

Science and Society Forum, March 2005
Rapporteur: Catherine Adley

Session 4: Fostering diversity, inclusiveness and equality in science.

The European Research Area (ERA) was launched at the Lisbon European council in March 2000. The Lisbon agenda to make Europe a knowledge-based environment has been outlined in Session One. However, the core issues of diversity, inclusiveness and equality are a prerequisite for the Lisbon agenda's success. The Barcelona Agreement, in March 2002, set the objective to increase the European R & D budget to 3% of the EU GDP by 2010, from the present level of around 2%. The European research budget lags behind those of the United States (2.8%) and Japan (more than 3%). In order to reach these objectives the core issues of diversity, inclusiveness and equality in science were addressed.

Diversity in Science.

The inclusion of women, ethnic minorities and the disabled are all areas that can and will increase the number of people working in science in Europe. The question might be asked, why bother? Scientists can be imported from non-EU countries, where standards of science education are high and where there are many motivated people interested in working in the EU. The EU, however, also has the issue of the 'brain drain' of its best scientists moving to the USA, where there are better facilities, resources and salaries. The career structure within the EU is not conducive to keeping our scientists at home. A high level group, commissioned by the Science and Society Directorate, reporting on *'Increasing human resources for science and technology in Europe'*¹ came to the following conclusions:

There is a need to increase the number of researchers per 1000 of the workforce from the average, which in 2001 was at 5.7 for the EU-15, and 3.5 for accession countries. This compares to 9.14 researchers per 1000 of the workforce for Japan and 8.08 for the USA. Where will these people come from? There is a need for a dramatic change in recruitment. This can be achieved through increasing the number of women and ethnic minorities entering science careers.

Figure 1: Increasing participation in S & T



Employment and salary conditions among science graduates are recognised, in some cases, to be good and the diversity of career opportunities varied. However, the time

taken to reach a permanent position is long, especially for people from less affluent societies and for women who wish to have a family. The time frame from graduation (4 years), to doctorate (average 4 years) to post-doctoral work experience, generally undertaken in another country (average 4 years) is 12 years and can be longer. The salary remuneration for these years is poor, just above subsistence levels. Permanent or stable employment after this long educational journey is uncertain. The scientist has now become highly specialised and job opportunities diminish exponentially. Coupled with this, if the scientist has children, or has other care responsibilities, is that potentially two people may be looking for employment in the one location and the priority will be given to the male partner. Finally, women and ethnic minorities who persist, find historic blockages to promotion: the glass ceiling syndrome.

Promotion opportunities for women are poor. Women who wish to have a family and devote their time to family or other care responsibilities lose time at their research; their production output is reduced and they have fewer publications. The domino effect takes over; with fewer publications there is less chance of success in grant/funding initiatives. Male-dominated scientific institutes have historically set promotion within recognised time frames, whether this is in industry or academia. Promotion to senior positions is therefore less achievable for women. The glass ceiling has been cemented.

Dr. Margo Brouns from the University of Groningen in the Netherlands, outlined how the perception of excellence in academia must be changed. A major change in mindset must be fostered. The stepping stones for promotion must be changed.

Figure 2. *Science is not a macho world.*



The indicators of success in academia include:

(i) the number of publications in high impact journals and citations². Women who have children, take leave of absence or work part-time and when they return to work after a leave of absence they cannot achieve the same publication output as full time people. Thirty percent of articles are published by 10% of men. If men publish more then the number of citations achieved will increase. This is not a reflection of competence. Full professors publish more, because they manage larger teams of scientists and have independent senior scientists writing papers in their teams. Success in grant applications depends on published work. Travel and participation at conferences promote networking and citations are a by-product of networking. Women get involved in administration work, they write more reports, and take on more teaching

responsibilities. They play a bigger role in social aspects of the job. This work is not considered under the 'excellence' criteria.

The next indicator in the road to success discussed was:

(ii) Standards for judging scientific quality and for job success. In selecting candidates for higher positions, there are double standards. Male candidates qualify if they are 80-90% satisfactory and almost fulfil the selection criteria. Women on the other hand must be 100% satisfactory. A senior male colleague, in a 'similar to me' syndrome, mentors a junior male colleague. The dominant image of a 'real' scientist is the Olympian model: a young male, devoting time and dedication to the job, who is competitive and individualistic, glittering at the top of the esoteric scientific community².

Women do want to compete, but do not persist in the competition. They see other societal aspects of life that they feel are more important to their life style. This is not the case with all women. There are women with confidence, image, and total dedication to their jobs, but in these instances they have strong support systems in place such as an understanding partner or 'house husband'. We saw a selection of strong independent women interviewed in the film, *Femmes de Tête / Women of Science*, an ARTE/ European Commission co-production, made by Hervé Nisic (director) with support from the Women & Science unit in Science and Society Directorate. This film outlined that more than 50-60% of women are in higher education, but are being lost. Successful women often change their career structure to non-scientific jobs such as politics and administration. There are no high profile women to 'pull everyone up'. There is a need for a 'female Einstein' or a 'glamorous star' image to attract more women into the field. Will women scientists agree to this approach? It is unlikely, as the women interviewed in the film including, Ene Ergma, Agnes Wold, Christine Wennerås, Julia Higgins, Marguerite Saler, demonstrated. They are more interested in the science; they do not necessarily worry about their careers or image; they just want to 'solve problems'. 'If they stand out they are punished'. Women scientists are 'tenacious' and 'stubborn' but there is also 'loneliness' in being a successful woman scientist. These confident women agreed that they succeeded because they had understanding companions and because of their love of science. We need a profound discussion of science as a social institution in the 'knowledge society' and a reflection on the socially-constructed nature of any conception of 'quality'.²

The Women & Science Unit in the Science and Society Directorate of DG RTD, has carried out Trojan work in compiling statistics on womens' participation in science and technology, developing databases of women scientists and monitoring EU participation in framework programme grant applications. Their publications can be found at http://europa.eu.int/comm/research/science-society/women-science/women-science_en.

Individual countries have initiated projects. In the UK, the Athena Awards project was established to encourage the advancement of women in higher education and to significantly increase the number of women recruited to top posts. Part of its remit is mentoring, networking and staff development for women in science and engineering. It also aims to increase equality and diversity in terms of race, age, disability and gender. In Austria, fFORTE (www.fforte.at) facilitates access and improves opportunities for women in S & T. In Germany, the FiF Contact Point group (www.eubero.de) offers coaching to increase significantly the number of German women coordinating or

participating in European research. A second German initiative, the Centre of Excellence Women and Science (www.cews.org), helps women to develop career strategies to gain senior positions. In the case of ethnic minorities, a trans-national project, ETHNIC (www.bit.ac.at/ethnic), is underway, to raise the awareness of S & T among ethnic minority young people and adults. In the majority of countries there are voluntary organisations that promote women issues, such as 'Woman in Technology and Science' groups. These initiatives are just scratching the surface. When women are in senior positions, do they mentor other women? The reality is that they do not. How can we change the trend?

Can we have a redefinition of the image of our daughters? Can we imagine them as engineers and scientists when they grow up? This image of our daughters may be changing, as men/women in senior positions are now more attuned to equality and can visualise their daughters taking their place in senior management. The 'same as me syndromes' can be changed, but at present, in only an insignificant number of incidences. In these cases, it is within a privileged, minority group.

Tackling and closing the technology gap

Is there a technology gender gap or just a human computer interface CAP? David Passig, futurist and head of the graduate programme of ICTE Bar Ilan University in Israel, addressed the conference with a model for why there is a gender gap in computer usage, science and learning from kindergarten to university. These differences have been explained, in the past, in many societies, by social, environmental and even genetic factors. Large efforts and investments, in the last decade, aimed at closing this gap, have been unsuccessful. Scientific studies on this issue have been undertaken recently to provide factual knowledge. The results show that there are gender differences in multimedia based learning such as (i) time on task, (ii) intrinsic satisfaction and (iii) interests and usage preferences.. In measuring the attitudes of very young participants in the studies, a tool developed by Lampert (1981) called the Pollimeter ruler was used. This is an instrument for measuring behaviour, based on visual moving elements that enable almost anyone to present their opinion and does not depend on verbal capabilities. His test material was a multimedia electronic book that measures presentation, conversation, navigation and control³. The results showed that:

Boys prefer

Navigational support

Control elements

1. How to continue
2. Sharp transitions
3. Variety of choices
4. Lonely learners
5. Green and blue colours

Girls prefer

Presentation design

Conversation elements

1. Overall appearance
2. Many colours
3. Feedback possibilities
4. Many animations
5. Red and yellow colours

The outcomes from these studies suggest that developing gender-free interfaces or addressing specific gender issues will close the technology gap that hold girls back from using computers. There needs to be a radical change in presentation if we are to encourage a gender balance in S & T disciplines. Women may not like this view of themselves, but if this is the reality, then it must be taken seriously.

The Engine of Change

Our future scientists and technologists are our children. How are we going to increase participation of young people in science, whether they are men or women, to reach the targets of the Lisbon agenda? It states that *'all research institutions of the enlarged Union must be given the means to take the road to excellence'* ⁴. To achieve such excellence, we must have the people, and the EU needs to promote the development of scientific careers because:

- ❑ Even very able pupils opt out of S & T, particularly girls.
- ❑ Young people do not choose S & T careers because it is good for the national economy.
- ❑ They make choices based on their own values, motifs, interests and 'self realisation'.

To increase the number of scientists will be a challenging target, considering the early reports from the ROSE project- the Relevance of Science Education (www.ils.unio.no/forskning/rose/), a project on the attitudes of a cohort of 1000 children in each of 40 countries. Using a 4 point Likert scale, a total of 250 items under seven headings were surveyed:- My out of school experiences; What I want to learn about; My future job; Me and the environment; My science classes; My opinions about science and technology; Myself as a scientist (open written response). The results were very revealing and do not reflect well for S & T demand that is required to make the EU a 'knowledge-based' power centre. On the Likert scale, four is positive, and one is negative.

The results of the ROSE project in the area of S & T in Society were mostly positive:

- Children in all countries agree strongly that S & T are important for society.
- That a country needs S & T for development, with boys agreeing a little more than girls.
- S & T can find cures to disease like HIV/AIDS and cancer.
- Thanks to S & T, there will be greater opportunities for future generations. In the Nordic countries and Japan, the belief was not so strong.
- Less positive were the attitudes that technology will make work more interesting. Again the Nordic countries and Japan, but more particularly girls were more sceptical. There were significant differences in the EU and the developing countries attitudes.
- A surprising result was obtained when the children were asked their opinion on *'if the benefits of science were greater than the harmful effects it could have'*. In the industrial countries the ambivalence was particularly strong among girls, and Japanese boys and girls were even more sceptical towards science.

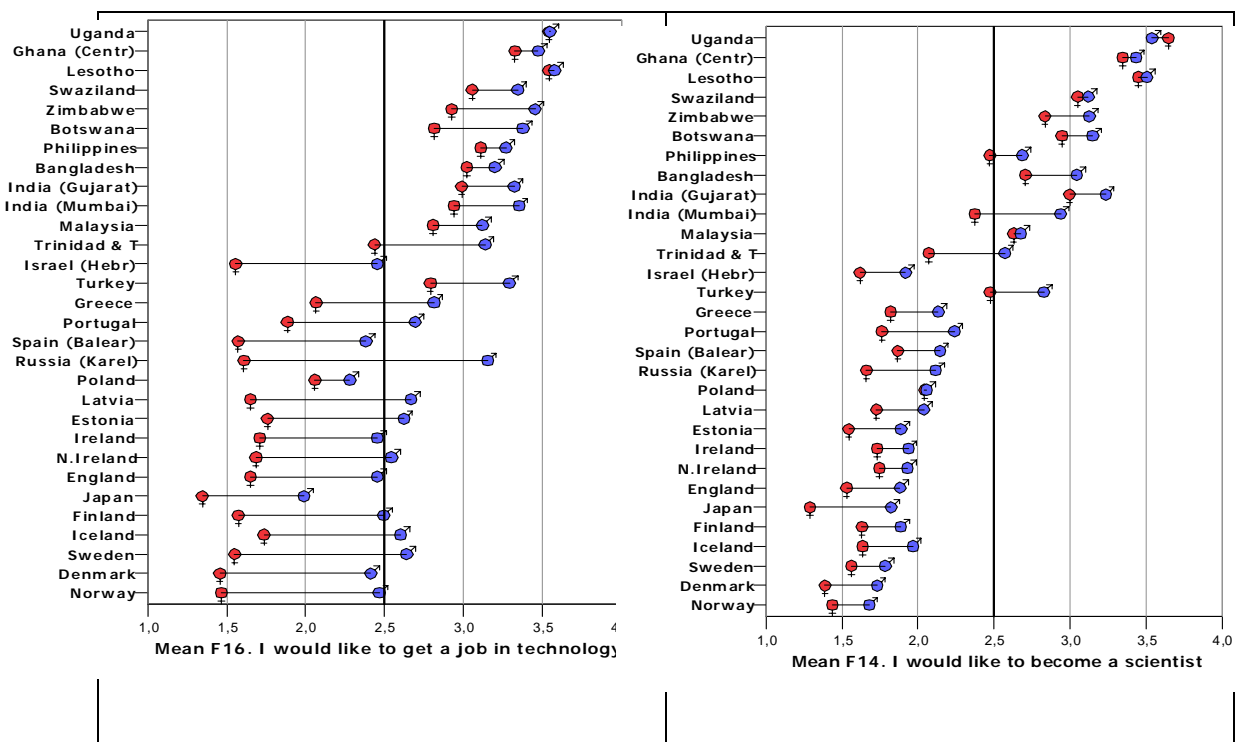
Trust in science and the belief that scientists are neutral and objective was not high in most countries, among the children surveyed. The girls had less trust than boys. There was little trust that scientists and experts would take care of the environment, however the girls were less sceptical than the boys on this point, with Japanese children being the most sceptical of all. They also did not believe that S & T could solve environmental problems.

What are the indications that children will take up science as a career? From the ROSE project results, children do not like school science; girls dislike being more prominent than boys. They do not see job opportunities from doing science. These children's image and future job descriptions do not fit the vision of the EU Lisbon and Barcelona agenda had envisioned. These children have a desire to work in an environment that fits their attitudes, helping other people, finding meaningful employment. In all these cases, the girls have the strongest attitudes to these considerations.

As the ROSE project shows, a major cultural change is required, if we are to achieve the vision of increased diversity in science and the increased participation of girls in science. Girls and more surprisingly, boys do not wish to become scientists, they do not want a job in a technology-driven industry, with Japanese children showing the least interest in a job in technology. **Figure 3a/b** The engines of change need to be redesigned if we are to achieve the targets, if we are to make the EU a knowledge-based society and give it a competitive edge in S & T.

The representative from the Learning and Development Institute Jan Visser, (www.learndev.org), pointed out that 'building the scientific mind is something that goes way beyond science education' and that an overall educational policy should be the development of 'the spirit of relentless questioning and critical evaluation of issues that drive science' and 'to the extent that girls and boys approach the world in different ways with different personal interests in mind, it is important that such differences be taken into account in developing the spirit of science'

Figure 3a/b Results from the ROSE project on children's attitudes to S & T



Integrating ethics into European research practice

Can we change the attitudes of our citizens to S & T, improve diversity and foster inclusiveness, if we have strong ethical guidelines in research? Can we foster increased trust by imposing increased ethical standards? New technologies bring with them new dimensions in ethical aspects, which require wide public debate. To be successful in grant proposals within the EU Sixth framework programme, ethical guidelines must be in place. Committees are established to oversee potential ethical oversights.

The integration of ethics into the ERA is under the guardianship of the Council of Europe based in Strasbourg. The aim of the Council of Europe is to achieve a greater unity between its members (Article 1 - Statute of the Council of Europe).

The Council of Europe (CoE) is the continent's oldest political organisation, founded in 1949. It groups together 46 countries, including 21 countries from Central and Eastern Europe; it has an application pending from Belarus, it has granted observer status to 5 more countries (the Holy See, the United States, Canada, Japan and Mexico); it is distinct from the 25-nation European Union, but no country has ever joined the Union without first belonging to the Council of Europe. The role of the CoE and its remit in providing know-how in areas such as human rights, local democracy, education, culture and the environment, was outlined by Pēteris Zilgalvis, Bioethics department in the CoE.

The council works in conjunction with other partners, including, the EC, EP, WHO, OECD, UNESCO, civil society including NGO's, patient groups plus academia and industry. This cooperation avoids duplication of work and global viewpoints in formulation of charters of rights. Biomedical and environmental ethics play a considerable part.

The ERA can draw on the Charter of Fundamental Rights of the European Union, which was adopted in the year 2000⁵, to provide recommendation for ethical guidelines, particularly in light of changes in scientific and technological developments. Chapter 1: Article 3 defines the 'Right to the integrity of the person'

1. Everyone has the right to respect for his or her physical and mental integrity.
2. In the fields of medicine and biology, the following must be respected in particular:
 - o the free and informed consent of the person concerned, according to the procedures laid down by law,
 - o the prohibition of eugenic practices, in particular those aiming at the selection of persons,
 - o the prohibition on making the human body and its parts as such, a source of financial gain,
 - o the prohibition of the reproductive cloning of human beings.

These principles have been further enshrined in the 'Convention of Human Rights and Biomedicine ((European treaty series) ETS-164 1997), together with an explanatory report (Council of Europe Dir/Jur (97)5). In particular Chapter 5 and the conditions on 'Scientific Research' were highlighted, including Article 16: protection of persons undergoing research. Article 17: protection of persons not able to consent to research. Additional Protocols to the Convention on Human Rights and Biomedicine in 2004 (Council of Europe Dir/Jur (2004)4), have been added, which covers the full range of biomedical research activities involving interventions on human beings. Chapter 3

Articles 9: independent examination by an ethics committee, article requires all research to be submitted for independent examination of their scientific merit and ethical acceptability in each state in which any research is to take place.

The significant features of the Convention of Human Rights, provide that transparency of research is a requirement, with full information for the ethics committees, the publication of negative results, informed consent is fundamental and does not give 'carte blanche' to researchers to do as they please. The protection of vulnerable groups and those unable to consent and the protection of participants in the 'developing countries' is outlined.

Biometrics –Emilio Mordini, The Centre for Sciences, Society and Citizenship, Rome outlined the informatization of the body. Knowing the location of our bodies using GPS implants, can be of interest e.g. finding missing children. Instead of passports or ID cards the use of retinal and/or iris scans, facial scans, hand geometry, voice recognition, may be used in the future for entry into buildings and secure locations. How living biometrics, may be able to detect diseases, pregnancy, and this may have significant implications for securing and maintaining employment and for insurance acceptance. Living biometrics parameters will be required to deter criminal and terrorist activities as body parts can be removed and used to evade security measurements. There are grave ethical implications to biometrics. Slaves were marked physically. Is biometrics a new dimension for labelling 'groups'? The ethics and policy of these new technologies need to be addressed.

Putting the recommendation of the Council of Europe into practice is very different 'in the field'. Dominique Boutriau, GlaxoSmithKlein Biologicals, outlined a case study of a meningitis vaccine programme in Africa. The burden of disease is so great in Africa and vaccination is not high on the list of priorities for governments concerned. The study was therefore considered in environments where the trial would have the optimum impact. Using good clinical practice, even under restrictive environmental conditions, complying with the Convention of Human Rights and Biomedicines conditions (e.g. informed consent), in certain ethnic environments the rules can be difficult to impose. In this case the women in Africa could not give their individual consent. This had to be obtained from the tribal chief and elders, the woman's husband, her mother-in-law and brother-in-law, before she had any consent. However, community consent does not replace individual consent. The conditions relating to the illiterate and the mentally impaired must also be dealt with in an ethical manner. What are the ethical implications in providing remunerations to very impoverished communities for the research carried out? Each case must be considered on a one-to-one basis. Each research situation must be examined individually. In each case however good clinical practice, standard operation procedures, targeted training of local groups and use of the highest ethical standards, must be demanded.

Many multinational companies' share/stock price depends on it having high ethical standards, incorporating diversity and inclusiveness and financial accountability. Pierre Bismuth, the vice president of personnel for Schlumberger Ltd., outlined the value of a high quality 'company culture' being recognised worldwide. Schlumberger Ltd (established in 1920) is a major oil exploration company and when it initially

began to employ women, the surprise was that the men found this to be beneficial. Dual career problems surfaced but with cooperation with other companies, this was solved. Work environments for women were incorporated into the work environment. Further diversity was embraced with recruitment of personnel from emerging development countries in the 1980's. The overall result was that the share price has increased with changed cultural milestones.

Conclusions:

What conclusions can be deduced from the papers and discussions on diversity, inclusiveness and equality of science?

- Europe must embrace greater diversity to increase research productivity.
 - The system is not beneficial to women at this time. The official policy is not working. We need to redefine excellence for women, ethnic minorities and disabilities groups until such time as equilibrium exists.
 - Action should be on men to change their way of thinking in selections candidates for job promotion.
 - A radical change in curriculum presentation is necessary, if we are to encourage young people and increase the gender balance in S & T disciplines.
 - The curriculum at present is already 'fossilised'. Communication of science must be a 'whole life' process.
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- Recommendations for ethical standards are not sufficient - they must be legally enforced.
 - The ethical aspects for new technologies such as living biometrics require extensive public debate. However, not all new technologies should be feared.
 - We need to learn respect; for people; the individual; for privacy; our culture; our environment.

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