



**Competitiveness and Innovation Division (IFD/CTI)**  
**RG-T2584**  
**Gender Gaps in Science, Technology and Innovation in LAC**  
**CALL FOR PROPOSALS**

Title of the study:

**Research on Science, Technology and Innovation Gender Gaps and their Economic Costs in Latin America and the Caribbean**

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External advisor: **Janet Stotsky**

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## **1. Justification and background**

In September 2015, the United Nations ratified the Sustainable Development Goals, which set 17 critical socioeconomic and environmental goals for the world's countries to achieve over the next 15 years. In order to obtain these vital internationally agreed goals, modern economies largely depend on their efforts in science technology, and innovation (STI) activities.

However, women worldwide remain largely underrepresented in many dimensions of these activities in academia, public institutions and private sector, generating a potential important shortfall of talent and creativity. This situation reflects a broad set of factors (Castillo et al., 2014; NRC, 2007; OECD, 2012; UNESCO, 2015; World Bank, 2012), such as: widespread cultural stereotypes; a persistent wage-gap in highly-skilled occupations; the difficulty to reconcile professional careers and child-caring responsibilities, because of a work environment that excessively rewards employers who keep long hours and favors competition over cooperation (OECD, 2012); explicit and implicit biases against women in academic life (NRC, 2007; Moss-Racusin et al., 2014) and the absence of adequate role models (Anderson, 2015), which compounds the difficulties women face in confronting these biases (Hunt, 2010).

For the case of Latin-America, available data shows that although the enrollment rate of females in secondary and tertiary education exceeds that of males' (UNESCO 2015, and World Bank, 2012), women remain highly *underrepresented* in many dimensions of science, technology and innovation activities. The latest available data published by UNESCO show that the proportion of women researchers in engineering and technology was just 21 percent in Chile for 2011 and 19 percent in Colombia for 2010. Available data on intellectual property rights (IPRs) also reflects this situation. From 2006 to 2011, only 6.5 percent of the Latin American patents registered in the United States were by solo women, while 69.6 percent were by solo men, and the remainder was registered jointly. The largest number of patents in total was from Brazil, Mexico, and Argentina, in this period. In these countries, solo registrations by women were less than one-tenth of the total while women and men jointly comprised about one-quarter in Argentina and somewhat less than one-quarter in Brazil and Mexico (Morales and Sifontes, 2014).

This situation represents a serious waste of available creative intellectual resources and lost opportunity for societies (Pollitzer and Schraudner, 2015). Therefore, estimating what are the economic costs resulting from women's underrepresentation in these activities is a topic that has lately caught the attention of scholars and policymakers. However, it is still relatively unexplored in the context of LAC, although the situation of women in the region is not dissimilar to that in developed countries.

Considering this, the IDB has approved the Technical Cooperation RG-T2584 "Gender Gaps in Science, Technology and Innovation in LAC", which – among other activities - will finance the development of a research project on the economic costs of STI gender gaps in the region, in order to enhance the capacity of LAC policy-makers to assess and allocate resources needed to implement policies, strategies and action plans aimed at promoting gender equality in STI activities in the region.

## 2. Objectives

The objective of this call for proposal is to generate empirical evidence on the existence and magnitude of the costs of gender gaps in STI activities for LAC. The sources of these gaps have been addressed to some degree in the literature, but the effect that they are having on economic outcomes is still an under-researched field.

More specifically, this call for proposals aims at:

- (1) Identifying what economic outcomes are more likely to be impacted by gender gaps in STI activities;
- (2) Measuring the magnitude of the (positive) negative effects that (closing) gender gaps in STI activities have on the identified economic outcomes; and
- (3) Understanding the mechanisms that explain the causal effect from gender gaps in STI activities to economic outcomes.

## 3. Research questions

The above mentioned objectives can be addressed by research in the different topics that are described in this section. However, researchers are welcomed to propose any additional research topic aligned with the objectives of this call. Researchers are expected to apply quantitative or qualitative methods, depending on the approach and type of research question to be addressed.

1. **Macroeconomic costs:** Addressing the effects of gender gaps at the economy level.

Research questions that could be potentially addressed include:

- *What would be the effect of reducing barriers to women's role in STI activities on aggregate output or output growth and other macroeconomic variables?*
- *From a theoretical perspective, what specific features of the models are critical to capturing the role of women in the most meaningful manner, including time use, wage*

*and other labor market constraints, and constraints on other inputs available to women such as financial credit?*

The number of studies focusing on the macroeconomic losses from women's limited role in STI activities is sparse. However, a larger literature focusing on women's participation in economic markets in general suggests that there is a significant economic loss from women's underrepresentation. These studies take a variety of approaches with emphasis on different aspects of women's economic participation, including their labor force participation and their role as managers and entrepreneurs. Most of the evidence has been derived from the study of developed economies and only a limited number of studies address the developing country context, and specifically, that of Latin America. We briefly summarize some key studies below.

The McKinsey Global Institute (2015) develops a supply side model of women's labor force participation and then scales up women's labor force participation to a level more equivalent to men to estimate the effect on global and country output. Murphy et al. (1991) develop a framework demonstrating how distortions in the allocation of talent have growth implications by focusing on the role of a country's most talented people. Esteve-Volart (2000 and 2004) relies on a similar framework to model the growth effect of sex discrimination in the labor market and managerial positions. Hsieh et al. (2012) estimate the effect of occupational segregation by gender and race in the U.S. market on economic growth. Cuberes and Teignier (2013 and 2015) explicitly account for differences between men and women in labor force participation and entrepreneurship and its effect on economic output through a model of occupational choice. Cavalcanti and Tavares (2008) include endogenous determination of savings, fertility, and labor force participation in a model, where exogenous wage discrimination against women leads them to make different labor market and fertility choices. Agenor and Canuto (2015) assess the losses in productivity and economic output from women's job market participation by developing a model that takes into account gender-based differences in men and women's time allocation. Klasen and Lamanna (2009) model the effect of gender gaps in education and employment on growth. Similarly, Thevenon et al. (2012) assesses the extent to which the increase in women's human capital has contributed to growth in OECD countries by drawing upon a Solow type model.

2. **Scientific production:** Addressing how gender gaps affect research focus, publications, research outputs and scientific collaboration. Research questions that could be potentially addressed include:
  - *What could be the effects of a higher participation of women in science and technology activities on the type of research questions addressed by academia?*
  - *How would productivity of research, i.e. publications, citations or patenting, be affected by a higher participation of women in science and technology activities?*
  - *How would research agenda setting and financing (gender mainstreaming) be affected by a higher participation of women in academic boards? What are the implications of this?*

- *What could be the effects of a higher participation of women in science and technology activities on national and international scientific collaboration? What could be done to facilitate greater women's participation in international scientific collaboration?*

Evidence available for developed countries shows that women perform as good as men in academic activities. For example, NRC (2007) finds that women science and engineering faculty have comparable publication productivity to men, when women have equal access to institutional resources and controlling for other factors. Hunt et al. (2012) find that the composition of women's employment in sciences accounts for a large part of the gap in patenting between men and women, with men in more patent-intensive fields. Also, it has been shown that gender biases in research limit scientific creativity and excellence (Schiebinger and Schraudner, 2014).

3. **Firm Performance**: Addressing the effects of gender gaps at the firm or industry level, including the dimension of high potential entrepreneurship. Research questions that could be potentially addressed include:

- *Is there a relationship between gender balance in employment (diversity) and firm innovation (propensity and intensity)?*
- *Is there a relationship between gender in business ownership and firm innovation?*
- *Is there a relationship between gender in business ownership and employment dynamics?*
- *What could be the effects of a higher proportion of startups founded by women? For example, are women more likely to identify and address different types of needs than men?*
- *What could be the effects on the entrepreneurship ecosystems if gender gaps in high potential entrepreneurship were narrowed?*
- *Considering startups supported by venture capital, is there a performance difference between women and men owned/managed businesses?*

A growing literature examines the effect of gender gaps in STI activities on research, innovation, productivity, market structure, and entrepreneurship. Women's voices are critical in establishing key STI concerns because their orientation toward research may be influenced by their traditional societal roles (UNCTAD, 2011; UNESCO, 2015). Teruel et al. (2015) examine how gender diversity in research and development teams and in the workforce affect product, process, marketing, and organizational innovations, using multivariate probit techniques on panel data from Spain. As for innovation performance, OECD (2012) finds that there is no gap between U.S. men and women, after having controlled for other characteristics. Dezso and Ross (2012) assess the effect of greater women's representation in top management, using panel data on top management teams of Standard and Poor's 1,500 firms. They focus on whether diversity is important for firms that focus on innovation, measured by research and development expenditures as a share of assets and test against several measures of women's

representation. Turner (2009) assesses the effect of gender diversity on innovative performance, with specific focus on research and development. She distinguishes the effect of gender from other forms of diversity. She relies on data from four international companies participating in the European Commission's working group Women in Science and Technology, for 2004 and employs a number of statistical techniques to evaluate the impact of diversity on research and development. Pfeifer and Wagner (2014) investigate the effect of age and gender on firm productivity, using data from German manufacturing. And a critical mass of women in a small setting such as a corporate board can cause a fundamental change in the boardroom and enhance corporate governance (Kramer, Konrad and Erkut, 2006).

4. **Impact evaluation**: Addressing the effects that existing programs aimed at promoting gender equality in STI activities have on key economic outputs.

- *Which is the impact of existing programs aimed at promoting gender equality in STI activities in LAC? What economic outputs are affected by these programs? Through what mechanisms do they impact?*
- *What structures seem to work best and have the most lasting value?*
- *What lessons can be learned to feed-back future policy action?*

Although evaluations of gender-specific programs in STI field are sporadic, this research could extend a growing literature evaluating STI programs in the Latin American region. In particular, the IDB has played a role in encouraging study and evaluation of these programs in the region. Since 2005, the IDB Evaluation Office (OVE), the Strategy Development Division (SDV) and the Competitiveness and Innovation Division (CTI) have evaluated the impact of innovation and research policies in Argentina, Brazil, Chile, Colombia and Panama (Benavente et al., 2007; Binelli and Maffioli, 2006; Chudnovsky et al., 2006; Hall and Maffioli, 2008; Crespi et al., 2011a). Moreover, in 2011 the IDB published a methodological toolkit to evaluate the impact of STI policies (Crespi, Maffioli, Mohnen and Vazquez, 2011), which should be taken into account in the methodological design of the proposal.

#### **4. Content of the proposals**

In order to participate in this project, interested researchers should submit a technical proposal, either in English or in Spanish, no longer than 5 pages, including:

1. A descriptive section that includes: (i) the research question to be answered; (ii) a general conceptual framework related to the research question; and (iii) how the proposed investigation is relevant to this call for proposals.
2. A background section that includes: i) the proposed methodological approach to answer the research question; and ii) the data to be used.

If the methodological approach involves empirical work, this section should include the most likely empirical specification, econometric or simulation techniques to be used. If the methodological approach follows qualitative methods, it should include a description

of the interview method, a list of topics to be covered and a preliminary list of potential interviewees.

If the data to be used involves data collection, describe what type of data will be collected, a draft of the questionnaire and how this will be accomplished within the time frame of the current project.

If the data to be used relies on survey data, include a description of the dataset, access status to it and any other relevant information, like feasibility of linking it with other datasets, among others. Demonstrating access to data is a necessary condition for proposals following a quantitative methodological approach.

3. A final section providing a preliminary view to the nature of the conclusions that the study will yield and potential policy applications.
4. CV of the research team (in a separate annex) indicating a team leader, showing current affiliation and publication record and highlighting any publications that are relevant to the topic at hand (2 pages maximum per researcher).
5. A budget and timeframe (in a separate annex) indicating the resources that will be used within the context of the research work plan. The proposed budget should distinguish between items financed by the IDB (the Bank) and those financed by the research team. The proposed timeframe should take into account that a first draft of the paper, containing preliminary results, should be ready by the end of April 2016, for the Gender Summit 8, to be held in Mexico City.

Final papers will be disseminated as IDB technical notes or working papers and are expected by June/July 2016.

## **5. Products and Schedule of Activities**

The tentative schedule of activities is as follows:

**December 15, 2015:** Call for research proposals issued.

**February 7, 2016:** Due date for receiving proposals. Proponents should ensure that complete documentation is submitted. Complete documentation includes: the research proposal (up to five pages), CVs (up to two pages per researcher involved), budget and timeframe. Send proposals electronically to [gendergapscti@iadb.org](mailto:gendergapscti@iadb.org). Any inquiries relative to this call can also be sent to the same e-mail address.

**February 22, 2016:** Announcement of selected research proposals.

**April 15, 2016:** Due date for receiving a 1st draft of the research paper.

**April 28-29, 2016:** Presentation of the preliminary results in the Gender Summit 8, Mexico City.

**June 15, 2016:** Due date for receiving the 2nd draft including comments to the first draft.

**June 2016:** Technical Seminar in a venue and day to be determined.

## 6. Evaluation of the proposals

The evaluation team will be coordinated by Matteo Grazzi (IFD/CTI) and Jocelyn Olivari (IFD/CTI), with the collaboration of an external principal scientific advisor and of an advisory committee.

**External Advisor:** Janet Stotsky

**Advisory Committee:** Alice Abreu, Gloria Bonder, Ernesto Fernandez, Geoffrey Oldham, and Elizabeth Pollitzer.

## 7. IDB Contribution

The IDB will contribute **up to US\$12,000** for each selected study proposal. The payment schedule will be structured as follows:

**20%** at the signature of the formal agreement between the IDB and the researcher.

**40%** upon approval by the Bank of the first draft of the research paper.

**40%** upon approval by the Bank of the final research paper.

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