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POLICY TOWARDS GENDER EQUALITY IN SCIENCE AND RESEARCH

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ABSTRACT:

The following article summarizes the meta-analysis of policies towards gender equality in science and research across Europe spanning the years 1980 to 2008. Observed overarching trends in the research literature are summarized, including the impact of higher education restructuring on gender equality in science and research and measures for advancing women's science careers. The article closes by stressing three key challenges: first, the integration of gender policy assessment with theories of social change; second, the gendering of innovation policy; and third, re-addressing the question of power and political struggle in relation to policy.

KEYWORDS: Gender Equality, Women in Science, Innovation Policy.

INTRODUCTION

The following article presents the main findings of the meta-analysis of policy towards gender equality in science and research. It is based on an extensive report (Castaño et al. 2010) published as part of the overall effort to produce a Meta-analysis of Gender and Science Research in Europe[1]. The specific objective of this report consisted of analysing existing evaluations of, and comparisons between, policies towards gender equality. It can therefore be seen in parallel with previous and similar gender equality efforts in science at European level, such as different expert groups (ETAN, WIR, ENWISE). At the same time, and in contrast to previous reports, this article is not aimed at an exhaustive and detailed overview of existing gender and science policy situations across Europe, as others have done this sufficiently (EC, 2002; EC, 2008a; EC, 2008b; EC 2009). Rather, our main objective is to review and examine the effectiveness of micro and meso-level policy measures. Gender equality policies in science have become an important issue in all EU member states. Apart from equal treatment laws, many countries have also passed "gender mainstreaming" legislation and integrated it into administrative procedures. Several countries have also devised direct support measures, such as improved child care or specific mentoring programmes. Most EU member and associated countries have a Ministry for Women's Affairs / Statutory Gender Equality Agency (EC 2008a, pages 42-3). 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 patchier picture emerges. The variety of policy measures and the persistence of unacceptably high levels of inequality (relating to pay, funding, career possibilities, etc.) across most EU countries forces one to examine the effectiveness and impact of these policy measures.

A central reference in this undertaking is the report published by the European Commission on *Benchmarking policy measures for gender equality* (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, establishing clear-cut relations between certain policy measures and the overall representation of women in science is problematic (*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 make 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 at sub-national levels (*ibid.*, p. 38). Local and small-scale initiatives could have a more decisive impact on women's participation in science than large-scale programmes. The report on policies towards gender equality in science and research aimed to close this gap.

However, at the same time it is clear that this article does not simply attempt to

[1]Meta-analysis of gender and science research is a project which forms part of the 7th EU RTD Framework Programme (contract no.: RTD-PP-L4-2007-1), led by Maria Caprile at the CIREM Foundation. http://www.genderandscience.org/

summarize the main findings of the policy report. Given space constraints, our focus shifts slightly towards identifying the major shortcomings of policy evaluations for gender equality in science and research and suggests ways to move forward. The main challenge from our point of view consists of overcoming the almost exclusive focus on a human resources approach to gender equality policy and to achieve a tighter theoretical integration of what are often isolated evaluation studies in order to tackle the difficult issues of promoting and fostering cultural change.

Methodology

The meta-analysis project proposal offered an initial conceptual framework which 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 which emerged during grouping of the reviewed literature. Despite the existence of a strong theoretical discussion of the potential benefits and drawbacks of gender mainstreaming vs. positive actions, this 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 work/life balance measures.

- 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.

- The gender dimension in research and higher education, including gender proofing pedagogy and curriculum, exclusive education, institutionalisation of gender studies and gender assessment of research.

The thematic priorities are the result of a review of 1,296 abstracts from the Gender and Science Database (GSD). The initial entries in the GSD were made by national gender experts. Where available, selected key texts were studied in depth. This often produced new sources and texts not yet available in the GSD, but subsequently added to it. The content analysis was supported by a statistical analysis of the GSD entries on "policies towards gender equality".

Important limitations with regard to this meta-analysis concern the analysis of the GSD entries. All abstracts are made available in English. Original texts were consulted whenever possible. This means that an in-depth review of the literature on policy measures was restricted 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 from 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. It has also been reviewed by the scientific steering

committee.

A further limitation might involve the classification of the literature when it is entered in 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).

MAPPING THE SCIENCE & GENDER POLICY LANDSCAPE

In the following section we will comment on the most distinctive features of the reviewed literature addressing policy towards gender equality in science. This includes a first approximation of the type of policy we are discussing followed by a short outline of the theoretical models deployed.

What Policy? Supply Side Policy!

The participation and position of women in science is the result of a series of compound factors involving not just direct gender equality policy but also wider social policy frameworks, in addition to the national R&D sector or the socio-historical context at large. The European Commission report on *Benchmarking policy measures for gender equality* (EC 2008a) provides an important overview in this respect. The combined existence of women's science units, targets, mentoring, and special funding schemes has been found to positively correlate with the proportion of women in professional grades. However, the influence is relatively weak considering other factors such as the size of the private R&D business sector and labor market participation of women. Indeed, the second most important factor which positively influences the female proportion of researchers is the female proportion in employment aged between 25 and 50 (EC 2008a, p.26). The more women participate in the labour market, the higher the percentage of women scientists. This seems to be intuitively plausible and puts the spotlight on the importance of wider social and labour market policies which encompass not just work in science but the conditions of the female workforce as such. Apart from labour market participation, the main factor

> "..., which negatively influences the female proportion of researchers is the relative size of the business enterprise R&D sector in terms of the numbers of researchers employed. This means that countries with large business enterprise R&D sectors have lower proportions of women researchers than countries with small business R&D sectors." (EC 2008a, p.27)

Countries which have a strong national system of innovation, where research enjoys a relatively high status in terms of salary, therefore appear to have fewer women. Thus, new Eastern European member states have a relatively high share of women in science and a low-performing innovation system (EC 2008c). This crucial correlation inevitably puts the spotlight on the demand side problem of women in science: if a decisive factor in the under-representation of women in science is indeed the size of the national business sector, then policies that target the supply of

technical talent are clearly insufficient to bring about fundamental change. However, most of the reviewed literature on policies towards gender equality in science does precisely that, in other words target supply side factors such as human resources aspects by improving the career prospects of women in governmental and higher education sectors. Among the most commonly researched measures, one first finds career and professional development programmes involving all sorts of coaching and training activities which target the personal skill levels of women in academia. There is then a second bundle of measures offering stipends and position scholarships (sometimes bundled with targets or quotas) specifically geared to women in order to reach the next qualification level, either a PhD or qualification for full professorships. Finally, there is a relative abundance of research on women's support networks, especially mentoring initiatives. More genuine gender mainstreaming measures (Daly 2005; Walby 2005; Rees 2005; Woodward 2008), although potentially targeting the whole of society by gender proofing research funding, pedagogy & curricula, installing gender observatories, women's science units or institutionalizing the gender studies themselves, are mainly restricted to the government and higher education sector and thus appear to be very limited in terms of reaching the crucial R&D business sector. Looking at the distribution by institutional sector of the revised literature, 87.7% deals with higher education, 23.7% with the government sector and only 10.7% relates to the private business sector (non-exclusionary). What the *Benchmarking* report, in conjunction with our meta-analysis, therefore suggests is a rather sobering view on the potential of existing supply-side public policy to substantially improve the participation of women in science and research. As we will argue, other policy arenas must be tackled apart from human resources measures.

The evident limits of human resources policies suggest from the outset the need to recognize different policy streams. With Lundvall & Borrás (2006), one could distinguish between (1) science policy, (2) technology policy, and (3) innovation policy. This threefold distinction follows a historical evolution where the emphasis on knowledge production and the provision of technical solutions by science and technology policy is replaced by innovation policy concerns for economic growth and international competitiveness. From a more gender-informed perspective, Cozzens (2008) makes a distinction between (1) research policies which invest in the knowledge base, (2) innovation policies which stimulate the development of new products and processes, primarily in private industry, and (3) human resources polices which develop technical talent. Although these two resources split up the policy arena in relation to science slightly differently, there is agreement on the importance of innovation policy in contemporary society. Since innovation policy primarily targets private industry it could become a new focus for gender equality policy; as mentioned it is precisely the strength and size of the private R&D sector which has a decisive impact on the proportion of women in science. The focus must therefore shift from supply-side to demand-side policies; that is, towards "employer policies and/or strategies", which means "changing the culture and organisation of the science sector as a whole" and especially industrial research in the business enterprise sector (EC 2008a, p.37).

Indeed, one result which emerges from the meta-analysis concerns the implicit correlation between the strength of national innovation systems, the under-representation of women from science and research and the relative abundance of

research carried out on policies towards gender equality. Looking at the overall statistical distribution of the 1296 entries in the GSD classified under policy issues, just over a third (33.2%) came from continental Europe, 22.3% from the UK and Ireland, 17.6% from northern European countries, 12.7% from Eastern Europe and 12.3% from southern European countries. The fact that the majority of publications come from Germany, Austria, Switzerland, Luxembourg, Belgium and the Netherlands is not only important in quantitative terms but also qualitatively speaking. Large-scale and well-documented gender equality initiatives were predominantly available from Germany (*Hochschulsonderprogram HSP II / III, Hochschul und Wissenschaftsprogram*), Austria (*Frauenfördernde Massnahmen am bm:bwk*) and Switzerland *(Bundesprogram Chancengleichheit).* This wealth of policies and concomitant evaluation reports in continental European countries is not a coincidence if one considers precisely the role of national innovation systems in conjunction with gender equality issues. According to the European *Innovation Scoreboard 2007* (EC 2008c), Germany, Switzerland and Austria, along with Sweden, Finland, the UK and Denmark, amongst others, have a high-scoring system of innovation whereas many southern and Eastern European countries score below the EU27 Summary Innovation Index average. Now if this country-specific innovation typology is overlaid by a country specific gender-equality context (EC 2009), it becomes clear that those countries which have few women in science and research but a high innovation profile are precisely the ones which have produced most publications on policy towards gender equality, particularly Germany, Austria, Switzerland and to a lesser degree Belgium and the Netherlands. These countries have been characterized by a rather traditional, male-breadwinner oriented gender regime that co-exists alongside a strong system of innovation. The low participation of women in science and research implies that women in those countries are clearly disadvantaged because they lose out disproportionally on high quality, prestigious, well-paid jobs – a situation which has been addressed by the aforementioned gender equality initiatives in science and research.

Evaluating policy

Another important finding from our meta-analysis concerns the type of evaluations carried out by the reviewed projects. Except in isolated cases (specifically those already mentioned in Germany, Austria, and Switzerland), the theoretical foundations for operationalising gender equality and carrying out sound evaluations were seldom explicitly acknowledged or mapped out. This is concurrent with similar meta-analysis carried out for example on literature on women in computer-related majors. The finding that "...most of the research is descriptive and is driven by practical considerations, such as the need for increasing the number of women in computer-related majors"(Singh et al. 2007, p.513) certainly holds for the reviewed research on women in science and research. Although a large part of the GSD policy entries are conceptual and state-of-the-art papers often debating the theoretical benefits and potential of different policy instruments (positive discrimination and/or gender mainstreaming), this is seldom integrated into empirically-grounded theory building. Most research therefore identifies measures and factors that are beneficial for the advancement of women in science but fall short of integrating these findings into a sound theoretical model for social change.

In general, the reviewed publications referenced to very varying degrees the standard dimensions of evaluation. The widely used standard definition by the Joint Committee on Standards for Educational Evaluation published in 1981/1991, which sees evaluation as "the systematic assessment of the worth or merit of an object", was rarely explicitly acknowledged. A programme has *merit* if it performs well according to its purpose. It is a question of the internal quality of a given programme. *Worth*, in contrast, assesses whether a given programme addresses a real need and is therefore tied to a needs assessment. This definition has important political and epistemological consequences. As noted by Bovens et al (2006), *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 "effectiveness" of certain measures (their merit) but also imply an agreement on their worth, i.e. do they address a real need. Since women are still under-represented in science decision-making structures, social agenda/advocacy approaches (for a typology of evaluation approaches see Stufflebeam & Shinkfield, 2007) 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 et al. 2007, p. 17):

(1) A normative aspect, especially apparent in an analysis of the goals to be achieved. The questions asked usually involve the definition of the target group to be addressed (e.g. students, professors, selection committees and vice-chancellors, among others) and the 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 a change in sensibility towards gender issues or professional culture?).

(2) An analysis of the implementation process. Is the implementation process appropriate as regards reaching the goal set? How does implementation change over time? Which factors support or hamper 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, such as personal relations, margins in interpretation, accommodation and resistance. Studies that evaluate policy implementation could in this context draw on findings from research on policy transfer (Dolowitz & Marsh 1996, 2000).

(3) The evaluation of policy also concerns a third aspect, namely the analysis of its impact. Analysing the possible impact of policy poses another major challenge. As the GSD literature shows, 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 secondary *structural* impact dimensions are much harder to evaluate. Isolating cause-effect relationships that undertake to trace changes to certain policy interventions in the science environment are quite scarce given the additional difficulties of limiting the time frame for scrutinising potential effects.

EMERGING TRENDS & NEEDS

The role of women in science emerged as a major policy concern in the late 1990s at European level. The aim 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 equality in science was embedded in the broader commitment of EU policy to guarantee equal opportunities for 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 be systematically addressed in the field of science and research from the late 1990s onwards. Whereas formerly, during the preceding decade of the 1980s, equal opportunities for women and men in science were mostly restricted to sporadic and isolated positive measures at individual universities and research institutes, towards the end of the 1990s a broader and more comprehensive approach began to be seen. The quest for specific support measures targeting supposed “deficiencies” of women in science has been reduced in favor of addressing and overcoming the structural barriers that prevent greater participation of women in science and research.

Starting with the most recent trend (late 1990s and early 2000s), the literature increasingly discusses the impact of higher education (HE) and research restructuring. The mass access of students to HE, in combination with the scarcity of state finance and global competition for talent, has had and continues to have a strong impact on HE. A new managerialism has been introduced in HE institutions, challenging existing traditional self-conceptions of autonomy and independence in science. 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. Along similar lines one can understand the decline of discussions relating to the negative, stigmatising effect of “women-only” promotion schemes which have become much less popular when compared to the “neutrality” of performance-related measures and new quality standards for science and research. In addition, the context of university reform also draws attention to the professionalisation of women's representatives. Although the micro-social settings documented by earlier research are still important, more sophisticated instruments deployed in university management mean that equality officers are required to have a sufficient understanding of these complex tools for their use to achieve gender equality.

A more country-specific trend concerns the importance of single-sex educational settings in Germany which peaked during the late 1990s and early 2000s. Several single-sex degree courses in SET disciplines were created. Together with the *International Women's University – Technology and Culture* (ifu) in 2000, 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.

The discussion on science careers and all aspects of career training began primarily in the mid-1990s. Specific support measures directed towards women but also aimed at 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 on 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 which facilitate the professional mobility of both men and women as a couple.

Gender and Higher Education Restructuring

The following section reviews publications that deal with the gendered aspects of Higher Education (HE) restructuring, including the implications for research institutes across Europe. Seen from a historical perspective, the latest introduction of new management strategies into HE and research means that important changes have been made not so much with regard to the goals (e.g. raising the proportion of women in higher career positions), but rather in terms of the steering mechanisms used to achieve them. Several policy instruments such as legal/rights measures, positive actions (such as quotas), co-exist alongside more recent "mainstreaming" mechanisms and new steering instruments such as target/incentive-bound resource allocation. 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 a solution for streamlining 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 well-being 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. Vice-chancellors and deans receive more power and autonomy to profile their institutions and align them according to "market" opportunities for international talent, research funding or students. The traditional, direct-steering approach of public science and education ministries is thereby deregulated; detailed control of inputs and processes is 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 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 an end to the traditional way of doing science, characterized by unconditional funding and minimal state intervention (see Parker & Jarry, 1995; Prichard & Willmott 1997).

The main question discussed in "gender" literature now focuses on the ways in which NPM might serve to make inroads into the very encrusted and reform-resistant science and HE institutions. The picture that emerges is inconclusive at best. A Swiss large-scale initiative attempted to provide financial incentives to hire more women in HE but encountered low acceptance from within academia itself (Spreyermann & Rothmayr 2009). On the other hand, more positive experiences can be found in the case study of the FU Berlin, which has pursued a NPM approach over the last two decades (Koreuber 2008; Färber 2007). 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 (Thomas & Davis 2002; Morley 2003, 2005; Deem & Morley 2006; Barry et al 2006). Case studies carried out in Austria alert us to the fact that new managerialism involves a strengthening of top positions, thus reducing the possibilities of democratic participation of the lower ranks within the university hierarchy, where proportionally more women are situated (Rothe et al. 2008).

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's" measures or even legal rights-based interventions. Especially in northern European countries, research has scrutinized the often negative attitudes towards quotas and positive measures that clash with the supposedly objective and meritocratic science system (Rogg 2004; Teigen 2000; Jordansson 2003, 2005; Willemsen & Sanders 2007). Since women's promotion has become part of larger quality concerns that are in the interests 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, the danger is now that it will be seen as interfering with the neutrality of economic and formal allocation procedures. The renewed importance of women's representatives and equality officers who continue to play key roles in order to politicise the apparently apolitical budgetary, expert-based decisions is therefore crucial (Zimmermann 2003).

The role of equality officers, equality committees and equality observatories has received considerable attention (Steffens et al. 2004; Schmalzhaf Larsen & Holzbecher 2000; Bagilhole & Robinson 1997; Roloff 2007; Barben et al. 2006). Research has largely emphasized the micro-political settings under which equality officers operate. Although the literature usually emphasises the importance of women's representatives for bringing gender issues to light in the day-to-day business of higher education institutions, it also points out the very frequent lack of real decision-making power that limits their influence. What is more, as the Austrian example underlines, interventions by the equal opportunity officer against discrimination that are based on a clear legal mandate are often the most ineffective due to the highly stigmatizing effects for those involved. Precisely the strongest weapon the equality committee has at its disposal, the legal channel, actually proves

to be the most ineffective (Wroblenski et al. 2007, p.284), thereby limiting the role of EO officers to informal operations such as acting as a quality watchdog in appointment procedures.

Given the diversity not only of higher education institutions but also 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 on a personal level. Considering the field of institutional reform, this concentration on individual benefits is especially striking. Given the existing variety within certain universities (between faculties and departments), there is currently little research which addresses the impact of new steering instruments on women's promotion and gender equality as a whole. Comparative studies between individual higher education institutions or even between countries are equally rare. As a consequence, more research is needed in order to clarify the conditions under which 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, "the *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).

Advancing Science Careers

In the following section we discuss policies and programmes for supporting women's scientific careers. The whole field of career development is focused on the core issue of promoting women in science. The well-known, albeit misleading, metaphor of the "leaky pipeline"[2] bears witness to the fact that women are more severely under-represented the higher they climb up 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, linked 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 level of institutional integration and unfavourable tutoring relations are especially vulnerable to "cooling out" processes.

Likewise, the years of exclusive dedication to a science career, especially at PhD and postdoc level, coincide with women's fertile age. Along with the uncertainty of a whole science career, which is characterised by instability and high levels of

[2]It is misleading because this metaphor suggests an overly linear approach to the career path that does not contemplate the many possible interruptions and re-entries (e.g. after maternity leave). It also wrongly suggests that all scientists advance at an equal pace while policy has to concentrate primarily on measures to patch up leaks without considering different necessities within science careers.

dependency until a relatively late stage, the result is that women are discouraged from remaining in science. Last but not least, the availability and dedication necessary for a successful science career is modelled on an 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 the same dedication to their science career as men. The lack of childcare facilities and general prejudices against women scientists with children are other major obstacles.

In fact, given the importance and centrality of work/life balance issues for female and male scientists, it is surprising to find so few concrete evaluations of existing interventions. Flexibility of working hours, compressed hours, working from home, parental, maternal and adoption leave, returning schemes and childcare facilities are the targets of many individual HE institutions, if not national legislation. The existing policy overlap between national legislation affecting women's entry into the labour market (e.g. taxation) and a policy specifically targeting women in science might be responsible for the few concrete evaluations found. More research is needed to clarify how the work/life balance affects men and women differently and to what extent it can really 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 will not reduce the pressure of having an excellent scientific track record (*Beyond Bias & Barriers*, p. 179), nor does their shortage explain the lower proportion of women in higher positions in science (Lind 2008).

Looking at other 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 involving all sorts of coaching and training activities which target the personal skill level of women in academia. There is then a second bundle of measures offering stipends and position scholarships specifically geared to women in order to reach the next qualification level, either a PhD or qualification for full professorships. Finally, among the better-researched topics are women's support networks, especially mentoring initiatives. Except for stipends and scholarships, which operate on a more structural level, both skills training and support networks foster women's careers on an individual level.

In recent decades several large-scale national and international initiatives have been undertaken to provide career and professional training programmes. Among these mention should be made of *Anstoss zum Aufstieg* (Impetus to Advancement) in Germany, which ran from 2001 to 2005 (see Dalhoff 2006, Färber 2007), its European extension "Encouragement to Advance – Training Seminars for Women Scientists" (Lipinsky, 2009), the FP6 project "ADVANCE", which ran from 2006 to 2008 (Husu et al., 2009) or *fFORTE_Coaching* (Wroblewski et al., 2007, p.218ff.) in Austria. The general result of these training programs is that they encourage women in their career aspirations. Women gain self-confidence, network with colleagues in similar situations and acquire a deeper understanding of university and research organisations and structures. However, due to their partial success and the generally very slight increase in the number of women in top positions, the effectiveness of these measures beyond the individual level is arguable (Brown 2000; Devos et al.

2003). End-of-course evaluations typically show a high level of satisfaction with content and delivery on a personal level (longer-term benefits in terms of increased confidence, clarity of focus and understanding of the system), but do not result in broader institutional change.

The second bundle of measures to advance science careers concerns the provision of stipends and scholarships for women. Again, several initiatives have been documented in the reviewed literature, including the ASPASIA programme (Visser et al., 2003; Bosch & Potting 2001; Donselaar 2006) for PhDs or post-doctoral positions in the Netherlands, the Charlotte-Bühler and Hertha-Firnberg support programme in Austria (Wroblewski et al., 2007, p.295ff), the FREJA program for research funds in Denmark (Hilden 1997; de Coninck-Smith 2000) or the German *Lise-Meitner* programme (Lind 2004), supporting the qualification of women scientists among others. In general, the literature shows that scholarships are an invaluable instrument for reaching the next qualification stage. However, they do not guarantee integration into the scientific community or show any sign of impact at the organisational level of research institutes or universities. Temporary positions with stipends and scholarships do not often lead to a fixed position. In fact, considering the structural change involved in achieving a sustainable increase in the number of women in science, financial support through the creation of concrete positions would be preferable. As Krimmer *et al*. (2004, p. 27) pointed out, the financing of permanent positions (such as assistant professorships for example) at a university institute is the most secure path to a full professorship. A similar conclusion was drawn by Löther & Mühlenbruch (2002, p. 9): evaluations of programmes undertaken in Hamburg and Lower-Saxony showed that direct positions in institutes are more successful for integrating women into academic networks than stipends (for a similar point regarding Austria see Wroblewski et al. 2007, p.205). Along the same lines, Rosenbeck's critique of the FREJA program in Denmark (2000, 2003a) suggested that it did not lead to any structural change at institutional level.

The third bundle of measures to advance women's science careers concerns mentoring programs and networking activities. Mentoring programmes across Europe constitute one of the most widespread and popular measures to foster the inclusion and advance of women in science. The website of the German parent organisation of mentoring initiatives[3] lists approximately 75 mentoring programmes across varying universities and faculties of applied sciences in Germany. In Switzerland, 39 different mentoring projects were funded in the period from 2000 to 2007 (Spreyermann & Rothmayr 2009; Müller et al. 2007; Bachmann et al. 2004). Equally, EU projects such as eument-net (Füger et al. 2008; Nöbauer & Genetti 2008) or TANDEMplusIDEA[4] bear witness to the importance of mentoring schemes at European level. The evaluation reports available in the GSD paint a reasonably positive picture of the usefulness of mentoring programmes for retaining and advancing women in science. Similar to career training seminars, these findings are based largely on qualitative interviews, reflecting the first hand experiences of participants. However, what is striking is the absence of any negative statements

[3]http://www.forum-mentoring.de consulted 13/07/2009
[4]http://www.idealeague.org/tandemplus consulted 13/07/2009

from the evaluation reports – although this "underestimation" of the real complexities of mentoring relations is a fairly familiar pattern in evaluation studies (Eby & Allen, 2002; Tenner, 2004). Positive experiences of participants are foregrounded while difficulties and problems seldom appear. Especially in the Swiss case, with their large-scale programmes and evaluation in place, any limits and negative experiences with regard to mentoring programmes are only mentioned in passing (Müller et al., 2007, p. 44).

In summary, the result of the available literature on policy towards advancing women's science careers shows that although these measures are highly beneficial on the level of individual scientists, they seldom affect broader institutional structures. Individual benefits were repeatedly contrasted with concerns for "making women adjust" to the male-dominated scientific culture. Career development for women scientists needs to be combined with a change in the culture of science at large and should not be modelled according to male-shaped job and life patterns. Wroblewski et al. (2007, p. 369) suggest that the structural effects of mentoring and coaching programmes for example 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. Furthermore, career promotion and supply side policy cannot be considered a remedy for the general lack of positions in universities and research. 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 et al. 2006, p. 39). In contrast, measures that take into account disciplinary differences seem to be a more promising alternative in the long run. Policy measures will need to take into account these specific disciplinary aspects in order to be successful.

THEORY, CULTURE AND (INNOVATION) POLICY

The final section of this article aims to provide a further reflection on the relationship between policy towards gender equality in science and its evaluation. The reviewed literature is indeed very diverse, which on the one hand mirrors the different national higher education and research systems but simultaneously testifies to the fragmentation of the "field" itself with regard to evaluation standards, methodologies used and theoretical frameworks deployed. Significantly, there continues to be an open discussion on what gender equality entails (Walby 2005) and consequently how progress towards gender equality can be measured. What are the indicators of success? This is quite straightforward if we consider the gender wage gap or vertical segregation but is more difficult if we consider horizontal/occupational segregation, since numerical parity per se does not guarantee changes in associated value judgements between traditional male and female professions. Taking into account a broader gender equality agenda, what are the indicators not just of numerical parity but also of having "fixed" the culture of science and engineering and its gendered bias in knowledge production (Schiebinger 2008, p.5)? What do we mean by the measurement of scientific excellence and

productivity which does not take the male career path and working habits as the norm?

What is lacking in a certain way is a more thorough theoretical engagement of projects and research which implement and evaluate gender equality policies. As Verloo stresses "*...gender impact assessments merely make gender visible, by producing statistics for instance, but they fail to provide an analysis of such statistics in terms of their link to producing gender inequality, and therefore are not really gender-sensitive, let alone transformative.*" (Verloo 2005, p.357). Indeed, the majority of the reviewed approaches concentrate on the individual (satisfaction, benefit) level. Surveys and interviews before and after certain activities such as training seminars, summer schools, etc. are frequent. Large-scale evaluations which not only focus on individual benefits but also on structural change are much harder to come by. Apart from the short-term logic of research funding and the political quest to show quick success, the lack of explicit theory is a further handicap to tackling these aspects of structural and cultural change. Cultural change is complex, tendentiously all-encompassing, slow and hard to detect. Given the very real scarcity of resources, ways have to be found to prioritize between the important elements which further structural change in higher education and research institutions and those that are rather more marginal in terms of moving towards gender equality. A strong theoretical model of how gender inequality intersects with other social inequalities and is continuously reproduced in society will be a vital element. The potential for understanding the interplay between several factors and measures, ranging from individual skills training, stipends, equality officers, gender proofing curriculum and pedagogy to work/life balance measures over a longer period of time, not only requires more resources but also a clearer model of how these factors might be related in order to manage the issuing complexity. The call for theory in this sense is not a call for "truth" to define gender equality once and for all and to "wash away" the political differences within feminism (Verloo 2005, p.357), but rather to strengthen a learning process across many isolated and short-term initiatives which helps to avoid the same mistakes being repeated over and over again.

By necessity, any policy evaluation towards gender equality in science which takes the call for theory seriously will become an interdisciplinary undertaking. Mary Daly (2005) concludes that while gender mainstreaming is "*trumpeted as fundamentally transformative, it lacks, as yet anyway, a full articulation of a theory of change*" (p. 447). As she furthermore contends, this shortcoming is due to a missing sociological core that would enable reflection on the relationship and gaps between policy implementation and changes in societal values. Along similar lines, Dreas & Klenk (2004) argued that GM has remained below its transformative potential because it works with unrealistic and simplistic accounts of organizational change and transformation. Hence the call for a closer collaboration with organization studies which would allow the consolidation of mainstreaming through a detailed analysis of the organization under consideration and its integration into existing organizational changes (see also the "Beyond Armchair Feminism" volume of *Organization* in the year 2000). Furthermore, a close ally in terms of taking into account the empirical difficulties of structural change comes from policy transfer and innovation studies. Policy transfer and diffusion studies have identified several

important factors which determine the “success” of a certain policy implementation. Whereas in the past, excessive focus was given to the role of individual actors (politicians, bureaucrats, etc.), currently a more ecologically-oriented perspective is being 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.). Important insights can be gained from policy and innovation studies on the complexity, contingency and time scales of policy implementation processes usually 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 can easily decrease the chance of success. Moreover, 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.

A further crucial resource should be to explicitly build on innovation policy studies. As mentioned in the introduction, the private R&D sector is the most important factor in determining the proportion of women in research. Innovation policy is primarily directed towards the private business sector. At the same time, although innovation policy has developed a more complex and systemic account of innovation as a multifaceted process, it incorporates few if any references to gender (Ranga & Etzkowitz 2010). In the few cases that gender is mentioned in relation to innovation policy, this happens as an aside or is portrayed as non-problematic while continuing to take men as the norm (Pettersson 2007). Cluster policies and the talk of innovation milieus underpin high-tech regional development through incubator industries, technical resources, human capital and skills, business networks and venture capital, but are simultaneously not aware of how gender structures form part of the local labour market and economy (Gray & James 2007; Blake & Hanson 2005). By concentrating too narrowly on export-based innovation and valuing growth-oriented profits through technology, other forms of innovation which focus more on equality or community well-being are neglected. The Swedish *Vinnova* funding agency is an interesting example which actively tries to incorporate a gender perspective in its approach to funding innovation (Danilda & Granat Thorslund 2011). *Vinnova* echoes Londa Schiebinger's (2008) argument on how a gender perspective leads to better science, heightening critical rigor by stressing that gender as “non-normative” thinking strengthens innovation milieus. A crucial step therefore consists of questioning the male bias in definitions of innovation which channel available funds into certain types of high-tech male dominated industries (Lorenzi 2011). Broadening the understanding of innovation to include the creative industries or tourism provides alternatives to the usual HR-centred policies of work/life or childcare balance by supporting entrepreneurship in often feminized occupational sectors (see also Ranga & Etzkowitz 2010). Women entrepreneurs encounter significantly more difficulties attracting investment for their firms than men (Robb & Coleman 2010). This essentially extends the business/diversity case for gender equality to a broader call for the macro-economic benefits of gender equality (Danilda & Granat Thorslund 2011; Pérez Zapata 2010).

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