

EUROPEAN COMMISSION

Monitoring progress towards Gender Equality in the Sixth Framework Programme

Aeronautics and Space

Executive Summary

A study for the European Commission
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Introduction

“The pursuit of scientific knowledge and its technical application towards society requires the talent, perspectives and insight that can only be assured by increasing diversity in the research workforce. Therefore, a balanced representation of women and men at all levels in research projects is encouraged. When human beings are involved as users, gender differences may exist. These will be addressed as an integral part of the research to ensure the highest level of scientific quality” (EC, 2007:6).

This statement opens the FP7 Cooperation Work Programme. It shows the European Commission’s commitment to enhance scientific excellence by mainstreaming gender equality, giving continuity to the gender mainstreaming goals already established for FP6: to promote the participation of women scientists in Framework Programme activities (40% target) and to ensure that the gender dimension is addressed in European research wherever relevant.

In establishing these two goals, FP6 made an important step towards gender equality in science. However, mainstreaming them in day-to-day research requires awareness, training and a variety of specific measures, including regular monitoring of results. In this line, a series of studies were launched at the end of 2004 to monitor progress towards gender equality in a set of FP6 specific thematic areas. Their objective was to examine the participation of women and the integration of the gender dimension in research content, with a view to both evaluating the success of current gender mainstreaming strategies and making recommendations for future action.

This is the Executive Summary of one of these monitoring studies. It presents the main results, conclusions and recommendations for Priority 4 of the Specific Programme 1 *Integrating and strengthening the European Research Area (2002-2006): Aeronautics and space*. The overall synthesis report, which also includes results for other thematic priorities (Nanotechnologies and nanosciences, knowledge-based multifunctional materials, and new production processes and devices – NMP, Sustainable energy systems, Sustainable surface transport and Euratom) can be found at the DG – Research website (<http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=27>).

Research in aeronautics and space is closely related to physics and engineering, which are not only the most male-dominated scientific fields, but also the ones in which the relevance of gender in research content is least evident and most questioned. However, EU-funded research adopts a strong end-user approach, opening up the opportunity to integrate gender issues in research content. In aeronautics, gender and other social diversity issues may be relevant whenever research addresses the impact on health or the improvement of accessibility, customer satisfaction, safety and security standards. Space-based applications may address a variety of social needs in which social diversity issues, including gender, may be relevant. In both themes, the study has found good examples of research projects in which the integration of the gender dimension has clearly enhanced scientific excellence. The same holds true for the implementation of specific project measures aimed at ensuring a balanced participation of women and men at all levels of research. On this basis, the study provides a set of recommendations for making further steps towards gender equality in Framework Programme activities.

A Study on the Status of Women Faculty in Science at MIT (1999) – Introductory Comments from Professor Lotte Bailyn, Chair of the MIT Faculty

“The key conclusion that one gets from the report is that gender discrimination in the 1990s is subtle but pervasive, and stems largely from unconscious ways of thinking that have been socialized into all of us, men and women alike. This makes the situation better than in previous decades where blatant inequities and sexual assault and intimidation were endured but not spoken of. We can all be thankful for that. But the consequences of these more subtle forms of discrimination are equally real and equally demoralizing”.

Massachusetts Institute of Technology (1999), *A Study on the Status of Women Faculty in Science at MIT*, p. 3.

Monitoring results

Objectives, methodology and empirical background

According with the European Commission's gender mainstreaming strategy, two basic dimensions of gender equality in research were considered:

- The promotion of women as scientists in the different consultation and implementation stages of FP6. Consequently, quantitative (gender composition) and qualitative (degree of responsibility and decision-making) dimensions were analysed. This means “an analysis of gender composition at the organisational level of doing science”.
- The promotion of research that takes into account sex and gender as relevant dimensions in designing research objectives and methodologies, while ensuring that EU funded research and innovation meets the needs of both its female and male citizens. This means “an analysis at the content level”.

These two dimensions were analysed and assessed as appropriate in two crossed issues: the whole life cycle of FP implementation and all the actors involved in the implementation and management of FP6. For this purpose, the methodological design of the study combined different methods and techniques, based on three main strands: the content analysis, the statistical analysis and the fieldwork (interviews, surveys and case studies). In addition to this, the study held broad discussions with high-level experts in the framework of the Advisory Board meetings and the working seminars that were organised.

Empirical background of the study

The study started at the beginning of 2005 and finished at the beginning of 2008. The empirical work carried out during these three years includes the following tasks, all of them referring to the five FP6 thematic areas monitored:

- Analysis of the gender composition across the whole FP6 life-cycle:
 - Analysis of data from around 2,500 individuals belonging to FP6 relevant bodies (Commission Staff, Advisory Groups, Programme Committees, National Contact Points and Evaluation Panels).
 - Analysis of data from all available submitted proposals (around 4,800 proposals and 61,000 partners) to determine the sex of the scientific coordinator and the sex of the scientific contact person of each participating partner.
- Analysis of the integration of the gender dimension in the research contents across the whole FP6 life-cycle:
 - Content analysis of relevant FP6 documents (Work Programmes, Calls for Proposals, Guides for Proposers and Guidance Notes for Evaluators).
 - Content analysis of all the available abstracts of submitted proposals (around 4,700).
 - Content analysis of the gender-related material of a random selection of 640 retained proposals.
- Fieldwork:
 - Case studies in ten FP6 projects.
 - Key interviews with five members of the Advisory Groups and Programme Committees.
 - Key interviews with five evaluators.
 - National Contact Point Survey (around 45 individuals surveyed).
 - Survey of researchers (around 750 institutions surveyed, with information on 3,500 researchers participating in FP6 projects).
- Dissemination, discussion and contrast:
 - Four meetings of the Advisory Group in 2005 and 2006, with the aim of making a high-level and multidisciplinary contrast of the methodological design, the results and the recommendations.
 - Four high-level working seminars in 2007, with members of the FP6 relevant bodies, contractors of FP6 projects, scientific institutions, gender and science experts and policy-makers. These seminars were organised with the support of the following institutions: the Spanish National Research Council (CSIC, Spain); the Women and Science Unit of the Ministry of Education (Spain); the Centre Nationale de la Recherche Scientifique (CNRS, France); Mission pour la parité dans la recherche et l'enseignement supérieur (France); the Femmes et Science association (France); the Nordic Network for Women in Physics (Norway); and the Danish Research Council (Denmark).

How far away is the 40% target?

FP6 requires that a 40% target of women's participation be systematically achieved across all the bodies and actors involved in the whole life cycle of the programme, from advisory groups through to project teams. The first aim of the study was to analyse how far away the overall 40% target is.

The proportion of women in the Aeronautics and space FP6 relevant bodies is 8% on the Evaluation Panels, 15-17% in the Advisory Groups, the Programme Committee and the Commission staff and 30% in the National Contact Points, although there are no women as the main contact in this network. Overall, the proportion of women in all Aeronautics and space bodies is 13%. The 40% target is still far away and, in comparison with other thematic areas, the presence of women is very low (see Table 1).

Women account for only 7% of the partners' scientific contact persons in the submitted proposals. This is a low percentage, although it is at least equal to the percentage of women among coordinators. Furthermore, almost half of the submitted proposals have a completely male-dominated team, with no women at all among the scientific contact persons.

With regard to FP6 projects, the proportion of female scientific contact persons is 7%, although it is somewhat higher for female coordinators (11%).

Table 1. Percentage of women in FP6 relevant bodies by thematic priority

	NMP	Aeronautics and space	Sustainable energy systems	Sustainable surface transport	Euratom	Total
European Commission (management and scientific staff)	32	17	10	17	10	16
Advisory Groups	26	15	12	16	12	17
Programme Committees	20	15	20	16	9	16
National Contact Points	28	30	41	41	25	33
Evaluation Panels	27	8	21	23	5	18
Total	26	13	20	23	10	18

Source: Own calculations, based on data from the European Commission.

So Few Pulsars, So Few Females

S. Jocelyn Bell Burnell, Dean of Science at the University of Bath, United Kingdom

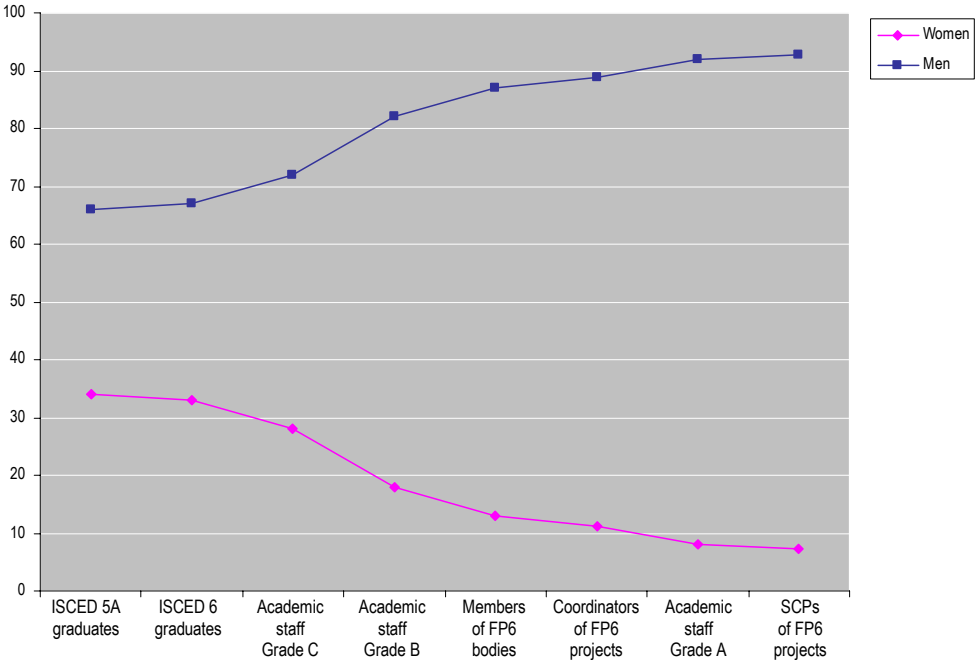
"It took a relatively long time to recognize the first pulsar. However, once that happened, pulsar research rapidly advanced, although often in unexpected ways and in sudden spurts. Following the developments in pulsar research over the past 36 years has given me immense pleasure. More disappointing have been the developments in the recognition and advancement of women in astronomy. In December 2003, the International Astronomical Union (IAU) published an analysis of its membership. With only 10% of their membership female, the United Kingdom and the United States fall well below the international average. The only thing that has changed since a similar survey about 5 years ago is that the proportion in most countries has gone up a few percent. Admittedly, it tends to be the more senior astronomers who are IAU members, and there tend to be more women in the junior ranks, but at this rate it will take 50 years until 50% of senior astronomers are female. The pipeline is leaky: A higher proportion of females than males quit at each rung of the ladder.

I no longer believe that making women more courageous, more assertive, "more like men," is the right way to move forward. Women should not have to do all of the adapting. It is time for society to move toward women, not women toward society. There have been some excellent female astronomers in the past who were not fully recognized for their contributions. Although advancement and recognition of female astronomers may come in unexpected ways and in spurts, like pulsar research, I hope that they will come more rapidly in the future. However, there are more women in astronomy now than in 1967, when I was a graduate student, and society has grown more accustomed to their intellectual presence. Women have begun to move society toward them, and familiarity will help to breed acceptance. I hope that younger women will find the field increasingly open and accepting, and that their achievements will be readily recognized."

Bell Burnell, S.J. (2004), 'So few pulsars, so few women', *Science*, Vol. 304, p. 489.

In general, the presence of women in Aeronautics and space is in line with the presence of women in a typical academic career in science and engineering (see Figure 1). As illustrated by the metaphor of the “leaky pipeline”, the higher the status in the research career, the lower the presence of women. This phenomenon is especially pronounced in the field of science and engineering, where women account for 33% of PhD graduates but only 8% of the highest academic positions. In Aeronautics and space, the percentage of female members of FP6 bodies and FP6 coordinators is between the percentage of female senior lecturers and female professors. As a negative trend, it should be stressed that the presence of women as scientific contact persons is even lower than their presence at the top of the scientific hierarchy.

Figure 1. Percentage of women and men in ‘Aeronautics and space’ and in a typical academic career in science and engineering



Notes: data for a typical academic career correspond to EU25 for 2002. Science and engineering includes the following ISCED fields of science: 42 (Life sciences); 44 (Physical science); 46 (Mathematics and statistics); 48 (Computing); 52 (Engineering and engineering trades); 54 (Manufacturing and processing); and 58 (Architecture and building). Grade A corresponds to the highest academic positions (professors); Grade B to senior lecturers or similar; Grade C to lecturers or similar.

Source: Data for a typical academic career: Eurostat education database, Eurostat WIS database and She Figures 2006; Data for FP6: Own calculations, based on data from the European Commission.

Promoting excellence through mainstreaming gender equality

ETAN report

"Women constitute half the undergraduate population. However, there is a continuous drop in the numbers of women at each level of the academic ladder and many highly trained women are lost to science. Institutions that employ scientists tend to be behind the times in addressing the life/work balance and need to modernise.

Old-fashioned practices characterise employment and promotion procedures in some of our academic institutions. Reliance on patronage, the 'old boys network' and personal invitations to fill posts cuts across fair and effective employment procedures. More sophisticated means of assessing merit are recommended.

The peer review system is revered for its objectivity and fairness but does not always work as it should. Both sexism and nepotism have been documented as interfering with the peer review process. Recommendations are made for modernising peer review and ensuring fairness in research funding.

The narrowness of the characteristics of the scientific elite is highlighted, especially in decision-making bodies. The case is made on democratic grounds for women to have more say in shaping the scientific agenda. We propose a minimum of 30% of both genders on such committees by 2002 and 40% by 2005. In addition improvements in the quality of science could be brought about through more gender-aware research.

Attracting more young people into science poses challenges for education. The sexstereotyping of science and scientists needs to be tackled through the curriculum, through pedagogy and through the media. Various strategies to encourage women to enter and remain in science are commended. These include role models, mentoring, networks, schemes for parents returning after career breaks, and encouragement to women to apply for fellowships and posts."

Osborn, M., Rees, T., Bosch, M., Ebeling, H., Hermann, C., Hilden, J., McLaren, A., Palomba, R., Peltonen, L., Vela, C., Weis, D. and Wolh A. (2000), *Science policies in the EU: promoting excellence through mainstreaming gender equality. A report from the ETAN Expert Working Group on Women and Science*, Office for Official Publications of the European Communities, Luxembourg, pp. viii-xix.

Are work programmes truly engendered?

FP6 requires that gender issues be systematically integrated at all stages of the policy and programme implementation process (from calls for proposals through to evaluations and contract negotiations), and wherever relevant as a cross-cutting dimension in research content itself. The second aim of this study was to determine the extent to which the gender dimension in research content has been systematically integrated.

The content analysis of relevant Aeronautics and space FP6 documents shows that the relevance of the gender dimension for achieving excellence in science is stated only at the most generic level. Neither the Work Programmes nor the Calls for Proposals make any reference to specific gender issues that might be relevant for research. Furthermore, social issues, which may be an entry-point for gender issues, are not always well integrated.

The content analysis of the available abstracts of submitted proposals shows that proposals tend to be more gender-sensitive than Work Programmes and Calls for Proposals. According with the conceptual framework of the study, a proposal was considered to be gender-sensitive when it took into account at least one of the following issues: interdisciplinarity between socio-economic and technical issues, social diversity and gender. From this broad perspective, 21% of the Aeronautics and space proposals can be considered gender-sensitive.

Furthermore, gender issues are explicitly taken into account in 11% of the submitted proposals. This is a high percentage in comparison with other thematic areas, and shows that specific gender issues can be included as relevant in this field of research. Biological differences between women and men may be relevant whenever impact on health and physical well-being is considered. Differences related to gender relations may be relevant whenever equity in the allocation of resources, opportunities and life chances is addressed.

Making science responsive to the needs of society: the gender dimension

Sophia Huyer, Gender Advisory Board of the United Nations Commission on Science and Technology for Development

"Most professionals working in science and technology are insufficiently aware of the needs of their society and the impact of their work on these needs. Equally, citizens are insufficiently aware of the positive potential of science and technology to meet these needs. In particular, the gender specific nature of the needs and the differential impact of science and technology on the lives of men and women are inadequately recognized by either science and technology professionals or citizens".

Huyer, S. (2006), *The Gender Working Group Transformative Action Areas: Then and Now*, Gender Advisory Board of the United Nations Commission on Science and Technology for Development, p. 6.

The study has identified several Aeronautics and space FP6 projects in which gender issues have been taken into account. The following are just a few examples:

- One IP intends to support the development and widespread adoption of satellite communication services to deliver broadband services for rural areas. One of the principal outputs of the project is to improve the social position of women in the agriculture world. This will be done by promoting their role and involvement in satellite agricultural applications. The project will also promote tele-working applications.
- Another project is focused on designing, developing, implementing, testing and validating a complete next generation integrated surveillance system. The project underlines the importance of taking into consideration the diversity of life patterns, needs and interests among citizens, including gender-related diversity, in order to ensure a high quality surveillance system.
- Several projects in Aeronautics aim to improve passengers' comfort, health, safety and cabin services, paying special attention to social diversity issues related to body size, age, gender, specific needs and diversity of life-styles. They acknowledge that the findings of passengers surveys and comfort-related research indicate that there is no universal optimal setting for comfort-related parameters in a plane. Most of the projects focus on delivering a diverse range of solutions for "office/home" in the sky, especially for long-distance flights in economy class. Gender and other social diversity issues are also taken into account in other projects aimed at improving the environmental conditions that affect the safety and health of workshop operators and crew.

Is there a gender mainstreaming approach in evaluation?

The third aim of our study was to analyse the extent to which the gender mainstreaming approach is effectively implemented in the evaluation procedures—in other words, the extent to which the balanced gender composition of the project team and the gender sensitiveness of the research contents are both taken into account positively in the evaluation process.

In Aeronautics and space, the descriptive evidence is mixed. With regard to gender composition, the success rate follows a U-inverted pattern: the maximum (41%) is found in proposals with 10-20% of female scientific contact persons and the minimum (26-28%) at the two opposite extremes: male-dominated proposals and proposals with more than 20% of women. With regard to gender sensitiveness, the success rate of gender-sensitive proposals (28%) is lower than that of non-gender-sensitive proposals (32%).

The results of the logistic regression analysis confirm these trends (see Table 2):

- The gender composition of the project team is significantly related to the evaluation results, after controlling for other factors. On the one hand, the higher the percentage of female scientific contact persons, the lower the probability of the proposal being retained. On the other hand, there is a relevant exception to this rule: completely male-dominated proposals show a similar low rate of success to proposals with a high percentage of women.
- The gender sensitiveness of the research content is significantly related to the evaluation results, after controlling for other factors. Gender-sensitive proposals have a lower probability of being retained than non-gender sensitive proposals.

The data provided are insufficient to carry out an in-depth analysis of why this is happening. However, they suggest that evaluation procedures do matter and that there is room for improving the gender mainstreaming approach.

Table 2. Logistic regression. The probability of proposals passing the evaluation thresholds, depending on the percentage of female scientific contact persons in the project team and the degree of gender sensitiveness of the research content (Proposals of Aeronautics and space, Sustainable energy systems, Sustainable surface transport and Euratom)

Explanatory variables	Coef. Exp (B)	Sign.
Percentage of female SCPs (reference: 0)		0.003
0-20%	1.411	0.003
>20%	-	n.s.
Gender sensitiveness (reference: non-gender-sensitive)	0.734	0.021
Constant	0.283	0.000
N	1,677	
chi-square	89.375	
Prob > chi-square	0.000	
- 2 Log likelihood	2,163.119	
Cox & Snell R square	0.052	
Nagelkerke R square	0.070	

Note: Results controlling for instrument.

Source: Own calculations, based on data from the European Commission.

Are the Gender Action Plans effective for promoting gender awareness?

The contractors of the new instruments of FP6 (IPs and NoEs) are required to prepare a Gender Action Plan (GAP) for the promotion of gender equality within their project and to later report on it. The GAP should include: 1) an analysis of the current situation relative to the participation of women in research, and to the integration of the gender dimension in the research area in which the application is being submitted; and 2) specific actions based on the analysis, for implementation of gender equality and women's-promotion measures. The fourth aim of our study was to analyse the extent to which the GAPs have been an effective measure for promoting gender awareness among the scientists participating in FP6. The results obtained apply to Aeronautics and space as well as the other priorities included in the study.

The content analysis of the GAPs and other gender-related material of the retained proposals shows an uneven picture. GAPs do not seem to follow a common pattern and there is some overlapping between them and other gender-related sections. In general, they appear to be quite heterogeneous in terms of the theoretical approach to gender equality and the quality of the measures considered. A common feature of most GAPs is that gender equality is identified with the presence of women, without taking into account the gender dimension of research content. In spite of these criticisms, around 23% of the GAPs might be considered good, whilst the rest are just satisfactory or poor. GAPs therefore appear to be a useful initiative for promoting gender awareness in scientific research, if they are taken seriously.

The following are some examples of measures addressed in the GAPs analysed:

- Measures for increasing women’s presence in project activities, particularly in management positions, workshops and training courses.
- Measures for encouraging young female scientists, such as contacts with schools and universities and the organisation of dissemination activities.
- Measures for promoting networking and exchanges with gender-sensitive networks.
- Measures for promoting and facilitating work-life balance, such as family-friendly measures for women and men for part-time work or leave for childcare.
- Measures for disseminating gender-sensitive research results.

Are the key actors involved in the gender mainstreaming strategy?

Mainstreaming gender equality at all FP6 stages requires an active involvement of all the key actors, from members of the Advisory Groups and Programme Committees to scientists participating in FP6 projects. The fifth aim of the study was to ascertain the role played by the key actors with regard to the gender mainstreaming strategy. For this purpose, a series of interviews and surveys were carried out. The results obtained apply to Aeronautics and space as well as to the other priorities included in the study.

The interviews with members and experts of Advisory Groups and Programme Committees show that the level of gender awareness and gender expertise in these bodies is very poor, and that their capacity for leading the gender mainstreaming strategy is almost null. The interviewees do not seem to have a clear understanding of what is meant by the gender mainstreaming strategy in FP6. They are aware of the 40% target, but they are not at all aware of the goal of engendering the Work Programmes. Furthermore, the Advisory Groups and the Programme Committees are not seen as the best place to make specific recommendations on gender issues. The interviewees tend to adopt a cautious attitude towards policies for encouraging the participation of women in research. In their view, equal participation of women and men in science cannot be enforced. The traditional gender roles persist at all societal levels, not only in science, and should be mainly addressed through wide societal policies, with especial emphasis on education and family issues.

The interviews with evaluators show that gender equality is usually understood only in terms of women’s presence and is not considered to be a relevant dimension for evaluating scientific excellence. However, the interviews also show that a minority of evaluators are fully aware of the pertinence of taking into account both the gender composition of the project team and the gender dimension in research content. Basically, they claim that gender issues need to be scored and that there is a crucial need to review the dominant definition of scientific excellence in order to promote new talented people. According to their experience, the presence of people with a strong international reputation is often one of the most relevant criteria for assessing the quality of a proposal, which can favour men over women due to their unbalanced presence in senior positions.

Gender and engineering design in transport

Londa Schiebinger, John L. Hinds Professor of History of Science in the History Department at Stanford University

“Taking women into account can also improve engineering designs. Several years ago, historian Rachel Weber explored how the cockpits of airplanes had to be redesigned when women were admitted into the U.S. Air Force in the 1990s. As is often the case, changes made with women in mind improve the situation for men. The new cockpits not only accommodated the shorter sitting height of women but also shorter men—who had previously also been excluded from careers as pilots. In this volume, Tatiana Temm, from Volvo, describes how an all-woman design team created a concept car designed especially for women. She emphasizes, however, that many of the innovations—greater visibility for shorter people, extra ease in opening doors, and the like—although designed for women, also improve the driving experience for men.”

Schiebinger, L. (2007), ‘Getting more Women in to Science: Knowledge Issue’, Introduction to Schiebinger, L. (ed.) (forthcoming), *Gendered Innovations in Science and Engineering*, p. 12.

The survey of NCP staff shows that only a minority of the NCPs appear to be dealing with gender issues. In general, the level of awareness of the gender mainstreaming strategy is quite low and there is little understanding of what integrating the gender dimension in research content means.

Finally, the survey of scientific contact persons of FP6 projects shows that the issue of gender equality in science attracts less interest or is considered less relevant than other issues related to science and society. Only the need to encourage more young women to take up studies in male-dominated scientific fields appears to be considered as a highly relevant issue.

Is FP6 helping to avoid the gender bias in scientific practices?

The sixth aim of our study was to analyse the extent to which the FP6 is helping to reorient scientific practice in order to avoid gender bias. For this purpose, a set of case studies were carried out in scientific institutions that were performing FP6 research projects. The results obtained apply to Aeronautics and space as well as to the other priorities monitored in the study.

The case studies confirm that the careers of researchers, their personal strategies and their professional success (both objective and subjective) are conditioned by the prevailing model of scientific excellence (uninterrupted career, priority to work over any other activity, long working days and participation in complementary activities). This model is particularly detrimental for many women and some men who try to achieve a better work-life balance.

Some institutions have formal or informal work-life balance measures. This approach allows housework and care to be made visible and facilitates the management and organisation of working time, though it does not contribute to a greater equality between women and men in scientific work. The work-life balance facilities offered by the institutions are only taken up by women, which helps to perpetuate the traditional gender division of labour and is detrimental to women's careers.

The study shows that the management of FP6 is not decisively helping to modify these scientific practices. There is little capacity to promote a greater presence of women in research, to influence the organisation of scientific work or to enhance gender issues in the research content. The GAP could be a useful instrument for reorienting scientific practices, but in many cases it becomes a simple administrative procedure, lacking suitable mechanisms for reinforcing it through negotiations and follow-up.

Girls to whom having a family is important do not choose physics!

*Corinna Kausch, Gesellschaft für Schwerionenphysik
Barbara Sandow, Freie Universität
Monika Bessenrodt-Weberpals, Max-Planck-Institut für Plasmaphysik
Silke Bargstaedt-Franke, Infineon Technologies AG*

"In scientific careers, a long period of probation is required before a permanent job is obtained. Many women disappear from research during the postdoctoral time when scientists get only short-term contracts. This is also the time to have a family, and it is difficult for a woman to manage both a family and a career.

The traditional role of a woman in Germany is that of being a mother, which poses a very severe barrier to achieving a successful career in physics. Society still thinks that a working mother with a small child is a bad mother, and that a father who reduces his working time to care for his child is unable to pursue a career. Since childcare is usually a private problem, a very supportive husband is necessary.

Physics is known as a profession that cannot be combined with a family. Girls to whom having a family is important do not choose physics!"

Kausch, C., Sandow, B., Bessenrodt-Weberpals, M. and Bargstaedt-Franke, S. (2002), 'The Status of Women in Physics in Germany' in IUPAP, *Women in Physics: The IUPAP International Conference on Women in Physics. Conference proceedings*, p. 163.

Conclusions and recommendations

The European Commission seeks to mainstream gender equality in scientific research by promoting the participation of women scientists in Framework Programme activities and by ensuring that the gender dimension is addressed in European research wherever relevant. Two main goals were proposed for FP6: a 40% target for women's participation in committees, groups and panels, and the integration of gender issues in research content.

This monitoring study was built on the conviction that these two goals are interdependent and necessary in order to achieve excellence in science. In establishing them, FP6 made an important step towards gender equality in science. However, mainstreaming them in day-to-day research requires awareness, training and a variety of specific measures. The results of the study show that there is still a long way to go before these two goals will be achieved.

Our main recommendation is thus to intensify efforts towards achieving real results within the FP: to combine more specific "soft" gender awareness and women-friendly initiatives with new "hard" measures at both the content and the organizational level. Recent developments in FP7 suggest that things might indeed be moving forward, namely in terms of increasing the presence of women in relevant bodies and integrating gender issues in research content.

General recommendations

New rules and additional efforts for achieving an overall 40-60% balance between the sexes in FP relevant bodies

- A mandatory rule of a 40-60% balance between sexes should be established in FP bodies that are under the direct responsibility of the European Commission: the Advisory Groups and the Evaluation Panels.
- The European Commission should explicitly recommend that an overall 40-60% balance between the sexes be achieved in Programme Committees and National Contact Points.
- Measures aimed at promoting work-life balance for women and men participating in FP relevant bodies should be adopted: for example, reducing the face-to-face period of evaluation (maximum 2 days) and the parallel use of new technologies such as video conferencing and on-line communication.

The European Commission should implement positive action measures to make progress toward a 40-60% balance between the sexes, at all levels, among the Commission's staff.

Making explicit the relevance of the gender dimension in the Work Programmes

- The relevance of the gender dimension should be made explicit in each Work Programme from a twofold perspective:
 - Defining as core issues of excellence in science the interdisciplinary approach, the acknowledgement of social diversity of all kinds and the establishment of a more open dialogue between science and society.
 - Defining a detailed set of gender issues relevant to research.

- The integration of the gender dimension in each Work Programme should be ensured by the following mandatory rule:
 - At the beginning of the FP, a report on gender and research contents would be commissioned to external gender experts. This report must establish a detailed list of relevant gender issues for the Work Programme.
 - The Advisory Group and the Programme Committee would adopt a formal resolution on how to integrate these recommendations into the Work Programme and other FP materials.

Evaluating gender at the content level

- Gender issues should be evaluated and marked as a relevant dimension of “S&T excellence”. Guidance for evaluators should include specific guidelines for evaluating gender issues as a relevant dimension of “S&T excellence”.
- Gender equality should be evaluated and marked as a relevant dimension of “potential impact”, alongside other dimensions of societal impact such as quality of life and social cohesion. Guidance for evaluators should include specific guidelines for evaluating gender equality as a relevant dimension of “potential impact”.

Evaluating gender at the organisational level

- The gender composition of the proposal team should be evaluated and marked as a relevant dimension of “quality of management”. Guidance for evaluators should include specific guidelines for evaluating the gender composition as a relevant dimension of “quality of management”. These guidelines should specify the female/male proportions considered as poor, fair and good, in accordance with the percentage of female PhD graduates in the related scientific field.

Improving the effectiveness of GAPs

- Proposers should be required to develop only one “Gender issues” section, in order to avoid overlapping between different sections.
- The “Gender Issues” section should present: (i) a diagnosis of the current situation regarding women's participation and gender issues in the research content, and (ii) proposed actions based on this diagnosis.
- The “Gender issues” section should be improved during the negotiation procedures and transformed into a “Gender Action Plan” (GAP):
 - The GAP should contain specific measures for increasing the presence of women at all levels of the project implementation and, when appropriate, specific measures for disseminating gender-sensitive results.
 - The measures included in the GAP should be in accordance with the length and budget of the project. Contractors of small projects will be required, at least, to provide sex-disaggregated data on the participation of researchers at all levels of the project implementation (junior and senior researchers, leaders of workpackages, participants in workshops and seminars, and authors of scientific publications). Contractors of Large-Scale Integrating Projects and Networks of Excellence will be required to implement more ambitious measures and to establish a percentage of the total budget devoted to the implementation of the GAP.
- The implementation of the GAP should be regularly monitored through the follow-up reports.

Increasing women's presence in FP6 projects – An example from a Gender Action Report

Statistics

"The participation of women is monitored through the 3 monthly progress reports. To illustrate the changes in gender statistics, the numbers at the start of the project were compared to the current numbers (see table 1.1 and table 1.2 below). The aim as defined in the Gender Action Plan was to increase women's participation in the IP by at least 15 pp compared to the initial situation. Comparing the numbers of 2004 with the current numbers an increase of female participation of about 8 pp is achieved. This constitutes a considerable improvement, but it also shows that there is still progress to be made.

Table 1.1 Overview of female researchers per Sub-Project – April 2004

Sub-Project	Female Researchers	Percentage
SP1	2 of 16	12%
SP2	1 of 21	5%
SP3	1 of 24	4%
SP4	0 of 9	0%
SP5	3 of 24	12%
SP6	1 of 13	13%
SP7	1 of 18	5%
Total	9 of 125	~7%

Table 1.2 Overview of female researchers per Sub-Project – April 2007

Sub-Project	Female Researchers	Percentage
SP1	3 of 26	12%
SP2	2 of 19	11%
SP3	4 of 29	14%
SP4	2 of 13	15%
SP5	8 of 46	17%
SP6	2 of 15	13%
SP7	4 of 22	18%
Total	25 of 170	~15%

Female representation in management

Initially all of the technical Sub-Projects were lead by male managers. At this moment two of the nine Sub-Project Leaders are female, counting for 18%. To further improve this number it is recommended to favour a female SP Leader when a position becomes available and when there are equally qualified candidates. This was done in the case of the resignation of the SP4.

Female representation at project workshops

Female representation at workshops is monitored and organisations are stimulated to send female delegates to the workshops and trainings. These workshops are an important instrument to enhance female networking and thus creating new career opportunities and exchange of experiences. Furthermore, the aim is to have at least 25% female speakers at any project workshop. This goal is mentioned in the workshop template to be filled out by the SP leader in charge of organising the workshop, as one of the criteria to assess the workshop preparation plan."

From one Gender Action Plan follow-up report of an IP FP6 project

Enhancing gender expertise in FP relevant bodies

- The European Commission should take into account gender expertise as one of the relevant criteria for selecting the members of the Advisory Groups and Evaluation Panels.
- The European Commission should explicitly recommend that gender expertise be taken into account as one of the relevant criteria for selecting members of the Programme Committees and the National Contact Points.
- The European Commission should make additional efforts to reinforce the gender expertise of its scientific staff.

Adopting a more proactive approach

- The European Commission should make additional efforts to better disseminate information among the scientific community regarding its interest in gender-sensitive experts and gender-sensitive projects. Proactive measures include:
 - Sponsoring seminars aimed at bringing together gender experts and natural scientists and engineers.
 - Disseminating good examples of gender-sensitive projects.
- The European Commission should implement more proactive measures that are specifically tailored to reach women in the research community, such as drawing up lists of women in senior and junior positions in scientific institutions and establishing networks of exchange with specialised networks.
- The European Commission should make additional efforts to attract young women to research, particularly in the most male-dominated scientific fields. In accordance with contractors, specific FP projects should be selected in order to disseminate their results among young students, ensuring a balanced gender composition among the speakers and the public.
- The European Community should continue to regularly monitor the progress made towards gender equality in the Framework Programme.

Specific recommendations on research content

Aeronautics

EU-funded research on aeronautics is aimed at promoting a more efficient, safer and environmentally friendly air transport. It includes the full range of research and technology development from basic research to large-scale technology integration and validation activities in support of research, as well as policy-related activities. Interdisciplinary research particularly addresses the analysis of the role of air transportation for competitiveness and its environmental impact, including the development of operational tools, modelling and forecasting to support policy making. From an end-user perspective, gender and other social diversity issues may be relevant whenever research addresses the impact on health or the improvement of accessibility, customer satisfaction, safety and security standards.

The following are examples of gender-sensitive issues relevant to this thematic area:

- Adapting aircraft design to physical and social diversity:
 - Research on aircraft design, addressing the physical diversity of travellers (women and men, but also babies, children, elderly people, people with disabilities and pregnant women) in order to improve accessibility, health conditions, safety (traffic collisions, ground collisions, adverse weather) and security standards.
 - Development of improved passenger service orientation in aircraft design, addressing innovative solutions and technology in order to contribute to enhanced flight environment and health conditions in the cabin, paying special attention to the social diversity of travellers.
 - Research on aircraft design, in order to improve crew working conditions (e.g. adapting cabins to female pilots).
- Improving airport design and developing advanced concepts and techniques for efficient passenger and luggage flow in the terminal area, paying special attention to specific target groups (children, elderly people, people with disabilities, pregnant women, people carrying babies, etc.), in order to remove architectural barriers and improve mobility.

- Promoting interdisciplinary research on noise and pollution, in order to refine the establishment of socially acceptable standards, considering social diversity at large (patterns of noise and pollution exposure related to the diversity of lifestyles and socioeconomic differences; the impact of noise and pollution on health, paying special attention to specific groups such as children, pregnant women and the elderly).

Space

European-funded research on space includes the development of space-based applications at the service of European citizens and R&D support to the foundations of space science, exploration, space transportation and space technology. Space-based applications may address a variety of social needs with a positive impact on the quality of life. From this end-user perspective, addressing social diversity, including gender, may be relevant.

The following are examples of gender-sensitive issues relevant to this thematic area:

- Space-based applications for improving the management of security and civil protection. Research in this field should pay special attention to the most vulnerable social groups.
- Space-based applications for better anticipation of atmospheric events and natural disasters. Research in this field should take into account that there are differences with regard to vulnerability related to age, gender and socioeconomic inequality.
- Space-based applications for a wide range of uses in rural areas (rural communication networks, accessibility to education, weather predicting, etc.). Gender inequality tends to be more pronounced in rural areas and this kind of application may have a direct empowerment impact.

Glossary

Sex and gender

The point of departure of this gender monitoring study is the basic distinction between sex and gender. “Sex” refers to the biological differences between women and men, while “gender” is a socio-economic and cultural construct for differentiating roles, responsibilities, constraints, opportunities and needs of women and men in a given context. The unequal power relations between women and men are a central issue for understanding gender relations. While sex is biologically determined, gender is learned and changeable over time, and has wide variations both within and between cultures (Laurila and Young, 2001).

Gender equality in science

The issue of gender equality in science goes far beyond the simple sex-counting approaches. According with Schiebinger (2007), three analytical levels can be distinguished:

- The first and most straightforward level focuses on increasing the participation of women in science, with the aim of promoting an equal presence of both sexes at all levels.
- The second level is related to the cultures of gender and science. A culture consists in the unspoken assumptions and values of its members. Despite claims to objectivity and value-neutrality, the sciences have identifiable cultures whose customs have developed historically in the absence of women and taking men as the norm. Promoting gender equality does not mean treating women in the same way as men, but giving equal consideration to the life patterns, needs and interests of both. Efforts at this level range from removing subtle gender biases from selection, hiring and promotion practices to restructuring the academic work/life balance.
- The third level is related to the integration of the gender dimension in research content. It entails systematically questioning whether, and in what sense, sex and gender are relevant in the objectives and methodology of projects. Addressing gender issues leads to opening new questions for future research and enhancing scientific knowledge.

Gender and interdisciplinarity

The integration of the gender dimension into research content requires a re-constructive perspective in the scientific approach, focusing on interdisciplinary and transdisciplinary research and methods and integrating natural, technological and social sciences. The recognition of socio-economic elements provides entry-points for the identification of gender issues relevant for research (Schiebinger, 1999; Laurila and Young, 2001).

Gender and social diversity

The integration of the gender dimension into research content is related to the acknowledgement of diversity of all kinds. There is no universal woman as there is no universal man. From a gender perspective, not only gender but also other forms of diversity are considered, such as age, ethnicity or sexual orientation. In order to meet the needs of all citizens, science should acknowledge all the biological and social differences between individuals (Laurila and Young, 2001).

Horizontal and vertical gender segregation in science

Horizontal gender segregation refers to concentration rates of women and men in certain disciplines or institutional sectors. Vertical gender segregation concerns the position of women and men within the scientific hierarchy.

Higher education is still very much gender-segregated, both horizontally (field of study) and vertically (advanced research degrees). However, the under-representation of women in the highest scientific positions cannot only be explained by the different educational patterns of women and men. There are leaks at each moment of transition from one scientific stage to another: the higher the stage, the more restrictive the mechanisms for entry. The metaphor of the “leaky pipeline” points to the decreasing proportion of women rising up in the scientific hierarchy (Etzkowitz *et al.*, 2000).

Gender bias in science

Gender bias is the often unintentional and implicit differentiation between men and women situating one sex in a hierarchical position to the other. Gender bias in the scientific system may impact on the selection, hiring and promotion procedures, on the distribution of resources or on the assessment of scientific excellence. Gender bias is prohibited, but still exists, though it adopts more subtle forms than in the past (Osborn *et al.*, 2000; Addis, 2004).

For instance, in 1999, the Massachusetts Institute of Technology (MIT) admitted to having given the 15 female tenured professors in the School of Science less space, resources and salaries than their 197 male counterparts. In the next four years, women’s salaries were raised to equal men’s by an average of 20%, several women were promoted to the high-level scientific committees and it was ensured that women were awarded similar money and space to conduct research to that of men (MIT, 2002).

Even the peer-review system is not as neutral, objective and fair as it is claimed to be. In the first-ever analysis of peer-review scores for postdoctoral fellowship applications in Sweden, it was found that female applicants had to be 2.5 times more productive than the average male applicant to receive the same score (Wennerås and Wold, 1997).

Positive action measures to promote gender equality in science

Positive action measures are based on the recognition that members of a group (in this case, women in scientific careers) experience disadvantages as a consequence of indirect discrimination. Such measures are designed to compensate for those disadvantages. The main positive action measures in science identified by the Helsinki Group (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 preferring women to men in appointments, where equally suitable candidates exist, in order to achieve a better gender balance.
- Role models and mentoring, i.e. actions to demonstrate that it is possible to be a senior figure in science and also a woman (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 of resources for women scientists, either in terms of encouraging the participation of women, setting women’s targets or devoting these resources only to women.

Gender mainstreaming measures to promote gender equality in science

Gender mainstreaming is a long-term and strategic approach to fostering gender equality, designed to complement equal treatment (under the law) and positive action measures. According to Rees (2002), it entails the systematic integration of gender equality into all systems and structures, policies, programmes, processes and projects, into ways of seeing and doing, into cultures and their organisations. The main gender mainstreaming measures in science identified by the Helsinki Group (Rees, 2002) are:

- Legislation, i.e. including equal opportunities issues into the legislation regulating higher education, and legislation to ensure a gender balance on 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 resources 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.

Gender equality in European research policy

In 1996 the European Commission issued the Communication *Incorporating equal opportunities for women and men into all Community policies and activities*. This was the first step towards the implementation of gender mainstreaming in the European Union.

The Amsterdam Treaty of 1997 laid the legal foundation for gender mainstreaming, namely in articles 2 and 3:

Article 2: The promotion of equality between men and women is a task of the European Community.

Article 3: In all its activities the European Community shall aim to eliminate inequalities and to promote equality between men and women

In 1999 the European Commission issued the Communication *Women and Science: mobilising women to enrich European research*. This was the first step towards a gender equality policy in European research. Within FP5 (1998-2002) several efforts were made to promote gender equality in Framework Programme activities. This approach was broadened and reinforced during the implementation of FP6 (2002-2006), which established two main goals: a 40% target of women's representation in committees, groups and panels and the integration of the gender dimension in research content.

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