



Meta-analysis of gender and science research

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Topic report

Policy towards Gender Equity in Science and Research

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Executive Summary

The present report forms part of the overall effort to produce a meta-analysis of gender and science research across Europe (FP7 RTD-PP-L4-2007-1). Its objective is to analyse national, regional and local policies, measures and programmes towards gender equality in science and research covering the period from 1980 to 2008.

The available literature classified under “Policies towards gender quality in research” (1,296 entries) in the Gender and Science Database (GSD) was revised and grouped according to three main thematic priorities: (1) measures towards advancing women’s science careers; (2) science management and reform, and (3) gender dimension in research and higher education.

In general terms, an unequal distribution of the research literature was observed. There is a relative abundance of positional statements, conceptual clarifications, and recommendations dealing with gender issues in science and research across most participating countries. Equally, there is a relatively large body documenting the vertical and horizontal segregation of women in relation to men in science and research. However, there are comparatively fewer systematic evaluations of policy measures. Geographically, most evaluation and accompanying research of implemented measures is found in the three continental countries Germany, Austria and Switzerland.

The main findings concerning measures for advancing women’s science careers substantiated that career development and training seminars, mentoring or qualification stipends are highly beneficial for the individual scientist. Their impact on the structural level, however, remains unclear. The literature under this subtopic also testified to the importance of disciplinary differences: policies that are tailor-made for specific disciplines prove more effective than generic measures. It was also clear that top-level involvement and institutional commitment to equality policies was a crucial success factor. Within the science-career literature, the need to rethink the linear pipeline model and to take into account more dynamic and fragmented careers paths was manifest.

The literature dealing with science management and reform left little doubt on the importance of equality officers at research and Higher Education institutions for advancing gender issues. The impact of new management instruments such as targets and incentives deployed at universities throughout Europe on gender-equality concerns is far from clear. Results are contradictory at best; the need to politicise new “neutral” formula-based steering instruments was apparent more than once. In contrast, the findings concerning quotas and positive discrimination are quite consistent: they are not well received in academia by either women or men.

The topic of Gender in Research and Higher Education showed, on the one hand, that single-sex education measures have a positive impact. Summer camps and universities, workshops or girls-only work-camps are usually received positively by participating women. However, the evidence on their structural impact and cultural change in science, engineering and technology fields is scarce. The same holds for the institutionalisation of gender and women’s studies. No systematic research was available. The results on the combination of curricular and pedagogical reform are also far from conclusive; however, it seems that gender concerns lead to a general improvement of the quality of teaching for all.

Concerning the main gaps in the research literature, it was apparent that most (accompanying) evaluation studies are project-driven. On the one hand, targeted research on specific aspects of certain measures such as mentoring is absent. On the other hand, what is also missing are sound theoretical frameworks and shared evaluation standards. In particular, organisation studies, insights on policy transfer, or theories of educational change are seldom referenced in research on gender equality in science and research. The research landscape on policy towards gender equality in science is fragmented. In addition, there is little research on the long-term effects of certain policy measures and research examining the interplay between several factors such as attraction measures, mono-education, mentoring, stipends, new governance instruments, etc. is also hard to come by.

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1. Introduction

The present report forms part of the overall effort to produce a meta-analysis of gender and science research across Europe (FP7 RTD–PP–L4–2007–1). Its objective is to analyse national, regional and local policies, measures and programmes towards gender equity in science and research. Parallel thematic reports target (1) horizontal- and (2) vertical segregation, (3) gender pay gap, (4) stereotypes and identities, (5) science as labour activity, (6) scientific excellence and (7) gender dimension in research content. The specific objective of the present report consists of analysing existing evaluations of, and comparisons between, policies towards gender equality in science. We are especially interested in fleshing out the impact and practical consequences of these measures on the situation of women in science and research as well as on gender dimensions in research content. It is important to indicate from the outset that this does not include an exhaustive and detailed overview of the existing gender and science policy situations across Europe. Others have done this sufficiently (EC, 2002; EC, 2008a; EC, 2008b; EC 2009).

Gender equity policies in science have become an important issue in all EU member states¹. Apart from Equal Treatment laws, many countries have also passed a “gender mainstreaming” legislation and integrated these into administrative procedures. Several countries have also devised direct support measures, such as improved child care or specific mentoring programmes. As the EC report (2008a, pp. 42-3) on *Benchmarking Policy Measures for Gender Equality in Science* demonstrates, most member and associated countries of the European Union have a Ministry for Women's Affairs / Statutory Gender Equality Agency. However, when it comes to a commitment to mainstreaming or specific Women in Science Units and committees, or even such elementary services as collecting sex disaggregated statistics, a far more patchier picture emerges. The variety of policy measures and the persistence of unacceptably high levels of inequalities (related to pay, funding, career possibilities, etc.) across most EU countries, urges one to examine the effectiveness and impact of these policy measures.

A central reference in this undertaking is the already cited report on *Benchmarking Policy Measures* (EC, 2008a). By correlating key national policies targeting women and science with national statistical profiles, the authors hope to identify “main drivers of progress towards gender equality” (*ibid.*, p. 14). This presents two real difficulties: (1) on the one hand, it is problematic to establish clear-cut relations between certain policy measures and the overall representation of women in science (*ibid.*, p. 14). Besides the lack of time-series data to assess the long-term impact of policies, specific measures always form part of a wider social context that makes it hard to attribute change to one source alone. (2) On the other hand, some of the policies or measures examined showed no statistically significant correlation with the proportion of women in science. As the authors argue, however, this should lead to a more thorough examination of measures and initiatives below the national level (*ibid.*, p. 38). Local and small-scale initiatives could have a more decisive impact on women's participation in science than large-scale programmes.

Although the *Benchmarking* report establishes a first guiding framework on the correlation between certain national policies and their effectiveness towards gender equality in science, the current meta-analysis provides additional material. The incorporation of literature of national-, and above all small-scale evaluation reports allows for a more detailed assessment of the quality and potential impact of these gender policies and programmes. In addition to an analysis of the presence or absence of certain policies, the present work captures the more qualitative aspects of these measures as expressed, for example, through the opinion of the participants. From the available literature we also

¹ Although gender *equality* and gender *equity* are often used in the literature interchangeably, we conceive the importance of policy to encompass not only the liberal notion of “equal” opportunities but as addressing “equal” constraints. Whereas equality refers to equal resources/opportunities (equal pay, access to opportunities, freedom from harassment), equity takes into account the wider socio-economic conditions under which given people have to perform (constraints have to be accounted for). Policies for providing equitable situations for women and men in science should comprise equal opportunities and equal constraints.

expect to obtain new insights into the transferability of these policies and thus identify context-sensitive factors of success from more general aspects driving gender equity in science.

The aim of this first introductory chapter is to establish the dimensions of our analysis. What emerges from the literature is a general lack of concrete evaluation of policy measures towards gender equality in science when compared to the variety of measures in place. Except for a handful of large-scale (both in time and thematic depth) studies, concrete evaluations and reports on the outcomes of these policy measures are suspiciously absent. The majority of the revised literature is either descriptive of the general under-representation of women in science or indulges in theoretical reflections on the validity of the desired policy objectives. Some, however, do incorporate concrete, empirically sound evaluations. The lack of empirical research on policy for women and science therefore requires an initial mapping of the terrain from a more conceptual perspective. By crossing the literature on the evaluation of public policy with the available policy instruments and objectives, we establish a grid of theoretical approaches. This will allow us to identify the gaps in the literature that otherwise – from a meta-analysis of the available literature – would be hard to perceive.

1.1. Dimensions and Evolution of EU Science Policy

1.1.1. Policy Contexts

Despite many EU initiatives and policy directives, national frameworks of R&D and social policy crucially determine the overall conditions for women in science and research. A wide variety of historical developments and national policy settings can be observed across the EU that shape and influence the roll-out of policy towards gender equity in science and research.

Cozzens (2004) distinguishes between three large policy fields in science and technology, namely (1) research policies, (2) innovation policies that stimulate the development of new products and processes, and (3) human resources policies. The most common form of policy towards equity in science and research both in the US and in Europe is found within the human resources approach. The key indicator of success here relates to the proportional participation of women in all areas of the science and research system (*ibid.*, p. 169). However, despite the fact that Cozzens distinguishes these different policy domains, it is important to note that advancement in gender equity is a result of the combined effect between the R&D innovation systems, the relevance of science for the national economy, the features of the labour market, and the equity policies in place besides the policy instruments and agents used.

As shown in table 1, the *Benchmarking* report (EC, 2008a) clusters countries on the basis of the gross domestic expenditure on R&D spent per R&D personnel. Two large country groups can be distinguished, namely “higher vs. lower systems of innovation.” Within the first group we find the “innovation leaders” such as Sweden, Switzerland, Finland, Denmark and Germany and the “innovation followers” such as Iceland, France, the Netherlands, Belgium, Austria and Ireland. Within the “lower systems of innovation” the report distinguishes between “moderate innovators” (Austria, Cyprus, Czech Republic, Estonia, Italy, Norway, Slovenia and Spain) and the “catching-up countries” (Bulgaria, Croatia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania and Slovakia).

Above EU27 Average Summary Innovation Index (SII) Score		Below EU27 Average Summary Innovation Index (SII) Score	
<i>Innovation Leaders</i>	<i>Innovation Followers</i>	<i>Moderate Innovators</i>	<i>Catching-up</i>
Sweden	Luxembourg	Estonia	Malta
Switzerland	Iceland	Norway	Lithuania
Finland	Ireland	Czech Republic	Greece
Israel	Austria	Slovenia	Portugal
Denmark	Netherlands	Italy	Slovakia
Germany	France	Cyprus	Poland
UK	Belgium	Spain	... among others

Table 1: European Innovation Scoreboard 2007. PRO INNO Europe Paper N° 6

Instead of foregrounding the expenditure on R&D personnel, *The Gender Challenge in Research Funding* (EC, 2009) report proposes a slightly different but nevertheless instructive classification based on the general gender equality context in each country (see Table 2). Thus, countries are roughly divided into proactive ones, which promote and monitor gender equality in research with active policies and measures, versus comparatively inactive countries that display few such measures and initiatives. Within the proactive countries, three important sub-groups are established: Finland, Norway and Sweden belong to the “global gender equality leaders”. These northern welfare states are characterised by early (from the late 1970s - early 1980s onwards) committed efforts to embed gender equality into science policy and society at large. A second proactive group comprises “newly active countries with traditionally fewer women in research” such as Germany, the Netherlands, Austria, Belgian Flanders, and Switzerland. In recent years, these countries have developed a very active policy agenda in order to address the below-average (EU) representation of women in science. And third, the proactive countries also include “newly active member states with more women in research” such as Spain, the UK and Ireland.

Gender Equality Leaders, small gender gap, more women in HE research (Group 1)	Newly active countries, few women in HE research (Group 2)	Newly active countries with more women in HE research (Group 3)	Relative inactive countries, some with more women in HE (Group 4)
Finland	Austria	UK	Bulgaria
Norway	Belgian Flanders	Spain	Croatia
Sweden	Germany	Ireland	Czech Republic
Iceland	Netherlands		Cyprus
Denmark	Switzerland		Greece,
			Estonia, Hungary, Israel, Italy, Luxembourg, Malta, Poland, Portugal, Romania, Turkey

Table 2: Classification based on EC 2009, *The Gender Challenge in Research Funding*

Reading both EC reports together establishes an interesting cross-section concerning our meta-analysis. As the *Benchmarking* text contends, "... countries which have high levels of women researchers are less likely to have policies for women in science." (EC 2008a, p. 20). This is true for the northern welfare states – the gender equality leaders – where the relatively high participation of women in science can be considered a result of its early and comprehensive treatment of gender issues across all policy areas. Pettersson (2007) writes in this regard that in Finland and Denmark, the high participation of women in the labour market is taken as an indicator of achieved gender equity. Gender is then consequently deproblematized and not present on the policy agenda. But an even higher percentage of women in science is found in "catching-up" countries, which have few policies and low R&D personnel expenditure (EC 2008a, p. 25). Rather than reflecting the results of recent gender policy intervention, the relatively high percentage of women in the science and research sector can be understood as a result of the equal integration of men and women into the workforce (Miroiu, 2003).

This picture of the relation between the presence/absence of broader equity policies and women's participation in research illustrates a specific pattern that emerges in the review of the literature. There exist relatively few publications dealing with empirical *research* on policy towards equity in science from the northern countries and the new Eastern European member states. Due to very different (historical) reasons, there are either few policies to do research or the issue of gender is not perceived as problematic (any more). In contrast, the most abundant literature can be found in those countries which are innovation leaders but have a below average representation of women in science. Especially Germany, Austria and Switzerland have developed many national initiatives to increment women's participation at all levels of the science and research system. These three countries provide the most thorough and comprehensive body of literature on policy towards gender equity in science. Evaluation and accompanying research is a crucial element of these structural initiatives and much of the revised literature on concrete evaluation experiences and their impact is found across these continental European countries. Finally, among those countries which have recently become more active in policy towards gender equity (UK, Ireland and Spain), one might expect to see a growing body of literature concerned with the evaluation of their measures which is currently still lacking.

However, apart from the relative importance of public policy towards gender equity in science and research it is important to remember that "... the main factor, which negatively influences the female proportion of researchers, is the relative size of the business enterprise R&D sector ..." (EC 2008a, p. 27). Countries with large private business R&D sectors have lower proportions of women researchers than countries with smaller business R&D sectors. This means that innovation policies (in contrast to HR policies) which are directed to stimulate the development of new products and processes in the private sector are an area which is especially under-researched despite its strategic importance for questions of gender equity (see also EC, 2008a, p. 39).

1.1.2. Legislation Approaches

Legislation can affect the position of women in science in two main ways. Firstly, it can prevent discrimination (for example, equal pay and recruitment) and secondly it can promote positive action (for example, quotas and networks).

Equal opportunities legislation can affect the participation of women in science by preventing and sanctioning discrimination based on sex and is present in all countries studied in the *Benchmarking Policy Measures for Gender Equality in Science report* (EC 2008a, p.29). Legislation relating to equal pay and the reduction of the wage gap are important tools in the push for gender equality in science. Various countries have included equal opportunities issues into the legislation regulating higher education, including the financing of universities (Rees *et al.*, 2002, pp.22/23).

Legislation as regards positive action has also been developed, for example, the Nordic and some Southern EU member states in particular employ quotas and targets to create an impact on gender balance in public bodies and scientific committees. It has been found that this legislation has had a

significant effect on the proportion of women found in senior university and research institute committees, research councils, selection panels etc. (ibid). At national level, most countries have a ministry for women although the impact of its presence / absence on women in science is difficult to evaluate (EC, 2008:29).

Literature in the GSD evaluates different legislative approaches and their shortcomings for increasing the representation of women in science in different contexts within Europe. By examining these within the different approaches to gender equality, we can begin to paint a comprehensive picture of the literature regarding how legislation helps to advance the position of women in science.

Booth and Bennett's 2002 approach to gender equality as three related perspectives is useful to distinguish analytically between the dominant trends and their legal implications (see *Box N° 1*).

History of gender equality

The history of gender equality is usually divided into three distinct phases that coincide with the evolution of feminism. The first wave of feminism is linked to campaigns for women's suffrage rights. This trend is characterised by liberal principles of equal rights and treatment before the law. The second wave predominant in the 1960s can be linked to a growing demand of feminists above all for positive action and separate women's provision. From the 1990s, this wave shifts to the gender perspective highlighting gender relations which recognise the rights of both women and men, stressing the need for equal work and the involvement of men in the process of change.

Timeline of gender equality		
1st Wave	2nd Wave	3rd Wave
1918	1960	1990
Equal Perspective	Women's Perspective	Gender Perspective
Equal rights & opportunities	Equality outcomes	Equal but different
Legislative response	Separate institutional provision	Managing diversity

This linear explanatory model is difficult to apply (even in countries like the UK, France, Germany or the United States) as it neither reflects the complexities of the struggle nor the progressive mechanisms of change. This conceptualisation goes some way to explain the global experience but not the history of gender equality in specific contexts at the regional or national level.

Source: Booth and Bennett, 2002

Box 1: History of Gender Equality

The equal treatment perspective was the dominant legal framework of most European countries that regulated women's presence in science until the 1970s and is comprised of actions that guarantee women the same rights and opportunities as men in the public sphere. Its delivery mechanisms are through statutory and mandatory legal instruments. Rees (2005) terms this approach 'tinkering'. The foundations of this approach were laid in the 1957 Treaty of Rome and put into effect in the 1970s when high-profile legal challenges invoked the equal treatment of women and men in employment in the European Court of Justice (Hoskyns, 1996, cited in Rees, 2005). This was combined with an increasing demand from feminist movements and resulted in various EU directives (equal pay for men

and women 1975; equal treatments as regards employment and working conditions 1976; equal treatment in social security, 1978) (Booth and Bennett, 2002). Various legal provisions were then developed regarding equal access to employment, vocational training, working conditions and, to a lesser extent, social protection (*ibid.*). These legal provisions vary in scope from binding member states to implement national legislation to merely a guiding policy. The equal treatment perspective is characterised by an individualised rights-based approach that falls on legal redress to promote equality once discrimination has already occurred. The implicit assumption is, therefore, that institutions are gender neutral and power relations become invisible. The incapacity of the liberal norm of 'equality' to deliver substantial socio-economic change in contemporary liberal democratic societies received the greatest criticism of sex-equality law at both National and EU levels (e.g. Fredman 1997; Shaw, 2000). These criticisms led to a new approach to gender equality which recognised the structural disadvantage of women and therefore promoted a range of positive actions in order to improve the position of women in society.

The women's perspective thus inspires legislation and policy that focus on women who are presumed to be in need of particular treatment and specialist provision. This perspective recognises how past experience of discrimination and disadvantage has become institutionalised and therefore needs to be put right (Booth and Bennett, 2002). Rees (2005) terms this Positive Action phase 'tailoring', placing particular emphasis on group disadvantage, 'special' projects and measures. This was the dominant approach of the 1980s although the recent emphasis on quotas and targets conceptually fits into this approach. In the 1980s, it was acknowledged at European level that there was a need to increase women's representation in the labour market. Therefore various initiatives were developed specifically to facilitate the incorporation of more women in training, employment and enterprise. For example, childcare and transport on the one hand, and confidence building and networks on the other, were all given impetus in order to facilitate women's participation in the labour market (Rees 2005, p.558). Quotas for women's formal representation in political parties, evaluation committees, scientific committees and other decision-making bodies have gained ground. Despite the fact that some authors classify this approach as gender mainstreaming (as it coincides with the dominant mainstreaming approach) it is conceptually different for a number of reasons. Quotas for women's representation are based on an attempt to redress the structural disadvantage faced by women in institutions and decision-making bodies. It is a positive action (that can be legally binding) developed to specifically enhance the position of women on decision-making bodies. There have been several critiques of the positive action approach, especially as to how the difference between men and women is conceptualised as problematic. Women are seen to be in need of measures to put them on an equal footing with men but there is no recognition of the need to change the rules of the game. This recognition led to the currently dominant approach of gender mainstreaming.

The gender perspective promotes actions that will lead the organisation of society towards a fairer distribution of human responsibilities that can be delivered by means of new tools for gender-sensitive policy-making (Booth and Bennett, 2002). This approach has been dominant since the 1990s and termed by Rees (2005) as 'transforming' due to its emphasis on systems and structures that add to group disadvantage. Its overall aim is to integrate gender equality into mainstream systems, structures, policies and institutions. Gender mainstreaming does not rely on law enforcement mechanisms but involves a long-term transformation of public policy (Stratigaki 2005, p.167). Gender mainstreaming, in fact, relies more heavily on so-called 'soft' (i.e. legally non-binding) policy instruments and voluntary cooperation (Mazey, 2002). The question remains as to whether this, in the long term, implies a watering-down of equality concepts enshrined in the existing equality directives. Criticism of gender mainstreaming examines how it becomes lost in implementation / practise: as it is 'all-embracing' no-one assumes responsibility, while women's offices have been dismantled. The conditions necessary for effective gender mainstreaming in terms of law and policy-making, and thus implementation, are not clearly specified or understood (Beveridge *et al.*, 2000).

1.1.3. Policy Instruments

One important conceptual distinction concerns the different instruments with which policy towards gender equity is implemented. The report of Rees (2002) on *National Policies on Women in Science in Europe* draws a distinction between positive action measures and gender mainstreaming although, as we have confirmed in our analysis of the literature, this distinction is not clear cut; on the contrary, both types of measures are increasingly combined and seen to complement each other for different gender policy purposes.

There are different definitions of gender mainstreaming as well as considerable variation in practice (Walby, 2005) as this concept encapsulates some of the dilemmas in feminist theory and practice, and offers a new focus for debates on how to advance gender equality (Crompton, 2001; Rees, 2005).

Positive action comprises a wide range of interventions in Higher Education, public and private organisations and the labour market, in order to give women more opportunities to overcome gender inequalities. The implementation of positive action has to consider the target population, the goals to be reached and the tools to be deployed, (such as the funding required) and other policy instruments that must be specified in order to assess outputs and objectives.

The main positive action measures in science identified by Rees (2002) are:

- Networks, i.e. the setting-up of or support for women's scientific networks and equal opportunities networks.
- Quotas and targets, i.e. specific procedures for appointing women where equally suitable candidates exist in order to achieve a better gender balance, and facilitate women's advance to top positions.
- Role models and mentoring, i.e. actions which demonstrate that it is possible to be a woman and a senior figure in science (role models) and schemes to link senior women scientists with junior colleagues for advice and support (mentoring).
- Earmarked chairs, research funds and prizes, i.e. earmarking resources for women scientists, either in terms of encouraging the participation of women, setting women's targets or devoting these resources only to women.

In addition to these measures listed by Rees (2002), our revised literature also suggests:

- Women's universities and specific summer schools, i.e. exclusive education for women.

Gender mainstreaming is a long-term and strategic approach to fostering gender equality, designed to complement legal equal treatment and positive action measures. It entails the systematic integration of gender equality provision into all systems and structures, policies, programmes, processes and projects, into ways of seeing and doing. In this way, gender mainstreaming is a transformative strategy which seeks change particularly in the spheres of culture and organisation. The most common gender mainstreaming approaches, as identified by Rees (2002), are:

- Legislation, i.e. including equal opportunities issues into the legislation regulating higher education, and specifically regulations to ensure a gender balance in public bodies, including scientific committees.
- Gender studies, i.e. gender-sensitive studies on science, addressing issues such as gender relations in scientific careers, gender impact assessment of institutional practices and gendering excellence.
- Modernising human resource management, i.e. measures aimed at avoiding nepotism, patronage and sexism in human resource management, such as measures for ensuring

transparency in appointment and promotion procedures and for avoiding any potential gender bias in assessing merit and scientific excellence.

- Gender-proofing the pedagogy of science education, i.e. a thorough examination of pedagogy, its methods and instruments, in order to avoid potential gender biases.
- Work-life balance measures, i.e. policies promoting a good life-course work-life balance for both women and men.

In addition to the previous approaches, from our review of the literature, mainstreaming includes further measures like:

- Women's officers and women's representatives in research- and higher education institutions.
- Gender observatories, i.e. specific university-based or public institutions that monitor the representation of women and act as consultants for implementing equity measures.
- Evaluation procedures for gender-proofing research and funding, specifically in the EU Framework Programmes, as well as criteria of excellence in scientific careers.

In the majority of countries and at various institutional levels, both perspectives (positive action and gender mainstreaming) overlap and are adopted simultaneously.

Both strategies seem to mutually reinforce and foster the success of equity policies, but several authors emphasise the different role that positive action plays in the contextualisation of gender equity with respect to gender mainstreaming. Rees (2005, p.560) claims that “positive action projects can be the laboratory for the development of good practice to implement in the mainstream”. In this context, positive actions would be a part of the main goal pursued by gender mainstreaming. From a different position, Stratigaki (2005) considers the introduction of gender mainstreaming as a complementary strategy, but one that does not replace previous gender-specific equality policies, for example equal treatment legislation and positive action. She also rejects the prevalence of gender mainstreaming as an alternative to positive action that aims to carry out specific policies on gender equity. Daly (2009, p.441) offers another vision of the term, claiming that “many of the initiatives implemented under the rubric of gender mainstreaming draw philosophically from a positive approach”. She notes how critiques draw attention to the technocratic approach of gender mainstreaming, underlining that it was developed by technocrats rather than being based on civil society struggles for women's advancement (Daly, 2005; Rees, 2005). Nevertheless, gender mainstreaming involves a critical position regarding the persistence of a patriarchal and “malestream” society that should be overcome and goes beyond the “tailoring” of positive measures (Rees, 2005).

Another interesting dimension of the debate considers to what extent mainstreaming policies overlap with the “diversity” perspective as a means of advancing gender equity policies. Danowitz (2008, pp.89-90) presents both strategies as alternative positions adopted in the 1990s. While European Union institutions incorporated mainstreaming into communitarian policies, in the United States, diversity was promoted as a remedy against discrimination. Diversity policies appear as new management tools of private corporations (albeit also present in universities and other organisations) in order to recruit diverse candidates to enhance innovation and creativity. It is also adopted as a means to foster social responsibility, in order that organisations reflect the diverse society we live in. This approach integrates a liberal conception of the competitive enterprise while considering new candidates (for example women, but also the elderly, immigrants and other minorities) that have been traditionally excluded from the labour market.

1.1.4. Geopolitical Coverage of Policy

Analytically, we can distinguish between several levels of geopolitical coverage of policy. In the context of the present meta-analysis, the European context of gender mainstreaming and science

policy has been highly influential. Secondly, national frameworks not only of science policy, but of wider labour market and social policy, equally shape the participation and role of women in science and research. Depending on the organisation of each country, below the federal level, important differences might exist on the concrete implementation of science policy at regional level (such as in Germany) and finally the individual institutional level.

1. **EU / Supra-national level.** With the signing of the Amsterdam treaty in 1997 and its enforcement in 1999, the European Council approved that equal opportunities between men and women become binding for all member states. This consolidation of gender mainstreaming had been prepared by previous working documents such as the position paper prior to the United Nations' Fourth World Conference on Women in 1995 in Beijing (EC 1995) or the recommendation "Incorporating Equal Opportunities for Women and Men into all Community Policies and Activities" (EC 1996). However, only with the official signing of the Amsterdam treaty, the obligation to consider gender aspects in all fields of political action acquired legal force for the member countries of the EU. This will become especially pertinent for the new and acceding member states from Eastern Europe, where gender questions are beginning to play a role in the admission process, and also for "old" EU countries such as Germany, where gender questions have been relatively neglected in comparison with the northern welfare states, for example.

Gender mainstreaming is pursued in a threefold manner in the research Framework Programmes (see Zimmermann & Metz-Göckel, 2007, p. 53): first, by targeting 40% of women's participation in research (by women); second, by pursuing a qualitative evaluation of the funded research projects under gender aspects (research for women), and third, by funding research on gender issues directly (research about women).

More recently, it has been seen that Bologna process – although not directly related to EU level research policy – could become an important player for further mainstreaming gender into the EU higher education system, and consequently science.

2. **National policy frameworks.** Apart from the EU and supra-national level of policy towards gender equality, we can distinguish the national policy frameworks for science which themselves have to be seen in relation to the wider social policy framework. Thus, according to the already cited *Benchmarking* report, apart from the strength of the private R&D sector, the second most important factor influencing the female proportion of researchers is the proportion of women in employment (EC 2008a, p.53). However, the integration of women into the labour force is related to the wider social policy framework of each country. Following Esping-Andersen's (1990) classification, one can distinguish between liberal (England, Ireland), social-democratic (Finland, Sweden, Norway) and conservative-corporatist (Germany, France) welfare models. In addition, one has to consider the "Mediterranean" or "Latin rim" model of the southern countries Spain, Portugal, Italy, Greece (Ferrera, 1996) and the Eastern European countries.

Feminist social policy research has developed this line of thinking in terms of gender and has established that various types of welfare state can be distinguished according to different models of gender relations (Lewis, 1992). Pfau Effinger's (2004) theoretical approach of 'welfare arrangements' looks at the relationship of welfare state policies and culture in order to explain national variations in female labour market participation. She identifies three main long-standing gender models in Western Europe that imply state policies: *Male-breadwinner – female part-time carer model* (for example, Germany), the *dual breadwinner – outside care model* (state / market based care) (for example, Finland) and the *dual breadwinner – dual-career model* (for example, the Netherlands). Emphasis is placed on how dominant social norms and values regarding the nature of gender relations in different contexts shape female labour market participation. Therefore, prevailing policy contexts and gender arrangements of these country groups illustrate important national differences and indicators for the overall situation of women in science and research.

3. **Sub-national/regional level.** On a third level we can distinguish policy issued at a regional level such as the *Bundesländer* in Germany or the Autonomous Regions (*Comunidades Autónomas*) in Spain. These sub-national policy levels often become decisive during the implementation and concrete execution of EU and national policy frameworks. Thus, within the framework of the so-called *Hochschulsonderprogramm I-III* in Germany, different *Bundesländer* had initiated specific programmes for supporting women before it became an explicit concern of the wider federal policy framework. Once active engagement with gender issues became binding at the federal level, different schedules and speeds with which gender questions were implemented across all *Länder* could be observed. These differences at sub-national level are important because they explain certain patterns in the available literature – why it is more abundant for certain regions than for others.
4. **Institutional level.** Fourth, it makes sense to single out concrete research and higher education institutions when it comes to policy towards gender equity. The institutional context is decisive for showing how concrete measures are implemented and to what degree they are able to change given organisational structures of scientific work. Although most science policy does not target individual institutions but all universities at the regional level, for example, the concrete institutional context is a determining factor as to how a certain policy is included into a concrete measure or activity such as a mentoring programme in any given department. In other words, at the institutional level, policy as an agenda- and framework-setting activity is distinguished from concrete activities and measures that convert it into action.

Considering the entries analysed in the GSD, the majority of the literature comes from evaluations of concrete measures of the institutional Higher Education (HE) sector. The EU and national level usually mark the general framework for gender equality in science; national and regional authorities might set up national funds and framework programmes for promoting women in science that are then implemented through individual initiatives for career training or mentoring networks to name just two. This draws attention to equally locally bounded evaluation studies that analyse the worth and merit of these initiatives in their proper context. However, it leaves unanswered an important question regarding the interplay between individual measures and impacts at a more regional/national/EU level.

1.2. Policy Transfer

Among the implicit objectives of the present meta-analysis is that of distilling new insights by comparing the different policy experiences available throughout the EU countries. The well-developed research field of comparative analysis of public policies provides an important starting point in order to carry out this cross-national analysis. Based on a long tradition in political sciences, it enables the identification of the most important dimensions for enriching the possible comparison between, and transfer of, policies.

Analytically, the literature distinguishes between policy *transfer*, *-convergence* and *-diffusion* studies (Knill, 2005). Although these differences – diffusion and transfer studies being concerned with process patterns and convergence studies with effects – are important in terms of research design and explanatory models, our primary interest lies in more “practical” questions concerning the actors of policy transfer or its facilitating and constraining factors. Dolowitz and Marsh (1996, 2000) provide a contemporary analytical framework for analysing policy transfer building upon earlier approaches of Bennett (1991a, 1991b) and Rose (1991, 1993).

Dolowitz and March identify nine main categories of political actors engaged in policy transfer: elected officials, political parties, bureaucrats/civil servants, pressure groups, policy entrepreneurs and experts, transnational corporations, think tanks, supra-national and non-governmental institutions (Dolowitz & Marsh, 2000, p. 10). Apart from these actors, a further important distinction to draw concerns the content of policy transfer. In responding to the question of “what gets transferred”, one

can differentiate broadly between the content (motivation) of a certain policy and its concrete implementation. Thus, transfer concerns the policy goals and content, policy instruments and administrative techniques, policy programmes (concrete implementation), institutions, ideologies, ideas and attitudes, and negative lessons (*ibid.*, p. 12).

Overall, the literature has identified several important factors that condition the “success” of a certain policy transfer. Whereas in the past, excessive focus was given to the role of individual actors (politicians, bureaucrats, etc.), currently a more ecologically oriented perspective is put forward, where individual agents operate under the constraints of past policies, existing socio-economic conditions, ideological climate or the efficiency of the available bureaucratic and administrative infrastructure (see Dolowitz & Marsh, 1996, p. 353ff.) Thus, policy transfer is usually a complex process situated on a continuum between several voluntary and coercive factors. Although actors might be highly willing to implement a certain policy, a lack of existing resources, institutional barriers or an oversized and incompetent bureaucratic sector easily diminishes the policy goal throughout the many phases of its implementation. On the other hand, the best and most efficient government organisation might be in vain if a certain policy transfer founders on the ideological and cultural resistance of its collective target. Indeed, Hall (1993) establishes a certain hierarchy suggesting that change (and hence, successful policy transfer) is most difficult when it comes to ideas, given their deep embeddedness in dominant beliefs. Instruments or policy programmes and even administrative settings can be transferred more easily since they are not dependent upon deep cultural and ideological changes.

Two levels may be particularly pertinent when considering the possibilities of policy transfer in terms of equal opportunities in science within the EU countries. First, the national differences. Given the present situation of the EU member countries, it is evident that differences exist at the level of the available economic resources invested in R+D+i activities (see *Innovation Scoreboard*). However, it is not only the economic back-up that frames the success chances of policies towards gender equality but also the existing organisation and infrastructure of the HE and research system. At national levels, the available literature of the GSD demonstrates quite convincingly that a clear policy transfer in terms of goals and instruments has occurred towards the new Eastern member states whereas the adoption of concrete policy programmes is still missing.

Second, differences (individual universities and other higher education institutions) at institutional level might be especially important for the successful transfer of gender and science policies. Many concrete policy programmes and activities are associated with concrete institutions. It will be especially interesting to flesh out the differences between these institutions in order to identify aspects of success or failure when implementing higher level policy goals towards gender equity in science. Important aspects could involve type of human resource management, existence of corporate culture, ties to business, and so on.

1.3. Evaluation of Policy

The evaluation of existing policies is an imminent task. This is often conceived as determining the effectiveness and impact of certain measures towards gender equality. Since *the* key indicator of the success of a policy towards gender equity in science relates to the proportional participation of women in all areas of science and research, evaluation is easily misconceived as determining if certain policy measures have been effective to increase women’s participation in science. However, as straightforward as this may sound, evaluation is a far more complex and multilayered undertaking.

There are many definitions of evaluation (see for the following Stufflebeam & Shinkfield, 2007, p. 8). A widely used standard definition by the Joint Committee on Standards for Educational Evaluation published in 1981/1991 reads as follows: “evaluation is the systematic assessment of the worth or merit of an object.” This definition goes beyond one of the earliest and still most widely used definitions which conceives evaluation as determining whether objectives have been achieved. Although this

second definition might be more intuitive, it is not sufficient because given objectives might be corrupt, dysfunctional, unimportant or fail to address the needs of the intended beneficiaries. Moreover, the earlier focus on outcomes limits the evaluation by focusing too much on results while forgetting programme goals, structure, and process.

Evaluation is a wide-ranging field. The Joint Committee distinguishes broadly between personnel-, programme- and student evaluations. Although evaluation of students and researchers is a contested terrain and highly relevant in terms of gender, policy towards equity in science requires programme evaluation approaches. Within programme evaluations, Daniel Stufflebeam has charted on various occasions the different approaches available (Stufflebeam & Webster, 1980; Stufflebeam & Madaus, 2002; see also Mark, Greene & Shaw, 2006, p. 13). An overall of 22 different approaches can be identified and classified in four large categories: (a) pseudo-evaluations, (b) questions- / methods-oriented, (c) improvement / accountability, (d) social agenda advocacy (Stufflebeam & Madaus, 2002, p. 36). The last approach is especially interesting for evaluations in the field of gender equity because it aims at comprehensive evaluations that pertain to the relativist school and stress the need of deliberation and democratic principles between all stakeholders involved in programmes and their evaluation.

The definition by the Joint Committee also clarifies from the start that all evaluation involves value judgements. These value judgements should be related to the worth and merit of a given programme. A programme has *merit* if it performs well according to its purpose. It concerns the internal quality of a given programme. *Worth*, in contrast, assesses if a given programme addresses a real need. It is therefore tied to a needs assessment. This definition has important political and epistemological consequences. As Bovens, Hart, & Kuipers (2006) write, *public policy evaluation is the continuation of politics with other means*. Scales of measurement, indicators of quality or definitions of success and failure are highly contested, value laden social constructions. Evaluations thus not only provide feedback on the very “effectivity” of certain measures (their merit) but also imply an agreement on its worth, i.e. does it address a real need. Since women are still under-represented in science decision making structures, social-agenda / advocacy approaches provide an opportunity to collectively define and negotiate the desired worth and merit of policy measures. In general, the evaluation of policy involves three aspects (see also Wroblewski 2007, p. 17):

- (1) A normative aspect, especially apparent in an analysis of the goals to be achieved. Questions asked usually involve: definition of the target group (e.g. students, professors, selection committees and rectors, among others) to be addressed; required resources (are they realistic given the set goals?); do the objectives address a real problem and need? What is the target (for example, to increase the proportion of women in science? To aim for more ephemeral goals such as change in sensibility towards gender issues or professional culture)?
- (2) An analysis of the implementation process. Does the implementation address the goal set? How does implementation change over time? Which factors support or hamper the implementation? Policy implementation under a post-positivist paradigm acknowledges that implementation is never a straight-forward 1:1 process (see e.g. Winship 2006; Hajer & Wagenaar, 2003). The reception and implementation of policy depends on many contextual factors, personal relations, margins in interpretation, accommodation and resistance (see also section 1.2 Policy Transfer).
- (3) An analysis of its impact. Analysing the possible impact of policy poses a further major challenge. As the GSD literature will show, most evaluations concern the effects of certain measures at the level of the individual scientist. The benefit in terms of new skills, motivation and self-esteem of certain measures such as career training is relatively easily captured by interviews and surveys among the participants. However, the second *structural* impact dimensions are much harder to evaluate. Qualitative changes at the level of perceptions and dispositions towards gender happen rather slowly; to detect cultural change requires a large and elaborate methodological apparatus. But even then, determining the effectiveness of a certain policy measures is a difficult task since it always forms part of a wider social reality. Isolating cause-effect relations that would venture to trace changes in the science

environment to certain policy interventions are quite scarce given the additional difficulties of limiting the timeframe for scrutinising potential effects.

Given these challenges and dimensions inherent in evaluations, certain types of evaluations are more realistic and probable than others. When considering the entries in the GSD – apart from the few systematic evaluations carried out in general – it becomes apparent that the majority of approaches concentrate on the individual (satisfaction, benefit) level. Surveys and interviews before and after certain activities such as training seminars, summer schools, etc. are relatively easy to carry out and are thus frequent. Apart from being relatively “simple” and direct they also have the advantage of being bound in space and time. Large-scale evaluations that not only focus on individual benefits but on structural change are much harder to come by. They are more costly, methodologically and financially speaking.

This can readily be seen in relation to the implementation of gender mainstreaming. To start with, there are a variety of definitions circulating which often present different ideas on how best to implement mainstreaming (Walby, 2005; Strategaki, 2005). As a consequence, the real effects are not clear and evaluation becomes difficult. Diversity between countries and between institutions within the same country is also a source of difficulty in terms of the design and evaluation of these policies (Crompton and Le Feuvre, 1996; Crompton, 2001). Given the diversity in national, regional and university contexts, the scarcity of comparative and benchmarking studies comes as no surprise.

The evaluation of policy towards gender equality is thus confronted with several inherent and contextual difficulties. The clear need for the future is to overcome often isolated and local studies and to understand the interplay between several measures (career, structural HE reform, institutionalisation processes) and contextual factors (such as wider workforce participation and availability of child care facilities, to name just a few). Their coherence and consistency in relation to each other has to be considered. Thus, the need for more comprehensive approaches also points to a shared set of quality standards for evaluation that would make different approaches comparable.

1.4. Methodology

In order to carry out the meta-analysis on the literature on “Policy towards Gender Equity in Science and Research” the following steps were carried out:

The meta-analysis project proposal elaborated a first conceptual framework that classified policy towards gender equality according to the policy instrument used; broadly speaking “positive measures” vs. “gender mainstreaming” approaches. This classification was replaced by a more thematic, problem-oriented grid that emerged from the grouping of the reviewed literature. Despite the existence of a strong theoretical discussion on the potential benefits and drawbacks of gender mainstreaming vs. positive actions, it does not necessarily inform empirical research and evaluation studies to an equal degree. Here, the literature is rather foregrounded in one of the following three thematic areas:

- advancing science careers through career and skills training, stipends and scholarships, networking and mentoring, and measures for balancing work-life.
- science and management and reform, including the role of new legislative frameworks, institutional structures such as equality officers, committees and observatories, quotas, or new steering instruments such as incentives and targets.
- Gender dimension in research and higher education including gender proofing pedagogy and curriculum, exclusive education, insitutionalisation of Gender Studies and gender assessment of research.

These thematic areas that organise the present report emerged from the revision of 1,296 abstracts of the Gender and Science Database (GSD). Each entry in the GSD is classified according to the eight

topics outlined in the introduction: (1) horizontal- and (2) vertical segregation, (3) gender pay gap, (4) stereotypes and identities, (5) science as a labour activity, (6) scientific excellence, (7) gender dimension in research content and (8) policies towards gender equality in research. Point (8), furthermore, is subdivided as follows: 8.1) evaluation of measures, 8.2) gender mainstreaming measures and 8.3) positive measures. Filtering according to 8.1 OR 8.2 OR 8.3 produced 1,296 entries. Since entries can be classified across multiple topics, 1,296 abstracts were revised to single out those texts that dealt mainly with policy issues towards gender equality (see *section 8. Bibliography*)². Where available, selected key texts were studied in depth. This often produced new sources and texts not yet available in, but subsequently added to the GSD.

The content analysis was supported by a statistical analysis of the GSD entries on “policies towards gender equality” (contained in section 3 of this report).

Limitations

Important limitations of this meta-analysis concern the analysis of the GSD entries. All abstracts are made available in English. Original texts were consulted whenever possible. This implies that in-depth revision of the literature on policy measures was confined by the languages and texts available to the research team (English, Spanish, Catalan, German and French). This might produce a certain bias in the in-depth study for the meta-analysis; however, texts in other languages (deemed important due to the abstract) were requested as an extended summary to the respective country group correspondents. In addition, the report has been compared to the specific policy section of the country (group) reports in order to detect any serious omissions.

A further limitation might involve the classification of the literature when entered into the GSD. Particularly in relation to structural reforms of universities, differences were detected as to how certain entries are classified although they essentially deal with the same restructuring process (first from a policy analysis and then from a more individual, subjective perspective). Thus, for each topic, the available literature in the GSD has been complemented by and contrasted with additional literature searches on the specific topic.

² There are differences between the entries found in the GSD and the Bibliography contained in this report. Not all references used in this document are part of the GSD, because (1) not all chapters of edited works are listed separately in the GSD, (2) some entries are not (yet) contained in the database or (3) literature not strictly dealing with science policy has been used to elaborate the present report.

2. Main Trends and Debates between 1980 and 2007

The following section summarises the evolution of gender concerns in Europe and how these are reflected in the GSD. Different legislative and policy initiatives have been put forward at European level, which have affected the member states according to different rhythms and paces. This section will summarise the main stages in terms of gender concerns and policies. Section 2.2. deals more specifically with the main debates and trends that emerged from the analysis of the GSD entries. As section 2.3 on the statistical analysis will argue, there has been a huge increase in science- and gender-related publications from the late 1990s onwards. This quantitative increase will be analysed when presenting the main topics under consideration. In very general terms, as policy has moved from positive action towards a more structural approach to gender equality, research and evaluation has also reflected this shift.

2.1. Evolution of Gender Concerns in Science Policy in Europe

The role of women in science emerged as a major policy concern in the late 1990s at European level. The purpose was to promote the equality of women and men in science as an essential condition for building the European Research Area. This concern for gender equity in science was embedded in the broader commitment of EU policy towards guaranteeing equal opportunities of women and men across all spheres of social life. Key documents included the EU position paper prior to the United Nations' Fourth World Conference on Women in 1995 in Beijing (EC 1995) or the recommendation on adopting a gender mainstreaming approach *Incorporating Equal Opportunities for Women and Men into all Community Policies and Activities* (EC 1996). The official signing of the Amsterdam Treaty in 1997 and its ratification in 1999 then laid the legal foundation for implementing gender mainstreaming across all policy areas of the EU and its member states.

With the overall legal framework in place, gender issues started to receive a systematic treatment in the field of science and research from the late 1990s onwards. Whereas formerly, during the preceding decade of the 1980s, equal opportunities between women and men in science were mostly restricted to sporadic and isolated positive measures at single universities and research institutes, towards the end of the 1990s, a broader and more comprehensive approach started to materialise. Part of these more systematic efforts was a series of working groups and reports commissioned by the EC. Thus, in 1999, the European Commission adopted a Communication and an Action Plan: *Women and Science: Mobilising women to enrich European research*. In parallel, the DG Research commissioned a group of women scientists to form ETAN (European Technology Assessment Network) in order to prepare a report on women and science in the EU called *Science policies in the EU – promoting excellence through mainstreaming gender equality* (2000). Both reports provided the cornerstones to initiate a political debate on the importance of tackling gender issues for building the European Research Area (Zimmermann & Metz-Göckel, 2007, p. 53). The main argument deployed insisted on the importance of integrating women into science in order to strengthen the European knowledge economy. The necessity of equal opportunities between men and women was linked to opportunity in terms of mobilising human resources and talent which would translate into scientific development and economic advantages.

On this basis, the Research Council invited EU Member States to engage in a dialogue on national policies and to collect data on women in the scientific research system at the level of the government, higher education and the private sector (Council Resolution May 1999, Action Plan *Women in Science: Mobilising Women to enrich European research*). The Plan underlined the need for the European Union to set itself objectives regarding equal opportunities for men and women in the field of scientific research and to address women's under-representation in the field.

The Plan called for efforts at European and member state level supported through a number of Commission actions including:

1. stimulating discussion and the sharing of experiences in this field among the Member States so that action can be taken as effectively as possible at all levels of power;
2. ensuring that women are informed about the schemes and programmes intended to increase their participation in scientific research;
3. making a considerable effort and developing a coherent approach towards promoting women in research financed by the Union, with the aim of significantly increasing the number of women involved in research.

As a result, the Helsinki Group on Women and Science was established by the European Commission in November 1999. The Helsinki Group was composed by 15 member states, 17 associated and candidate countries and Iceland, Norway and Israel. The mandate of the Helsinki Group focused on promoting discussion at national level, collecting statistical data and monitoring women's participation in research. It aimed at providing a sound basis for the current situation of women in science across the member states in order to prepare the ground for further effective action.

On the other hand, the collection of data and stimulation of political debate was complemented by integrating a gender dimension into European research starting from FP5 onwards (1998-2002). Three perspectives were presented to be monitored by a so-called *Gender-Watch-System*, stating that:

- women's participation in research both as scientists/technical experts and in the evaluation, consultation and implementation process has to be increased to 40% (research *by* women);
- research must respond to the needs of women and men by incorporating the perspective of gender whenever relevant (research *for* women);
- research must be carried out to contribute to an enhanced understanding of gender issues (research *about* women).

Whereas during the 5th Framework Programme, gender issues were handled within the transversal programmes of *Improving the human resource potential and the socio-economic knowledge base*, during the 6th Framework Programme (2002-2006), gender equality in science was implemented under the priority of the *Science and Society Action Plan*. The overall strategy for promoting women and science at European level is conceived as a coherent, multidimensional, long-term approach pursued along three lines: a reinforced policy forum, an improved understanding of "gender and science" and an enriched *Gender-Watch-System*. More specifically, the instruments used during FP6 such as networks of excellence or integrated projects required the integration of gender equality plans.

Some of these fundamental actions combined with the composition of the expert groups and the thematic reports have guided the promotion of gender equality. The most important elements of this process are the following:

1. The European Technology Assessment Network (ETAN expert group) was set up by the Commission in 1999 to work on a pilot action addressing gender balance in research policy.
2. Since 1999, the *Women and Science Unit* of the EU has been producing a directory of networks of women scientists.
3. The EU programme of statistical work was initiated in 2001 through the works of the Helsinki Group and this led to the yearly publication of *She figures*, the new edition of which was published in September 2009.
4. The *Women in Industrial Research* (WIR) expert group. Established in 2001 by the EC to provide advice on how to support gender equality in the private research sector, where women constitute a minority of 15% compared to 30% in the public sector. The WIR initiative

produced several reports dealing with the general under-representation of women and the importance of achieving a work-life balance (Rübsamen-Waigmann *et al.*, 2003), good practice examples in companies (Meulders *et al.*, 2003), and ways of attracting more women researchers to the industry (EC, 2006).

5. The *Women Scientists in Central and Eastern Europe and the Baltic States* (ENWISE) expert group was launched in October 2002, with a view to examining the situation faced by women scientists in these countries. Even if the proportion of women in science in these countries is considerably higher than in the old EU countries, the ENWISE report (EC, 2004a) highlights that the current prospects for young female scientists are bleak due to the unavailability of funding, rigid patterns of promotion and recognition and the lack of appropriate Welfare State policies.
6. Also in 2002, the ETAN expert group elaborated the influential report *Promoting Excellence through Mainstreaming Gender Equality*, focused on 15 member states of the EU. This report is the result of one of the actions of the Science and Society Action Plan aiming to promote gender equality in science in a wider Europe.
7. In 2004, the Commission published a report on notions of 'excellence' in the shaping of scientific careers. The report *Gender and Excellence in the Making* (EC 2004b) considers in what ways gendered assumptions underpin constructions of excellence and what these imply for both women and men.
8. A *European Platform of Women Scientists* (EPWS) was launched in 2005 to bring together networks of women scientists and organisations committed to gender equality in scientific research³. The Commission gathered information from the study completed in 2003 to identify and survey existing networks of women scientists in order to obtain an overview of the situation and provide recommendations for the setting up of the platform.
9. The establishment of the EU expert group *Women in Science and Technology – The Business Perspective* was launched in February 2005 through an initiative of the Women in Industrial Research (WIR) group in order to analyse the promotion of women in science and technology from a business perspective. This work highlights the need to provide solutions for dual career couples and for managing culture changes in private companies and the implementation of gender diversity strategies in the management of human resources.
10. In 2007, the Commission set up an expert group on *Women in Research Decision Making* (WIRDEM) whose mission it was to identify and review positive actions and gender equality measures at institutional and national levels in order to promote women into senior positions in public research. The report *Mapping the Maze: Getting more women in to the top in research* highlights the problem of poor gender awareness and visibility of women, and underlines the lack of transparency and unfair evaluation in promotion procedures and the need for a change of culture in scientific and research environments. The last report published deals with *The Gender Challenge in Research Funding* (EC 2009).

In summary, in order to advance towards the goal of gender equity in science and research, the EU and the national governments have established the following set of intervention strategies:

- Increasing women's participation in science, technology and innovation, especially in industrial research.
- Empowering women in decision-making positions in public research and private companies.
- Reconciling professional and private life (family-friendly working environment).

³ http://ec.europa.eu/research/science-society/pdf/women-sc-net-guide_en.pdf. See also *The European Platform of Women Scientists* (<http://www.epws.org>) and Women and Science section of the Science and Society Priority: <http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=27>

- Redefining research excellence with the participation of women.
- Overcoming gender bias in assessment criteria.
- Strengthening gender research across the whole European continent.

2.2. Summary of Trends in the Reviewed Literature

It is difficult to crystallise the main trends of the literature. The research and entries in the GSD dealing with policy towards gender equality are very heterogeneous in their scope and methodology applied. As already indicated, there is a clear bias in terms of literature coming from the German speaking countries (Austria, Switzerland and Germany). Thus, rather than mirroring European-wide trends, one must clarify which thematic discussion constitutes a trend in which specific country and country group. Except for the very general and overarching trends already described in the preceding section that expand from liberal, equal rights issues towards positive action and finally gender mainstreaming, few EU “universal” discussions can be identified. This is surprising, on the one hand, since the circle of gender researchers and key authors is relatively small. On the other hand, it is not surprising at all given the very different national and institutional contexts, as described in section 1.1.1. Policy Contexts.

To start with the most recent trend (late 1990s early 2000s), the literature increasingly discusses the impact of Higher Education (HE) and research restructuring. The massive access of students to HE in combination with the scarcity of state finance as well as global competition for talent has had and continues to have a strong impact on HE. A new managerialism is introduced in HE institutions which challenges existing traditional self-conceptions of autonomy and independence in science. The gender literature neither completely condemns nor celebrates these recent changes but rather is eager to analyse the potential benefits and drawbacks of these reforms for advancing women in science. The available evidence up to date draws a rather ambivalent picture, which is also conditioned by national contexts. Whereas the UK literature is rather sceptical towards a new managerialism in HE, a large body of literature exists in Germany which claims that these new steering instruments improve the situation for women.

It is interesting to see that in this more recent literature, a key issue relating to positive actions is largely absent. The negative, stigmatising effect of “women-only” promotion schemes does not figure any more as prominently as in earlier publications. Direct positive measures such as women's quotas for full professorships or earmarked stipends for female PhD candidates, and so on, often are disqualified as interfering with the neutrality and meritocracy of science. However, where new performance-related measures and quality standards from a diversity perspective are introduced, the need to defend women's promotion against unfair accusations is less apparent.

The discussion of equality representatives has evolved. Formerly, research mainly emphasised the lack of formal power within the HE institutions and the need to focus on the micro-political negotiations necessary to introduce gender aspects. However, in the context of university reform, the professionalisation of women's representatives shifts into focus. Although the micro-social settings are still important, the more sophisticated instruments deployed in university management also require equality officers who sufficiently understand these tools in order to use them for gender equity concerns.

The discussion on science careers and career training in all of its aspects began mainly during the mid-1990s. Specific support measures directed towards women but also addressing the structural inequalities of the science system were adopted. The most common formats are career training seminars, coaching and mentoring relations. The literature has focused mainly on the positive impact of these measures at an individual and personal level while pinpointing the need for further structural

change. A more recent topic concerns the issue of dual-career couples, that is, specific measures that facilitate the professional mobility of both men and women as a couple.

A more country-specific trend concerns the importance of single-sex educational settings in Germany which peaked during the late 1990s and early 2000. Several single-sex degree courses in SET disciplines were created. Together with the *International Women's University – Technology and Culture* (ifu), in 2000, the debate focused not only on the potential individual benefits of mono-educational classroom settings but also on the potential benefits in terms of establishing new disciplinary cultures in SET or epistemic cultures (Knorr-Cetina 1999). However, the results of this discussion remain rather inconclusive based on the available literature in the GSD.

Furthermore, the concern for evaluation of policy measures is also a more recent trend seldom found in the early entries (pre-1990s) in the GSD. In part, this is equally tied to the restructuring reform of HE which involves evaluations and monitoring as part of its quality assessment procedures. However, it is also linked to the insight that, despite continued intervention efforts and policy measures, progress is harder and slower than desired. The effectiveness of policy towards gender equity becomes a concern as indicated in this same meta-analysis.

3. Statistical Overview

The following section presents an overview of the statistical distribution of the entries in the Gender and Science Database (GSD). Apart from the thematic priorities of the meta-analysis, the database contains a pre-established classification scheme used for tagging each entry. As the following section demonstrates, this includes geographic coverage, thematic coverage including institutional sector, scientific field, and life course as well as a methodological module gathering information on quantitative vs. qualitative methodologies used. The following section therefore provides a brief overview of the quantitative trends as they are given according to the classification of the GSD entries relating to policies towards gender equality in research.

Looking at the distributions in relation to the countries and country groups under consideration, the aforementioned importance of national policy contexts is confirmed (see 1.1.1 Policy Contexts on page 2). In addition, according to the statistical data, most of the literature is of a conceptual nature and occupied with presenting “state of art” accounts. A clear surge in the literature dealing with policy issues can be detected from the 1990s onwards, corresponding to the general trend towards gender mainstreaming.

Concerning the methodological approaches, despite the general recommendations of the literature to produce more data for the evaluation of the longitudinal progress of the participation and position of women in science, qualitative methods predominate.

Regarding the institutional level, most of the literature is focused on higher education and refers to concrete experience and some positive actions implemented in these types of organisations. The access and involvement of the authors in these actions explains the higher frequency of this type of entries. On the other hand, studies referring to government and enterprises have a weaker presence in the literature included in the GSD.

3.1. Distribution over Time

A third of the literature of the GSD is related to gender equality policies and this issue has become more important. As shown in the following graph, towards the second half of the 1990s the volume of literature rapidly increased, especially over the last decade – from 2000 onwards – when nearly two thirds of the available literature is focused on policies. This literature tends to address topics such as vertical and horizontal segregation, pay gaps, stereotypes, all of which often constitute the main goals of policies, and implementation strategies.

The increasing interest of policy-makers in gender equality tools and a greater awareness of gender equality policies in Europe are reflected in the increase of entries in the GSD. In order to help policy-makers make informed choices among policy instruments (positive actions vs. gender mainstreaming) the need arises to compare and evaluate the effectiveness of each instrument. This is one of the reasons that explain the increase in the literature devoted to evaluation from the year 2000 onwards, when mainstreaming was institutionalised and experience regarding affirmative action was accumulated.

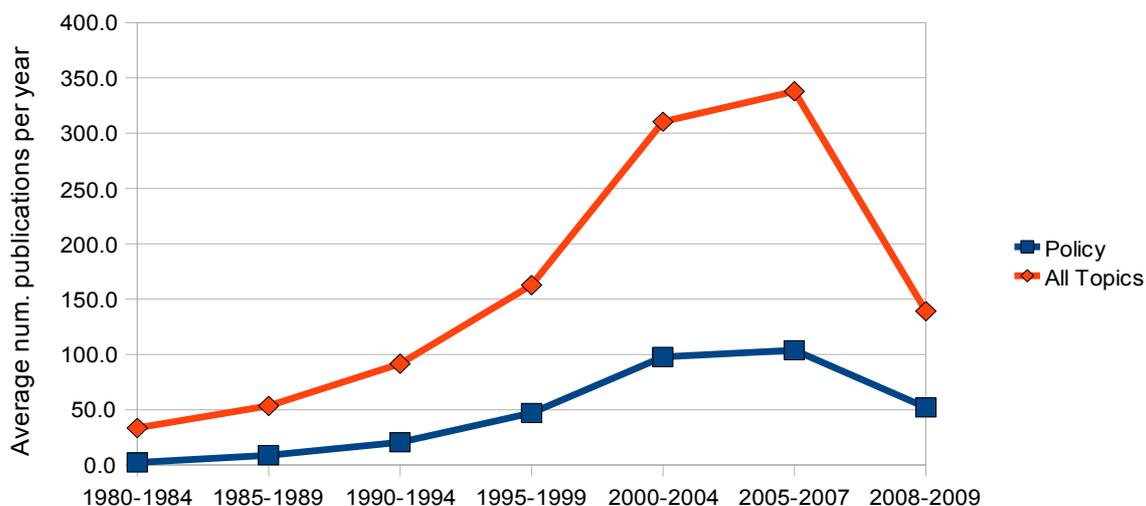


Illustration 1: Evolution of the reference of Policies towards Gender Equity in the GS Database in relation to distribution of all entries. Source: Elaboration from the GSD.

3.2. Topics Treated in Conjunction

The next table shows the relative weight of the other topics in the literature dealing with policies. Slightly more than half of the entries classified under policies towards gender equity also dealt with “vertical segregation” (54.8%), closely followed by the topic of “horizontal segregation” (48.5%) and “stereotypes and identity” (45%). In addition, if we compare these percentages with the overall distribution of topics across all entries we note that the issue of policy is disproportionate compared to “pay and funding” and “scientific excellence”.

Topic analysed	PE (%)	All Ts (%)	Ratio PE/ATs
Horizontal segregation	48.5	43.2	1.1
Vertical segregation	54.8	44.7	1.2
Pay and funding	20.0	12.6	1.6
Stereotypes and identity	45.0	54.0	0.8
Science as a labour activity	32.8	32.6	1.0
Scientific excellence	26.1	19.8	1.3
Gender in research contents	34.3	31.5	1.1
Policies towards gender equality in research	100.0	28.5	3.5

Table 3: Percentage of other topics treated in the literature dealing with policy

In addition, it is apparent that the issue of policies towards gender equity in science and research is a strong transversal issue. Since policy might address any of the remaining seven areas, it frequently deals with more than one topic alone. This is clearly visible in Table 4 below which shows that approximately 70% of all policy entries deal with 3 or more topics. The proportion between policy entries and all entries (Ratio PE/AT) also emphasises that the literature on policy is disproportionately better represented the more topics are treated simultaneously.

Number of topics	PE (%)	All Ts (%)	Ratio PE/ATs
1	10.2	22.6	0.5
2	20.9	32.2	0.6
3	23.1	21.2	1.1
4	17.6	12.7	1.4
5	12.0	6.2	2.0
6	7.0	2.5	2.8
7	5.6	1.6	3.4
8	3.5	1.0	3.5
Total	100.0	100.0	1.0

Table 4: Number of further topics dealt with in the literature on policy

3.3. Country Groups

The volume of literature varies according to the county group of publication. This seems to be related to several key factors such as the experience accumulated in gender equality policies and the perspective adopted. For example, authors from Nordic countries publish more on issues related to mainstreaming while those in Anglo-Saxon countries are more concerned with positive action. Each country begins to develop literature about these topics when a certain level of experience has been gained. For example, literature from the Eastern and Southern country groups tends to lag behind the Nordic, Continental and Anglo-Saxon country groups. Feminist approaches were less frequent in Eastern and Southern country groups and as a consequence, gender policies were implemented later than in the Northern countries. One third of the specific literature relating to gender policies comes from continental Europe, followed by Anglo-Saxon and Nordic countries. There is much less literature on this topic from the Eastern and Southern country groups. The graph below shows the distribution of all the literature in the GSD (red column) and gender policies (blue column). We can see that the Continental, Anglo-Saxon and Eastern country groups have an ample number of contributions on gender policies in relation to their contribution to the literature in general.

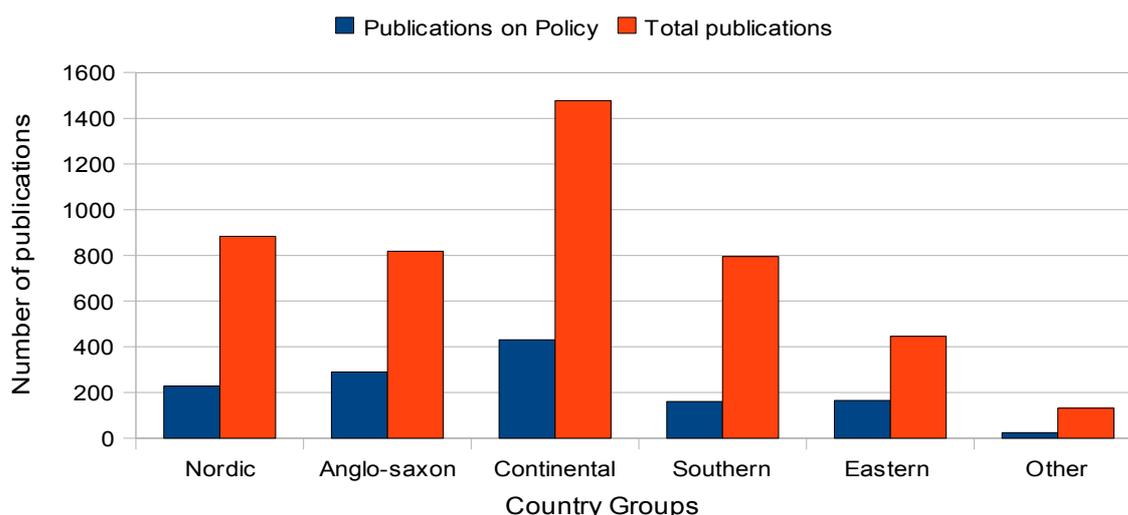


Illustration 2: Distribution of policy-related entries in the GSD in comparison to the total number of publications grouped by country group. Source: Elaboration from the GSD

The next graph represents the distribution of entries relative to the three different topics previously mentioned in terms of policies for gender equality in science. As we have already mentioned, the distribution of these main topics regarding the place of publication highlights the fact that certain countries have a tendency to produce specialised literature. Hence, positive measures are a core topic in the Continental, Anglo-Saxon and Nordic countries but not in the other two groups. Evaluation is most frequent in Anglo-Saxon countries; it is also present in Continental countries while being less frequent in the Southern and Eastern countries. Gender mainstreaming literature tends to come from Continental and Eastern countries while it has a weaker presence in the Anglo-Saxon literature.

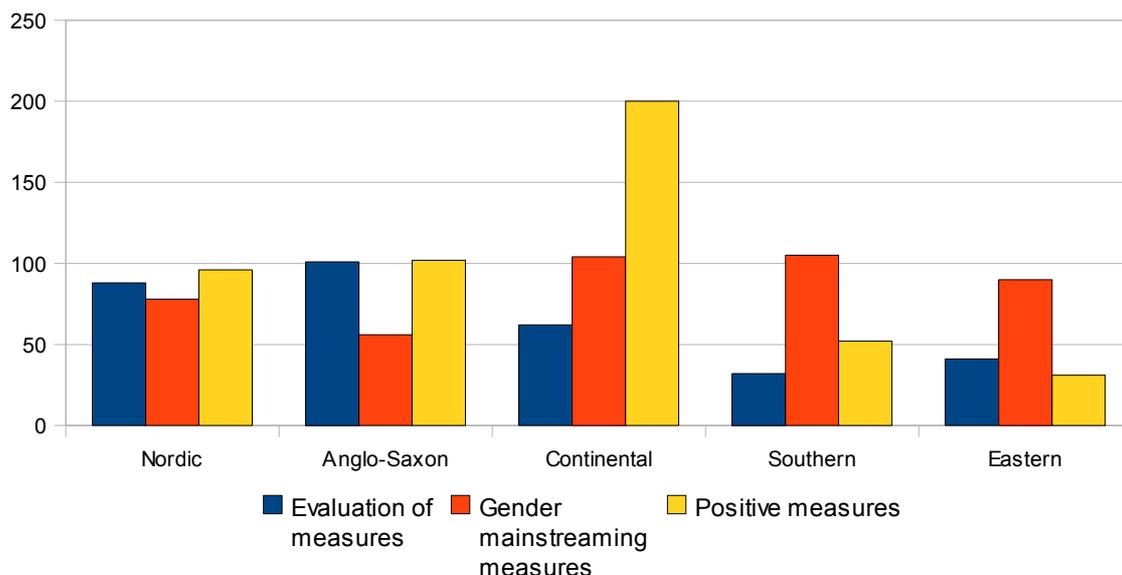


Illustration 3: Distribution of the three different topics in terms of policies according to country group. Source: Elaboration from GSD

3.4. Institutional Sector

The articles included under the topic “gender equality policies” tend to adopt a mixed perspective regarding the sector of performance. They often refer to more than one sector and findings tend to be of a more general nature. However, the predominance of implemented actions in higher education, - especially positive measures - is reflected by a high number of references in this institutional sector, where the majority of actions are implemented, as it is also the environment that academics (those who write the articles) are most familiar with. The Government sphere is the next most cited sector. A large number of measures affect both sectors (higher education and government) as there are references to the legislative framework and to the specific action to be implemented in these spheres. The business sector and non-profit institutions are mentioned much less in the articles included in GSD. The weaker presence of the private sector in the literature could be due to difficulties in terms of research access.

Institutional sector - Other	PE (%)	All Ts (%)	Ratio PE/ATs
Business enterprise sector	10.7	10.6	1.0
Government sector	23.7	26.0	0.9
Higher education sector	87.7	86.7	1.0
Private non-profit sector	3.6	3.4	1.0

Table 5: Distribution of entries on policies according to the institutional sector.

3.5. Field of Study

The next table shows the distribution of the literature according to field of study. Central fields in the GSD are 'science, computing and mathematics', ' and 'engineering, manufacture and construction'. This is due to the scarce number of women in these fields, which has implied that these fields have also become the preferred targets of policy intervention.

Scientific field - Other	PE (%)	All Ts (%)	Ratio PE/ATs
Education	26.6	20.6	1.3
Humanities and arts	17.5	18.3	1.0
Science, mathematics and computing	46.1	46.6	1.0
Agriculture and veterinary	9.5	8.5	1.1
Health and social services	20.5	21.9	0.9
Engineering, manufacturing and construction	32.3	25.1	1.3
Social sciences, business and law	33.6	34.1	1.0
Services	0.8	0.7	1.1

Table 6: Distribution of entries on policies according to field of study

3.6. Life Course

The dropout rate of women during the first stages of the scientific career is highlighted as an important point in the literature. The literature therefore concentrates first on the doctoral level (ISCED 5 and ISCED 6) and secondly on early career stages / when women set out on their scientific trajectory.

It is striking to observe that the literature concentrates on the scientific career without paying much attention to the decisive influence that primary and secondary school education plays in the career decisions of boys and girls. As we commented earlier, in the case of the institutional sector, the fact that academics are based at higher education institutions could explain the high volume of articles relative to the post-doctoral and early scientific career stages. This also tends to be the phase in which positive actions are concentrated.

Life course stage -Other	PE (%)	All Ts (%)	Ratio PE/ATs
ISCED 0	2.8	2.0	1.4
ISCED 1	6.3	6.8	0.9
ISCED 2	8.5	11.0	0.8
ISCED 3	11.4	13.8	0.8
ISCED 4	7.6	6.4	1.2
ISCED 5	44.9	36.2	1.2
ISCED 6	52.3	38.4	1.4
Early-career scientists	76.3	67.6	1.1
Mid-career scientists	72.6	62.8	1.2
Late-career scientists	66.7	59.4	1.1
Other	4.2	6.5	0.6

Table 8: Distribution of policy entries according to life course stage

3.7. Methodological Approaches

The conceptual and theoretical approaches of different authors in terms of positive action, mainstreaming and diversity are an important classifying element of the articles included in the GSD. This non-empirical research clearly constitutes the majority (59%) of entries in the database. These entries tend to consider the different gender equity instruments available and try to make a case for the implementation of a single one or a combination of several. However, the evaluation of specific cases which would involve a clear empirical component is less frequent if we consider that the quantitative and qualitative techniques total approximately 40% of all entries. As the proportion between policy entries and all entries in the GSD shows, empirical research within the policy field remains below average while non-empirical research is slightly more frequent in the literature on policy than on other topics.

Empirical research	PE (%)	All Ts (%)	Ratio PE/ATs
Non empirical research	59.0	50.6	1.2
Empirical research. Quantitative techniques	11.4	17.9	0.6
Empirical research. Qualitative techniques	19.7	22.7	0.9
Empirical research. Quali-quantitative techniques	9.9	8.8	1.1

Table 9: Distribution of type of research carried out in the GSD literature

With respect to empirical analysis, qualitative methods are more frequent than quantitative methods. Despite the relevance of quantitative methods – often highlighted in the political discourse of mainstreaming – and the fact that the evaluation of policies generally also tends to be linked to quantitative data, (in terms of accurately measuring the implemented action), qualitative methods are the preferred research approach of the authors in the GSD literature.

While statistical information is frequently used in order to provide introductory information about the country, the population or the institution of reference, gender indicators are scarce.

As mentioned above, there is a gap in the evaluation literature in terms of specific types of measures and tools. Few studies review similar cases and compare their methods and success in order to provide information about the utility and efficacy of the policy measures.

Approach	PE (%)	All Ts (%)	Ratio PE/ATs
Conceptual	42.9	39.1	1.1
State-of-the-art	51.9	40.4	1.3
Compilation of statistics	25.9	20.7	1.3
Building gender indicators	5.6	2.8	2.0
Empirical research. Quantitative techniques	21.3	26.7	0.8
Empirical research. Qualitative techniques	29.6	31.5	0.9

Table 10: Distribution of methodological approaches among GSD entries

A variety of qualitative methods is reflected in the topic gender policies in the GSD. Interviews are the most common technique involved, often used to reflect the experience of the participant in the implemented policies. This type of analysis is frequently complemented by other empirical and objective measures, such as statistical information, in order to reinforce the findings of the study.

The second most frequent technique used is the case study of an applied positive action in a specific institution. Other qualitative techniques such as observation and biographical research are used to a much lesser extent. Finally, it is important to highlight the scarce use of software tools in the qualitative analysis.

Qualitative techniques	PE (%)	All Ts (%)	Ratio PE/ATs
Biographical research	12.3	17.6	0.7
Case studies	25.8	15.4	1.7
Content analysis	19.6	15.4	1.3
Interviews	64.0	64.8	1.0
Observations	15.7	15.2	1.0

Table 11: Distribution of main qualitative techniques used in the GSD literature

According to the distribution of data, a typical quantitative study on gender equality policies utilises descriptive statistics and a cross-sectional perspective. Both techniques are involved in describing the country or regional context as well as providing descriptive results of case studies. These approaches can also be linked to the state of the art research and the use of official data from statistical units.

Quantitative techniques	PE (%)	All Ts (%)	Ratio PE/ATs
Representative sample	59.1	57.0	1.0
Micro-data	41.7	48.6	0.9
Longitudinal/cohort	7.6	8.2	0.9
Multivariate analysis	25.7	30.8	0.8

Table 12: Distribution of main quantitative techniques used in the GSD literature

4. Measures for Advancing Women Science Careers

In the following section we discuss policies and programmes for supporting women's scientific careers. The whole field of career development centres on the core issues of promoting women in science. The well-known, albeit misleading, metaphor of the "leaky pipeline"⁴ bears witness to the fact that women are more severely under-represented the higher they climb on the career ladder. When entering higher education, women constitute the majority in many countries, and yet it seems that at each consecutive stage, from graduation to PhD to full professorships, more and more women drop out.

Women disappear from the science career path between one qualification phase and the next. The PhD level is of particular importance given that there is a tendency to work alone, bound to one doctoral advisor. However, integration into the scientific community, support networks and positive feedback are important factors that facilitate the successful completion of a PhD. Women are usually less embedded in existing networks and are less encouraged to pursue their doctorate degree; candidates with a low institutional integration and unfavourable tutoring relations are especially vulnerable for "cooling out" processes.

Likewise, the years of exclusive dedication to a science career, especially at the PhD and Postdoc level, coincide with the fertile biological age of women. Together with the uncertainty of the whole science career, which is characterised by instability and high levels of dependency until a relatively late stage, the result discourages women from remaining in science. Last but not least, the availability and dedication necessary for a successful science career is modelled on the ideal male career unbound by any other social obligations (EC 2004b, p.19). In comparison, women have proportionately more care responsibilities to fulfil which prevents them from showing equal dedication to their science career as men. The lack of child care facilities and general prejudices against women scientists with children are other major obstacles.

Women's science careers have several common features that inform to different degrees the promotion measures described below. In the past⁵, women careers were described as slower than those of their male colleagues; the mean age for PhD and Habilitation was also older. Furthermore, the literature has consistently reported on the less stringent career planning of women in science, being more dependent on opportunity offers. However, more recent research reveals that the age, duration and career planning of women are more aligned than ever to those of their male colleagues. Another important differential factor concerns the self-conception of ability of women in science. The more defensive self-presentation, a more modest dealing with competitive situations and the underestimation of one's own capabilities are well-established facts in the socio-psychological research literature (Eccles 1987, Abele 2002).

Policy addresses these issues to different degrees. Consulting the literature, one can generally distinguish between three main areas where large-scale programmes have been implemented over the last decade in Europe: first, career and professional development programmes that involve all sorts of coaching and training activities that target the personal skill level of women in academia. Then, a second bundle of measures offer stipends and position scholarships specifically geared to women in order to reach the next qualification level, either PhD or Habilitation for full professorships. And third, among the better-researched topics are women support networks, especially mentoring initiatives. Except for the stipends and scholarships which operate at a more structural level, both skills training and support networks foster women's careers at individual level.

⁴ Misleading because this metaphor suggests an overly linear approach to the career path that does not contemplate the many interruptions and re-entries (i.e., after maternity leave) possible. It also wrongly suggests that all scientists advance at an equal pace while policy attention has to concentrate mainly on measures to patch up the leaks without considering differential necessities within science careers.

⁵ See for the following overview Lind (2006a), and *Beyond Bias and Barriers*, 2007

4.1. Career Training & Development

Geoff Davis delivers an example of the importance of professional planning for the post-doctoral level in the US where explicit planning at the outset of an appointment was related to higher satisfaction and higher publication and grant proposal rates (Davis 2005, p. 12ff; see also *Beyond Bias & Barriers*, p. 77). Although this survey did not target women-only professional development programmes, it allows us to appreciate the importance of more strategic planning skills for advancing in a science career, the type of skills that are precisely covered in career development seminars.

A large-scale career development initiative *Anstoss zum Aufstieg* [Impetus to Advancement] was implemented in Germany from 2001 until 2005 (see Dalhoff 2006, Färber 2007). The German Ministry of Education and Science commissioned the *Centre of Excellence Women and Science* (CEWS) to conceive and deploy a series of training and coaching seminars for highly qualified women scientists. The goal of the programme consisted in increasing the percentage of women in top leadership positions in universities and research institutions. In order to reduce vertical segregation, a series of career development seminars were conceived in order to help women with a completed Habilitation to secure a full professorship. In addition, post-doctoral women researchers were given support to attain a junior professorship or a professorship at a university of applied science. The focus of the career training was on profiling the scientific qualifications and dealing with the specific framing conditions of scientific work for women. The budget at the project's disposal was roughly 1 million euros, with 75% provided by the federal government and the rest by private sponsors (L'Oreal) and participants' contributions. Of the 1,007 applicants, 706 participants were finally selected. Over two years, a total of 52 seminars were held with approximately 14 participants each, clustered according to the "big" disciplinary divisions between the humanities, social sciences, economics and law, on the one hand, and the natural science, engineering and medicine on the other. The seminars operated with several modules including: (a) role play of the appointment committee, (b) the preparation of the candidacy presentation, (c) coaching, (d) support for preparation of candidacy documentation (e) networking (f) inside view of established professors (g) dress advice. In addition to the seminars, three individual coaching sessions were offered, one held during the seminars and two that were carried out at a later date.

The programme was supplemented with an evaluation study (Lind & Löther, 2006). A questionnaire with 134 items was distributed to participants shortly after the seminar and then again after six months. The second stage of the questionnaire, distributed as a postal survey, had a relatively high return rate of 70%. The questionnaire included extensive socio-demographic and professional information in addition to the general evaluation of the seminars and eventual changes in the participants' careers. The authors are quite cautious about making any strong claims for the effectiveness of the programme, especially since many appointment procedures in higher education take longer than six months, that is, longer than the period between the end of the seminar and the second survey. Nevertheless, within the first six months after the end of the programme, 38 participants had been appointed to full professorship positions, 13 of which were life-time positions. In general, the participants were very satisfied with the seminars and would recommend them to their colleagues. The "role play" of the appointment commission was the most highly valued seminar module. The training of competences, networking, and coaching in relation to their qualification profile was considered as most useful. Although 78% of the participants had not had any coaching sessions before *Anstoss zum Aufstieg*, 82% valued them as a very useful instrument for their individual career planning. However, within the six-month time span, no large changes had occurred in relation to the professional status of the participants: for 74% it remained the same; the rate of activity for participating in appointment procedures also remained quite stable. Those who were active before the participation of the seminar were also the most active afterwards.

As part of the 6th Framework Programme, under the Science and Society priority a follow-up project called "Encouragement to Advance – Training Seminars for Women Scientists" (ENCOWOMSCI) was initiated by CEWS (Lipinsky, 2009a; Lipinsky & Tölle, 2009). The overall goal was to repeat the German experience at European level and offer seminars on the professional preparation of women scientists for appointment procedures at universities in selected countries. The Commission granted

428,080€ for a 27-month project in order to prepare and conduct 12 seminars for a total of 112 women scientists (selected among 152 applicants) between April 2007 and April 2008. The participants of the seminars came from the Netherlands, the Czech Republic, Belgium, Austria, Switzerland and Germany, countries where women scientists are strongly under-represented in Grade A positions. Evaluation included three data sets consisting of the application form and two questionnaires, one during the seminar and a second one distributed four months afterwards. In addition, qualitative interviews were held with 11 participants over the phone (Tölle 2009). The project results demonstrated the importance of taking into account not only country- but also discipline-specific factors for promoting science careers. The importance of professional and disciplinary cultures was stressed (Hubrath 2009, p. 67). It is interesting to observe the changes in ratings on the usefulness of the different aspects directly after the completion and 4 months afterwards (see for the following Lipinsky 2009b). While “argumentation strategies with the appointment committee” were rated the most useful during the seminar (66.7%), they received the sharpest decrease (-16.7%) in the second survey, albeit still being the most valued item. Similarly, only 55.7% of the participants rated “personal consultation with trainer” as very useful four months after the training event, while 66.7% rated it very useful right after the seminar. The sharpest increase occurred with the item “training and stress management and overcoming stage fright” which rose from 19.2% to 28.7% four months later. In general, the quantitative and qualitative material shows that participants were highly positive about the seminars: 94.9% felt encouraged by the seminars; four months after the seminar 83% confirmed that participation was a valuable experience and 88.9% stated that they would recommend it to other women scientists in similar situations. Due to the multiple factors that come into play in appointment procedures, however, neither success nor failure should be attributed to the training seminars. What remains, therefore, are the subjective impressions of participants of feeling encouraged in their career ambitions and skills.

Liisa Husu and collaborators report on a similar FP6 programme called “ADVANCE” (which is different from the aforementioned Encouragement to Advance). The project ran from 2006 to 2008 in a cooperation between six European universities from Poland, Finland, Austria, Bulgaria, and the Netherlands. It combined personal coaching with mentoring and a summer school for supporting female scientists in acquiring research and career management skills (Husu *et al.*, 2009). Originally planned to reach women scientists from public institutions and private research, only 1 of the 33 summer-school participants came from the private sector, the rest being employed by public institutions. Furthermore, 18 researchers participated as mentees. Apart from the positive impact at individual level (increase in motivation and self-confidence, acquiring professional and management skills, more knowledge about the gender aspects of the science system, etc.) the project generated awareness among several participating organisations which now aim to establish or expand mentoring programmes. The comparison between the different countries underlined the importance of the national and professional specificities between participants.

The experience of these career-development seminars targeting women scientists exclusively mirrors the results of the value of women-only training seminars at large. Willis & Davis (1997) conducted a survey on the experiences of UK women with women-only training courses across all occupational sectors. 1.452 questionnaires were received (42.2% response rate) of women who had participated in these kind of training seminars. In general, women identified more advantages than disadvantages, the most important advantages listed being that: (a) women's point of view is heard, (b) similar issues arise between participants, and (c) women can explore issues especially relevant to women. The positive effect of these exclusive courses was that women's confidence increases and they feel more able to express their views and to take risks, among other aspects. “The majority of women believed that they gained benefit from women-only development courses and that their learning was enhanced by the single-sex nature of the courses. A substantial majority of women with experience of women-only development training courses would recommend them to other women.” (Willis & Daisly 1997, p. 60). See also point 6.2. Single-sex education.

Monks and Barker (1999) report on a two day management and development course undertaken for women academics and administrators at Irish universities during 1996/1997. An evaluation undertaken immediately after completing the course and 1-2 years after completion generally showed a very positive response from the participants. 95% of those attending rated the course content and delivery

upon completion as “excellent”. The questionnaire sent out to 53 women after 1 year of completion was answered by 24 women academics. Most responses identified the main outcomes of attending the course with a clearer understanding of “women in universities” and “ideas on how to progress”. Also, respondents stated that due to the training, they had shifted priorities away from administration and teaching and more towards research as a central aspect of their academic career. None of the respondents reported changes in their career, although many of the participants claimed to have joined a committee or applied for a particular position. Participants also stated that they had made improvements in their own time management and prioritisation of tasks as a result of attending the training courses.

Rosemary Brown (2000) sums up many issues and points raised so far. In reviewing efforts of women-only career training in the UK during the 1980s and 1990s, she states that participation in these programmes have been highly effective at individual level. Women feel encouraged in their career aspirations, gain self-confidence, appreciate networking with colleagues in similar situations and acquire a deeper understanding of university and research organisation and structures. However, due to their partial success and the generally low increase of women to top positions, the effectiveness of these measures beyond the individual level is questioned. Previewing the results obtained in career development projects implemented much later (such as the CEWS lead projects), Brown underlines already in 2000 the fact that end-of-course evaluations typically record a high level of satisfaction with content and delivery at a personal level (longer-term benefits in terms of increased confidence, clarity of focus and understanding of the system), while they do not result in broader institutional change. Hence the demand of Devos, Mclean & O'Hara (2003) to embed women's career development activities into broader agendas of institutional change.

Austria reports on a series of coaching seminars called *fFORTE_Coaching* (Wroblewski *et al.*, 2007, p.218ff.). The overall goal consisted in strengthening the participation of female scientists in European research projects, especially FP6. The two coaching seminars carried out in 2003 and 2004 were structured around (1) management skills, (2) interdisciplinary communication and (3) gender awareness raising. A total of 75 women across all disciplines participated. The interdisciplinary mix of the participants revealed above all the need for discussion and exchange between academic fields; it also underlined the difficulties already documented in relation to other Austrian initiatives such as *Gender IT* or certain international fellowships (see the overview of the fFORTE initiative in the *Box* below) to work in an interdisciplinary fashion. Wroblewski *et al.* (2007) strongly argue that true interdisciplinary work has a strong transformative potential for the technical disciplines involved but is also very hard to achieve.

fFORTE – Frauen in Forschung und Technologie

The Austrian fFORTE initiative *Women in Research and Technology* provides a singular case in terms of a coordinated and comprehensive approach to women and science. The overall goal of fFORTE is to increase the percentage of women in scientific and technological professions by making professional trajectories more attractive and by providing better access to these fields. Since its inception in 2003, fFORTE has integrated a variety of individual measures broadly grouped according to:

1. structural measures, such as integration of interdisciplinary research at universities or gender-impact assessments of national research programs
2. qualification and career measures spanning secondary (see p. Error: Reference source not found) and higher education for improving access (*MUT, FIT, IMST*) and further qualification of women (*ditact_women's IT summer studies*, Hertha-Firnberg positions, *APART stipends*, international fellowships)
3. training measures that include mentoring activities but also awareness raising of university and research managers (mentoring, coaching, *fFORTE_coaching*, gender training for teaching staff and HR personnel)
4. awareness measures such as awards to make women's achievements in science more visible (women science and technology day, *FEMtech*, *biografiA*, women environmental-technology award)
5. accompanying research programmes in order to assess the impact of the devised initiatives (impact research, gender research program *GENDER IT*, evaluation of national science and funding processes)

fFORTE is singular not only insofar as it conceives a whole battery of gender policy measures in an integrated way, starting from secondary school moving through higher education and in the private research sector, but also in the way it is organised. The initiative is coordinated by an inter-ministerial group comprised of members of the ministry for education, science and culture (bm:bwk), the ministry of economics and labour (BMWA), the ministry of traffic, innovation and technology (BMVIT) and members of the research and technological development (RFT). According to Wroblewski et al. (2007, p.235), this coordinated effort across several ministries enables structural changes due to the synergies made possible. The connection to the ministry of economics and labour (BMWA), for example, guarantees a much stronger involvement of the private sector in these gender equity efforts than is usually the case.

Box 2: The Austria fFORTE initiative, see Wroblewski et al. 2007, pp.175ff.

Various chapters in Dalhoff (2006) present further career development initiatives, one at the University of Göttingen in Germany (Cornelius 2006), a German career training agency called "Uni-Ruf" (Schön & Weiss, 2006), and a career development initiative at the University of Graz in Austria (Hey & Wieser, 2006). Despite differences in content delivery (online coaching at the University of Göttingen), seminars and slight variations in the concrete target audience and objectives (career planning, coaching for appointment committees, time management skills, knowledge on science system, etc.)

these initiatives also confirm the positive impact for women scientists in terms of motivation, efficiency and self-confidence.

Apart from direct career training and development initiatives there exist so-called “returning schemes” that aim to facilitate the re-entry of women into the labour market after a career break. Interestingly, the eight entries listed in the GSD all pertain to the UK. None of the listed publications directly treats women returnees in science or higher education; rather they are directed towards the UK High-Tech industry. Phipps (2008, pp. 83ff.) gives an overview of different courses offered to women returning to the SET labour market in the UK. Herman & Kirkup (2008) report on a 100-hour Open University course using ePortfolios to support women returners to SET. Equalitec (2005) finds evidence of barriers and limited opportunities for women who want to return to their ITEC jobs. The study has shown that women returners are not a homogeneous group and that the length of their career break appears to play a key role in the re-entry process; the longer the break, the greater the impact of the course. Linked to these, career breaks are found to counteract career development due to the lack of support mechanisms such as flexi-time schemes and more specifically, part-time work and insufficient training.

The discussed staff- and career-development programmes address the issue of vertical segregation in science careers. The first publications on career services revealing the general lack of research appeared during the 1990s (Coles & Maynard, 1990; Willis & Daisly, 1997). The more recent evaluations described previously testify to the high positive impact of these programmes at individual level. Problematic issues are raised specifically in relation to the difficulty of holding women-only seminars which easily stigmatise women as a disadvantaged group, reinforcing rather than undermining certain deficiency stereotypes. Hey & Wieser (2006) note how the rise of the gender mainstreaming discourse is currently used to discredit these affirmative actions as outdated. Despite the negative image of these women-only career development projects, the benefit for women participants is established as a clear result.

In addition to this well-rehearsed critique of positive actions, another issue relates to the “uneasy” objective of “making women adjust” to the male-dominated scientific culture. The positive individual effects are often contrasted with the need for a deeper, institutional change of the male-dominated science culture at large. Career development for women scientists needs to be combined with changing science and should not be modelled according to male-shaped job and life patterns (de Vries, 2006).⁶ The Lower-Saxony assistant programme might be a point in case which apparently tried to combine personnel development strategies with more encompassing university management strategies (Mertel & Karsten, 2003); science policy relates here to structures and individuals. The only critical voice found in the GSD states that women's promotion programmes actually stabilise vertical segregation by routing women to dead-end jobs in the university (Lösch-Sieveling 1994).

Gaps

A crucial gap in the available literature concerns the lack of knowledge on specific disciplinary career paths, advancement and obstacles. Research on appointment procedures and scientific excellence from the Netherlands showed that “implementation of very general policy measures targeted at academia as a whole is not the best way to obtain a gender-balanced workforce in the upper echelons in universities” (van den Brink, Brouns, & Waslander 2009, p. 39). In contrast, measures that take into account disciplinary differences seem to be a more promising alternative in the long run. Apart from the mentioned EU projects, this was also emphasised by research in Germany where the percentage of PhD promotions varies considerably between disciplines. While in more feminised areas such as humanities and social sciences women drop out in higher rates at the PhD level, in male-dominated areas such as engineering, fewer do. The reasons why this might be the case are summarised by Lind (2006a, p. 7), pointing to the importance of considering specific discipline measures to advance women in their science careers.

⁶ A review of current research on women-only staff development specific to the Australian context is available in Tessenes (2008). See also Devos, Mclean & O'Hara (2003).

Relative little is known about returning and re-entry schemes, after maternity leave for example. Returning schemes have been analysed mainly in the context of the UK and SET professions but not explicitly in relation to research and higher education.

Little research exists on the relation between career planning and professional success. The factors related to professional success might be less related to career planning and more to the value attributed to past experiences. Given that self-attribution of ability is a particularly important factor in women's science careers, the interplay between career-planning initiatives and self-evaluation and ability requires further research.

4.2. Qualification Stipends, Scholarships & Positions

In the following section we will review the main entries in the GSD that deal with scholarships and stipends for advancing women's careers. A fundamental difference from the perspective of women's promotion relates to measures that support women in reaching their next qualification level in the form of stipend versus programmes that create "fixed" PhD positions. As the literature will demonstrate, the latter is usually preferable since it provides a better integration of the PhD candidates into the institutional arrangements including the scientific community and support networks. The focus in this section is therefore on temporary programmes that support the advancement of science careers for women during a specific period of time – whether they are tied to stipends or positions within departments – for research (PhD or Habilitation level) or other qualification-related measures such as acquiring teaching experience. Initiatives where earmarked money has been used to assign fixed and full professorship positions will be reviewed in *section 4.3*.

Although many individual scholarships and qualification measures indeed exist across Europe, the following paragraphs only take into account the evaluation literature available and published in the GSD.

Kirscher (2004) offers a detailed report on the evaluation and controlling of the measures for the advancement of women in science in Bavaria. The evaluation of the programme was carried out by a full-time position (during 26 months). Specifically, 5% of the overall budget was reserved for the monitoring and supervision of the initiatives. Besides the actual beneficiaries, the evaluation encompassed the university equality officers and university management. It involved explorative interviews, a written questionnaire of the equality officers / women representatives, a written questionnaire of those who received the stipends and guided interviews of the representatives of the University management. The programme had several target groups:

- Graduates of Fachhochschule that wished to initiate a PhD
- Doctorates finishing their PhD
- Women with work experience who wished to qualify for University teaching by acquiring a PhD
- Post-doctoral positions preparing a Habilitation
- Fine arts students continuing their oeuvre
- Post-habil women who had finished their Habilitation but were waiting for a full professorship

The author reports a generally good reception of the stipends (no matter at which qualification level) which outweighs the negative "stigmatising" aspect of these support measures as "women quota". Comparisons are made with "normal" scholarships such as the DFG-stipends which are usually more highly valued. One danger mentioned concerns the tendency of granting committees to "channel" women into HWP scholarships, thus indirectly "liberating" the more highly valued DFG stipends for men. Beneficiaries criticised the economic donation of the stipends which did not include the compulsory health insurance; lectureship appointments were not remunerated either despite

considerable additional time investment. Beneficiaries recommended the conversion of the stipend into a real, temporary position. Since the evaluation was still in progress at the time of the publication, no “final” judgements on the success or disadvantages were made. One central aspect underlined by the evaluation reports is the fact that the scholarships are managed by the women's representatives in each university, who have no competence when it comes to the allocation of “real” positions.

Stewart & Schindler (2004) report on a lectureship programme for women in universities of applied science (*Fachhochschule*) in Bavaria that took place from 2001-2006. Candidates for a full professorship need a PhD, five years of industry work experience and a proven track record in teaching experience. The programme aimed to increase the percentage of women professors in universities of applied science by providing them with opportunities to pursue a PhD and above all, to gain practical teaching experience through lectureship appointments. The accompanying evaluation study used a survey, direct interviews with beneficiaries and interviews with representatives of the university management and equality officers. The participants evaluated their teaching experience positively, especially the possibilities of coaching, networking and mentoring that accompanied their lecture-duties. From the viewpoint of the university management, the programme is effective since it gives women the chance to acquire teaching experience, a necessary precondition for the successful appointment candidates. In the second survey, carried out 5 years after the start of the programme, more than half of the participants had applied for a full position, 12% of whom achieved a full professorship and another 12% of whom were on appointment lists (Stewart 2006). The teaching competence gained with the lectureship programme has been decisive for these successful applicants. The programme thus taps into a new reservoir of qualified women with on-the-job experience for a university career path.

Körber-Weik (2004) reports on a similar lectureship programme called Mathilde-Planck-Programm in Baden-Württemberg, Germany. In comparison with other support measures (PhD stipends, etc.) within the broader equality framework (HWP), the actual number of appointments to full professorship positions for women is higher. The low cost (one stipend is usually below 10,000 €) of these “scholarships” makes this measure highly efficient. In relation to the other measures offered by the programme (PhD scholarships, getting work experience, skills seminars), the lectureship stipends appear as the most effective and efficient. Since its inception in 1997 up to October 2010, at least 120 full women professorships have been appointed in relation to the programme.⁷

A similar experience is available in the Netherlands, the so-called ASPASIA programme (Visser *et al.*, 2003; Bosch & Potting 2001; Donselaar 2006). Under this programme, female assistant professors (or junior lectures) were able to apply for funding of a four-year PhD research project or a two-year post-doc research project. In a first call, instead of the foreseen 15, 68 women were promoted, bringing the percentage of female associated professors from 8.5% to 11%. The large number of highly-qualified applicants alerted universities to the under-use of women's potential; however, it is not clear how the scholarships were valued by the scientific community at large and what happened in the long run to the women's scholarship holders. Apart from the ASPASIA programme, Donselaar further mentions programmes such as Meervoud or the incentives scheme Veni-Vidi-Vici (2006) which apparently have been evaluated, yet without citing concrete sources or reports.

Austria has experience with several stipend-based support measures (see Wroblewski *et al.*, 2007, p.295ff): the Charlotte-Bühler programme (since 1992) provides financial support during a maximum of 24 months to women scientists that wish to do their habilitation; in contrast, the Hertha-Firnberg support programme (since 1998) aims to support women in the early stages of their career or when they return after maternity leave to science for a period of up to 36 months. These programmes intend to give women the opportunity to concentrate on their scientific career by providing financial security during a certain period of time. An online survey (N=239) was carried out with the participation of the different stipend programmes including 97 applicants whose proposal had been rejected; also including stipends of the APART (Austrian Programme for Advanced Research and Technology) action which supports both men and women at the postdoctoral level. Wroblewski (2007, p. 299) documents a wide variety of background information on the participants, such as disciplinary

⁷ See http://apollo.fh-nuertingen.de/~lakof/01_extern/15_foerderprogramme/fr15x00.htm

distribution, access to support measures, motivation to participate, professional situation, international mobility, integration in the host institutions, interruptions of stipends and professional trajectories, among others. Results concerning the evaluation of the support measures by beneficiaries proved to be most interesting. In general, participants were satisfied with the stipends and the opportunity to dedicate their time fully to research was valued very positively. Critical points relate to missing accompanying measures such as specific training and coaching for effective publishing and career planning. In addition, the unsatisfactory institutional embedding was a recurrent negative element. Stipend-holders have a temporary, “external” status that does not guarantee their integration into the university. In this sense, Wroblewski *et al.* (2007, p.349) contend that the mentoring character of these programmes should be strengthened in order to achieve a better integration of the stipend holders into the host institution. Meanwhile, the stipends have a positive effect in terms of qualifications for the beneficiaries and they are in-effective for addressing the general lack of university positions. This is also apparent when considering the DOC-fORTE stipend modality for young female doctoral candidates, especially in the fields of natural sciences, technology, life science and mathematics. While 26 and 35 high quality proposals were received in 2003 and 2004 respectively, only three stipends were conceded.

In 1998, Denmark launched a research funding programme called FREJA (Female Researchers in Joint Action). It ran in parallel to the broader initiative towards gender equality in science put forward by the Minister of Science, the so-called Jytte Hilden 11-point plan (see Videnskabsministeriet 1997; Kjaergaard 1997; Hilden 1997; de Coninck-Smith 2000). The participation of women tenure staff is persistently low in Denmark. The FREJA plan was an equality initiative to distribute DKK 78 million (€10.5 million) in research funds among qualified female researchers (Koeller 2001). It did not exclude men, but it did openly state that women would be given preference if two candidates were equally qualified. 327 applications for a total of DKK 2.2 billion were submitted and only 16 research projects were selected to share the funds. Koeller (2001) interviewed some of the successful applicants and noted that because competition was fierce, the negative stigma of “women quota” could be countered. From the interviews, it also emerged that these grants help women scientists to get funding and recognition for their interdisciplinary projects, often off the radar of the scientific mainstream.

Christensen & Fox Maule (2004) undertake an evaluation of the FREJA programme and note that it has helped universities to sustain their younger female researchers. However, relative inequalities between men and women tenure researchers are still a reality. Women disappear from academia before they receive tenure. As opposed to Koeller (2001), the authors criticise that few female scientists have received funding by the programme. Their main critique targets the lack of structural change: once the funding has been used, no institutional change will have taken place.

Along the same lines, Rosenbeck criticises the general lack of structural change at the institutional level in Denmark (2000, 2003a, 2003b, 2003c). Despite the FREJA funds, the proportion of female researchers remained extremely low. The success rates of FREJA was 3.5%, thus competition was very steep. However, overall allocation of funds in Denmark was very unequal: the National Research Council for the Humanities allocated DKK 4.95 million to women and DKK 44.9 million to men during the period 1998-2002. She believes that various research strategies have, as a by-product, increased inequality. One of these was the “researcher recruitment plan” from 1985 to 1992, during which the proportion of female adjuncts dropped from 21% to 19% (2003c).

The German *Lise-Meitner* programme, supporting the Habilitation of women scientists, has existed since the 1990s; it is considered a pioneering initiative for these types of qualification-related measures (Lind 2004). During its thirteen years of existence, it has supported more than 280 scientists. Women with children are given special consideration and are offered special child support supplements and part time study arrangements. The evaluation is based on an online survey among the beneficiaries and an interview with experts. Evaluating the impact of this Habilitation support measure, the increase in completed Habilitations and full professorship positions in *Nordrhein-Westfalen* (Land) is compared with the rest of the Germany. While the proportion of women with Habilitation clearly exceeds the country-wide average, there is no corresponding increase in full professorships compared to Germany at large (Lind 2004, p. 140). The study concludes that the scholarship programme has been very successful at a personal level, given that most beneficiaries

have completed their Habilitations. However, these do not result in a real integration into the scientific community or in a real increase in achieving full professorship positions. Women complete the programme being highly qualified, motivated and productive, but do not receive a call for a final position at university. Metz-Göckel sustains (2007a, p. 123), on the contrary, that given the overall reduction of full professorship positions C3 (298 positions fewer) and C4 (78 positions fewer) from 1994-2004 in NRW, even the slight increase in the percentage of women professorships is a success. Negative aspects in the evaluation study point to the short duration of the programme which did not coincide with the real duration of the qualification. Moreover, only 40% of the participants ascribed a positive impact to the scholarship in appointment procedures, compared to 37% who attested rather little influence.

Indirectly, Peschel & Höppel (2008) argue that the financial support of the habilitation programme for the women of the *Land* Baden-Württemberg, launched in 1997, was insufficient. The *Margarete von Wrangell-Habilitationsprogramm*, therefore, was combined with accompanying measures such as mentoring programmes.

In general, the literature shows that scholarships are an invaluable instrument for reaching the next qualification stage. However, they do not guarantee actual integration into the scientific community nor do they exhibit any impact at the organisational level of the research institutes or universities. Often, the temporary positions of stipends and scholarships do not lead to a fixed position. On the contrary, considering the structural change of reaching a sustainable increase of women in science, financial support through the creation of concrete positions would be preferable. As Krimmer *et al.* (2004, p. 27) note, the financing of fixed positions (such as assistant professorships for example) at a university institute is the most secure path to full professorship. A similar conclusion is available from Löther & Mühlenbruch (2002, p. 9): evaluations of programmes undertaken in Hamburg and Lower-Saxony show that direct positions in institutes are more successful for integrating women into academic networks than stipends. Wroblewski's (2007, p.205) report on the Austrian *WIT (Wissenschaftlerinnenkolleg Internettechnologien)* initiative further underlines the transformative potential of integrating women support measures directly into the existing university structure. The women-only dissertation programme *WIT* does not only provide valuable support to other female students at the technical university of Vienna, but also encourages by its sheer presence and visibility the rethinking of gender issues among the predominantly male scientists.

Gaps

The presented evaluations of exclusive scholarships and programmes for women document efficiency when it comes to the personal level of supported women scientists. The evidence concerning their impact for increasing the percentage of women, however, is very weak and scarce. This does not only concern the already mentioned difficulty of isolating a causal relation between certain measures and a increase or decrease of women in science, but the supposedly weak impact of stipends and scholarships is also apparent to the grant-holders themselves. They complain about the general lack of available positions, regardless of the qualification levels reached.

In addition, the literature also underlines the fact that support for reaching the next academic qualification level is no guarantee that a deeper structural change will take place. As Metz-Göckel (2007a) sustains, these isolated measures directed exclusively to women are not effective enough. Special interest should therefore be directed towards measures that combine positive measures such as earmarked money with other promotion activities such as mentoring schemes.

4.3. Networking & Mentoring

Mentoring programmes across Europe constitute one of the most widespread and popular measures to foster the incorporation and advance of women in science. The website of the German parent organisation of mentoring initiatives⁸ lists approximately 75 mentoring programmes across varying universities and faculties of applied sciences in Germany. In Switzerland, 39 distinct mentoring projects have been funded in the period spanning from 2000 to 2007. Equally, EU projects such as eument-net⁹ or TANDEMplusIDEA¹⁰ bear witness to the importance of mentoring schemes at European level. In contrast to this evident popularity, the absence of targeted research on mentoring for women in science is striking. The few publications included in the GSD database concern mainly (self-) evaluation studies of certain mentoring initiatives. One has to turn to the US literature in order to embed the European efforts into a wider conceptual framework and previous research efforts.

In a very broad sense, a mentor is someone who takes a special interest in helping another person develop into a successful professional (NAS, 1997). In contrast to an advisor or a role model, a mentoring relationship involves mutual respect, trust, understanding, and empathy – attributes that all imply a certain commitment between the mentor and the protégé over an extended period of time. In this very broad sense, mentoring is found across several fields, such as academy, business or military. Although mentoring traditionally has always been part of academic life, its contemporary revival and popularisation started in the business sector some 30 years ago, receiving a more formal and scientific treatment than usual in the academic circles up to that point. Kanter (1977), Roche (1979) and Lunding *et al.* (1978) provided the classic arguments on the benefits of mentoring as being associated with a successful career development, satisfaction and self-efficacy of the protégé in the private industry. Kram (1985) introduced the important conceptual clarification of the dual benefits of mentoring, entailing the career or technical functions on the one hand and its psycho-social functions on the other.

Although the US research literature over the last four decades has gathered multiple evidence on the potential benefits of mentoring¹¹, it has also pointed out two main challenges of mentoring specifically for women and other minorities in academic life. First, power in organisations is predominantly distributed hierarchically with informal social networks and connections often providing the means for upward mobility. The benefits of the career function of mentoring have been seen in introducing protégés into these informal (power) networks. However, women and other minorities in science do not have the same access to these informal networks as their white male counterparts. This disadvantage has been largely explained by what Witz and Savage (1992) have called “homosociability”, namely the fact that faculty members are naturally attracted to protégés with whom they can identify and who are similar (in terms of character, taste, interests, etc.) to themselves. Since white men occupy the majority of positions of power in business and academe, this implies that they are more inclined to mentor other white men. Women therefore face difficulties in establishing informal mentoring relations. In order to remedy this situation, academic institutions have agreed to implement formal mentoring schemes in order to break the reproduction of these so-called “old boys’ networks”. Several studies thus address the potential benefits or drawbacks between informal and formal mentoring schemes (see Zellers *et al.*, 2008 for an overview).

The second central challenge for mentoring of women in academe relates to the fact that women might experience mentoring differently to men. The traditional mentoring model is based on a specifically male, dyadic “hierarchical power model” (Touchton, 2003) between an experienced, adult mentor and an inexperienced, younger protégé following the script of a “heroic journey” (Chesler & Chesler, 2002). The mentoring relation between males, therefore, is characterised by an instrumental

⁸ <http://www.forum-mentoring.de> consulted 13/07/2009

⁹ <http://www.eument-net.eu/> consulted 13/07/2009

¹⁰ <http://www.idealeague.org/tandemplus> consulted 13/07/2009

¹¹ For recent US research literature review on faculty mentoring see Zellers *et al.* (2008); for mentoring in academic medicine see Sambunjak *et al.* (2006);

approach favouring informational and technical conversations, where competition and challenges are the main ingredients in a process of “heroic mentorship” to forge a successful professional. However, “young women may be more comfortable responding to praise than to challenge, profit more from either non-affronting or non-aggressive challenges, perform better when supported rather than tested, seek peer collaboration rather than competition, and may wish to construct their careers (and lives) around different priorities to those of their male counterparts.” (*ibid.*, p. 51). These differences have led to the exploration of alternative mentoring models such as multiple-mentoring, peer-mentoring, or mentoring consortia (see Chandler, 1996; McGuire & Reger, 2003; Cullen & Luna, 1993). Zellers *et al.* (2008, p. 560), for example, summarise the research on problematic issues in cross-gender mentoring, such as paternalistic dynamics due to gender stereotyping, diverging importance given to a stable work-life balance, feeling wary towards male mentors with psychosocial functions, or sexual tension / romantic interests that can undermine the actual mentoring relation.

As this short conceptual overview demonstrates, there exists a wealth of research on the different dimensions of mentoring in academic life. However, there are no entries in the GSD database for Europe. The existing literature largely derives from two large-scale federal interventions in Germany and Switzerland which explicitly fostered formal mentoring programmes as part of a greater effort to increase the percentage of women in science.

In Switzerland, “Module 2” of its federal programme of equal opportunities between men and women in science dedicated CHF 7 million in grant funding to 39 distinct mentoring programmes covering the period from 2000 to 2007. Universities were obliged to co-finance 50% of the total costs. The funded projects ranged from one-to-one mentoring and peer-mentoring, to one-time courses, lectures and networking platforms and information strategies for potential students. Most projects (18 out of 32) were directed towards doctoral and post-doctoral women researchers, although other academic career stages such as the Master’s level were also addressed. The two periods of the federal programme (2000-2003 and 2004-2007) were evaluated and the results were published in Spreyermann & Rothmayr (2009), Müller *et al.* (2007) and Bachmann, Rothmayr & Spreyermann (2004).

Overall, Module 2 made a huge contribution to the creation of mentoring projects which did not exist in Swiss universities before the year 2000. A total of approximately 1,080 young female scientists participated in mentoring projects over the whole eight-year period. Counting the participants of coaching seminars and networking platforms, a total of 4,500 women in science were reached during these years.

The evaluation of the Swiss mentoring effort was based on self-evaluation reports of the individual mentoring projects, on interviews with selected mentees and a questionnaire administered to the project-leaders (?). The evaluation reports used predominantly qualitative methods, apt to reflect the experiences and opinions of the involved actors rather than statistical signification relations between one or several variables of mentoring relations.

According to the collected statements of the self-evaluation reports and their subsequent meta-analysis, mentees considered networking and the career specific support as the most beneficial. The three most frequently mentioned support measures were:

- (a) “better and more exchange with women at my qualification level”,
- (b) “improved knowledge of the networking possibilities in the scientific community”, and
- (c) “getting a sense of the career and daily life of scientists”

Two thirds of the mentees stated that the benefit of the mentoring received during their scientific career was large or very large. Mostly, mentors were seen as having a direct influence on reaching the next qualification level. In the evaluation of the first programme period (2000-2003), 51% of participants of mentoring projects reached the next qualification level during their one-year mentorship. 75% of those who did attain the next level in their academic career stated explicitly that mentoring was a major contribution to their success. A key recommendation in the evaluation reports highlights the need to align mentoring initiatives with the actual needs of the target groups both in terms of the academic level as well as in terms of the discipline in question.

Similar conclusions have been drawn by Leicht-Scholten (2008), who studied from a comparative perspective to what extent “disciplinary cultures generate specific modes of gender relations or gender imbalances with regard to the recruitment of academic professions” (*ibid.*, p. 163). The study was carried out with participants of female PhD mentoring programmes at the University of Cologne (social sciences), the University of Bonn (life science and medicine) and the University of Aachen (natural sciences and engineering). Questionnaires were sent out to a total of 188 mentees with a return rate of 67.8% (n=120). Apart from a sense of general satisfaction with the mentoring programmes across the disciplines, slight variations could be detected as to which mentoring functions were more valued according to the discipline of the mentee. Mentoring was selected by 50% of the social science PhD students vs. 30% of the natural science students as the instrument from which they had benefitted most. Networking and mentoring were more highly valued by engineering students than students from the other disciplines. This may be due to the low number of women in engineering, which implies that mentees benefit more from networking events where they establish contact with other women PhD students.

The FP7 EU funded project eument-net draws in part on the experiences of the Swiss mentoring initiatives. Project partners included four active mentoring initiatives in Germany (MuT – University of Mannheim and Stuttgart), Austria (muv - University of Vienna), Switzerland (Réseau romand de mentoring pour femmes, University of Fribourg, and Mentoring Deutschschweiz, University of Berne) and the Bulgarian Academy of Science as possible transfer partners. The experience of the participants is available in Füger *et al.* (2008) and Nöbauer & Genetti (2008). For “muv” at the University of Vienna, see also Wroblewski *et al.*, 2007, p.353. There are two basic types of findings: on the one hand, new insights generated through the comparison between the existing mentoring initiatives and on the other hand, the results of a survey on the expectations of and interest in a European network of mentoring programmes.

With regard to the latter, a questionnaire was sent to 770 stakeholders from 37 European and associate countries, with a return rate of 21% from 30 countries. A second questionnaire was addressed to 109 coordinators of mentoring programmes in 15 countries, with a return rate of 36%. The survey was carried out during June and July 2007. According to the initial results of the survey, there is an unequal distribution of knowledge about programmes for gender equality between middle and northern European countries on the one hand, and eastern and southern European countries on the other. This unequal distribution also applies to knowledge about mentoring programmes. Almost 100% of the stakeholders in gender equality in middle and northern Europe were aware of mentoring programmes, and yet this was the case for less than 40% of those in southern and eastern European countries. The results of the survey also provide evidence on the interest in building a network among mentoring programmes at European level (more than 88% of the respondents expressed such an interest). According to the respondents, such a network should deal with the exchange of best practices, sharing guidelines and standards, strengthening women’s impact on science policy and decision making, and so on.

On the other hand, the comparison between existing mentoring programmes revealed several facilitating and limiting factors at different geo-political levels for their successful implementation (Füger & Stretenova, 2008):

- organisational and administrative structures such as gender equality offices appear to play an important role as facilitators in implementing measures. Their role ranges from assessment of specific needs, the dissemination of knowledge and the elaboration of a targeted project design to fund raising and project management.
- Apart from supportive institutional structures, successful implementation of mentoring programmes require committed individuals either in administration and/or the academy who give support. Mentoring programmes benefit greatly from the resources of high-ranking agents who are willing to share their experience and personal networks for the benefit of the programme.
- The presence of a critical mass of potential mentors who are willing to share their knowledge and experience is a decisive factor for the development of mentoring programmes. Even if

programmes do not draw entirely on women mentors, a critical mass of female role models is an important element for successful mentoring programmes.

- The potential mentor's readiness to provide support and to network through alternative channels and in a different setting from traditional, male-dominated structures is also an important factor for successful mentoring programmes.
- It is important to recognise the mentor's activity in the programme, even symbolically, if no remuneration is possible.

Based on the experience of eument-net, an explicit goal consisted in developing quality standards for mentoring programmes (see Füger *et al.*, 2008). Together with experiences from other initiatives, mainly in Germany¹², there exists a solid catalogue of what high-quality mentoring programmes should look like.

Franzke (2004) reports on the evaluation of mentoring programmes for women at universities in Lower Saxony (Germany) which ran from 2001 until 2003. Based on 16 qualitative interviews, the personal benefits in terms of networking are underlined. The author draws attention to the increasing competition between women the higher their position on the career ladder and how this might negatively influence mentor-mentee relations. Franzke (2004b) contends that the organisational potential for change through mentoring projects lies primarily in collaboration and networking among women scientists. However, there is no systematic discussion within gender and women studies on how mentoring can affect gendered structures in universities (*ibid.*, p. 175).

Gaps

The presented evaluation reports paint a reasonably positive picture of the utility of mentoring programmes for retaining and advancing women in science. However, these findings are based largely on qualitative interviews, reflecting the experiences of participants. What is striking is the absence of any negative statements from the evaluation reports – although this “under-estimation” of the real complexities of mentoring relations is a quite familiar pattern in evaluation studies (Eby & Allen, 2002; Tenner, 2004). Especially in the Swiss case, with its large-scale programmes and their evaluation in place, the limits and negative experiences with regard to mentoring programmes are only mentioned in passing (Müller *et al.*, 2008, p. 44).

There appears to be no research that addresses specific aspects of mentoring programmes (such as the role of cross-gender mentoring, mentor matching, the relation between mentoring and other equality initiatives, etc.). As Leicht-Scholten (2008, p. 165) also maintains, there are no studies that examine whether the lack of “natural mentoring relationships” can be substituted by “mentoring projects”. Nor are there any studies – in the European context, to be more precise – that evaluate the chances, risks or limits of mentoring programmes in the different scientific fields. This lack of more targeted research makes it hard to put the existing evaluation findings into dialogue with published (US-American) literature on mentoring.

A further shortcoming concerns the systematic study of the more structural impact of mentoring projects. Mentoring programmes are mainly scrutinised for their benefits at individual level in terms of collaboration, networking and emotional/psychological support. However, none of the reviewed publications scrutinises how mentoring might interact and counter the gendered structures at universities (an impression shared by Franzke, 2004b, for Germany). Wroblewski *et al.* (2007, p. 369) suggest that structural effects of mentoring and coaching programmes are “assumed” on the basis of their embedding in and combination with larger, strategic support measures. However, concrete evidence of structural change was not provided.

There is no research (comparative research) on mentoring experiences in the private sector. Although the business sector contributed considerably to the later popularisation of mentoring in the academy, there is not one single research report on women’s mentoring in the private sector in the GSD.

¹² See the criteria for quality management in mentoring initiatives published by the German Mentoring Forum: http://www.forum-mentoring.de/download/2007_Kriterien_Mindeststandards_Messmethoden_de.pdf

4.4. Measures for Work-life Balance

The issue of work-life balance operates as a major structural constraint on women's careers, and not just in science and research. Xie & Shauman (2003) identified motherhood as the factor most likely to preclude women from advancing in their academic career. In the English-speaking literature the multiple constraining barriers that women scientists with family responsibilities face have been called the *maternal wall* (Williams 2004)¹³. Although work-life and work-family balance concerns men and women, women are usually more affected by its negative consequences. Given that women still carry the main burden of child and elderly care at home, this is not surprising. Thus, having children and pursuing a scientific career is mainly perceived as conflictory by women as opposed to their male colleagues, who do not see their professional ambitions compromised by having children. Interestingly, besides the actual pressure to demonstrate excellence and have children, women identify as a major obstacle prejudices that take for granted the negative impact of children on science careers. What is experienced as a strong obstacle for advancing in a science career is the prospect of having a child rather than actually having one. Research has been carried out to counter the negative stereotypes showing equal productivity between women with and without children. Results, however, are not conclusive.

Given the importance and centrality of work-life balance issues for women and men scientists, it is surprising to find so few concrete evaluations of existing interventions. Flexibility of working hours, compress hours, working from home, parental, maternal and adoption leaves, returning schemes and child care facilities are the targets of many individual HE institutions, if not national legislation¹⁴. The existing policy overlap between national legislation affecting women's entry into the labour market (e.g. including taxation) and a policy specifically targeting women in science might be responsible for the few concrete evaluations found.

Interesting results should be expected from the large-scale study carried out by the Centre for Excellence Women and Science – CEWS on *Balancing Academia and Parenthood* (BAWIE)¹⁵ in Germany. The project carried out a nationwide survey (N = 3,990) on work-life balance of scientists. Combining insights into individual decision-making and organisational structures in German universities, new insights into the impeding and benefiting factors for combining a science career with parenting are expected. The first results confirm that work-life balance issues concern both sexes although women are more greatly affected by the negative consequences of parenthood (Lind 2008a, 2008b).

Module 3 of the Swiss Federal Programme on equal opportunities between women and men provided financial resources of 7 Mio CHF for the creation of childcare facilities for university personnel (Spreyermann & Rothmayr 2009). 219 new nursery places were created. From 2003 to 2007 the available places increased from 130 to 416. The child care module has contributed considerably to improving child care possibilities for university staff by doubling the available places and extending care time, besides other measures. It has been used by two thirds of women staff. Nevertheless, the available offer of kindergarten places does not cover the existing demand: in 8 universities there are waiting lists of up to 10 months. The increasing percentage of women in universities will most likely exacerbate the demand for child care facilities in the future. From the first evaluation report (Bachmann, Rothmayr & Spreyermann 2004), faculty requested childcare during vacations and care that responded to the specificity of academic life (such as congresses).

For the third programme period ending in 2011, the Swiss Federal Equal Opportunity at Universities Programme will include measures and support for dual-career couples. This means that each partner

¹³ For the following overview of the research on work-life balance in higher education and science see *Beyond Bias and Barriers*, pp. 176 ff. & Lind 2006a, pp. 8ff.

¹⁴ See OECD (2006), Ruest-Archambault (2008), also Roloff, Biffel & Löther 2007, p. 26ff (for Austria), for Germany see the list of higher education institutions that obtained the certificate of family-friendly university: <http://www.beruf-und-familie.de/index.php?c=22>

¹⁵ <http://www.bawie.de/>

is actively engaged in developing and maintaining a professional career. Often, these dual-career couples are partnered within the same academic field rather than across fields. Although dual-career hiring policies are of increasing importance in the competition between US higher education institutions to capture talent (Schiebinger *et al.*, 2008), little research on this topic exists in Europe, let alone evaluations in terms of their gender implications (see Rice *et al.*, 2007 for US). Dual-career policies at the university may have a favourable impact on gender equality (*ibid.*). Women are more likely to have academic partners than men; at the same time women are more likely to prioritise their partner's career before their own. In Schiebinger's study, the main reason why women refused an outside offer was that their partner was not able to find a position of equivalent status in the new location (Schiebinger *et al.*, 2008). Active dual career couple hiring policy – although sometimes rather geared as a competitive advantage in the quest for talent rather than for equal opportunities – has clear gender implications in that it encourages equality of careers between women and men.

The literature on dual career couples and work-life balance in general (as reflected in the GSD) is rather fragmentary. Most entries identify the problem or map out coping strategies but do not engage in evaluations of work-life balance policy measures. Behnke & Meuser (2003a) affirm that double career couple research is marginalised in Germany, its focus being the US and UK. The authors also confirm that women usually have to pay much closer attention to the compatibility of their career plans with the total family structure (2003b). Henderson (2004) undertakes a comparison of work-balance policies for academic institutions between the US and Sweden. The analysis is based on the comparison of the state level policies and also of data related to male and female employment and participation in care.

In the UK, the Leeds Metropolitan University and Oxford Brooks University are the best documented with regard to work-life policy experiences (Woodward 2007; Doherty & Manfredi 2006; Manfredi & Holliday 2004). Doherty & Manfredi (2006) report that flexibility in the UK HE sector is rather informal, inconsistent and not monitored effectively. A particular issue of work-life balance within the academy is linked to the fact that academic staff traditionally enjoy high autonomy and flexibility in the organisation of their work, which does not really address the real problem of heavy workloads and requirements to work long hours. Effective work load planning was suggested by staff to be incorporated into explicit university work-life balance guidelines.

Gaps

As stated by Lind (2008a), the two major problems in relation to the work-life balance issue is (a) the tendency to leave men out of the picture and frame it as women's responsibility and (b) to use it as an explanation for the low presence of women in higher positions. The lack of concrete evaluation studies despite the widespread implementation of work-life balance measures is telling. More research is needed to clarify how work-life balance affects men and women differently and to which degree it really can help to improve the position and proportion of women in science. Flexibility of working arrangements and other family-friendly policy measures are key; however these policies alone do not reduce the pressure of having a high scientific track record (Beyond Bias & Barriers, p. 179) nor does their shortage explain the lower proportion of women in higher positions in science (Lind 2008a).

Future research should tackle the evaluation between work-life balance measures, especially the interplay between national policy frameworks and initiatives on the institutional level. Evaluations should take great care to frame the issue not just as an exclusive responsibility of women; the impact of measures has to take into account to what extent they are able to involve men in care responsibilities and to what extent they are able to alleviate the pressure of career performance. Another gap concerns the lack of analysis of the interplay between the vertical segregation and work-life balance issues in conjunction with other structural barriers.

4.5. Concluding Remarks

Recapitulating the literature presented across all sections dealing with 'Advancing Science Careers', several common insights stand out:

First, the importance of differences between disciplines. Considering the sub-topic of career training besides stipends and mentoring schemes, it is apparent that the impact of equality measures in these areas depends on the historically developed specific culture and disciplinary requirements in place. This was consistently reported in EU collaborative projects but also in national projects that undertook comparative research on the differential impact of certain measures across the "hard" and "soft" sciences.

Second, a further shared concern juxtaposes the highly beneficial impact of career measures at individual level with its "weak" structural impact. The available literature leaves no doubt as to the positive effect of career training or mentoring programmes, for example. Even though these positive actions might potentially be stigmatised as "women only" activities, the participating female scientists mostly reported very positive experiences with these types of support measures. However, what is clearly lacking is a more systematic discussion on how individual benefit and structural change might be tied together. Although there exists anecdotal evidence that these individual support measures trigger processes of sensibilisation at institutional level towards gender issues, there is no systematic approach, either theoretically or in the form of empirical research, that addresses how personal benefit and structural change might be interwoven.

The comparison between stipends and direct positions is exemplary in this case. Both measures support women in their science career; although fixed positions have been described as more successful in terms of integrating scientists into existing networks and departments than merely providing economic resources. It is important not only that specific support measures exist, but how they are implemented: where in the institutional hierarchy are they located, which level of the university administration is involved, what commitments are required by whom. The discussion scarcely focuses on these broader and more crucial aspects for advancing science women's science careers beyond the individual scientist.

Third, and in connection with the previous aspect, there are few systematic and integrated policy approaches to women and science (careers). Coordinated efforts that conceive and implement measures along the whole life-cycle (from schooling to university and eventually the transition to the private industry) while also involving a variety of stakeholders such as different ministries, public and private research institutions are clearly the exception (one notable exception is the Austrian fFORTE initiative). Measures for advancing women science careers are often limited in duration and scope, seriously hindering chances for synergies between many isolated efforts.

Fourth, research carried on the worth and merit of career measures is largely descriptive. When comparing research on mentoring carried out in the US and Europe, it is apparent that there is a certain lack of systematic discussion in Europe. There is little thematic-driven research on science careers that carry out an in-depth analysis of some of its aspects; most reports are accompanying evaluative studies that reflect the very logic of the specific programme or measure rather than certain thematic / theoretical questions. The reports are mostly descriptive and do not explain their theoretical assumptions and points of departure. Thus, research in this sense becomes rather repetitive in the problems it addresses and the solutions it proposes. This is not only true for mentoring but also for the other aspects of women's promotion and science careers. This might be partly due to language issues; as noted by the present meta-analysis, comparison between countries is usually limited to specific EU collaborative projects; the rest of the national initiatives usually remain confined to their national languages. Hence, the need for more powerful theoretical work that would allow for more comparative work and the production of new knowledge.

Another striking fact concerns the lack of evaluation reports on work-life balance measures. Despite the centrality of this issue for the scientists involved, there are few entries that directly scrutinise the (non-)impact of certain measures. As mentioned, one reason might be that work-life balance issues

easily transcend the HE sector as it implies regional and often national policies not easily contemplated in small-scale, “project” centred research approaches. However, the necessity for a more complex research design can hardly explain the distinct lack of research on the impact of policy addressing work-life balance issues. Together with the fact that work-life balance is often wrongly used to explain the under-representation of women in higher positions in science, the newly emerging dual-career couple scheme also makes this field an important area of future research.

5. Science Management & Reform

The following section reviews policy targeting the modernisation of Higher Education (HE) and research at institutional level. More specifically, we consider the literature that deals with the gender aspects of these institutional reform processes. Historically, there has been an evolution from positive actions toward mainstreaming (see *Introduction*). Considering the institutional level, this means that important changes have occurred not so much regarding the goals (e.g. raising the proportion of women in higher career positions), but rather the control mechanism deployed in order to achieve them. Several policy instruments, such as the more classical positive actions of “quotas”, co-exist with more recent “mainstreaming” mechanisms such as “incentive systems.” Women representatives or equality officers reflect this change in their shifting responsibilities and tasks.

Recent higher education reform has come under the sway of New Public Management (NPM) strategies. On a very basic level, NPM offers itself as a solution to streamline an apparently inefficient and oversized bureaucratic state apparatus by introducing market logic into the non-market public sector (Hood 1991; Bouckaert & Pollitt 2005). According to the rationality of a “free” market, fostering competition within and between higher education and public research institutes promises to maximise their efficiency and thus the wellbeing of the public at large. In more concrete terms, this means introducing modern management strategies into the relatively independent and self-administered “ivory towers” of science institutions. Rectors and deans receive more power and autonomy to profile their institutions and align them according to market opportunities. The traditional, direct steering approach of public ministries of science and education is deregulated; detailed control of inputs and processes are replaced by control of outputs and results. Thus, the relative autonomy and decentralised decision-making of HE is framed by targets and incentive systems that promise to steer them in the desired direction. This implies the introduction of regulated evaluation schemes and performance measures that hold actors accountable and monitor progress towards set targets. Evaluations of research output or excellence in teaching audits thus constitute not only a means of securing quality but also guarantee comparability, and ultimately competition for financial and personal resources. These overall NPM strategies put paid to the traditional way of doing science, namely unconditional funding and minimal state intervention (see Parker & Jarry, 1995; Prichard & Willmott 1997).

The main question discussed in the “gender” literature now centres on the ways in which NPM might serve to make inroads into the very encrusted and reform-resistant science and HE institutions. Mainly the German-speaking literature discusses the possible benefits of NPM for a more gender-balanced science environment from a theoretical perspective. In contrast, the UK literature, where NPM has a much longer pedigree, reports less on the potential benefits of the new managerialism for gender equity and rather focuses on its gendered impact in the concrete work-life of academics. Thus it appears that the integration of gender into the new steering mechanisms has been considered very differently across the consulted countries.

Identification of obstacles

Before entering the literature on specific policy instruments, special mention must be made of several studies that have approached the issue of equity policies in Higher Education from a more comprehensive perspective. This literature specifically identifies the obstacles that arise when implementing equal opportunities in HE. For example, Barbara Bagilhole (2002), in her study of a pre-1992 university in the UK, raises concerns about the general *in*-effectiveness of previous policy measures. Based on a national survey among UK higher education institutions (Bagilhole & Robinson, 1997) the relative ineffectiveness of existing policy measures is apparent: while 96% reported to have equal opportunities (EO) policy, 80% of the universities also reported that no action was taken after monitoring. Positive action was limited to women-only training and development and advertising. In 2000 she conducted 37 semi-structured interviews including academic staff at all levels of the university. The large degree of professional autonomy, its isolationist, competitive culture and the nature of its management at departmental level have rendered the realisation of EO for women

virtually unattainable (Bagilhole 2002, p. 56). The gap between existing policies and successful implementation is striking.

Similarly, Heward & Taylor (1993) see EO policies as having marginal effect in terms of access and employment in higher education institutions in the UK. The belief in rhetoric of equality, the notion of academic merit as an objective construct and the values underlying the exclusive prestige hierarchy all contribute to the complacent managements. Williamson & Busby (1997) equally identify the strongly-held belief in the importance of individual merit as the main difficulty for universities to move beyond a limited liberal interpretation of equal opportunities (just focusing on the absence of overtly discriminatory practice instead of structural conditions).

Van Emmerik *et al.* (2002) have scrutinised the effects of equity policies at the University of Utrecht in the Netherlands. They describe how non-compliance with EO policies is rationalised either by a “lack of female candidates” or a “lack of positions”. Above all, they detect that without a strong commitment on the part of the university, equity policies have little chance of success. These findings are corroborated by Timmers *et al.* (2007), who engaged in extensive evaluation of equality policies in 14 Dutch universities between 2000 and 2007. Besides detecting a great variety and fragmentation of policies across universities and faculties, they clearly point out that initiatives all too often depend on an enthusiastic individual without a clear commitment of the university governing board and faculty deans who are, in effect, the most crucial agents of success.

According to Bagilhole (2002), the rather formal adoption of EO policies without a clear implementation strategy and resources can actually become counter-productive in that it leads “especially in the liberal context of academia [...] to a conviction that EO 'now exists'” (2002, p.57).

5.1. Legislation

Equal opportunities, positive action, and gender mainstreaming place different emphases on the capacity of legislative mechanisms to promote gender equity. The first perspective sees legal redress as integral to gender equality. The second perspective – positive action – has a more ambiguous relation to legislation. It can be legislated (for example, setting quotas) but it also can occur without legislation (for example, employers encouraging under-represented groups to apply for job positions). The third perspective – gender mainstreaming – has as its primary sphere of action the policy arena, although it might base its policies on legislative developments. It is not surprising, therefore, that the majority of the literature in the GSD as regards legislation can be classified as falling predominantly within the first two perspectives. This does not mean that the literature agrees with either equal opportunities legislation or positive action, but engages with either of them (or both simultaneously) as its subject matter. Where articles deal with more than one perspective, we have included reference to the literature in the section where more weight has been given. For example, Holzleithner (2002) in the case of Austria, discusses equal treatment and positive action. We have included reference to this article in the equal treatment legislation section as this is the main issue of the article.

Equal Opportunities Legislation

The literature in the GSD that refers to equal opportunities legislation tends to evaluate this approach either positively or negatively in terms of its affect on increasing the representation of women in science.

There is a rich literature coming from Austria (Fürst, 1997; Ulrich, 2003; Holzleithner, 2002; Aichhorn, 2000) discussing the implementation of legal measures at universities to fight discrimination. This was the result of the most important legislative measure, the Working Committee on Equal Treatment at Universities created by an amendment of the University Organisation Law in 1990 and established in 1993. Fürst (1997) discusses the Working Committee on Equal Treatment in terms of its objectives (to prevent discrimination against women based on sex – including applications and appeals procedures),

its powers from a theoretical perspective, and its implementation. She concludes that legal mechanisms are not sufficient and measures to overcome prejudice and the conscious prevention of the exclusion of women are also necessary. Ulrich (2003) also discusses the Working Committee on Equal Treatment and examines the reform of the University Organisation Law which became effective in 2004 and saw each university implement positive action. Holzleithner (2002) discusses the legal foundations and the daily practice of equal treatment at universities, as experienced and designed by the members of the working group for equal treatment. She uses a statistical analysis to demonstrate the impact of the legislation as a successive, yet slow increase of the proportion of women in occupation groups and functions at the university. She sees the university reform, i.e. the emphasis on positive action, as a potential threat to the slow but constant progress achieved through equal opportunities legislation. Aichhorn (2000) looks at the promotion of women in scientific work and compares the proportion of women first-year students, degree holders and assistant professors with the proportion of female professors. She recognises the benefits brought by the equal treatment perspective in terms of gender-specific discrimination but recognises how this approach should have had a greater impact on the proportion of female scientists at the highest levels in the university. She blames the increasing shortage of resources and the streamlining of university structures.

In various different national contexts, it is recognised that gender equality in science cannot be achieved by legislation and regulation alone (see Degen, 2001; Aichhorn, 2000; Schömer, 1999; Petroulaki, 2008; Mason, 2004). Degen, (2001) in the German context, criticises the lack of law enforcement and sanctioning mechanisms and the complicated and non-transparent body of legislation as reasons for the lack of women's advancement in the university system. The development of "preventative teams to intervene" or the acceptance of the conflict in relation to gender as the 'norm' are seen as measures that will advance the equality of women in science. Schömer (1999) in the Swedish context looks at the Equal Opportunities Act that came into force on the 1st January 1992. The article highlights the paradox of equal opportunity before the law, specifically in relation to equal pay, "whilst there is formal equality between the sexes i.e. they shall be treated equally, there is still the possibility of the law giving preference to one sex at the expense of the other". The author looks at employers' equality actions (statutory obligations include employers with more than 10 employees having to draw up an annual equality plan) and the Labour Courts Judgement of cases concerning pay-discrimination. The study is an attempt to bring together an analysis of the law (normative elements) and of society (what actually happens) to highlight the inadequacy of the former approach as an answer to gender equality. Petroulaki *et al.* (2008) similarly highlight how legislation in Greece is inadequate as regards achieving equality as sex disaggregated data in education (in terms of students, teachers and those with decision making-powers) shows how women are under-represented in terms of decision-making, physical sciences and mathematics. They note how women academics are concentrated in the two lower ranks of academia whilst female students are under-represented in engineering. They conclude that the state should deconstruct traditional stereotypical images of gender roles. Similarly, Mason (2004) in the UK context looks at how current sex equality laws, e.g. the Equal Pay Act 1970 and the Sex Discrimination Act 1975, have not been wholly effective at preventing discrimination. It is recognised that laws prior to the UK duty to promote equality in the UK, 6th April 2007, only gave individuals the right to challenge discrimination after it had happened. This duty means, however, that public authorities have to be proactive in eliminating unlawful discrimination and harassment rather than waiting for individuals to take cases against them and promoting equal opportunities rather than just avoiding discrimination.

Positive Action

The GSD includes fewer entries regarding legislation in terms of positive action. In the case of France, Gilgenkrantz (2002) highlights the disparity between the legal system in support of women and the reality of the situation of women in science. However, instead of concentrating on legislation preventing discrimination she examines quotas in committees. The article focuses on European measures and goals of the Law of 6th June 2000 which "obliges the lists presented in two ballot proportional elections to be composed of the same number of candidates of each sex". The article

highlights the under-representation of women scientists and science policy managers despite the establishment of the European Research Area which aims to reach at least 40% of each sex on all committees. Alipranti (2008) similarly focuses on quotas as a means towards gender equality and describes the Greek initiative of the Periktion Network (comprised of women scientists and researchers) in collaboration with the "Research and Technology Committee" which proposed suggestions to improve the draft law about the "Institutional framework for research and technology". They aimed to enhance women researchers' representation and equal participation on scientific boards and decision-making bodies by incorporating into the law an article setting a quota of at least a third of women's participation in all national scientific committees. The provisions of the article only entered into force on 1st January 2009 and therefore the article does not look at implementation. Schiek (1998) critiques the positive action approach focusing on 'women's promotion in the scientific area' in Germany highlighting how this approach neglects gender relations. The author explains the legal framework for equality policy at universities considering the different levels of regulation i.e. federal law, state university laws and state equality laws.

5.2. Equality Officers, Committees & Observatories

One of the principal agents for promoting and accompanying equal opportunities at Universities are equal opportunity officers. Similar terms refer to equal opportunity advisors, women's representatives, or equality representatives. Their tasks, regardless of whether they are bound to one single person or group or team of equality advisors, usually include participation in appointment procedures, elaboration of strategic plans for the implementation of equal opportunities measures, provision of data and reporting, management of funds, conceptualisation and implementation of concrete support measures, among others. Women's representatives are not limited to higher education institutions but can be found across many different public institutions where they hold a key position for advancing gender issues. Together with "women in science units", networking or gender observatories, or equal opportunity committees, equal opportunity officers form part of a wider strategic institutionalisation of women's promotion in science. Although the literature usually emphasises the importance of women's representatives for setting gender issues in the day-to-day business of higher education institutions, it also points out the very frequent lack of real decision power that limits their influence.

Steffens, Reichle & Winter (2004) report on the potential impact of equal opportunity officers in appointment procedures. Equal opportunity officers should ensure that female applicants receive the same opportunities as male candidates. The article emphasises the role of unwritten rules and the complex social negotiations during appointment deliberations, for which women's representatives have to prepare themselves well in order to fulfil their mission. Philipp (2003) also analyses women's representatives' factual chances of influencing academic appointment procedures and which situational factors can support them despite their limited power. Müller (2000), in reviewing the gender equality programmes in North Rhine-Westphalia, Germany, underlines the enormous importance of micro-level politics in universities (due to professional autonomy, independence from the state) and hence the role of the equality representative. Although equipped with little formal power, she plays the role of an agent of change and organisational development. Together with Holland-Cunz (1996) all four authors could be said to draw attention to how difficult it is to evaluate the real influence of equality representatives in the light of the informal procedures and silent agreements that are often more important in appointment procedures than the formal regulations.

Schmalzhaf Larsen & Holzbecher (2000) alert how difficult it is for women's promotion measures to affect academic culture by reviewing the achievements of the "Principles for the advancement of women" which came into force in 1993 in Germany. Equal opportunity officers are seen, according to the authors, as those in charge of carrying women's promotion to the core of the disciplines. Andresen (1994) reports on the self-perceptions and experiences of women representatives at the Free University of Berlin on the basis of interviews with 17 women's affairs officers. Cheauré (2000) describes the resistance and provocations that women's representatives usually confront at

universities. The four problematic fields are: (1) the term 'women's promotion', (2) a claim of "unacceptable privileges for women" and that women's promotion means loss of quality, (3) the general climate at universities and the (4) importance and necessity of women's and gender studies.

Bagilhole & Robinson (1997) in their national study of university policies and practices in the UK draw attention to the relatively extended appointments of Equal Opportunity (EO) Officers albeit the few effective resources available to them. 84% of UK universities had an individual at senior level with institutional responsibility for EO; 69% had a consultative forum or committee to discuss EO issues, but only 28% had a budget set aside for EO objectives. Not surprisingly, 42% identified lack of financial and staffing resources as a major obstacle for EO implementation. For a comprehensive action plan, one part-time EO Advisor is not enough (Bagilhole 2002, p. 56).

Max-Planck-Society, Germany.

The Max-Planck-Society operates 80 institutes for the purpose of conducting basic research in the natural sciences, humanities, education and social sciences. Each institute consists of several departments, each headed by a department director, who has a similar status to university professor, but without the teaching load and with better resources. In January 1997, only 5 of 220 directors (2.3%) and only 10 of 182 research group leaders (5.5%) were women. The total scientific staff consisted of 13.7% women.

Since then, the Max Planck Society has taken a number of measures to increase the female staff: assistance with child care, special programmes for promoting women scientists at the group leader level, institutionalisation of equal opportunities officers in each institute with a central opportunity officer located at the administrative headquarters and implementation of a basic plan for the advancement of women with targets for increasing the percentage of female scientists at all levels.

Box 3: Max Planck-Society, Mirbach (2005)

Roloff & Zimmermann (2000) identify the allocation of funds, information management and networking as the central action fields for equal opportunity officers in reform processes of higher education institutes. The contribution includes a quantitative survey carried out in 1999 of all women's officers at German universities (with a return rate of 38%, 116 of the 320 universities replied). Further personal interviews were conducted with 11 men and 14 women across three universities and two science ministers. The self-valuation of the equality representatives shows that they think that they have contributed positively to improve the situation of women in German universities. The women's representatives became important agents in the reform process of HE in Germany, particularly with regard to integrating gender aspects into the new NPM steering strategies. They play important roles in specifying the targets and formulae according to which gender-equity is measured and funds are ultimately distributed. As Roloff (2007) furthermore clarifies, equality representatives are important not just in terms of integrating gender equality into NPM instruments, but also because these reform processes give the women's representative the platform to "point out and sharpen the argument that gender equality can be realised only within the context of reform by enlarging the talent pool, taking up personnel development in academia and contributing to the means of knowledge production" (Roloff 2007, p. 51) However, as Zimmermann (2003) clarifies, the participation of women's representatives in crucial decision processes (between universities and science ministries) where performance (and gender) indicators are negotiated is neither regulated nor self-evident, but highly dependent upon personal networks and idiosyncrasies.

The evaluation study of the Federal Programme on *Chancengleichheit von Frauen und Männern an den Fachhochschulen* (Barben, Ryter, Strub & Hüttner 2006) illustrates the important role that equality officers play in institutionalising equal opportunity agenda in the Swiss Universities of Applied Sciences. Despite the fact that equal opportunity officers could be installed in all *Fachhochschulen*, they criticise their low factual decision power at university management levels. The decisions on HR are made in the management committees of the universities where the equal opportunity agents are not present (*ibid.*, p. 21). However, they have been a decisive logistical component for promoting and advancing individual women's promotion projects. The apparent dangers are that women's officers are isolated in their efforts and that too much of women's promotion stands and falls with the engagement and personal commitment of those dedicated individuals.

Parallel findings emerge from the evaluation report for the Swiss Universities (Bachmann, Rothmayr & Spreyermann 2004a). The equal opportunity officers are the central and unquestionable agents for the implementation of the federal programme at university level as they are responsible for disseminating the programme itself, for making decisions on received funding and to develop concrete projects (e.g. of mentoring or work life balance). During the initial phase of the programme (2000-2003), part of the financial resources available allowed universities to create and consolidate equality officers who were then in charge of conceiving, applying for and co-ordinating, for example, the mentoring projects of the Module 2 of the federal programme. According to the available evaluation reports, the establishment of the equality officers was an important (structural) milestone for enabling other subsequent initiatives such as the mentoring schemes. As the authors argue, the influence of the equal opportunity unit depends to a large extent on its integration within university management. There is a delicate balance between delegating all equal opportunity issues to a more or less formal agency outside the real decision structure of the university or involving it in the actual decision process taken by management (see also Spreyermann, Bachmann & Rothmayr 2004, p.34; Roloff, Biffi & Löther 2007 for similar suggestions in Austria). The fact that university management is responsible for reportings and usually contributes 50% of project financing from its own funds guarantees that gender issues will stay on the universities' agenda. Similar findings are reported by Färber (2000b, p. 250), who contends that gender-sensitive incentive systems strengthen the role of equal opportunity officers in so far as their role as consultants in budgetary decisions is strengthened.

Important insights on the work of the equality committee in Austrian universities can be found in Wroblenski *et al.* (2007, 255ff). Based on four extensive case studies on the equality committees of the University of Vienna, the Technical University of Vienna, the University of Economics of Vienna and the University of Graz, important insights on the strengths and disadvantages of equality work are drawn. A central result from the structured interviews with committee members, deans and other experts is the fact that quality in terms of transparency, accountability, comprehensibility of appointment procedures has improved. Regardless of the gender issues, the work of the equality committee, therefore, has brought about the professionalisation of the appointment routines. This professionalisation often operates, in turn, as the precondition to identify and avoid discrimination. Especially interesting are the findings on the "moment" of intervention in appointment procedures by members of the equality committee. As long as those interventions happen prior to the actual evaluation and selection process in the form of encouraging more women to participate, no consequences are usually expected for the women scientists. However, in the case of conflicting situations where the equality committee actually activates legal measures that reject existing decisions in favour of or against a certain candidate, the consequences for the women involved are frequently experienced as highly stigmatising, apart from being ineffective. In other words, precisely the strongest legal weapon the equality committee has at its disposal proves to be the most ineffective in reality (*ibid.*, p.284). None of the interventions by members of the equality committee made on legal/formal grounds in favour of a women candidate was successful. This confirms that equal opportunity officers are largely confined to operate on an informal basis; even if they have a clear legal mandate, interventions on this basis are strongly stigmatised.

In Spain, the first Equality Observatory in a Spanish university was created in 2005 at the Universitat Autònoma de Barcelona (UAB - Izquierdo *et al.*, 2004). It presented the first step to monitoring the situation of women at the university and proposed a gender action plan. It also undertook the task of

situating the UAB within the wider framework of other gender-oriented initiatives in Spain, Europe and the USA and thus provided an important conceptual synthesis. In 2005, the Advisory Council of the Observatory was founded and in 2006, the first action plan for equality between men and women at the Universitat Autònoma de Barcelona was approved. A second follow-up plan was approved in 2008 that will be valid until 2012. Although no concrete evaluations of the impact of the Equality Observatory at the UAB are available in the GSD entries, it served as a milestone for similar initiatives in other Spanish universities.

Gaps

The literature on equal opportunity officers is scarce in the GSD database, despite their centrality for institutionalising a gender equality agenda in higher education and research institutes. The available evaluation studies all point to the central importance of equality officers for mainstreaming gender into higher education institutions. However, due to their formal lack of power or imposing sanctions, research has pointed to the social micro-cosmos that equality officers have to work in (between university management, professors, and administration). Within this context, there is relative little research on: (a) the new or changing role equality representatives fulfil in higher education restructuring processes and (b) to what degree equal opportunity officers within the context of higher education are different or equal to other equality workers in other public sectors. It might be worthwhile to consult academy-external literature in order to determine in more precise terms the role and impact of equality officers beyond a general sensibilisation towards women's issues.

5.3. Quotas

There exist numerous entries in the GSD that deal directly with gender quotas in the science system. Reserving a certain percentage of seats, positions or any other type of resource exclusively for women has been debated extensively throughout the years, provoking almost in every case a similar exchange of arguments. Quotas appear on the one hand as a very effective instrument in order to increase the number of women. On the other hand, they are seen as interfering with the supposed objectivity and neutrality of scientific knowledge as well as coming into conflict with arguments of fairness. Earmarked positions, funding or training for women is easily stigmatised and devalued since it supposedly interferes with the “neutral” meritocratic principle in science. The necessity for quotas is not interpreted in terms of the systematic disadvantages inherent in the male-dominated science system but as women's deficiency in terms of scientific excellence. A classic exchange of arguments in this sense can be found for example between the Danish Ministry of Education (Vig Jensen, 1997) and Thomas With (With 1997a, 1997b, 1997c; also Ammitzboll, 1996), where the former outright rejects the proposed use of quotas because it means introducing a non-scientific criterion into recruitment and evaluation processes.

Rogg (2004) discusses how the proportion of female professors has risen in “leaps” in Norway. At the University of Oslo, the proportion of female professors increased by 50% during two years from 1987 onwards. Rogg reports not only on the fierce struggle against gender quota fought in the name of meritocracy but also that university departments set their practical (personnel) needs above the meritocratic ideal. However, even if meritocracy is temporarily suspended, it was never questioned as the true ideal of academia.

Teigen (2000) analyses the tension between utilitarian and justice arguments in a debate on earmarking student admission quotas for women at the Department of Computer and Information Science of the Norwegian University of Science and Technology (NTNU). Only 6% of the new students in 1996 were women, but in 1997, mainly as an effect of the earmarking initiative, the proportion of women increased to 38%. While Teigen's focus is on the merit and fairness dimensions of quota in science, Lagesen (2007) has analysed the impact of increasing the proportion of female

students at NTNU Computer and Information Science Department. Contrary to the “critical mass” argument – which argues that after having reached a critical threshold of women, a self-sustaining qualitative change of the culture (discipline, department, etc.) is set in motion – Lagesen maintains that even a “fairly large number of women was not self-increasing or even self-sustaining” (*ibid.*, p. 87). Similar critical remarks of the “critical mass” argument have been put forward by Etzkowitz *et al.* (2000) and Grey (2006). Nevertheless, when the number of women is high, the symbolic image of the field changes from 'masculine' to a more neutral or gender-diverse image. “Consequently, it may be more accurate to characterise the threshold effect as a *degendering mass* – the proportion of women in a techno-scientific field that changes its symbolic interpretation from 'masculine' to a more open gender coding” (Lagesen 2007, p. 88). Similar effects on the micro-culture of Computer Science and the “symbolic” meaning of numbers was observed by Blum *et al.* (2007).

Fürst (1988), in her influential report on the barriers women face in reaching permanent positions in Norway, found that the proportion of women at the University of Oslo decreased, despite the use of moderate gender quotas (see also Rogg 1997). Nielsen (2004) argued, on the other hand, that while in 2002, one third of the new professorships were women due to legal provision of earmarked positions (going back to an equality measure of the university law of 1997), in the consecutive years the percentage of women significantly decreased. In mid-2004 only one in 7 new professors was a woman. As the evolution of the appointed women professors indicate, the percentage of women would have been much lower if the quota had not been used in previous years.

Törnqvist (2006) explores the conditions under which gender politics can be justified in different arenas of social life. Based on discourse analytical approach, the author shows how quotas in the political sphere are more easily justified on representative claims whereas they are met with resistance in the academy. Democracy as tied to equal representation paved the way for gender quotas in the political system in Sweden (where every other seat in parliament is reserved for women), whereas ideas of meritocracy and individual creativity work against the introduction of positive action measures in science.

The discussion has to be seen in the context of the Swedish Tham professorships (*Thamprofessorerna*). In 1995, the Swedish Minister of Education, Carl Tham, set up 31 full professorship positions for women on the basis of the gender equality law in education (Ěervinková 2003; Jordansson 1999). Jordansson (2003, 2005) reports on how this political intervention was viewed as curbing of scientific autonomy and was not well received. As a result, the political intentions of the Tham professorships tended to be watered-down. As Jordansson (2005) maintains, success of this intervention was dependent on co-operation and the alliance between politicians and gender researchers. Similarly, Bondestam (1999) reports on experimental work with positive measures for research assistants at Uppsala University.

Mählick (2006) is among the few to report on the experiences of those women appointed to quota positions. Analysis is based on a survey of a total of 74 researchers and 8 in-depth interviews. The investigation shows that the majority of the research assistants associated with the positive actions initiated by Carl Tham felt a lack of support from the departments and that financial issues hindered them in the choice of their research subject. One third of them have left their original department.

In the Netherlands, Willemsen & Sanders (2007) have conducted a survey among 188 Dutch female professors. The results mirror the general impression that quotas are not very well received in academia. The majority of respondents claimed that in order to increase the number of female professors, they prefer transparent career development policies for women in higher positions and clear career development trajectories for academics. Financial incentives for the appointment of women and the obligation to have women candidates on appointment shortlists were less well received.

Böhmer (1993) carried out a small survey (36 respondents) among the female scientific assistant positions (C1) and assistant professor positions (C2) at the Free University of Berlin (FU). In a special women's promotion programme, the chamber of deputies in Berlin agreed to grant 2.6 million DM to the creation of 65 assistant positions – 43 of which were located to the FU Berlin – from 1991

onwards. The positions were distributed especially in disciplines with a high discrepancy between promotion and habilitation rates. Böhmer's work points to the shortcomings of modelling women science careers on a male model; due to her study, faculties had to integrate stronger junior staff with their own financial means in order to secure the continuity of the positions. Since 1996, the special programme positions have been changed to fixed positions. Currently the programme is evaluated by the equal opportunity officer of the FU-Berlin.¹⁶

Gaps:

When reviewing the literature on “quotas” it is interesting to note that most of the GSD entries come from northern European countries. The main point of discussion usually concerns the legitimacy and “negative” stigmatising effect of quotas in the context of science. However, there is a clear lack of systematic exploration as to why and how quotas do or do not work. Since the main body of literature on “quotas” has been developed in the context of politics, it is surprising that there are so few publications that would more systematically exploit the insights about “quota” won on different terrain such as the equal participation of men and women in political representation. Törnqvist's (2006) contribution underlines why “quotas” are regarded more poorly in science than in politics; however it still leaves many questions unanswered. Thus, it might be worthwhile to draw analytically similar distinctions between (a) “the policy outcome perspective” and (b) “politics as a workplace perspective” when researching the implications of quotas (Dahlerup 2006, p. 519). When considering the structural implications of quotas for universities and research institutes it would be particularly interesting to see:

- (a) to what extent more women in certain disciplines and also in higher positions are able to change the content of science itself (e.g., earmarked research funding was mentioned to allow women to carry out more interdisciplinary work)
- (b) whether higher proportions of women are capable of shaping the science system towards a more gender-neutral and women-friendly environment (e.g. how scientific excellence is evaluated, how formal/informal networks operate, access to research funding, etc.)

What would be needed thus, are fewer descriptions of the reactions that the introduction of quotas produced and more on their effectiveness beyond a too naive “critical mass” argument. The political science literature on “critical mass” and “quotas” has emphasised that the belief in qualitative change by reaching a certain proportion of women cannot be sustained. While the debate has moved on in analysing the various impeding and sustaining factors for women's quota in the political arena, this is not true for quota in the science context. What is missing is research on the various “accompanying measures” that would allow first to counter their stigmatising aspects and second, to convert the increase in numbers into qualitative and sustainable change in science practice.

5.4. Targets, Incentives & Gender Budgeting

In the context of science, and above all higher education reform, new instruments for achieving gender equality in science have been deployed. While the majority of GSD entries on quotas come from the northern European countries, most entries analysing the introduction of New Public Management (NPM) for restructuring higher education and research stems from the German-speaking literature. On the one hand, this has to do with the relatively recent thorough reform of higher education financial management in German universities. Contracts on performance-oriented budget distribution are now a reality between the state and the universities as well as internally between university management and the individual faculties. Performance indicators have been introduced, such as the number of degrees, publications, external funding but also in some cases, indicators linked to gender aspects such as the proportion of female full professorships. However, given that NPM has been used more widely and

¹⁶ No concrete data was available as of December 2009. See <http://www.fu-berlin.de/sites/frauenbeauftragte/foerdern/evaluation/c1c2/index.html>

thoroughly in the Anglo-Saxon context, it is surprising to find relatively few publications from the UK discussing the potentials, pitfalls and dangers from a gender perspective of introducing NPM instruments into science. This might point to differences in classification of the literature in the GSD but also mirrors the fact that NPM has not been developed in the UK as a policy towards gender equity as it has been in other countries. What we find, nevertheless, are articles discussing the impact of NPM on everyday academic life. That is, since the UK literature mainly discusses the work-life implications of a very broad bundle of NPM strategies, a clear link between specific policies and their impact on the gendered organisation “erased” them from a policy-related discussion (and thus, the policy-related entries in the GSD).

Spreyermann & Rothmayr (2009) report on the incentive system (Module 1) used to achieve a more equitable higher education and research system in Switzerland. The incentive system of the overall federal programme for equal opportunities in HE aimed to increase the number of female professors at Swiss universities from 7% in 1998 to 14% in 2006. Financial incentives totalling 1.35 million. CHF were to be distributed among universities that appointed women professors. More specifically, this module encouraged the appointment committee to:

- invite more female applicants and
- revise its evaluation criteria of candidates.
- In addition, the programme aimed to encourage universities to adopt a more pro-active attitude towards equity measures

The active take-up of these incentive systems was the responsibility of the university management. The published evaluation report indicates that no university management team developed concrete initiatives to thematise equal opportunities during appointment procedures. There is a clear lack of active implication at the top-level of university management, often justified by the argument to avoid interference in academic issues of faculties and departments. From the accompanying evaluation survey carried out it emerges that the incentives system has a problem of legitimisation: 55% of the surveyed presidents of the appointment committees think that the incentives harm academic community and 30% think that they are stigmatising for the appointed women. Universities that did receive money for appointing women destined these additional resources to initiatives and programmes for equality measures within the university. After its first seven years of existence the federal programme reached the target of 14% of female professors (indicating +/- differences depending on statistical sources consulted). As the authors sustain, despite the difficulties to gauge the impact of the programme, it seems clear that it has not contributed to a significant increase in the proportion of women professorships (*ibid.*, p. 39). The role of the incentive system is described as minor; however its positive effect might consist in making visible the situation and proportion of women to university management.

Einarsdóttir (2004) reports on research funding and the incentive system at the University of Iceland until 1989, whereby academics were paid for overtime hours of research done outside their required working hours. This system has been evaluated several times and some questions have been raised on the way in which it awards people. Firstly, the system creates incentives for the staff to work excessive overtime which may, in turn, affect the quality of teaching. Secondly, it seems to have negative gender implications. Women are less likely to receive payments for extra research activities; of those who applied for extra pay and did not receive it, 28% were women and 12% men. This incentive system has now been changed to include academic work other than research. When the system is analysed across the academic hierarchy (lecturers, senior lecturers, professors), a clear gender difference appears 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 needs some amendments to stimulate research activities, however, as it is not family-friendly or even employee-friendly and can lead to increased stress levels and excessive competitiveness.

**Quality Management and Gender Equality
at the Free University of (FU) Berlin.**

Women's promotion has a long history at the Free University of Berlin. Böhmer (1993) described the special women's promotion programme that created 43 women faculty positions back in 1991. The FU was among the first to offer continued education to female scientists and career training seminars in the early 1990s. From a relatively early date (since 1992), the university internally practiced a performance-oriented allocation of funds. More recently, since 1999, and with the approval of the quality management reform, this performance-oriented distribution of funds and quality control are combined and legally anchored. Due to its long history of various women's promotion measures combined with the more recent turn to a NPM-inspired steering approach, both of which have been documented, the case study of the FU Berlin provides valuable insights not only from a long-term perspective but also considering the range of equality instruments deployed.

The FU-Berlin was rated the most "corporate" university in a benchmarking study carried out by the Prognos AG, Basel in 2006; it has twice received the Total E-Quality Award and the audit family-friendly university. The quality indicators of the FU Berlin include (a) teaching, (b) research, (c) equality: women's promotion across all levels and a balanced success record of degrees, (d) university management and (c) internationality.

A cornerstone of the structural reform are contracts between the government and university as well as contracts at the internal university level. Funds are allocated based on performance indicators distributed as follows: 50% teaching, 45% research and recruitment / young talent and 5% equality. The percentage of performance-oriented funds has risen from 25% in 2007 to 30% in 2008.

Christine Färber closely analyses the impact of performance-related allocation of funds in relation to teaching, research, recruitment promotion and women's promotion. She contends the "practical success" of the women's policy concept at the FU. Success was related to the fact that the legal base for performance-related allocation of funds implied a strengthening of the women representatives' position in top level decision commissions.

The reports issued by the Gender Equality Officer of the FU-Berlin deliver more recent insights into the positive impact of making faculties responsible for co-financing new positions. Thus, by combining faculty-specific budget with financial resources available for hiring women, faculties are able to create more positions, which has led to a considerable increase in women academic staff.

Box 4: FU Berlin. Sources: Färber 2000a, 2000b, 2007; Kühlcke 2008, Koreuber 2008

Thomas & Davis (2002) describe the implications of NPM for women academics in the UK. Based on 53 semi-structured interviews across three universities, the authors show how the changes taking place in the management and structure of higher education were generally seen as putting the individual academics' working lives under strain. From a gender perspective, NPM could be seen to promote gender-neutral performance criteria. However, "with the intensification of work regimes, to succeed in the new climate of higher education requires working long hours, with single-minded ruthlessness and competitive zeal" (ibid., p. 384). Restructuring of higher education thus appears to be geared towards an individualised, competitive culture that promotes a masculine career path that does not contemplate domestic commitments or other career options. Thomas (2007) further showed that

the power relations operating in appraisal work to 'normalise' the academic role as a highly competitive, productive unit focused on identifiable, quantitative outputs.

Similarly, Morley (2003; 2005), through a micro-level analysis of the effects of audit and the evaluative state, suggests that hegemonic masculinities and gendered power relations are being reinforced by the emphasis on competition, targets, audit trails and performance. According to Fletcher (2007), there is little chance that manager academics in the UK will counterbalance these new requirements in terms of gender equality. Through 22 semi-structured interviews, she demonstrated the persistent gap between theory of gender equity and practice of manager-academics who had little knowledge of conceptual issues surrounding gender equity while using a discourse of choice and agency to explain continuing inequalities.

For the further education sector, McTavish & Miller (2009) conclude that while change has increased opportunities for women, masculinised managerial practices have led, in many instances, to the re-gendering of organisational practices with unequal gender impacts. Similar, Saunderson (2003) underlines for the UK context that without an assimilation of equal opportunity policy into the core institutional culture, the higher education equal opportunities and treatment will remain little more than "lipstick on the gorilla." Her idiographic analyses of a small number of case studies suggest that, despite considerable recent gains, some academic women's identities are compromised, challenged and made 'vulnerable' through feelings of being undervalued, overburdened and often the subjects of unequal treatment – more than 30 years after the Equal Pay Act and almost 30 years after the Sex Discrimination Act. Müller (2006) is equally critical of the gender implications of newly-established criteria regarding success, excellence, and marketisation.

It is important to note that although this literature does not establish a direct causal relationship between specific policy measures and their outcomes, it "loosely" interprets recent changes in work-life experiences and gendered academic subjectivities as being tied to restructuring measures.

Several authors conceptually discuss the allocation of funds as a new instrument for gender equality policy at the universities (Löther & Plöger 2000; Kriszto 2005; Ziegele 2000; Roloff 1998; Riegraf 2003; Plöger 1998; Kaufhold 2002; Ebeling 1999). Körber-Weik (2003) speculates that the promotion of women through the budget, as opposed to traditional measures, has the advantage of raising the self-interest of decision makers at the universities. Koreuber & Güttner (2003) discuss the potential of combining the quantitative formula-cased allocation of funds with more qualitative aspects of target agreements for the promotion of women studies, for example. Zimmermann (2003) discusses the relation between economic and scientific modernisation and their implications for gender equality. Holzleithner (2004) reflects on the potentials and dangers of neo-liberal reform for advancing gender equality at the University of Vienna, especially in relation to the apparent ease with which previous legal requirements were largely ignored or circumvented with great ingenuity.

Nickel (2007) argues for the connection between quality management, academic reforms and gender equality. Morely (2005), in contrast, critically remarks that "quality management" within New Public Management strategies do not necessarily coincide with equity achievements. Her research suggests that quality assessment procedures appear to reinforce gendered divisions of labour by considering teaching quality as female and research quality as male-dominated. Equally, Deem & Morely (2006) argue that the introduction of managerialism in UK higher education institutions with its concomitant concerns for student-customer satisfaction and a celebration of diversity *per se* have undermined much of the previous redistribution struggles of previous decades. According to the authors, senior management stressed the pursuit and celebration of organisational diversity alongside recognition strategies of social justice which reflect a relative de-politicisation of the staff equality agenda in HE. Roloff (2002), on the other hand, argues for the German context, i.e., the systematic link between university reform, quality improvement and gender equality (see *QueR* case study below).

**QueR – 'Quality and Innovation – Gender Equality as reform strategy'
University of Dortmund**

The University of Dortmund, Germany, was among the first universities to introduce new strategies of quality assessment and performance-based financing during the early 1990s. Due to the recommendation of the equality representative, efforts were made to integrate gender monitoring into evaluation and quality assessment. In 1997, the first financial incentive to support gender equality was established. The overall reform project involved:

- women's representatives
- new quality management
- a more gender aware HR policy
- experiences across four pilot departments including chemistry, spatial planning and teacher training faculty

Activities at the faculty and departmental level included the modernisation and improvement of academic advice and study programme reforms, improvement of study conditions, guidance and mentoring of students, academic career guidance, career advice for academic professionals outside the university, integration of gender competence training in HE didactics and media instruction for research teams. Financial incentives were used to initiate the activities with faculties obliged to contribute with one quarter of their own funds.

"In 2000 the university law was amended and now requires *progress and gender equality* be added to the criteria governing the reallocation of financial resources. Furthermore, the law requires gender-equality criteria in quality assessment and gives representatives for equal rights admittance to the meetings of the governing board" (Roloff 2007, p. 56).

Box 5: QueR - University of Dortmund. Source Roloff 2007; Roloff & Selent 2003

Wetterer (1994) critically discusses the achievements made so far through women's promotion schemes. Her evaluations of women's promotion schemes in Lower-Saxony show that scientific achievements of women in appointment procedures have been devalued in order to maintain the *status quo*. Continuing her criticism of the ineffectiveness and even counter-productivity of previous women's promotion, she contends that due to the new structural instruments, exclusion mechanisms will change and become more subtle (1998).

Barry, Berg & Chandler (2006) provide one of the few comparative studies on the gendered impact of new managerialism in England and Sweden. Drawing upon more than 60 semi-structured interviews, they stress how the new managerial requirements elicit different identity-management responses. Despite cultural differences and the time lag when reforms were introduced in Sweden and England respectively, it emerges that women academics in both countries face more difficult compromises than their male counterparts to sustain work in higher education. "This meant, for the male academics, the retention of a research identity and/or organisational status, whilst for the female academics, the consequences involved ill health, moving job and/or the loss of research" (*ibid.*, p. 292-3).

Rothe *et al.* (2008) compare efforts to introduce a "gender budgeting" approach in three different universities across Germany (University of Augsburg), Austria (Vienna University of Economics and Business Administration), and Poland (University of Gdansk). Apart from the differences between the

participating universities in terms of taking gender equality indicators into consideration for special funding, the authors contend that important aspects of university reforms “like transparency, target-oriented governance and financial controlling” are good starting points for gender equality – at least as long as the strengthened university management is firmly committed to gender equality policies. However, the concentration of power at the management level also implies that these policy issues can be dropped much more easily than before (*ibid.*, p. 9). Despite the fact that a new financial instruments tied to performance-oriented evaluations could have remarkable effects on gender equality, the authors observed that financial matters are now much more easily labelled as “purely technical procedures” emptied of their political contents. A general unawareness of gender issues among financial experts at the university management level entails the risk that the steering potential of the budget may be lost. In addition, with the university structure becoming more hierarchical, the opacity of the budgeting process might have a negative impact on gender concerns; informal networks gain more importance, a fact which tends to be disadvantageous for women.

Gaps

A rather contradictory picture emerges from the reviewed literature. The restructuring of universities and the introduction of NPM strategies is discussed as a potential new ally for gender concerns in science. At the same time however, the new steering instruments as target setting, audits, quality control and performance measures were described as disadvantageous for women academics.

As a consequence, more research is needed in order to clarify under which conditions NPM may serve as an instrument towards gender equality in higher education, or rather may tend to reinforce existing inequalities and the hegemonic masculine imprint in academia. As Barry *et al.* argue, “implications for university academics are unclear, since one of our main conclusions is that responses vary, with the likelihood of differing institutional settlements” (2006 p. 293).

In this sense, it is important to note that there is a clear split between the evaluation of concrete measures that are often bound to concrete institutions and moments in time, on the one hand, and micro-level analysis of work-life transformations that refer to general restructuring of higher education under the NPM paradigm, on the other. However, what is missing are large-scale, comparative evaluations that could establish (a) how these NPM strategies interlock with other mainstreaming measures (such as women’s representatives or women’s studies, etc.) and (b) which contextual factors condition their success or failure.

Zimmermann (2003) describes the challenges that women’s representatives face when having to penetrate the new formula-based distribution mechanisms and incentive systems. Expert knowledge is required not only to understand the economic calculus behind those new steering instruments, but also to estimate their gender impact. The degree to which these steering instruments and models are actually useful for furthering gender equality is among the most pressing and least answered problems, according to the author.

5.5. Concluding Remarks

Without a doubt, the measures deployed for women’s promotion in science and higher education have become more diverse and varied. Legislation and positive measures such as top-down creation of quota now occasionally co-exist with newer governance instruments. Targets and incentive-based allocation of funds provide new means to reach “old” goals: to increase the percentage of women in higher positions as well as across certain male-dominated disciplines such as engineering and computing.

The larger diversity in terms of policy instruments now adds to the pre-existing variety of policy contexts. The fact that HE now may differ not only between countries or regions but also within the same region (due to their gained autonomy in terms of “how” certain targets are pursued) adds further

to the complexity of policy transfer issues or comparative research on the “effectiveness” of those new instruments.

The picture that emerges from the literature present in the GSD is inconclusive at best. The Swiss large-scale imitative attempts to provide financial incentives to hire more women in HE but it encounters low acceptance from within academe itself. On the other hand, more positive experiences are found in the case study of the FU Berlin which has pursued an NPM approach over the last two decades. While the German literature draws specific attention to the potential benefits of new result-oriented steering approaches, the UK literature reports on the detrimental effects of a new managerialism on women in HE. Case studies carried out in Austria alert to the fact that new managerialism involves a strengthening of top positions, thus reducing the possibilities of democratic participation of lower ranks within the university hierarchy where proportionally more women are situated.

The move from direct positive interventions towards an output-oriented steering approach seems to have levered out much of the negative and pejorative arguments against “women” measures or even law-based interventions. Since women’s promotion has become part of larger quality concerns that are in the interest of all, they cannot be as easily rejected as before. However, as some of the reviewed contributions have made clear, while women’s promotion was formerly seen as an unjustified intrusion into the objectivity and meritocracy of science, now the danger consists in seeing it as interfering with the neutrality of economic and formal allocation procedures. Hence, the renewed importance of women’s representatives and equality officers who continue to occupy key roles in order to politicise the apparently a-political budgetary, expert-based decisions.

Given the diversity not only between higher education institutions but also in the increasing variety of policy instruments, the lack of large-scale comparative studies is especially troubling. As already mentioned, evaluation studies usually focus on the impact of certain measures at the personal level. Considering the field of institutional reform, this concentration on the individual benefits is especially striking. Given the existing variety within certain universities (between faculties and departments), little research exists to date that addresses the impact of new steering instruments on women’s promotion and gender equality as a whole. Comparative studies between individual HE or even between countries are equally rare.

6. Gender Dimension in Research & Higher Education

The following section concentrates on policy that pushes for the integration of gender into all aspects of education and research. It thus deals with gender mainstreaming in its transversal sense: gender becomes important for: (1) reforming teaching methods and rethinking curricular content, (2) the organisation of the educational setting as such, and (3) as a different model of science and knowledge production.

Reform of higher education pedagogy is discussed from various angles. On the one hand, the literature points to several dimensions of a gender-sensitive pedagogy involving an interdisciplinary, cooperative, problem-, project- and research-based teaching and learning style (Kahlert 2003). Cooperation should happen between students but also between teachers; role models and examples should illustrate real-world applications of knowledge while participative learning and teaching methods that naturally foster rhetoric and presentation skills are important assets in today's professional worlds. Teaching methods have to change in order to make education more participative, diverse and problem-oriented. This has been described not only as benefiting women but all students and the quality of higher education in general. Thus, reform of teaching methods has become part of a quality assessment of HE that is tied up with creating a more diverse, innovative and thus productive environment. However, a major factor impeding teaching reform is the relatively small importance teaching has in advancing science careers. Research publications are much more highly valued than excellence in teaching with the result that pedagogical reform is a largely neglected activity.

On the other hand, the literature testifies quite unanimously the differences in study choices between men and women (see Eccles, 1987, 1994, 2007; Eccles *et al.*, 1999). Interdisciplinary studies and studies with an ecological, social or health spin are considered more attractive for women. Thus, although women are a minority in the male-dominated engineering field, they find themselves predominantly in degrees which are considered "useful" for society such as environmental engineering, waste or water management. Curricular reform from a gender perspective therefore needs, on the one hand, to give abstract oriented knowledge and technology fields a social and interdisciplinary problem orientation and, on the other hand, to analyse more directly the gendered aspects of supposedly neutral fields of knowledge such as physics or medicine. It addresses and promotes a reform that moves from a "narrow" to a "broad" definition of the curriculum. In classical science and engineering disciplines, a "narrow" understanding of the curriculum dominates whereby knowledge is conceived as uncontentious and unproblematic, a well-defined body of knowledge to be transferred to mainly passive students via lectures. This usually corresponds to a pedagogy that is highly formal, based on the authority of the lecturer and the passivity of the students, the abstract nature of the subject content (Thomas 1990, cited in Bagilhole & Goode 1998). The "broader" but hidden curriculum, on the other hand, takes into account the values, attitudes and knowledge frames embedded in organisations and schooling; as pointed out above, it is much more "application" and "impact" oriented while fostering a student-centred approach and the acquisition of transversal "soft" skills.

Mono-educational settings, as well as the establishment of women's studies and research centres, are important anchor points from which these transformations of the established educational setting and ways-of-knowing can be pursued.

Gender at large is linked here to a process of modernisation of higher education and research not only in the sense of disclosing male power structures but also in terms of improving the quality and diversity of knowledge. Insights into the close relationship between a more gender-sensitive approach to higher education and research and the resulting increase in quality for all have contributed to making this an explicit policy target. The incorporation of gender aspects into the Bologna process is the most prominent example. However, the form and impact of direct measures that aim to reform pedagogy and curricular content is once again far from evident.

6.1. Reforming Pedagogy and Gender Proofing Curricula

Curricular reform and especially its gender aspects have been discussed mainly in the context of schooling. For example, Watts & Bentley (1986) already argue for a more radical change of curriculum. Instead of making “cosmetic changes” in terms of developing “girl-friendly” science, they advocate coming to terms with the masculinity of science as such. Schools and science must change, not girls. In general, the focus has been on appropriate subject content, classroom interaction and appropriate assessment methods, among others.

Within the context of the fFORTE programme, Austria reports on the difficulties to improve and professionalise gender sensitive mathematics and natural science lessons in secondary schools (Wroblewski 2007, p. 195). The combination of the below-average performance of Austria in the Third International Mathematics and Science Study (TIMSS) together with the large gender gap with boys clearly outperforming girls led to the creation of the *Innovations in Mathematics, Science and Technology Teaching* (IMST) project to improve mathematics and science teaching. The project disposed of 145.000 euros from 2002-2004. Several attempts were made to tackle gender-specific issues in science and mathematics teaching for teachers with little success. In general, teachers and schools showed scarce interest in gender issues. Apart from the “stigmatising” effects that teachers associated with registering in targeted professional training courses dedicated to gender issues, there very few teachers were interested to begin with. Several modalities of integrating gender into the innovation project were tested (stand-alone courses, vs. transversal incorporation of gender aspects across all courses / projects) with moderate success.

University Curricula & Teaching Reform

Verdonk, Mans & Lagro-Janssen (2005, 2006) map recent attempts to establish gender- and sex-specific curricula in Dutch medical schools. A concrete project at the Radboud University Nijmegen Medical Centre which integrated gender into the basic medical curriculum has been largely successful. After screening the curriculum for language, content and context, adjustments for incorporating gender issues into the basic medical curriculum were made. This quick scan on the absence of sex and gender issues beyond biological reproduction was important in order to demonstrate the need to incorporate gender into the medical curriculum and gain the commitment of policy makers in all Dutch faculties. Important success factors included: motivated block-coordinators who personally recognised the importance of gender in patient care, concrete and directly executable content-oriented proposals and the adequate translation of gender differences into actual patient care. The authors emphasise the need to gain large-scale support in order to successfully introduce gender into the medical curriculum.

The Dutch insights into the importance of large-scale institutional commitment necessary for the successful implementation of gender issues in university teaching and curricula gains validity when seen in the context of the remaining literature: most entries in the GSD point out and analyse the obstacles that prevent gender issues from being incorporated into academic curricula not only at a superficial level but in a sustainable way. Jeansson (2000) writes that despite the notable integration of a gender perspective into some syllabi and textbooks of sociology at the University of Gothenburg during the 1990s on a formal level (analysing gender equality plans, syllabi, textbooks), an “applied” gender perspective remains a women's issue. Similarly, Pantouli & Fotakopoulou (2008) found that the introduction of gender issues in tertiary education in Greece caused significant changes in curricular content, pedagogy and above all, evaluation methods. However, these changes were restricted to certain disciplines such as anthropology, sociology, pedagogy and did not reach the “hard” sciences such as physics. Heilmann & Sharp (1997) see a major obstacle in the existing male-dominated power relations in the university. Women's issues are not fully integrated into the academic curriculum because the latter remains male-dominated and hence discourages women students from finding their voice and asserting deviant perspectives. The article further reports on two student conferences held at the German Department of the University of Leeds between 1993 and 1994 which allowed for staff and students to interact in non-hierarchical ways and to explore more open ways to make the gender issue part of the “mainstream” curriculum.

Salminen-Karlsson (1999) looks at curriculum reform processes at two Swedish Institutes of Technology from a gender perspective. The primary goal of both projects consisted in making computer engineering careers more attractive to female students. Based on Davis & Rosser's (1996) work, the author constructs a framework for evaluating curricular reform; her analysis of the reform projects shows that despite a certain increase in numbers of female students there was no deeper change taking place. According to her analysis, the reform projects focused too much on teaching methods. Equally important issues such as curriculum content and interaction patterns or increasing awareness and knowledge on gender issues among staff were not addressed sufficiently. Female students were largely perceived by reformers as non-technical, "additional elements" that rather have to adapt to the technological education than the other way round (*ibid.*, p. 219). Gender-related reforms were thus hampered by the stereotypical conceptions of women and a general lack of knowledge on gender issues among reformers. Reformers were not aware of any other criteria for gender inclusive education other than "increase in numbers", there was confusion between making education more inclusive and attracting more female students. In addition, the importance of keeping up the status of a programme and the heritage of engineering education as a whole worked against reforms.

Wistedt (1996, 1998, 2001) evaluates with an interval of five years the Swedish Government programme launched in 1992 in order to attract new student groups to traditionally male-dominated technology careers. 5 million Swedish crowns per year were allocated for a period of three years to create innovative degree programmes in science, mathematics and technology that would be able to recruit mainly female students, primarily by creating a more supportive study environment. Enrolment across the 7 programmes receiving funding in 1995 showed that most programmes, except the computer engineering degrees, scored well above national average in recruiting women to their degrees. One strategy to achieve this involved expanding the recruitment pool to those student groups that traditionally would not choose a science or engineering related career such as students with a humanistic or social sciences related background. However, as the council responsible for the selection of the projects made clear, projects were not selected on specific recruitment strategies but rather according to pedagogical aspects of their proposals. Teaching methods should be rethought, course-work organised differently, new ways of evaluating explored in order to tackle the exclusionary "nature" of many male-dominated programmes. Problem-oriented approaches, co-operative and interdisciplinary work were thought to create a more inclusive and attractive study environment in general, and for women more specifically.

One of the central insights according to Wistedt (2001) was the fact that modest changes had minor impact. Incidentally, two programmes which merely made adjustments to their existing programmes (e.g. entry level courses in the first year) in computer engineering had the least success while programmes that were created from scratch were more successful initially and after the first five years of operation. The possibility of offering new forms of teaching and learning also attracted new groups of students. The co-operative forms of work implemented helped to create a social environment that differed from the traditional academic one. Classroom climate and activities also determined continuance.

Factors that contributed to the success of programmes and factors that were obstacles:

- Similar to Salminen-Karlsson (1999), Wistedt argues that the prestige or need to live up to a respectable engineering programme hindered reform attempts and the introduction of new methods in the computer engineering programmes. Proposing far reaching changes entails criticising the existing approach and will provoke likely resistance.
- Successful programmes had a diverse student population. Not only were there more women students and women staff but also a considerable disparity in age, social background, and experience.
- The size of the programmes is important. The newer and more successful programmes were smaller in size; this allows people to work closely together and create their own strong (counter) culture to the traditional professional and academic ideals of computer engineering.

- The teachers involved in the successful programmes were committed to and deeply involved in the change.
- Programmes that offered a variety of subjects going beyond the traditional engineering curriculum and overlapping into humanistic and social sciences areas were more successful. This curricular mixture was combined with a collaborative, problem-oriented teaching and learning approach.

Overall, Wistedt (2001) concludes that “the more radical attempts to launch new programmes with an alternative organisation of the subject matter in terms of structure and content have been more successful” (p. 119). This is in concordance with research from SME (Science, Mathematics, and Engineering) fields: “if programmes addressing under-representation are primarily shaped by a search for undiscovered talent, while the structural and cultural barriers to enrolment and persistence among under-represented groups remain obscure or unaddressed, such a programme cannot succeed” (Seymour & Hewitt, 1997, p.8; cited after Wistedt 2001, p. 120).

Henwood (2000) in her comparative empirical study of two groups of women – one studying a traditional computer science (CS) course and the other, a interdisciplinary information technology (IT) course – points out that women are usually more attracted to courses that emphasise social issues, usability and wider applicability of computer science. One important point relates to the fact that the more interdisciplinary approach to IT offers the enrolled women the chance to deconstruct existing gender-technology stereotypes and thus integrate technical skills more akin to their overall identities. She argues that it is precisely because of the “continued exposure to symbolic constructions of gender-technology relations” that women are prevented from “internalising” technical skills. More innovative educational curricula would offer greater opportunities for involvement and achievement, that is, for appropriating technical skills beyond the existing gender-technology relations.

Similar findings are presented by Bagilhole & Goode (1998). Based on 37 semi-structured interviews of men and women across all academic levels and across all schools, the authors analyse the role of the “narrow” and “broad” understanding of the curriculum in an “old” (pre-1992) university in the UK. In the science and engineering faculties, a “narrow” definition of the curriculum was predominant; gender-sensitive evaluation of the curriculum was difficult precisely because gender was not perceived as a problematic issue in the face of an unproblematic body of use-oriented knowledge that corresponded closely to (a) what the industry required and (b) what “real” engineering students were interested in. On the other hand, in departments with a higher percentage of women, a broader definition of the curriculum was apparent involving a more student-centred approach. However, where this “informal curriculum” was considered, the potential negative effect for women academics was equally pointed out, according to which the invisibility of pastoral support of students added above all to the workload of women.

With respect to making technical careers more attractive to female students by changing the curriculum, Wistedt (2001) and Ingemarsson & Björck (1999) argue for so-called “open-entry” schemes. Instead of obliging students to make final decisions regarding a specific career (that is, making a choice regarding specific curricular content) both authors argue for postponing this choice of degree programme. This, implicitly, has much to do with the curricular content: potential female students who face the difficult decision of whether to enter a technical career and defend their non-traditional career choice before their peers and parents might find it easier to do so if their choice can be presented as less final. They are given the chance to try out these degree programmes and to become more familiar with them before deciding. As the author clarifies, it is not enough to simply postpone the decision to take a specific degree; students should be given the chance to become better acquainted with these different subject areas. This differentiates less successful “open entry” initiatives such as at Lulea Technical University from more successful ones like Stockholm University or Göteborg University (Wistedt 2001, p. 117; Wistedt 2000).

Mahony & Van Toen (1990) also underline the weight and inertia of a traditional concept of science and knowledge where the mathematical formalism is used as a way of occupational closure in computing. This closure in favour of “hard” areas such as mathematical formalism does not only put off

women who are interested in computing but also fails to address the industry's future needs, which will rely more on arts-based skills and skills that have traditionally been associated with women.

Bologna Process

Although the GSD lists some entries relating to the gender impact of the Bologna process, these are rather speculative articles so far. Since this is a recent process, no concrete research was identified in the current meta-analysis. Key publications so far include those by Michel & Löffler (2006), Hemmings (2006), Griffin (2006), Carrera & Suárez (2006), Bührmann (2007) and Widerberg (2006).

6.2. Single-sex education

Single-sex education has been discussed mainly in the US literature in relation to women's colleges. Several previous studies report on the potential benefits of single-sex education in terms of educational achievement.¹⁷ More recent studies, however, have come to the opposite conclusion given that no difference in terms of academic achievement between single-sex and coeducational settings was observed. Among the major potential negative factors in co-education for female students, one author found that: (1) educational and occupational aspirations and ultimate attainment might be lowered; (2) self-confidence and self-esteem might be damaged; (3) sex bias and unequal treatment might be found in classrooms, teachers and curriculum opportunities (Riordan 1994). In contrast, women-only classes and degrees provide for successful role models and peer support that help to create a more favourable overall study climate for women. Cohoon (2001), for example, shows that the single most important aspect affecting retention of women students in 23 computer science departments is the gender composition of enrolment. Departments with higher female proportions of enrolment were more likely to retain women at rates comparable to men's due to the availability of peer-support. On the other hand, critics of single-sex education do not fail to point out the paradoxical nature of this measure: being based on segregation by sex it rather re-inscribes the very gendered hierarchies that it sets out to resolve in the first place. Another argument in favour of co-education and against single-sex education points out that since co-education reflects real world social interaction, it does not create artificial situations of a strict separation between the sexes that has nothing to do with real social life.

When looking at the GSD entries, most entries dealing with single-sex educational settings stem from Germany. Congruent with the different modalities introduced (summer camps, single-sex degrees, women's universities, and so on), different agendas for implementing women-only educational settings come into play. Far from being exclusively focused on the improvement of academic achievement, they span a whole set of objectives ranging from attracting more female students to technical careers to transforming the male-dominated culture of science and technology.

Most entries in the GSD are descriptive in nature. Few texts actually engage in a deeper evaluation of the experiences or tease out theoretical implications. What is worth noting, however is that none of the entries deals with single-sex educational settings from the "deficit perspective" - where female students would be in need of a "girl-friendly" and specifically adapted content. Rather, these initiatives focus on networking and peer-support in order to create the necessary cultural counter-balance of a female minority located in male-dominated fields and careers.

Summer schools, workshops & summer camps

Several projects of single-sex summer schools have been implemented, often linked with new innovative approaches to technical careers: the Technical University of Dresden (2001), the

¹⁷ For a general overview of the research, see Riordan (1994), Mael (1998), Kahlert & Mischau (2000), Jacobs (1996)

Informatica Feminale – Summer University for Women in Informatics at the University of Bremen (Vosseberg & Oechtering 1999), Summer University for Women in natural sciences and technical studies at the Gerhard Mercator University in Duisburg (Tobias 1996, Kucklich 1996), or the summer university in engineering and science for girls at the University of Dortmund (Pfaff 2002). These initiatives all approached the under-representation of women in technical careers from a more radical stance, offering women-only summer schools. Articles on these pioneering forms of higher education are quite descriptive, presenting the overall concepts and strategies followed. Written shortly after the first (and second) summer schools, no evaluation results are presented. A parallel initiative since 2003 is reported from Austria, *dictat_women's IT summer studies* (Wroblewski 2007, p.199). The evaluation reports that the results of a questionnaire distributed among participants provides valuable insights into their motivation. Interestingly, apart from the personal interest of the participants, what motivated them most were the additional qualifications and the mono-educational environment. Networking or establishing contact with like-minded colleagues, on the other hand, was less valued.

On the secondary level, there are ample experiences of girls-only summer camps or workshops. While summer schools for university students might aim to bring together like-minded female students in SET careers in order to exchange experiences and to network, summer camps or workshops for secondary students often form part of a recruitment and attraction strategy. They offer information on technical careers, often combined with direct, hands-on experience. Wistedt (2001) argues that these traditional recruitment strategies have a limited effect when compared to more radical approaches of educational reform (see preceding section). "The recruitment efforts, which were smaller or larger parts of all the projects, such as week-end seminars for female students at the upper-secondary school, information brochures and recruitment campaigns, have not yielded the expected outcomes". Apart from the fact that these recruitment strategies need a constant input of money, a deeper reform is needed to address the exclusionary dimensions of traditionally male-dominated careers and disciplines (Wistedt 2001, p. 111). Kotte (forthcoming), on the other hand, states that a girls-only summer camp organised by the Technical University of Trondheim in Norway was successful in attracting new students. However, a long-term perspective is missing.

Well-documented initiatives for attracting girls to technical careers are also available from Austria (see Wroblewski *et al.*, 2007, pp. 188-195). FIT (*Frauen in die Technik*) and MUT (*Mädchen und Technik*) are two attempts, integrated into the overall strategic fFORTE programme, to broaden the career options of girls to non-traditional choices. While FIT is mostly oriented towards pupils during their last school years before entering university, MUT targets the vocational training level of girls in rural areas. The issued evaluations document a slight increase, or at least a weaker decrease, of female students in comparison to the general decrease of male students across different technical careers. It is not clear to what extent this has been caused by the FIT information days in which, according to cautious estimates, 10,000 students have participated. Evaluation reports on the MUT document a high satisfaction and reception of technical workshops by female pupils. However, concrete changes in career choices are less frequent due to the persistence of gender-appropriate career stereotypes, also among parents.

Single-sex courses and degrees

Apart from single-sex summer schools or camps, several universities of applied sciences introduced single-sex courses and degrees. The University of Applied Sciences Bremen offered, from the winter semester of 2000 until 2005, an international women's course in computer science (IFI) for 30 women (Viereck 2002; Vatterrott 2009). Since the winter semester 2000/2001 the University of Applied Science in Stralsund has offered a women's degree course in Industrial Engineering (Jordanov 2002, 2004). From 2001 to 2003, the Züricher Hochschule Winterthur (ZHAW) carried out mono-educational foundational courses in communications and computer science (Bolli-Schaffner 2009). For a comparison between the experience of Bremen, Wilhelmshaven, Stralsund and Winterthur, see Hofstätter 2009.

The University of Applied Sciences in Wilhelmshaven addressed the extremely low percentage (5%) of women students in industrial engineering with a single-sex degree course based on a new curriculum (Siegle 2000). Starting in the winter semester 1997/1998 this single-sex degree course was the first of its kind in the German university system and co-existed in parallel to the traditional co-educational courses. This mono-educational degree course was evaluated right from the start and documented in Knapp & Gransee, 2003. The first cohort of female students was interviewed twice over a time span of 1.5 years. The positive points, according to Schleier (2009), were that:

- the percentage of women students considerably increased since the start of the single-sex degree course
- female students described their experience in the mono-educational environment as very positive
- lacking technical experience (often linked to socialisation) was not a problem and could be regained during the course
- it included non-technical curricular add-ons (languages) that were very beneficial for students
- female students inscribed in a parallel co-educational career perceived the mono-educational setting as a safety net

Among the problematic aspects of the mono-educational courses were the following aspects:

- male students perceived their exclusion from this mono-educational setting as a provocation which resulted in devaluations or envy
- the opacity between the mono-educational and the co-educational setting; the prestige and recognition of the mono-educational courses depended on the public availability of performance requirements
- the impact of external coverage of the mono-educational setting as producing “super-women” or a new “female elite”. The implied negative assertions regarding men were rejected by the female participants

In general, the answers given by the female students illustrate the history of the model “industrial engineering for women” as a process that involved positive learning experiences, increased self-confidence and the development of special group solidarity, but also the difficulties faced by a constant devaluation of the women’s degree course and its female students as well as the overstated presentation as new female elite. Schleier (2009) stresses that institutions should avoid foregrounding gender-based inspiration of the mono-educational setting in favour of emphasising the quality and new learning opportunities at the university as a whole. Also, the stereotypes and strong open rejection to mono-educational setting that came from students and staff alike at the beginning of the experience came as a surprise to the project coordinators, and participants should be well prepared to confront the headwind these measures will most likely stir up (see also Bolli-Schaffner 2009).

In 1998, the University of Applied Science of Bielefeld introduced a women’s-studies-oriented course in energy consultation and energy marketing as a measure to increase the share of women in electrical engineering (Schumacher & Belinszki 2000). According to Möller (2000) this reform project changed the situation of female students drastically: during the winter semester 1998/1999 and the winter semester 1999/2000 the percentage of female students in electrical engineering rose from less than 5% to 40%. The success of this reform project is based on the fact that it combined important factors that increased the attractiveness of technical courses for women: a combination of various disciplines, mono-education for female students at universities, new forms of teaching and learning, mentoring and networking.

Interesting results at school level are available from Denmark (Sendrup & Frimodt-Møller, 2001). Through experimental pedagogical work in natural science education in upper secondary schools

involving sex-segregated tuition, the authors conclude on the importance of sex-segregation in order to establish confidence and success for girls. The authors furthermore stress that pedagogical method, rather than curricular reform (in terms of a higher degree of interdisciplinarity, for example), is more effective. Teachers are largely responsible for creating an appreciative and tolerant environment and thus optimising learning conditions. .

Teubner (2000) discusses more theoretical aspects by drawing from experiences gained in women's universities and women's colleges in the United States. According to the author, these forms of gender separation in higher education will lead only to larger gender equality if they do not drive both genders towards different study contents and learning forms.

However, positive experiences might also come from initiatives that practice a combination of single-sex entry courses vs. entire single-sex degrees. Wistedt (2000) describes a two-year entry initiative called *Female Entry to Computer Science and Engineering* (DTI) programme at the Luleå University of Technology in Sweden in 1993. Although the programme was not linked to an educational reform project, it was successful in attracting new women students (from 8% to 21% in the second year of the programme). Due to the single-sex introductory two years, women students were given the opportunity to create their own (female) computer science culture – in many ways different from the traditional technological setting. Although they faced typical prejudices associated with positive actions (where women-only is interpreted according to the deficit model), they were able to create a supportive environment where they “could try out their interests in the computer science field and where they dared to raise questions and reveal their own lack of knowledge” (Wistedt 2001, p. 119).

Women's University

Several entries in the GSD (Neusel 2000, 2005, 2006; Metz-Göckel 2002; Kahlert 2000) describe and analyse the first *Internationale Frauen Universität (ifu) Technik und Kultur* (International Women's University – Technology and Culture). The implementation of the project occurred in the context of the EXPO 2000 in Hannover. This reform experiment of organising technology-related higher education from a women's perspective was precisely conceived as a contribution to modernise traditionally male-dominated disciplines. Knowledge was reorganised according to project areas that address contemporary, real world, global challenges: labour, information, body, migration, cities and water. Students and faculty were recruited globally. A complex situation of knowledge production was thus created: problem relevant, interdisciplinary, international, transcultural, gender oriented and mono-educational. Maiworm *et al.* (2002) analyse the potentials, risks and output of the *ifu* from a participant's point of view. More specific results on the outcomes and long-term impact of the *ifu* were not available in the GSD.

Gaps

Despite the numerous experiences with single-sex education in all of its different forms, what remains rather unclear are the long-term consequences. Possible structural effects are suspiciously absent from the literature. This is particularly troubling since these mono-educational settings are not just discussed in terms of differential outcomes or in terms of academic performance but in terms of changing the male-dominated science and knowledge culture. Thus, it would be interesting to see not only to what extent these single-sex educational settings are able to attract more female students, but equally to what extent they are able to make inroads into new forms of knowledge and doing science.

6.3. Institutionalisation of Gender & Women's Studies

The institutionalisation of gender and women's studies provides an important indicator as to the extent to which gender has entered mainstream science. The establishment of university departments for gender and women's studies provides public recognition as regards the importance of gender issues, not only for a more just society but also as a corrective towards traditional, male-dominated science. It

establishes an important platform not only for making visible the skewed power relations that permeate past and contemporary society, but also for enabling alternative “ways of knowing” that explore epistemic cultures from a feminist point of view. Helgo Nowotny (1999), for example, speaks in this context of a shift from the traditional, disciplinary-oriented way of doing science (knowledge production in Modus 1) towards a more problem-oriented and holistic one (knowledge production Modus 2)¹⁸. The literature reviewed reflects these multiple and co-existing agendas: questions on feminist methodologies are discussed and the struggle between established “hard” sciences and women's studies, the (historical) relation between gender studies and the women's movement or the historical accounts on the institutionalisation process are the most common entries. The discussion also reflects the tensions between the integration of women's studies into the mainstream (criticised as “malestreaming”) vs. the separation (criticised as ghettoisation) within academia vs. maintaining feminist knowledge outside of academia (geared towards the “average women”). Concrete empirical research on the conditioning factors that allowed or hampered the institutionalisation of women's and gender studies is quite scarce.

Several texts deal with the more or less superficial institutionalisation of gender and women's studies. Metz-Göckel (2004) distinguishes in this sense between “integrative” vs. “additive” institutionalisation. With the German government decree of 1999, gender mainstreaming was established as a guide to all political action and as a result, gender studies received a strong legitimisation and push. However, this has not caused gender studies to be established as an independent discipline. A certain disillusionment has set in since the initial hopes that gender studies would change mainstream given that these hopes have not been fulfilled. Similarly, Hammarström, Hovelius & Wijma (2004) report on the long history of integrating women and gender research into medicine in Sweden since the 1980s. Despite many important achievements backed up by a political will, the main obstacle is that women and gender research has still not been accepted as a scientific field from mainstream medicine. Grotenhuis, in an article from 1989, reaches similar conclusions regarding the ambivalent impact of the political will. The fact that Dutch universities and colleges are financed by the central government, which pursues an affirmative action policy for education, has contributed to the introduction of women's studies into various HE institutions. In spite of some success, the author was cautious in 1989 to speak of a successful institutionalisation of women's studies in Dutch universities. In too many cases, women's studies remains temporary and experimental. More recent publications that would shed further light on the experience were not found in the GSD..

Hermann & Cyrot-Lackmann (2002) see the weak position of French gender studies in its lack of institutionalisation and from the isolation of the single researchers in their specialised disciplines. More specifically, when gender issues are integrated into other disciplines, the threat of isolated work, which hinders real change, surfaces repeatedly in the reviewed literature. Birbaumer & Tellioglu (1999) report similar findings from Austria where gender-specific research (here in technology) depends on the commitment of some women, mostly working in isolation.

Two publications provide a more systematic, comparative assessment on the crucial factors tied to the institutionalisation of women and gender studies. Delhez *et al.* (1998), in their report to the Swiss Science Council, argue that the degree of institutionalisation depends on the following factors:

- Existence or absence of autonomous or faculty-based women's studies centres
- Academic standing of the staff involved, including PhD qualifications and senior staff-level appointments
- Size and variety of the programme
- Possibility of obtaining a degree in the field
- Finances: amount and origin of funding; structural or temporary

¹⁸ According to Nowotny, in this transformation process, knowledge production opens itself towards its societal environment and stops being a self-closed activity. Knowledge becomes practice-oriented and much more sensitive towards social expectations (Nowotny 1999).

- Number of special chairs and lectureships, and their character: permanent or temporary
- Number of disciplines involved, variety of themes

The report furthermore argues that a consolidated institutionalisation depends on a double-track policy that aims both at a certain degree of autonomy of women's studies and its integration into the existing science and higher education institutional arrangements. Furthermore, it is vital to strive for sustainable structural financial measures instead of temporary ones.

Andriocci & Feuvre (2006) explore the institutionalisation processes of feminist studies in Europe. Through a comparative analysis, they attempt to understand the factors that have enabled the development of feminist studies in universities and laboratories. Generally speaking, the nature of the links between universities and the surrounding society seems to constitute a pertinent point of view to analyse the processes of institutionalisation in the different countries under study. Indeed, the way the educational systems are structured and particularly their level of permeability to social demand may be a determining factor of the development of the feminist studies. Likewise, it seems that the importance given, within a given societal context, to the development of public policies in support of promoting equality between women and men, plays an essential part in the process of academic institutionalisation of feminist studies.

Several publications from Finland do not deal with the conditioning factors for successful institutionalisation of women's and gender studies but rather discuss on a more conceptual level the relation with men's studies. The institutionalisation of women's studies has a long history in Finland, which runs in parallel to questions on the establishment of men's studies (also tied to a FP5 research project on men in Europe).

The studies by Smirthwaite (2005) document the efforts in Sweden to integrate a gender perspective into higher education across 14 universities either as a stand-alone subject or as a transversal theme. Högskoleverket (2007), on the other hand, evaluates gender science programmes at Swedish universities. Besides the overall good quality of the teachers and programmes, the report pinpoints the material and infrastructure shortcomings as well as the lack of staffing.

Griffin (2003) draws attention to the contradictory currents within the institutionalisation process of women's studies in the context of the UK higher education reform since the 1980s. A major hindering fact is the lack of recognition of women's studies as a discipline with its consequent lack of funding. "The establishment of the TQA [Teaching Quality Assessment Exercise] created accountability in terms of more extensive documentation of higher education processes, and would have constituted an opportunity for women's studies to gain recognition for its innovative pedagogic approaches but that was lost through the non-recognition of women's studies as a discipline" (*ibid.*, p. 48-9).

Widerberg (2006) provides insights from a comparative perspective into different national configurations and trajectories for institutionalising women's studies. Rather than strategic decisions, the structure of higher education is decisive. Based on the national reports featuring individual case studies, Widerberg analyses mainly the interplay between higher education and/or research infrastructure in processes of institutionalisation of gender studies. From historical case studies carried out by the project, it became evident that the marketability and the modular system of higher education in the UK facilitated the development of gender studies courses and degrees; however, in 2005 it was still not recognised as an independent discipline, thus hampering its institutionalisation tied to research funding and assessment. In France, the rigid disciplinary structure in combination with the radical nature of the women's movement prevented the institutionalisation of women's studies as an independent discipline and was relegated to a rather marginal position "acted out inside traditional disciplines". In the case of the Nordic experiences of Sweden, Finland and Norway, the difference between institutionalisation processes tied to research vs. teaching is apparent. The modular structure of the Swedish higher education system fostered the introduction of short courses on the subject from the 1970s onwards, which later received an institutional push thanks to the Tham Professorships (9 of 31 positions were earmarked for discipline oriented gender studies; see page 52). In contrast to Sweden, the non-modular structure of higher education in Norway pushed women's studies more

towards research activities which were consolidated with the creation of the Secretariat for Women's Research located at the National Research Council in 1977. The institutionalisation of women's studies started later in Finland than in the rest of the Nordic countries but during the 1990s, it became an independent subject while also being integrated into traditional subject areas, also counting on the establishment of eight 5-year full professorships in women's studies. In general, as Widerberg remarks, "[A] double strategy, going both for integration within the disciplines and disciplinisation through the establishment of a room of one's own seems necessary to guarantee continuity and development of Gender Studies" (ibid., p. 137).

6.4. Concluding remarks

As in other sections of this report, the research presented on policy measures towards pedagogical and curricular reform is quite patchy. Although the literature discusses quite extensively the benefit of new teaching methods or the importance of gender proofing curricular content, relatively few concrete experiences have been documented so far.

Except for Wistedt (2001) and Verdonk *et al.* (2005, 2006) there is little systematic evidence on the obstacles and possibilities of combined pedagogical and curricular reform. It would be interesting to probe further the relation between single-sex education, pedagogic reform and an interdisciplinary approach to knowledge. The women's university and single-sex degree courses in Germany are inspiring examples but from the GSD entries it is not apparent to what extent real organisational and institutional change was achieved.

Girls-only summer camps and schools have been described as quite positive experiences. They provide possibilities of creating exclusive female environments unaffected by the typical derogatory judgements associated with other women-only measures such as quotas or single-sex courses, for example. They provide valuable spaces to establish contacts and probe alternatives to the male-dominated science and technology fields. Despite these positive individual experiences of female participants, there is little evidence on their potential impact for attracting female students to technical careers or for transforming the dominant male SET culture. Isolated experiences are available on how a more diverse student population "de-genders" the traditional male culture (Langese 2007; Blum *et al.*, 2007) of computing – how these experiences, however, travel between countries, institutions or disciplines is another matter. The section on single-sex education overlaps in this sense not only with the section on women-only career training but also with its conclusions. These mono-educational experiences are highly beneficial for girls and women but there is no larger research that analyses more carefully how it contributes to institutional change. In addition, the repeatedly stated difficulty in transforming existing well-respected and "high status" engineering and science departments is somehow left unaddressed – except for the fact that the introduction of mono-educational settings usually provokes heavy rejections that mirror the pro/contra arguments on quota. However, the crucial question of shifting power relations in the academy and how "deep" cultural change could happen is rather absent.

The systematic research on single-sex education in women's colleges that exists in the US, especially in relation to potential benefits in academic performance, is not matched in the available literature in Europe. This might be partially due to the geographic restriction of single-sex HE experiences to Germany; however given its potential benefits, not only in terms of academic performance but also in such terms of networking, counter cultures and formulating alternative – i.e., more situated, ecological problem-oriented – ways of knowing, invites further research on single-sex education as well as promoting its implementation in countries other than Germany.

With reference to the institutionalisation of women's studies and gender studies, no final conclusions are possible. The reviewed literature is mainly descriptive but more systematic approaches exploring

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an eventual shift from knowledge production Modus 1 towards a more problem- and practice-oriented Modus 2 (Nowotny 1999) could not be found.

7. Concluding Remarks and Recommendations

The present report aims to deliver a meta-analysis on policies towards gender equity in science and research across Europe. Its main objective consisted in analysing existing research, evaluations of and comparisons between policies. In contrast to other reports issued by the European Commission, it does not aim to provide an exhaustive overview of existing policies. Besides the macro-level of gender and science policy it also incorporates concrete empirical research and evaluations of meso- and micro-level interventions. The incorporation of national, but above all small-scale evaluation reports allows for a more detailed assessment of the quality and potential impact of these gender policies and programmes. Besides an analysis of the presence or absence of certain policies, the present work therefore captures the more qualitative aspects of these measures as expressed, for example, through the opinion of the participants.

Spanning a wide variety of different initiatives from the EU level down to single departmental measures, the resulting information on potential impacts and effects of certain policy measures has become more fine-grained but also much more heterogeneous. One obvious difficulty concerns drawing meaningful comparisons between the huge variety of individual and idiosyncratic studies. The variety of the thematic issues covered (science career, HE reform or gender in research) combined with diversity in terms of methodologies used, and more notably, the differences between the concrete objectives, target groups and contextual settings (disciplinary, institutional, national, etc.) remove a common framework of analysis out of easy reach. In addition, there is no shared cross-national understanding of what comprises policy evaluations, nor a “disciplinary” culture of “gender and science policy” that would allow the dispersed experiences and studies to be conceived as addressing “the same” problem. In general, what remains are descriptive rather than theoretically informed, (nationally and thematically) isolated studies. To be precise, this is the case, for those few countries which actively engage in research and evaluations and make the results public. Nevertheless, despite these limitations some common themes and issues were apparent and will be summarised in the following paragraphs.

The present meta-analysis is based on the entries in the Gender and Science Database classified under “policies towards gender equality in research”. The available 1,296 abstracts in English provided a first orientation for in-depth study of selected texts. Close reading of original texts was limited to the languages available to the research team (English, Spanish, Catalan, German and French). Where publications in other languages were deemed important and their abstract was insufficient, more detailed information on their content was requested from the country correspondents.

The country group distribution of publications under “policies towards gender equality in research” reveals that most literature stems from the German-speaking countries. Switzerland, Germany and Austria all created relatively recently large-scale research and HE reform agendas that incorporate important gender aspects. These reform projects have been extensively evaluated and therefore supply the major strand in relevant publications for this meta-analysis. Other countries such as the northern country group – although they exhibit more favourable situations for women in science and higher education – have fewer research and evaluation publications. The same is true for the new member states of the European Union, where gender equality policy has not yet been put into practice. Thus, owing to very different historical reasons, the northern and eastern European countries have relatively few publications on policy towards gender equality in research. As a result, the centre of gravity is clearly given to the continental European countries as the main body of research on gender and science.

With regard to the institutional sector, it is equally evident that the majority of publications deal with the public higher education sector. A minority of texts address the private research sector or research institutions in general. Thus, policy towards gender equality in science and research predominantly addresses human resources issues in the public sector. This is all the more interesting since the size of the private R&D sector is decisive for predicting the proportion of women researchers in a given country (EC 2008a). Thus, innovation policies – as opposed to HR policies – which aim to stimulate

the development of new products and processes in the private sector belong to an area which is remarkably under-researched despite its strategic importance for questions of gender equity.

From a historical perspective, we can discern a clear diversification of measures that aim to reduce inequality between men and women in science. Starting with equal rights legislation during the 1960s and 1970s through to positive actions dominant during the 1980s and gender mainstreaming approaches since the 1990s, the scope and depth of how inequality has been tackled has steadily increased. Liberal, rights-based approaches have come to stand beside measures that aim to compensate for systematic group disadvantages experienced by women in science (positive discrimination). Gender mainstreaming, on the other hand, goes one step further and aims to transform the very systems and structures that continually reproduce these inequalities. All three – equal opportunities, positive action, and gender mainstreaming – place different emphasis on the capacity of legislative mechanisms to promote gender equality. The first perspective sees legal redress as integral to gender equality. The second perspective has a more ambiguous relation to legislation despite the fact that it can be legislated (e.g., setting quotas) or not (e.g., employers encouraging under-represented groups to apply for job positions). The third perspective, mainstreaming, has as its sphere of action the policy arena and not the legal sphere. This historical development can be observed in the statistical increase in publications dealing with science policy and gender equality in the GSD (see page 20). Thus, since the 1970s there has been an increasing diversity in how gender inequality in science has been tackled. Rather than clear-cut historical periods, legislation, positive discrimination and structural approaches exist side by side.

7.1. Summary of Main Findings

From a thematic point of view, the literature could be grouped into three large blocks comprising measures dealing with:

- Science career: training and advance in scientific careers, stipends and scholarships, programmes of mentoring and measures for work-life balance.
- Science and higher education reform: measures including legislation on gender equality, institutional structures such as equality officers, committees and observatories, quotas, new steering instruments such as incentives and targets.
- Gender as content in research and higher education including gender proofing pedagogy and curriculum, exclusive education, institutionalisation of gender studies and gender assessment of research.

A summary of conclusions will be given of these thematic blocks in the following paragraphs.

Advancing Women's Science Careers

The chapter on advancing women's science careers dealt primarily with the literature on career training and development, stipends and scholarships, networks and mentoring and measures towards balancing work and life.

First, the importance of differences between disciplines is highlighted. Considering the sub-topic of career training besides stipends and mentoring schemes, it became apparent that the impact of equality measures in these areas depends on the historically created specific culture and disciplinary requirements in place. This was consistently reported from EU collaborative projects but also by national projects that undertook comparative research on the differential impact of certain measures across the “hard” and “soft” sciences. Policy measures will need to take into account these disciplinary specific aspects in order to be successful.

Second, a further shared concern juxtaposes the highly beneficial impact of career measures at individual level to its “weak” structural impact. The available literature leaves no doubt regarding the positive effect of career training or mentoring programmes, for example. Even though these positive actions might potentially be stigmatised as “women-only” activities, the participating female scientists generally reported very positive experiences with these types of support measures that made a difference to their career prospects. However, these individual benefits were repeatedly contrasted with concerns of “making women adjust” to the male-dominated scientific culture. Career development for women scientists needs to be combined with changing the science culture at large and should not be modelled according to male-shaped job and life patterns. Isolated measures exclusively directed towards women are not effective enough. Another limitation is the fact that career promotion cannot be considered a remedy for the general lack of positions.

Third, the institutional level of involvement emerged as a key aspect for the success and real impact of policy measures. Given that scientists traditionally enjoy a high degree of autonomy and independence, the way gender policy can penetrate work and organisational habits is key to making a real difference. This became especially apparent in terms of stipends vs. fixed PhD positions for women, where the latter provided a better integration of the PhD candidates into the institutional setting and scientific community. But it was also apparent in the way women were able to participate in the decision-making process in HE institutions and the governing body’s commitment or lack thereof to gender issues. High-level implication and commitment of the rector and/or dean were usually a prerequisite in order to make gender a real issue on the HE / research institutional agenda.

Fourth, there is a need to rethink the linear model of the science career. Despite the fact that career breaks are penalised in science, there might be untapped possibilities and potentials for women entering science. The example of the “lecturing stipends” for Universities of Applied Science in Germany demonstrated that it provided an effective way of encouraging women from the industry to re-enter HE. Relatively little is known about returning and re-entry schemes in relation to research and higher education.

Science Management and Reform

The chapter on science management and reform dealt primarily with the literature on gendered aspects of institutional reform including legislative frameworks, the role of equality officers and equality committees, quotas, and new HE governance instruments.

The literature on equality officers and representatives in general agrees on their central role in advancing gender issues in science. Mostly barred from real decision power, these figures nevertheless manage to pinpoint concrete cases of discrimination and sensitise the whole science environment towards the importance of gender issues. Research has focused mainly on the micro-politics and tactics of equality representatives in their task to advance women’s issues at universities. In the context of recent HE reforms, their role often changes towards increasing expertise and professionalism concerning the gendered impact of new steering instruments.

In general, the literature that deals with the restructuring of HE and its gendered impact is very inconclusive to date. It is important to note the country-specific uptake of new public management instruments in HE under a gender perspective. While the reviewed literature in the UK paints a rather negative picture in which NPM reinforces the already existing male bias and disadvantages for women in HE, the German literature aims to co-opt NPM for gender equality concerns. The reasons for these different uptakes (which might be related to the different role of equality representatives in the respective countries) would be an interesting question in itself. We can point to different experiences – such as the Swiss case vs. certain German institutions like the Free University of Berlin – that provide first approximations of the potential and effects of NPM on gender equality in science and research.

The move from direct positive interventions towards an output-oriented steering approach seems to have levered out much of the negative and pejorative arguments against positive actions, concretely

“quotas”. Since women’s promotion has become part of greater quality concerns in the interest of all, they cannot be rejected as easily as before. However, as some of the reviewed contributions have made clear, while women’s promotion was formerly seen as an unjustified intrusion into the objectivity and meritocracy of science, now the danger consists in seeing it as interfering with the neutrality of economic and formal allocation procedures. Hence, the renewed importance of women’s representatives and equality officers who continue to occupy key roles in order to politicise the apparently a-political budgetary, expert-based decisions. Apart from the danger of depoliticising formula-based allocation mechanisms and economic calculus, the introduction of managerial steering tends to make decisions less transparent and participatory. This might turn out to be especially disadvantageous for women who are predominantly in the lower ranks of the HE and research hierarchy.

In general, as Zimmermann (2003) maintains, the degree to which these new steering instruments and models are actually useful for furthering gender equality is among the most pressing and least answered problems in the current debate on policy towards gender equality in science and research.

Gender Dimension in Research and Higher Education

Chapter six deals with gender as tied to a process of modernisation of higher education and research. This involves not only uncovering male power structures, but also improving the quality and diversity of knowledge. The insights into the close relationship between a more gender-sensitive approach to higher education and research and the resulting increase in quality for all have made this an explicit policy target.

Most prominently, the GSD contains several entries relating to the gender impact of the Bologna process. However, the articles so far are rather speculative. Since this is a recent process, little concrete research was identified in the current meta-analysis.

Except for some selected publications, there is little systematic evidence of the obstacles and possibilities of combined pedagogical and curricular reform. It would be interesting to probe further the relation between single-sex education, pedagogic reform and an interdisciplinary approach to knowledge. The women’s university and single-sex degree courses in Germany are inspiring examples, but from the GSD entries it is not apparent to what extent real, sustainable organisational and institutional change was achieved.

Girls-only work camps or summer schools have been described as fairly positive experiences. They appear to provide a way of creating an exclusive female environment that is not the target of the usual devaluation experiences that occur in the case of single-sex degrees or courses. Nevertheless, they provide valuable spaces to establish contacts and probe alternatives to the male-dominated science and technology fields. Despite these positive individual experiences of female participants, there is little evidence regarding their potential impact with respect to attracting female students to technical careers or transforming the dominant male SET culture. The key question of how well-respected, traditional “high status” engineering fields can be transformed and opened up remains clearly under-addressed in the available literature. The crucial question of shifting existing power relations in the academy and how a “deep” cultural change could occur is notably absent – in part due to the fact that very few examples exist where such a change was achieved.

The systematic research on single-sex education that exists in the US regarding women’s colleges especially in relation to potential benefits in academic performance is not matched by the available literature in Europe. This might be partly due to the geographic restriction of single-sex HE experiences to Germany. However, given its potential benefits, not only in terms of academic performance but also in such terms of networking, counter cultures and formulating alternative – more situated, ecological, problem-oriented – ways of knowing, invites further exploration in this field.

The map of the institutionalisation of gender and women’s studies in Europe remains largely undrawn. There is evidence available from EU research projects in the form of case studies but there is no

systematic research that describes in more detail to what extent we really have moved towards a more holistic and problem-oriented production of knowledge (see Nowotny 1999).

7.2. Summary of Major Recommendations

Just as important as the main findings are the major gaps identified in the reviewed literature. We have grouped the individual gaps pertaining to each thematic section according to three topics: (1) a shared language of evaluation, (2) lack of theory and (3) long-term research.

The need for common quality standards for evaluation.

What the reviewed literature clearly demonstrates is a need for a common language of evaluation of policies. Existing studies and reports provide material that remains isolated since a common framework of comparison is lacking. Evaluations are often linked to the very objectives and implementation logic of the project under question and seldom respond to general considerations from an evaluation point of view. An example of this difficulty could be the confusion between gender equality and the deconstruction of a male-dominated science model vs. the simple increase of women in science (higher ranks).

A common evaluation framework might be useful to address the related problem of detecting structural change. The majority of approaches concentrate on the individual (satisfaction, benefit) level. Surveys and interviews before and after certain activities such as training seminars, summer schools, and so on, are frequent. However, large-scale evaluations that do not only focus on individual benefits but on structural change are much harder to come by. Thus, indicators that enable the detection of structural, sustainable changes would be welcome.

A clear need for the future are comprehensive approaches that overcome frequently isolated and local studies and understand the interplay between several factors and measures, i.e., the possibility of combining mentoring with certain scholarships, single-sex degrees, etc. This also points to the need to make explicit the normative component of many evaluation studies. As argued in the introduction, evaluation of policies can be understood as the continuation of politics with other means. Therefore, it is important to argue carefully which “desired” ideal states serve as a measuring stick for evaluation. Although individual benefits are important and a crucial stepping-stone, broader concerns and long-term issues beyond the micro-level have to be taken into account.

Last but not least, there is a need for a meta-reflection on the impact and possible effects of evaluations. Critical voices have claimed that evaluations have become just another bureaucratic obligation that has little real impact. This makes it necessary to reflect further on different evaluation approaches available and their potential benefit for advancing gender issues in science – apart from their apparent role as steering / monitoring instruments for performance-related targets.

Need for theory and interdisciplinarity.

Closely connected to the first need of a shared evaluation framework is the need for more theory building. Most studies are descriptive and lack explicit theoretical references. The empirical situation under study is seldom distilled and exploited in terms of theoretical concerns or theory building. This reinforces the isolated nature and lack of comparison between case studies across Europe.

The lack of theory building is evident along several lines. On the one hand, when compared to research in the US, for example, on mentoring or single-sex education, it is apparent that research in these areas does not address overarching questions but rather focuses descriptively on the concrete measures carried out. This makes it hard to put the insights emerging from the evaluation case studies into dialogue with other studies and research carried out in the rest of the OECD countries.

Disciplinary and institutional differences turn out time and time again to be important factors for the successful implementation of certain promotion measures. In order to affront the resulting explosion of empirical details, it is necessary to develop theoretical models that help to see not only the pieces of the puzzle but how they might fit together.

On the other hand, considering interdisciplinarity, few cross-inspirations are taking place. For example, even such a closely-related field as primary and secondary education, which have a long history of reform attempts (including many failures), is not tabbed in order to understand the many-sided aspects necessary for institutional change. As pointed out, the discussion on “quotas”, for example, does little to flesh out the similarities and differences between positive measures in the science context and other public areas such as political representation. Especially rare are those cases in which an existing evaluation study would refer to or even take further problems known from other disciplinary fields such as organisation studies. As Simon (2005) states, missing are primarily implementation strategies on the background of unrealistic assumptions on organisations and their potential for change.

Considering the transferability of policies of equal opportunities in science within the EU countries, a clear policy transfer in terms of goals and instruments has occurred towards the new Eastern member states whereas implementation process is still rudimentary. Not surprisingly, from the literature one can confirm the importance of national legislation and policy frameworks for gender equality in science. In addition and crosswise, we have to consider the differences between the disciplines as important influential factors concerning what does and what does not work. And third, the concrete institutional set-up is important especially as HE is restructuring and changing its governance and steering mechanisms.

Need for research on long-term effects.

A further clear need is tied to the lack of long-term research. The problem of the rather isolated studies is further aggravated by the fact that most studies on policy towards gender equality in science are also restricted in time. Most evaluations happen just before, during and shortly after the actual activities are carried out without being able to consider their long-term impact. This would be especially important to see not only what works but also why certain measures did not achieve the desired results or might even be counter-productive. This might be the case for certain examples where the continued emphasis on gender issues has installed “equality” on a discursive level but not on a practical one. Transforming practice has to confront not only the ignorance of gender issues but also a lack of discrimination between the rhetoric of gender equality and real, cultural change.

7.3. Concluding Remarks

This short review of the existing EU efforts towards gender equity in science and research demonstrates two matters: first, the dimensions of the scarcity of women at all levels of science are well established. A decade of data-gathering, reflection and comparative analysis has demonstrated the reality of horizontal and vertical segregation, the existence of pay gaps, stereotypes, and the biased nature of criteria of excellence. Second, despite an awareness of the problem, not much has improved. Women become more under-represented the higher one climbs up the scientific ladder. The persistence of these disadvantages requires new strategies in policies towards gender equity in science in the EU which will be briefly outlined in the following paragraphs of this last section.

A crucial insight concerns the fact that in order to progress towards a truly developed knowledge society, science policy targeting allocation of financial and human resources based on criteria of transparent and fair scientific evaluation procedures will not be sufficient. Rather, in order to take advantage of the existing pool of researchers and innovation talent, a cultural change in terms of challenging traditional gender roles specifically in terms of more gender balanced decision-making in research will be required. The scarcity of women in positions of power and science decision-making is not a problem that will be resolved over time (as soon as the number of women candidates increase).

In fact, the number of women candidates is increasing, but the participation of women in research activities is not associated with more funding for research and innovation or more intense private research efforts. Employers continue to be reluctant to incorporate women (EC, 2008a). The key challenge is not to change women but, on the contrary, to change the culture of science and research. This change would concern not only the definition and assessment of excellence but also issues relating to work-life balance.

The strong emphasis placed on work-family balance policies is oriented towards attracting and retaining female talent. The concept of gender diversity is also incorporated as a key element of good management of research and innovation policies. Diversity is required not only for economic reasons (improving efficiency by the optimisation of human resources, gender equity would contribute to competitiveness); diversity also improves the quality of science and research by increasing creativity and bringing science closer to society.

This new perspective involves a “shift from formal equality to opportunity or equality in numbers, to gender balance and equity” (EC 2008b, p. 23). It also involves a different sequence of measures in order to achieve gender goals. At present, the main challenge is not to define new policies but to test their effects through the following steps: evaluating policies, identifying successful measures (*best practises*), in depth analysis of policies and measures.

In the end, the new EU perspective on gender and science comprises the idea that gender policy is not only made by regulation and legal changes but mostly by leadership and a commitment to change structures and cultures.

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