The Gender Working Group Transformative Action Areas: Then and Now

Prepared for the GAB International Conference

Gender, Science and Technology for Sustainable Development: Looking Ahead to the Next 10 Years

Sophia Huyer
Senior Research Advisor, Gender Advisory Board, UNCSTD
shuyer@wigsat.org

In 1993 and in anticipation of the 1995 World Conference on Women to be held in Beijing, the UN Commission on Science and Technology for Development (UNCSTD) sought to affect the inclusion of S&T into consideration of issues that would come before the UN in 1995. There were two major initiatives on the horizon: the Social Summit and the Women's World Conference. Work groups were convened to begin to collate the research related to S&T's impact on these topics. Despite the fact that UNCSTD had few women members, the Commission decided to explore how it might make an intellectual contribution to the upcoming Beijing Conference. Collaborating with the Secretariat for the Conference, it met in concert with an expert panel meeting in New York, made up of primarily of women. It was determined that the Commission would have a better chance to develop innovative thinking around these concerns if they drew on the talent of some of the panel participants, and in this way the Gender Working Group (GWG) of UNCSTD was formed. Over the next two years the GWG commissioned studies and met four times to consider the extent of the research base which existed to support the idea of a "gender perspective" in science and technology. This work resulted in a scholarly publication, *Missing Links: Gender Equity in Science and Technology for Development*, and a policy document that proposed so-called "transformative actions" for nations to implement in moving toward a greater role for women in S&T as well as a greater use of S&T to address women's needs. Both the GWG and its successor the Gender Advisory Board (GAB), which was established to implement and monitor the transformative action recommendations, were supported by the Ministry of Foreign Affairs of the Netherlands. The Carnegie Corporation of New York also contributed to the work of the Gender Working Group (Malcom, 2005).

Transformative Action Areas

In 1995 the Gender Advisory Board articulated a set of transformative actions as a result of a deliberate desire to develop recommendations that were forward looking, that were long term rather than immediate, and that were what one scholar has referred to as "glocal" – global issues viewed through a local lens, with implications for local practice.

The Transformative Action Areas are:
1. Gender equity in science and technology education
2. Removing obstacles to women in scientific and technological careers
3. Making science responsive to the needs of society: the gender dimension
4. Making the science and technology decision-making process more "gender aware"
5. Relating better with "local knowledge systems"
6. Addressing ethical issues in science and technology: the gender dimension
7. Improving the collection of gender disaggregated data for policy makers.

For each of the areas, the CSTD Gender Working Group recommended a series of feasible policy actions for national governments and science and technology bodies and agencies. (Malcom, 2005). See Annex One for the full set of recommended actions. (They can also be found at http://gab.wigsat.org/transfom.htm.)

In this paper, the original problem assessment of each Transformative Action Area by the Gender Working Group is compared with the current situation and activities to assess its continuing relevance and identify potential new areas and actions for progress.

1. Gender equity in science and technology education[1]

> Gender Working Group, 1995:
> Fewer girls than boys are given the opportunity to obtain formal education. Of the girls who do gain access to schools, a smaller proportion than boys obtain training in science and technology. This limits girls and women's opportunities to meet their basic needs and improve the quality of their lives and those of their families; gain access to employment; create businesses; and acquire skills for citizenship. It also deprives nations of the contribution of many highly talented citizens. The extra barriers and obstacles confronting girls who seek training in science and technology subjects must be removed.

Access to education has increased in many countries and gender disparities in enrolments are decreasing, in some cases in favour of girls and women. At the primary levels, girls are in the minority overall, but at secondary and tertiary levels enrolments of girls and women are at parity with or greater than that of boys and men. However, in science education disparities in favour of males continue.

We know that a range of barriers continue to limit access to and completion of educational courses for girls and wome. 53% of the 115 million children in the world who do not attend primary school are girls (this is improved from 2/3 a few years ago). Even if girls start school, they are far less likely to complete their education at primary levels, although in many regions completion rates for boys are lower at secondary levels; and girls who miss out on primary education grow up to become the women who make up two-thirds of the world 's 875 million illiterate adults. A six-year-old girl in South Asia is expected to spend six years in school, compared with nine years for a boy. Living in the countryside widens the gap; a girl living in a rural area is three times more likely to drop out of school than a boy in the city. (UNESCO, 2003; 2005).

Factors affecting the lower enrolment of girls include choices to invest in boys' education at the expense of girls who are kept at home to help with domestic chores, and preconceptions that girls do not "need" education as much as boys, since they are often not expected to move into paid employment outside of the home. Early marriage and motherhood is also a factor : in Nepal, 40% of girls are married before age 15. Other issues include lack of acceptable or appropriate sanitation facilities at schools and sexual harassment in schools. Armed conflict is also a factor, as girls are more vulnerable to rape, sexual violence and exploitation than boys. HIV-AIDS is also a factor, as the rate of infection for females in increasing at a greater rate than males in many regions (UNESCO 2003, 2005, 2006).

[1] Parts of Sections 1 and 2 are based on Huyer, 2004.

Reasons for a lack of comfort and/or interest in scientific and technological subjects on the part of girls are varied. Sociocultural attitudes about what is considered appropriate for girls and women are passed on from parents to their daughters.[2] Teacher's attitudes also have been shown to be influential (UNESCO 2003).

According to UNESCO, girls' enrolments have increased faster than boys' from 1990-2000, as overall access to primary education also increased.[3] Latin America and the Caribbean have seen large increases, and are close to achieving universal primary education, with net enrolments of 97%. East Europe also sees high rates of literacy and primary enrolment (UNESCO, 2003). In certain regions, such as Sub-Saharan Africa and parts of South Asia, enrollment rates for girls remain far below those of boys. By 2010, it is expected that 10% of school-age children in Sub-Saharan Africa will be orphaned by HIV/AIDS and other diseases, and armed conflict.

At the secondary level, while admission rates are usually lower for girls, their survival rates are more often equal or higher, and in regions such as Latin America and the Caribbean girls are in the majority at secondary and tertiary levels. This is generally true in all regions except sub-Saharan Africa and Central Asia (UNESCO, 2005).

Two strategies which have proven effective in increasing the enrolment of girls are the elimination of school fees and flexible scheduling of classes which accommodates girl's domestic duties. Increasing a household's wealth index by one unit enhances a boy's chances of attending school by 16%, against 41% for girls (UNESCO, 2003).

At the tertiary level, women have seen continued increasing levels of enrolment to almost 50% globally, with the greatest gains in absolute terms made in developing countries. However, there are wide regional variations in participation: in OECD and Central and Eastern Europe, gross enrolment rates (GERs) at this level stand at 45%, while in the great majority of developing countries, the percentage is under 30%. Of those countries which gather sex-disaggregated data, women make up the majority of students at this level in most European countries, Latin America and the Caribbean, and North America, but are poorly represented in sub-Saharan Africa, with varying rates of enrolment in the Arab States (from 82% to 8%). In several countries in Asia and the Pacific, female enrolment is less than 2/3 of male enrolment (UNESCO, 2003, 2006).

In 1990, the World Declaration on Education for All noted that **quality of education** needed to be improved, and identified quality as a "prerequisite for achieving the fundamental goal of equity. (UNESCO 2005:29)" The Dakar Framework for Action defined quality education to include healthy motivated students, competent teachers, active pedagogies, relevant curricula, and good governance and equitable resource allocation (UNESCO 2005). Improved science teaching methods are attracting both girls and boys into science subjects. It appears that new educational methods are benefiting girls in particular, although they also benefit boys who are not as successful in traditional approaches. (UNESCO, 2003).

When one factors in the representation of women and girls in science and technology-related courses the trends are not as straightforward. Girls at the secondary level tend not to enrol in scientific and technical subjects. For example, in Chile, of those students who enrolled in secondary level technical streams, 82.2% of girls chose a commercial specialisation, while 58.5% of boys (and 13.1% of girls) chose the industrial specialisation. In the US, while gaps between girls and boys in maths and sciences courses seem to be diminishing, more boys continue to take

[2] Studies show that women scientists tend to have fathers/mothers who are scientists in greater proportion than their male colleagues. See Rathgeber, 2002; National Research Council, 2001.

[3] The exceptions are Chad, Benin, Burkina Faso, Guinea-Bissau, Mali, the Niger and Pakistan. Poverty is a major factor in those countries which have with a high level of gender disparity in school enrollments.

advanced courses. They also achieve higher scores in the National Assessment of Education Progress testing (UNESCO, 2003; AAUW, 1998).

Analysis of tertiary-level enrolments in science, engineering and technology subjects sees further evidence of a gender gap. In many regions the participation of women in bio and life sciences has increased and continues to increase. Judith Glover refers to the "feminisation" of the biosciences in Europe, where women make up over 50% (2001), while in the US primatology is dominated by women, who receive over 80% of PhDs awarded in the discipline (Schiebinger, 1999). At the same time, women's level of representation in "harder" sciences such as physics and engineering is persistently low around the world. In OECD countries, women make up 30% of university graduates in maths and computer sciences overall, while in 9 OECD countries women make up only between 9 and 25 percent (EU, 2006).[4] The numbers for computer sciences are especially concerning: in the US and Canada, female participation in the technology sector is declining. In 1985, women received 37% of all U.S. computer science undergraduate degrees, and by 2000 that number had fallen to 28%. At the top US schools, the number is now below 20% ("Technology's Too-Small Sisterhood", 2004).

These numbers are echoed elsewhere, with some variation. Dependable sex-disaggregated data for other countries is available only in certain cases. In Latin America, data for women researchers in S&T ranges from

2. Removing obstacles to women in scientific and technological careers

> In many countries, there are few women in scientific and technological careers. In addition to considerations of equity, no country can afford to lose up to one half of its pool of creative and innovative human resources. The obstacles to greater participation of women in scientific and technical careers need to be addressed and overcome.

This theme is still current with progress in understanding some of the issues and barriers. Terminology has changed slightly – discussions in North America and Europe refer to "workforce" issues – while the science and science policy world are coming to recognize the gender dimensions of building national human resource capcity for national knowledge and innovation systems. The latter was a theme for example in the InterAcademy Council publication, *Inventing a Better Future* (2004).

Increased gender parity in education overall and, to a lesser extent, in science and technology education could be assumed to lead to gender parity in the science, technology, engineering and mathematics workforce. Nevertheless, evidence of the last 10-15 years indicates that increased numbers of girls and women at the lower levels of the system has not translated into increased numbers at the upper end. This rate of low translation of women's scientific training to recruitment indicates that the factors affecting the quality and quantity of women's participation in STEM involve more than appropriate qualifications or waiting for a critical mass of women to work their way through the system. Data and research in both the university setting and industry indicate that, overall: the representation of women decreases as one moves up the ladder in the system; women's rate of temporary and shorter-term work is greater than that of men's; and women are paid significantly less than men (European Union, 2006; National Science Foundation, 2003; Glover, 2001).

[4] However, it should be noted that in the EU, women's participation in engineering and the "hard" sciences is increasing gradually (Gotzfried, 2004).

Available data show that gender ratios in employment in science, technology and engineering vary considerably from country to country and region to region. While in the transition countries percentages of female science researchers tend to range from 30-50%, in Latin America rates range from 50% in Argentina and 42% in Venezuela to between 20-30% in most other countries. The overall average percentage for female representation in science and engineering in the EU countries is 29%, while in Japan, women make up only 11.4% of the scientific workforce (EU 2006; Normile 2006);[5]

Two kinds of gender segregation exist in the scientific workforce: horizontal and vertical. Horizontal segregation constitutes segregation by discipline or sector. In general, most women scientists work in the bio and health sciences, while the "hard" science disciplines such as physics, computing and engineering remain primarily male. In Central and Eastern Europe the presence of women in science in publicly-funded research institutions and universities can be seen as an opening up of spaces vacated by male scientists who shift to better-paying and more prestigious posts in the private sector or abroad. Evidence from other countries supports the contention that in certain situations women enter scientific fields in greater numbers when men do not choose to enter these fields, i.e. for reasons of prestige or remuneration or opportunities in the private sector (Bonder, 2005; Long 2001; NSF, 1996). Assessing whether and to what degree the position of women in the sciences is linked to the prestige and level of resources in science is an area for further research.

Another form of horizontal segregation relates to what Malcom refers to as an "over-response". In the US, formally male fields which have become female-dominated, such as veterinary medicine, have come to be associated with declining salary levels and loss of status and prestige of the profession (Malcom, 2006).

In the UK, the main activity for men with scientific qualifications is management, for women it is teaching and non-professional activities not requiring a university degree[6]. These findings are supported by studies in other countries, for example, Rathgeber found that men are overrepresented in the higher, more senior research and management positions in the CGIAR centres (2002). These findings were corroborated at the WCS Slovenia women's forum in 1998, where concern was expressed about the implications of the situation for decisions made on S&T research and orientation:

> The absence of women scientists in top managerial positions in educational and research institutions and also at ministerial level, excludes female voices in an equal partnership in decisive decisions on the current and future orientation of science and technology ("Women in Science", 1999).

In its survey on research on gender differences in science careers, the National Science Foundation found that

> Taken as a whole, the body of literature we reviewed provides evidence that women in academic careers are disadvantaged compared with men in similar careers. Women faculty earn less, are promoted less frequently to senior academic ranks, and publish less frequently than their male counterparts (National Science Foundation, 2003a:1).

[5]See also UNESCO Institute of Statistics R&D Tables 2006 (retrieved 24 June 2006, from http://www.uis.unesco.org); Latin America Network on Science and Technology Indicators (RICYT), www.ricyt.org.

[6] I.e. as technicians.

These findings are supported by studies in other countries, including India and South Africa. (Department of Science and Technology, South Africa, 2004; Indian National Science Academy, 2004, see also Rathgeber, 2002).

The lower number of women in senior positions can be attributed to a limited extent to the lower age of women in science, but a wider range of factors leading to a glass ceiling also apply, including work-life balance; gendered patterns and approaches to productivity; and performance measurement and promotion criteria. There is also a need to more closely examine the "conventional androcentric assumptions (Harding, 1995)" in S&T culture, its institutions (at international, national and local levels) and among recipients of development or targeted beneficiaries of scientific advances. Current research is beginning to identify unexamined or unacknowledged gendered practices and cultures in S&T in terms of who are the main players, whose priorities are represented, and who benefits.

A comprehensive review of the US situation undertaken by the National Academies of Science on the participation of women in academic science and engineering found:

- Women who are interested in science and engineering careers are lost at every education transition from high school to full professorships
- The problem requires larger action than feeding more females into the "pipeline"
- Women from minority racial and ethinic backgrounds are virtually absent from the leading science and engineering departments in the US
- Women are likely to face discrimination in every field of science and engineering which limit the appointment, retention and advancement of women faculty.
- Evaluation criteria contain arbitrary and subjective components that disadvantage women so that they are paid less, promoted more slowly, receive fewer honors, and hold fewer leadership positions than men, discrepancies which do not appear to be based on productivity, the significance of their work, or any other measure of performance.
- Academic organizational structures and rules contribute significantly to the underuse of women in academic science and engineering (NAS, 2006).

The literature in this area is solid and comprehensive (NSF, 2003). Progress remains slow, although some progress may be made in certain regions and countries as a result of decreases in the scientific workforce in industrialised countries. Several recent influential reports have profiled this issue, which may help to bring it onto the agenda of national governments: the Inter Academy Council has issued two major reports: *Inventing a Better Future* which focused on increasing national scientific human resources; and "Women for Science", a report to science academies which made recommendations on strategies to increase the participation and profile of women in scientific communities. Several national-level reports released recently have also called attention to this issue (Department of Science and Technology, South Africa, 2004; Indian National Science Academy, 2004).

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

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

This Transformative Action Area now tends to be conceptualized in terms of the Millennium Development Goals or poverty reduction, although it is also included in S&T for social development discourse. The Millennium Task Force on Science, Technology and Innovation (STI) for Development argues that STI can contribute to human welfare by promoting economic development through job creation and alleviation of poverty, and contribute to national development through improved agriculture and food security, preventative and curative health measures and improved management of complex ecosystems (Juma and Lee, 2005).

The first issue identified by the Gender Working Group in this section – awareness of scientists of the needs of society – relates to the contributions of women to the formulation of research agendas as well as the implementation of science and technology once developed. This is still in general a missing ingredient in R&D and the setting of the S&T research agenda (Malcom, 2006). More research should be directed towards women's interests, needs and concerns. What technologies do women need to increase the rate and quality of food production? What are the community-based issues which have had insufficient technological attention? How can science and technology improve sanitation and cleanliness and provide affordable energy in ways that empower women and girls? These questions are not enough asked, nor are technologies developed to answer them.

While the need for smaller-scale technologies for women has not disappeared, development assistance has in fact been moving away from what used to be called "appropriate technology" to a focus on "high tech" – biotechnology, computers and internet, etc. For example, in a recent internal survey on S&T funding at a bilateral agency, it was noted by staff that funding for technology development tends to go to the big flashy technologies, disregarding the low and medium technologies needed by women in much of the developing world for their agricultural and productive activities. Work in this area continues to be urgently needed.

The Millennium Task Force Report on STI picks up this theme in the distinction it makes between developing national capacity to develop and adapt new technologies such as biotechnology and ICT, recognizing that for some countries it is more appropriate and more important to adapt and use "mature" technologies to meet the MDGs, promote employment, and address poverty reduction. These include mechanization of small farms, small-scale irrigation and potable water installation, small energy systems, rural roads and transportation, and basic ICTs. Creative approaches are needed to blend new technologies with old technologies, local and traditional knowledge and know-how with science and engineering R&D (Juma and Lee, 2005).

Since 1995, some new trends have emerged or gathered momentum which affect the ability of women to use S&T for social needs and development. HIV/AIDS is causing a dramatic decrease in the life expectancy of both women and men in Sub-Saharan Africa, where the rate of infection for women is now higher than that for men. This is in addition to the double burden women bear as producers of food and caretakers of the sick. They are more at risk of infection for physiological, economic and cultural reasons, while women who experience food insecurity are more likely to die when infected with HIV. The loss of labour force due to HIV/AIDS in Sub-Saharan Africa means that women are more in need than ever of labour-saving technologies and crops which improve production while requiring decreased labour inputs (Kebede and Retta, 2004). Rates of infection are increasing in other regions as well. Globally, there were 2.9 million deaths and 4.3 million new HIV infections in the past year.

Globalisation poses both promise and peril for women. They are employed in greater numbers than men in certain sectors of the IT industry, especially where it is expanding in South and Southeast Asia. Women make up the majority of SME owners in many regions, and globalisation can help them find greater access to markets for their products[7]. New technology fields may be burdened less with stereotypes about what is appropriate work for women, although there is some evidence to suggest that this "window" occurs for only a relatively short time before the participation of women begins to decrease. Studies in Southeast Asia show that many of the jobs emerging for women in this sector in the region are at the lowest levels, with little pay and low skill requirements (Blum et al, 2006; Schinzel, 2002; Bleeker and Jacobs, 2004; Mitter, 2001).

According to the FAO, work on gender dimensions of natural resource management is increasing, at national and international levels. FAO's areas of focus are biodiversity and agrobiodiversity; plant genetic resources management; and livestock management. Natural Resource Management (NRM) is a main thematic area of the CGIAR program on Participatory Research and Gender Analysis (PRGA) PRGA's work. Its research indicates that participatory and gender-sensitive methods are most commonly applied in technology-oriented NRM research relating to management of soils, water, forests, and biodiversity. It notes that in general, participatory research in NRM remains relatively scarce, while a large volume of work is geared towards participatory adaptation and extension of existing technologies to farming communities. A recent 5-year synthesis report (1997-2002) found that farmers are involved in a variety of ways at the later stages of research, but seldom in the actual technology development process, and that farmer-led research is not being effectively mixed with participatory research led by scientists. Even when projects use gender analysis or particpatory research, this does not mean women or the poor are targetted as beneficiaries. Nevertheless, the program notes that the use of participatory research and gender analysis is increasing in agricultural technology and research, although not yet widespread (Saad, 2003).

A related issue which is promoted by the larger women's movement is women's access to land rights and land tenure, although unfortunately we do not yet see a lot of cross-over between the women's movement activities in this area and work in gender and agriculture/natural resources management.

Agriculture and food security is an area where increasing attention is paid to women's contributions. IFAD, FAO, the International Plant Genetic Resources Institute (IPGRI), CGIAR and the International Food Policy Research Institute are some of the main international groups working on this issue.

Other issues in this Area include what is now termed "popularization of science", or the education of citizens to understand scientific concepts and use them in their daily lives and occupations. This is a theme picked up in particular by the Organization of American States (see OAS 2004) but also by the CSTD Working Group on Information, which refers to a knowledge society which reflects the aspirations, interests and perspectives of all members of society. The Millennium Task Force Report on STI refers to the importance of teaching science, technology and innovation literacy in early education both to lay the foundations for a scientific workforce, but also to provide citizens with the skills to understand the science of health and nutrition and lay the basis for an innovative society (Juma and Lee, 2005).

[7]See Carr, 2004.

Since the 1995 sessions, some organizations which have been continuing work in related issues include: ENERGIA, an international network on gender and sustainable energy. Activities include information dissemination through ENERGIA News, as well as research, capacity building, advocacy, and establishing a resource centre. WEDO and SEWA among others work in water and sanitation. WOCAN is an international network of professional women in agriculture and NRM which works to promote organizational change for gender equality and environmentally sustainable development. WIGSAT is returning to one of its original goals, to Promote the development and dissemination of technology (including ICTs) which enable women (especially those living in developing countries) to contribute to and benefit from growth and development in the global knowledge society. This will include a focus on the use of technologies (including but not restricted to ICT) to support women's SMEs and poverty reduction activities. See Annex 1 for more information on groups involved in these areas.

4. Making the science and technology decision-making process more gender aware

> Current structures and processes for decision-making in science and technology for development do not systematically take into account the needs and aspirations of both women and men in a gender-disaggregated manner. Women's needs and interests have been relatively neglected.

There has been some movement on this front, at least at the level of policy formulation at national and international levels[8]. This is due partly because of the leadership role the GAB has taken in this field, but also because the "science and technology" world is beginning to understand the importance of building on the intellectual resource that women represent. To a lesser extent perhaps, there is recognition that social development depends in part on addressing the science and technology issues which arise throughout the course of women's daily lives. Many of the policy developments discussed here are led by or in collaboration with the GAB.

4.1 GAB national and regional level activities

National Committees on Gender, Science and Technology
The role of the National Committee was conceived as convening national stakeholders to bring to the attention of government and civil society the gender dimensions in national S&T policy. Specifically, the National Committee is intended to undertake a national review of gender, science and technology in national policy and research, implement followup activities identified as critical for the country/region, and/or continue to identify means of providing input into important national and regional policy processes.

National Committees are facilitated by Regional Secretariats which support the development of National Committees and national-level activity, linked together in regional networks. The activities involved in this function include national and regional networking, provision of information and materials for national committees, and connections to global networks and policy where useful and necessary.

Identification of a National Focal Point is often the first step towards establishment of a National Committee. National focal points are chosen for their interest and experience in gender, science and technology, as well as their influence and range of contacts in the relevant stakeholder

[8] International policy to be addressed in a presentation by Shirley Malcom.

groups. Ideally the NFP is situated in a government ministry or an influential national or regional agency, with access to resources.

The GAB regional secretariat for Southeast Asia, RESGEST, has seen increasing interest in gender issues related to S&T for national development in the Asia-Pacific region and contacts have been made with several S&T policy bodies in the region.

National Committees in Indonesia and the Philippines have lobbied high-level policy makers for the integration of gender in S&T policies. In Indonesia, the GEST National Committee has committed to continue advocating for gender mainstreaming in all stages of S&T activities and at all S&T institutions under the Ministry of Research and Technology.

Discussions concerning the establishment of GEST national committees were held with other member countries, particularly with the gender machinery in China, Vietnam, Myanmar and Cambodia.

In Africa, the GAB Regional Secretariat continued with the strategy of strengthening partnerships and liaising with governments through national focal points to ensure that enabling policies and frameworks are in place to complete review of national gender, science and technology situations, share these findings with a wider spectrum of stakeholders and develop national as well as sub-regional action plans for implementation. Currently there are eight (8) NFPs/NCs in the region, namely: Egypt, Kenya, Rwanda, Sudan, Swaziland, Tanzania, Tunisia, and Uganda.[9]

The national committees and focal points are located in governmental departments in their countries:

Kenya – National Council for Science and Technology
Rwanda – Kigali Institute of Science and Technology
Tanzania – Tanzania Commission for Science & Technology
Uganda – Dept of Women and Gender Studies, Makerere University
Swaziland – Forum for Africa Women Educationalists (FAWE)
Egypt – National Council for Women
Sudan – UNESCO Chair of Women in Science and Technology
Tunisia –Genius International Consulting.

In Latin America, an Expert Workshop on Gender, Science and Technology was co-organized with the Office of S&T of the Organisation of American States (OAS). It produced a set of policy recommendations on the gender dimensions of national S&T which were presented at the Meeting of First Ministers and High Officials of Science and Technology of the OAS in November 2004 in Lima, Peru.

The "Declaration and Plan of Action of Lima", includes the statement:

> Science, technology, engineering, innovation, and education are fundamental to promote the integral development of the countries of the Americas, which encompasses the economic, social, educational, cultural, scientific, and technological fields, as well as job creation to confront poverty, in the framework of protection of the quality of the environment and **integration of the gender perspective** in policies and to strengthen democracy.

[9] www.gabafrica.org

The Lima Plan also includes a commitment to "Foster the expansion of human, institutional, and infrastructural capacities to undertake scientific and technological research in a framework of environmental protection, gender equity and equality, and openness to the inter-relation between the public and private sectors".

GAB was also represented at the OAS Civil Society Roundtable on Science and Technology, part of the Summit process, in September 2005. GAB worked with the UNESCO Chair on Women in S&T in Latin America to develop gender input for the declaration of the Roundtable, which was presented at the Summit Dialogue with Civil Society held immediately afterward.[10]

Currently, GAB is collaborating with the OAS, the Inter-American Commission on Women and the UNESCO Chair on Women in S&T in Latin America on a followup activity, "Promoting the integration of a gender perspective in science and technology policies and programs in the Americas" with the intent of building on the gender recommendations in the Summit Agenda by contributing to institutional strengthening for gender-sensitive policy and program formulation and implementation in science and technology in the Member States and increase women's participation and contribution to science and technology capacity. Activities include workshops, training and making expert resources available to institutions in Member States.

A new National Committee is in development in Brazil under the leadership of Dr. Alice Abreu, Regional Coordinator for ICSU. A meeting was held on October 31 to launch the Committee and establish its short and long-term objectives. Agencies represented included L'Oreal, UNIFEM Office in Latin America, the Ford Foundation, and the Brazilian Academy of Sciences.

4.2. Other National Government Initiatives

A promising sign is the establishment in several countries of Women in Science bodies by governments independently of any GAB advocacy or seed funding. These include SET4Women in South Africa, the Taskforce on Women in Science in the Indian Department of Science and Technology, and the major EU initiative on Women and Science.

The Women and Science section of the European Commission research theme Science and Society has initiated a number of activities to promote gender equality in science in Europe, one of which is the Helsinki Group. The Group is made up national representatives from all the EU Member States and countries associated to the Framework Programmes. Its goal is to promote the participation and equality of women in the sciences on a Europe-wide basis. It meets twice a year and provides an important forum for dialogue about national policies.

The Helsinki Group helps the Commission build a clear picture of the situation on the ground at the national level, particularly through appointed national statistical correspondents to help the Commission gather and compile sex-disaggregated statistics and build gender-sensitive indicators.[11]

[10] See www.science.oas.org/english/ev_ini_e.htm.

[11] http:// ec.europa.eu/research/science-society/page_en.cfm?id=2906

SET4Women was originally established as the South Africa Research Group on Women in Science (SARG). It is located in the Department of Science and Technology, with the following objectives:

- Assist the National Advisory Council on Innovation (NACI) to promote a research agenda, including influencing funding that will improve QOL of women.
- Assist NACI to promote innovation that will allow women to make a greater contribution to wealth generation in South Africa.
- Provide advice on developing mechanisms that will increase the participation and contribution of women in Science and Technology.
- Highlight role models that promote women's entry and advancement in Science and Technology.
- Monitoring role in tracking institutional impact.[12]

One of its first activities was the collection and analysis of data on participation in S&T in South Africa, disaggregated by sex and race.

In India, the Scientific Advisory Council to the Prime Minister recommended the establishment of a Task Force on Women in Science under the Ministry of Science and Technology to ensure that the interests of women practitioners in science are protected and that appropriate measures are taken to promote women to take up the scientific profession.

The idea of an international campaign to educate and convince policy makers of the importance of the gender dimensions of S&T for development as well as the importance of building on the potential contributions of women in national human resource development has been promoted by the GAB in various ways. The idea of such a campaign is included in the Framework for Action of the 1999 World Conference on Science. This kind of campaign has not been launched yet, although recent reports by the Inter Academy Council (Inventing a Better Future and Women for Science), and an upcoming UNESCO International Report on Gender, Science and Technology are helping to raise the international profile of this issue in the S&T policy world.

5. Relating better with local knowledge systems

> Science and technology has inadequately addressed the potential of local knowledge systems, especially women's knowledge in the design and implementation of development programs. There is a need to develop new methods of interaction between the two systems for their mutual benefit. Local knowledge is frequently not recorded and is in danger of being lost.

The valuing of "indigenous" or "traditional" knowledge in farming and NRM continues to be a recognized issue, although it has not been mainstreamed in agricultural R&D. The gender dimension profile of this issue may have actually decreased since 1995, although some of the major international agencies have initiated programmes.

LinKS, a program of FAO in Mozambique, Tanzania, Zimbabwe and Swaziland, explores the linkages between the crucial issues of local knowledge systems, gender roles and relationships, food provision, and the conservation and management of agrobiodiversity. It does this by

[12] www.sarg.org.za.

strengthening the capacity of institutions in the agricultural sector to apply approaches that recognise men and women farmers' knowledge in their programmes and policies.

IGNARM is a network of organizations based in Denmark addressing the interrelationships beetween indigenous peoples, gender and natural resource management. The purpose is to share, explore and strengthen their experiences and knowledge within the field emerging at the intersection between indigenous peoples, gender and natural resource management.

This area relates to an issue which has emerged more prominently on the international agenda, intellectual property rights. This is currently addressed in the framework of WIPO, WTO, and through biotechnology research and policy. The gender implications of this work is being looked at by very few groups outside of health issues such as AIDS. According to the Bridge Cutting Edge Pack on Gender and Trade, "the gender dimensions of both the health aspect of intellectual property laws as well as the impact on traditional knowledge, food security, sustainable agriculture and transfer of technology are still relatively unexplored." There is work being done at the national level on some of these topics in some regions, for example in the Pacific around biodiversity. The International Environmental Law Research Centre in Nairobi addresses the impact of intellectual property protection and access to biotechnology for small scale farmers with a focus on women's access to and use of resources and new technologies. The African Panel on Biotechnology convened by NEPAD includes as one of its areas of focus the protection of IPR for low-income groups, especially rural farmers, traditional medicine enteprises, rural women and small-scale informal enterprises.

At the international level, the International Gender and Trade Network engages in policy-focused advocacy at regional and international levels, as does WEDO to a certain extent. Some donor agencies, such as the Canadian International Development Agency and the Canadian International Development Research Centre, are developing frameworks to guide their funding in agricultural biotechnology.

The Expert consultations on the Gender Dimensions of Biotechnology R&D[13] convened by the GAB in 2004 identified key areas for research and programming relating to biodiversity and protection of women's IPRs:

1) Biodiversity

- How biotechnology can be used to extract active ingredients in herbs for increased effectiveness, further pharmaceutical uses and testing, and to understand the combinations of herbs and chemicals used. This would also contribute to preservation of these plants and related knowledge systems.
- Increase knowledge of plant properties held by women.Documentation of herbs and their effects or functions.
- Development of seed banks, for herbs as well as crops.
- Strategies for sharing indigenous plant and herbal knowledge (communication and education) between communities to prevent loss of plants and erosion of knowledge.
- Analysis of the gender and socioeconomic implications the National Biodiversity Strategy Action Plans and other related international agreements, national strategies and policies.

[13] http://gstgateway.wigsat.org/TA/ethics/gdrbiotechfinal.pdf

2) Intellectual Property Rights

- Implications of and strategies to allow release of IPRs to poorer countries in the area of health.
- Documentation of local or community IP and investigation of legislative, legal, and ownership strategies to ensure fair recompense to owners and rightful ownership to IPR
- Review of national IP legislation from a gender and socioeconomic perspective
- Research on and comparison of efforts to preserve traditional plant varieties.
- Examine Explore potential for recourse in cases of biopiracy, such as through the CBD.
- Research on protecting women's knowledge base in cultural and social contexts.
- Analysis and comparison of policy to support the ability to use and benefit from patents while at the same time protecting women's ownership.
- Assessment and exploration of strategies to resolve the tension between protection of knowledge and exploitation of knowledge for public good, e.g. libraries, databases

6. Addressing ethical issues in science and technology: the gender dimension

Ethical issues associated with both the conduct of scientific research and the application of the results of research frequently have a gender dimension which has not been sufficiently recognized or addressed.

When initially set out by the GWG, this Area focused on health technologies and their effects on women and called for participatory approaches to definition, articulation and implementation of health systems and strategies.

The GAB expert consultative workshops on the Gender Dimensions of Biotechnology R&D addressed in part the implications of health biotechnologies and the potential for harm to and exploitation of women, including the right to information of women undergoing reproductive procedures, and issues such as trafficking in organs, eggs and DNA.

Members of the GAB network were involved in a project on Globalization, Gender and Health, organized by the Canadian Institute for Health Research (CIHR), The Centre for Research in Women's Health (CRWH), The World Health Organization (WHO), Harvard University, Yale University, the Canadian Coalition for Global Health Research, The Fogarty International Centre and the Office of Research on Women's Health at the National Institute of Health (NIH). Issues addressed included globalization, food security, HIV/AIDS, infectious disease, tobacco use, occupational health and safety, and mental health. The Institute for Gender and Health of the CIHR also looked at the relation of women's health to gender issues relating to globalizing processes, policy, and household dynamics. Initial findings indicate that globalizing processes, such as increased market liberalization and the privatization of social services, affect the health and well-being of women and men in different ways, from household to global levels.

Conclusions of the project in 2006 identified priority areas for research: mental health and additions; violence, including trafficking of women; occupational health and safety; and infection dieseases, including HIV. It called for research to be undertaken in multi-sectoral, trans-disciplinary and mixed-method frameworks; the strengthening of existing surveillance systems; disaggregated and comparable data; and flexible funding (Maclean, 2006)

7. Improving the collection of gender disaggregated data for policy makers

There is a paucity of data available at the national and international level on the participation rates of men and women in scientific and technological education and careers. There still is no systematic approach or coordinated method for ensuring the systematic collection of gender-disaggregated data on science and technology. Of equal importance for policy makers is the unavailability of data on the differential impact of technical change on men and women's lives.

Progress has been made in this area. The GAB collaborated with UNESCO in 1999 to produce a Toolkit on Gender Indicators in Engineering, Science and Technology. This toollkit was well-received and has just been updated. It is scheduled for publication in early 2007.

Sex-disaggregated data on women's representation in science, industry and research in the EU has been collected for several years now, with input from GAB members and others. The then-named SARG group also recommended and oversaw the collection and analysis of sex-disaggregated data on women's participation in S&T in South Africa. RICYT in Argentina promotes and collects sex-disaggregated data in the sector where possible, as does the UNESCO Institute for Statistics, but while progress has been made, the results are less systematic and not all countries are collecting this kind of data.

There is also movement on sex-disaggregated data relating to ICTs and the information society. The WSIS Geneva Plan of Action called for the development of gender and ICT indicators. WIGSAT worked with Orbicom and Statistics Canada to develop an analysis of "Women in the Information Society" which included a quantitative analysis of existing national and regional sex-disaggregated data on ICT use and access (from radio to cell phone to Internet). Currently, the second stage of this work is in process with the goal of developing a series of indicators to measure women's participation in the knowledge society. Other organizations beginning work in this area include ECLAC, OECD and the EU.

Little progress, however, has been made on data which measures the differential impact of technical change on men and women's lives, beyond some isolated work by CGIAR's PRGA.

Summary: Are the Transformative Action Areas Still Relevant? What Needs to be Done?

In general, the Transformative Action Areas are still extremely relevant to the current global context. Progress has been made in some areas, some of it a direct or indirect result of Gender Advisory Board work through research, advocacy and work with policy makers, but much remains to be done. If we summarize each Area, we find:

1. Gender equity in science and technology education

There has been quite a bit of research and experimentation in this area, and a great deal is known about good models, improved curricula, and what the barriers are to increased success of females in science at all levels. The next step in this area could be to develop strategies for dissemination, replication and transfer of successful strategies and approaches from countries like the USA to other regions.

2. Removing obstacles to women in scientific and technological careers

Similarly, we are coming to a more sophisticated and nuanced understanding of the barriers to women of equal representation in the S&T workforce in terms both of patterns of participation and the gendered nature of research/workforce system structures. There is certainly increased understanding at the global policy and agency level of the importance of encouraging the participation of women in the national development and innovation system. Nevertheless, with a few national exceptions there remains a long road ahead before women can contribute and be recognized as equals. Collaboration and comparison of the experience, results and activities of the GAB network with other initiatives to promote women in the S&T/IT workforce may be a useful area with the goal of arriving at one or more sets of comparative baseline criteria, guidelines and indicators for progress. Another area for further attention may be to assess whether there are gender dimensions to the brain drain issue. Some studies indicate there might be – for the South Africa data on migration of women and men in SET.[14]

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

In some respects there has been progress in this area – the work of organizations like FAO and CGIAR is increasing our understanding of women's agricultural and NRM-based activities and knowledge, for example, although application of that knowledge is still fairly weak. Some groups like WOCAN, WEDO and ENERGIA are focusing on "spreading the word", and integrating gender analysis into projects, programming and policy.

However, there have been setbacks as well, most particularly in the area of developing small-scale appropriate technologies to support women's subsistence, agricultural and income-generation activities, which has gone by the way-side in the charge to the big, sexy, high-tech R&D in biotechnology, advanced networking, nanotechnology, etc. This is one reason WIGSAT proposes to return to the issue, in the context of promoting women's SMMEs through technology support.

4. Making the science and technology decision-making process more "gender aware"

This is one area where there has been progress since 1995, both internationally and in regional and national governmental processes. However, the barrier of implementation at the national level remains, due to lack of understanding, political will, or in some cases, resistance. One of the GWG recommendations in this area, "Increase the understanding of all decision-makers about the gender implications of their decisions through explicit training programs" could be an area for the GAB to promote, related to the idea of a campaign to educate policy makers.

5. Relating better with "local knowledge systems"

While a range of groups are addressing the gender dimensions of indigenous knowledge for agriculture and natural resources management, there is less attention to the related issue of intellectual property rights, including protection and access to benefits. This is increasingly important in the context of trade agreements, WIPO, the resurgence in use of "traditional" herbs and plants in the developed countries, and the threats posed by biotechnology to ownership and management of natural resources. It is also a gender issue in that women tend to have less access

[14] See Department of Science and Technology, South Africa (2004); Dodson, 2002; Andres and Licker, 2003.

to resources and information on protecting their IPRs, while possessing much of the world's remaining indigenous and local knowledge.

6. Addressing ethical issues in science and technology: the gender dimension

The GAB and its network was influential in the early development of the Globalization, Gender and Health project. The question to be answered here is whether the project has generated momentum in this area, and/or whether "gender and health" world is covering this issue adequately.

7. Improving the collection of gender disaggregated data for policy makers.

There has been progress in this area and several important regional and international statistical organizations are beginning to investigate the collection of sex-disaggregated data in ICT and S&T. One potential contribution of the GAB could be to continue to work with these and other organizations at national levels to increase understanding of policy makers and statistical agencies of the value of collecting disaggregated data.

Recent Critical Emerging Issues: New Areas of Action for the GAB?

Since 1995, three new S&T issues in particular have emerged as having both important global implications and gender dimensions: biotechnology (both health and agricultural); new information and communications technologies; and climate change. Aside from ICT, where there is quite a bit of activity both on the ground and at the international level, there has been comparatively little work in these areas around gender dimensions and effects on women and gender relations (some of which the GAB has engaged in). The GAB may be in a position to make some useful and unique contributions.

1. **Biotechnology**

A position paper on Critical Issues Pertaining to the Gender Dimensions of Biotechnology Policy was commissioned from Sandy Thomas of the Nuffield Ethics Foundation. In 2004, the Board held expert consultative workshops in Asia and Africa on gender issues pertaining to both health and agricultural biotechnologies for IDRC. Both the report and the expert workshops made clear that health-based and agricultural biotechnologies could be detrimental to women's health, food security and status if implemented in a gender-blind manner. The GAB has been unable to follow up on this work for lack of funding, although many of the recommendations made at these meetings are still relevant. The GAB may decide to re-visit efforts to develop a policy research programme in this area.

Aside from the GAB work, the CGIAR Program on Participatory Research and Gender Analysis (PPRGA) is looking at some of these issues and in India in particular some work is done in the field with women farmers, but much remains to be done in this important area.

The overall critical issues relating to the gendered impacts of agricultural biotechnology R&D were identified as:

1. C**ultural relationships** and culturally-based differences in roles, status and power between men and women, and how they affect gender equity as well as the opportunity of women and men to benefit equally from technological development and implementation.

2. **Technical assessment** of socioeconomic, political and cultural costs and benefits, and how appropriate bio- and conventional technologies can be developed which have a positive impact on all members of society.

Specific recommendations for further research and action made by the expert groups concerning agricultural technologies include:

- Research on and recognition of gender roles concerning different crops and varieties;
- Research on socioeconomic, gender and environmental consequences of targetting women's vs. men's crops; and synthesis and survey of research and data which already exists.
- Involvement of women and other stakeholders in identification of the technology to be developed and determination of what intervention is most appropriate to the gender and socio-cultural context, in the context of local knowledge, agricultural and environmental systems. This would include a survey of the activities undertaken by women in the community, and how these activities might be affected by the implementation of a particular biotechnology, including development of benchmark information to measure effects on health, income earning, time allocation and rights.
- Assessment of existing biotechnologies implemented in the region or locality in terms of use and benefit patterns and performance results
- Development of strategies and guidelines to identify who is in a position to choose technologies, in view of mitigating factors such as poverty, food security and other situations.
- Documentation of gender equity trends and experiences in sensitisation and training with respect to biotechnology implementation in the field, including colleciton of sex-disaggregated data.
- Assessment of gender patterns in recent cases of technology introduction, such as Makhatini Flats. The introduction of genetically-modified cotton and maize was identified as particularly important to assess.
- Research in use of biotechnologies by small-scale farmers, in view of inputs needed (fertilisers, herbicides) with accompanying health, environment and economic implications.

Recommendations for research in health biotechnologies included:

- Research into and development of technologies which allow women to make their own health decisions and protect themselves from communicable diseases, e.g. microbicides
- Measuring the utility and effectiveness of indigenous health practices and medicinal herbs, with a view to recognising and improving them
- Exploring use of and connections between indigenous and western medicines.
- Gathering, assessing, and developing strategies against misuse of reproductive technologies for cultural reasons.
- What biotechnologies can be developed and used to improve the nutritional status of women and children?
- Methodology to measure differential impact on lives and physiologies of women and men.
- Monitoring and synthesising long and short-term effects of biotechnologies on women's and men's health.

Recommendations for research on policy and implementation of biotechnologies:

- What models exist for gender mainstreaming of institutions? What has been the experience of other institutions, such as UNEP-GEF?
- Surveys of government legislation and policies affecting gender dimensions of biotechnology research and implementation.
- What is being done to sensitise men and women in policy and programming at all levels on women's health issues and the rights of women to make informed choices?
- What role can women's ministries and advocacy groups play in lobbying for increased participation of women and incorporation of gender concerns in policy and programming? What strategies exist or can be developed to get them involved and activated?
- Research on approaches and indicators to monitor progress of gender-related issues, including impacts, risks and benefits in development, policy and implementation
- Development of indicators to track relevant long- and short-term policies
- Assessments of and strategies to increase regional/national capacity and human resources to administer and monitor health biotechnologies.
- Survey of existing or potential differential impacts, risks or benefits of biotechnology.
- Comparisons of gender and biotechnology issues between North and South as well as continuation of dialogue with women from developed countries and S&T networks.

One of the major recommendations to come out of these meetings was the development of a gendered technology development, assessment and transfer framework, which would include biotechnology, but be applicable to all technologies. This is a topic the GAB would be uniquely positioned to address in view of its research strengths, its mandate, and its network.

2. ICT

The GAB has not addressed this topic in a major way, although it commissioned papers on "ICTs, Globalisation and Poverty Reduction: Gender Dimensions of the Knowledge Society" from Swasti Mitter and Sophia Huyer with funding from IDRC in 2003. More recently, its parent body, the Commission on S&T for Development, was mandated to monitor UN system-wide followup to the World Summit on the Information Society. The GAB is in a position to make contributions to this work, but a lack of funding to engage with the CSTD on this issue and to coordinate work on the gender dimensions of this followup is a major obstacle. The GAB is a member of the GENWIN network, a network of civil society groups monitoring gender issues in the major WSIS followup and implementation activities.

The areas identified at WSIS as having important gender dimensions include education, employment, support to SMEs, health, and data collection on gender issues in the information society.

One of the GAB network groups very much involved in this area is WIGSAT, which engages in policy research, analysis and advocacy on gender and ICT for development and poverty reduction issues. WIGSAT is working with Orbicom, the Network of UNESCO Chairs in Communication, on developing gender indicators to measure women's participation in the knowledge society in direct followup to a WSIS recommendation that gender indicators on participation in the information society be developed. The Orbicom work will be presented at the Global Knowledge Partnership conference in December 2007. WIGSAT is also co-lead of the recently established international Task Force on Women and ICT which is organizing the GKP Gender Forum.

3. Climate Change

The effects of climate change on women's environment and natural resource-based activities is not known, although we know that it will pose added stresses to women's activities, particularly as rates of natural disaster and natural shocks are likely to increase. Joni Seager has pointed out the gender dimensions of natural disasters which are related to poverty as well as to physical abilities. In the 2004 tsunami in southeast Asia, death rates for women were 3-4 times that of men as a result of sex differences in physical ability, gendered differences in development of physical ability, and gendered family responsibilities. That is, women were less likely to be able to swim, less able to withstand physical shocks and forces, and more likely to be slowed down in their movements by children (Seager, 2005).

A group of women's organizations including ENERGIA, WEDO, Women in Europe for a Common Future as well as the IUCN made a submission to CSD 14 on gender, energy and climate change. With respect to climate change, the submission identified three key gender-related dimensions: i) women are affected differently and more severely by climate change and natural disasters because of social roles, discriminatino and poverty; ii) women are under-represented in decision-making about climate change, greenhouse gas emissions and adaptation/mitigation; and iii) there are gender differences in carbon emissions related to income and education levels – women drive cars and travel by air less than men, for example (ECOSOC 2006).

Irene Dankelman has outlined five main climate-change related effects on gender roles and relations:

- gender-specific resource-use and management patterns that can degrade the environment such as men's higher car and fuel purchasing from male-dominated industries
- gender-specific effects of climate change such as the extra time women need to spend collecting water during droughts
- gendered aspects of climate change mitigation and adaptation such as women's valuable indigenous knowledge and practice of environment management
- decision-making on climate change such as the limited role women are playing as producers in the energy sector and in energy policymaking
- human capacity inequalities such as women's lower access to education, training and technology (Dankelman, 2002).

It has been pointed out by WOCAN that very little in the way of research or advocacy on this issue currently exists, although LIFE e.V., has just received funding from the FAO to carry out a Review, Analysis & Assessment of Research Relating to Gender and Climate Change. The next session of the CSD will take as one of its themes climate change, including adaptation and effects on natural resource degradation. The GAB may want to consider allying with WOCAN and other groups to advocate on gender dimensions of climate change as it relates to agricultural production, disaster and natural shocks, and natural resources management.

Conclusion

It seems clear that the analysis by the GWG of critical issues, and recommendations for Transformative Action continue to be relevant today. What has changed is the increased body of research in some Areas which is enriching and expanding our knowledge; as well as a moderate increase in the range of organizations and activities at regional and international levels.

Nevertheless it is also clear that a great deal of work continues to be needed, both in research and analysis as well as in policy and programming. The GWG and the GAB are recognized leaders in this area and are recognized as having been influential in changing part of the global agenda.

At the same time, global science and development policy is increasingly taking into account the gender dimensions of science R&D and agenda-setting. It now remains for the policy to be translated into action on the ground and in the university.

This meeting is an opportunity for the GAB to influence the global agenda again, in collaboration with its partners and the networks emerging at all levels. Work in many of the GWG-identified areas needs to be moved to the next level: to a more sophisticated and nuanced understanding of the gender dimensions and factors of these issues, as well as finding a way to increase momentum for change through collaborations, institutions and opportunities.

References

American Association of University Women Educational Foundation (1998), *Gender gaps – Where schools still fail our children*. Washington, DC: American Association for University Women.

Andres, Lesley and Aaron Licker (2003, June 1-4). Beyond Brain Drain: The Dynamics of Geographic Mobility and Educational Attainment of B.C. Young Women and Men. Paper presented at the annual meeting of the Canadian Society of Sociology and Anthropology Association, Halifax, Nova Scotia.

Bleeker, M.M. and J.E. Jacobs. (2004). Achievement in math and science: Do mothers' beliefs matter twelve years later? In *Journal of Educational Psychology 96,* pp. 97-109.

Blum, Lenore, Carole Frieze, Orit Hazzan, and M. Bernardine Dias (2006). Culture and environment as determinants of women's participation in computing.

Bonder, Gloria (2005). The impact of science and technology policies in social development: Advances in gender and S&T research, education and policy-making in Latin America. In *APWIN*, No. 7, pp. 102-118.

Carr, Marilyn, ed. (2004). *Chains of fortune: Linking women producers and workers with global markets*. London: Commonwealth Secretariat.

Dankelman, Irene. (2002). "Climate Change: Learning from Gender Analysis and Women's Experiences of Organising for Sustainable Development" in *Gender and Development*. July, Vol 10, No. 2.

Department of Science and Technology, South Africa. (2004). Women's Participation in Science, Engineering and Technology;

Dodson, Belinda. (2002). Gender and the Brain Drain from South Africa. SAMP Migration Policy Series No. 23. Kingston: Queen's University.

ECOSOC. 2006. Discussion papers submitted by major groups. Addendum: Contribution by women. Commission on Sustainable Development, Fourteenth Session, 1-12 May.

European Commission Directorate-General for Research. (2006). *She figures: Women and science statistics and indicators*. Luxembourg: European Communities.

Glover, Judith. (2001). Targeting Women: Policy Issues Relating to Women's Representation in Professional Scientific Employment. *Policy Studies*, Vol. 22. No.2.

Gotzfried, August. (2004), Women, science and technology: Measuring recent progress towards gender equality. Statistics in Focus. Theme 9 – June. Brussels: Eurostat.

Harding, Sandra. (1995). Just add women and stir? in IDRC (ed.) *Missing links: Gender equity in science and technology for development*. Ottawa: International Development Research Centre, pp. 295-307.

Huyer, Sophia. (2004). Gender and Science and Technology from an International Perspective. Organization of American States, Inter-American Commission on Women, Gender Advisory Board, CSTD. Washington, DC.

Indian National Science Academy. (2004). Science Career for Indian Women: An examination of Indian women's access to and retention in scientific careers. October. New Delhi. Retrieved November 29, 2006 from http://www.insaindia.org/Scienceservice/science.htm.

Juma, Calestous, and Lee Yee-Cheong. 2005. *Innovation: Applying Knowledge for Development.* UN Millennium Project Task Force on Science, Technology and Innovation. London: Earthscan.

Kebede, Dawit and Solomon Retta. (2004). Gender, HIV/AIDS and food security: Linkage and integration into development interventions. DCG Report No. 32. As, Norway: Drylands Coordination Group.

Long, J. Scott, ed. (2001), *From scarcity to visibility: Gender differences in the careers of doctoral scientists and engineers.* Washington, D.C.: National Academy Press.

Maclean, Heather. 2006. Crossing Borders and Disciplines: Lessons Learned from the Globalization, Gender and Health Initiative. Presentation, March 27.

Malcom, Shirley. 2005. Proposal for a Bellagio Conference on Gender, Science and Technology for Sustainable Development: Looking Ahead to the Next 10 Years. Gender Advisory Board.

Malcom, Shirley. 2006. Women in Science and Engineering: A Global Imperative. Paper presented at the meeting MUJER CIENCIA 2006 - Mujeres Latinoamericanas en las Ciencias Exactas y de la Vida, Mexico City, May 3-5.

Massachusetts Institute of Technology. (1999). A study on the status of women faculty in science at MIT. Retrieved 26 June 2006 from http://web.mit.edu/fnl/women/women.html#Real%20progress.

Mitter, Swasti. (2001). *Asian women in the digital economy: Policies for participation*. Kuala Lumpur: UNDP.

National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. 2006. *Beyond Bias and Barriers: Fulfilling the potential of women in academic science and engineering.* Committee on Maximizing the Potnetial of Women in Academic Science and Engineering. Prepublication copy. Washington, DC: The National Academies Press.

National Science Foundation Science Resources Studies Division (1996), Women and underrepresented minority scientists and engineers have lower levels of employment in business and industry;. Data Brief no. 14, December 31. Retrieved 26 June 2006, from http://www.nsf.gov/statistics/databrf/sdb96331.htm.

National Science Foundation. (2003). Gender Differences in the Careers of Academic Scientists and Engineers: A Literature Review. NSF 03-322. Division of Science Resources Statistics. Arlington, VA.

Normile, D. (2006). Getting women scientists back on the career track in Japan. In *Science*, 3 March, p. 1236.

Rathgeber, Eva. (2002). Female and Male CGIAR Scientists in Comparative Perspective. October. Washington, DC: CGIAR.

Schiebinger, Londa. (1999). *Has Feminism Changed Science?* Cambridge, MA: Harvard University Press.

Schinzel, B. (2002). Cultural differences of female enrollment in tertiary education in computer science. In *IFIP Conference Proceedings* 1. Kluwer, Deventer, The Netherlands: IFIP.

Seager, Joni. (2005). And they're women too, in case you didn't notice. Editorial. *Chicago Herald Tribune*. September.

Saad, Nadine (2003). 5-year synthesis report: PRGA program: synthesis of phase I (1997-2002). Cali, CO: CGIAR Systemwide Program on Participatory Research and Gender Analysis.

Technology's Too-Small Sisterhood. (2004, May 12). *Business Week Online*. Special Report: Women of Tech. http://businessweek.com/print/technology/content/may2004/tc20040512_2760_tc147.htm?tc (last accessed May 25, 2004).

UNESCO (2003). Gender and education for all: The leap to equality. Summary Report. Paris: UNESCO.

UNESCO (2005). Education for all global monitoring report 2005 - The quality imperative. Paris: UNESCO.

UNESCO (2006). Education for all global monitoring report. Literacy: The core of education for all. Paris: UNESCO.

Women in Science - Quality and Equality. Conditions for Sustainable Human Development. 1998. European Regional Conference, Bled (Slovenia), 5-7 November 1998. http://www.unesco.org/science/wcs/meetings/eur_bled_e_98.htm (last accessed June 8, 2004).

Zo, Randriamaro. N.d. Gender and Trade: Overview Report. Institute of Development Studies, Brighton, UK.