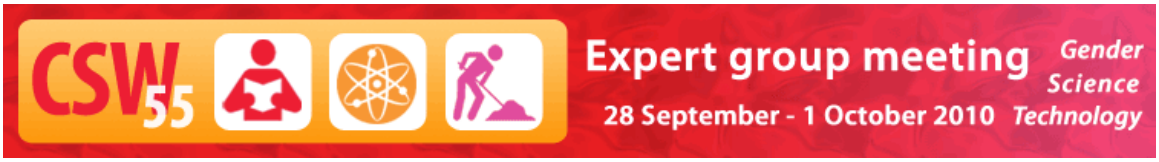

Gender, science and technology

Report of the expert group meeting*

Organized by

United Nations Division for the Advancement of Women (DAW), part of UN Women
in cooperation with
United Nations Educational, Scientific and Cultural Organization (UNESCO)

Paris, France
28 September – 1 October 2010

* The views expressed in this document are those of the experts and do not necessarily represent the views of the United Nations

TABLE OF CONTENTS

I. Introduction

1. In accordance with its multi-year programme of work for 2010-2014, the Commission on the Status of Women (CSW) will consider 'Access and participation of women and girls in education, training, science and technology, including for the promotion of women's equal access to full employment and decent work' as its priority theme during its fifty-fifth session, from 22 February to 4 March 2011. In order to contribute to a deeper understanding of the issue and to assist the Commission in its deliberations, the United Nations Division for the Advancement of Women (DAW), part of UN Women, in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO) convened an expert group meeting (EGM) on 'Gender, science and technology' from 28 September to 1 October 2010 in Paris, France.

2. This report is the outcome of the meeting. It will provide inputs for the reports of the Secretary-General to the CSW. The report will be widely disseminated at the fifty-fifth session of CSW, including through a presentation during a panel discussion.

II. Organization of work

A. Participation

3. The EGM was attended by 12 experts from different regions of the world, 16 observers and one consultant. Five staff members of UNESCO and three staff members of DAW also attended the meeting (see Annex I).

B. Documentation

4. The documentation for the meeting consisted of:

   - A background paper prepared by a consultant
   - A background paper prepared by UNESCO
   - Twelve papers prepared by experts
   - Four papers prepared by observers

5. This report and all documentation relating to the meeting (see Annex II) are available online at:
   http://www.un.org/womenwatch/daw/egm/gst_2010/index.html

C. Programme of work

6. At its opening session on 28 September 2010, the meeting adopted the following programme of work (see Annex III):

   - Opening of the meeting

- Election of officers and adoption of the programme of work
- Presentation and discussion of the background papers
- Presentation of papers prepared by experts
- Working groups on issues and recommendations
- Adoption of the findings and recommendations
- Closing session

D. Election of officers

7. The experts elected the following officers:

- Co-chairs: Klaus Schroeder and Judith Zubieta
- Rapporteurs: Sophia Huyer and Verdiana Masanja

III. Global policy and legislative framework

8. Commitments on women's and girls' access to and participation in science and technology have been made by Governments at the international level. The Beijing Platform for Action, adopted at the Fourth World Conference on Women (1995), calls on Governments and all stakeholders to increase women's access to and retention in science and technology, including by adapting curricula and teaching materials and by increasing the share of women teachers in scientific and technological disciplines at all levels of education (paras. 82 (g) and 83 (f)). In addition, stakeholders should provide information on the availability and benefits of training programmes in these fields and funds for special programmes in science and technology to advance opportunities for women (paras. 82 (c), (e) and 85 (b)).

9. The Platform also urges stakeholders to promote gender-sensitive and women-centred health research, treatment and technology, and to link traditional and indigenous knowledge with modern medicine (para. 109 (b)), as well as to create training, research and resource centres that disseminate environmentally sound technologies to women (para. 258 (b)(v)). It emphasizes the need to undertake legislative and administrative reforms to give women equal rights with men to economic resources such as new technology (para. 165 (e)). In addition, it calls for outreach programmes to inform low-income and poor women, particularly in rural and remote areas, of opportunities for market and technology access, and to provide assistance in taking advantage of such opportunities (para. 173 (c)).

10. The outcome document of the twenty-third special session of the General Assembly (2000) highlights the need to encourage and support the education of girls in science, mathematics, new technologies, including information technologies, and technical subjects, and to encourage women, including through career counselling, to seek employment in high-growth and high-wage sectors and jobs (para. 82 (i)). It also stresses the importance of providing access to and

control over technology, particularly for women living in poverty and for women entrepreneurs (paras. 74 (a) and 82 (g)).

11. The Science Agenda – Framework for Action of the UNESCO World Conference on Science (WCS) (1999) calls for special efforts by governments, educational institutions, scientific communities, non-governmental organizations and civil society, with support from bilateral and international agencies, to ensure the full participation of women and girls in all aspects of science and technology.

12. The World Summit on the Information Society (WSIS) recognizes, in the Geneva Plan of Action (2003) and the Tunis Agenda for the Information Society (2005), the importance of promoting women's participation in information and communications technologies (ICT), including at decision-making level. It calls for equal training opportunities in ICT-related fields for women and early intervention programmes in science and technology, targeted at young girls, in order to increase the number of women in ICT careers. It also highlights the need for gender-responsive ICT policies. In addition, at the United Nations World Summit (2005), Governments committed to ensuring women's equal access to productive assets and resources, including technology.

13. The Commission on the Status of Women has addressed the topic in a number of its sessions since 1996. The agreed conclusions on women and the environment (1997) urge stakeholders to support the role of women in developing environmentally sound technologies and in influencing the development of new and appropriate technologies, while the agreed conclusions on education and training (1997) call for renewed importance to be given to education in mathematics, science and technology for girls and women, including the use of information technology. They also stress the importance of information services and professional guidance to promote equal participation in these fields, and to encourage women's participation in development of new technologies, from design to application, monitoring and evaluation.

14. The agreed conclusions on participation in and access of women to the media and information and communication technologies and their impact on and use as an instrument for the advancement and empowerment of women (2003) call for equal opportunities for women and for monitoring gender representation in different categories and levels of work, education and training in ICT. In addition, the agreed conclusions on enhanced participation of women in development: an enabling environment (2006) highlight the need to increase women's and girls' equal and effective access to and use of information and communication technologies, as well as applied technology. The agreed conclusions on financing for gender equality and the empowerment of women (2008) recognize the importance of assisting women-owned businesses in participating in and benefiting from technological innovation and transfer.

15. The Commission on Science and Technology for Development (CSTD) is the sole functional commission of the United Nations Economic and Social Council (ECOSCO) to have a Gender Advisory Board (GAB), established in 1995. The GAB, previously the Gender Working Group, developed a set of 'Seven Transformative Action Areas' to progress toward gender equality, which were endorsed by ECOSOC in 1995. In 2006, the GAB added an eighth transformative action area. The CSTD has addressed gender equality issues in its resolutions.

16. The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), in its article 14, requires States parties to ensure the right of women living in rural areas to have access to appropriate technology.

IV. Findings and recommendations

17. The potential of science and technology (S&T) to advance development and contribute to people's well-being has been well-recognized. Science and technology is vital for the achievement of internationally agreed development goals, for instance by facilitating efforts to eradicate poverty, achieve food security, fight diseases, improve education, and respond to the challenges of climate change. It has also emerged as an important means for countries to improve productivity and competitiveness and to create decent work opportunities.

18. The contribution of science and technology to development goals can be accelerated by taking into account its gender dimensions. For instance, greater access to and use of existing technologies, as well as better products that respond to women's needs, can increase women's efficiency in carrying out productive and other tasks. Acquiring science and technology education and training can empower women in all aspects of their lives. Eliminating barriers to women's employment in science and technology fields will further the goals of full employment and decent work.

19. The EGM covered a wide range of issues related to the intersection of sex and gender, and science and technology. Discussions focused on three main aspects: the participation of women and girls in science and technology education and employment; their access to and use of technology; and the need to integrate a gender dimension into research content and product design.

20. After clarifying key terms, this section presents the findings of the meeting and the recommendations adopted by the experts. More information on participants' individual contributions is available on the EGM web page, where expert and observer papers and presentations have been posted.

21. While recommendations are addressed to all stakeholders, they may be of particular relevance to the following actors: governments at all levels, including ministries of education, science and technology, labour, environment; national

gender equality and science machineries; donors; multilateral agencies; funding agencies; educational institutions including public and private schools; research institutions; the private sector, including enterprises developing and marketing technology products; employer organizations; trade unions; professional bodies; and non-governmental organizations (NGOs).

Terminology

Science and technology

22. The term 'science and technology' can be understood in a broad sense, including fields as different as physics, political science and literature, or in a narrow sense that covers primarily academic and professional disciplines related to natural sciences, engineering, mathematics and computing. This report uses the latter definition.

23. It is also important to recognize that the definition of science can include indigenous science and traditional knowledge systems. The concept of technology is, likewise, socially and culturally diverse, referring to hand-made tools as well as complex products and processes, for instance information technology (IT) systems. This report uses these definitions.

Gender, sex, and gender analysis

24. UNESCO provides the following definitions.[1]

"*Gender* refers to the roles and responsibilities of men and women that are created in our families, our societies and our cultures. The concept of gender also includes the expectations held about the characteristics, aptitudes and likely behaviours of both women and men (femininity and masculinity). Gender roles and expectations are learned. They can change over time and they vary within and between cultures. Systems of social differentiation such as political status, class, ethnicity, physical and mental disability, age and more, modify gender roles. The concept of gender is vital because, applied to social analysis, it reveals how women's subordination (or men's domination) is socially constructed. As such, the subordination can be changed or ended. It is not biologically predetermined nor is it fixed forever."

"*Sex* describes the biological differences between men and women, which are universal and determined at birth."

"*Gender analysis* is the collection and analysis of sex-disaggregated information. Men and women both perform different roles. This leads to women and men having different experience, knowledge, talents and needs. Gender analysis explores these differences so policies, programmes and projects can identify and

[1] United Nations Educational, Scientific and Cultural Organization (2003). UNESCO's Gender Mainstreaming Implementation Framework for 2002-2007.

meet the different needs of men and women. Gender analysis also facilitates the strategic use of distinct knowledge and skills possessed by women and men."

25. This report uses the above definitions. In consequence, references to gender analysis can cover both biological (sex) and socially-constructed (gender) factors. The same applies to the term gender bias.

A. Women's and girls' participation in S&T education and employment

26. Participating in S&T education is important to support women's and girls' role as users and innovators of technologies as well as researchers, scientists and technologists. Their low participation is problematic not only from a rights point of view, but also from an economic angle. In an era where economic growth is often linked to a country's capacity for innovation, women's contributions become especially important. Women help diversify research and development teams, bringing different points of view that can fuel creativity and result in better quality outputs. For example, in 2007, American IT patents produced by mixed-sex teams had higher citation rates than those produced by male-only or female-only teams.[2]

27. Women and girls have long been underrepresented in S&T education and employment, and much has been done to understand the causes and identify solutions. Initiatives have been put in place at the international, regional, national and sub-national levels, and stakeholders, including Governments, universities, the private sector and NGOs, have over time developed a wide range of policies, programmes and projects. However, efforts have generally focused more on S&T education than on employment. In some regions, little has been done to address the hurdles that women scientists and engineers face.

28. It is difficult to assess how much progress has been made globally, particularly with regard to women's employment in S&T. Substantial variations exist among countries and within specific subfields of science, as statistics presented in the background and expert papers illustrate. A lack of comparable, sex-disaggregated data on participation in education and employment by discipline and research and development sector hinders analysis at the global or, in many cases, regional level. For example, data is rarely disaggregated by subfields of study in engineering, and statistics on researchers often refer to all fields of science, including humanities and social sciences.

Recommendations

29. The Expert Group urges stakeholders to:

[2] National Center for Women & Information Technology (NCWIT) (2006). Who Invents IT? An Analysis of Women's Participation in Information Technology Patenting.

a) Encourage and accelerate the development of statistical indicators and collection of sex-disaggregated data to allow for clear tracking of trends and monitoring/evaluation of actions.
b) Carry out gender-sensitive monitoring and evaluation of all programmes.
c) Mainstream a gender perspective in S&T educational institutions and particularly in the workplace. Concrete actions can include:
    i) Monitoring the implementation and evaluating the impact of education-related gender policies adopted by countries and educational institutions;
    ii) Adoption of gender equality policies in employment;
    iii) Adoption of policies and practices on anti-harassment and violence against women and girls;
    iv) Development of gender action plans by institutions and their human resource units with specific goals and monitoring frameworks and accountability structures, linked to accreditation and funding;
    v) Development of guidelines for gender-sensitive S&T education and employment;
    vi) Establishment of mandatory gender-sensitization for all staff, particularly professors and managers.
d) Undertake a global study on the level of participation of women and girls in S&T education and employment, and identify good practices that have increased their participation.

S&T education

30. Access to education is a prerequisite for girls to train in science and technology-related subjects. On a global scale, however, many children remain out of school, and in several regions girls' enrolment at the primary and secondary levels continues to lag behind boys'. In many countries, there are hidden costs to education which have a disproportionate impact on women and girls. Families must factor in the opportunity cost of educating a child, in particular a girl – that is, the loss of income if the child can no longer work outside the home or take on domestic responsibilities. In addition, some Governments under-fund the education sector, which leads to private schools filling the gap and creates a two-tier system, where only wealthy students have access to quality education. Failing to educate all girls and boys, however, has economic consequences both for the individuals and for the country.

31. It is difficult to attract and retain women and girls in S&T education, and to ensure that they make the transition from higher education to professional life. Negative stereotypes impact on girls' interest in science and technology; they can also contribute to science anxiety. The media can play a key role in maintaining or challenging the social construct of S&T as a male sphere, depending on whether it depicts women and girls as scientifically and technologically competent and capable. Textbooks and other educational materials can also perpetuate or question this bias. While science textbooks often portray scientists as males, or depict women in stereotypical roles, some textbook authors have

systematically removed gender bias from science reporting and images.[3] In addition, the family environment and the choice of toys available at home and at preschool can also reinforce or combat the gender-science stereotype.

32. Whether S&T subjects are taught at the primary school level, and the way in which they are taught, can play an important role in promoting interest in science in both girls and boys, and later reducing the leakage of girls from S&T education. Quality of learning rests heavily on the quality of teaching and on the positive and negative messages that are communicated within the classroom. While having a poor literature teacher would not prevent someone from ever opening a book again, a poor science teacher may alienate a person from science and technology.

33. However, primary school teachers often lack training on science subjects, and more generally, teachers at various levels of education tend to have little information on how to teach S&T subjects in gender-sensitive ways. For instance, emphasizing the potential of S&T innovations for improving people's everyday life may help engage girls. In addition, finding qualified science and mathematics teachers can be difficult, particularly in view of the alternative employment opportunities with higher pay, status and respect that exist outside schools.

34. Exposing girls to successful female role models in mathematics and science is another way to reduce negative stereotypes and improve girls' performance and interest in mathematics and science.[4] There is a need to raise the number of women S&T teachers, who play a significant role in enhancing girls' interest in scientific subjects. In the Republic of Korea, while 80 per cent of teachers are women, few of them teach mathematics or science subjects.

35. In some countries, distance education has increased women's access to tertiary education in science and technology, in particular for women who would have to leave their families and communities behind to pursue higher education away from home. Distance education also provides women with the flexibility to fit their study time into their daily schedule. In addition, some women feel more comfortable participating in virtual rather than in-person class discussions. Open source resources, which are freely available for use and redistribution, can also be useful in increasing women's access to education. Distance education can be combined with periods of field or laboratory research to meet the requirements of some S&T subjects.

36. The variety of barriers to women's and girls' participation in S&T education highlights the need for responses that not only focus on encouraging women and girls to enter S&T fields, but also on changing institutions to make S&T more

[3] See for example the following tertiary level textbook: Gilbert, S. (2009). *Developmental Biology (8th ed.).* Sunderland, Mass.: Sinauer.

[4] American Association of University Women (2010). *Why so Few? Women in Science, Technology, Engineering and Mathematics*. Washington DC: AAUW.

attractive to women and girls. The following table provides examples of different initiatives.

Table 1: Initiatives to increase women's and girls' participation in S&T education

Country/ region	Key actor	Initiative	Aim of initiative	Activities
Burkina Faso, Cameroon, Ghana, Kenya, Malawi, Mali, Mozambique, Rwanda, Senegal, Swaziland, United Republic of Tanzania, Uganda, Zambia, and Zimbabwe	Association for the Development of Education in Africa (ADEA) and Forum for African Women Educationalists (FAWE)	Female Education in Mathematics and Science and Africa (FEMSA), and Science, Mathematics and Technology model	To increase and sustain access, interest, participation and performance of girls in science, mathematics and technology subjects at all levels.	Science camps and clubs, study tours, profiles on women achievers in science-based fields, exposure to role models, and awards to female achievers in science, mathematics and technology subjects
European Union	European Commission	Science education now: A renewed pedagogy for the future of Europe	To examine a cross-section of on-going initiatives and draw from them elements of know-how and good practice that could bring about a change in young people's interest in science studies	Analysis of ongoing science education initiatives within the European Union
Republic of Korea	Government	Women into science and engineering (WISE)	To increase girls' participation in S&T education	Online and offline mentoring
Republic of Korea	Government	Women's Academy for Technology Changer in the 21st Century (WATCH21)	To increase girls' participation in S&T education	Providing high school girls with experience at engineering research laboratories

Recommendations

37. The Expert Group urges stakeholders to:

Access to quality S&T education

a) Promote women's and girls' access to free quality formal education, technical and vocational education and training and non-formal education throughout the life cycle as the essential foundation for women's careers in science and technology and use of technology.
b) Ensure the provision of quality education for girls and women throughout the life cycle.
c) Ensure adequate funding, in particular to pay for qualified S&T teaching, training, materials, equipment, and infrastructure, so that both public and private systems can provide equal opportunities to girls and boys, independently of socio-economic condition.
d) Review teacher education policies and programmes to provide quality gender-sensitive pre-service and in-service training in science and mathematics for teachers.
e) Develop effective, high-quality S&T education and technical and vocational education and training programmes in order to foster personal and societal interest in these disciplines and to ensure that curricula are relevant to the socio-cultural context and physical environment, using appropriate approaches and materials, such as manipulative toys for girls at preschool, and practical applications.
f) Integrate science and technology into non-formal education, supported by appropriate policy frameworks, capacity development programmes and trained teaching personnel, including through:
    i) Reaching out to girls and women in rural or depressed urban areas in particular, and to those who missed full educational opportunities and are in the labour market;
    ii) Using non-traditional delivery mechanisms, such as distance learning technologies, open source courseware, mobile phones, webcasts, podcasts, partnerships with museums and private-public partnerships.
g) Promote the use of ICTs by women as a means to provide access to education and vocational training, and to increase employment opportunities for women in the IT sector.
h) Take into account and eliminate implicit and explicit socio-cultural barriers to girls' and women's participation in science or technology education (e.g. family dynamics; division of roles and responsibilities within the family; expectations, parenting messages), including how gender may combine with other factors of inequality to leave girls multiply disadvantaged.

Addressing the gender-science stereotype[5]

i) Address the negative gender stereotypes concerning the perceived suitability of women in science and technology careers at all levels, including through:
    i) Harnessing the transformative power of the media at local, national and international levels to eliminate negative stereotypes and highlight the social and economic benefits to society of women's participation in S&T;

[5] These recommendations are also relevant to further women's participation in S&T employment.

ii) Sensitizing science journalists, science communicators, including scientists themselves, on non-'technical' issues, such as democracy, development and gender equality;
iii) Developing gender-sensitive educational material and training teachers as part of their professional development to ensure that negative representation of women perpetuating inequality are not retransmitted in the classroom.

j) Promote positive female role models and images in the classroom, workplace, community and home, in collaboration with volunteers, professional bodies, women's groups within S&T networks (both in universities and outside academia), to address the underrepresentation of women scientists, technologists and educators.
k) Take specific measure to reach gender balance among teaching personnel in science and mathematics.

Raising awareness of S&T careers for girls[6]

l) Complement the formal curricula with innovative activities such as science camps, girl days, specially designated days focused on S&T, company competitions/fellowships for girls and boys.

A 'Girls and ICT Day', similar to the IT Girls initiative of the European Union, could be established internationally to introduce young girls to opportunities in technical fields in both the public and private sector. Governments, the private sector and the UN system would work together to organize events such open door activities, lectures, and shadowing of both male and female workers.

m) Develop support structures, in particular mentoring programmes, gender-sensitive counselling, career guidance, and post-course job placement services, to encourage women and girls to go into careers in S&T with the support of their families and local communities; develop appropriate materials and provide gender-sensitive career information on possible careers in S&T.

S&T employment

38. Women who graduate in S&T subjects do not necessarily transition to a career in this field, or may drop out of it later in their professional life. In addition, few of them reach senior management positions. Attraction, recruitment, promotion, retention and recognition are key points where effective strategies are needed to increase women's participation in S&T in academia and in the public and private sectors.

39. The unequal sharing of family responsibilities is an important reason for the underrepresentation of women in S&T employment, including in decision-making positions. In the academic field, for instance, caregiving activities make it more difficult for women to establish the necessary record of research, teaching, and administrative service to obtain tenure, that is, senior, permanent academic

[6] These recommendations are also relevant to further women's participation in S&T employment.

positions. Stopping the tenure track clock, that is, extending the probationary period for those who care for newborn or newly adopted children, is an example of a measure that helps parents reconcile their work and family responsibilities. Other examples of family-friendly policies include parental leave, daycare supplement, and emergency care for children and elders.

40. In some cases, the socio-cultural environment may discourage women's progression in S&T careers. For instance, in some countries, women who take up jobs in S&T teaching and research are unable to do the travel that would be necessary for their research, and end up teaching only. This in turn constrains their publishing record and lowers their chances for career advancement.

41. Gender pay gaps persist in S&T, including in countries where women are as well- or better-qualified than their male colleagues. In addition, more research is needed to understand how the geographic mobility and the types of contracts and benefits that are prevalent in S&T research work affect women and men differently.

42. Women are also less likely to apply for grants, and tend to apply for lower amounts than men do. Depending on the country, factors contributing to this situation include family obligations, curriculum vitae (CVs) lacking publications, and lack of confidence.

43. Many initiatives have been undertaken throughout the world to increase women's participation in S&T employment. The following table provides examples of such initiatives.

Table 2: Initiatives to increase women's participation in S&T employment

Country/ region	Key actor	Initiative	Aim of initiative	Specific actions
Africa	Consultative Group on International Agricultural Research (CGIAR)	African Women in Agricultural Research and Development (AWARD)	To fast-track the careers of African women scientists and professionals delivering pro-poor agricultural research and development that benefit rural communities, especially women	Pairing of women fellows with senior professional mentors – both men and women – for one to two years. Offering mentors access to special events such as leadership or research proposal writing courses
European	European	genSET	To improve the	Providing a forum for

Union	Commission		excellence of European science through inclusion of the gender dimension in research and science knowledge making	dialogue between European science leaders, science stakeholder institutions, gender experts, and science strategy decision-makers, to help implement effective overall gender strategies
Republic of Korea	Government	Recruitment target system for women scientists and engineers	To increase the average rate of women recruits, and consequently women employees	Recruitment target system applied to 98 government-funded, -invested, and national institutes, and included in evaluation factors of the heads of the institutes. Monitored by the Institute for Supporting Women in Science and Technology and reported to the National S&T Council every year
Republic of Korea	Government	Establishment of the Institute for Supporting Women in Science and Technology (ISWIST)	To foster women professionals in S&T from the start of their employment to their becoming leaders in the S&T workplace	Research in policy development; education, training and consultation with women in S&T; provision of information on employment; and support to organizations of women scientists and engineers
Republic of Korea	Government	Research funds for women scientists and engineers	To retain women scientists and researchers and to foster their career	Point award system that gives extra points to women researchers or those returning from maternity leave. Quota system in which 14 per cent of project managers must be women. Some research funds reserved for women scientists and engineers
Republic of Korea	Government	Daedeok Research	To assist women and	Establishment of a childcare centre at a research

		Complex childcare centre	men in work/life balance	complex, open from 7.30 a.m. to 10.30 p.m.
Republic of Korea	Government	Promotion target system for women scientists and engineers	To ensure that 30 per cent of those promoted are women	Promotion target system recommended to 25 government-funded S&T institutes. Monitored by the Institute for Supporting Women in Science and Technology and reported to the National S&T Council every year
Republic of Korea	AMORE-PACIFIC and Korean Federation of Women s Science & Technology Associations	AMORE-PACIFIC Awards and Fellowships	To honour women scientists and young female researchers	Provision of awards and fellowships to increase the visibility of women scientists through publicizing their achievements
United Kingdom	United Kingdom Resource Centre for Women in Science, Engineering and Technology (UKRC)	Athena Charter for Women in Science	To recognize good employment practices for women working in science, engineering and technology in higher education and research	Awards for good practices on recruiting, retaining and promoting women in science, engineering and technology in higher education institutions
United States of America	University of Michigan and National Science Foundation	Strategies and Tactics for Recruiting to Improve Diversity and Excellence (STRIDE), part of the national Increasing the Participation and Advancement of Women in Academic	To maximize the likelihood that diverse, well-qualified candidates for faculty positions (for instance women and minorities) will be identified, and if selected, will be recruited,	Sensitization workshops for faculty and administrators involved in hiring, and meetings with chairs, faculty search committees, and other department members involved with recruitment and retention

		Science and Engineering Careers (ADVANCE) programme	retained, and promoted	
Global	L'OREAL and UNESCO	L'OREAL-UNESCO Awards and Fellowships	To honour women scientists and young female researchers	Increasing the visibility of women scientists through publicizing their achievements

Recommendations

44. The Expert Group urges stakeholders to:

a) Provide financial support for women in tertiary and post-graduate S&T programmes.
b) Provide more professional support and leadership programmes for women scientists.
c) Consider establishing quotas on women's representation in senior positions in S&T institutions and decision-making bodies.
d) Provide training on grants applications to early career researchers, particularly women.
e) Promote collaboration among a variety of stakeholders, including at the local level, to:
    i) Implement measures to attract, recruit, advance, retain and reintegrate more women in S&T careers;
    ii) Ensure that enabling environments (salaries, collective agreements, laws, regulations, etc) are work- and family-friendly for both women and men; encourage employers and workers to include such measures in collective agreements, and provide incentives to employers to implement such measures.
f) Provide special funding for returners, dual careers, nurseries and kindergartens, and mentoring.
g) Establish complaint and redress procedures for discrimination on the basis of sex in S&T employment, and provide resources for legal aid.
h) Apply gender-responsive budgeting principles, especially in grants and award criteria.
i) Apply the principle of equal pay, entitlements and benefits for work of equal value, and ensure equal social protection, while taking into account the gender dimensions of mobility (e.g. contracts, pension, work permits, brain drain, dual career opportunities) and career progression.

B. Women's access to, development of, control over, and ability to benefit from technology

45. Women spend a large amount of time performing labour-intensive tasks. Technology can support them in their multiple roles in production, community management, domestic and care responsibilities, such as the provision of care to children, the sick and the elderly. Technology is influenced by cultural, economic and social factors, therefore it is not gender-neutral.

46. Women are technology developers, producers and users. In many parts of the developing world, women play a key role in food production and household nutrition, working up to 13 hours per day in agriculture-related and food preparation activities, including planting, weeding, harvesting, processing, and cooking. They are often the holders of traditional knowledge, for instance on seeds, production techniques, climate, soil conditions, and seasonal plant cycle calendars. Women, however, do not only rely on using ancient methods and materials: they also experiment and develop new techniques, for example to improve seeds, better manage pests, and conserve food. Their role, however, is often not formally recognized.

47. Access to technology is key to improving women's and girls' lives. Technologies, while designed for a primary goal, often have benefits that extend to many other aspects of a person's life. For example, easier access to safe water both improves health and sanitation, and reduces women's and girls' work burden, therefore freeing up time for other activities. Solar energy can transform a community by, among others, preventing eye strain, providing light for children to study by, and allowing longer storage of food.

48. Yet, too few women enjoy the benefits of technology. For instance, women's access to ICT – a key source of information and knowledge – is lower than men's in the majority of countries. In those countries approaching or close to gender parity in ICT access, this parity occurs only in urban centres.[7]

49. Technology development institutions and industrial enterprises have often overlooked women's concerns. The design and development of technology is often male-biased, focusing on technological excellence (faster, larger, and more powerful) rather than focusing on benefits that would improve people's everyday life. Technology often is incompatible with women's physiology, with the tasks they perform, and with their need for local, human-scale solutions. In addition, women's local and indigenous knowledge tends to be marginalized or ignored. Technology design and development is also too rarely grounded in specific knowledge of the local environment and socio-cultural setting. And yet, how technologies are developed or designed can prevent or promote entrepreneurship and income generation opportunities.

50. The failure to recognize women's technology needs and to support women's role in development hinders poverty reduction and national sustainable development.

[7] Huyer, S. et al. (2005). *From the Digital Divide to Digital Opportunities: Women in the Information Society.*

There is an urgent need for Governments to implement new models and approaches to scaling up technologies for infrastructure and livelihoods, for instance in the field of transportation, water and sanitation, and ICT.

51. To better respond to the needs of women, it is important to integrate users' concerns in the technology development process, by making research and development more participatory and user-driven. For example, in much of Africa, women have the main responsibility for fetching and carrying water. Tapping into women's knowledge of soils and their water yield can help civil engineering teams find the best well placement.

52. Taking into account women's needs is also key for designing appropriate responses to global challenges such as climate change. Focusing on gender and technology dimensions will provide opportunities to address some of the challenges in adapting to climate change, that is, the need to reduce vulnerability to known hazards, to improve resilience of livelihood strategies, and to build adaptive capacities to cope with uncertainty.

> A study in Andra Pradesh, India, found that the majority of farmers were not receiving vital information on weather alerts or cropping patterns. However, this lack of access to information was much more acute among women: only 21 per cent of women reported having access to this information, versus 47 per cent of men.[8]

53. Globalization and trade are other issues that impact on women's access to technology and technology-related work. They can provide opportunities for women, for instance by creating work in the service sector, call centres, electronics manufacturing, and by opening new markets for women. However, they can also exacerbate existing inequalities by disrupting women's work and profit margins in certain sectors, such as agriculture. Women producers may be unable to compete with foreign goods, which can result in longer working hours, lower pay, or push women out of a sector entirely.[9]

Recommendations

54. The Expert Group urges stakeholders to:

    a) Adopt a participatory, user-driven approach, rather than a technology-driven approach, in research, knowledge production and technology development that takes gender into account and is tailored to the local context.

[8] Food and Agriculture Organization of the United Nations (N.d). Does Gender Make a Difference in Dealing with Climate Shifts? Research Results from Andhra Pradesh, India.

[9] United Nations Conference on Trade and Development (2002). Mainstreaming Gender to Promote Opportunities through the Increased Contribution of Women to Competitiveness. Note by the UNCTAD Secretariat. Commission on Enterprise, Business Facilitation and Development Sixth session Geneva, 18–22 February.

b) Systematically include gender analysis, and consult with women on design, use and deployment of technologies that support women's needs in all tasks they undertake.
c) Undertake gendered situational analysis/assessment and gender analysis of programming and implementation for all science, technology and innovation (STI)-related actions, policies and programmes.
d) Review and assess existing technologies, practices and models for lessons learned and replication or scaling up to the national level.
e) Include monitoring and evaluation of implementation in all programmes, including collection of sex-disaggregated data.
f) Collect and assess existing practices to identify lessons learnt and models for replication and scaling up.
g) Ensure women's and men's participation in all decision-making bodies as well as in the design, planning and implementation of STI programmes and policy.
h) Harness women's knowledge networks and information channels to disseminate technologies.

Supporting women's productive and other activities

55. In many parts of the world there is a distinction made between men's crops and women's crops. Men tend to cultivate cash crops, while women grow crops used for subsistence and family needs. This division of labour, combined with women's involvement in food preparation and distribution, makes women key actors in the achievement of food security. However, agricultural productivity tends to be lower on women-owned plots. Women have limited access to a wide range of agricultural assets, including land, agricultural inputs, technological resources (fertilizer, improved seed, clean water, insecticides, mechanical power), and when they do have access, they often lack decision-making power or capacity to mobilize these agricultural assets.

56. Agricultural technologies have tended to be focused on practices undertaken by men, including large-scale enterprises, while women's agricultural technology needs have been overlooked. Tools for agricultural production often do not suit women's physiology in terms of height and strength, or are not appropriate to women's tasks. This requires the development of cost-effective/affordable labour-saving technologies as well as technologies which can reduce the burden of use.[10] This is all the more urgent in the context of HIV and AIDS, which increases demands on women.

57. Access to basic infrastructure, technology and services is also a gender issue in view of women's household and subsistence management activities. For instance, women are disproportionately affected by indoor air pollution, caused by cooking meals in unventilated spaces on fires fuelled by wood, dung and other biomass.

[10] Carr, M. and M. Hartl (2010). *Lightening the Load: Labour Saving Technologies and Practices for Rural Women.* Rugby, UK: International Fund for Agricultural Development and Practical Action.

58. ICTs constitute another important tool that can help women in many aspects of their lives, by supporting economic empowerment, livelihoods, and access to education. Community ICT centres, for instance, can be an effective vehicle to help women acquire literacy and numeracy skills, learn about reproductive health and financial issues, and become socially and politically active. ICTs can also improve governance and access to government services, disseminate traditional knowledge, and improve and update traditional products and skills.

59. To ensure that ICTs fulfil their potential, however, access strategies must be implemented in ways that are appropriate to local situations and socioeconomic status. Barriers to women's access to ICTs include the opening times of community centres, restrictions on women's travel outside home and interaction with strangers, the cost of access and training, and negative stereotypes on women's ability to use technologies. In addition, women have lower literacy rates, and in the case of minority and indigenous groups, are more likely than men to only be proficient in local languages.

Recommendations

60. The Expert Group urges stakeholders to:

Labour-saving technologies and infrastructure

a) Promote the development and adaptation of labour-saving technologies and practices to reduce the workload of women at home and in their productive activities, including:
   - Improved shelter and housing design;
   - Improved access to sanitation and waste management and safe drinking water;
   - Improved clean energy access, including renewable energies;
   - Improved clean cooking technologies;
   - Improved food processing, preservation and storage technologies.

As part of the National Biogas Program in Rwanda, Heifer International provided farmers with cows, which provide milk, an important source of protein and income, but also manure, a source of fertilizer for crops and of biogas for cooking. The Government subsidized biogas collection tanks, which provide methane from decomposing manure, for cooking. The fuel is cleaner burning, eliminating the smoke that comes from other sources of fuel, and women and girls are no longer required to collect or buy firewood, saving both time and money and protecting the environment. Other partners include the Ministries of Finance and of Infrastructure, as well as Rabobank, SNV and GTZ, which provided micro-credit to farmers wishing to invest in a biogas digester.[11]

b) Explore public-private partnerships with various private sector actors, from SMEs to multinational corporations, to provide and improve infrastructure and technology.

[11] Devries, J. and D. Nierenberg (2010). For Poor Households in Rwanda, One Cow Makes a Difference. *The Huffington Post*, 24 March; and http://www.fmo.nl/smartsite.dws?ch=DEF&id=1733

c) Implement multi-stakeholder partnerships to make technologies widely available.
d) Work with local people, including women, to identify technology needs, and identify and use local resources.
e) Incorporate local and traditional knowledge in the choice and development of technologies.

Agriculture and food security

f) Ensure that international research institutions such as the Consultative Group on International Agricultural Research (CGIAR), national agricultural research systems, universities, NGOs, government agencies and the private sector enhance partnerships and collaborations with the purpose of integrating gender perspectives and the inputs of women producers into research and development.
g) Ensure that relevant Government departments collaborate to exchange resources and knowledge as well as training on gender dimensions of agriculture.
h) Undertake gender budgeting and gender audits of agricultural spending, and collect sex-disaggregated data on access to agricultural extension services.
i) Take measures to ensure gender balance in agricultural decision-making structures and institutions.
j) Increase the number of female agricultural extension officers.
k) Take into account the differential needs of women in the selection of varieties, crops and processing (taste, packaging, bio-fortification, nutrient-rich vegetables, and processing techniques).
l) Provide greater support to kitchen, backyard and urban garden cultivation and production, including through access to common land, and undertake more research on local indigenous vegetable varieties, as a means of improving women's production systems, diet, as well as biodiversity.
m) Work with leaders at the community level to illustrate how increasing the value of women's agriculture-based economic activity is of benefit to everyone, and bring women into community decision-making.
n) Ensure that science fairs highlight agricultural techniques and technology for the general public.

ICTs

o) Collect sex-disaggregated data on access to ICTs at the community and household levels.
p) Undertake market and regulatory reforms to promote widespread use and affordability of ICTs, and use universal service funds12 to extend networks to under-served areas, in particular rural areas, including through community ICT centres.

[12] Universal service funds subsidize the provision of ICT services to high-cost areas, for instance remote areas. Such funds may be financed by a national service charge on some telecommunication services.

The Rwanda Vision for 2020 is intended to move the country from an agriculture-based economy to a knowledge-based economy in 20 years. As a result, gender issues are integrated into ICT access, training and implementation strategies. The goal to provide wider access and connectivity to all is intended to be achieved through a mix of access strategies:
- Information Access Points or kiosks,
- Multipurpose Community Telecenters
- Encouraging the spread of ICT to homes,
- Encouraging rural areas to use ICT through the promotion of its benefits via various media: radio, TV and press.[13]

q) Consult with women and women's groups on ICT implementation and distribution strategies, and locate ICTs in or within reach of women's multiple social and communication networks, including women's organizations, schools, libraries, post offices, government offices, and health clinics.
r) Promote women's and girls' use of ICTs, and in particular of social networking tools and applications, as a tool to access and share information, including in the context of emergency situations.
s) Support accessible and assistive technologies for persons with disabilities.
t) Ensure that women have access to government services and information, including government-issued licences, certificates and permits, through web portals, mobile services, and mixed technologies.
u) Train women in using and maintaining ICTs, as well as developing content, applications and software, including free and open source software.
v) Promote the development of content that speaks to women's interests, responsibilities and activities, and ensure its accessibility, including through the use of local languages and audio-visual materials.

Supporting enterprise development, innovation and market access

61. Women's participation in entrepreneurship and innovation is key to job-creation, wealth-generation and national economic growth. The participation of women in the establishment, management and leadership of medium and large-scale enterprises, including technology-related companies, is an important factor for national innovation.

62. Technology relates to entrepreneurship in two main ways. Enterprises may offer products or services directly related to technologies, such as improved pumps, or in the ICT sector, data processing, telephone access, and cyber cafes. Technology can also support enterprises through improved production, processing, or communication processes. For example, ICT can make business activities more efficient by enabling producers to track weather patterns, access financing, or acquire new skills.

[13] Bayingana, M. (2007). Gender & Poverty Reduction: Policy Action Items of the Rwanda ICT Policy-NICI 2010. Presentation at ICTs, Gender and e-Government Workshop, Maputo, Mozambique, 28-30 May.

63. Overall, women's enterprises tend not to use technology to the same extent as men's enterprises, due to lower educational level, less resource support and less comfort with technology, among others. In addition, in many countries, men tend to use mobile technologies that are more sophisticated, and to use them in a more sophisticated manner.[14]

Launched as a tripartite initiative of the Department of Biotechnology, the Tamil Nadu state government, and the M. S. Swaminathan Research Foundation the Golden Jubilee Biotech Park for Women in India aims to improve opportunities for women scientists, but also to use science to improve women's lives, by supporting women biotechnology entrepreneurs in developing and marketing products. The governing body of the Park also has members from research and development institutions, financial institutions, and women entrepreneurs. The Park offers long- and short-term leases, land modules for building factories, project assessment and support, project identification and technology sourcing, consultancy advice, market linkages and training.[15]

64. Enterprises function within a larger value chain. The value chain describes the full range of activities that firms and workers do to bring a product from its conception to its end use and beyond, including design, production, marketing, distribution and support to the final consumer. Global value chains analysis differentiates between producer-driven chains in which large, usually transnational manufacturers play the central role in coordinating production networks, and buyer-driven chains, in which large retailers, marketers and manufacturers set up decentralized production networks in a variety of exporting countries, typically located in the South. The latter present an opportunity for small-scale women producers and cooperatives to produce specialized crops and products for international export, relying on labour-intensive technologies.

65. Gendered patterns of behaviour can be found along global value chains, from production to processing. A gender approach to value chain analysis and programme design can provide an understanding of men's and women's access to productive resources and opportunities to add value, both as individual and group enterprises; and of how the interaction between gender and power relations, regulations, and trade impacts the distribution of value along the value chain.

66. In addition, it is important to factor in intellectual property issues. Women traditionally hold much local and indigenous knowledge, but may not own it or derive financial benefits from it. In particular, local women are likely to lack knowledge of the patenting process and resources to support a patent application.

Recommendations

[14] Huyer, S. (2008). Gender and the Core ICT Indicators. Presentation at the Global Event on Measuring the Information Society, Geneva, Partnership on Measuring the Global Information Society, 27-29 May.
[15] Nair, S. (2009). Glad Tidings! *Biotech News.* Vol. IV, No. 5, October.

67. The Expert Group urges stakeholders to:

a) Support the development of small-scale innovation systems by:
   i) Undertaking a mapping analysis of the gender dimensions of value chains and innovation systems to assess the location, participation and benefits of women and men and the role of technology in the system, as well as their access to reliable information on resources, export laws and regulations, cross-border transactions, supply and production networks;
   ii) Training women in entrepreneurship;
   iii) Continuing to analyze shifts in power relations, and access to benefits and resources between women and men as these systems develop or continue.
b) Test and investigate appropriate structures, funding, regulation and training to support small, micro and medium business development based on S&T knowledge, technology and innovation systems.
c) Sponsor inter-departmental collaborative technology-based incubators for women's enterprises including ministries of women/gender equality, industry, S&T, trade, economics, labour.
d) Promote women's access to services such as marketing, credit, business advice and day care, in order to support innovation systems and women's enterprises.
e) Create an enabling policy environment, for instance by ensuring that tax or trade policies support the development of women's enterprises.
f) Ensure women's access to credit and financial services at all levels, from micro-credit to venture capital, to support the expansion of women's enterprises, including by:
   i) Addressing the specific constraints faced by women in accessing financial services;
   ii) Instituting women's banks or women's funds;
   iii) Mobilizing electronic and mobile-based banking services.

M-PESA is a mobile phone-based money transfer service in Kenya, which allows users to complete basic banking transactions without visiting a bank branch. It is used for transfers to business associates and family, as well as for international remittances.

g) Ensure that scientists and technologists work collaboratively with women's groups and entrepreneurs to develop products and increase process efficiency.
h) Encourage ICT-based strategies to support market access and enterprise development, including by:
   i) Promoting development of appropriate software and mobile applications, including free and open source software, to support SMEs;
   ii) Providing vocational training, credit and other forms of business support for women to run ICT-based service enterprises;
   iii) Ensuring structures are in place for training and technical support.

When women of the Songtaaba Association, an organization that markets shea butter skin care products in Burkina Faso, started using ICTs, their profits more than doubled. The Association set up telecentres in two villages that are entirely managed by the rural women trained by the Association. Within two years of having set up a website, profits increased by 70 per cent.[16]

i) Ensure that women's groups and standardization and certification bodies (e.g. ISO, CODEX and national regulatory bodies) collaborate to increase certification and improve quality control, for instance on plant health, organic food, and biodiversity, thereby expanding market opportunities for women's enterprises.
j) Promote women's inventions and protect women's intellectual property.
k) Research and address the implications of trade regimes for intellectual property rights (IPRs) of local and indigenous common-property knowledge.

The San people in Southern Africa receive a share of profits from the drug extracted from hoodia cactus which suppresses hunger and which they have been eating for thousands of years.[17] In India, the government and textile producer associations are working with weaver and textile groups to obtain geographical indication status[18] on their textile designs and products. The Khambhat Weavers' Association, the Ahmedabad Textile Industry's Research Association (ATIRA), the Indian Merchants Chamber (IMC), Mumbai, and the United Nations Conference on Trade and Development (UNCTAD) India, are working with weavers to patent the Panetar sari.[19]

C. Gender analysis and innovations in science, knowledge, and technology design

68. Science and technology research, results, epistemologies, products, and processes are commonly viewed as value neutral. S&T, however, is influenced at least in part by cultural, economic and social factors, and as a result, can be affected by conscious and unconscious gender bias.

69. Gender bias limits excellence in S&T, and therefore reduces the benefits that research and development brings to society. For example, in medical research, data arising from studies conducted mainly on males are often extrapolated to both sexes, despite the biological and social differences between women and men.

[16] Melhem, S. and N. Tandon (2009). Information and Communication Technologies for Women's Socio-economic Empowerment. *World Bank Group Working Paper Series*, 30 June.
[17] World Health Organization (2003). Hunter-Gatherers Win Profit-Sharing Deal for Obesity Drug. *Bulletin of the World Health Organization*, Vol. 81, No. 5, 313-386. http://www.who.int/bulletin/volumes/81/5/News0503.pdf
[18] According to the World Intellectual Property Organization, "a geographical indication (GI) is a sign used on goods that have a specific geographical origin and possess qualities, reputation or characteristics that are essentially attributable to that origin. GIs are protected in accordance with international treaties and national laws under a wide range of concepts." See http://www.wipo.int/geo_indications/en/.
[19] Halliday, A. (2010). UN Body Shows a Global Dream to Weavers. *India Express.com*, July 9. http://www.indianexpress.com/news/un-body-shows-a-global-dream-to-weavers/644150/.

When drugs are not tested on females, the cost to human life and to business is high. Between 1997 and 2000, ten drugs were withdrawn from the market in the United States because of life-threatening health effects – four of these showed greater severity in women.[20] Preclinical research where testing was done primarily on male animals has been evoked as an explanation.[21]

70. This example highlights the importance of integrating gender analysis into S&T research and design. First, including a gender perspective in S&T development stimulates creativity, enhances scientific knowledge production as well as technological and business innovations, and leads to greater social applicability.[22] Secondly, ignoring a gender framework wastes resources and affects profits. In industrialized countries, women's purchasing power has risen dramatically in recent decades, but products do not necessarily take women's needs or preferences into account.[23] This makes gender-sensitive innovation and a focus on female preferences for technology products an attractive but overlooked business case for many industries.

71. Thirdly, the use of gender analysis also touches on women's right to health and well-being, which Governments have an obligation to protect and promote. In some sectors, failing to perform gender analysis has serious – and possibly fatal – consequences for women. For example, women are often left out of basic engineering design. Automobile crash test protocols, for example, define short people (mainly women, but many men as well) as 'out-of-position' drivers because they sit too close to the steering wheel. Not all tests adequately take into account 'out-of-position' drivers, and this group is more likely to be injured in accidents.[24] Medical research provides another illustration: as a result of gender bias, adverse drug reactions occur more frequently in women than in men. For example, over-the-counter antihistamines, initially tested in men, can lead to potentially fatal heart arrhythmia in women.[25]

72. It is important to highlight how gender analysis also benefits men. Osteoporosis is a disease traditionally seen as affecting post-menopausal women, and men have historically been excluded from osteoporosis research. Examining sex in diagnostic reference models in osteoporosis research has turned attention to understanding the disease in men. As a result, diagnostic criteria are beginning to include men.

[20] United States General Accounting Office (2001). Drug Safety: Most Drugs Withdrawn in Recent Years Had Greater Health Risks for Women. Washington, DC: US Government Publishing Office.
[21] Wald, C. and C. Wu (2010). Of Mice and Women: The Bias in Animal Models. *Science*, 327, 1571-1572.
[22] Schiebinger, L. (2008). *Gendered Innovations in Science and Engineering.* Stanford, CA: Stanford University Press.
[23] Schroeder, K. (2010). Gender Dimensions of Product Design (EGM/ST/2010/EP.13).
[24] Hallman, J., N. Yoganandan, and F. Pintar (2008). Torso Side Airbag Out-Of-Position Evaluation Using Stationary and Dynamic Occupants. *Biomedical Sciences Instrumentation, 44,* 123-128.
[25] Kaiser, J. (2005). Gender in the Pharmacy: Does it Matter?, *Science,* 308, 1572.

73. The issue of gender biases in knowledge production and product design is linked to that of women's participation in S&T employment and in production processes. Including women as researchers and innovators represents more than a gain in talent and skilled labour: it also leads to the inclusion of the specific types of knowledge women develop and maintain as a consequence of gender roles.

74. Rural and indigenous women are responsible for food production and medical care in much of the developing world, and possess unique intellectual resources (such as knowledge about the medicinal properties of plants and about preserving biodiversity) as well as material resources (such as seeds for drought-resistant crops).[26] Women's ethnobotanical knowledge can help local communities secure foods and medicines, prevent deforestation, and better adapt to climate change.[27]

75. In developed countries, the exclusion of women from the design and development of new information technologies (IT) has produced artificial intelligence (AI) with limited capacity. AI has traditionally been modelled on rational-cognitive processes associated with males. More gender sensitive technologies need to be developed such as sociable robots with Ambient Intelligence (AmI) that incorporates 'social' and 'emotional' learning.[28]

76. Women's needs and preferences are not necessarily taken into account in research and development, which traditionally has been mainly carried out by men (see also previous section). This can be attributed to a number of factors, including the lack of gender balance in product design teams and the lack of consideration of gender differences in determining end-user preferences. Efforts to cater to female clientele often focus on superficial adjustments to the exterior design of products, a practice referred to as 'pinking'. The design research project 'Female Interaction', sponsored by the Danish Government, focuses on understanding the needs and preferences of female users and establishing guidelines to develop gender-responsive products. By means of operational guidelines for gender-sensitive innovation, the technology industry can contribute largely to empowering women by developing technology that responds to their everyday needs and preferences.

77. Some institutions have begun to recognize the importance of gender analysis. The European Union's Directorate-General for Research, in its sixth framework programme for research, advised scientists to address, in their research design, whether and in what sense sex and gender are relevant to the objectives and the

[26] World Intellectual Property Organization (2006). WIPO Addresses Indigenous Issues at UN Forum. *WIPO Magazine, August (4)*, 19.
[27] Suminguit, V. (2005). Indigenous Knowledge Systems and Intellectual Property Rights: An Enabling Tool for Development with Identity. Paper prepared for the Workshop on Traditional Knowledge, the United Nations and Indigenous Peoples, Panama City.
[28] Breazeal, C. (2002). *Designing Sociable Robots*. Cambridge: Massachusetts Institute of Technology Press.

methodology of the project.[29] Likewise, a number of scientific journals, for example the *Journal of the American College of Cardiology* and the American Heart Association journal *Circulation*, require the use of gender methodology when selecting papers for publication. *Nature* is considering adopting this policy.

78. Such initiatives, however, have had limited success because few stakeholders – including policy makers, business executives, designers of technologies, researchers and academic administrators – are proficient in gender analysis. Incentives to use gender analysis in research and product design, and to monitor and evaluate performance in doing so, are often missing. In addition, methodologies may be poorly applied. It is not enough to 'add in' a gender component at a later stage of a project. Research must consider how sex and gender factor in from the beginning, that is, from the proposal concept to the final reports, publications, and any other outputs including patents.

79. Another difficulty is the need for methods of gender analysis to be both globally agreed upon and locally customizable: these methods must work across the modern sciences, ethnosciences, and indigenous knowledge systems. This would allow researchers and engineers to systematically analyze problems and to better seek innovative solutions that take the full complexity of factors into account.

Recommendations

80. The Expert Group urges stakeholders to:

Gender analysis and methodologies

a) Undertake a systematic review of existing methods of gender analysis for S&T.
b) Compile and extend these methods and concepts to all sciences, medicine, engineering and technology. When developing methods, it is important to:
   i) Draw methods from all regions;
   ii) Draw methods from across disciplines;
   iii) Analyze differences and similarities across and between women and men;
   iv) Analyze other factors that interact with sex and gender, such as age, ethnicity, cultural factors;
   v) Analyze sex and gender in research subjects at all levels, for example in the life sciences from the single cell to animal models to human subjects and processes;
   vi) Include users' perspectives, for instance by means of user-driven participatory design methods.

[29] European Commission (2003). *Vademecum: Gender Mainstreaming in the 6th Framework Programme– Reference Guide for Scientific Officers/Project Officers.* Brussels: Directorate-General for Research; European Commission (2001). *Gender in Research: Quality of Life and Management of Living Resources.* Brussels: Directorate-General for Research; European Commission for Community Research (2004). *Gender and Excellence in the Making.* Brussels: Directorate-General for Research.

c) Develop instruments to mainstream the use of gender analysis, such as guidelines and checklists for practitioners.
d) Develop gender analysis in research and design throughout the lifecycle of the project from setting research priorities, to choosing a specific subject for research, to planning the research process, to collecting and analyzing data.
e) Ensure that research priorities, goals, and outcomes meet girls' and boys', women's and men's specific needs, as identified by gender analysis, including through questions such as:
   - How are priorities set in the context of limited resources?
   - Do women and men from different socioeconomic backgrounds and cultures benefit from a particular project?
f) Establish multi-disciplinary research and design centres and networks to develop gender analysis and methods.

Capacity development and training

g) Disseminate research findings based on gender analysis to practitioners by producing guidelines and case studies applicable to their work.
h) Train the current generation of researchers in gender concepts and methodology and require such training for personnel in research, programme and project planning, business management, implementation, monitoring, evaluation, and innovation, including through:
   i) Trainer programmes, where opinion leaders among scientists and engineers learn gender analysis methods and train their peers and the scientific community;
   ii) On-the-job training for junior and senior scientists and engineers, staff, administrators, and technicians.
i) Train the next generation—boys and girls, men and women—by mainstreaming gender issues and methods of gender analysis into curricula at the primary, secondary, and tertiary levels, including in core science, medicine, and engineering courses.
j) Develop national education policies to incorporate gender methods, concepts, and issues into curricula at all levels.
k) Integrate gender analysis, results and concepts into textbooks, training materials, interactive programmes, etc.

Funding and partnership

l) Identify S&T leaders in academia, private sector, government, international, and non-governmental organizations to support mainstreaming gender analysis into institutions and knowledge production.
m) Convene and fund an international expert group for gender, science, technology and innovation, consisting of gender experts working in national, international, governmental and non-governmental organizations, professional societies, and the private sector, to develop innovative methods, terms, and concepts for doing gender analysis in research, technology, and design for scientists, engineers, policy makers, and teachers.

n) Link funding to the formation of gender-balanced research and development teams that conduct gender-responsive research, through a variety of incentives to achieve high quality research, products, services and processes, including through:
   i) Encouraging granting agencies to require applicants to include gender analysis in research design and methodology from the ideation to the final product;
   ii) Using gender analysis in the funding and reviewers committees to ensure that the selected projects consider specific different priorities, needs, interests and resources for both men and women.

Assessment

o) Implement, revise, and develop monitoring and evaluation instruments and tools to ensure that gender analysis is carried out, starting from the ideation, to the plan, the budgets, and the outcomes.
p) Set up standards and metrics for evaluating and benchmarking the extent to which gender analysis is integrated into research, technology and design, including through harmonizing methodologies, review processes, recommendations, guidelines, procedures, and standardizing comparable data across countries and disciplines.
q) Develop mechanisms to ensure the immediate transfer of research findings equitably to both men and women end-users; this is also useful for teaching purposes.
r) Ensure that regulatory agencies, such as the Federal Drug Administration in the United States of America and the European Medicines Agency in the European Union, adopt and promote the use of gender analysis.

Motivation and change management

s) Promote access of women and men, both inside and outside the research establishment, to research findings and guidelines on gender analysis and innovation, including by:
   i) Collecting and communicating guidelines, tutorials, check-lists and best practice cases for gender-responsive innovation, as well as highlighting the negative consequences of disregarding factors related to sex and gender, particularly in the field of health;
   ii) Encouraging editors of peer-reviewed journals to require sophisticated use of gender analysis in methodology when selecting papers for publication;
   iii) Identifying S&T leaders in academia, governments, private sector, international and non-governmental organizations to support the mainstreaming of gender analysis into institutions and knowledge production;
   iv) Appointing acknowledged gender-sensitive ambassadors of both sexes in different regions and fields, to serve as role models and demonstrate and communicate the positive effects of gender-responsive innovation, not only on projects but on entire organizations, basing their communication on sex-disaggregated data;

v) Publicizing best practice examples and recognizing excellence in gender-responsive innovations through regular awards.

Raising public awareness

t) Demonstrate to the public the impact of gender bias in science, medicine, technology, technical products, services, processes, and organizational systems.

u) Demonstrate to the public the potential benefits of employing methods of gender analysis for excellence in science and technology design.

v) Popularize the results of gender analysis among the general population, including parents, educators (at all levels including vocational trainers), journalists, and the mass media.

ANNEX I

List of Participants

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ANNEX II

List of Documents

BACKGROUND PAPERS

EGM/ST/2010/BP.1 *Gender, science and technology*
Londa Schiebinger (Consultant)

EGM/ST/2010/BP.2 *Women's and girls' access to and participation in science and technology*
UNESCO

EXPERT PAPERS

EGM/ST/2010/EP.1 *Women, development, and the knowledge society*
Judith Zubieta (Mexico)

EGM/ST/2010/EP.2 *Gender dimensions of science and technology: African women in agriculture*
Judi Wakhungu (Kenya)

EGM/ST/2010/EP.3 *Gender dimensions of science and technology in agriculture and climate change: A case study*
Mereseini Seniloli (Fiji)

EGM/ST/2010/EP.4 *Advancement of women in rural India*
Viswanath Venkatesh (India)

EGM/ST/2010/EP.5 *Gender, science anxiety, and science attitudes: A multinational perspective*
Jeffry Mallow (United States of America)

EGM/ST/2010/EP.6 *Effective policies for supporting education and employment of women in science and technology*
Kong-Ju-Bock Lee (Republic of Korea)

EGM/ST/2010/EP.7 *Science, technology and innovation policies and funding*
Sophia Huyer (Canada)

EGM/ST/2010/EP.8 *Increasing women's participation in science, mathematics and technology education and employment in Africa*
Verdiana Grace Masanja (United Republic of Tanzania)

EGM/ST/2010/EP.9 *Women's and girls' participation in science and technology in North Africa*

Monia Cheikh (Tunisia)

EGM/ST/2010/EP.11[30] *What has worked in Europe to increase women's participation in science and technology*
Nikolina Sretenova (Bulgaria)

EGM/ST/2010/EP.12 *Sex and gender analysis in medical and pharmacological research*
Flavia Franconi (Italy)

EGM/ST/2010/EP.13 *Gender dimensions of product design*
Klaus Schroeder (Germany/Denmark)

OBSERVER PAPERS

EGM/ST/2010/OP.1 International Labour Office (ILO)

EGM/ST/2010/OP.2 French Association of Women Engineers (Femmes Ingénieurs)

EGM/ST/2010/OP.3 American Association of University Women (AAUW)

EGM/ST/2010/OP.4 Organization for Women in Science for the Developing World (OWSDW)

INFORMATIONAL DOCUMENTS

EGM/ST/2010/INF.1 Aide-mémoire

EGM/ST/2010/INF.2 Information note for participants

EGM/ST/2010/INF.3 Programme of work

EGM/ST/2010/INF.4 List of participants

EGM/ST/2010/INF.5 Experts' biographies

EGM/ST/2010/INF.6 List of documents

EGM/ST/2010/INF.7 Procedures

[30] As one expert had to cancel, there is no EGM/ST/2010/EP.10.

ANNEX III

Programme of Work

Tuesday, 28 September 2010

8.30 a.m.	Registration of experts starts
9.00 a.m.	Briefing of experts (election of officers) - *closed meeting*
9.30 a.m.	Registration of observers starts

Plenary session

10.00 a.m.	Welcome address and opening of meeting
	S. Gülser Corat, Director, Division for Gender Equality, Office of the Director-General, UNESCO
	Sylvia Hordosch, Acting Chief, Gender Analysis Section, United Nations Division for the Advancement of Women (now part of UN Women)
10.20 a.m.	Introduction of experts, review of programme of work, and information on working methods
10.40 a.m.	Presentation of background paper and discussion
	Londa Schiebinger: *Gender, science and technology* [EGM/ST/2010/BP.1]
11.30 a.m.	Break
11.50 a.m.	Presentation of UNESCO paper and discussion
	S. Gülser Corat: *Women's and girls' access to and participation in science and technology* [EGM/ST/2010/BP.2]
12.30 p.m.	Lunch break
1.45 p.m.	Presentations by experts and discussion **Theme 1: Use of science and technology for development**

Judith Zubieta (Mexico): *Women, development, and the knowledge society*
[EGM/ST/2010/EP.1]

Judi Wakhungu (Kenya): *Gender dimensions of science and technology: African women in agriculture*
[EGM/ST/2010/EP.2]

Mereseini Seniloli (Fiji): *Gender dimensions of science and technology in agriculture and climate change: A case study*
[EGM/ST/2010/EP.3]

Viswanath Venkatesh (India): *Advancement of women in rural India*
[EGM/ST/2010/EP.4]

3.45 p.m. Break

4.00 p.m. Presentations by experts and discussion
Theme 2: Women's participation in science and technology education and employment

Jeffry Mallow (United States of America): *Gender, science anxiety, and science attitudes: A multinational perspective*
[EGM/ST/2010/EP.5]

Kong-Ju-Bock Lee (Republic of Korea): *Effective policies for supporting education and employment of women in science and technology*
[EGM/ST/2010/EP.6]

Sophia Huyer (Canada): *Science, technology and innovation policies and funding*
[EGM/ST/2010/EP.7]

5.30 p.m. Closing of meeting – day 1
Reception by the UNESCO Division for Gender Equality

Wednesday, 29 September 2010

Plenary session and working groups

9.00 a.m. Summary of day 1 by Rapporteur

	Introduction to work by Chair
9.30 a.m.	Presentation by experts and discussion **Theme 3: Regional perspectives on women's participation in science and technology education and employment** **Verdiana Grace Masanja** (United Republic of Tanzania)**:** *Increasing women's participation in science, mathematics and technology education and employment in Africa* [EGM/ST/2010/EP.8] **Monia Cheikh** (Tunisia)**:** *Women's and girls' participation in science and technology in North Africa* [EGM/ST/2010/EP.9] **Nikolina Sretenova** (Bulgaria)**:** *What has worked in Europe to increase women's participation in science and technology* [EGM/ST/2010/EP.11]
11.00 a.m.	Break
11.15 a.m.	Presentation by experts and discussion **Theme 4: Gender biases in scientific research and technology design** **Flavia Franconi** (Italy)**:** *Sex and gender analysis in medical and pharmacological research* [EGM/ST/2010/EP.12] **Klaus Schroeder** (Germany/Denmark)**:** *Gender dimensions of product design* [EGM/ST/2010/EP.13]
12.45 p.m.	Lunch break
2.00 p.m.	Introduction to working groups by Chair Working groups
4.00 p.m.	Break
4.15 p.m.	Working groups (cont'd)
5.30 p.m.	Closing of meeting – day 2

Thursday, 30 September 2010

Working groups

9.00 a.m.	Summary of day 2 by Rapporteur
9.30 a.m.	Working groups (cont'd)
11.00 a.m.	Break
11.15 a.m.	Working groups (cont'd)
12.45 p.m.	Lunch break
2.00 p.m.	Working groups (cont'd)
4.00 p.m.	Break

Plenary session

4.15 p.m.	Report back on discussions of the working groups
5.30 p.m.	Closing of meeting – day 3

Friday, 1 October 2010

Plenary session

9.00 a.m.	Presentations by working groups
	Discussion of findings and recommendations from working groups
11.00 a.m.	Break
11.15 a.m.	Discussion of findings and recommendations from working groups (cont'd)
12.45 p.m.	Lunch break
2.00 p.m.	Consolidation of findings and recommendations
4.00 p.m.	Break

4.15 p.m.	Adoption of findings and recommendations
4.45 p.m.	Closing remarks