The Impact of Science and Technology Policies in Social Development

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Introduction

The accelerated progress of science and technology in the Latin American/Caribbean region is indisputable, as is its impact on economic, social, and cultural aspects. In spite of women's important contribution to this progress, the region's national programs and policies for scientific and technological development have not fully addressed gender equity as a fundamental component for achieving those goals. Although the number of women as students and professionals in science and technology (S&T) careers has increased over the past decades[1], they are still mostly concentrated on certain disciplines and fields of research[2], under-represented in decision-making positions in scientific institutions[3] and receive less stimulus and support to access, use, and specially to produce, scientific and technological innovations.

The academic, political and social concern to understand the standing of Latin American women in S&T and, in a broader sense, to throw light on the impact of such knowledge and resources on their lives, is quite recent. Except for some pioneer work carried out in the 70's, most studies and proposals, either influenced or utterly based on the gender analysis, arise in the mid 90's and come increasingly into the spotlight towards the end of that period.

A much richer picture has been cast by Women's Studies on other significant topics and dimensions since the 80's. However, there is a historical explanation for that: The prevalence of researchers in this field coming from Social Sciences and their agenda of priorities, either implicitly or explicitly, has led the struggle of women for legal, social and economic equality in the Region[4].

In fact, the so-called Women Studies, and more recently the application of the gender analysis to research, and education have been spiraling out over the past 20 years and have become increasingly more recognized in the academic arena, having some impact on policy-making as from the 90's[5]. During this period, the main topics of concern for those involved in this current were: issues concerning women's access to education, the revision of sexist patterns in school -specially at elementary school level, the critical analysis of the law

[1] In most Latin American countries, women represent –or are just about to- half the studentship across all academic levels. In some countries, women's enrollment in university careers exceeds that of men; for example, in Argentina, Ecuador, Uruguay and Venezuela.

[2] Women's enrollment is mainly concentrated on areas that have been traditionally related to women and their social care-giving role, that is Social Sciences and Humanities, Education and Health. Males continue to prevail in areas such as Engineering and Basic Sciences. It should be highlighted that, on average, women show better rates of attendance and performance throughout their studies. In most Latin American universities, a high percentage of female students complete their studies successfully. In the case of some careers, over 50% of the total number of graduates is females. For example, in Venezuela, in the 90's, women accounted for 66% of graduates. In Argentina, during the 1996-1999 period, there were 413 graduates from the School of Medicine, out of which 55% were women.

[3] For instance, the Argentine National Commission of Science and Technology is made up of 8 board members and only one of them is a female. Evaluation boards are composed of 22 men and only 3 women and working commissions by 48 men and 6 women respectively. The same happens in Chilean Universities regarding female participation in examinations for scientific research projects (FONDECYT). Major gender differences arise in engineering related projects (16% of male vis-à-vis 2% of women submits a proposal). The opposite happens in the area of Social Sciences. Interestingly enough, females far surpass males as aides in research teams whereas men usually hold the project leader position.

[4] This tendency is similar to those in other regions, although most certainly limited institutional resources available for research in Latin America, as well as other economic and political factors, have slowed down growth in this field.

[5] See Bonder, Gloria (publisher) "Studies on Women in Latin America" INTERAMER Collection, No. 56, 1998 OAS.

enforcement, women's position in the job market (particularly the identification of discrimination factors), health-related issues (mainly regarding sexual and reproduction issues), women's limited involvement in politics and other decision-making spheres, their role in social reproduction and community life, the incidence of poverty on their standard of living and, most specifically, the understanding of violence against women, its prevention and redress[6].

These issues continue to stir up concern at present[7]. Theoretical approaches have become more complex, knowledge has increased markedly and a significant critical mass of specialists, or better say "builders" in this field of knowledge, has arisen. However, the increasing significance--more discursive than practical--given to science and technology for the economic and social development of Latin America in the context of globalization has paved a new way to include gender issues in research agendas, develop ad hoc educational activities and stimulate advocacy at national and regional level.

The purpose of this presentation is to show the main findings of a research[8] conducted within the framework of the Meeting of Experts on Gender, Science and Technology held at the Organization of American States (OAS) on August 24-25, 2004. It describes the steps followed by researchers in this field and provides some examples of educational projects aimed at articulating science and technology with social and economic development based on gender equity and human rights. Also, it puts forward a number of policy recommendations stemming from that meeting, such as changes at institutional level, creation, utilization and dissemination of knowledge, education and training, gender equitable S&T workforce, and monitoring of national policies.

II. Women/Gender, Science and Technology in Latin America: Tracing the Boundaries of a Knowledge and Practice Roadmap

The topics that so far have aroused greater interest on the part of researchers, educators and related organizations, as per the corpus of surveyed documents, are set out below. Said topics are not listed based on any priority criteria, but rather they all convey, to some extent, the concerns that have broken ground to include women/gender and S&T relationships on research agendas and to formulate relevant policies in the Region.

Participation of women in all fields, levels and areas of expertise in science and technology. The amount of descriptive research work has increased lately. Based on both statistical and, to a lower extent, qualitative data, such work intends to document women's involvement in science and technology at high-school and university level. Furthermore, it seeks to document their progress over the past decade in graduate and postgraduate education, as well as the hindrances they must overcome to perform successfully when choosing these fields. Some of the most suggestive studies include the analysis of psychological and socio-cultural dimensions (attitudes, values, stereotypes, expectations, gender differences in learning styles and performance) in the field of science and technology. This information furnishes some relevant "input" to recommend changes in science pedagogy and teachers' training.

[6] There is also some significant disciplinary development; for example, in the field of History, aimed at revising official accounts and discloses the silenced or unknown history of women in the Continent.

[7] What is more, certain issues have "come back to the surface", such as poverty and gender due to changing socio-economic conditions in the Region and, therefore, to the need to learn about the crisis differential impact by gender and to spot some appropriate measures.

[8] The study entitled "*Gender Equity in Science and Technology in Latin America: Grounds and Projections in Building Knowledge, Agendas and Institutions"* consisted in surveying, analyzing and systematizing research, documents, publications and programs developed between the 80's and 2004 in connection with gender/women and S&T issues in Latin America. This study also contains a special section describing some regional initiatives specifically geared to women and ICTs. The search for information made it possible to trace historical data accounting for advances and transformations in the theoretical and empirical sphere when dealing with this issue and its related outcomes. This document was used as the foundation for the final declaration of the Meeting of Experts on Gender and Science and Technology.

Virtually all countries within the Region have conducted this type of studies and have obtained similar results[9].

Today there is an increasing number of women involved in S&T related careers and in some areas they have already become the majority, save for the fields of Engineering. Their performance has proven to be the same as or higher than that of males. Doctorate and post-doctorate courses reveal the first differences, especially when they imply that women should move abroad and when they happen to be married or have children. Major inequalities, however, crop up during their professional career and, above all, when it comes to participation at top decision-making levels. Most women scientists are involved in research and teaching at universities and research centers, whereas a greater percentage of males choose the private sector where they can earn higher salaries. One outstanding feature in the Region is the devalued compensation of scientists. In some countries, such devaluation is indeed quite significant. This phenomenon, together with poor investment in S&T by the State, may be directly tied to the feminization of the scientific profession. Professional paths taken by women scientists. Descriptive work based on statistical data analysis prevails. In some cases, such work is supplemented with interviews in which women share their own life experience and provide their insight into discrimination in S&T arena. They also talk about their strategies to strike a balance between family and professional life, their outlook on changing science and institutions, etc.[10].
In this respect, many similarities arise across different studies. The professional career of women scientists is very much restrained by factors inherent to institutional cultures and the academic community. For instance, they are usually appointed to committees having little control or budgetary resources or far-away offices with little support staff, etc. Likewise, their professional career is affected by certain prevailing social and cultural patterns and models that influence --generally in a subtle way-- their behavior. That is, the need to be responsive to the cultural model of the "ideal mother" or the "good mother" which makes women bear a huge burden of demands and social sanctions.

Studies and programs on sexism in scientific and technological education in the formal and hidden curriculum, in the interaction between the faculty and students, in pedagogical books and materials and in the class and educational institutional environment at large[11].
Today national and regional bodies such as OREALC–UNESCO and UNESCO Chair of Women, Science and Technology in Latin America are beginning to set sight on these issues. The purpose is to put into practice the recommendations set forth, once and again, at national, regional and international meetings on women's status and/or those particularly referred to their situation in S&T. In this respect, the strategic role of education is specifically highlighted as the way to overcome inequalities and contribute to the improvement of scientific and technological development. As a result, the creation of programs encouraging girls and young women to approach these fields is fostered.

Over the past years, there has been a shift in this approach. In fact, rather than focusing on getting girls involved in the "hegemonic" model of S&T, emphasis is now placed on the need to transform the curricula and the pedagogical and learning methodologies in order to align them with the concerns and needs of both genders. In other words, the focus is more on issues tied to women rights and human development.
Along these lines, UNESCO Regional Chair of Women, Science and Technology in Latin America has prepared and is implementing a hyper medial environment aimed at training high-school and university teachers. The objective is to set into motion an education program on the "Science, Technology and Society" paradigm enriched with a gender perspective.

[9] It should be highlighted that the regional situation is not different from that at global level.

[10] A multifocal research paper on ***"****Gender Equity in Science and Technology in Latin America: Representations and Proposals by Officials, Researchers and Scholars in Institutional Leading Positions"* provides information from various standpoints. Also, some papers presented at the IV Ibero-American Congress on Science and Technology and Gender held in Madrid on 23-26 July 2002, Instituto de Filosofía - C.S.IC.

[11] See documents prepared by OREALC-UNESCO; Bonder, Gloria and Veronelli, Claudia. Research work: *"Gender Representations in Scientific and Technological Education: School Text Analysis after the Educational Reform"*, 1998.

This program is geared to power new Information Technologies and Communications to build a top-of-the-line educational environment where people from different countries may interact. Current advances in the so-called E-learning or virtual education field show the benefits of using the abovementioned technologies to build innovative learning contexts and teamwork and to set up practice networks and communities at regional level. This environment consists of the following: CD Rom: "Alice in the Land of Science and Technology"[12] and video, "Expanding the Frontiers of Science and Technology: Education gives way to Latin American Young Women"[13], and the virtual training course: "Science, Technology & Society: A gender perspective"[14].

Other topics include: *Theoretical and epistemological work tackled in debates on the patriarchal-sexist nature of the universality, neutrality and S&T objectivity premises and on elaborations on the existence of different styles in connection with knowledge, learning production and use of S&T as per gender*[15].

Recovering the "forgotten history" of women in building scientific knowledge and developing technologies[16].

Educational proposals and programs aimed at improving the quality of training in the field of S&T, as well as the performance of girls and young women, while building non-sexist or co-educational learning environments and pedagogical orientations[17].

Policy and program building approach. Throughout the period described herein a great number of meetings, forums, workshops as well as other national and regional events have taken place. They all put forward recommendations to improve or transform the overall factors that curb the full validity of gender equity in S&T. By reading the documents drawn from such events, one can observe a great deal of repetition, which is not necessarily negative. In fact, it shows a growing consensus on the changes that should be made. Later on, we shall provide a systematic approach of these proposals.

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[12] Inspired by the famous Lewis Carroll novel, this CD ROM uses interactive tools in an attractive visual format to: 1) Encourage an intellectual and emotional "journey" throughout the history of women in science and technology; 2) Stimulate interest and participation of female and male students and create a collaborative learning environment; 3) Raise awareness on the contribution of gender studies to these fields; 4) Offer creative pedagogical activities to students and teachers; 5) Give access to a larger number of documents.

[13] This video is based on life stories of female scientists, teachers' testimonies, historical and statistical data and a revision of gender differences in the socialization processes. Contents are organized by topic and can be used to promote debates and organize workshops or courses with students and/or teachers, as well as for television programs.

[14] www.educoas.org

[15] One of the most outstanding representatives in the Region is Philosopher Diana Maffía. See *"Knowledge and Subjectivity"* published in Science and Technology, Coordinators Eulalia Pérez Sedeño and Paloma Alcalá, Cortijo, Complutense Publishing House, Madrid 2001. Other major contributions have been made by Ana María Cetto: *"Women's Role in the Transformation of Science: A Different Approach"* presented at UNESCO Regional Forum, 1998; and by Hebe Vesuri at the opening conference on *"The Second Sex and Gender Relations in Ibero-American Science. Challenges of a New Scenario"*, presented at the IV Ibero-American Congress on Science, Technology and Gender, Madrid, July 23-26, 2002.

[16] See Mafia Diana *"The Hidden Sex of Science"* (History of Sexual Science and Politics) in Science and Gender, Coordinators Eulalia Pérez Sedeño and Paloma Alcalá Cortijo, Complutense Publishing House, 2001, Madrid. Bonder, Gloria, CD ROM: *"Alice in the Land of Science and Technology"* and the virtual course called *"Science, Technology and Society from the Gender Perspective"*, FLACSO-Argentina, Buenos Aires, 2004.

[17] For instance, the high-impact Regional Program on Professional and Technical Strengthening of Low Income Women (FORMUJER) under the umbrella of CINTERFOR-ILO, which has been developed in various countries, and the preparation of methodologies and resources. See http://www.ilo.org/public/spanish/region/ampro/cinterfor/temas/gender/formujer/index.htm. Another program at high-school level was conducted in Brazil by the State Secretariat of Science and Technology of the State of Rio do Janeiro: *"An Educacao em Ciencia e tecnología, a partir de uma Perspectiva de Género"*, presented by Nilda Teves at UNESCO Regional Forum, Bariloche, 1998. Another recent initiative is the creation of a Multimedia Environment for a High Quality Scientific and Technological Education with a Gender Perspective, developed by UNESCO Regional Chair of Women, Science and Technology in Latin America. A description of this initiative is attached hereto. Also, other projects on male and female equality in technical training access have been fostered in Costa Rica in 2001 by the Ministry of Public Education and endorsed by the National Women's Institute.

An analytical examination of the corpus of the aforementioned knowledge and proposals bring the following aspects to the forefront:

1. Albeit most people apply the concept of gender as the strand of their theoretical framework and/or policy orientation, but very rarely do they define such a concept. This leads to certain ambiguity and reveals lack of recognition of the heterogeneity of conceptions regarding gender and its differences. Actually, almost all papers focus on the situation of women rather than on the relationships/differences between males and females in the face of each problem.

2. Little is known about early studies and publications performed in the Region and internationally. Therefore, there is a tendency to revisit topics and approaches that have been previously explored, thus "reinventing the wheel".

3. Most papers support the integration of women in S&T institutions on the same footing as men. Nevertheless, their current conditions are not usually challenged and, if so, only certain aspects of the institutional procedures and practices are revised. There is virtually no work on the general premises and values guiding the scientific activity from the gender approach or on its link with the various concepts of development and democratization of these social assets and with ethical, funding and cooperation matters, and other key aspects in this field. As well as in other subject matters, the rationale underlying the thinking of many female researchers engrossed with the feminist or gender theory seems to be that of "getting more women to join in and expanding the frontiers" ("add women and stir", according to Charlotte Burch). Promoting more discussions and studies in this area is necessary in order to prove what this stream of thinking and intellectual and political change can contribute to the global analysis of the present and future status of science and technology in different Latin American scenarios.

III. Steps towards Gender Mainstreaming in S&T Policies: Studies, Projects and Programs

The need for gender mainstreaming has already become common ground. Now then, what does it mean and which theoretical, methodological and practical implications does this statement carry? According to the United Nations, "gender mainstreaming purports a process of evaluation of the outcomes of any planned actions on males and females, including laws, policies and programs across all areas and levels. It is a strategy so that the needs and experiences of women, the same as those of males, may provide for a comprehensive dimension of the design, implementation, monitoring and assessment of policies and programs of all political, economic and social spheres in order for both men and women to reap the same benefits and inequality to come to an end. The ultimate goal is to achieve equality."

On the other hand, the United Nations Program for Development states that this integration implies "to take into account gender concerns in every policy, program, administrative and financial activity, as well as in organizational procedures, in order to contribute to a deep organizational transformation." In concrete terms, this would imply to assert that gender analysis and the gender equity principle should underlie all decision-making processes of organizations. To that end, a systematic action is required, which should entail the following, among others: collection of information broken down by sex, ongoing advocacy strategies and teamwork building, gathering all necessary capabilities to influence the decision-making, implementation and evaluation processes.

Which progress has been made in this respect regarding S&T policies in Latin America? Although there are no consistent diagnoses on this issue, experts agree that strategies are still far from becoming a reality, owing to the following restraints, among others:

- A gap between the arguments posed in the documents drafted by international bodies, and the policies set forth by each country, and the actions that are ultimately put into practice.
- The statement of recurrent recommendations and initiatives taken out of the S&T context of each country.

●Proposals based on an ideal "TOP-DOWN" mainstreaming model, detached from the specific scenario of each institution, and lacking any knowledge on the level of perception of the problem concerned on the part of decision-makers, as well as sensitivity and willingness to change by the scientific community.
●Low output of studies, metrics and evaluations of policies based on this approach, which could throw some light on past learning and define "good practices".

IV. Reflections and Orientations towards the Future

"It is not a matter of adding gender to the world's main cosmologies, but rather to rewrite them from their deepest roots."[18]

The study contained herein pinpoints some issues that give rise to complex answers and cannot be dispelled easily. We shall mention only a few to then set forth a number of recommendations agreed upon at an OAS meeting. Except for some small circles, the issues concerning women in the field of S&T are being duly acknowledged by stakeholders responsible for planning and leading national and regional policies on science, technology and innovation. This situation is the result of manifold reasons, such as the following, among others:

●Poor communication between specialized research, education and/or advocacy groups on S&T issues and political stakeholders involved in these areas.
●Reluctance on the part of researchers to tackle this issue, as they consider that their role is exclusively linked to the fulfillment of their individual discipline or field of study and who, therefore, are not keen on what they deem "social or cultural issues."
●Resistance or lack of skills on the part of "gender" researchers to discuss these issues with the "hard" scientific sectors. Also, insufficient information available to support arguments accounting for the need to introduce changes.
●Low priority of this issue on the research agendas of universities and other academic institutions and, therefore, few resources available to develop appropriate lines of research in the medium and long term.
●Lack of dissemination of the results of studies and of coordination between groups involved in this area.

However, there are some signs of opening that should be tapped by taking concrete actions, fueled by the lessons learnt, both past and present, in Latin America and other regions. In principle, we shall mention some favorable aspects stemming from the general agreements reached at the Hemispheric Meeting mentioned above[19]. The final document of the foregoing Meeting[20] stresses the relationship between science and technology and the strengthening of democracy and social development. In this respect, it lays down the foundations to encourage the revision of assumptions, objectives and goals tied to S&T from a gender perspective.

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[18] Report prepared by UNESCO World Commission on Culture and Development: *"Our Creative Diversity"*, published in September 1996.

[19] The position that is being adopted by the EU regarding this issue is a significant source of inspiration. After having gone a long way in this field, the EU is now launching a proactive initiative supported by a Program and Action Plans geared to raise awareness on gender differences and the attainment of equity. This initiative will be materialized in a practical and strategic tool that will prop up the achievements reached in women's involvement in scientific and technological research activities, while maintaining the highest quality standards.
As for this proposal, we would like to highlight two main aspects. First, the need to avoid or overcome previous strategies that were just too broad and did not render the expected results. To this end, we should start off by having a deep knowledge of all procedural, cultural and regulatory factors, among others, that may have an impact on the unequal participation of both genders in different science-related spheres: Education, research centers, the private sector, etc. Second, it poses the need to lay new theoretical and ethical grounds regarding gender social relationships as the starting point to take action. Such grounds should prove that inequalities between males and females are not merely a "gender" concern, but rather a general issue that involves society as a whole, a requirement for the development of democratic processes and a cause for the loss of creative potential, in addition to a limitation to market strategies.

[20] Organization of American States. Inter-American Committee for Integral Development (CIDI) 4th Regular Meeting of the Inter-American Committee on Science and Technology. April 15-16, 2004, Washington D.C. *"Consolidated Hemispheric Science and Technology Policy Proposals for the Americas"* (Draft).

These recommendations add up to the ones put forward at the Meeting of Experts on Gender and Science and Technology (August 24-25, 2004), which were submitted for consideration to the *First Meeting of Ministers and High Authorities in Science and Technology within the framework of CIDI-OAS*, in Lima, Peru on November 11- 12, 2004.

The main conclusions state that, although there is now considerable knowledge and understanding about the critical importance of including the gender dimension in science and technology for sustainable development, this knowledge is not yet widespread among policy-makers, the scientific community, development authorities or the general public, both in developed and developing countries.

It states, "Consequently, there is a need for a campaign to promote enhanced awareness on the gender dimension in all aspects of science, technology and development. This campaign would identify the problems of ignoring the gender dimension and suggest ways for overcoming them." The campaign should bring together all agencies with an interest in this subject. Furthermore, a global and regional plan of action should be developed.

We shall particularly highlight those that pave the way for strategic action in different dimensions and which could render some results in the short and medium term.

Institutional Strengthening: Sensitize and train those in charge of the formulation of science and technology, as well as policy-makers, to integrate a gender perspective and strengthen networks and organizations in this field, through training, allocation of resources, dialogue and planning of common tasks.

Establish channels for systematic dialogue among science and technology researchers, specialists in gender studies, policy-and decision-makers, and pertinent social organizations, in order to plan actions, evaluate their execution, and promote the participation of representative civil society institutions related to science, technology, engineering and innovation in policy discussion.

Creation, Acquisition, Utilization and Dissemination of Knowledge: Generate a database including research projects, researchers, centers and other relevant information that can serve as a source of reference and orientation for future studies in this field.

Develop gender indicators for the area of science and technology, ensuring that all statistics gathered are broken down by sex.

Undertake studies to address new topics and priority areas for gender in science and technology, including: Analysis of everyday practices and institutional structures that reflect concrete behaviors related to gender inequality regarding opportunities, institutional cultures and the academic community;

Priority areas in science and technology: Biotechnology, clean technologies and renewable energies, information technology and communications, materials and nanotechnology and health, among others.

Education and Training: In conjunction with the ministries of education and research institutions, including the academia: renovate curricula and teaching materials, and train teachers to integrate the gender perspective at all levels, in order to provide high-quality scientific and technological education;
Create public awareness programs on the importance of science and technology, including initiatives to encourage parents to provide their children with early stimuli during the first three years of childhood.

Towards a Gender-Equitable S&T Workforce: collect sex-disaggregated data on women's participation in the science and technology workforce, broken down by discipline, sector, salary and position, as well as longitudinal data.

Initiate employment and performance assessment policies, which address women's life responsibilities, sexual harassment and career development.

Recommend action policies to support women's increased representation in research teams and in governing bodies of science and technology.

Implement policies and programs to support women's re-entry into the workforce through bridging, retraining and updating programs.

Implement programs, awards and fellowships to recognize and promote women's achievements in science and technology.

Science and Technology for Economic and Social Development: Develop and implement policies and programs to support the advancement of women in micro, small and medium-sized enterprises.

Promote the knowledge and application of science and technology to address the needs of destitute men and women, taking into account the gendered nature of indigenous knowledge.

Other recommendations that conclude this presentation are:

Building the Knowledge Society through Gender Equity and Equality

New technologies should not reproduce old inequalities.

Reduce gender barriers to Information Technology and Communications (ITC) education and training, and promote equal training opportunities in ITC-related fields for girls and women. Early intervention programs in science and technology should pay particular attention to young girls, with the aim of increasing the number of women in ITC careers.

In collaboration with stakeholders, formulate conducive ITC policies that foster entrepreneurship, innovation and investment, with particular emphasis on the promotion of participation by women.

Develop gender-specific indicators on ITC use and needs, as well as measurable performance indicators to assess the impact of ITC projects on the lives of girls and women.