to investigate if there are structures in the labour market or in the school system that impact on this "choice". Recent research shows that highly educated women ask for significantly lower pay than their male colleagues. The counteroffer from employers is also lower for women than for men. This is problematic as the entrance pay is often the basis for future pay rises.

Granqvist, L. and Regnér, H. 2003, Löneskillnader mellan kvinnor och män. Vad kan vi lära oss av ekonomisk forskning?, Sveriges Akademikers Centralorganisation, Stockholm.

Very often studies are of the descriptive type investigating different issues at the same time, such as vertical and horizontal segregation between men and women, science policies, and equal opportunities of women and men in science. The gender pay gap is often seen as an indicator of inequality. It is perceived as a result of segregation and of the exclusion of women of highly paid functions or disciplines. Career development (part-time work, career interruptions or pensions) is also analysed concomitantly with the gender pay gap.

When data are available, some studies present the gender pay gap across different sectors. Comparisons are carried out in some cases between sectors or between specific occupations and the rest of the labour market (Allmendinger and Hinz 2007).

Research mainly focuses on accumulating data (compilation of statistics or empirical studies) provided by political or scientific, national or regional institutions.

Box 8: Do women in Slovenia receive lower wages than men for the same scientific research work?

The article presents and analyses statistical data on the gross incomes of workers in public research institutions for the years 2001, 2002 and 2003, sorted by gender, education and the academic title of the researcher. Alongside gross income, data was also collected on functional supplements and stimulation. In comparing the data, it is possible to establish differences in incomes of workers in public research institutions and relate these to gender, since on the average, women's incomes are lower than men's with the same education, while the gender differences are even more evident in the case of researchers with identical academic titles. The general pay gap is, on average, still 90.5%, in addition to which differences in functional supplements and stimulation are considerable (where the pay gap varies from 6.6% to 86.7%). The general conclusion is that gender segregation and direct and indirect discrimination are still considerable, despite the fact that Slovenian legislation does not tolerate any kind of discrimination.

Novak, P. 2006, 'Ali ženske v Sloveniji prejemajo nižje plaèe od moških za enako znanstveno-raziskovalno delo?', Časopis za kritiko znanosti, domišljijo in novo antropologijo (Journal for Science Critique, Imagination and New Anthropology), vol. 34, no. 224, pp. 168-181.

Longitudinal and cohort analyses have been carried out in several studies (Marry 2001, Granqvist and Regnér 2003, Ljunglöf et al. 1998, Ljunglöf and Pokarzhevskaya 2003, McNabb and Wass 1997, Minks 2001, Allmendinger and Hinz 2007).

Box 9: Male-Female Salary Differentials in British Universities

The average wage differential between male and female academics in Britain in 1992 exceeded 15 percent. Using individual data covering all full-time academic staff in the old universities for the years 1975, 1985, and 1992, the authors find that a significant part of the differential is explained by the fact that women are underrepresented in senior ranks. However, even after controlling for rank, age, tenure, and faculty, a gender effect in the remuneration of British academics remains. Moreover, neither the average wage gap nor that part attributable to an independent gender effect have fallen since 1975.

McNabb, R. & Wass, V. 1997, 'Male-Female Salary Differentials in British Universities', Oxford Economic Papers, vol. 49, no. 3, pp. 328-343.

There are very few empirical and quantitative studies that have tested the factors that contribute to pay inequality. In Israel, on the basis of the National Census or of the National Wages Survey, both conducted by the Israeli Statistics Bureau, different calculation methods have been

employed in order to examine possible correlation of the pay gap to various demographic and occupational factors (Rom-Rivit and Schkolnik (2009) Country report Israel).

Econometric analysis is used in some cases (Adam et al. 2004, Caldicott 2007, Allmendinger and Hinz 2007, Brynin 2007, Mitra 2002, Booth et al. 2002, Euwals and Ward 2000, Addis 1997) in order to evaluate the explanatory power of the different variables (level of education, age, occupation, "choice" of study, career expectations…). Gender differences in income expectations have been studied through quantitative research (Need and De Jong 2008).

Box 10: Subject of degree and the gender wage differential: evidence from the UK and Germany

The authors show that controlling for subject of degree explains a significant part of the male/female gender wage differential amongst graduates. Using data from the labour force surveys of the United Kingdom and Germany, the authors find similar results in these two countries: subject of degree explains the about 2–4% higher wages of male over female graduates after controlling for age, industry, region, part-time and public sector employment. This is a significant part (between 8 and 20%) of the overall male/female gender wage gap, and an even larger amount of the part explained by factors entered into the wage equations (at around 24–30% of the explained component). The authors describe subject of degree differences between male and female graduates in the UK and Germany in 1996. They also present decompositions of the gender wage gap. The results provide evidence for the view that promotion of gender equality, and any associated reduction in the gender wage gap, should also involve looking at educational "choices" that shape the subject of degree "chosen" by men and women and hence that occur before young people enter the labour market.

Machin, S. & Puhani, P. A. 2003, 'Subject of degree and the gender wage differential: evidence from the UK and Germany', Economic Letters, vol. 79, no. 3, pp. 393-400.

Very few studies aim at developing gender-neutral indicators for the assessment of academic and professional positions. A publication from the National Statistical Institute of Bulgaria provides aggregate statistical data about the gender wage gap over the period from 1997 to 2002. These statistics were summarized into a single indicator – the 'ratio between female and male average monthly wage and salary'.

Box 11: Basic factors determining the gender pay gap

In 2002, for the first time, the National Statistical Institute of Bulgaria published aggregate data on the gender wage gap. These data were summarized into a single indicator – the 'ratio between female and male average monthly wage and salary'. The objective of this paper is to develop a system of indicators/factors for a better understanding of the gender pay gap. The author suggests three groups of such factors classified as: objective factors; human capital factors; discrimination factors. The author provides multi-profile analyses and assessment of the objective factors' influence on the formation of gender differences in pay at several levels. The human capital factor is further analysed from the point of view of its subjective characteristics divided into three subgroups: Education and qualification; Experience, skills and level of competence; Leadership qualities, e.g. ability for decision-making. The analysis of the factor 'direct and indirect discrimination' reveals some common forms of discriminatory practices in the wage formation by gender. On the basis of other research, the author assesses the 'weight' of each group of factors on wage formation by gender as follows: objective factors – relative share 40%; human capital factors – relative share 30%, and discrimination factors – relative share 30%.

Стоянова, К. 2007, 'Основни фактори детерминиращи различията между жените и мъжете в заплащането на труда ', Икономически изследвания, vol. XVI, no. 2, pp. 89-116.

Finally, qualitative methods to study the gender pay gap have also been used. These studies are mainly based on interviews that aim to investigate the perception of women of their income situation and of potential discrimination. Analysis of the legal framework with respect to pay was also carried out (Einarsdóttir 2000, Schömer 1999, Dennis and Dennis Kunkel 2004, Červinková 2003, Mason 2004, Kristmundsdóttir 2000).

3.2.4. Results

3.2.4.1. International comparisons

A recent report "Remuneration of researchers in the Public and the Private sector" (2007)[1] gives us data on the remuneration of researchers and on the gender pay gap in this particular occupation. The main objective of the study is "*to give a clear idea of the existing differences between researcher careers in EU25 and Associated Countries. Other areas of interest addressed in the study are the existing differences between researching and other similar professions, and differences between researchers working in Europe and those in Australia, China, India, Japan and the United States" (p. 22)*. The authors define a researcher as any person who devotes at least 50% of her/his time to carry out research activities. The report provides a scale of net and gross remunerations of researchers in the public and private commercial sectors in the EU25 and Associated Countries at the various stages of their career. The collection of information on the remuneration scheme of researchers was realised by means of an on-line survey. The percentage of researchers covered by the sample is 3.49% (N=6110). The weighted average of researchers' remunerations per gender has been calculated considering data on the country's total yearly salary of researchers in purchasing power standards.

The analysis includes a comparison of the remuneration of researchers with other professions socially recognised as hosting comparable qualifications, such as life sciences, engineering, etc. These data on the remuneration of other professions was extracted from data published by Eurostat and classified through the ISCO classification as related to "professionals".

Even if the sample is relatively small and that the reliability of the data may be questioned, the study is worth mentioning since it is the only existing investigation on the remuneration in scientific occupations in Europe. It is thus interesting for this meta-analysis.

[1] European Commission 2007, *Remuneration of researchers in the Public and the Private sectors*, European Commission, Luxembourg.

Table 18: The average weighted total yearly salary of researchers in EU25 and Associated Countries, per country and gender

Country Gender	Female	Male	Difference Male-Female (%)
Austria	45.689	65.647	30,40%
Belgium	42.161	62.326	32,35%
Bulgaria	5.345	6.270	14,75%
Croatia	16.404	20.274	19,09%
Cyprus	37.661	54.472	30,86%
Czech Republic	25.313	39.831	36,45%
Denmark	39.777	44.740	11,09%
Estonia	12.179	23.070	47,21%
Finland	29.938	41.063	27,09%
France	40.317	52.111	22,63%
Germany	46.134	56.385	18,18%
Greece	27.922	32.568	14,27%
Hungary	22.029	29.386	25,04%
Iceland	33.820	37.592	10,04%
Ireland	39.487	55.051	28,27%
Israel	37.298	59.812	37,64%
Italy	25.652	38.440	33,27%
Latvia	-	-	-
Lithuania	19.033	25.526	25,44%
Luxembourg	45.758	60.093	23,86%
Malta	42.392	40.014	-5,94%
Netherlands	43.317	64.691	33,04%
Norway	38.233	43.395	11,89%
Poland	16.795	23.606	28,85%
Portugal	25.721	40.671	36,76%
Romania	12.429	15.358	19,07%
Slovakia	15.403	19.636	21,56%
Slovenia	34.095	40.249	15,29%
Spain	32.268	43.484	25,79%
Sweden	41.553	50.168	17,17%
Switzerland	48.462	63.334	23,48%
Turkey	20.707	28.939	28,45%
United Kingdom	43.830	58.907	25,59%

Source: European Commission, 2007, p. 48

One can see from the Table 18 that in most countries, the remuneration of men is higher than that of women and the gender pay gap is in general as important as previously shown in this report. The countries with the highest pay differences (over 35%) are Estonia, the Czech Republic, Israel and Portugal. On the contrary, the gap is smallest (below 15%) in Bulgaria, Denmark, Greece, Iceland, Malta and Norway.

In Table 19, the remuneration of researchers is presented by sector of activity. It gives an idea of the differences in remuneration by sector and by country. Huge differences are observed. For example, in some countries, wages are higher in the private sector while in others, they are higher in the government sector. There are thus important national differences in the pay of researchers across sectors.

Table 19: Average Total Yearly Salary of researchers in EU25 and Associated Countries per sector of activity[1]

Country/sector	Business Entrprise Sector	Government	Higher Education
Austria	65.805	49.182	62.069
Belgium	68.228	63.306	46.507
Bulgaria	-	6.988	6.598
Croatia	19.082	33.690	21.087
Cyprus	56.096	50.687	56.579
Czech Republic	46.925	34.217	47.682
Denmark	65.476	41.849	48.118
Estonia	-	13.856	22.657
Finland	37.407	37.173	33.084
France	40.705	52.058	50.881
Germany	49.723	54.036	45.893
Greece	29.276	39.452	32.045
Hungary	39.377	34.096	31.706
Iceland	-	32.512	34.622
Ireland	59.806	39.890	42.763
Israel	-	86.798	75.000
Italy	36.575	37.559	34.204
Latvia	24.691	40.255	18.433
Lithuania	46.813	30.970	26.564
Luxembourg	52.344	52.802	63.995
Malta	69.480	27.559	40.965
Netherlands	64.080	46.208	65.923
Norway	44.709	37.984	42.949
Poland	27.865	18.054	25.467
Portugal	22.673	39.893	27.495
Romania	19.333	17.365	14.780
Slovakia	30.644	21.278	18.514
Slovenia	34.335	34.420	41.501
Spain	40.543	37.827	36.817
Sweden	47.162	39.435	51.893
Switzerland	51.548	66.396	62.337
Turkey	35.119	35.945	30.539
United Kingdom	60.360	57.449	50.310

Source: European Commission, 2007, p. 49.

For Bulgaria, Estonia, Iceland and Israel, no data were collected by the survey for researchers working in the Business Enterprise Sector.

[1] The publication does not provide sex-disaggregated data for the different sectors of economic activity.

Table 20: Total yearly salary of researchers in EU25 and associated countries, per gender and per level of experience

Country/ Level of experience	0-4 years		5-7 years		8-10 years		11-15 years		> 15years	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Austria	34.473	37.244	41.921	50.446	49.369	63.648	56.817	76.850	64.266	90.052
Belgium	27.767	26.802	35.079	40.933	42.392	55.064	49.705	69.195	57.018	83.326
Bulgaria	2.045	1.961	2.668	2.689	3.292	3.417	3.915	4.144	4.539	4.872
Croatia	9.862	9.458	12.665	12.124	15.468	15.541	18.270	19.922	21.073	25.537
Cyprus	22.234	21.208	28.051	32.147	33.867	43.086	39.684	54.025	45.500	64.964
Czech republic	7.478	10.728	10.792	15.015	14.105	19.301	17.419	23.587	20.733	27.874
Denmark	43.117	42.852	51.460	52.204	59.804	61.556	68.147	70.908	76.490	80.260
Estonia	4.825	7.691	6.939	10.068	7.636	12.444	8.334	14.821	9.053	17.198
Finland	23.369	28.886	29.776	36.724	36.182	44.563	42.589	52.401	48.996	60.239
France	30.223	30.726	38.859	39.225	47.494	50.075	56.129	63.926	64.765	81.608
Germany	22.143	25.716	35.969	38.731	49.795	51.746	63.621	64.761	77.447	77.776
Greece	13.462	11.823	19.131	18.370	24.800	24.917	30.469	31.464	36.138	38.011
Hungary	6.902	10.706	10.152	13.244	13.401	15.783	16.650	18.322	19.899	20.861
Iceland	45.664	44.713	50.070	50.073	52.273	55.432	54.475	60.792	58.881	66.152
Ireland	26.428	20.290	39.691	41.073	52.954	61.856	66.217	82.639	79.480	103.422
Israel	16.329	13.523	22.407	20.453	28.486	30.933	34.564	46.783	40.643	70.754
Italy	12.244	12.760	19.777	23.488	27.310	34.216	34.844	44.944	42.377	55.672
Latvia	12.000	-	14.667	-	17.335	-	20.002	-	22.670	-
Lithuania	7.356	6.836	8.286	9.068	9.216	11.299	10.146	13.531	11.076	15.763
Luxembourg	24.742	43.578	40.365	53.864	55.988	64.150	71.611	74.436	87.234	84.722
Malta	24.364	21.364	27.267	23.746	30.169	26.393	33.071	29.336	35.974	32.606
Netherlands	22.518	31.921	35.655	47.095	48.792	62.269	61.929	77.443	75.066	92.617
Norway	49.031	52.829	54.174	58.346	59.316	63.864	64.459	69.381	69.602	74.898
Poland	5.921	8.453	8.088	10.166	10.255	12.226	12.421	14.703	14.588	17.682
Portugal	10.512	12.051	14.693	17.541	20.535	25.532	28.702	37.164	40.115	54.095
Romania	3.813	2.476	4.696	4.474	5.785	6.473	7.126	8.472	8.778	10.471
Slovakia	5.547	5.895	6.794	7.187	8.041	8.762	9.287	10.681	10.534	13.021
Slovenia	16.424	17.976	22.502	22.372	28.581	27.844	34.659	34.654	40.737	43.130
Spain	16.416	17.228	22.858	22.955	29.300	30.586	35.742	40.754	42.184	54.301
Sweden	28.591	28.012	41.900	42.655	55.209	57.298	68.518	71.941	81.827	86.584
Switzerland	39.599	40.862	55.711	61.075	71.823	81.288	87.935	101.501	104.047	121.714
Turkey	7.674	8.634	10.707	11.387	13.740	15.016	16.773	19.803	19.806	26.116
United Kingdom	25.411	29.060	37.461	38.608	49.511	51.293	61.561	68.146	73.611	90.536

Source: European Commission, 2007, p. 47.

Table 20 shows pay differences by level of experience. In most countries, the wage gap increases with the level of experience. At lower levels of experience (0-4 years), the remuneration of researchers is higher for women than for men in 11 countries (Belgium, Bulgaria, Cyprus, Croatia, Denmark, Greece, Iceland, Ireland, Israel, Lithuania, Malta, and Romania). Then, as experience rises, the remuneration of men tends to surpass that of women. At the highest level of experience (more than 15 years), women earn more than men only in Luxembourg and Malta.

In "*Women in industrial research*", a report edited by Meulders and Caprile (2003), differences in the gender pay gap across research disciplines in the industrial sector are reported. In Sweden, for example, this gap varies between 78% and 88%: it is lower in physics, mathematics, technology, life sciences and health sciences than in medicine or the social sciences. The report

also shows a correlation between marital status and the gender pay gap: 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. This 'gender pay gap by marital status' has not decreased over the last 10 years. Another interesting finding concerning the gender pay gap put forward by this research on women in industrial research is that female scientists in this sector seem to perform worse in terms of wages than women in the economy as a whole.

"[…] *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 Earnings Survey (ESES) does not provide disaggregated data on occupation and education at the European level. However, it seems meaningful to make reference to more aggregated European ESES data as well as to the literature at the national level in order to draw a basic picture of the gender pay gap among highly qualified employees. […] 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 – secondary education, and a significantly larger pay gap among workers with higher education. […] 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."* (Meulders and Caprile 2003, pp. 31-35)

"[…] *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."* (Meulders and Caprile 2003, pp. 31-35, cfr. Table 21)

Table 21: 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
	W/M	0.72	-	0.84	0.76	0.81	0.83	35
7	Women	-	-	-	-	-	-	0.77
	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	-	-	-	-

Source: Meulders and Caprile 2003, p. 35.

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.

"[…] *The gender pay gap among scientists and engineers has been widely confirmed across European countries. In Portugal, in 2001, 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. 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. 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. A gender pay gap among scientists and engineers has also been confirmed in the Netherlands and Germany."* (Meulders and Caprile 2003, pp. 31-35)

A recent report by Palasik et al. (2008) examines career patterns of female scientists and the gender pay gap at several European universities.

The data do not point towards a significant pay gap at the Budapest University of Technology and Economics. If executive allowances are taken into consideration, the average wage of men is higher, because most of the executive positions are held by men.

At the Semmelweis University of Budapest, "*salaries of civil servants are regulated by law. Employees are categorised mainly by education; the income categories have a rather narrow interval of salaries. Thus compensation for different jobs is similar regardless of age and gender. Although no data exist on the wage distribution by gender, the common opinion is that men's and*

women's wages do not differ. A pay gap may exist in other forms of income, such as grants and informal resources such as gratuities" (p. 36).

According to the same report, "*the Turkish higher education system does not discriminate against female and male staff in terms of wages and/or other related payments. There are, however, no data on additional payments and given that women constitute a small minority in top-level managerial positions, there is almost certainly a pay gap in these additional income sources*" (p. 35). The report also states that there is no gender pay gap at the ITU (Istanbul Technical University): "*30% of the academic staff and of the students are women, and women have well represented in decision-making positions. There are schools for the staff's children, residential units and sport facilities on the campus. University policies include equal opportunities for research and academic promotions, equal opportunities for academic scholarship programs and guarantees for an equal teaching load organised and tailored according to the needs of the academic staff. Women are visible in very high administrative positions*" (p. 43).

In Estonia, at the Tallinn University of Technology, "*there is a slight pay gap between men and women. Women in academic positions earned on average 95% of the income of men. The gap gets slightly bigger if we consider additional payments received for additional (administrative) assignments, e.g. heads of departments, which mostly increment the salary of men, as most of the heads of departments are men*" (p. 36).

The University of Oulu in Finland has developed a "*new salary system as part of a reform of the public payroll system. The transition to this new system is recent and partially ongoing, so the gender effects of the change are not yet visible. In the new salary system the salary is negotiated with the closest superior and reviewed annually. The amount of the salary depends more on the person's negotiating skills, confidence, and relationship with the superior. The goals of the pay policy are defined in the Plan for Equality of the university. The salary system is developed from a seniority increment-based system towards a system that is based on the job requirements and person's competence, skills, performance and results. The assessment of the job requirements and personal performance, and the transparency of the salary system should promote a fair and equal pay policy at the university*" (p. 36).

Finally, the report states that in Italy at the University of Rome 'Tor Vergata', the gender pay gap does not really exist. The salaries are equal for men and women in the same positions but women are less likely than men to reach top-level positions.

3.2.4.2. Determining factors of the pay gap

a) Individual factors

Mousourou (1983) found that women's professional mobility is also determined by the wish to improve working conditions whereas men's mobility was uniquely based on their wish to increase their wages. In Greece, during 60s and 70s, women were mostly employed in "feminine" sectors of industry and services. Gender inequalities in employment mostly concerned gender pay gaps and women's limited promotion prospects. Women were forced to reduce or stop their work

during their pregnancy and afterwards. As they had to conform to the socially accepted roles and patterns, they could not reach high-rank positions.

Tytherleigh et al. (2007) investigated the relationship between gender, stress and health among English university staff. They found that men were stressed because of pay and bvenefit issues than women. On the contrary, women were more sensitive to the negative outcomes of health.

Box 12: Gender, Health and Stress among English University Staff – Exposure or Vulnerability?

In May 2002, a national benchmarking exercise of occupational stress in English Higher Education Institutions (HEIs) was carried out using the ASSET (an organisational stress screening tool), on a stratified random sample of all categories of staff. This paper presents a secondary analysis of these data by gender for full-time, permanent staff only. Results show that when differences in age and job exposure (i.e. type of university; category of employee; salary level; hours worked per week; and additional responsibilities) were accounted for, men and women reported similar levels of stress in work relationships, work-life balance, overload, job security, control, resources and communication, and job overall. They also reported similar levels of commitment. In contrast, however, men were more troubled by pay and benefits and women reported higher levels of physical and psychological (ill) health outcomes of stress. Interpreted in accordance with the differential vulnerability and exposure hypotheses, our results show that men are more vulnerable to the negative effects of stressors associated with pay and benefits, and women are more vulnerable to the negative outcomes of health, and not by differential exposure to them.

Tytherleigh, M., Jacobs, P., Webb, C., Ricketts, C. & Cooper, C. 2007, 'Gender, Health and Stress in English University Staff—Exposure or Vulnerability?', Applied Psychology: An International Review, vol. 56, no. 2, pp. 267-287.

A recent study from Need and De Jong (2008) shows that income expectation is considered as one of the most important personal traits to influence the gender pay gap.

Box 13: Personality traits and gender-specific income expectations in Dutch higher education

In this article, the authors examine gender differences in income expectations of students in higher education. They found quite large gender differences. Men and women differ significantly in the income they expect to earn at the top of their career. The authors examined how much personality traits contribute to explain gender differences in income expectations and to what extent personality typologies can add insight into the earnings potential established by human capital theory. The research shows that personality does affect expected income and that that impact goes beyond indirect effects of personality, which are conveyed largely through gender differences and students' "choice" of study subject. The results described in this article support the hypothesis that personality traits do have a substantial influence on the income expectations of students in Dutch higher education. These effects are to a large extent independent of social origin (Van Eijck and De Graaf 2001), but correlate significantly with the "choice" of a specific area of study. In addition, the authors found significant differences in personality traits between men and women. Thus, personality traits have not only an indirect effect, conveyed via gender and the "choice" of a specific area of study, but also a direct effect that is independent of gender and "chosen" study area. This research thus shows the usefulness of supplementing human capital theory with a study of personality traits when income expectations are under scrutiny. A final conclusion of this research is that some personality traits are more useful than others when it comes to earning a high income. Emotional stability is one of the most important personality traits that influences gender differences in income. Men and women generally differ a great deal in their degree of emotional stability.

Need, A. & De Jong, U. 2008, 'Personality traits and gender-specific income expectations in Dutch higher education', Social Indicators Research, vol. 86 , no. 1, pp. 113-128.

Euwals and Ward (2000) investigated the impact of productivity on pay within the academic community, drawing upon a detailed dataset of academics from five traditional and well-established universities. The authors analysed the complex relationship between teaching and research skills, but found no evidence in support of the previous hypothesis that the most productive researchers are also the best teachers. Results from this paper outline the importance of publications, grant receipts and teaching skills in the determination of pay. This paper reveals that a large financial penalty is associated with time out of the profession, which, with productivity variables, can go towards (entirely) explaining the gender pay gap and renumeration differences between male and female staff. Results from this study also suggest that the best academics stay within academic professions.

According to Granqvist and Regnér (2003) and Machin and Puhani (2003), the "choice" of occupation seems to be an important determinant of pay differences.

Concerning the level of education, in 2002 the average monthly salary of a Bulgarian woman with a university degree (bachelor and master) was 75.5% of that of her male counterpart. The average gender pay gap among male and female holders of a PhD appears smaller (11.3%). This information indicates that as the degree of scientific formation rises, the gender pay gap diminishes (Sretenova 2009 (Country report Bulgaria)).

The report on women and science in the ENWISE countries (Blagojevic et al., 2003) mentions a wider gender pay gap for the most educated (which includes women scientists and researchers) in the Czech Republic[1] and Slovakia. It means that whereas female graduates earn more that female non graduates, the benefit of having a higher level of education is greater for men than for women.

Finally, Einarsdóttir (2000) found out that women in academic positions received lower supplementary payments for their annual research work (publications etc.) although they were more educated than men in comparable positions.

b) Organisational factors

Saportah and Elvira (2001) studied how collective bargaining affects the gender pay gap. The authors study the effect of unionisation on gender wage differentials for production workers in nine U.S. manufacturing industries. They find that the wage gap is significantly smaller in unionised establishments for six of the industries, even after controlling for occupation and establishment gender composition. But this union effect does not hold within three industries. The authors conclude that unionisation generally reduces wage inequality between blue-collar men and women, but does not hold the same effect on skilled workers specialising in engineering, science and technologies. The effect might be contingent both on the overall proportion of women in an industry and on union characteristics. The authors discuss the implications of these findings for income inequality and union policies.

Marry (2001) examines the impact of the feminisation of the engineering profession in France and Germany. She observed that the executive and higher intellectual professions remain marked by difference and inequality in terms of careers, wages, and access to power and decision functions. The author shows that there is a double movement: on one hand, because women have become better qualified and have a stronger desire for professional recognition, their careers have become more diversified, and on the other hand, the "glass ceiling" continues to prevent them from acceding to the highest positions. Different factors - companies' practices, the family division of work, and women's multiple responsibilities – are combined and refrain women from acceding to the "last circle".

Einarsdóttir (1999) investigated the evaluation system at the University of Iceland and the gender gap in extra pay. She found that women were less likely than men to receive extra pay for their academic research activities and that the premia they received were lower. This finding led to further analysis of the work evaluation system at the university. During the period 1992-1997, 80% of all applicants for extra pay for research activities received payments. Among the 20% not receiving payments, women were more numerous. Male staff at the Department of Social Science

[1] « *Czech data from 1999 show that, among employees with basic educational attainment, women's salaries were 74.7% of men's salaries (representing a gender pay gap of 25.3%). In 2001, the average gross monthly earnings for full-time employees in enterprises were 18 481 CzK28 (572 Euros) for men and 13 755 CzK (426 Euros) for women - a similar gender pay gap of 26%. Among employees with a university education, the salaries are higher but the gender pay gap is even wider: these women only earn 62.5% of men's salaries - a pay gap of 37.5%. In 1999 the average salary for male graduates was 27 814 CzK (less than 1 000 Euros) and 17 395 CzK (600 Euros) for women." (p. 86)*

received the highest payments and the staff at the Human Science Department received the lowest amount. The gender gap in these extra payments was the largest among the scholars lowest in the occupational hierarchy and almost non-existent among professors. A possible reason for the gender pay gap in the work evaluation system is that women publish less than men as they are less likely to be professors who have the most extensive time for research. She rose the question whether women are hindered in their progression to higher level jobs. Finally, an important finding was that men were more likely to hold higher positions within the university independent of education and age. Education pushed men further up the academic hierarchy than women.

A similar research was conducted in 2004 (Einarsdóttir 2004). At that time the incentive system had been changed to include academic work other than research. An analysis of the system across the academic hierarchy (lecturers, senior lecturers, professors) reveals a clear gender difference in the lower positions which disappears and in some cases reverses among professors. Today, the incentive system does not use overtime hours as a measure but research points based on outputs such as publications. This change seems to have benefited women as the gender gap in research points is much smaller than when the overtime yardstick was used. The incentive system still need further amendments to make it more family friendly or even employee friendly. This is essential to stimulate research activities and avoid increased stress levels and excessive competitiveness.

Mancarella (2008) has analysed the influence of flexibility, part-time work and gender pay gap at university.

Box 14: Gender differences and atypical work in the Salento University

The article aims is to give an overview of gender differences and atypical work at the University of Salento (Puglia Region, in Southern Italy). The last decades have seen the transition to the so-called "flexibility model", calling for more adaptability, sometimes without clear protection rules. Nowadays, even technology is flexible: from ICT to IS, part of the work can be displaced out of the office. This scenario thus brought a greater discontinuity of employment, career, income, influencing workers' personal life choices. The study shows that work flexibility has entered in the public service, and that in the University people with a flexible contract are more likely to be women. At the national level functional areas in which flexibility is increasingly present are the administrative ones (931 units) and the Research ones (125). MIUR data from 2001 show that in Italy, flexible workers in the universities are mainly women, ranging from a minimum of 50% in the Faculty of Agriculture at a maximum of 100% in Architecture through 83, 3% in the Faculty of Languages and 73% and 72% in those of Law and Economics. The same type of percentages is remarkable in the Salentinian University. The study also deals with part-time work, that is also a way to make the job more flexible. At the Italian level, the majority of persons working whit this solution in University are women. Part-time work normally is the less prestigious and is characterised bt lower salaries. Women choose it for many reasons: not only reconciliation, but also for lack of better opportunity in finding a more qualified job, suitable to their capabilities. In this case, in Salento University data are in contrast with national

ones.

Mancarella, M. 2008, 'Differenze di genere e lavoro atipico nell'Università del Salento' in L'Università flessibile: genere, lavoro, vita quotidiana, Coordinamento SIBA, Lecce, pp. 37-56.

c) Horizontal segregation

Part of the gender pay gap in science can be attributed to horizontal segregation, female and male academia is not equally distributed over the different fields of science.

In Belgium, the gender pay gap varies significantly across occupations: from 28% among physicists and chemists to 14% among mathematicians and statisticians. On the other hand, 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 (Meulders and Caprile, 2003).

Other research has proven that in the same position and with the same professional expertise, women are generally less paid than men (Einarsdóttir 2000, Bahovec 2009 (Country report Slovenia), Bagic 2009 (Country report Croatia)). Research in Slovenia has also proven that on average, women's incomes are lower than men's with the same education, while gender differences are even more evident in the case of researchers with identical academic titles (Novak 2006).

Other studies show that there are no pay gaps between men and women if they are in the same position with the same seniority (Palasik 2009 (Country report Hungary)). Data from universities do not reveal any significant pay gap. However, it is worth mentioning that additional payments are not taken into account although these are common practice in some countries.

The extent of wage differences between men and women and the impact of mathematics and verbal skills on the wages of men and women across different levels of education and occupations has been studied by Mitra (2002). The author used data from the National Longitudinal Survey of Youth (NLSY 1993). Results show that significant wage differentials exist between men and women at different educational and occupational levels even after incorporating detailed worker and job characteristics. However, the importance of quantitative skills in the labour market becomes apparent as the author finds that among professional men and women with above-average mathematics skills, there is no significant gender wage gap. Separate analyses by gender show that women with superior mathematical skills experience wage gains that are comparable to or higher than the wage premiums enjoyed by men. In contrast, verbal skills do not lead to substantial wage gains for women. Although women earn significantly lower wages than men across all levels of education and occupational categories, the gender wage gap is not significant among professional men and women with above-average mathematical skills. In light of the fact that quantitative skills are in such high demand in the labour market, perhaps

women should invest in taking more mathematical courses in high school and improve their quantitative skills, thereby enhancing their opportunities for entering high paying professions that demand technical skills.

The feminisation of a profession or a sector may also influence the gender wage gap. It has been reported that the feminisation of professions lowers wages and prestige. According to Kreetz (2004), the increasing integration of women in research comes along with flexibilisation and growing gender pay gaps. Šporer (1987) observed that the more women are represented in a certain profession (including professional scientists and researchers); the lower is the average wage for the whole professional group. Recent research has also shown that as the prestige of teaching has decreased with women entering the profession, wages have decreased accordingly (Blank and Palmqvist 1998).

Box 15: Feminisation of the engineering profession in France and Germany

Feminisation of management and higher intellectual professions has increased over the past 15 years. The strong growth of girls' schooling went with an increase of women's place in these categories. This feminisation deeply affects the executive category and that of engineers. As in the case of other professions, the influence of feminisation on the transformation of these professional groups can be explained by the part that women play in the dynamic of the changes: modalities of access to the category, transformation of the professional identities, and evolution of the career patterns. Nevertheless, the authors observe that feminisation of the executive and higher intellectual professions remains marked by difference and inequality at the level of careers, wages, and access to power and decision functions. The author shows that there is a double movement: on the one hand, more diversified careers are progressively offered to women because of their increasing access to diploma and of their desire of professional recognition, and on the other hand, the permanency of the “glass ceiling” that impedes their access to the highest positions. Different factors - company practices, family division of work, anticipation and women's “choice” for balancing different kinds of desires – are linked, and contribute to make women's access to the “last circle” less probable.

Marry, C. 2001, 'La féminisation de la profession d'ingénieur en France et en Allemagne' in Cadres, la grande rupture, La Découverte, Paris - France, pp. 281-296.

Box 16: The Issue of Sex-Based Wage Differentiations

The chapter addresses the issue of wage differences depending on sex, as women are trapped in "feminine" professions that are characterised by low prestige and low salaries. In the 70s in Greece, wage differences existed and women's salaries rose less than men's salaries. The negative factors that contribute to the pay gap are also age, expertise, and years of previous professional experience. After 1981, an effort towards equal pay was observed. According to the data, the wages of married women were similar to those of unmarried women, while married men's wages were 48% higher than unmarried men's. Women, who have the same level of education as men, don't work under the same working conditions as men. Women hold low prestige positions, with less responsibility, and, as a result, earn low salaries. Many theories have tried to approach this issue, but most of the time, don't take into account the social factors that contribute to sex-based wages differences. This chapter and the book as a whole, contributes to the understanding that such problems are not just "female" or "work" problems, but are wide social problems.

Mousourou, L. 1993, 'Το ζήτημα της Διαφοροποίησης των Αποδοχών ανάλογα με το Φύλο' in Woman and Employment: Ten Issues , Gutenberg, Athens, pp. 90-108.

A research in Turkey found that women's representation among the lower paying ranks of academia in private universities is higher than in state universities (Sağlamer 2009 (Country report Turkey)).

According to Ercolani (2005) the marked pay gap between men and women in ICT and the permanence of horizontal segregation may work against women choosing science as training and ICT as a career.

d) Vertical segregation

With regard vertical segregation, we should differentiate on the one hand the pay gap directly related with vertical segregation (women less present in high positions); and on the other hand, the difficulties in career advancement.

The fact that women are as likely as men to be promoted is discussed. Booth, et al. (2003) found that women are promoted at roughly the same rate as men, but may receive smaller wage increases consequently upon promotion. To help explain these phenomena, this study constructs a new "sticky floor" model of pay and promotion. In this model, women are just as likely as men to be promoted but find themselves stuck at the bottom of the wage scale for the new grade. The article provides information on wider organisational theory that can be applied and used to enhance understanding of scientific organisations and gender mainstreaming measures.

On the other hand, other studies show that pay gaps are indirect: women earn less because they are less promoted (Daune-Richard, et al. 2004).

Gender differences in pay and promotions can be partly attributed to outside offers, men receive more and are more likely to take them/ask for more money too, whilst women have a sense of loyalty that influences their attitudes to pay and promotion (Blackaby, et al. 2005).

Box 17: Outside Offers and The Gender Pay Gap: Empirical Evidence From the UK Academic Labour Market

The objective of this article is to use a unique data source on academic economist labour market experiences to explore gender, pay and promotions. In addition to earnings and productivity measures, the authors have information on outside offers and perceptions of discrimination. The data set for this project derives from a questionnaire undertaken by the Royal Economic Society Working Party on the representation of ethnic and other minorities in the economics profession. The authors find both a gender promotion gap and a within-rank gender pay gap. A driving factor may be outside offers: men receive more outside offers than women with comparable characteristics, and benefit from higher pay increases in response. This may arise due to discrimination. We find that perceptions of discrimination and also outside job applications correlate with an individual receiving earnings below expected, given his/her characteristics.

Blackaby, Booth and Frank, J. 2005, 'Outside Offers And The Gender Pay Gap: Empirical Evidence From the UK Academic Labour Market', *The Economic Journal*, vol. 115, no. 501, pp. F81-F107.

Ackers (2007) presents some recent research on the progression of women in science careers in five EU Member States – the UK, Italy, Austria, Portugal, and Greece, examining the growing gender pay gap in science careers. She focused on the recruitment and participation of women, but also on their retention and progression. The interviews with scientists highlighted the importance of various dimensions of 'time-use' to an understanding of the progression of women and men in science careers. Her article focuses on three dimensions of time: (1) time over the working day; (2) time over the working week; and (3) time over the working year. It describes the typical working schedules of the respondents, the functional use of that time and the particular challenges this presents for scientists with caring responsibilities. The results confirm previous findings, underlining the importance of working hours in science for the attractiveness of science careers—and the ability to recruit and retain men and women—and for career progression. Within this context, the article considers the potential of recent European legislation designed to regulate working time (Council Directive 93/104) to create a more level playing field and improve the progression of women in science.

Finally, Webster (2007) made an interesting point recommending the future research agenda to develop a new understanding of 'skills': "*It is asserted in a number of the research projects, and elsewhere, that women utilise whole areas of skill in the course of their work which are simply not visible, not recognised, not accredited, and not valorised. Many of these skills are generated in the domestic sphere; others are acquired through other types of life experience but are not accorded the label 'skill'. Some job evaluation schemes, for example in UK public authorities, now recognize and valorise such skills as part of a wider project to introduce equal pay for work of equal value. Many employers, however, whilst declaring the importance of 'life skills' for certain types of employment, do not formally accredit these skills or treat them as the basis for*

pay rates and promotion eligibility. This is another source of labour market discrimination against women. There is a pressing need for research to systematically identify and formally label skills which are now increasingly in demand but remains largely invisible in terms of pay and grading systems. Such an inventory could be envisaged as a basis for the revision of gender-blind job evaluation systems and skills accreditation schemes (p. 47)."

e) Combination between work and private life

In Turkey, the impediments of promotion to higher paying management positions in academia or accepting jobs offering extra pay have been attributed to women's family responsibilities. It was also argued that even if the women themselves did not consider family responsibilities as impediments, the employers used them as "rationalisations" to discriminate against female employees (Sağlamer 2009 (Country report Turkey)).

In Scotland, French et al. (2006) explore gender differences in contractual commitments, job satisfaction and spouses' occupation among general practitioners (Table 22). The research is based on data provided by a self-completion of a postal questionnaire survey. The study has attempted to incorporate spouse's occupation/income as a factor in the career choices of general practitioners in Scotland. The authors find amongst other things that females earned less than males irrespective of the contract. Women are more likely to consider salaried posts than males because the hours of work are considered to be more compatible with childcare commitments.

Table 22: General practitioners' annual net income

						Household income				
			Males		Females			Males		Females
Own income	*N*	*N*	Per cent	*N*	Per cent	*N*	*N*	Per Cent	*N*	Per cent
<£40,0000	297	84	16	213	60	58	29	7	29	9
£40,000-59,999	388	273	51	115	32	252	152	29	100	30
£60,000-79,999	177	156	29	21	6	290	185	36	105	31
£80,000 or more	31	25	5	6	2	275	153	30	104	31

Source: French, F. et al., 2006, p. 169.

Brynin and Schupp (2000) investigated the relationship between education, employment, and gender wage inequality amongst couples.

Box 18: Education, Employment, and Gender Inequality amongst Couples

It is well understood that children benefit from the education of their parents. However, transfers of the benefits of human capital within the home occur between partners too. The more educated an individual the more able he or she is to provide a partner with effective career support. Individuals will on average earn more the higher the education of their partner. This reciprocal support need not, though, be equal. Various factors may intervene to make the transfer asymmetrical, thus creating implicit gender inequalities. While women have broadly the same educational background as men, they work less and on average get paid less. This suggests some 'under-used' human capital. Although if she works she benefits from his education, their differing work and domestic roles mean that he is likely to benefit more. This argument re-invokes the 'domestic labour debate' in which it was argued, and contested, that female domestic labour is a subsidy either to the employer or to the woman's working husband. Here it is argued that female human capital can be thought of as a source of subsidy to her partner's wage. It also re-invokes an earlier debate in economics explicitly concerned with transfers of social capital between spouses: should wage models include a term for partners' education? Here, in a comparison of men and women in two countries – Great Britain and (West) Germany – the authors include such a term, but, using household data, produce models of both male and female wages. The results show that apparent transfers do occur, that broadly though not universally, they are more in favour of the male, and that these effects vary by the degree of educational homogamy in the two countries. The study provides an important contribution to our understanding of how gender imbalance and inequalities in SET are linked and influenced by prevailing cultures and attitudes. It provides essential theoretical underpinning for empirical studies and analytical reviews.

Brynin, M. & Schupp, J. 2000, 'Education, Employment, and Gender Inequality amongst Couples ', European Sociological Review , vol. 16, no. 4, pp. 349-365.

Women adjust their career path to family expectations and societal traditions. The pay gap can thus be seen as a result of the reproduction of the traditional division of labour, where women are economically dependent on their partner.

In her article "Flexible working policies, gender and culture change"[1], Lewis (2009) reports on a survey carried out in France in the private sector. She finds out that women with children freely choose to work less and by implication, to be "non ideal" workers by not conforming to the male model of work. Additionally, mothers have to choose between sacrificing time for family and sacrificing pay. *"Earnings are viewed as less important to mothers, whose partners, it is assumed, will be the main providers. The idea that mothers could both have time for family and accomplish a full week's workload in less time with full time pay is rarely considered. This is not viewed as in any way discriminatory, but as giving women choices to opt out of "ideal" careers to be what is widely perceived as good mothers. […] One impact of the ideal worker norm is that*

[1] Lewis S. (2009) "Flexible working policies, gender and culture change" In European Commission 2009, *Women in science and technology. Creating sustainable careers*, Office for Official Publications of the European Communities, Luxembourg (pp. 40-48).

mothers themselves often assume that they are lucky to be able to "deviate" from the male norm. Thus despite the loss of pay associated with condensing work into four days they regard this very favourably (p. 43)". A respondent of the survey explained *"...I work at home on Monday or Tuesday, when the children are asleep, I finish my work at home because I have to leave in the evening. In fact I think it's good to have this flexibility…I can leave early in the evening and finish what I didn't do at home. Interviewer: But you pay for that, in terms of salary? Yes (p. 44)."*

Glover (2002) gives insight into the balance between commodified (paid) work and uncommodified (unpaid) domestic work. Her thesis is that one of the factors behind women's decision making related to 'employment mobility' may be a perceived need to maintain a balance between commodified (paid) work and uncommodified (unpaid) domestic work. 'Employment mobility' principally refers to three types of movement: 1) from outside the labour market into paid work; 2) from part-time to full-time paid work; and 3) from a lower to a higher post (via promotion). All these movements imply an increase in the time taken up by paid work and may also have spatial implications. The article suggests that a spatial-temporal increase in the paid work sphere may create pressure on unpaid work and bring about a perceived imbalance in individual women's lives and in the household. The threat or the actuality of this may mean that women 'choose' not to increase their paid work. This will add to the disadvantage that women experience in the labour market, where part-time working is notoriously subject to low pay and where vertical sex segregation is a causal factor in the pay gap between women and men (Humphries 1995). The focus of the publication is the post-1970s liberal welfare regime in the UK. The article conceptualises the sub-spheres of unpaid work as work that related to a range of interpersonal roles, including mother, partner/wife, daughter and friend. In addition, there is household work, household management, indirect care and emotional work, as well as charge arising from the interaction of these roles. A wish to preserve balance (by not undertaking employment mobility) may therefore be one explanation of women's position in the labour market: their overall representation, their level of balance becomes an object of women's decision making in the economic sphere. The study provides an important contribution to our understanding of how gender imbalance and inequalities in SET are linked and influenced by prevailing cultures and attitudes.

f) Discrimination

Measuring discrimination is a very sensitive task. Indeed, discrimination is not systematically visible and empirically measurable. Many scholars mention a direct, indirect or subtle sort of discrimination when studying the gender pay gap (Novak 2006, Husu 2005, Addis 1997, Chevalier 2007, Daune-Richard et al. 2004, Corominas et al. 2008, Granqvist and Regnér 2003, Ljunglöf et al. 1998, Blackaby, et al. 2005, Booth et al. 2002, Mason 2004, Reimer and Schröder 2006, Стоянова 2007).

Стоянова (2007) shows that discrimination explains 30% of the gender pay gap. The analysis of the factor 'direct and indirect discrimination' reveals some widespread forms of discriminatory practices in the wage formation process by gender.

A Dutch study concludes that there are discriminatory effects of the customary rules and procedures of almost every academic institution (Van Doorne-Huiskes and Luijkx 1988).

Box 19: Wage differences between women and men in academia

There is a general sense in which female capacities are underestimated, as compared with male, in the institution studied. The reasons for women lagging behind men in rank (the factor to which wage differences are due) are complex. These differences are partly caused by the attitudes and "choices" of female staff members. At the same time these differences raise the issue of how much freedom of choice women have in a society where the division between unpaid and paid labour still coincides to a large degree with that between women and men. An important part of these 'unjust' differences in position can be ascribed to indirect discriminatory effects of customary rules and procedures of almost every academic institution. The lack of systematic forms of career planning, for instance, has particularly negative effects on people in minor positions. Where the organisation's educational policy stresses individual initiative, and possibilities for further education within an organisation are linked to present function, this tends to consolidate existing relations between men and women. The same applies to forms of internal recruitment.

Van Doorne-Huiskes, A. & Luijkx , R. 1988, 'Wage differences between women and men in academia', *Netherlands journal of sociology*, vol. 24, no. 2, pp. 146-158.

According to Booth, et al. (2002) found both a gender promotion gap and a within-rank gender pay gap. A driving factor may be outside offers: men receive more outside offers than women with comparable characteristics, and gain higher pay increases in response. This may arise due to discrimination. We find that perceptions of discrimination and also outside job applications correlate with an individual receiving earnings below expected, given his/her characteristics.

The specific situation concerning the gender pay gap in the ICT sector in UK has been studied by Adam et al. (2004). In this sector, individualised pay packages are common and require strong negotiation skills and a high level of confidence, two characteristics that women do not systematically have. There is also a culture of 'salary secrets'. Women have reported that they only find out about pay inequalities once they reach management level and have access to the information. On the other hand, employers expect confidentiality about pay. Disclosing this information to colleagues can lead to disciplinary action. Women were also reported to have experienced discrimination in pay and promotion after returning from maternity leave and choosing to work family friendly hours. Finally, in the IT industry, part-time working is rarely an option.

Finally, an interesting study that deals with direct discrimination, besides horizontal and vertical segregation, is the report on gender pay differences among academics published by the organisation of academics in Sweden (Ljunglöf and Pokarzhevskaya 2003). It presents the results of a study based on information for a total of 190 000 members in 46 different occupations/educational domains in 2001. Saco had earlier, with data from 1991 and 1996, analysed pay differences between men and women among the academics of Sweden. This study aims to examine whether pay differences have changed between 1996 and 2001. In the public sector, including the universities, it would take, at the current pace, 60 years to achieve gender equal pay. Currently women's pay amounts to 80% of men's pay. For the last ten years the percentage has increased by 0.3 points per year. The direction is acceptable, but it is

devastatingly slow. The investigation shows three different types of pay differences: - Structural – female dominated sectors have lower pay than male dominated ones. - Differences in positions – men are over-represented in higher positions - Direct – pay differences that cannot be derived from anything but gender. The report also shows another clear differing factor – childbirth. In the beginning of a career there is no difference between genders. At about 23–30 years of age men draw away and the pay gap continuously increases up to 50 years of age in local government sectors and lifelong in public sectors.

g) Multivariate analysis

Using a sample of recent UK graduates, Chevalier (2002) tested the influence of subject of study and occupation as well as career expectations and aspirations on the gender wage gap.

First, a base model was estimated with a parsimonious specification typically found in the literature, including a quadratic function in months of labour market experience, dummies for graduating after the age of 24, being white and region of residence. This base model explains only 20%.
A second specification includes various measures of educational achievement such as A-level score, degree results, type of institution and postgraduate achievements. The inclusion of these variables improves the explanatory power of the model. When subject area is included, the explained gap increases to 50% of which 77% is explained by subject area. The wage gap for graduates thus originates from subject segregation rather than from differences in educational attainment. Women graduate from subjects that have lower financial returns.
To test the effect of job characteristics on the gender wage gap, characteristics of the work place (size, sector), type of contract and feminization of the occupationare added to the base model. These variables account for 74% of the explained wage gap, which rises to 65% of the raw gap. The number of jobs held since graduation accounts for 7% of the explained wage gap.
A fourth model extends the base model with individual character traits. This model explains 66% of the raw gap. The 12 job-values account for 45% of the explained gap and career expectations for another 30%. "*Thus, character traits and differences in expectations between genders are important determinants of the wage gap, and yet they have usually been overlooked in the literature*" (p. 831).
A final model includes all the available information. The full model explains 84% of the wage gap. Degree subject, job characteristics and job values each account for about a quarter of the explained gap. However, degree subject and career expectations account for a large part of the differences in job characteristics. Character traits are unlikely to solely self-justify one's labour market position.

In order to provide additional information, the author decomposed the gender wage gap using the method proposed by Brown and Corcoran (1997). A Delta (Δ) was created defined as *"the change in female earnings if women had the same characteristics as men and were rewarded at the men's rather than the women's price […] A negative* Δ *indicates either that women have a greater endowment of this characteristic or that the returns to this characteristic are larger for women*" (pp. 832-833). The author then reports the estimated returns for the group of variables that have been found to affect the gender wage gap. "*Law, maths, medics, and engineering and*

business graduates earn at least 10% more than graduates with an arts degree. Men graduating from law, social sciences, maths, natural sciences and medicine have substantially higher returns than women graduating from these subjects, whilst the converse is true for graduates in languages. Despite these variations in returns and the difference in the feminization of subjects, the impact of each individual subject on delta is limited (p. 833) […] *Only a few characteristics have a substantial impact on delta. These are whether an individual graduated from Math, the proportion of female in the occupation, working in the public sector, and the number of jobs held since graduation. Character traits whose returns and probability differ by gender are willingness to do a socially useful job, expectations on making a career change, taking a career break and expecting the partner to do so* (p. 837)".

The study concluded that career break expectations, explain 10% of the gender wage gap. Women expecting to take such a break reduce their search (even before the fertility decision is observed by the employer), are more likely to be found in a poorer job match and are less willing to change employer. The reduced search intensity could be the mechanism by which childrearing preferences affect wages (p. 839). Women with a more traditional view concerning childrearing are found to have less intensive search behaviour. Additionally, character traits and expectations differ by gender: women are more altruistic and value their job environment while men are more selfish, career-driven and financially motivated. The author also underlines that higher education levels tend to reduce the gender wage gap. Men and women differ in the "choices" made at university and in their early career. The wage gap for graduates does not originate from differences in educational attainment but mostly from subject segregation, with women graduating from subjects that have lower financial returns.

Another interesting finding from the study is that a woman working in an occupation where she is the only female is paid 22% more than if she was in an occupation that is 100% feminised. For men, concern with ecological issues and doing a socially useful job, two typically female traits, are penalised while these character traits have no significant effect on female wages which suggests that men with non-traditional motivations may be discriminated against. This research finally suggests that family friendly policies could play a large role in reducing the differences in expectations by gender and could thus contribute to a substantial reduction of the gender wage gap.

Reimer and Schröder (2006) also carried out a multivariate analysis in order to define the determinant factors of the gender pay gap.

Box 20: Tracing the gender wage gap: Income differences between male and female university graduates in Germany

The aim of this paper is to shed light on the causal mechanisms leading to the gender wage gap, drawing on neoclassical as well as sociological labour market theories. A unique dataset from the 2001/2002 Mannheim University Social Sciences Graduate Survey, which overcomes several limitations of standard population surveys when investigating the gender wage gap, is used for the empirical analysis. The sample is homogenous with respect to the measures normally used in income analyses - all of the respondents are university graduates, have a degree in the same field of study, and are observed at career entry. Furthermore, the dataset includes detailed measures of human capital, job search, and career attitudes, which are not usually included in standard population surveys. The results of a sequence of nested regression models show that none of these measures reduces the gender wage gap substantially: on the contrary, the introduction of variables capturing human capital even leads to a small increase in the gap. This indicates that the earnings differential between female and male graduates in the study would be even larger if women had the same human capital endowment as men. Considering that a wage gap of almost 7 percent remains even with the extensive set of variables in the analysis, there is some indication that female university graduates are facing wage discrimination on the German labour market.

Reimer, D. & Schröder, J. 2006, 'Tracing the gender wage gap: Income differences between male and female university graduates in Germany', Zeitschrift für ArbeitsmarktForschung, vol. 39, no. 2, pp. 235-253.

3.2.4.3. Measures

According to Ljunglöf et al. (1998) the principle of equal pay and equal work conditions for equal work is fundamental. The belief in every human's equal value leads to gender equality. That why the work of eliminating gender based pay differences built on discrimination or structural hindrance for women to reach higher appointments is crucial. Unmotivated pay differences between women and men as well as discrimination in careers demand for powerful countermeasures. The authors suggest that legislations and agreements must be followed; gender equality at home to support women's careers; organisations must be more flat; not only should they become more efficient, they should also support female career development; increase the low pay of female academics in local governments; stimulate competition. When more employers compete over qualified staff, this will increase pay, especially in sectors that today are dominated by women.

Adam et al. (2004) enumerate actions and initiatives to close the gender pay gap in the ICT sector. The authors suggest to encourage organisations to implement a job evaluation scheme. This method consists in comparing different jobs and defining a basis for a fair grading and pay structure. Employers are also encouraged to undertake "Equal Pay Audits" so that they can identify discrimination in their pay structures, but this is not a legal necessity. On the other hand,

employees can request an equal pay questionnaire if they consider they are paid less than their colleagues.

Mason (2004) analysed ways to implement gender equality in science, engineering and technology with a special focus on equal pay laws in UK.

Box 21: The Gender Equality Duty in SET…and how to implement it

The new gender equality duty is expected to be the most significant change in sex equality laws since 30 years. It will affect public authorities and public service providers but it will only affect private sector companies and voluntary sector organisations who are contracted out to, or who carry out functions of a public nature on behalf of the public authority – but only in respect to those public functions. Current sex equality laws, e.g. Equal Pay Act 1970 and Sex Discrimination Act 1975, have not been wholly effective at preventing discrimination. There is still widespread discrimination in employment. For example, the Gender Pay Gap persists, women who work full time earn 17% less than men who work full time, while women who work part time earn 38% less. Current laws give individuals the right to challenge discrimination only after it has happened. The new gender equality duty is different in two crucial respects. Public authorities have to be proactive in: eliminating unlawful discrimination and harassment, rather than waiting for individuals to take cases against them, promoting equality of opportunity, and not just avoiding discrimination. The Government has introduced this significant piece of legislation in order to bring about real benefits for women and men. Public services are important to everyone, they have a huge impact on people's lives and employ many people. By challenging the wider causes of inequality the gender equality duty has the potential to deliver more responsive and effective public services and help to deliver gender equality for employees working in the public sector. The Government has already introduced public sector duties to ensure race equality and disability equality. It is now doing the same in respect of women and men. This is not just ethically and morally the right thing to do - there is also a clear and strong business case for gender equality.

Mason, A. 2004, *The Gender Equality Duty in SET… and how to implement it.*

Finally, it is worth mentioning a study from Corominas et al. (2008) that proposes a job evaluation system for a fair pay structure:

Box 22: ISOS: a job evaluation system to implement comparable worth

A fair pay structure is an essential element of the personnel policy of any firm. If the pay structure is perceived as arbitrary by members of staff, it becomes a cause of disturbance of labour relations. Particularly, a pay structure is unfair if it discriminates against women. Job evaluation is a traditional tool used by companies to assist in the process of determining pay structures. It can be also useful to detect and combat wage discrimination, since it helps determine whether two jobs are of comparable worth or not. Although there are many kinds of systems, authors agree when defining point factor methods as the most appropriate and fair job evaluation systems. However, as well-defined as they may be from a technical point of view, most existing systems give discriminatory results with regard to gender. ISOS, a new job evaluation system which is described in this paper, has been designed with the aim of setting forth a neutral system with regard to gender, based on present job characteristics, existing job evaluation systems and job description questionnaires, the knowledge of international experts and a wide body of literature on gender discrimination and its relation to job evaluation. Using ISOS can contribute to detect, combat and eliminate part of the existing wage discrimination in general and, in particular, against women. ISOS includes all aspects of work ensuring that no characteristics are omitted. The system can be applied in any company to evaluate any job and offers flexibility to be adapted to the specific characteristics of an organization. ISOS can also be used to detect and combat wage discrimination. Furthermore, characteristics of present jobs, such as cross-training or flexible working time, are also included, providing a system that can be considered innovative in the very traditional field of industrial engineering.

Corominas, A., Coves, A. M., Lusa, A. & Martinez, C. 2008, 'ISOS: A job evaluation system to implement comparable worth', *Intangible Capital*, vol. 4, no. 1, pp. 8-30.

4. Statistical Gaps and recommendations

There is a persistent gender pay gap in all countries on the labour market in general and also in scientific and research occupations. There is no reliable evidence for a closing of the pay gap. The increase in the level of women's qualifications observed over the last decades has not led to a proportional reduction of the wage gap. This indicates that individual qualifications are not the main explanatory factor of the wage gap.

Several interrelated factors explain the gender pay gap and it is difficult to separate and measure their relative importance. This is illustrated by the heterogeneity in the results from the case studies. The main cause of the gender pay gap is segregation, sectoral or horizontal and occupational or vertical. However, differences in working time arrangements of men and women, differences in terms of extra pay and bonuses or promotions (vertical segregation), problems with the conciliation of work and private life and (direct or indirect) discrimination also lead to pay differences.

Out of 4299 entries in the Gender and Science Database, only 337 deal with the topic "gender pay gap" although not exclusively. This illustrates the limited research in this area compared with other topics such as "scientific excellence" or "vertical segregation". The gender pay gap has been predominantly analysed in the higher education sector. Much less research addresses pay differences in the government sector, the business and enterprise sector and the private non profit sector. Furthermore, there are important research gaps in terms of the scientific fields covered. The most investigated scientific field is mathematics and computing but engineering, manufacturing and construction, health and social services, and education have also been thoroughly investigated.

The present state of knowledge is also unsatisfactory due to weaknesses in the methodological approaches to the issue of the gender pay gap in science and research. Research is in most cases descriptive (statistical information on gender differences in monthly wages). Scholars mostly investigate if women in leading positions earn the same as men at these levels and they compare women's pay in male dominated and female-dominated sectors. Few publications provide deeper analysis of the processes and factors that cause the gender pay gap. Purely quantitative techniques are a lot less commonly employed in research on the topic of the gender pay gap in science and research.

The lack of harmonised statistical data and especially the low coverage of existing data are mentioned in all country reports. In order to draw conclusions on this topic, the few publications that document on the gender pay gap in science for the whole of Europe should be completed with case studies illustrating particular national situations.

From She Figures 2009, it appears that the gender pay gap is higher for high qualified professions than in the labour market as a whole and that it is is higher in occupations where highly qualified female professionals are better represented. It is even surprisingly larger in public sector

enterprises. This somehow illustrates the workings of a glass ceiling that women hit during their ascent in the academic hierarchy.

This glass ceiling is rooted in the gender differences that are observed in terms of study fields. There is generally a large concentration of female students in traditional female disciplines, such as nursing and social sciences. The completion of these disciplines in most cases leads to jobs in the public sector whereas the completion of male-dominated disciplines such as engineering leads to jobs in the private sector resulting in higher wages and more freedom to bargain for individual wages. Gendered disciplinary "choices" are not a problem in se, if their consequences would be the same in terms of earnings and working conditions. However, this is not the case. Moreover, the gender pay gap and remuneration policies function as barriers for the recruitment, retention and promotion of women in science and research.

Other factors are behind the gender pay gap: differences in working conditions, differences in working time and arrangements, differences in life expectations… Systematic empirical research on the respective role and power of all factors influencing the gender pay gap is necessary for each country, for the labour market in general and especially for the scientific professions, preferably using comparable data and techniques. Additional aspects, important in scientific professions, such as networking, the number of publications, mobility or the different types of scientific professions (coordinating, teaching, directing), rewards for supervision or extra administrative efforts should also receive more attention. Their relation with the gender pay gap needs to analysed in-depth. All of these analyses together would allow to complete the picture of pay (and extra pay) differences between men and women in science and research occupations.

Finally, little research has been carried out on the potential positive effects of policies aimed at reducing the gender pay gap. Here again studies are strongly needed.

Part II: Access to research funding

1. Concept and methodology

1.1. General definition

National research landscapes vary considerably across Europe. This variation concerns many aspects: the overall size of the research sector; the relative research intensity measured by R&D investment; the proportion of researchers in the total labour force; the relative size of government budget allocations to R&D; the relative size of different research sectors; the degree of centralisation and governance of funding systems; the organisation and funding of research careers (e.g. tenure); and the role and proportion of competitive research funding in research careers (European Commission 2007). The funding situation in a country is to a great extent linked to research policies at the national, sub-national and/or European levels.

Academic and fundamental research in Europe is mainly funded by the state and subject to national decision-making and monitoring. Some EU member states, such as the UK and the Netherlands, have a national research council to allocate research funding for academic and fundamental research. In other countries, academies of science are traditionally the major national elite research organisations. In a few countries, such as Italy and Greece, the relevant ministries directly allocate public research funding without having to go by intermediate national organisations. Many countries combine several funding systems. Funding organisations and programs are strategically important in each country. They affect the dynamics of the national scientific community in various ways: research job openings, opportunities for mobility, the pool of potential national evaluators and reviewers, the preferred area of research, and so forth.

Funding may also vary in geographical coverage, in time coverage and in the field of research involved. Moreover, the funding can be allocated to an individual or to a group of researchers. The large variety in the scope and the sources of research funds constitutes an obstacle for comparisons. Finally, data on funding are not always transparent and/or accessible.

Several actors intervene in the process of allocation of funds. Peer review is a specific form of evaluation to distribute the majority of grants and funds necessary for conducting research over the research community. Peer review implies that the evaluation exercise is carried out by a group of experts from the academic community in order to guarantee that only the quality of the submitted project is taken into consideration. The review thus concentrates on scientific merits. Peer review is a key element of academic life and an important mechanism in safeguarding excellence (Osborn et al. 2000).

More largely, decision-making with respect to research funding involves numerous gate-keepers: members of national science and technology councils, funding organisation directors, managers,

board members and staff members, members of evaluation committees and panels, and external reviewers. They are all in a position to define what is excellent, to distinguish between what is good and what is not. As a result, an analysis of research funding must also address both organisational and individual gate-keepers and their policies and practices. Gate-keepers should in this sense be understood as fund-awarding organisations that function as the collective gate-keepers of research funding and as individual gate-keepers who participate in the decision-making bodies of key fund-awarding organisations. These organisations and individuals play a pivotal role in forming the future research landscape and in recruiting the future research labour force. They are in a key position to influence what kind of research is supported and encouraged and what kind is marginalised and discouraged, and what kind of eligibility criteria and measurements of excellence are introduced and how these are applied in practice (Husu 2004). Gate-keeping can function as exclusion and control, but also, it can facilitate and provide opportunities and resources.

Differences in women's and men's success rates to obtain funding have been studied by many scholars. The Swedish study by Wenneras and Wold (1997) on post-doctoral fellowships in biomedicine clearly demonstrated the existence of a gender bias and nepotism in the evaluation process. The study played a key role in attracting interest and research on the topic. It has also had consequences for the Swedish council in terms of monitoring this gender bias. The study is a reference in the field, its impact has turned out considerable.

1.2. Measures and indicators

According to a recent publication of the European Commission "*The Gender Challenge in Research Funding. Assessing the European national scenes"* (2009)[1], *a* first level of evaluation of the outcome of a funding operation is the *success rate*, defined as the ratio of the number of proposals funded to the number of proposals submitted and commonly expressed as a percentage:

Success rate = number of proposals funded / number of proposals submitted

"*This rate, which measures the probability of receiving funding, can be calculated separately for proposals whose main researcher is male or female, allowing for a comparison of the degree of success according to the sex of the project leader*." (p. 52).

The report nevertheless recommends not to use the success rate by sex alone as a gender indicator of funding. The number of male and female applications must simultaneously be taken into consideration for a better representation of reality.

Another way of measuring success in receiving funding is via the amount of funding obtained. Success rates can be calculated not with numbers of proposals but with amounts of money, by calculating the ratio of the total amount of funding allocated to the total amount requested by applicants:

Money success rate = amount of funding allocated/ amount of funding requested

There is a lack of comprehensive statistics regarding funding. A report from the European Commission (2008) explains that "*finding detailed information on funding (particularly male-female breakdown) or on peer-review is still problematic since the organisation of statistics in this area tends to be country-specific – i.e. not officially requested by Eurostat. Information on the male-female representation on research decision-making boards (and funding data) is collected directly by the European Commission, but is not uniform and is not provided by all countries*" (p. 16). There is a lack of harmonised data broken down by sex on funding per research institution, appointment procedures to funding committees and the evaluation of research funding applications. Nevertheless, the data that are available clearly demonstrate that there is an equality issue in how research funding is allocated (European Commission 2008).

[1] European Commission 2009, *The Gender Challenge in Research Funding. Assessing the European national scenes*, Office for Official Publications of the European Communities, Luxembourg.

2. Results of European comparisons

The allocation of research funding involves many stakeholders: researchers applying and receiving the funds; those who set the funding agenda, those who evaluate applications, the management and administration of funding organisations and policy makers that decide on R&D policy and funding priorities (European Commission 2009). This section presents European comparisons of the gender composition of some of these stakeholders: the proportion of women in grade A academic positions, the proportion of women at the head of a higher education institution, the proportion of women on boards (gate-keepers that are in a position to allocate research funds and that have an influence on research policies), success rates in obtaining research funding and the proportion of women researchers by R&D expenditure.

There is a lack of data on women's success in applying and obtaining research funding in European countries. Indeed, research landscapes and their impact on research funding vary considerably across European countries. This variation is linked with general societal gender contexts.

In its report "*The gender challenge in research funding: Assessing the European national scenes*" (2009), the European Commission proposes a categorisation of national and organisational policies related to gender in research funding. "*A group of countries with long term, more recent or very recent proactive approaches could be identified, as well as another, large and heterogeneous group, which can be described as relatively inactive in this area. Among the most proactive countries with advanced policies and measures, three subgroups were distinguished: firstly, the Nordic countries, global gender equality development leaders with long embedded traditions in gender equality promotion; secondly, a group of newly active countries with high research activity but very poor representation of women in research: Austria, Germany, Netherlands, Switzerland and Flanders, and finally, the UK, Ireland and Spain. The last three countries have more women in research than the newly active ones but have become active much later than the Nordic ones. A common feature most of these proactive countries share is that the overall gender gap in society is relatively small from a global and a European perspective, measured by the Global Gender Gap index by the World Economic Forum, and that the national governments have shown strong political will to promote gender equality in research.*
The other group, quite large and heterogeneous, includes the remaining countries, both old and new EU member states as well as some associated countries. They can be characterized as relatively inactive when it comes to gender equality in research funding. These countries show little initiative in monitoring gender balance or promoting gender equality in research in general. Most of them have a relatively large societal gender gap. Some have among the highest proportions of women in HE research In a European comparison, some average and some less than average proportions. Although the national governments in these countries have shown little initiative, if any, to promote gender equality in research, some recent positive developments could be identified.
The key national funding organisations […] vary in their approach to gender equality issues. Several national research councils have adopted a very proactive role. These include the FWH in Austria, the Academy of Finland, the German DFG, the SFI in Ireland, the NWO in the

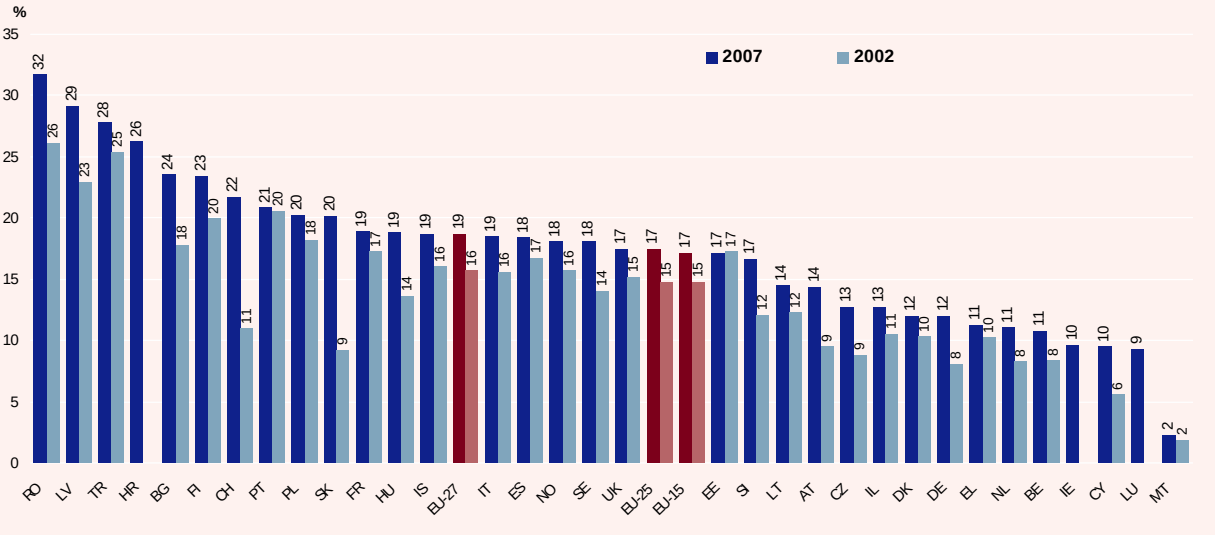
Netherlands, the Norwegian Research Council, the Swedish Research Council, the Swiss SNSF, and the UK Research Councils. Many of these have established more or less permanent infrastructures to monitor and promote gender equality in research funding, launched gender equality action plans with targets for a gender balanced representation, set up specific measures to promote women in research, and conducted or are planning in-depth studies and monitoring activities from a gender perspective." (p. 69)

All these cross-national differences in the research and funding landscape make a comparision between countries difficult.

The following tables present data from She Figures (2009) which is a unique source of harmonised and comparable data at the European level on these issues.

Table 23 yields the proportion of women in positions requiring the highest level of education, i.e. grade A, in 2002 and in 2007 in the EU27 member states. In general, the table shows that the proportion of women in grade A positions is relatively small in all countries. The EU27 average of the proportion of women in grade A academic positions rose from 16% in 2002 to 19% in 2007. The countries where this proportion is highest are Romania, Latvia, Turkey and Croatia. The lowest proportions of women in such high positions are observed in Malta, Luxembourg, Cyprus, Ireland and Belgium.

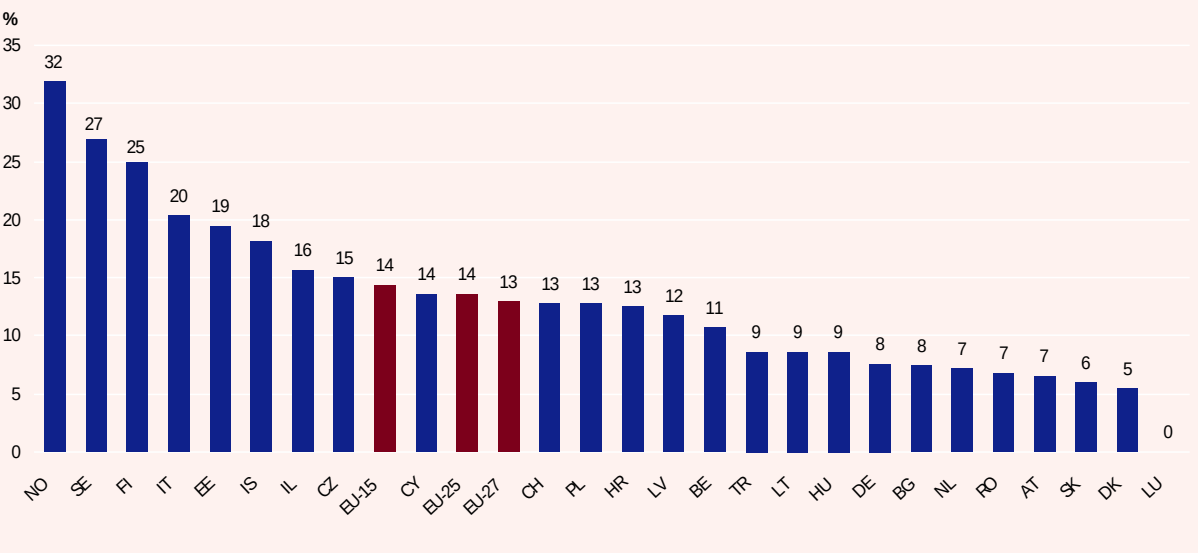
Table 23: Proportion of women in grade A academic positions, 2002/2007



Source: She Figures, 2009, p. 76; on the basis of WiS database (DG Research); Higher Education Authority for Ireland
Exceptions to the reference year(s): 2007 HR: 2008; UK: 2007/2006; DK, FR, CY, LU, AT, IL: 2006; EE, MT: 2004; PT: 2003; IE: 2002-2003; EL: 2000; 2002 NO, UK, NL: 2003; IL: 2001; EL: 1999
Data unavailable: HR, LU, IE: 2002
Break in series: CZ (2005)
Provisional data: ES
Data estimated: EU-27, EU-25, EU-15 (by DG Research), SI
Head count
NO: before 2007 biannual data

Table 24 presents the proportion of women at the head of an institution of the higher education sector for 2007. The EU15 average stood at 14% in 2007. When including the new member states, the European average decreases slightly, the EU27 average stood at 13%. There is a high degree of cross-country variation in this proportion. While some countries have a considerable number of HES institutions directed by women (Norway, 32%; Sweden, 27% and Finland, 25%), others have a very low percentage of women is such a position (Denmark, Slovakia, Austria, Romania and the Netherlands). In most countries, the proportion of women at the head of a higher education institution is lower than 15%. These figures thus clearly illustrate the workings of vertical segregation in the higher education sector. Women are strongly under-represented in high decision making positions that have a significant influence on research policies (and funding decisions).

Table 24: Proportion of female heads of institutions in the HES, 2007



Source: She Figures, 2990, p. 97; on the basis of WiS database (DG Research)
Exceptions to the reference year: IT: 2009; BE (Dutch-speaking community), DE, EE, HU, AT, PL, SK, FI, SE, HR, CH, IL: 2008; DK, CY: 2008/2007; RO: 2007/2006
Data unavailable: BE (French-speaking community), IE, EL, ES, FR, MT, PT, SI, UK
Data estimated: EU-27, EU-25, EU-15 (by DG Research)
BE data refer to Dutch-speaking community

Table 25 presents the proportion of women on boards. "*[…] boards data cover scientific commissions, R&D commissions, boards, councils, committees and foundations, academy assemblies and councils, and also different field-specific boards, councils and authorities. The table indicates to what extent women are involved in top decision-making committees that have a crucial impact on the orientation of research*" (She Figures 2009, p. 93). For the year 2007, the average proportion of women on boards for the EU 27 is 22%. This means that women constitute only a fifth of the members of decision making instances that have the power to impact on research policies. In some countries, women's proportion is higher (Sweden, 49%, Norway, 45%; and Finland, 44%). In Luxembourg, Poland, Italy, Israel, Cyprus and the Czech Republic, women's proportion is very low with respectively 4%, 7%, 11% and 12% of women on boards.

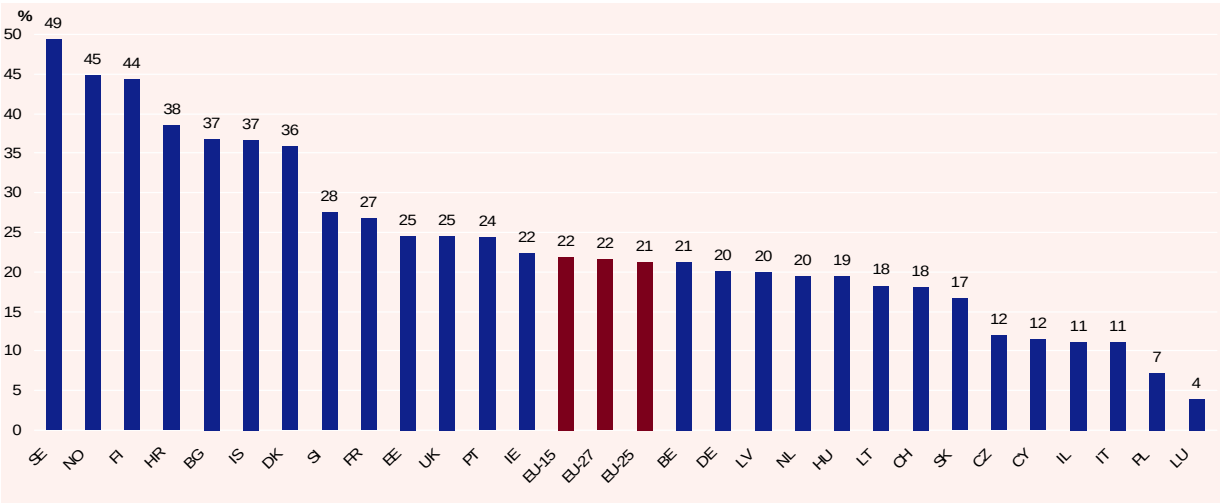
She Figures 2003 documents on the proportion of women on boards in the EU member states and the associated countries in 2001 (Tables 26 and 27). When comparing these results with the ones from She Figures 2009, the proportion of women on boards appears to have changed considerably in several countries. In Bulgaria, for example, the proportion of women on boards rose from 15% in 2001 to 37% in 2007. In Iceland, their proportion rose from 28% to 37% over the same period. In Slovenia, the proportion of women on boards rose from 18% to 28%; in Estonia, from 6% to 25%; in Belgium, from 10 % to 21%; and in Germany, from 11% to 20%. On the contrary other countries show a very important decrease in the proportion of women on boards between 2001 and 2007. In Italy, the proportion passed from 40% in 2001 to 28% in 2007; in Portugal, from 68% to 24%; in Slovakia, from 25% to 17% and in Poland the percentage of women on boards decreased from 18% to 7%. Luxembourg, the United Kingdom, Finland and Norway show a slight decrease (by about 2-3 percentage points) over the period while Cyprus, the Czech Republic, Hungary, the Netherlands, Latvia, France, Denmark and Sweden show a slight improvement in the proportion of women on boards(an increase in women's proportion by 2-4 percentage points). However, these figures must be interpreted with caution because there is no common definition of boards (She Figures 2009) and because the data are not comparable between countries due to differences in coverage of the boards (She Figures 2003).

Nevertheless, it seems that in general there has been a more significant evolution in the proportion of women on boards in the old member states than in the new ones.

To sum up, "*women are clearly underrepresented in leading and strategic positions in science and science policy organisations. This could result in a gender bias in the decision process for the allocation of grants and funding. From a gender point of view, the weak presence of women in high-power positions, and the male dominance that results from this, bias (often unconsciously) decisions that are taken at these high ranks and that shape scientific policies, determine the choice of research subjects, orient research credits and fix nominating rules and criteria*" (She Figures 2009, p. 93).

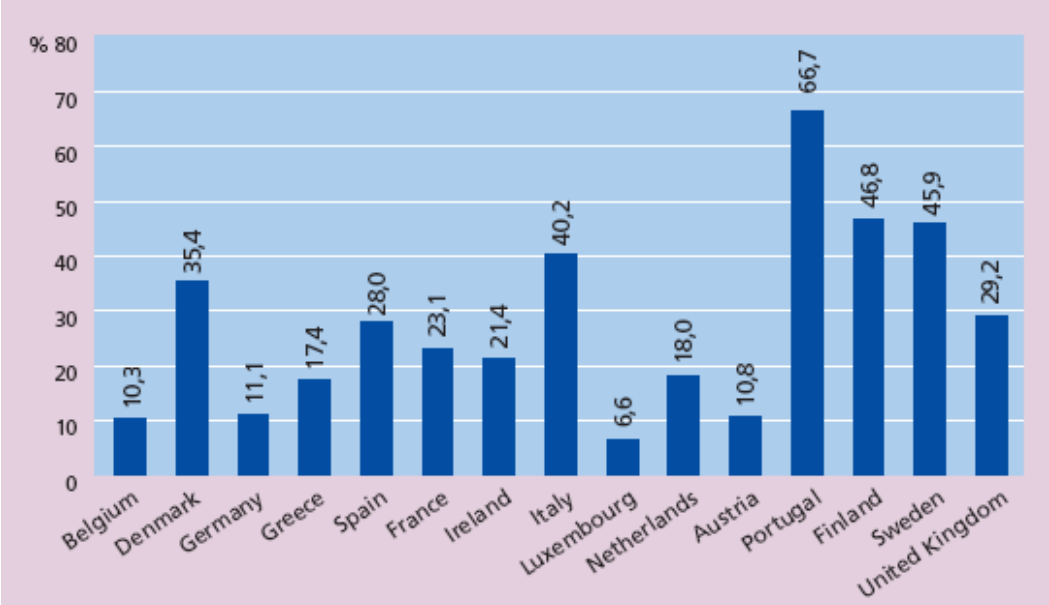
The gate-keepers of research funding are majoritarily male academics (about 80%). The ETAN report already observed this male dominance nearly ten years ago: gate-keepers are generally middle-aged male academics (Osborn et al. 2000). Women are thus strongly underrepresented in leading positions in science and science policy organisations.

Table 25: Proportion of women on boards, 2007



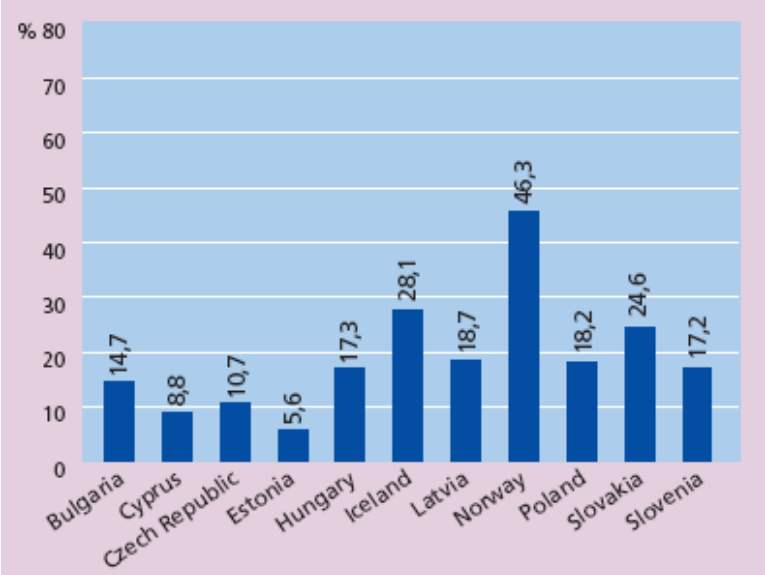
Source: She Figures, 2009, p. 99; on the basis of WiS database (DG Research)
Exceptions to the reference year: CZ, SK, IL: 2008; IT: 2005; IE: 2004; PT: 2003; FR, PL: 2002
Data unavailable: BE (Dutch-speaking community), EL, ES, MT, AT, RO, TR
Data estimated: EU-27, EU-25, EU-15 (by DG Research)
Some differences exist in coverage and definitions between countries
The total numbers of boards varies considerably over countries
BE data refer to French-speaking community

Table 26: Percentage of women on scientific boards (academies and universities) in EU Member States, 2001(1)



Source: She Figures, 2003, p. 76; on the basis of DG Research, WiS database
Notes: (1)Exceptions to the reference year: FR: 1999-2002; EL, IE: 2002;
BE: 2000; ES, AT: 1999
Data are not comparable between countries due to differences in coverage

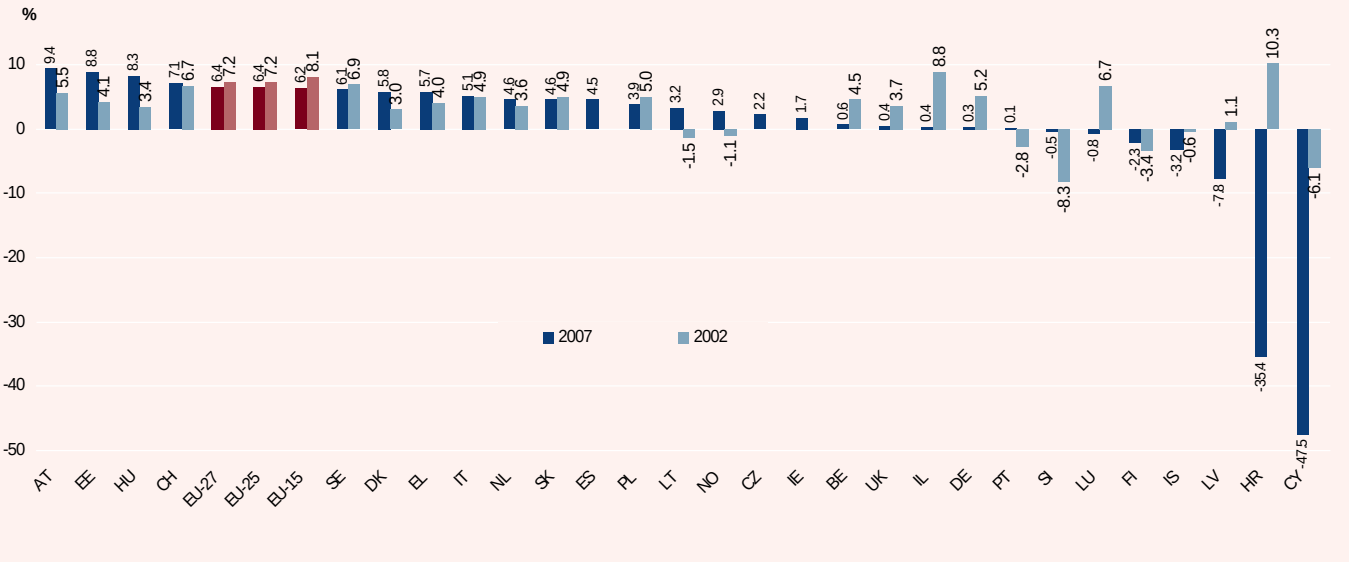
Table 27: Percentage of women on scientific boards (academies and universities) in Associated Countries, 2001(1)



Source: She Figures, 2003, p. 76; on the basis of DG Research, WiS database
Notes: (1)Exceptions to the reference year: BG, CY: 2000
Data are not comparable between countries due to differences in coverage

Table 28 gives an overview of the success rate differences between men and women in research funding for the years 2002 and 2007. At the EU27 level, the average of the gender difference in success rates was 6.4% in 2007 which is only 0.8 percentage points lower than in 2002. For the EU15, the evolution between 2002 and 2007 is more pronounced (a decrease by 1.9 percentage points). Again there is strong cross-country variation. While in some countries the gap in success rates has reduced over time, in Austria, Estonia, Hungary, Switzerland, Denmark, Greece, the Netherlands, Latvia, and Norway the gap in success rates has deepened. No general evolution can be drawn on the basis of these results.

Table 28: Evolution in research funding success rate differences between women and men, 2002/2007



Source: She Figures, 2990, p. 100; on the basis of WiS database (DG Research)
Exceptions to the reference year(s): 2007 CZ, IE, LV: 2003; EL, PT: 2002; SE: 1999; 2002 UK, HR: 2005; NL, SK: 2003; LV, SI: 2001; IL: 2000; EL, PT: 1999; SE: 1995
Data unavailable: BE (French-speaking community), BG, CZ (2002), IE (2002), ES (2002), FR, MT, RO, TR
Break in series: DK (2004)
Data estimated: EU-27, EU-25, EU-15 (by DG Research)
Some differences exist in coverage and definitions between countries
The total numbers of funds varies considerably over countries and period considered
Success rate men minus success rate for women
BE data refer to Dutch-speaking community

Table 29 breaks down the success rates differences between men and women by fields of science. Again, there is a high degree of cross-country disparity. Several countries show important differences in success rates by disciplines. In Estonia, the difference in success rates is significantly higher in the natural and in the medical sciences. In Cyprus, the success rate is surprisingly higher for women in engineering and technology, but also in the natural sciences and the humanities. In Latvia, women have relatively higher success rates, particularly in the medical sciences. In Lithuania, women are disadvantaged in the fields of engineering and technology. This is also the case for Switzerland where success rates are also very different between men and women in agricultural sciences. In Slovenia, women's success rates are relatively high in the fields of agricultural sciences, engineering and technology and in the medical sciences while they are disadvantaged in the natural sciences. In Slovakia, women have higher success rates than men in the social sciences and humanities while the contrary characterises the natural and medical sciences. In the United Kingdom, women have low success rates, particularly in agricultural sciences. In Croatia, women have very high success rates in the natural sciences and in engineering and technology. Given this high level of cross-country disparity when it comes to gender differences in success rates in obtaining research funding, it is impossible to reveal a general tendency in this respect.

Moreover, it is important to note that these figures do not inform on an important aspect,i.e. the application rate for funds. Indeed, "*it could turn out that even if there appears to be a gender balance in success rates, the proportion of women applying for research funds within the pool of*

potential female applicants is much smaller than the number of men who apply as a proportion of all potential male applicants" (She Figures 2009, p. 95).

Table 29: Research funding success rate differences between women and men by field of science, 2007

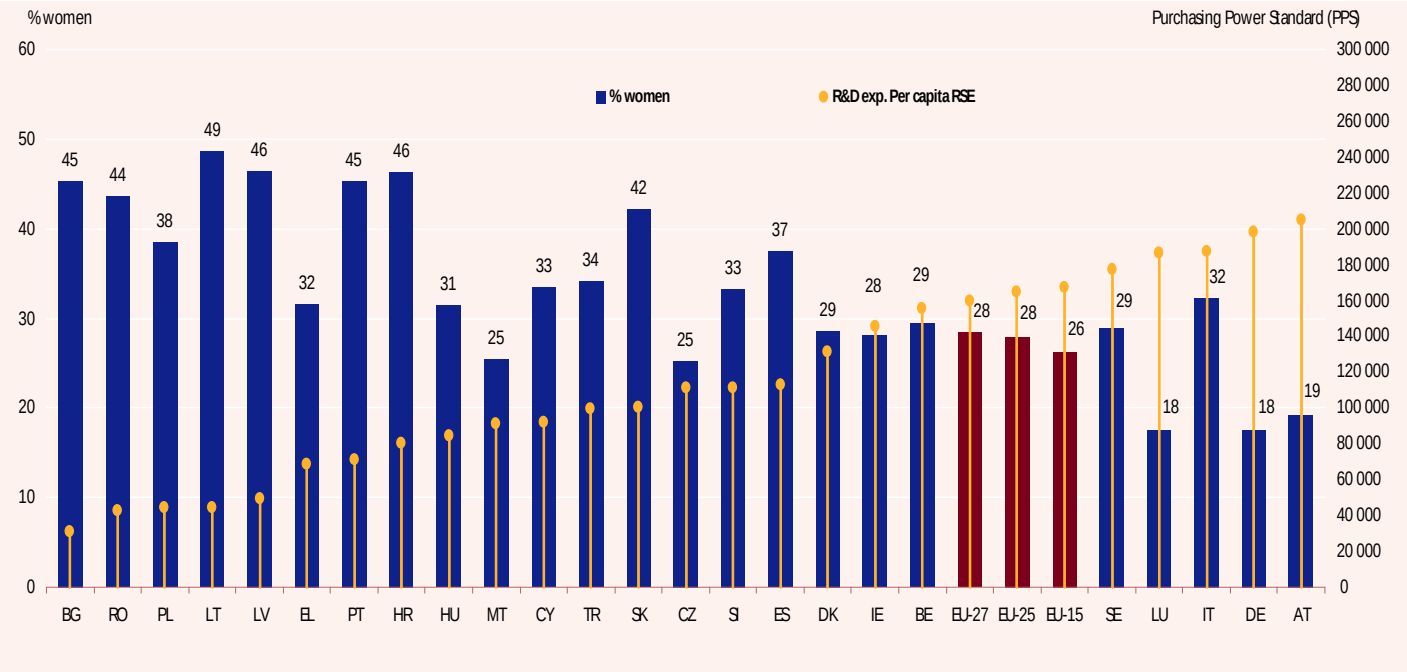
	Natural sciences	Engineering and technology	Medical sciences	Agricultural Sciences	Social sciences	Humanities
CZ	4.2	-0.8	-1.2	4.4	0.5	:
DE	3.2	-3.0	-0.7	:	-2.3	x
EE	14.5	-1.9	16.0	3.6	4.6	-2.6
IT	8.7	7.2	2.3	-2.0	7.3	6.7
CY	-9.1	-63.6	-30.0	-	-	-100.0
LV	-6.6	-8.0	-15.9	-4.3	-10.4	-5.9
LT	5.4	23.7	7.1	-100.0	1.8	-4.6
HU	14.2	14.1	10.4	12.4	-0.1	-3.0
PL	7.5	2.9	4.9	-4.6	4.1	4.2
PT	-0.5	4.8	-6.8	5.2	-3.2	x
SI	13.9	-13.0	-20.3	-29.9	5.3	0.2
SK	11.1	-1.0	11.4	5.7	-27.1	-13.5
SE	6.3	5.1	7.3	5.4	-0.1	-
UK	-0.2	1.2	1.3	7.9	-3.8	-1.4
HR	-72.9	-97.9	-4.2	-	2.6	20.0
IS	4.0	-5.6	-5.0	-9.2	1.9	13.4
NO	2.2	-4.5	3.2	-6.4	-2.1	6.5
CH	8.9	27.7	2.2	40.0	-0.7	1.3
IL	12.9	-	5.0	-	:	9.1

Source: She Figures, 2990, p. 101; on the basis of WiS database (DG Research)
Exceptions to the reference year: CZ LV: 2003; PT: 2002; IL: 2000; SE: 1999
Data unavailable: BE, BG, DK, EL, ES, IE, FR, LU, MT, NL, AT, FI, RO, TR
DE, PT: SS includes H; DE: MS includes biology
Some differences exist in coverage and definitions between countries
The total numbers of funds varies considerably over countries and period considered
x': data included in another cell; ':': not available; '-': not applicable

The overall level of R&D expenditure may also influence women's success rates in obtaining research funding (European Commission 2009). Table 30 presents the national level of R&D expenditure and at the same time the proportion of researchers in the country for 2006. There seems to be a negative correlation between R&D expenditure on the one hand and the number of women researcher on the other. Indeed, those countries with the highest level of R&D expenditure (Sweden, Luxembourg, Italy, Germany and Austria) have a relatively low proportion of women researchers. On the contrary, those countries with the highest proportion of women researchers (Lithuania, Latvia, Croatia, Portugal and Bulgaria) have the lowest levels of R&D expenditure. Women researchers are thus better represented in countries with a low R&D budget. The gender difference in success rates in obtaining research funding is smaller in those countries

than in those with high levels of R&D expenditure and consequently low proportions of women researchers.

Table 30: Proportion of female researchers in FTE and R&D expenditure in Purchasing Power Standards (PPS[1]) per capita researcher, 2006



Source: She Figures, 2990, p. 102; on the basis of S&T statistics (Eurostat)
Exceptions to the reference year: BE, DK, DE, IE, EL, LU, PT: 2005
Data unavailable: EE, FR, NL, FI, UK, IS, CH, NO, IL
Provisional data: R&D Expenditure: SE (HES)
Data estimated: EU-27, EU-25, EU-15 (by DG Research)
Researchers: FTE

[1] Purchasing power standard (PPS) is the artificial common currency into which national currencies are converted.

3. Access to research funding in the Gender and Science database

3.1. Synthesis and statistical analysis of the Gender and Science database

Out of 4549 entries in the Gender and Science Database, only 571 deal with the topic "gender pay gap and funding", 354 deal with the gender pay gap in science and research and 287 address the issue of access to research funding.
One fifth of the publications (20%) on the gender pay gap in science also deal with the topic of access to research funding whereas 24% of the publications on access to funding also deal with the gender pay gap in science (Table 31).

Table 31: Key issues

Presence of key issues in publications	GPG	ARF
Gender pay gap	100,0	24,4
Access to research funding	19,8	100,0

3.2.1.2. Cross-topical coverage

Table 32 informs on the other topics that are dealt with in the publications on access to research funding. Indeed, most publications on access to research funding also investigate other topics. A large majority of the publications on access to funding also address the topic of vertical segregation (73%), 55% are related to horizontal segregation and 53%, to scientific excellence.

Table 32: The topics dealt with in the publications in the Gender and Science database

Presence of topics in publications	ARF
Horizontal segregation	55,1
Vertical segregation	72,5
Stereotypes and identity	37,3
Science as a labour activity	46,0
Scientific excellence	53,3
Gender in research contents	24,7
Policies towards gender equality in research	44,6

3.2.1.3. Institutional sector coverage

Table 33 analyses the institutional coverage of the studies on access to research funding. The higher education sector is much more studied than the other institutional sectors: 89% of all publications on access to research funding concern the higher education sector. Access to research funding in the government sector is dealt with in 23% of the publications. 5% of the publications on access to research funding look at the private non-profit sector. Finally, the least

well covered institutional sector is the business enterprise sector which is addressed by just 4% of the publications.

Table 33: Institutional sector

Institutional sector - Other	ARF
Business enterprise sector	3,5
Government sector	22,5
Higher education sector	89,0
Private non-profit sector	4,5

3.2.1.4. Coverage of scientific fields of science

Table 34 presents the coverage in terms of fields of science of the publications dealing with access to research funding. The most investigated scientific field is that of science, mathematics and computing: 60% of all publications study access to funding in this field. Other fields in which access to research funding has been thoroughly investigated are the social sciences, business and law (48%), health and social services (42%), engineering, manufacturing and construction (37%), and education (36%). Access to research funding in services has received the least research attention (2%).

Table 34: Publications by fields of science covered

Scientific field - Other	ARF
Education	35,9
Humanities and arts	32,1
Science, mathematics and computing	59,5
Agriculture and veterinary	23,7
Health and social services	42,0
Engineering, manufacturing and construction	37,4
Social sciences, business and law	48,1
Services	2,3
Other	21,4

3.2.1.5. Life-course stage coverage

Access to research funding can be studied at different stages of the life course. Table 35 shows that analyses of access to research funding mostly concern early-career scientists (92%), followed by mid-career scientists (86%) and late-career scientists (80%). As far as publications on access to research funding also deal with other topics, Table 31 presents publications dealing with very early life course stages even though these stages do not directly concern access to research funding but treat, for example, of segregation rooted in early childhood education. Tertiary education is also often approached in the publications on access to research funding (25% at the first stage of tertiary education and 52% at the second stage). In general, these studies investigate the “choice” of study or aptitudes at school and their implications on future earnings. Lower

stages of the life course are analysed in publications that deal with all levels of the life course in general or in publications that focus on other topics besides access to funding.

Table 35: Life course stages

Life course stage	ARF
ISCED 0	0,0
ISCED 1	0,8
ISCED 2	0,4
ISCED 3	2,8
ISCED 4	3,1
ISCED 5	24,8
ISCED 6	52,4
Early-career scientists	92,1
Mid-career scientists	86,2
Late-career scientists	79,9
Other	5,1

3.2.1.6. Methodological approach

The methodological approach that is most used is that of drawing up a state-of-the-art on the topic of access to research funding, in 44% of the publications (Table 36). 43% of the publications relative to access to research funding use a conceptual approach. About 33% are compilations of statistics. Empirical research on the topic using quantitative techniques is carried out in 28% of the publications whereas qualitative methods are applied in 22%. Finally, merely 5% of the publications build gender indicators relative to access to research funding in science.

Table 36: Methodological approach

Methodological approach	ARF
Conceptual	42,9
State-of-the-art	44,3
Compilation of statistics	32,8
Building gender indicators	4,9
Empirical research. Quantitative techniques	27,9
Empirical research. Qualitative techniques	21,6

Table 37 presents the type of empirical research that has been carried out by researchers to investigate access to research funding in science. A large majority of the publications on access to research funding are non-empirical (60%). In the case of empirical studies, access to research funding in science has been analysed with quantitative techniques more so than with qualitative techniques (respectively 19% and 13%). Only 9% of the publications use both quantitative and qualitative research methods.

Table 37: Types of empirical research

Empirical research	ARF
No empirical research	59,6
Quantitative techniques	18,8
Qualitative techniques	12,5
Quantitative and qualitative techniques	9,1
Total	*100,0*

Among the use of quantitative techniques (Table 38), a representative sample is used in 71% of all publications on access to research funding in science. Micro-data are used in 43% of the publications. Less than one fifth (18%) of the studies uses multivariate analysis to examine access to research funding. Finally, few studies conduct longitudinal analyses (6%).

Table 38: Methodological approach: Quantitative techniques

Quantitative techniques	ARF
Representative sample	71,3
Micro-data	42,5
Longitudinal/cohort	6,3
Multivariate analysis	17,5

Concerning the use of qualitative techniques (Table 39), interviews are conducted in an important share of the publications (69%). The method of content analysis is applied in 23% of the entries. Case studies and bibliographical research are equally frequently used qualitative techniques: 16% of the publications use either one of these methods. An observation-based method was applied in 8% of the studies.

Table 39: Methodological approach: Qualitative techniques

Qualitative techniques	ARF
Biographical research	16,1
Case studies	16,1
Content analysis	22,6
Interviews	69,4
Observations	8,1

3.2.1.7. Evolution of the number of publications between 1980 and 2009

One can observe that the number of entries was very low during the 80s (Table 40). This number starts to rise during the 90s and more significantly in the early 2000s when the number of publications dealing with the topic of access to research funding in science has become more than 17 times higher than at the beginning of the period. In general, one can say that the study of this topic is very recent.

Table 40: Number of publications on the pay gap between 1980 and 2009

Publication year (mean per year)	ARF
1980-1984	1,4
1985-1989	1,6
1990-1994	2,8
1995-1999	7,6
2000-2004	24,0
2005-2007	25,0
2008-2009	12,5

The majority of the publications (61%) address the topic of access to research funding in science since 2000 (Table 41). When we go back in time, the share of publications on the topic steadily decreases. Whereas 58% deal with the topic in the 90s, 29% cover the 80s, 17% the 70s and 14% the post-World War II period. Access to research funding in science during the first half of the 20th century is studied in 11% of the publications, 6% deal with the topic in the 19th century. Almost no studies go back further in time.

Table 41: Time coverage of the publications on the pay gap

Time coverage	ARF
General / Not specified	2,1
Before the 18th century	0,3
18th century	0,3
19th century	5,9
1900-1945	11,1
1946-1970	14,3
1970s	17,4
1980s	28,9
1990s	57,8
2000s / Present-day	61,3

3.2.1.8. The pay gap by country group

Table 42 presents the proportion of all publications that deal with access to research funding by country. It is in Sweden that the topic has been studied most relative to the other topics: 27% of all publications deal with access to funding. Other countries with a relatively large proportion of publications (more than 15%) on the topic are the United Kingdom, Austria, Denmark, Germany, Hungary, and Italy. The countries where access to research funding in science has received the least research attention (less than 1%) compared with the other topics are the German Democratic Republic, the Soviet Union, and Yugoslavia.

Table 42: Number of publications on the gender pay gap by country

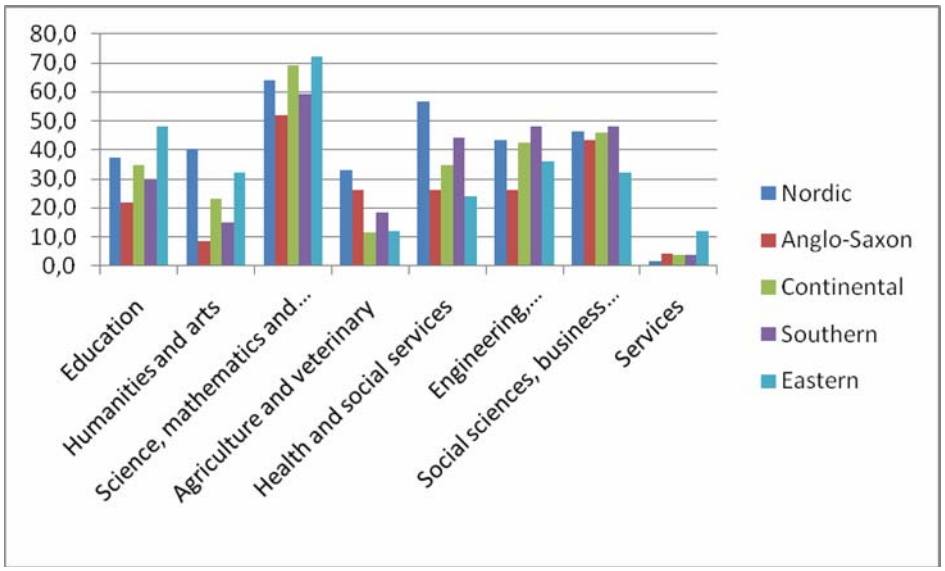
	ARF	
	n	%
Austria	52	18,1
Belgium	32	11,1
Bulgaria	22	7,7
Croatia	5	1,7
Cyprus	21	7,3
Czech Republic	42	14,6
Czechoslovakia	6	2,1
Denmark	62	21,6
Estonia	32	11,1
Finland	42	14,6
France	31	10,8
German Democratic Republic	2	0,7
Germany	46	16,0
Greece	34	11,8
Hungary	44	15,3
Iceland	9	3,1
Ireland	30	10,5
Israel	3	1,0
Italy	45	15,7
Latvia	30	10,5
Lithuania	29	10,1
Luxembourg	28	9,8
Malta	20	7,0
Netherlands	32	11,1
Norway	10	3,5
Poland	32	11,1
Portugal	29	10,1
Romania	23	8,0
Slovakia	42	14,6
Slovenia	29	10,1
Soviet Union	2	0,7
Spain	33	11,5
Sweden	78	27,2
Switzerland	9	3,1
Turkey	13	4,5
United Kingdom	62	21,6
Yugoslavia	0	0,0
(Other)	16	5,6

3.2.1.8.1. Scientific fields by country group

The most investigated scientific field in the studies on access to research funding in science is that of science, mathematics and computing in all country groups. The social sciences, business and law are the second most popular field in the publications on research funding in the Anglo-

Saxon, the Continental and the Southern countries although in this latter group this field has received as much research attention as the field of engineering, manufacturing and construction. The second most analysed field in terms of access to funding is health and social services in the Nordic countries and education in the Eastern countries. Services remain almost unexplored in all country groups. Agriculture and veterinary has been subject to relatively more research in the Nordic and Anglo-Saxon countries than in the other groups. Finally, humanities and arts are more studied in the Nordic, Eastern and Continental countries than in the other groups.

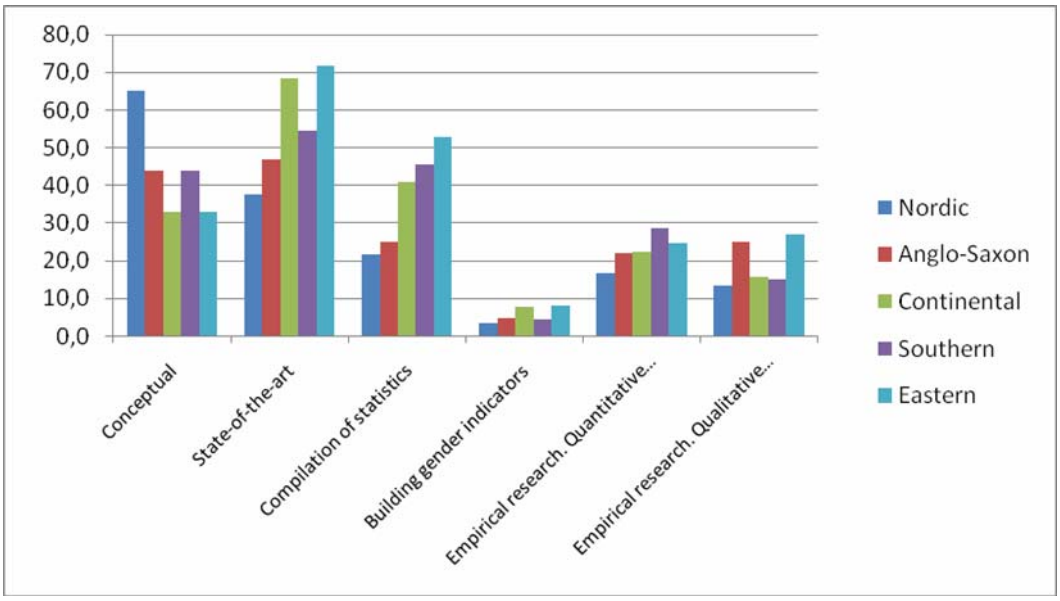
Graph 6: Access to research funding: scientific fields by country group



3.2.1.8.2. Methodological approach by country group

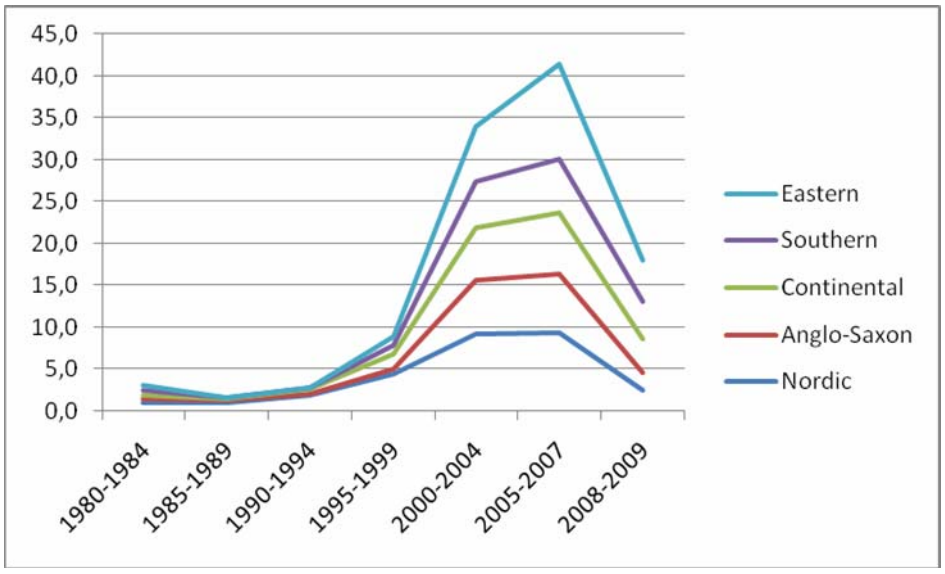
The conceptual approach is more widespread in the Nordic countries, compilations of statistics are more used in the Eastern countries and state-of-the-art reports in the Continental and Eastern countries. The Southern countries make a slightly wider use of empirical research based on quantitative techniques, whereas qualitative methods are more commonly applied in the Anglo-Saxon and Eastern countries. Finally, the construction of gender indicators is underdeveloped in all country groups.

Graph 7: Access to research funding: methodological approach by country group



3.2.1.8.3. Years of publication by country group

Graph 8: Access to research funding: years of publication by country group



The turn of the century has marked a sharp increase in the number of publications on the topic of pay and funding in all country groups although to a far less pronounced extent in the Nordic countries.

3.2. Research questions

3.2.1. Access to funding

This section deals with the allocation of research funding to women and men. How is research funding distributed between male and female researchers and scientists? Is this distribution equal? Investigation into the success rate of women in obtaining funding should also look at differences in the application rate of men and women. Do women apply more often than men for research grants, is there equality or do men apply more often than women? There is also the question of the amount of money received: Do women and men receive grants of equal value?

The analysis of these three issues (success rates; application rates; amount of the grant) should take place at the different levels of the scientific career. Indeed, gendered patterns can be different and, for sure, do not mean the same at predoc, postdoc or professorship level.

Almost every publication questions two aspects: the application rate and the success rate of women in obtaining funding. The allocation of funding may vary according to discipline and field of study. The differences in success and application rates by field of study were analysed by Brouns and Scholten (1999) and Jafnréttisnefnd Háskóla Íslands (2007). Some publications focus on just one field of science: physics (Chormaic, et al. 2005), medicine (Risberg 2004, Carlstedt 2007), political science, psychology and chemistry (Jänchen and Schulz 2005), environmental research (Rydhagen 1998), economics (Falcone et al. 1999), sociology (Allmendinger and Hinz 2002), and psychiatry (Killaspy et al. 2003).

The amount of money provided (Jafnréttisnefnd Háskóla Íslands 2007, de Coninck-Smith 2000), the level of competition in obtaining grants and the type of funding program have been investigated in relation to gender (Sandström and Hällsten 2008, Rosenbeck 2003, Koeller 2001, Bødker and Hazell 1992).

Box 23: The breakdown of applicants and grants by sex: The Research Fund of the Univerity of Iceland 2006 and 2007

This report presents the results of an enquiry made by the Equal Rights Committee of the University of Iceland in 2007 on grants given by the University's Research Fund. The focus was on the departments of Social Science, Humanities, Health Science and Engineering and Natural Science. The main results are that neither men nor women appear to be discriminated against regarding grants from the Research Fund. There were more women applicants than men. When the data was analysed across departments, it appeared that applicants from the department of Engineering and Natural Science received the largest share, followed by applicants from the Health Science department (except nursing). In 2006, the fund received 180 applications and 164 of them received funding. Around 86% of the funding went to pay for support staff. In 2007, 164 of 177 applications received funding and 88% went to pay for support staff. In 2006, women made up 32% of the applicants and 35% in 2007. It should be kept in mind that women constituted 31% of university staff in 2007. Of those receiving the highest amount, 1800 thousand ISK, in 2006, 4 were women and 13 were men. In 2007, 4 were women and 14 were men. Men were the majority of those receiving 500-1490 thousand ISK in research funding in 2006 and 2007 while women were the majority of those who received the lowest funding. The gender gap among those receiving research funds was almost non-existent in the department of Social Science and Humanities and the department of Health Science (women 37-50% of the grantees). In the department of Engineering and Natural Science, women were only 18% of those receiving funding in 2006 and 23% in 2007. The largest share of applications came from the department of Social Science and Humanities (around 43%) while they were granted 24% of the total amount the Research Fund granted. The lowest share of applications came from the department of Engineering and Natural Science while they received 46-47% of the total amount paid out.

Jafnréttisnefnd Háskóla Íslands 2007, Skipting umsókna og úthlutanir úr sjóðum: Rannsóknarsjóður Háskóla Íslands 2006 og 2007, Downloaded on 01/10/2008, Available at: www.ask.hi.is/solofile/1010675

Sandström and Hällsten (2008) analysed more than 20000 research grant applications submitted to four different Swedish research councils. The aim of the research was to look further for different structural aspects that could contribute to the explanation of the difference in success rates. Important in this study is that a distinction is made between new projects and renewals (prolonged projects).

Finally, the gender distribution of project coordinators was investigated by Maratou Alipranti (2006).

3.2.2. Causes, explanatory factors and consequences

The gender differences in the allocation of funding can be linked to various factors. The gender composition of boards is likely to influence gender (in)equality in the allocation of funding. The

extent of this influence is an important subject of concern. Is the gender composition of committees influencing the evaluation process and consequently women's success rates in obtaining funding? This interrelationship between the gender composition of boards and women's success in obtaining funding has been investigated by Palomba (2000), Linkova (2004) and Husu (2004).

Box 24: Gate-keeping, gender equality and scientific excellence

Gate-keepers and gate-keeping are a hitherto neglected but pivotal topic in studies of gendered patterns of science and academia. Gate-keepers are undoubtedly in a key position to influence the definition, evaluation and development of scientific excellence. More generally, gate-keeping processes can control or influence the entry or access to a particular arena, the allocation of resources and information flows, the setting of standards, the development of the field and the scientific agenda, or still the external image of the arena. Gate-keeping can function as a means to exclude and control, on the one hand, but, on the other hand, it can also facilitate and provide opportunities and resources. Women are particularly under-represented among academic gate-keepers and in leading positions in science and science policy organisations. According to the ETAN Report (2000), the gate-keepers of research funding in Europe are to a large extent constituted by middle-aged male academics. Such male domination also applies to countries such as Finland, despite the fact that the proportion of women among professors in Finland is the highest in the EU (21% in 2002). Finnish National Research Councils are, however, approaching gender parity, having had to follow the quota paragraph of the Gender Equality Act since 1995. Despite this, only 16% of the referees the RCs used in their funding decisions were women in 1999, as were only 14% of the board members of the largest Finnish research funding foundation. The paper presents ongoing research focusing on gender and gate-keeping in academia in relation to one key academic arena: research funding, which is analysed by studying both organisational and individual gate-keepers and their policies and practices. Gate-keepers refer here both to fund-awarding organisations as collective gate-keepers of research funding and to individuals who are involved in the decision-making bodies of such key fund-awarding organisations.

Husu, L. 2004, 'Gate-keeping, gender equality and scientific excellence' in Gender and Excellence in the Making, Office for Official Publications of the European Communities, Luxembourg, pp. 69-76.

The individual profiles of women who have been successful in obtaining grants and awards is also an important research question (Wright and Cochrane 2000, Delamont 1989). The choice of research subject and the gender differences in this regard have also been investigated (Zawadzka 2007, Allmendinger and Hinz 2002).

The gender bias in funding has often been analysed in relation to the way scientific excellence is measured and assessed (Schacherl et al. 2007, Husu 2004, Johansson 2006).

The criteria that are considered in the evaluation and the expectations and assessments of women were questioned in terms of their neutrality (Bagilhole 1993, de Pablo 2006, Brouns and Scholten 1999, Wenneras and Wold 1997, Izquierdo Benito et al. 2008). Are the demands addressed to women any different from those addressed to men? The question of gender neutrality in the work evaluation system applied by research institutions and universities is latent in most research on

this topic. More largely, the organisational culture has been questioned (Sutherland 1985) as well as general relfection on the place of women in science and its impact on funding policies (Comitato pari opportunità dell'Università degli Studi di Padova 2003).

Box 25: Gender bias and inequalities in the evaluation of academic quality

This article exposes the main results of the activities of I Congreso internacional "Sesgo de género y desigualdades en la evaluación de la calidad académica" (1st International Congress on gender bias and inequalities in the evaluation of academic quality) organised by the "Observatori per a la Igualtat de la Universitat Autònoma de Barcelona". The first part deals with the approach of science models and of science quality that is used in evaluation processes, as the general framework of evaluation. Secondly, evaluation agents are subject of analysis, focusing on the choice of evaluation personnel and the selection criteria, considering group principles of justice oriented towards mitigating the gender bias. The third aspect refers to the evaluation of the research and of the educational and academic trajectory of the applicant. The impact of introducing transparency mechanisms in the different evaluation processes is also assessed and funding distribution models are discussed paying special attention to equity, group justice and meritocratic mechanisms. Finally, the article presents the main proposals put forth by the Congress.

Izquierdo Benito, M. J., León Francisco, J. & Mora, E. 2008, 'Sesgo de género y desigualdades en la evaluación de la calidad académica', Arxius de Ciències Socials, vol. 19, no. december, pp. 75-90.

Women's perception of the evaluation system also constitutes an area of research (Palasik and Papp 2008, Jungersen 1997, Byrman 2006, Sutherland 1985, Belser 2006). The question of how the term "gender" has been used and interpreted by applicants and members of evaluation panels was investigated by Vetenskapsrådet (2004, 2007).

Box 26: Gender in research applications in educational science - a follow up of Vetenskapsrådet's draftings and outcome for the year 2004

An evaluation of gender research applications was previously carried out by the Swedish Research Council's Gender Committee. For the 2004 round of funding this was taken over by the appropriate Scientific Councils and the Committee for Educational Science. One of the aims of this follow-up report is to assess the effect of this change on gender research. In order to expedite a follow-up report, applicants for funding were asked to tick a box on the application form if the proposed project involved "questions of gender or had a gender perspective". The formulation of this was rather general and open to interpretation in a number of ways. It was not obligatory to tick the box, which many seemed to misunderstand: it was merely meant as a basis for carrying out a follow-up report. This follow-up report has been instigated on the initiative of the Swedish Research council's Gender Committee and is the third follow-up report in a series covering the 2004 round of funding applications. Focusing on the issue of gender the Committee looked at: how the term gender had been used and interpreted by applicants and members of the evaluation panel, the extent to which both applicants and members of the evaluation panel qualified in gender, and what kind of success rate applications with a gender angle had? The UVK received 315 applications: 63 percent of these were marked as having a gender angle. After examining

these applications it was decided that only 31 percent actually had a gender angle. A considerable percentage of the applicants were deemed to have insufficient expertise about the field of gender research. After studying the expertise of the members of the evaluation panel it was evident that each panel had at least one person who was a specialist in gender. The applications with a gender angle had a success rate of 17.7 percent compared to an overall success rate of 14.6 percent for research applications within Education Science.

Vetenskapsrådet 2007, Genus i forskningsansökningar inom utbildningsvetenskap - en uppföljning av vetenskapsrådets beredning och utfall år 2004, Vetenskapsrådet, Bromma.

Many other factors are discussed in the literature such as the combination between work and private life, the age limit for applying for funding, stereotypes, lack of transparency, the rejection of gender equality as a valid and integrated goal in research policies, the lack of knowledge about gender issues, … but no precise analyses have addressed these factors.

An important consequence of the gender bias in access to funding is its impact on career advancement and the development of the research career. In this sense, access to research funding is linked with vertical segregation. For example, scholars questioned why women advance slower than men in academia and show that access to and allocation of funding is an explanatory factor for slower progression or career advancement) (The Norwegian Research Council, Division for strategic priorities 2002, Comitato pari opportunità dell'Università degli Studi di Padova 2003, Leemann and Stutz 2008; Suomen Akatemian työryhmä 1997, Opetusministeriön työryhmä 2004, European Commission 2008).

3.2.3. Measures and recommendations

Gender and access to funding has been often analysed in relation with research policy and gender equality action plans at the national or institutional level. Evaluation of academic research policies and of the strategy plans of research councils, as well as changes in research policies and practices in order to avoid a gender bias in access to research funding has been carried out (Bødker and Hazell 1992, Carlstedt 2007, Johansson 2006).

Box 27: Gender project applications in medicine – a follow-up on the drafting and outcome of the Swedish Research Council's report for the year 2004

One of the tasks of the Swedish Research Council is to promote gender research and to work for the breakthrough of gender perspectives in research. An interdisciplinary committee identifies the problems of gender research. An evaluation of gender research applications was previously carried out by the Swedish Research Council's Gender Committee. For the 2004 round of funding, this was taken over by the appropriate Scientific Councils (Humanities and Social Sciences, Educational Sciences, Natural sciences and Engineering Sciences) and the Committee for Medicine. One of the aims of this follow-up report was to assess the effect of this change on gender research. In order to expedite a follow-up report, applicants applying for funding were asked to tick a box on the application form if the proposed project involved "questions of gender or had a gender perspective". The formulation of this was rather general and open to interpretation in a number of ways by the applicants. It was not obligatory for applicants to tick the box, which many seemed to misunderstand: it was merely meant as a basis for carrying out a follow-up report. Focusing on the issue of gender, the committee reached some conclusions. There seems to be an ignorance of the concept of gender research. The concept is scarcely used and in most applications gender is not interpreted as the socio-culturally founded sex. Instead it is used synonymous with, or has replaced, biological sex. It is important to reach a mutual understanding in this respect. Only one third of the "ticked" applications had a gender perspective. For the rest, the tick was motivated by sex-related issues. Also the judging committees seemed to have a defective understanding of the concept of gender. The percentage of granted applications with a gender perspective was lower (20 percent) than for applications without a gender perspective (28 percent).

Carlstedt, G. 2007, Genus i projektansökningar inom medicin - en uppföljning av Vetenskapsrådets beredning och utfall år 2004, Vetenskapsrådet, Bromma.

In many studies, the funding policy as a political matter is considered. Recommendations and policies to go against the lack of funding for women, as well as measures to avoid the gender bias in funding in the future have been proposed (Bødker and Hazell 1992, Papp and Groó 2005, Schacherl et al. 2007, Norwegian Research Council, Division for strategic priorities 2002, European Commission 2008, 2009). Different proposals to monitor whether the distribution of financial means is equal for women and men have been discussed (Jacobsson, et al. 2005, Suter 2008).

Leemann and Stutz (2008) stress the importance of integration and support, without which an academic career is not possible.

3.3. Methodology

The methodological approach is in most cases descriptive, with a focus on reporting and analysing the statistical data provided by institutions. These statistical reviews examine the total number of grants applied for by male and female researchers, the funding amount applied for by gender and the number of grants awarded (and the amounts awarded) by gender as a result. Most research analyses such data in order to conclude whether there is a gap in application and/or success rates.

A very large number of publications offer a compilation of statistics (Risberg 2004, Palasik 2006, Palasik and Papp 2008, Jungersen 1997, Schacherl et al. 2007, Leemann and Stutz 2008, Einarsdóttir 2004).

Empirical research based on quantitative techniques includes longitudinal studies, for example by Booth (1993). In Switzerland, the MHV-programme was evaluated on the basis of questionnaires filled out by former grant recipients of the years 1991-2002 in order to get information about the effectiveness of the program and possible improvements (Belser 2006).

Bivariate analysis is the method applied by Palasik and Papp 2008, Schacherl et al. 2007, Jafnréttisnefnd Háskóla Íslands 2007, Blake 2000, González Ramos 2009. Multivariate analysis were also conducted in the investigations on the gender access to research funding (Palasik & Papp 2008; Palasik & Schadt 2008; Henningsen, et al., 1980; Allmendinger, & Hinz 2002; Killaspy et al., 2003).

Box 28: Gender and Grants - an Examination of the relation between Gender and Grant Procedures in the Governmental Research Council for Social Sciences between December 1997 and May 1998.

The Danish governmental Research Council for Social Sciences has carried out an examination of it own grant procedures in order to assess if there were any systematic differences in grants awarded to men and women, i.e. to see if differences in the evaluation of grant applications were related to gender of the applicant and not to the quality of the application. Grant applications from December 1997 until May 1998 have been statistically analysed by disciplinary section, type of application, and the level of scores obtained in the evaluation. The analysis assesses the influence of the following factors: Gender and age of applicant, gender of primary assessor, and numbers of co-application. Women apply for and are awarded smaller amounts of money than men, but this is mainly due to differences in the kind of applications from men and women. Men have relatively twice as many applications with co-applicants than women and on an average more co-applicants than women. This finding also pertains to the types of applications men and women send. Applications for projects constitute 40% of women's applications and 50% of men's applications from 1990 to 1999. In the same period 40% of men's applications for projects were awarded, while only 25% of women's applications for projects won. In the evaluations of grant

applications women receive slightly worse scores than men on average, i.e relatively less women's applications than men's applications are considered worthy of a grant. However, of all applications deemed worthy of a grant, men and women have comparable shares.

Henningsen, I., Gundelach, P. & Juselius, K. 1980, Køn og bevillinger - En undersøgelse af sammenhængen mellem køn og bevillingspraksis i Statens Samfundsvidenskabelige Forskningsråd i perioden december 1997 - maj 1998., Statens Samfundsvidenskabelige Forskningsråd, Copenhagen.

In what concern qualitative studies, a large amount of researches carried out interviews (Byrman 2006; Palasik & Papp 2008; Palasik & Schadt 2008; Koeller 2001; Husu 2004; Jänchen & Schulz 2005; Killaspy, et al., 2003). These studies mainly aim at studying the perception and attitudes of women concerning gender bias in evaluation and allocation of funds. Content analysis have been carried out by Byrman (2006); Husu (2004); Vetenskapsrådet (2007); Jänchen & Schulz (2005).

Byrman (2006) carried out a research on language of the funding programme descriptions.

Box 29: The disregarded equality directive. Text- and gender analysis of three programme descriptions advertised by VINNOVA

VINNOVA, the Swedish Agency for Innovation Systems, is a State authority that aims to promote growth and prosperity throughout Sweden, by for instance, support research and development work of the highest quality in areas such as engineering, transport, communications and working life. The language and content of three programme descriptions advertised by VINNOVA, have been analysed by Byrman (2006) from a language and gender perspective. A questionnaire survey has also examined how officers at VINNOVA and applicants for programme funding perceive the texts. One reason why this study was initiated is that only 20 per cent of those who apply to the Agency for funding are women, and it was suspected that the language of the programme descriptions contributed to this. The methods used for the work were text analysis and gender analysis, questionnaires completed by VINNOVA staff and applicants, and interviews with staff. The study is based on gender theory and critical text and discourse analysis. The analysis shows that the texts are complex, dense in information, abstract, and virtually lacking human beings. The prose leads one’s thoughts to predominantly male structures, which can mean that women feel less inclined to apply. The orientation of the advertisements can also, to a certain extent, act to exclude women. The analysis also shows that equality and gender perspectives have made virtually no impact on the texts, despite the government directive according to which the Agency is supposed to integrate equality and gender perspectives in its work. The conclusions are that VINNOVA, if it is to comply with the government’s directive, should include explicit formulations about gender, equality, and also cultural diversity, and should give them greater priority among the assessment criteria in the programme descriptions, if they are relevant. In addition, the Agency should work for a simpler, more concrete language in order to attract new groups of applicants.

Byrman, G. 2006, Det förbisedda jämställdhetsdirektivet. Text- och genusanalys av tre utlysningstexter från VINNOVA, VINNOVA - Verket för Innovationssystem, Stockholm.

Regarding Switzerland, Bornmann et al. (2008) present a generalized latent variable modeling approach that can be used by research funding organisations to determine whether a certain group of applicants is possibly disadvantaged in the peer review process.

3.4. Results

Results tend to vary strongly from one study to another so that it is very difficult to summarise them. There is little agreement amongst the studies about the gender dimension in research funding decisions. This may not be very surprising given the high degree of diversity across studies in approach, topics and geographical focal points.

3.4.1. Access to research funding

In terms of access to research funding, the report "The gender challenge in research funding" (EC, 2009) put forth some important results and conclusions. First, in many cases the success rates in funding are regularly monitored and published but the gender of applicants and awardees is not followed up and success rates by gender are not calculated, or this data is not published. Second, all-male boards, committees and evaluation panels still exist in many countries and it is the case even in countries where the proportion of women in research is high. This may influence orientation and priorities in research as well as the gender equality policies of the funding organizations. This lack of women in gatekeeping positions gives the image of an organization unwelcoming to women. Furthermore, "*the absence or heavy under-representation of women among evaluators and decision-makers means that women researchers are offered fewer opportunities to gain valuable understanding of the research funding system, seen from inside, which undoubtedly would promote their own success." (p. 70)*. Third, the recrutement of the peer reviews often remain opaque. The evaluation is generally based on scientific quality criteria of the researchers and project, pertinence criteria concerning the funding scheme and often national and social relevance criteria. Gender is only rarely explicitly mentioned among them. A fourth and important conclusion is that based on the available data, one cannot conclude that women's success rates are systematically lower than men's. Concerning the application rate, the proportion of women applicants is lower than the proportion of potential applicants in practically all funding systems and most disciplines. The report also highlight that little research exists on application behaviour in general and especially on its gender patterns. Finally, important gender imbalances are observed among the awardees of highly prestigious grants, positions or prizes in many countries.

The publications in the Gender and Science Database confirm these tendencies: women apply at a lower rate than men; success rates are not systematically lower for women than for men; success rates may vary according to the type of grant. Table 43 synthetises these results.

Table 43: Access to research funding

	Application rate	Success rate	Amount/type of grant
Blagojević, M et al 2003 (Enwise countries)	women from the Enwise countries generally submit fewer applications for funding than men	Applications submitted by men are consistently more likely to be successful than those submitted by women.	
Chormaic, et al. 2005 (Ireland)	women represent 11% of all grant applicants	success rate across all disciplines was estimated at 15%, similar to that of their male colleagues	women were found to be under-represented, particularly among the beneficiaries of the larger and more prestigious awards in Ireland
de Coninck-Smith 2000 (Denmark)			women have a high success rate when they apply for small funds but not when considerable research grants are asked
De Henau and Meulders 2003 (Belgium)	the percentage of accepted demands is equally distributed between men and women	propensity of women to apply is lower than that of men	
Einarsdóttir 2004 (Iceland)	the number of female applicants rose by 25% between 1996 and 2003 while the number of male applicants fell	Women and men are equally likely to receive research grants from the fund.	
Jacobsson et al. 2005 (Sweden)	71.6 % of the applications for research funding received by the institution came from men and 30.4 % from women	In the Council for Humanities and Social Sciences as well as in the Committee for Educational Science, men had a slightly lower success rate than women. In the Council for Natural and Engineering Sciences, men had a slightly higher success rate than women and in the Council for Medicine, men had a higher success rate than women as well.	
Jungersen 1997 (Denmark)		No gender differences in obtaining funding	
Leemann and Stutz 2008 (Switzerland)	women submit applications just as frequently as men	Same chances of success	
Millard, D. & Ackers, L. 2008 (Ireland)	women introduced 19% of the total proposals in SET The number of applications was highest in biomedicine, followed by biochemistry, chemistry and genetics	15.5% of successful applicants	
Noordenbos 1999 (the Netherlands)	more male than female scholars apply for research grants		
Rosenbeck 2003 (Denmark)			there is more equality in the competition for ordinary funds than for specific programs
Sepou 2001 (Cyprus)	Out of the 258 proposals submitted in 1998-2000, 23 were submitted by female	Out of the 50 projects selected for funding, 7 were submitted by female	
WITS 2004 (Ireland)			EUR1.78 million per research grant for women compared with EUR2.04 million per grant for men

In Ireland, over the period 2001-2003, the Science Foundation Ireland (SFI, the agency overseeing Irish science and engineering research funding) handed out a massive EUR316 million to researchers. But only EUR30 million went to women researchers, that is less than 10% of the funds. Based on figures published by SFI, WITS (2004) calculated that women scientists also received considerably less on average than their male counterparts: EUR1.78 million per research grant for women compared with EUR2.04 million per grant for men. Other more recent SFI data (2007) illustrate that women introduced only 19% of the total proposals in SET. Of these 704 pre-proposals, 168 received funding, 26 of which were initiated by women (15.5%). In most fields, the number of applications by women was found to be very low. The number of applications was highest in biomedicine, followed by biochemistry, chemistry and genetics. In biomedicine, the main field in which women submit applications, they had a similar success rate to men's. In most other areas, there were wide differences. On the other hand, Chormaic, et al. (2005) analysed the SFI data for the Irish Institute of Physics. They show that women represent 11% of all grant applicants to SFI but only 9% of successful applicants. In 2005, the female success rate across all disciplines was estimated at 15%, similar to that of their male colleagues. Finally, women were found to be under-represented, particularly among the beneficiaries of the larger and more prestigious awards in Ireland.

In Iceland, Einarsdóttir (2004) analysed data obtained from the Icelandic Research Fund (Rannís). She points out that the number of female applicants rose by 25% between 1996 and 2003 while the number of male applicants fell. Women and men are equally likely to receive research grants from the fund.

In Belgium, De Henau and Meulders (2003) found that the percentage of accepted demands (demands that give rise to funding) is equally distributed between men and women. However, the propensity of women to apply is lower than that of men, when they are eligible. Access to funding becomes harder as the researcher's position in the hierarchy is higher. Access to a long term position is more difficult for women than for men.

An article by Noordenbos (1999) examines the percentage of applications by men and women to the Dutch Science Foundation (NWO) and the Royal Dutch Academy of Sciences (KNAW) in the Netherlands. The main conclusion is that many more male than female scholars apply for research grants. Several factors explain this gender asymmetry: the low percentage of women in higher positions at the universities in the Netherlands, the gender difference between research fields, the skewed distribution of caring responsibilities between men and women, and the low number of women in the committees that review the applications for funding.

A vast study among 3107 emerging researchers (between the doctorate and professorship) has recently been carried out by Leemann and Stutz (2008). This study was commissioned by the Swiss National Science Foundation. Up to five years after the doctorate, women submit applications for individual and project funding to the SNSF and other research funding institutions just as frequently as men. Among the people who submitted their first application to the SNSF between 2002 and 2006, women are no different than their male colleagues with regard to application patterns (total sums requested, sums requested on average, number of applications) or chances of success (sums received, sums received on average, number of successful applications). The authors add that there are no indications that women more frequently attempt

to finance their careers by means of third-party funding like stipends or research grants (which would be an index of their weaker integration into higher education employment). They did not find evidence either that women researchers are less well informed about the possibilities for obtaining research funding, that they are more reluctant to apply for funding, or that they experience the SNSF as less accessible and less supportive than men do.

Jacobsson et al. (2005) carried out a study on the funding practices of the Swedish Research Council for the years 2003-2005. This study shows that during the last decade, important changes occurred in the Swedish funding system. 71.6 % of the applications for research funding received by the institution came from men and 30.4 % from women[1]. The results vary between different types of research grants and between different scientific councils. In the Council for Humanities and Social Sciences as well as in the Committee for Educational Science, men had a slightly lower success rate than women. In the Council for Natural and Engineering Sciences, men had a slightly higher success rate than women and in the Council for Medicine, men had a higher success rate than women as well. On average, women who applied for project grants had a lower tenure than men, i.e. a shorter time had passed since they achieved their PhDs.
Regarding applications for fellowships implying a postdoctoral research period abroad, men had a higher success rate than women in 2005 as well as during the period 2003-2005 as a whole. This pattern was observed in all scientific councils but to a varying degree. The discrepancy cannot be explained by differences in levels of experience. In 2005, the Swedish Research Council initiated a new type of grant for postdoctoral positions within Sweden. The first year, men had a negligibly higher success rate than women: 7.7 % as compared with 7.3 %. During the period 2003-2005, the Swedish Research Council received 2226 applications for assistant professorships, of which 930 were introduced by women. The success rate of women was 10.8 % and that of men 10.6 %. Differences in success rates between men and women were negligible or small within the various scientific councils as well. The Swedish Research Council received 1103 applications for grants targeted at more established researchers during 2003-2005, of which 129 were funded. The success rate of men was 12.4 % and that of women 10.1 %. An examination of the outcome in the scientific councils shows that there was no noteworthy difference between the success rates of men and women in the Council of Humanities and Social Sciences nor in the Council for Natural and Engineering Sciences whereas men had a higher success rate than women in the Council for Medicine. Support funding for research infrastructure presents a different picture: men had a lower success rate than women, 29 % as compared to 38 %.

Table 44 summarises the findings of Jacobsson et al. (2005):

[1] This is almost exactly the proportion of men and women among potential applicants in Swedish higher education institutions. The increasing number of young women pursuing academic careers is reflected in the growing number of applications for postdoctoral fellowships and assistant professorships. In 2005, 45 % of the applications for these positions came from women.

Table 44: Differences between men's and women's success in obtaining research funding from the Swedish Research Council 2003-2005

Scientific Council /Comittee	Project grants	Post-doctoral fellowships abroad	Post-doctoral positions in Sweden	Assistant professor-ships	Grants for established researchers	Grants for research infrastructures
Council for Humanities and Social Sciences	Women (17%)	Men (11%)	Equal (♀27%)	Equal	Equal	
Council for Medecine	Men (1%)	Men (9%)	Men (10%)	Equal	Men(8%)	
Council for Natural and Engineering Sciences	Equal	Equal	Equal	Equal	Equal	
Committee for Educational Science	Equal (♀29%)	-	-	Equal	-	
Committee for Research Infrastructures						Women (17%)
Swedish Research Council in total	Equal	Men (5%)	Equal (♂47%)	equal	Men (15%)	Women (17%)

*Note :"*Women" means that women had greater success than men and vice versa. Within parenthesis is the probability that the differences were due exclusively to chance. "Equal" without a value within parenthesis means that this probability is higher than 50 %. "Equal" with the symbol ♂ or ♀ and a value within parenthesis means that men or women had somewhat greater success with the given probability (>20 %) that it was due exclusively to chance.
Source: Jacobsson et al. (2005, p. 8).

Rosenbeck (2003) notes how unequal the allocation of research funds is in Denmark. She argues that there is more equality in the competition for ordinary funds than for specific programs. However, it appears to be difficult to statistically prove this finding as gender-related information is rarely given in application forms. However, a study by Jungersen (1997) did not find significant gender differences in obtaining funding. Moreover, female Danish professors stated that they did not encounter gender-specific career barriers.

Maratou Alipranti (2006) analysed the participation of researchers in projects funded by the General Secretariat for Research and Technology (public sector) in Greece. The study shows that the scientific coordinators of the majority of the projects/coordination actions of the GSRT are mostly men (roughly 90% on average). Female participation appears to be limited to actions aimed at developing industrial research, the improvement of business competitiveness and the

connection of research with productive sectors i.e. activities that presuppose a high level of specialisation in the exact sciences or the sciences of engineering and technology. Female participation was considered satisfactory in activities/projects related to the transfer or exchange of "know-how" or the information and acquaintance of citizens and students with the technological civilization. The author also shows that only 22.4% of women are responsible for research programs compared with 78.6% of men. Women are under-represented in Physical science, Engineering and Technology and Agriculture. The presence of women as administrative executives is even more disappointing as only 9% of the total number of directors and presidents of research centers are women. The sex distribution in scientific advisory boards did not change this situation of women's underrepresentation.

The situation of women with respect to scientific research funding in Cyprus has been studied by Sepou (2001). The author underscores the scarcity of statistics on funding in Cyprus given the fact that Cyprus does not have a long tradition of research. Statistical data on R&D personnel are only available for 1998. Since 1998, the Research Promotion Foundation organises an Annual Programme for the Financing of Research Projects. Out of the 258 proposals submitted in 1998-2000, 23 were submitted by female research coordinators. Out of the 50 projects selected for funding, 7 were submitted by female coordinators. In the evaluation of all submitted proposals, 55 women evaluators were turned to. As far as the Research Committee of the University of Cyprus is concerned, it had no female members until 2001.

With respect to the Eastern European countries, the European report "*Waste of talents: turning private struggle into a public issue. Women and science in the Enwise countries*" (2003) explains that women from the Enwise countries generally submit fewer applications for funding than men. Applications submitted by men are consistently more likely to be successful than those submitted by women. This gap between the success rates of women and men is widest in Hungary and Poland. The system of R&D funding in communist times was not based on the principle of competition. Scientists were appointed on tenure positions and had a secured monthly income (salary). "*Scientists enjoyed the luxury of devoting all of their time to research activities and did not have to compete for project funding, which always and everywhere is an energy- and time-consuming enterprise. This particular situation entailed more effective work in the theoretical fields and less in the experimental fields of R&D during that period. This luxury however did not always have a positive impact on the effectiveness of the R&D sector as a whole: because there was no operating grant system and therefore no competition for project funding, hard work in the field of sciences was to a large extent a matter of personal choice, commitment and interest in the research field"* (p. 50). The restructuring of the R&D sector involved the introduction of new funding mechanisms for R&D on the basis of a grant system. Budgets continue to emanate directly from the state (as in the previous period) and are then distributed to the individual institutes. The newly shaped grant agencies and foundations for financing research activities which operate on the basis of competition should more or less be considered as offering additional sources of funding. The report notes nevertheless that women scientists are not sufficiently informed about the various funding possibilities. In Bulgaria, the funding opportunities for women in physics increased after accession to NATO (Пройкова и др. А., 2005).

According to de Coninck-Smith (2000) women have a high success rate when they apply for small funds but not when considerable research grants are asked.

From the above, we conclude that the gender gap in applications for funding and in access to funding varies across disciplines. In general, it is harder for women to obtain high prestige awards. Access to a long term position is also more difficult for women than for men. Female applicants have a higher success rate when they apply for small amounts of money than when they apply for huge research grants. Finally, access to funding is harder as the applicant's position in the hierarchy is higher (and this may be a cause of vertical segregation).

However, some studies fail to find gender-specific discrimination in research funding. Women submit applications for individual and project funding with the same frequency as men. They request similar amounts of funding and have the same chances of success. Nevertheless, gender-specific loss rates are still recorded (vertical segregation). It is also worth noting that even if no "gender effect" is found, there could still be hidden discrimination against women in the sense that women have to have better qualifications in order to achieve the same outcome as men (Leemann and Stutz 2008).

The following three boxes provide examples of studies on women's access to research funding in three different disciplines: environmental sciences, economics and psychiatry.

Box 30: Women in environmental research. What is the role of funding agencies?

This study, undertaken by the Centre for Women Studies at Luleå University on behalf of the Swedish Environmental Protection Agency, aimed at finding answers to the question of why women are less involved than men in research and research studies in environmental science fields. The study concentrates on explanations that may be influenced by research funding agencies. A survey was conducted of all institutions that perform environmental research, asking them about the proportion of female researchers, involvement in equality work and the inclusion of gender perspectives in research. A limited number of female researchers in various positions and institutions, and professors at those institutions, have been invited to speak about their experiences with equality issues and women's role in environmental research. This produced suggestions on what the research financing agencies could do to improve the situation of women in environmental research. Suggestions were also formulated as to how environmental research could be developed including a gender perspective: information to applicants about the funding body's gender equality projects and what gender perspective in environmental research means, a balanced representation of women and men in funding bodies, and encouragement of a balanced representation in research institutions, evaluation of the treatment of applications to funding bodies, looking not only at quantitative measures of applicants' sex but also at the qualitative assessment of language and formulation of applications, support for the development of gender competence in research, a review of the construction/composition of grants for short-term projects and long-term work, a discussion of the need for reform of the credit evaluation system towards more qualitative measures and evaluation of collective research efforts and co-authored papers, and a focus on multidisciplinary research the attracts female researchers.

Rydhagen, B. (ed.) 1998, Kvinnor i miljöforskningen. Vilken roll spelar finansiärerna?, Naturvårdsverket, rapport 4907, Stockholm.

Box 31: The allocation of research funds for economic research

The authors examine how public financing for research is distributed among universities. The main source of funding is the Ministry of Public Instruction through the dedicated 40% program (60% get distributed pro-capite, no strings attached) in the period 1990-1996. The number of projects financed increased much faster than the total amount of resources. Therefore, the average amount of CNR financing decreased from 20.8 million liras to 7.8 million liras and for MURST from an average of 10.5 to 7.4 million liras. There was also a marked increase in requests so that the number of projects excluded tripled. Southern Universities received less, northern Universities more, even if standardised by various measures such as size of the teaching body or size of the student body. The average amount of funds perceived by women was below men's, for both sources of funds, with women getting between 9.2% to 28.1% less, according to different years and sources. This is in part due to the fact that full professors get more than associate professors and more than researchers, and very few women are full professors.

Falcone, F., Musumeci, M. & Parisi, P. 1999, 'L'assegnazione dei fondi per la ricerca economica' in Che , Il Mulino, Bologna, pp. 235-270.

Box 32: Women in academic psychiatry in the United Kingdom

Although it is commonly believed that the proportion of women in academic psychiatry is substantially lower than in National Health Service (NHS) posts, there are no empirical data on this. In the USA, women physicians have been shown to be more likely to pursue an academic career than men (Nonnemaker 2000) but the number who advance to professorship appears to be significantly lower than expected (Reiser et al. 1993, Nonnemaker 2000). Women in academic psychiatry in Canada also appear less likely to advance to senior positions than their male colleagues (Penfold 1987). A recent survey of 44 academic institutions in the UK, carried out by the National Centre for Social Research (Blake and La Valle 2000), showed that women were overrepresented in lower grade academic posts and therefore were less eligible to apply for project research grants. Those that were eligible were as successful in obtaining funding as their male colleagues. The authors investigated the number of women in substantive academic psychiatry posts across the UK and compared this number with the number of women holding equivalent NHS posts. They also investigated the gender distribution within sub-specialities in academic psychiatry in London. Overall, men were significantly more likely than women to have an academic post as compared to an NHS post. Men were significantly more likely to occupy a professional position than women: 89% of professional positions were occupied by men.

Killaspy, H., Johnson, S., Livingston, G., Hassiotis, A. & Mary , R. 2003, 'Women in academic psychiatry in the United Kingdom', Psychiatric Bulletin , vol. 27, pp. 323-326.

3.4.2. Bias in evaluation?

Several studies find that a male bias exists in the evaluation procedure preceding the funding decision: men's applications are often favoured over women's applications (Risberg 2004, Jacobsson et al. 2005, Bornmann et al. 2007, Menntamálaráðuneytið 2002).

de Pablo (2006) shows that the evaluation process is not able to judge the scientific merit without any influence from gender. The author analyses the attribution of contracts "Ramón y Cajal", advanced post-doctoral fellowships, for the year 2005. According to the author, the general tendency is to over-select male applicants. The academic system is responsible for this bias in the evaluation process. Women's success rate is on average 10% while men's is 17%. The article thus provides indirect evidence of a gender bias in evaluation, without explicit proof for its existence.

Wenneras and Wold (1997) investigate the level of neutrality in the peer review system of the Swedish Medical Research Council. It is the first analysis based on actual peer-reviewer scores and it provides direct evidence that the peer-review system is subject to nepotism and sexism. This study has launched similar analyses in other countries and it remains a key reference. It should be noted that, to access the archives needed to carry out their study, Wennerås and Wold had to invoke a Swedish law on access to official documents. Their results show that female applicants received lower scores than male applicants who displayed the same level of scientific

productivity. Peer reviewers cannot judge scientific merit independent of gender. The peer reviewers over-estimated male achievements and/or underestimated female performance, as shown by multiple-regression analyses of the relation between defined parameters of scientific productivity and competence scores. Reviewers gave female applicants lower average scores than male applicants on all three evaluation parameters: scientific competence; quality of the proposed methodology; and relevance of the research proposal. They also tended to favour projects that confirmed their own views. Another factor that was found to influence the competence scores for obtaining funding is the affiliation of the applicant with a committee member. Nevertheless, the authors are not confident that a simple increase in the percentage of female reviewers would solve the problem of gender-based discrimination.

Risberg (2004) shows that gender affects scientific evaluations in clinical medicine, medical research and medical education in Sweden. This has implications for research assessments and interpretations (medical tutoring, research guidance, peer reviewing, and formation of evaluation committees for research funding). Moreover, teachers-physicians seem little aware of gender as an area of competence and knowledge and tend to connect gender issues with women. The author argues that depending on how 'difference' and 'equity' are apprehended, various forms of resistance to gender emerge, each with plausible bias risks.

A similar study as the one by Wenneras and Wold (1997) has been conducted for the Netherlands by Brouns and Scholten (1999). They investigated the assessment procedures of the Dutch Organisation for Scientific Research (NWO), more specifically a grant for talented young researchers who are expected to become the future 'top-10' scientists in their field. The authors found that women and men had equally high productivity scores and that women were more often characterised as 'good researchers' while men were described as 'brilliant researchers'. In the exact sciences, women have a success score of 84% (significantly higher than men's). In other disciplines, biology for instance, women had great difficulty in obtaining a grant (women success score is 26%, significantly lower than men's). Female applicants in the exact sciences were highly qualified, more than their male colleagues, but in biology, male and female applicants hardly differed. A strong difference is observed between disciplines. Women have higher success rates in the exact sciences but are disadvantaged in biological and earth sciences, realms where they are more numerous.

The Medical Research Council in the UK also analysed application and award rates for their fellowship schemes by gender for the years 1993/4 to 1996/7. The study concluded that there was no general evidence of bias for or against women applicants. In some schemes, women received more awards than expected, in others, fewer. None of the differences were statistically significant (Osborn et al. 2000).

Box 33: Gender as a factor of unequal access to resources or research promotion. Approaches to the analysis of selection procedures in the area of project promotion of the Swiss National Science Foundation

The Swiss National Science Foundation promotes and supports equal opportunities for women and men in the area of research funding. Still, differences between the success rates of men and women have been revealed as a result of an internal examination of the SNSF in 1999-2001. Why is gender still a factor that affects the opportunity to access research funding? Why do women overall have less access to resources? This pilot study had three aims. First, it established hypotheses about structural discrimination of women in the area of project funding. Secondly, it systematised and completed the database of the SNSF. Finally, it tested the methodical approaches to the complex inequality problems in project funding. Following a preliminary consolidation and differentiation of the findings, the purpose was to offer suggestions for a larger study in this field. Whether and to what extent such an extensive study would be carried out within the framework of the SNSF was not yet settled at the time of the pilot study. The pilot study examined women's chances of success as exemplified in three example disciplines: political science, psychology and chemistry. It became apparent that not the evaluation procedures but mainly the differences between men's and women's manners of application were concerned. Possible measures could be aimed at getting more women to apply for project funding.

Jänchen, Y. & Schulz, K. 2005, Geschlecht als Faktor ungleicher Zugangschancen zu Ressourcen der Forschungsförderung. Zugänge zur Analyse sozialer Selektionsprozesse im Bereich der Projektförderung des Schweizerischen Nationalfonds, Geneva.

3.4.3. Causes and factors

Various causes or factors lie behind this gender difference in success rates in obtaining research funding.

At the level of individual factors, Delamont (1989) studied British postgraduate funding policy from a gender perspective and found that the model that is portrayed for a social science student is a young, geographically mobile male. Female candidates, especially those of mature age, are likely to be disadvantaged by current policies and their presuppositions.

Zawadzka (2007) analysed a sample of French and Polish PHD students to show that male doctoral students are more likely to take a less passionate and more realistic point of view, thus outlining more "strategic" considerations linked to their career expectations and subject choices.

Menntamálaráðuneytið (2002) showed that women scientists are less likely to apply for research funding and that funding is heavily biased in favour of traditionally male dominated disciplines.

According to Allmendinger and Hinz (2002), application conduct does not differ by gender but women have a smaller chance of receiving funding than men. This inequality results partly from

individual, structural and contextual differences between men and women. The differences in opportunities between men and women are, to a large extent, explained by the gender-specific focus of the research proposals: half of the applications submitted by women can be categorised as gender-oriented research.

Box 34: Who applies for research funding? Key factors shaping funding application behaviour among women and men in British higher education institutions

The Wellcome Trust and the Research Councils commissioned the National Centre for Social Research to carry out a survey of academic staff. A total of 3090 academic staff drawn from 44 HE institutions in Great Britain took part in the survey, which achieved a 40 per cent response rate. The survey explores gender variations in research funding application activities and the possible reasons behind these differences finding that: 50 per cent of women and 59 per cent of men in the sample had applied for responsive mode grants in the past five years; when women applied for funding, they were as successful as their male colleagues: 51 per cent of female and 50 per cent of male applicants had obtained half or more of the grants they had applied for; virtually no gender differences were found in applications for competitively awarded fellowships: 18 per cent of women and 16 per cent of men in the sample had applied for this type of funding. The survey results also showed that: women were less likely than men to be eligible to apply for grants provided by all Research Councils and the Wellcome Trust, except for the ESRC; gender variations in terms of eligibility partly reflect women's over-representation among lower grade academic staff and those with fixed term contracts, as many of the grant schemes provided by the main funding bodies are not open to academic staff in these groups.

Blake, M. 2000, Who applies for research funding? , The Wellcome Trust, UK

Another explanatory factor is the gender composition of gate-keepers. There is a distillation (leaking pipeline) causing a predominance of men. These men measure male applicants with another scale than female applicants. The selection of the candidate is made in scientific commissions that are mainly exclusively masculine. In most countries*, "decision-making and other gate-keeping activities in research funding, including peer review, continue to be dominated by men, in some cases overwhelmingly so. All-male committees and evaluation panels still exist in many countries, even in those where the proportion of women in research is relatively high"* (European Commission 2009).

In Italy, few women participate in the general planning of institutes and of the research system in general. They are also underrepresented when it comes to allocating public funding for projects and managing resources. Men almost completely predominate in appointments for public research institutes (Palomba 2000).

According to Linkova (2004), the gate-keepers in the institution are the ones who decide who will get in and who will not. The ones who are allowed in, are the ones who are most "similar" to the gate-keepers, the ones who have the same interests and features. This is the way the organisational culture within the institution is reproduced. Women are excluded from the institutions, as the goal of the gate-keepers is to maintain "social homogeneity" in the institutions. "Homosexual reproduction" is to the author the reason why women are excluded from

institutions, as the gate-keepers tend to choose the most similar people to be surrounded with. Women who want to be successful in such institutions have to adopt masculine behavior such as working long hours which is very problematic for those having a family and children. Given that they have other duties to fulfill, women are stereotypically seen as less productive and less reliable workers.

Women's under-representation in funding is also linked to the way scientific excellence is assessed (choice of criteria). A gendered understanding of scientific excellence leads to different chances for funding and academic career advancement for women and men. While men are assessed according to merit, this is not the case for female applicants (Brouns and Scholten 1999).

Box 35: Gender and excellence. An explorative survey of excellence-measurement and performance-rating in the university system

Scientific excellence, still considered as a neutral indicator for scientific quality by the majority of scientific communities and research polities, is open to definition and consequently to bias in various ways. The Austrian Federal Ministry of Science and Research commissioned an explorative survey on measuring and assessing scientific excellence in research funding and academic careers. The aim of the project was to analyse established definitions and assessments of scientific excellence and the mechanisms causing (in)direct gender bias. Based on a critical status-quo analysis of the debates on scientific excellence in research polities and academia in Austria, the first part of the report aimed at a more profound understanding of the discourse and its implications on research funding systems and universities. The second part explored the characteristics of the dominant conception of scientific excellence at universities and the practical challenges for the Austrian Science Fund (FWF). The third part of the report investigated the effects of existing funding instruments on women's participation and their advancement in scientific systems. The report gave an overview of good practices, barriers in the implementation process of gender quality and recommendations to improve the situation.

Schacherl, I., Schaffer, N., Dinges, M. & Polt, W. 2007, Gender und Exzellenz. Explorative Studie zur Exzellenzmessung und Leistungsbeurteilung im Wissenschaftssystem.

Moreover, women appear to be more absent in the entire process of information and coaching and they face a lack of support and encouragement (Lange 1988, Husu 2004, Leemann and Stutz 2008).

Studies have also critically reflected upon the age limitation for applying for grants or the fact that actual research experience is not taken into account: 'academic' vs. 'biological' age (Brouns and Scholten 1999, Linková 2002). Women face the larger burden of balancing science and family life since they are still more involved in childcare and family work. There is also a mismatch or a lack of compatibility between parental leave and funding systems. The unequal distribution of caring responsibilities between men and women contributes to explain the lower application rate of women for funding.

In Switzerland, Belser (2006) evaluated the Marie Heim-Vögtlin (MHV) Program with regard to how it was organised and managed from 1991 to 2002. Flexibility has been an important factor

for the success of the program. It has allowed women in various situations to move a step further along their not always conventional career path. The author believes this flexibility should be maintained in the future and, where possible, even strengthened (e.g. duration of funding and possibility to interrupt the project).

The organisational culture is often mentioned as a factor that generates gender bias in access to funding. Bagilhole (1993) described the evaluation system in HE in the UK as "*paternalist, competitive and managerialist*" (p. 433). According to this author, the rules pertaining to appointment are male driven and are evaluated according to male standards. She speaks about the hegemony of a competitive male-dominated view of performance. The only meaningful criterion used in promotion decisions is the publication record. This discriminates against women because their other (non-accredited) academic responsibilities are not taken into account (women tend to have higher lecturing, administrative, and pastoral workloads when compared with their male counterparts). She explains that "*In the new competitive academic culture, only those who are willing or able to work at highly intensified work rates have a chance of succeeding. Those who fail to match up to the new standards are discounted. Academics with alternative career structures, those who value teaching and counseling first and those with domestic commitments, all lose out in such a culture*." (p. 434) Appraisers often reflect prevailing social expectations and attitudes which reinforce stereotypical expectations and assessments of women. Lecturing quality, administrative responsibilities, counseling and other community activities continue to be largely overlooked in the promotion game.

The equal opportunity committee of the Università degli Studi di Padova (Italy) investigated the relation between women and science in 2003 which was seen as a power relation. Science, and in a particular way the kind of science associated with universities, is not neutral and it is isolated from the social context in which it is created and used. Instead, there is a relation of power between those who research, those who "purchase" the research, those who teach the matter of the research itself and those who are being taught. Nowadays this relation is even more obvious, because science is getting more and more orientated towards those powers that have an economic interest in financing research to then use its results in business. Over the last years, universities have changed radically to adapt to the new assets of the market. So, even if nowadays scientific research is considered impersonal, objective and neutral, in reality, it has to deal with "the tyranny of funding", "career strategies", "techniques of persuasion", and the "bond between political and economical powers on the one hand and the contractual power of the scientist on the other". Following this approach, it is more and more evident, that in scientific research the one who obtained funding, the one who excels in the game of political alliances and succeeds to "take-home" the deal, is not even the one that does the research, but he/she manages the economic and political relations. This is increasingly becoming the key role of scientific research. Although women are doing scientific research, they generally do not entertain those kinds of relations. Science is, from this point of view, a male-dominated micro-cosmos (Comitato pari opportunità dell'Università degli Studi di Padova 2003).

3.4.4. Women's perception of their access to research funding

Sutherland (1985) observed a high degree of dissatisfaction among women with universities' equal opportunity policies and monitoring systems and also dissatisfaction with the adequacy of

equal opportunity training for (male) heads of departments and promotion policies. The interviewees felt that the promotion criteria used in university discriminate against women and underline the lack of women role models in higher education. This was not perceived as the result of attitudinal discrimination, but rather as the result of a promotion system that lays almost total emphasis on candidates' publication records. The organisational culture is also questioned. The quality of teaching, record of innovation, attendance to work-related training courses, pastoral care, administrative competences and the "added-value" that researchers may bring to the effective working of departments in interpersonal terms should be taken into account in the evaluation system.

Palasik and Papp (2008) studied several universities: the Budapest University of Technology and Economics (BME, Hungary), the Graz Medical University (Mug, Austria), the Istanbul Technical University (ITU, Turkey), the Semmelweis University (SE, Hungary), the Tallinn University of Technology (TUT, Estonia), the University of Oulu (OUL, Finland), and the University of 'Tor Vergata' (URTV, Italy). The results of a questionnaire survey among 786 researchers from these universities are interesting in terms of enlarging insight into funding mechanisms. To the question “how satisfied are you with funding?”, the vast majority of respondents, 70% of men and 77% of women, stated not to be satisfied with funding conditions. More women (29%) than men (21%) are not satisfied at all with funding. While 23% of women are satisfied or very satisfied, this percentage rose to 30% for men.

3.4.5. Measures and recommendations

The usefulness of fixing quotas in order to reach a critical minimal proportion of women in decision-making at this level has been the object of debate. According to the European Commission (2009), increasing the proportion of women among the gate-keepers of research funding does not, according to existing empirical evidence, necessarily or automatically lead to better success rates of women applicants.

Bødker and Hazell (1992) explain that the National Natural Science Research Council in Denmark decided that a number of Ph.D. grants should be reserved for women yearly. Since then the number of female Ph.D. applicants and the number of grants awarded to women have risen significantly. Later, in 1998, FREJA (Female Researchers in Joint Action) was launched. This equality initiative was launched by the Minister of Research in order to distribute DKK 78 million (€10.5 million) in research funds among qualified female researchers. The FREJA programme did not exclude men, but it did openly state that women would be preferred if two candidates were equally qualified. 327 applications for a total of DKK 2,2 billions were submitted and only 16 research projects were selected to share the funds. The competition was thus equally tough as the competition for normal funds, and only the most qualified projects gained funding. The fund gives female researchers the opportunity to develop new fields (Koeller 2001).

According to Leemann and Stutz (2008), important aspects of integration and support, without which an academic career is not possible, are lacking: advice on submitting applications for research funding, job opportunities and/or opportunities for (joint) publications. Their analysis shows a low level of integration of young female researchers into the academic network of the

scientific community. It also shows that the lower publication output of women is a factor that makes it more difficult for them to apply successfully for university positions and research money (in comparison with their male counterparts). Finally, the authors found no gender-specific disadvantages at work in SNSF research funding.

Box 36 gives insight into how equality in science and funding is implemented in Sweden, the country with the highest number of publications on gender and funding and where reflection on the issue has a longstanding history.

Box 36: Supporting Research of the Highest Quality

Areas of responsibility for the Swedish Research Council are research funding, research policy and science communication. The first task is the most important, but in the last few years the Research Council has played a more significant role in research policy as well and it has developed better communication with the research community. The Council has become an important channel to the government, for those who want to influence long-term Swedish science policies. The network for research funding involves many people. The staff at the head office in Stockholm consists of 140 employees. The scientific councils have about 90 members from the scientific community. The peer review groups engage about 400 people. Other committees involve 300 people and, finally, the Council engages about 200 experts, partially from Sweden, partially from abroad. In examining the quality of research projects, simple indicators such as numbers of publications and citations are not at all sufficient. The evaluation process is more intuitive. It is often based on scientific traditions in different fields, which also means that it can be somewhat conservative in this respect. By means of independent experts, the Swedish Research Council has analysed the success rates of men and women in the evaluation process. This showed that success rates are equal for men and women for positions and general applications. Independent relevance and scientific quality assessments have been crucial for handling relatively new research areas and other special areas. It is extremely important to include as many international assessments as possible in the measurement of research quality. One should relate to international standards and the international research front and try to involve international members in the review groups, as well as to support researchers to collaborate on an international level.

Johansson, A. 2006, 'Supporting Research of Highest Quality' in Reaching for scientific excellence in gender research, Vetenskapsrådet, Bromma, pp. 20-23.

4. Statistical Gaps and recommendations

In many countries, the discussion on the gender bias in funding has barely begun and has led to more questions than answers. In some countries, research on funding is (nearly) non-existent (Israel, France, Italy, Portugal, Spain, Turkey, Bulgaria, Hungary, Romania, Slovakia). In these countries, few research have been generated on the issue.

In general, many different research institutions allocate funds but only few have been investigated. Moreover, studies are often cross-sectional and based on small samples. Research on the gender issues in funding needs to be done more systematically and exhaustively in order to improve understanding of the problems that exist.

Research compiling information on the entire research funding systems of all the countries is needed in order to draw a complete and exhaustive description of the funding landscape. Regular, systematical, longitudinal and sex-disaggregated studies of application and success rates are lacking. Analyses that cover longer periods and larger data sets are needed.

The transparency/availability of data on the allocation procedures of funds is lacking (peer review and gate-keeping practices). There is also a lack of typologies based on women's success in funding and their presence on boards.

In general, there are almost no studies on research funding in the private R&D sector while information on public funding is usually easier to obtain and published more regularly. Much of the research focuses on one type of institution or sector.

In-depth analysis of all formal and informal factors that contribute to gender inequality in access to funding is needed. There is a lack of objective analysis of the practices of the different bodies and scientific committees that award research grants and funds and assess scientific excellence. In this respect, the lack of transparency in the peer review process could be a major obstacle for women researchers. Moreover, the recruitment procedures for peer reviewers, whose choice may be crucial, are often not gender neutral or objective. Only scarce and scattered information exists on recruitment practices to gate-keeping positions in research funding.

There is also a lack of studies on women's exclusion from relevant information and tacit knowledge that may be crucial for getting research funding. The importance of so-called men's networks in getting funding for research should also be analysed.

The analysis of gender differences in funding is not just a question of whether allocation practices are gender biased, but also of the ways in which institutions are complicit with the inequalities that have marked the academic trajectories of applicants.

Detailed data on success rates can help identify the levels at which discrimination occurs more clearly.

The European commission (2009) explains that the gender challenge in research funding concerns "*male dominance in decision-making about research priorities and attribution of funding, lack of gender monitoring and of general transparency of the evaluation process, low application rates of women, and difficulties in reconciling research and private life." (p. 69)*

In order to face this challenge, the report drawn up several recommendations that are worth mentioning in this concluding part. These recommendations are articulated around five objectives: taking the gender challenge seriously; increase funding applications for women researchers; improve gender balance among the gatekeepers; monitor gender data and publish the results; and generally improve transparency in research funding.

Finally, the report provides some advices for future research: "*Practically all the dimensions of research funding examined in this report require better monitoring and more research to improve understanding of the phenomena observed. Comparative international research and studies using long data series would be especially important.*

Application behaviour by gender should be studied from a broad career perspective, exploring several types of funding sources, taking into account age, career/academic age, academic position, discipline, and ethnicity.

In-depth studies of women and men applicants and their success rates should be undertaken in different national settings, in different disciplines and at different career stages. Quality indicators, such as bibliometrics but also more reliable methods of evaluating the quality of research production, need to be investigated.

The impact of competitive research funding should be explored from a gender perspective in different national research settings.

Gender impact studies of different funding instruments, such as targeted funding and various excellence initiatives should be conducted. Not only the gender of the Principal Investigator but the gender composition of teams should be taken into account.

Gatekeeping policies and practices in research funding should be studied, including the recruitment of gatekeepers, and the impact of gatekeeping positions on the gatekeepers' own careers and network building.

Cohort studies on academic careers should be conducted, such as the Swedish National Agency for Higher Education (2006) study on the significance of gender and social origin for postgraduate studies and research careers.

Comparative studies on the gender dimensions of different funding systems and national settings should be conducted, including analyses of the impact of specific actions, such as work-life balance provisions." (p. 74)

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