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Introduction

Scope and Objectives of this Manual

This reference Manual provides guidelines for advancing gender equality and equity in the field of science and technology. In so doing, it applies a gender perspective to a broad range of science and technology-related issues, examining conditions as they relate to both women and men and how policies, plans, programmes and projects impact on the lives of women and men differently. This means acknowledging the need to take into account the differing needs and conditions of women and men.

The Manual's main objective is to assist governments in advancing gender equality in their countries, especially through the establishment and operation of a Gender Management System (GMS). Where governmental structures include a Ministry of Science and Technology, it will play a pivotal role in gender mainstreaming. However, it needs to be stressed that both gender and science and technology are cross-cutting issues throughout almost all areas of government, and it would be ineffective to mainstream only in such a ministry even where it exists. Other ministries, for example Finance, Water, and Agriculture, also play a critical role since they make many of the decisions which affect how science and technology impact on women and men. In addition, Ministries of Science and Technology are often under-funded, with the amount they have for research and development being extremely small in comparison to the private sector, even in developed countries.

Since the Manual's main objective is to assist governments in advancing gender equality in their countries, it is tailored to governmental structures. However, it may also be of use to non-governmental stakeholders that are involved in determining and formulating policy, applying it and ensuring its enforcement. These include NGOs, women's groups, professional associations, the academic community and others committed to promoting gender equality.

This Manual provides an overview of some of the major gender issues in the area of science and technology, including global and Commonwealth mandates for promoting gender equality. It also provides an extensive list of recommendations to ensure that governments can create an enabling environment to maximise the human capital of both women and men in science and technology in each country.

The Manual is part of the Gender Management System (GMS) Series, which consists of a number of publications presenting the concept and methodology of the GMS, with sector-specific guidelines for mainstreaming gender in key areas. The GMS is explained most fully in the *Gender Management System Handbook*.

Gender and Development in Science and Technology

Relative to other issues of women in development which have stimulated a bank of scholarship and theoretical frameworks, issues of gender in science and technology are newcomers to the international stage. In 1979, at the first International Conference on Science and Technology, only one article referred explicitly to women in science and technology. A fuller agenda was elaborated in time for the 1985 Mid-Decade Nairobi World Conference on Women to complement the highly popular 'Tech and Tools' pavilion celebrating women's inventions and technical knowledge. In 1983, the newly set up United Nations Commission on Science and Technology (UNCSTD) designated gender as one of its three themes. In doing so, it drew on the expertise developed by the Once and Future Action Network (OFAN), an NGO umbrella organisation of women working in science and technology fields. A Gender Working Group was established with Commissioners from Saudi Arabia, China, Tanzania, Burundi, Romania, Saudi Arabia, the Netherlands and the United Kingdom (Chairperson). An 'Advisory Board' to the Commissioners was set up with senior representation of women in science, national policy and gender advocacy. Over 67 international experts had input into the debate. Nine science themes were distilled in challenge papers. The result was a 'Declaration of Intent' approved by governments at the Economic and Social Council (ECOSOC) (see Box 1). This was then forwarded to the 1995 Beijing Fourth World Conference on Women, with an associated set of 'Seven Transformative Actions'.

The Beijing Platform for Action contained cross-cutting references to issues of gender in science and technology interspersed in its themes. At the parallel NGO Forum, the 'Once and Future Pavilion' celebrated women in science and technology internationally and offered a wide-ranging set of workshops. The UNESCO 1996 World Science Report dedicated one of its five chapters to the consideration of the 'Gender Dimension of Science and Technology'. Its subsequent 1998 World Science Report continued commentary on gender issues, and the 1999 World Science Conference of UNESCO and IUSCU, held in Budapest, had a full theme committed to women in science and technology preceded by four preparatory gender workshops internationally.

At the NGO level, professional associations of women such as engineers, physicians, women veterinarians, women chemists and women in trades have been actively organising national, regional and international networks of support. Many of these networks have mounted websites. OFAN has carried forward from Beijing to promote global action agendas as have several key regional and global science and technology initiatives noted in this Manual.

Increasingly, as economies reposition themselves to compete in the new knowledge-based global economy, the gender gap in entry, promotion, decision-making and attrition in fields of study and remunerated endeavour in science and technology has caught the attention of planners. In some instances, Heads of State have commissioned national assessments of women's participation in science and technology based on calls to action by their Science Advisors or National Science and Technology Advisory Boards (such as Canada's 'Winning with Women'). Ministers of Science and Technology have also called for national reports on the barriers and opportunities for women in these areas (such as the UK White Paper entitled 'The Rising Tide'). In some cases, science and technology research agencies have examined women's barriers in science and established special mechanisms for recruiting, retaining and mentoring top female talent. One example is the establishment of Canada's five NSERC Chairs on Women in Engineering in Universities (see Box 2).

Box 1

Declaration of Intent on Gender, Science and Technology for Sustainable Human Development

The Gender Working Group of the United Nations Commission on Science and Technology for Development (UNCSTD), in its 1995 report on gender equity in science and technology, recommended that all governments adopt a Declaration of Intent by which they agreed to work actively towards the following goals:

- ◆ To ensure basic education for all, with particular emphasis on scientific and technical literacy, so that all women and men can effectively use science and technology to meet basic needs.
- ◆ To ensure that women and men have equal opportunity to acquire advanced training in science and technology and to pursue careers as technologists, scientists and engineers.
- ◆ To achieve gender equity within science and technology institutions, including policy-and decision-making bodies.
- ◆ To ensure that the needs and aspirations of women and men are equally taken into account in the setting of research priorities and in the design, transfer and application of new technologies.
- ◆ To ensure all men and women have equal access to the information and knowledge, particularly scientific and technological knowledge, that they need to improve their standard of living and quality of life.
- ◆ To recognise local knowledge systems, where they exist, and their gendered nature as a source of knowledge complementary to modern science and technology and valuable for sustainable human development.

Currently, there are regional offices of the UNCSTD 'Gender Advisory Board' located in South America and in Africa to facilitate governments implementing the Declaration and Transformative Actions.

Source: UNCSTD-Gender Working Group (1995)

Regionally, trade organisations and co-operative groups such as the Asia Pacific Economic Co-operation (APEC) have paid specific attention to the challenges of women in science and technology. In 1996, APEC Ministers for Industrial Science and Technology held a two hour 'Open Ideas Forum' on this issue in Korea, based on a challenge paper, 'Gender and Science and Technology in Knowledge Based Economies: Some Considerations for APEC' (McGregor, 1996). The outcome was the formation of a 'Gender Working Group', the convening of a regional Statistics Experts Meeting of member economies for attention to the collection of gender-data and sharing of best practices, and the request for an APEC website on gender in science and technology.

Supporting and stimulating these watershed events was the formation within APEC of a Women Leader's Network (WLN) which connects influential women in business, academia, public policy and parliament. The WLN adopted science and technology as one of its three themes of focus. The 1996 WLN Conference in the Philippines, its 1997 Conference in Ottawa and its 1998 Conference in Malaysia developed specific science and technology recommendations to Heads of State and Ministers of Science and Technology. The WLN contributed substantially to the drafting of the APEC Minister's challenge paper for Korea. Collaboration of the WLN with Ministers and APEC is a template for change and collaboration

In summary, there now exists a growing body of Prime Ministerial Reports and Reports by Ministers of Science and Technology containing a rich resource of recommendations. The UNCSTD 'Transformative Actions' and Declaration are being supported by

Box 2

Women in Science and Engineering Chairs (Canada)

In 1996, a unique public-private joint initiative on promoting women in science and technology was announced in Canada. The Natural Sciences and Engineering Research Council of Canada (NSERC) invested \$1.25 million to establish five new Chairs for Women in Science and Engineering (CWSE) at Canadian universities, an amount matched or exceeded by contributions from four major private companies. Distributed across Canada, these Chairs have the objective of encouraging the increased participation of women in science and engineering education programmes and in the workplace, including developing strategies to encourage female students in elementary and secondary schools to consider careers in science or engineering. The Chair holder also acts as a role model and contact person for women in these fields. Each Chair holder devotes up to half of her time to the activities of the Chair and the remainder to her normal professorial and research activities at the university.

Activities include:

- ♦ participating in public forums for scientists, engineers, employers, educators, researchers and others;
- ♦ visits to elementary, junior high and high schools to talk about science and engineering as viable career choices for women;
- ♦ meeting with employers of engineers, industry and government to suggest ways in which the climate for women scientists and engineers can be improved;
- ♦ working to improve the retention rate of women enrolled in Science and Engineering Faculties and in the workplace;
- ♦ discussing with university administrators and faculty members matters related to the learning environment, curriculum and teaching styles that facilitate the integration of women in these fields and the need to value women's contributions;
- ♦ consulting with PEO, CCPE, and scientific societies on strategies to increase the integration of women in scientific and professional activities and in the governance of these associations;
- ♦ speaking at universities to promote ideals of equity, fairness, professional ethics and harassment-free environments for women students;
- ♦ participating in broadcast and print media interviews; and
- ♦ being involved in scholarly work such as teaching and research.

regional implementation focal points to facilitate governments. Networks like the APEC Women Leader's Network are available to governments and Ministers as sources of advice and appointment. International umbrella NGO groups like OFAN are spearheading global considerations of gender in science and technology. Governments today are thus in a strong position to take action on gender and science and technology.

A Gender Framework

What is Gender?

Whereas the sex of an individual is biologically determined, gender refers to the socially constructed definition of women and men and the relationship between them. Gender is culture-specific and also varies over time. It determines the conception of tasks, functions and roles attributed to women and men in society, in both public and

private life. There is increasing recognition that society is characterised by a male bias: the male norm is taken as the norm for society as a whole, which is reflected in policies and structures. These policies and structures play a role in reproducing and institutionalising the social construction of gender, which contains an unequal power relationship. Male domination and female subordination is found in most spheres of life, and the tasks, roles, functions and values attributed to men are usually more highly valued than those associated with women.

Men and women are different, but these differences should not have a negative impact on their living conditions and should not discriminate against them. Such diversity should systematically be factored into an equal sharing of power in the economy, society and policy-making processes. In order for there to be gender equality, measures need to be taken so that both women and men have equal opportunities (in education, careers, etc.) and enjoy the same rights, privileges and decision-making responsibilities. Diversity in all of its aspects including class, religion, ethnicity, race or sexual orientation, also need to be taken into account in the elaboration of sound public policy.

Why Focus on Gender?

In 1995, UNIFEM sponsored a meeting of experts to establish guidelines for integrating gender perspectives into the human rights work of UN agencies. The expert meeting referred to gender perspectives as 'those which bring to conscious awareness how the roles, attitudes and relationships of women and men function to the detriment of women' (UNIFEM, 1996). A focus on gender does not ask for special treatment for women, however. It stresses the identification of different needs in the community and the formulation of policies and strategies that address those needs. It thus prioritises equality of opportunity rather than numerical equality and allows for the advancement of gender equality and equity regardless of whether it is women or men whose position needs to be advanced. In some regions and sectors, for example, women may be in a more advantageous position than men. Gender analysis can reveal this and serve to open fair and equitable opportunity for men.

Since gender is a social construct, and social roles are not 'natural,' 'pre-ordained' or 'permanent', this approach also allows for assumptions about what gender means to be deliberately exposed and changed. Society, in order to flourish in the fullest sense, is dependent on the utilisation of all human resources. The participation of both women and men in formulating and implementing policies and programmes will utilise the maximum talent available to a country and facilitate strong and sustainable public policy.

What is Gender Analysis?

Gender analysis involves the collection and use of sex-disaggregated data that reveal the roles and responsibilities of women and men. These data are fed into the policy process to enable assessments of how existing and future policies and programmes potentially affect women and men differently. Gender analysis also involves assessing how gender-inequitable power relations may impact negatively on the achievement of a range of development goals, including the goal of gender equality and equity.

Gender analysis needs to be both quantitative and qualitative. The use of gender sensitive indicators in such areas as participation rates in scientific education and careers and decision-making, and data on the differential impacts of policies and programmes can provide useful quantitative data. This should be complemented by qualitative data, which trace historical, political, economic, social and cultural forces in order to clarify how and why gender differences came about.

What is Gender Mainstreaming?

Gender mainstreaming is the process of bringing a gender perspective into the mainstream activities of government at all levels, including in policies, programmes and projects. It appeared for the first time in international texts after the United Nations Third World Conference on Women (Nairobi, 1985), in relation to the debate within the UN Commission on the Status of Women (CSW) on the role of women in development. It was seen as a means of promoting the role of women in the field of development and of integrating women's values into development work.

After Nairobi, international development agencies and governments promoted mainstreaming as a new strategy for taking women's concerns into account. By bringing women's issues into their mainstream policies, programmes and projects, they hoped that earlier problems of marginalisation would be overcome. Two different approaches to mainstreaming – 'agenda-setting' and 'integrationist' – have since been implemented. The agenda-setting approach aims to transform the thrust of development policy as it brings women's concerns into the mainstream. The integrationist approach merges women's concerns within existing activities without necessarily altering the agenda: it 'adds on' women to pre-existing programmes and policies (UNRISD, 1995). These two concepts are not mutually exclusive and actually work best in combination.

Gender mainstreaming builds on the knowledge and lessons learnt from previous experiences with gender equality policies. Specific gender equality policy is a strategy that directly addresses gender imbalances by taking into account the specific needs of women and men and elaborating policies to meet these needs. Gender equality machineries are the actors that carry out the government's fundamental role in redressing gender inequalities.

Gender mainstreaming, on the other hand, takes equality issues out of the isolation of gender equality machineries and involves more and new actors in building a balanced society. This accelerates and strengthens the process of transforming gender relations in the direction of gender equality. When policies having a large impact on society are devised, the specific interests and values of both sexes are taken into account. As a result, it becomes more visible that gender equality is an issue for both women and men. This requires the systematic use of gender analysis and sex-disaggregated data that can render visible gender differences.

Both gender mainstreaming and gender equality policies are needed if gender equality and equity are to result. The machinery for implementing gender in government should exist both as a stand-alone entity as well as a crosscutting capacity in all departments with science, research and technology policies and programmes. In this way it is similar to environmental policy, for example, which is generally accepted to exist as a sectoral policy, even if environment as an issue is to be taken into account in many policy fields, e.g. agriculture, economy, infrastructure, international trade and development co-operation. Mainstreaming cannot function optimally without 'traditional' equality policy, because this policy forms the necessary medium for mainstreaming.

Why Mainstream Gender in Science and Technology?

Gender mainstreaming is required to implement the 1995 Commonwealth Secretariat Plan of Action on Gender and Development, in particular its objective to accelerate the achievement of women's empowerment in member states. At the United Nations Fourth World Conference on Women (Beijing, 1995), the strategy of gender

Box 3

Dialogue on Women in Science and Technology (Canada/UK)

In May 2000, the Canadian High Commission convened a conference of over 100 women leaders and experts in science, engineering and technology (SET), and the social sciences from Canada and the UK to discuss a broad range of issues and challenges. The purpose of the conference was to provide a forum to address different perspectives on leading scientific and policy issues; to showcase and share the work of leading women in SET in business, public policy, journalism and academia; and to share best practice models for attracting, supporting and promoting women in science. The agreed vision of the delegates was a world where the impacts of science and technology were benevolent and reached women, children and men equitably; and where women played a full and equal role in science policy creation and in the planning and implementation of research, development and decision-making. The conference affirmed its commitment to the following principles:

- ♦ Women and men are equally capable of pursuing excellent science, engineering and technology (SET).
- ♦ Diversity contributes to, rather than conflicts with, excellence.
- ♦ The contribution of indigenous women's knowledge systems is essential to achieving global goals of sustainability.
- ♦ Decision-making in SET should reflect the whole range of human perspectives, including those of women.
- ♦ All science and technology policies and programmes should be subject to systematic gender-based analysis to identify the differential impacts of technological change on the lives of men and women.
- ♦ Issues of global stewardship, the impact of science and technology on society and the ethics of all scientific endeavours must be open to public scrutiny and debate.
- ♦ International institutions of governance must include women in SET and adapt to be inclusive, multidisciplinary, and empowered to address ethical issues with effective instruments of enforcement and accountability.
- ♦ Both commitment and action are required at all levels to ensure equal and equitable participation for all.

*Source: Conference Statement,
Women Leaders in Science,
Technology and Engineering,
4–5 May, 2000, London, UK*

mainstreaming was explicitly endorsed by the Platform for Action (PFA) which was adopted at the end of the Conference. It states that 'governments and other actors should promote an active and visible policy of mainstreaming a gender perspective in all policies and programmes, so that, before decisions are taken, an analysis is made of the effects on women and men, respectively' (para. 229). Many countries have adopted a national plan for gender mainstreaming.

One of the two central conclusions of the 1995 UN Commission on Science and Technology for Development (UNCSTD) Gender Working Group was that 'to ensure that science and technology benefits all members of society, attention must be paid to the respective needs and interests of men and women equitably'. The UNCSTD Gender Report endorsed by the UN ECOSOC called on all governments to address gender in the elaboration of science and technology policies and programmes.

In 2000, the need to further advance the process of mainstreaming gender was recognised in the Outcome Document adopted by governments at the 23rd special session of the General Assembly: 'Women 2000: Gender equality, development and peace for the twenty-first century'. Paragraph 116a of the 'Further actions and initiatives to implement the Beijing Declaration and the Platform for Action' calls on governments to: '[d]evelop and use frameworks, guidelines and other practical tools and indicators to accelerate gender mainstreaming, including gender-based research, analytical tools and methodologies, training, case studies, statistics and information'.

Currently there are several efforts in Commonwealth countries to incorporate gender issues in the mainstream of science and technology policy (see Box. 3). The main focus has been on 'integrating' women, or 'adding women in', through increasing the number of women scientists and policy makers. However, strategies to increase the number of girls and women in science and technology careers often meet with the discouraging reality that, once inside the system, many highly skilled women opt out. A 'supply-side' strategy, while necessary to redress historical imbalances, is not sufficient. Recruitment, retention and promotion of women in science and technology careers and decision-making is a starting point. The commitment to eliminate covert and overt biased behaviours and practices in institutions is also essential. But ultimately, the issue of how science serves society – and who in society is being served by science – must be addressed. Science carries values: it is not neutral. Technology impacts differently upon the lives of women and men and children.