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Key policy initiatives and capacity-building on gender mainstreaming: focus on science and technology

PROGRESSING TOWARD GENDER-RESPONSIVE SCIENCE AND TECHNOLOGY*

by

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*The views expressed in this paper are those of the author and do not necessarily represent those of the United Nations.

This paper presents key findings and recommendations from the expert group meeting (EGM) on *Gender, Science and Technology*, Paris, France, 28 September-1 October 2010.[1]

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

The contribution of science and technology to development goals can be accelerated by taking gender into account. For example, greater access to and use of existing technologies, as well as products that respond better to women's needs, can enhance women's work. Acquiring science and technology education and training can empower women. Eliminating barriers to women's employment in science and technology fields will further the goals of full employment and decent work.

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

EGM recommendations are addressed to all stakeholders. These include: governments at all levels, including ministries of education, science and technology, labour, and the environment; national gender equality and science organizations; donors; multilateral agencies; funding agencies; educational institutions, including public and private schools; research institutions; the private sector, including enterprises developing and marketing technology products; employer organizations; trade unions; professional bodies; and non-governmental organizations (NGOs).

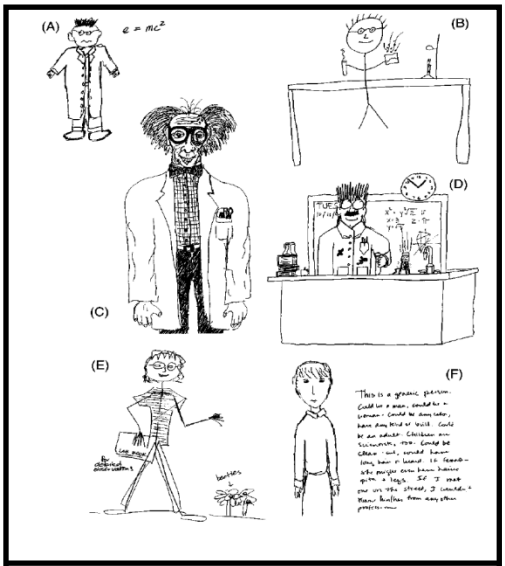

Figure 1.

The Participation of Women and Girls in Science and Technology Education and Employment

Gender differences are deeply embedded in science, technology, and society. Take for example these images of scientists drawn by school children (Fig. 1).[2] These images are ridden with stereotypes. First we see that 70 percent of students imagine scientists to be male—which reflects current international estimates of male participation. Look more closely. The male scientists in schoolchildren's minds are in the lab, actively experimenting. Note the Einstein hair. The lone woman scientist (E) looks a bit anorexic. Note also the flowers: there is a very strong connection between women and nature in these children's imaginations.

These stereotypes indicate that there are deep-seated structural problems that make recruiting girls and women into science and technology a challenge.

[1] EGM report available at: http://www.un.org/womenwatch/daw/egm/gst_2010/Final-Report-EGM-ST.pdf

[2] J. Rahm, P. Charbonneau, *Probing stereotypes through students' drawings of scientists.* In: American Journal of Physics 65 (1997), 774-778.

The expert discussion looked at key factors surrounding girls' S&T education:

- **Access to quality education** is a prerequisite for girls to train in science and technology-related subjects. In many countries, there are hidden costs to education which have a disproportionate impact on women and girls. Families must factor in the opportunity cost of educating a child, in particular a girl – that is, the loss of income if the child can no longer work outside the home or take on domestic responsibilities.[3]
- **Gender-sensitive** classrooms and teaching materials.[4] For example, science textbooks may need to be rewritten. One biologist carried out a "gender" check between editions of his very influential textbook and replaced all sexist images, language, and scientific theories with inclusive materials.[5]
- **Awareness of S&T careers for girls** through more female role models, summer camps for hands-on learning, and mentoring.[6]

Women who graduate in S&T do not necessarily transition to careers in these fields. The expert discussion also looked at key factors surrounding women and S&T employment:

- **Work/life balance** is a prerequisite for women to progress in a career.[7] Mobility—often required for professional development—is difficult if women shoulder an unequal share of family responsibility.[8]
- **Women in senior and leadership positions** are important to the future of S&T.[9] Women should be well-represented in S&T institutions and decision-making bodies.
- **Eliminating the gender pay gap** through evaluation of hiring, promotion, and compensation procedures.[10]

Expert recommendations concerning education and employment did **not** focus on "fixing the women" but on "fixing the institutions": **transforming educational and research**

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[3] Koolwal, G., & Van de Walle, D. (2010). *Access to Water, Women's Work and Child Outcomes.* Washington, D.C.: World Bank Poverty Reduction and Economic Management Network Gender and Development Unit. http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2010/05/10/000158349_20100510114112/Rendered/PDF/WPS5302.pdf

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

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

[6] United Nations Educational, Scientific and Cultural Organization. (2007). *Science, Technology, and Gender: An International Report.* Paris: UNESCO Publishing.

[7] Mason, M., Goulden, M., & Wolfinger, N. (2006). Babies Matter: Pushing the Gender Equity Revolution Forward. In Bracken, S., Allen, J., & Dean, D. (Eds.), *The Balancing Act: Gendered Perspectives in Faculty Roles and Work Lives* (Section I). Sterling, Virginia: Stylus Publishing. Schiebinger, L., & Gilmartin, S. (2010). Housework is an Academic Issue. *Academe, 96*, 39-44; Schiebinger, L., Henderson, A., & Gilmartin, S. (2008). *Dual-Career Academic Couples: What Universities Need to Know.* Stanford: Clayman Institute for Gender Research.

[8] Glover, J. (2002). The Balance Model: Theorising Women's Employment Behavior. In Carling, A., Duncan, S., & Edwards, R. (eds.), *Analysing Families: Morality and Rationality in Policy and Practice*, pp. 251-265. London: Routledge; Xie, Y. & Shaumann, K. (2003). *Women in Science: Career Processes and Outcomes*. Cambridge: Harvard University Press.

[9] Desvaux, G., Devillard, S., & Sancier-Sultan, S. (2010). Women Matter 3: Women Leaders, a Competitive Edge In and After the Crisis. McKinsey and Company Publications, April; Organization for Women in Science for the Developing World. (2010). Fourth General Assembly of the OWSDW, Beijing, China, 27 June – 30 June.

[10] Meulders, D., O'Dorchai, S., Plasman, R., & Rigo, A. (2010). Meta-Analysis of Gender and Science Research Topic Report: Gender Wage Gap and Funding. Luxembourg: Publications Office of the European Union.

institutions to be more successful at attracting and retaining girls and women. Key recommendations (in addition to those noted above) include carrying out gender-sensitive monitoring and evaluation of all programmes.

Women's and Girls' Access to and Use of Technology

The second area of concern was women's access to, development of, and ability to benefit from technology.

Access to technology is key to improving women's and girls' lives. The expert group recommended promoting the development and adaptation of labour-saving technologies and practices to reduce the workloads of women at home and in their productive activities. Priorities include:

- Improved shelter and housing design;
- Improved access to sanitation, waste management, and safe drinking water;
- Improved access to clean and renewable energy;
- Improved clean cooking technologies;
- Improved food processing, preservation and storage technologies.[11]

Access to information and communications technologies (ICTs) can also enable women's economic empowerment. This is where the connection to education becomes important: women tend to use technology less than men due to lower educational levels, less access to resources, and less comfort with technology.[12] Technology, and particularly ICT, is key to supporting women's entrepreneurship. Women's participation in establishing, managing, and leading businesses is key to job creation, wealth generation and national economic growth.

Women, however, are too often seen as passive consumers of technology. The expert group recommended adopting **participatory, user-driven approaches** rather than technology-driven approaches to technology development. Participatory research allows women's context-specific knowledge to be incorporated into technological systems. Women's participation in participatory research has the potential to enhance technologies and also ensure that women's needs are taken into account.[13]

A woman in the Volta region of Southeast Ghana mapping well sites.[16]

The expert group recommends systematically consulting with women on design, use, and deployment of technologies. For example, water procurement is women's work in much

[11] Carr, M. and M. Hartl (2010). *Lightening the Load: Labour Saving Technologies and Practices for Rural Women*. Rugby, UK: International Fund for Agricultural Development and Practical Action.
[12] Huyer, S. et al. (2005). *From the Digital Divide to Digital Opportunities: Women in the Information Society.*
[13] Gonsalves, J., Becker, T., Braun, A., Campilan, D., de Chavez, H., Fajber, E., Kapiriri, M., Rivaca-Caminade, J., & Vernooy, R. (2005). *Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook*. Ottawa: International Development Research Center (IDRC).

of Africa. Consequently, women have detailed knowledge of soils and their water yield. Tapping into this specific knowledge can help civil engineering teams optimize well placement. A study of water projects in 13 nations revealed that "equal representation and participation by women contributes to the success of community-managed water services."[14] Women's participation also correlates strongly with project sustainability.[15]

Integrating Gender Analysis and Innovations into Science, Public Health, and Technology

The expert group's third area of concern was gender analysis and innovations in scientific knowledge and technology design. Including a gender perspective in S&T development stimulates creativity, enhances scientific knowledge production as well as technological and business innovations, and leads to greater social applicability.[17] Gender analysis and innovations focuses **not** on fixing women or scientific institutions but on research. In addition to "fixing the number of women" and "fixing the institutions," we need to "fix the knowledge."

Gender analysis: examining the relevance to each project of possible biological (sex) and socially constructed (gender) differences between women and men. Gender analysis enhances S&T excellence and produces greater social applicability.

But why do we care? Why is it important to include women's views and gender analysis in the content of S&T?

1. **Social justice:** Women have a right to benefit from science and technology to the same extent as men.
2. **Economic development:**

A. On the positive side, including women's views and utilizing gender analysis bring new perspectives and knowledge that can fuel creativity and new jobs.

B. On the negative side, gender bias can be costly—in terms of human life as well as financially. Women have a basic right to health and well-being, which governments have an obligation to protect and promote. When basic research is done, for example, using only men's bodies, the consequences can be dangerous—perhaps even fatal—to women.

Sex refers to biological characteristics that define females and males.
Gender refers to the rules, traditions, and social relationships in cultures that together define and sanction feminine and masculine behaviours. Gender relations also determine how resources are allocated between, and used by, women and men.

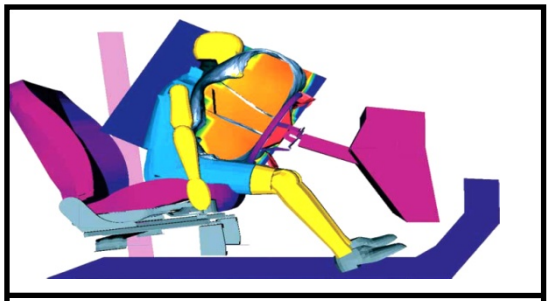
Two quick examples:

i. The first comes from medicine: Between 1997 and 2000, 10 drugs were withdrawn from the United States market because of life-threatening health effects; 4 of these were more severe in women—because testing on both animals in the lab and on humans in clinical trials were done primarily on males. This failure to test properly harmed women

[14] Postma, L., van Wijk, C., & Otte, C. (2003). Participatory Quantification in the Water and Sanitation Sector. *Participatory Learning and Action (PLA) Notes*, *47*, 13-18. http://pubs.iied.org/pdfs/9260IIED.pdf.
[15] Gross, B., van Wijk, C., & Mukherjee, N. (2001). *Linking Sustainability with Demand, Gender, and Poverty: A Study in Community-Managed Water Supply Projects in 15 Countries*. Delft, Netherlands: IRC International Water and Sanitation Centre.
[16] Image courtesy of the Afram Plains Development Organisation (APDO) and water.org.
[17] Schiebinger, L. (2008). *Gendered Innovations in Science and Engineering.* Stanford, CA: Stanford University Press.

and cost the American public billions of dollars in wasted research and development.[18]

ii. A second example from engineering: Automobile crash test protocols define short people (mainly women, but many men as well) as 'out-of-position' drivers because they sit too close to the steering wheel. These drivers—who do not fit the standard male norm—are more often injured in accidents. Importantly, some automobile companies are now working to redesign cars so that all drivers (both short and tall) will be safer.[19]



Automotive designers are utilizing computer simulations to redesign vehicle safety systems.[21]

3. Finally we care about gender analysis because it **promotes excellence and innovation in S&T**. Designing gender analysis into basic and applied research benefits society by making S&T more responsive to global challenges, such as poverty reduction and sustainable development. This is where the action is today. A number of governments and granting agencies—including the European Union, Bill and Melinda Gates Foundation, the World Health Organization, and others—require gender analysis in basic research so that monies funding research produce the best possible medicines, water pumps, agricultural infrastructure, etc.[21] S&T must serve men and women equally across both the developing and developed worlds.

One example of how gender analysis is beneficial:

Using gender analysis, we understand that social divisions of labour put rural and indigenous women in charge of food production and medical care in much of the developing world. These women often possess unique intellectual resources (such as knowledge about the medicinal properties of plants and about preserving biodiversity) as well as material resources (such as seeds for drought-resistant crops). Take the Subanen

Women may possess unique knowledge about the medicinal properties of plants or about preserving biodiversity.

[18] Wald, C. & Wu, C. (2010). Of Mice and Women: The Bias in Animal Models. *Science, 327,* 1571-1572; Zucker, I., & Beery, A. (2010). Males Still Dominate Animal Studies. *Nature, 465 (7299)*, 690; United States General Accounting Office (GAO). (2001). *Drug Safety: Most Drugs Withdrawn in Recent Years Had Greater Health Risks for Women.* Washington, D.C.: Government Publishing Office (GPO).

[19] Bührer, S., Gruber, E., Hüsing, B., Kimpeler, S., Rainfurth, C., Schlomann, B., Schraudner, M., & Wehking, S. (2006). *Wie Können Gender-Aspekte in Forschungsvorhaben Erkannt und Bewertet Werden?* München: Fraunhofer IRB Verlag; Schraudner, M., & Lukoschat, H. (Eds.) (2006). *Gender als Innovationspotenzial in Forschung und Entwicklung*. München: Fraunhofer IRB Verlag.

[20] MSC Software. (2006). *Tougher Airbag System Testing Requires Simulation for Success.* Detroit: Automotive Systems Laboratory (ASL) Publishing.

[21] Bill and Melinda Gates Foundation. (2008). *Gender Checklist*. http://www.enrap.org/events/ifad-events/Checklist%20Gender%20Gates%20Foundation%20April%2008.pdf; European Commission for Community Research. (2004). *Gender and Excellence in the Making.* Brussels: Directorate-General for Research; European Commission. (2003). *Vademecum: Gender Mainstreaming in the 6th Framework Programme–Reference Guide for Scientific Officers/Project Officers.* Brussels: Directorate-General for Research; World Health Organization. (2002). *Integrating Gender Perspectives in the Work of WHO*. Geneva: WHO; WHO (2002). *Gender Analysis in Health: A Review of Selected Tools.* Geneva: WHO; European Commission. (2001). *Gender in Research: Quality of Life and Management of Living Resources.* Brussels: Directorate-General for Research.

women in the Philippines, for example. These women's ethnobotanical knowledge helps their local community secure foods and medicines, prevent deforestation, and better adapt to climate change.[22]

It is important to highlight how **gender analysis also benefits men**. Osteoporosis is a disease traditionally seen as affecting post-menopausal women, and men have historically been excluded from osteoporosis research. Analyzing sex in diagnostic reference models has turned attention to understanding the disease in men. As a result, diagnostic criteria are beginning to include men and improve their health, especially in old age.[24]

The expert group recommended a **systematic review of existing methods of gender analysis for S&T and implementing these methods and concepts in all science, medicine, engineering and technology research**. When developing methods of gender analysis, it is important to:

- Draw methods from all regions of the world;
- Draw methods from across disciplines;
- Analyze differences and similarities between and within groups of women and men;
- Analyze other factors that interact with sex and gender, such as age, ethnicity, and cultural variables;
- Analyze sex and gender in research subjects at all levels, for example in the life sciences from single cells to animal models to human subjects;
- Include users' perspectives, for instance by means of user-driven participatory design methods;
- Integrate gender analysis throughout the research process from funding agency decisions about the research priorities, to methods used to design a project, to the process of hiring and promoting research personnel, to the process of reviewing manuscripts for publication.

Conclusion

Science and technology contribute better to development when gender is taken into account. Governments and research organizations are encouraged to work on three related issues: the participation of women and girls in science and technology education and employment, their access to and use of technology, and the need to integrate a gender dimension into S&T research.

Including women as researchers, innovators, and decision-makers represents more than a gain in talent and skilled labour: it also leads to innovation by including specific types of knowledge women develop and maintain as a consequence of gender roles.

In addition, governments and funding agencies now seek to employ gender analysis as a *resource* to stimulate innovation in S&T, and by doing so to enhance the lives of both men and women around the world. This action is important for all stakeholders to undertake, including

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[22] Suminguit, V. (2005). Indigenous Knowledge Systems and Intellectual Property Rights: An Enabling Tool for Development with Identity. Paper prepared for the Workshop on Traditional Knowledge, the United Nations and Indigenous Peoples, Panama City. Juma, C. and Yee-Cheong, L. (2005). *Innovation: Applying Knowledge in Development.* London: United Nations Development Programme, 91.

[23] Image courtesy of Zell, H. (2006). http://upload.wikimedia.org/wikipedia/commons/1/10/Ricinus_communis_008.JPG

[24] Miller, P.D. (2006). Guidelines for the Diagnosis of Osteoporosis: T-scores Versus Fractures. *Reviews in Endocrine & Metabolic Disorders, 7*, 75-89. http://www.springerlink.com/content/xm83757m60216735/.

ministries of education, S&T, labour, and the environment; funding agencies; universities and research institutions; professional bodies; NGOs and the like.

Innovation is what makes the world tick. Innovation is seen as a way to address major social problems. Both women's equal participation and gender analysis in science and technology are important to enhancing social justice and economic development. Can we afford to ignore such opportunities?