The gender perspective in agricultural science and technology:

# ANALYSIS AND STRATEGIES TOWARDS GENDER EQUALITY

2023

PROCISUR
Cooperative Program for the Agrifood and Agroindustrial Technological Development of the Southern Cone

The gender perspective in agricultural science and technology:

# ANALYSIS AND STRATEGIES TOWARDS GENDER EQUALITY

Author: Mariana Stegagnini

2023

We are grateful for the inputs and help provided by the following participants of the PROCISUR gender working group in reviewing this manuscript:

Cecilia Gianoni, PROCISUR; Daniela Bustos, INTA Argentina; Leticia González, INTA Argentina; Raquel Cavalcanti L Valadao Silva, EMBRAPA; Michelle Partarrieu Vistoso, INIA Chile; Carmen Cohene, IPTA; Lorena Clara, INIA Uruguay; Mariana Espino, INIA Uruguay; Silvia Castellano, IICA; Mariela Zúñiga, IICA; Priscilla Zúñiga, IICA.

PROCISUR
Cooperation that works

Cooperative Program for the Agrifood and Agroindustrial Technological Development of the Southern Cone

Stegagnini, Mariana
The gender perspective in agricultural science and technology: analysis and strategies towards gender equality/ Montevideo, Uruguay: IICA, 2023,
32 p.; 21x16 cm.

ISBN: 978-92-9273-094-9
Published also in Spanish and Portugese

1. gender mainstreaming 2. agricultural technology 3. Gender analysis 4. gender equality 5. South America I. IICA II. Título

| AGRIS | DEWEY |
|---|---|
| E50 | 331.48 |



This publication is also available in electronic (PDF) format from the Institute's web site: http://repositorio.iica.int/

Editorial coordination:
Cecilia Gianoni

Translation:
Lourdes Martino

Design and layout:
Esteban Grille



Montevideo, Uruguay.
2023

# Content

# List of acronym

| | |
|---|---|
| **LAC** | Latin America and the Caribbean |
| **AMIT** | Association of Women Researchers and Technologists of Spain |
| **IDB** | Inter–American Development Bank |
| **ECLAC** | Economic Commission for Latin America and the Caribbean |
| **CGIAR** | Consultative Group on International Agricultural Research |
| **S&T** | Science and technology |
| **GIA** | Gender impact assessment |
| **EMBRAPA** | Brazilian Agricultural Research Corporation |
| **AI** | Artificial intelligence |
| **R&D&I** | Research, development and innovation |
| **IICA** | Inter–American Institute for Cooperation on Agriculture |
| **INACAL** | National Quality Institute (Uruguay) |
| **INIAs** | National Agricultural Research Institutes |
| **INTA** | National Agricultural Technology Institute (Argentina) |
| **IPTA** | Paraguayan Institute of Agricultural Technology |
| **LACCEI** | Latin American and Caribbean Consortium of Engineering Institutions |

| | |
|---|---|
| **LATU** | Technological Laboratory of Uruguay |
| **LGTBIQ+** | An acronym that includes diverse gender identities: lesbian, gay, transsexual, bisexual, intersex, queer or unlabeled and all the groups not included in the previous terms |
| **MMCIT** | Inter–institutional Roundtable Women in Science, Innovation and Technology (Uruguay) |
| **SDGs** | Sustainable Development Goals |
| **OAS** | Organization of American States |
| **UN** | United Nations |
| **UN Women** | United Nations organization dedicated to promoting gender equality and the empowerment of women worldwide |
| **PROCI** | Cooperative Program in Agricultural Research |
| **PROCISUR** | Cooperative Program for the Agrifood and Agroindustrial Technological Development of the Southern Cone |
| **GGDP** | Global gross domestic product |
| **UNDP** | United Nations Development Programme |
| **SAGA** | STEM and Gender Advancement |
| **SERNAMEG** | National Service for Women and Gender Equality (Chile) |
| **STEM** | Science, technology, engineering and mathematics |
| **ICT** | Information and communication technology |
| **UNESCO** | United Nations Educational, Scientific and Cultural Organization |
| **UIS** | UNESCO Institute for Statistics |
| **WEF** | World Economic Forum |

# Foreword

The Cooperative Program for the Agrifood and Agroindustrial Technological Development of the Southern Cone (PROCISUR),[1] created in 1980 with the support of the InterAmerican Development Bank (IDB), is a joint initiative of the national agricultural research institutes (INIAs) of Argentina, Brazil, Chile, Paraguay, Uruguay and the InterAmerican Institute for Cooperation on Agriculture (IICA). Since its creation, the Program has been transforming its strategy and objectives to adapt its agenda to the needs set by the regional and global political, economic, environmental, social, scientific, and technological contexts.

In this context, including gender issues in the agendas of public and private organizations has become more relevant in recent years. Each country has its gender-related priorities, and the following actions illustrate the progress made: a) adopting the international SDGs (Sustainable Development Goals) agenda established by the United Nations General Assembly in 2015, which is to be achieved by 2030 and whose SDG 5 is Gender Equality; b) mainstreaming gender is becoming a requirement to obtain funding for projects; and c) clearly, the feminist movement for equal rights, which drives social transformations and creates meanings in all areas.

In particular, gender gaps at work have been addressed in the INIAs of the Southern Cone, in the inequality of rural women and, to a lesser extent, in science and research. The main actions include visibility campaigns, efforts to change regulations in countries and organizations, and awareness-raising and training strategies. In addition, some projects around systems of care are beneficial, as are the diagnostic and certification efforts made by some institutes.

However, despite the significant progress made, there is still a long way to go to achieve absolute equality at work and eliminate

1 PROCISUR is comprised by the INIAs of Argentina, Brazil, Chile, Paraguay and Uruguay, as well as IICA. Bolivia was a member of PROCISUR since its creation until 2019. PROCISUR's website is www.procisur.org.uy.

gender bias in institutional knowledge production. The considerable gap between discourse, regulations and implementation must be effectively addressed. To do so, we must fully understand the gender agenda, the current gaps, and the implications of developing unbiased science, technology and innovation (STI) policies for the region's scientific and technological development. Vast evidence points to how scientific research and innovation benefit from a diverse and multidimensional perspective.

Indicators show that the COVID–19 pandemic has slowed and even halted progress and created new barriers toward gender parity in all areas. In 2021, PROCISUR's Steering Committee prioritized regional work to strengthen initiatives to reduce gender gaps. It also recognized the long road ahead for the institution, both internally and in its public life.

We created a Gender Working Group, including institutional representatives from the five INIAs and the IICA, to jointly prioritize and outline some necessary strategies. The main strategies are: a) ongoing training of institutional stakeholders to ensure that organizations can approach strategic planning from a gender perspective b) assessing the problem by defining and surveying indicators that make inequalities visible; and c) creating tools to help the institutes mainstream the gender perspective in program and project design.

The following pages present the frame of reference that guides the joint development of our lines of action. We hope this publication significantly strengthens the region's agricultural and agroindustrial science, technology and innovation systems.

**Dr. Cecilia Gianoni**
Executive Secretary
PROCISUR

# Summary

Mainstreaming gender in science and research is a complex challenge. In recent years, valuable efforts have been made to include the gender perspective, particularly in the southern Cone's national agricultural research institutes (INIAs), which are part of PROCISUR.[2] This has been achieved by implementing strategies promoted by national governments, organizations that bring them together and supranational agendas. This document aims to review these efforts within the analysis of gender and science. Additionally, it seeks to include them in the agenda addressing the challenges of agriculture in the region, which are decisive in the INIAs' action plans.

The first part of the document describes the gender gaps in science and technology. More quantitative and apparent reasons for the unequal participation of women in scientific fields are addressed. A more qualitative analysis of labor segregation is also conducted through descriptive categorizations that summarize the most frequent forms of violence and discrimination. Then, the consequences of this unequal scenario on scientific and technological contents and practices are reviewed. Particular emphasis is given to mainstreaming gender in scientific production.

The second part of the document presents the main advances and challenges in reducing gender gaps in the INIAs of the Southern Cone. Valuable experiences are described, as they are more likely to positively impact the path towards equality and mainstreaming gender in the region's agricultural research projects and programs.

In summary, the quality of scientific-technological innovation in the region's agriculture and agroindustry and its potential to improve its global positioning and competitiveness can be significantly enhanced by reducing gender gaps. However, we need to do

2 INTA (Argentina), EMBRAPA (Brazil), INIA (Chile), IPTA (Paraguay) and INIA (Uruguay) and IICA.

more to overcome this challenge. We must implement processes that include an intersectional analysis[3] and the gender dimension in institutional projects and programs from the beginning. In this sense, international cooperation can strengthen national agendas and initiatives that add value to regional research and optimize its results.

3 Intersectionality is a tool that recognizes and proposes analyzing systemic inequalities given the convergence of different social factors, such as gender, ethnicity and social class. The term was used by attorney Kimberlé Crenschaw in a court case against General Motors in the United States (1989) to highlight the legal invisibility of the multiple discriminations suffered by black women workers. Gender analyses have formalized intersectionality as a paradigm of analysis.

# I. Introduction

In 2015, the 193 United Nations Member States adopted the 2030 Agenda for Sustainable Development,[4] the roadmap towards a new development paradigm, which promotes inclusive economic growth, poverty eradication, protecting the planet and reducing inequalities. This agenda has 17 objectives and frames the actions taken by the United Nations System.[5]

Gender equality and empowering women and girls are central to their fulfillment. The entire agenda states that development will only be sustainable if it benefits everyone equally. The plan specifies this in SDG 5 and target 5.5 as follows: "Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life."

The fulfillment of this target seeks to guarantee a fundamental human right: gender equality. It has multiple consequences for the economic development of nations, improving people's quality of life and the countries' social, economic, and environmental situation. A 26% increase in the global gross domestic product (GGDP) would be expected in 2025 if women's participation in the global economy were the same as that of men. The anticipated increase in Latin America and the Caribbean (LAC) would be 34% (Basco and Lavena 2019). Beyond this increase in the dynamics of economic growth, building parity requires transforming education, access to opportunities, and redefining institutional narratives and decision-making spaces to create more inclusive opportunities that foster equality.

Women are underrepresented in science and technology (S&T) policies. In addition, few women are in prominent research and development or senior positions. As stated in the sections below, vast gender differences appear in the success rate of research funding

4 https://www.un.org/sustainabledevelopment/es/objetivos-de-desarrollosostenible/

5 Each of the 17 Sustainable Development Goals (SDGs) includes targets to be met.

and the ratio of women on scientific councils or of men and women at different points in their careers.

Any reference to gender in this document includes the diversity of the LGTBIQ+ community. However, dichotomous data are presented in the female and male categories because the region's INIAs lack disaggregated data for a fuller analysis.

S&T becomes deeply significant in the current scenario of dramatic transformation. The world is going through the fourth industrial revolution, characterized by exponential technological change and the convergence of innovations in the physical, biological, digital and cognitive sciences.[6] This revolution is everywhere and affects all production systems and public and private organizations and their management models. This phenomenon is defined in agricultural production as Agriculture 4.0 or Digital Agriculture. It must sustain all kinds of pressure, mainly climate change, increasing urbanization, high projected population growth, environmental demands, the limits of arable land and the loss of biodiversity. The Southern Cone countries, agri-food leaders, have made Agriculture 4.0 one of the central lines of action of their visions for the future and strategic plans. Two lines of action stand out for this work: the convergence of nanotechnology, information technologies, biotechnology, and cognitive sciences and the application and integration of data sciences, software tools, and systems models.

In LAC, research and technological innovation have increased agricultural productivity over the last few decades (Stads et al. 2016). The diversity of LAC countries regarding social, economic, environmental and agricultural research systems implies challenges for governments and S&T institutions that differ from one country to another. However, new knowledge and innovation are decisive in the current scenario of all nations. Opportunities will be successfully grasped depending on how efficiently the systems for creating

6 German economist Klaus Schwab, founder and executive director of the World Economic Forum (WEF), has been one of the leading analysts of this transformation. He states: "We stand on the brink of a technological revolution that will fundamentally alter how we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before." (Schwab 2017:8).

new knowledge and innovation can drive transformation (Trigo et al. 2013), making the role of agricultural S&T institutions essential.

Gender equality as a cross-cutting policy in INIAs' initiatives would foster a more significant use of talents and opportunities and enhance future sustainable development. The following questions can guide our analysis to help us recognize the main characteristics of gender dynamics in the region and, more specifically, in the INIAs of the Southern Cone: Can scientific and technological production exist without a plurality of perspectives? Is it feasible to achieve gender equality in science and technology in the region in the medium term? Is it possible to eliminate biases in scientific and technological production? Can the acceleration of Revolution 4.0 avoid reproducing historical inequalities in the future, or will it perpetuate them?

# II. Gender gaps in science and technology

Gender gaps are linked to how gender relations work, as they comprise the fabric of the social structure, organizational designs and practices, work processes and spaces, and sociability within and outside organizations, among other factors. This helps us understand the consequences of men (and the pressures of hegemonic male culture) defining and dominating organizations or management models (Candela 2022). This sociocultural construct is dynamic and, in practice, becomes a mechanism for controlling access to resources and opportunities.

## II. 1 "Why so few?"

In 1965, sociologist Alice Rossi posed a question in *Science* about the relationship between science, technology and society: Women in Science: Why So Few? (Rossi 1965). The questioning was innovative because the issue of the absence of women in scientific knowledge production was identified and included in the agenda in the following decades. Since then, multiple studies on science, technology and gender have documented and analyzed the consequences of marginalizing and segregating women. Since the "United Nations Decade for Women: Equality, Development and Peace" (1976–1985), particular importance has been given to the role of women in science and technology (UNESCO 2007). The call to action intensified and became constant. The low number of women in science, technology, engineering, and mathematics (STEM) is a particular manifestation of this problem, which is relevant to this analysis. Another essential factor is this gap's steep current and projected impact on increasingly digitized economies.

Less than 30% of the world's researchers are women, and as is the case in the labor market in general, the gap widens the higher the level reached in the career ladder. There is a higher ratio of women in the lowest positions of responsibility. The literature on the

subject frequently refers to this situation as a leaky pipeline: women enter the system, graduate from universities, but fall through the cracks during their scientific careers. According to a UNESCO report (2018), women have reached parity (45%–55%) worldwide at the bachelor's and master's degree levels, accounting for 53% of the students. However, they are 43% of PhD candidates. The gap widens in research, where women account for only 28.4%, and becomes a chasm at the highest decision-making levels.

The UNESCO Institute for Statistics (UIS) is an online, interactive tool for accessing the latest available data for countries at all stages of development to explore and visualize gender gaps in research and educational trajectories. There, the overall data analyzed regionally are more encouraging, as LAC ranks second: the LAC data count reflects that the total number of women employed in research and development is, on average, 45.1%.[7] Despite this, horizontal and vertical segregation remains high: women researchers are still underrepresented at the highest professional levels and remain a minority in many STEM fields in almost every country in the region (Bello 2020).

We must focus on STEM disciplines related to this paper's topic: science and research in agricultural innovation institutions in the Southern Cone. As mentioned in the introduction, the exponential transformation caused by Revolution 4.0 on food production impacts these organizations' institutional research, development, and innovation agendas.

The IDB published the series "The Future of Work in Latin America and The Caribbean," which collects data from the region based on different variables—the "labor market GPS"—including recognizing declining and emerging occupations based on LinkedIn data. Technological change is profoundly transforming the occupations and skills required by the labor market worldwide:

> Artificial intelligence (AI) and robotics are gaining ground as we enter the fourth industrial revolution, so more tasks and occupations will become automated. If history serves as an

7 Data are available on the UNESCO Institute for Statistics (UIS) website per country for 2015–2021: http://data.uis.unesco.org/

> example, technology's resultant destruction of jobs will be accompanied by creating new ones in existing occupations and other occupations that are still hard to imagine (Azuara et al. 2019: 29).

Amaral et al. (2018) analyzed four Latin American countries (Argentina, Brazil, Chile, and Mexico). They found that of the 20 skills that increased the most in the average of the 4 countries, 10 are directly related to the development of technologies. In order of importance, we find Web design and software development tools, data storage, mobile application development, software development life cycle, human–computer interaction, software testing, AI, cloud computing, and scientific computing.

This indicates that efforts to reduce gender gaps in scientific and technological institutions require special attention when developing strategies that enhance the participation of women, particularly in STEM careers.

## II. 2. Gender relations and perceptions in scientific and technological practice

We need parity indicators to showcase and understand the complexity of gender gaps in science and research. Additionally, the analysis must include the qualitative aspects of the problem. Truly enlightening descriptions of occupational segregation have been made based on theoretical reflections and empirical material. These descriptions describe the most frequent violence and inequalities. Some of them are presented below.

- The **glass ceiling** is the metaphor that describes vertical segregation as an invisible but genuine barrier that limits women's career advancement. Women with a certain level of education and experience do not grow in their fields of work at the same rate as men with equal or even lower qualifications. It has become popular as a representation of systemic blockage in the decision-making process and upward mobility in the private and public sectors. Marilyn Loden, a business management consultant and diversity activist, developed the concept in 1978 (BBC World Newsroom 2017). She defined it as a company's pattern

of employee promotion where, although the written rules are not biased, the practice reproduces leadership stereotypes that directly associate it with masculine qualities.

- The **glass walls** is the metaphor that describes horizontal segregation. It represents invisible walls that segment women's educational and occupational development and group them in less dynamic and lower-paid sectors of the economy. This segregation arises from social dynamics that begin in childhood and is illustrated by the feminization of areas such as domestic work or education. This is a clear inequality marked by stereotypes and gender roles based on social and cultural constructs, which affect behaviors and expectations and influence (personal and institutional) decision-making. It shapes opportunity frameworks when there is a division of labor where women have jobs that reproduce female stereotypes and are relegated from other occupations considered typically male. STEM is a scientific area with horizontal segregation. Agriculture also has multiple recruitment biases.

- The **sticky floor** concept describes the slower pace of advancement for women than men in new positions. The lower promotion dynamics of women within organizations can be explained, among other things, by the challenge they face when balancing personal and professional lives when they reach a particular position.

- **The Wollstonecraft dilemma** is a conceptual conflict reflected in Mery Wollstonecraft's work, conventionally considered the origin of the feminist movement. In her book, published in 1972, Wollstonecraft calls for women's right to study and access the public world. Women's participation requires them to show qualities typical of male socialization: they must become men or be like men. Additionally, she advocates for the protection of motherhood (Wollstonecraft 1792). "Wollstonecraft's dilemma reflects the contradictions between the democratic principles of equality and the sexual order of inequality" (Reverter 2011:122). More specifically, the contradiction between the world of work and motherhood and care is summarized in the world of work.

However, more particularly in the field of science and research, other more specific descriptions characterize gender relations and their implications in science and technology in addition to the four concepts above.

- **The Matilda effect**. Matilda Joslyn Gage was the first activist to denounce the male appropriation of women's research achievements, which rendered them invisible. These women, ignored by history, cannot become culturally recognized models for girls and young women, which perpetuates stereotypes of science as a "boy thing." On many occasions, this invisibilization has gone hand in hand with the usurpation of authorship. There are popularly known cases of this phenomenon.[8] Efforts to make this gap visible and demand its reduction are supported by the public, private and civil society sectors through the figure of Matilda. Under the premise "We believe that the low presence of women in STEM courses is partly due to the lack of role models that encourage scientific vocation in girls and adolescents," the Association of Women Researchers and Technologists of Spain (AMIT) and the European Parliament launched the global movement #NoMoreMatildas to make women researchers visible, recover people lost in history and include them in learning materials to inspire others. In Latin America, within the 2020 International Multi-Conference of the Latin American and Caribbean Consortium of Engineering Institutions (LACCEI), the Latin American Open Chair "Matilda and Women in Engineering" was officially established to promote engineering vocations in girls and young women in Latin America and the Caribbean.[9]

- **The icon, Marie Curie**. Marie Curie was a remarkable scientist who studied and made discoveries (with her colleague and husband Pierre Curie) on radioactivity, was the first Doctor of Science to hold a professorship at the Sorbonne University in Paris,

8 The most famous case is probably that of Rosalind Franklin and DNA. Watson and Crick discovered the helical structure of DNA, but, as has been later recognized, the data they used to solve the rest of the structure were based on the results of Rosalind Franklin.

9 The Matilda Chair is defined as an academic space for debate, reflection, the collective construction of knowledge, teaching and research, and organizing activities that promote equal rights, opportunities and spaces for women in the academic and professional spheres. The virtual space is located at: https://catedramatilda.org

and was the first person in history to receive two Nobel Prizes. However, when she attempted to join the French Academy of Sciences in 1911, she was rejected because she was a woman. Her standing and the path she traveled represent how relegated women have been in scientific communities and knowledge production throughout history.

Finally, this qualitative description of the segregation of women in the workplace and particularly in science must highlight the critical contributions of gender studies to the production of science and technology in the last five decades: gender preconceptions operate on science and technology outputs, but these, in turn, reinforce gender stereotypes and social roles, as shown, for example, by research on the scripts that tell the story of the design of technologies such as household appliances, automobiles or video games (Van Oost 2003). Research on science, technology, and gender has made science and technology more aware of how gender preconceptions are their constituents. This is discussed in more detail below.

## II. 3. The gender dimension in science and research: an opportunity to improve S&T production

The absence, invisibilization, and segregation of women in science leads us to reflect on the impact on scientific and technological content and practices. As mentioned above, feminist approaches are the starting point to analyze the sexist and androcentric biases in science and technology that perpetuate stereotypes, inequalities and fallacious or erroneous results in scientific studies and activities.

Recent examples show the multiple consequences of biased scientific and technological production in different fields of knowledge. Medicine is probably where this has happened the most. Medical underdiagnosis of heart conditions, health care and prevention, as well as patients' self-perception of symptoms, have led to the figure of 95% of female deaths after a heart attack that could have been avoided (Ruiz 2009 and Portinari 2017). Pharmacological research that neglects biological differentiation in its trials has

reappeared on this agenda following studies indicating differential side effects in menstruating people (Ponce 2022).

Machine learning and AI are frequently cited as areas that illustrate biased design. Biased technologies that intersect with other forms of discrimination (ethnicity, body shape, and others) become evident in facial identifiers that do not recognize women of African descent or word processors with discriminatory language models (Alonso et al. n. d.).

Regarding the prevention of occupational risks and gender bias, efforts to develop preventive strategies seek to preserve the health and safety of working people by considering sex and gender differences in each stage. This involves analyzing the most frequent causes of occupational accidents disaggregated by sex and frequent diseases, integrating time use, and analyzing safety devices considering physical aspects and sizes, among others (Department of Labor of Catalonia 2010).

In November 2019, *Nature* published an article in its Perspective section called "Sex and gender analysis improves science and engineering" (Tannenbaum 2019). The authors argued that including sex and gender analysis in experimental design has led to advances in many disciplines, such as improved heart disease treatment and understanding of the social impact of algorithmic bias. They called on researchers, funding agencies, scientific journals, and universities to join efforts to implement sound sex and gender analysis methods, as they are vital to interpreting, validating, reproducing, and generalizing research results. In this way, they embody the demand for improvement in terms of gender equality in scientific and technological production.

In 2009, Standford University (USA) began implementing an intersection analysis project for innovation and scientific discovery: Gendered Innovations in Science, Health and Medicine, Engineering and Environment. This project has grown and currently works through international collaboration. Looking to the future of science and technology shows us that it is essential to identify biases but invites us to go further. The project has engaged over

200 experts from Europe,[10] the United States, Canada, and Asia in peer-reviewed interdisciplinary workshops and collaborations. The objective is to provide scientists and engineers with practical methods for sex and gender analysis. Professor Londa Schiebinger, the project manager, states that doing flawed research costs lives and money.[11]

It is essential to mainstream gender to achieve excellent scientific production that adds value to research and sustainability and provides better answers to society and the economy.

The European Commission's Horizon 2020 Expert Group published a policy review in July 2020 that updated and expanded its assessment of how this type of analysis contributes to science and research. The document states that integrating sex and gender analysis in research and innovation adds value to the research and is, therefore, essential to ensure Europe's leadership in science and technology and to support its inclusive growth.

The dimension covers all aspects of Horizon Europe 2020 and contributes to several stages in the research, development and innovation (R&D&I) cycle. The results of the assessments guide future programs and seek to contribute to the achievement of the SDGs.

In brief, integrating sex and gender analysis in research design, where relevant, can:

- add value to the research in terms of excellence and creativity;
- help research teams and innovators challenge gender norms and stereotypes and rethink standards and role models;
- lead to a deep understanding of diverse gender needs, behaviors and attitudes;

10 The groups of experts included the participation of the European Commission, Horizon 2020, the U.S. National Science Foundation, Canada, and Asian countries.

11 Taken from her lecture at the Spanish National Research Council (CSIC) held in November 2019. Available from https://www.youtube.com/watch?v=MTcCCBl_L2M

- address citizens' needs from a diverse perspective and, therefore, improve the social relevance of the knowledge, technologies and innovations produced;
- contribute to producing better goods and services that create greater development opportunities.
- The Gendered Innovations project works on several methods specified in more detail on its public platform.[12] The following are some examples:
- Alarming examples of algorithmic bias are well documented in AI. As AI becomes increasingly ubiquitous in everyday life, this bias, if left uncorrected, may amplify social inequalities. Understanding how gender works in the algorithm context helps researchers make conscious decisions about how their work functions in society. New methods have been designed to help computer scientists, robotics specialists, and AI researchers and innovators incorporate gender and intersectional analysis into their technical research.
- In robotics, robots[13] are designed in a living world with gender norms, identities, and relationships. Designing hardware according to current stereotypes can be dangerous and reinforce them. Robot and AI designers create products that reflect the world and support and validate certain stereotypical gender norms, perhaps unintentionally. The challenge for designers is to understand how gender is embodied in robots to design them in a way that promotes social equality.
- The project includes two case studies on agriculture[14] on the clear premise that agricultural innovations tend to affect women and men differently. Most innovations focus on solving technical problems. This case study posits that these innovations

12 The methods are developed on the project website: https://genderedinnovations.stanford.edu/

13 See case study at http://genderedinnovations.stanford.edu/case-studies/ genderingsocialrobots.html#tabs-2

14 Full case study at http://genderedinnovations.stanford.edu/case-studies/ agriculture.html#tabs-2.

often fail to account for a) how gender norms influence the implementation of technical solutions or b) how the implementation of technical solutions will influence gender norms. As a result, innovations may not reach women and may even amplify inequalities.

- One of the cases presented is that of gill nets in Bangladesh.[15] Gender-related cultural and religious expectations prohibit women in rural Bangladesh from collecting fish, even from their ponds. To support gender equality and ensure food security, WorldFish introduced, as an innovation, gill nets that women can make in the poorest areas. They are lightweight, preventing women from getting their clothes wet and making the task easier for them.

- The second case is GENNOVATE,[16] created by the gender experts of the Consortium of International Agricultural Research Centers of the Consultative Group for International Agricultural Research (CGIAR). This program aims to develop transformative approaches that include gender norms in innovation processes. It seeks to address an urgent need for agricultural research for development to better understand and reduce gender barriers to adopting innovations in agricultural and natural resource management. In brief, their approach aims to:

    1. encourage a critical examination of gender roles, norms and relations;

    2. recognize and strengthen positive norms that support equality;

    3. promote the position of women, girls and marginalized groups;

    4. help transform the underlying social structures, policies and widespread beliefs perpetuating gender inequality.

15 See the full case study at http://genderedinnovations.stanford.edu/case-studies/agriculture.html#methoda

16 https://gennovate.org/

GENNOVATE provides examples of standardized research methodologies and tools that include gender norms. It seeks to ensure its methods can be applied in any gender-sensitive baseline study or gender impact assessment (GIA).

# III. The Southern Cone: institutional mapping of science and technology for agriculture

The 2018 United Nations Educational, Scientific and Cultural Organization (UNESCO) regional science report for LAC shows the differences in specialization in specific scientific disciplines. It shows that research in LAC is mainly done in agriculture and geosciences. However, no other Latin American country except Brazil has an R&D&I intensity like that of dynamic emerging market economies. Governments should start by increasing the number of researchers to reduce this gap. Finally, there is a trend towards greater patenting in natural resource–related sectors such as mining and agriculture, mainly through public research institutions (UNESCO 2018).

In most countries in the region, the institutional, agricultural S&T system in LAC comprises many government research entities, higher education institutions, and private and international non–profit organizations. Of this group, the INIAs are the largest and most encompassing in scope. They were created in all Latin American countries as of the late 1950s. The INIAs include similar elements in terms of their institutional organization, objectives and mandates and have also evolved similarly following the transformations of the region and the international context. All of them have played a significant role in the modernization of the agricultural sector in Latin America (Piñero 2003). Agricultural research has been critical in increasing agricultural productivity in the region in recent decades. The analysis "Agricultural Research in Latin America and the Caribbean" (Stads et al. 2016) is primarily based on a series of country fact sheets developed by the Agricultural Science and Technology Indicators Program. It is a clear description of the map of stakeholders and the institutional distribution of agricultural research in the region, as follows:

- Some LAC countries have well-developed national agricultural research programs and produce technologies and methods applicable in countries elsewhere in the region and the world.
- IICA, headquartered in Costa Rica, helps coordinate, promote, and facilitate sustainable agricultural development in the region. The institute works with all LAC countries and several regional and other organizations.
- The Cooperative Technology Development Programs (PROCIs) comprise a group of subregional mechanisms, each formed by national agricultural research institutes and IICA. PROCIs mainly focus on developing and strengthening institutions, designing and coordinating multi-country research projects, and promoting technology transfer. PROCISUR is the current valid program in the Southern Cone. It includes the INIAs of Argentina, Brazil, Chile, Paraguay and Uruguay, and IICA.

## III. 1. Mainstreaming gender in the INIAs of the Southern Cone: Regulatory framework and current initiatives

In 2021, PROCISUR presented the document "La perspectiva de género como agenda de oportunidades estratégicas para los institutos de investigación agropecuaria" (The gender perspective as an agenda of strategic opportunities for agricultural research institutes),[17] which resulted from several meetings with the gender focal points of the member institutions.

This PROCISUR platform promotes the development of a joint agenda on the subject based on collective spaces for reflection, which will enhance individual progress and create new strategies strengthened through regional cooperation.

In 2021, the PROCISUR Gender Working Group in science and technology institutions was created. In 2022, it organized a training program to build the capacities and increase the knowledge on gender issues of the human resources of the INIAs and IICA.

17 Stegagnini Mariana, in collaboration with the PROCISUR Gender Working Group, 2022. The document is available on the PROCISUR platform:https://www.procisur.org.uy/adjuntos/procisur_documentos-doc-base_bd6.pdf

## III. 2. Outstanding experiences

The following data were collected in 2021 from the INIAs that make up PROCISUR:[18]

- The global percentages of female staff in the INIAs of the Southern Cone range between 30% and 40%,[19] while their presence in top management positions is nil or as low as 20%. In recent years, Argentina's INTA, Chile's INIA and EMBRAPA have had women presidents for the first time.

- They reported no pay gaps for the same range of positions. However, in this case, the "pay gap" refers to a comprehensive, average consideration of the women working in each institute. Proportional differences are considered in the hierarchy of positions and the benefits linked to their access.[20]

- Parity indicators are not used regularly by institutes as a follow-up variable for monitoring purposes. In general, there was no or very low systematization in the follow-up of gender indicators and a weak formalization of the issue in institutional objectives. However, some experiences seem encouraging, as in the case of Chile's INIA, which in 2022 achieved parity in the regional directors appointed (five women and five men).

A survey of gender initiatives conducted among PROCISUR's INIAs through the gender group shows that relevant efforts have focused mainly on institutionalizing the perspective and promoting visibility and awareness-raising. The main lines of action are highlighted below:

18 Except where specified, the information below was taken from interviews conducted by the author during 2021 with the gender focal points of INTA, IPTA, Uruguay's INIA, Chile's INIA and EMBRAPA, within the framework of INTA-IDB Technical Cooperation ART-1194.

19 The members of the PROCISUR gender working group representing Argentina's INTA indicate that 40% of the staff members are women.

20 Unless we compare the salary of a single woman with that of a single man, since these calculations are always made for groups of women and men. Then, the figure commonly used for each of these groups is the average of all the amounts in the group. This analysis includes an assessment of the impact of loss of attendance recognition and its effect on caregivers on pay salary in the absence of regulations. More information can be found from UN Women: https://shorturl.at/tCFZ2

- **Gender sensitization and training** This has generally been done as an introduction by promoting awareness and a common conceptual framework. Furthermore, perceptions, concerns and reflections on the subject are compiled collaboratively. In some cases, specific areas have been addressed in greater depth, as in the case of Argentina's INTA, through the Micaela Law course[21] within the biannual Training Plan that seeks to reach all the institute's personnel throughout the country. The Gender and Generations platform was created to mainstream the gender perspective,[22] and internal discussions and training sessions have been held in regional centers. The Paraguayan Institute of Agricultural Technology (IPTA) has consolidated its position since 2022 with the publication of the "Guía Metodológica para incorporar la perspectiva de género, generational, no discriminación y buen trato en el IPTA" (Methodological Guide for incorporating the gender, generational, non-discrimination and good treatment perspective in the IPTA) under the PROCISUR Gender Training Course. Its Annual Training Plan was approved to train and retrain public servants in the area of gender policies.[23]

- **Visibility. Remembrance Days**. There are four annual commemorations where an activity is organized or a message is conveyed: International Women's Day, 8 March; International Day of Women and Girls in Science, 11 February; International Day of Rural Women, 15 October; International Day for the Elimination of Violence against Women, 25 November. The institute generally organizes activities to raise awareness and visibility, such as talks, communication pieces on social media, and recognition of women with institutional, scientific, or rural careers. In some cases, the activity is part of their programs, such as the KUÑA TECHAPYRÃ Program, Exemplary Women for Paraguay's

21 The Micaela Law was enacted in Argentina on 10 January 2019. It establishes mandatory training on gender and gender-based violence for everyone working in the national civil service. Its name commemorates Micaela García, a 21-year-old victim of femicide.

22 Updated information provided in June 2023 by representatives from Argentina's INIA within PROCISUR's Gender Working Group.

23 Content of the approved plan: gender gaps in science and technology institutions, key concepts for gender and generational perspective in IPTA, affirmative action for equality and methodological guidelines. Information provided by IPTA's reps in PROCISUR's Gender Working Group.

Agricultural Innovation System, promoted by IPTA's Directorate of Gender and Rural Youth. In other cases, work is done to reinforce or support national[24] or international calls and campaigns within the INIAs.

- **Certification initiatives.** EMBRAPA's Gender, Race and Diversity Pro-Equality Program was implemented in 2007. For five editions, it considered the stages of diagnosis, action plan and certification under the "Seal for Gender and Race Equality," which guaranteed that the company worked with this perspective in mind. In Uruguay, several public institutions have collaboratively created a Quality Management Model with a Gender Equality Perspective.[25] Its implementation certifies organizations that implement the model. Uruguay's INIA began the certification process, which involves an annual admission, implementation, assessment and certification period.

- **Modification or creation of institutional rules aimed at guaranteeing rights, reducing the factors that condition career paths, addressing situations of inequality and empowering women**. The following examples, which are neither exhaustive nor exclusive, illustrate the scope of these regulations. Chile's INIA addressed gender issues regarding non-discrimination in health and safety documents and its code of ethics and conduct. In addition, there is a Gender Equality Policy, and the governance system of the Gender Equity Committee has been updated. Also, 50% of the regional research centers have a lactation room.[26] EMBRAPA has reduced working days for women with children up to two years old. Maternity is considered in the annual performance evaluation, paternity leave has been

24 On 3 June, marches and various activities are held in several countries in the region under the slogan #NiUnaMenos, created in 2015 in Argentina to showcase the different forms of male violence and report femicides.

25 Its advisory committee is made up of the chair, National Women's Institute, the United Nations Development Program (UNDP), the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), the Technological Laboratory of Uruguay (LATU), the National Quality Institute (INACAL), the PIT-CNT, the Business Chambers, the National Civil Service Office and the Ministry of Labor and Social Security.

26 Updated information provided in July 2023 by INIA representatives in PROCISUR's Gender Working Group.

extended to twenty days, and financial assistance is provided up to the child's seventh birthday. Argentina's INTA now has lactation rooms, has extended paternity leave, has an action protocol to address gender violence and requires the presence of women in selection boards. Uruguay's INIA considers maternity in performance evaluations. Furthermore, the IPTA has created lactation rooms,[27] and national laws have adapted the regulation of maternity, paternity, breastfeeding, and dependent individuals.[28] It also has a Code and Ethics Committee to receive, attend to and monitor issues related to having a work environment free of violence.[29]

- Several organizations have conducted diagnostic assessments, especially when integrating qualitative evaluations that assess the perception and recognition of institutional factors. These results are expected to become an input for a more suitable recognition of the subject and allow for adequate institutional planning and effective resource allocation. Chile's INIA has conducted several diagnostic assessments. Since its application to the National Program of Good Labor Practices with Gender Equality[30] in 2022, it has received technical assistance for two years, making the institutional diagnosis possible. Uruguay's INIA conducted a diagnostic assessment of the situation of its female employees. The following dimensions were used: care, work and non-work responsibilities, gender dissemination, creation of sex-disaggregated indicators on S&T production, and access to resources and training. Argentina's INTA plans to map institutional capacities, the capacities of work teams in the territory and experiences with a gender perspective.

27 A policy on the use and operation of the lactation was created.

28 The periods adjusted: paternity extended to 14 calendar days; prenatal and maternity for biological mothers extended to 18 calendar weeks; maternity for adoptive mothers extended from 12 to 18 weeks, depending on age; breastfeeding (90 min/day up to 7 months, and 60 min/day up to 24 months); dependents, up to 3 days/month.

29 Updated information provided in June 2023 by representatives from IPTA within PROCISUR's Gender Working Group.

30 This program is part of Chile's National Service for Women and Gender Equality (SERNAMEG).

- **The potential articulation in specific cooperation with the National and Regional Science and Technology Systems for joint work presented by some countries**. Uruguay has organized the Inter-institutional Roundtable Women in Science, Innovation and Technology (MMCIT) since 2016. It is an inter-institutional coordination institution formed by representatives of bodies, agencies, and institutions in Uruguay working in scientific and technological development, innovation, education, production, design, and management of public policies with a gender approach. This Inter-institutional Roundtable has published several diagnostic publications and seeks the help of participating institutions in their gender approach. It has also adapted and implemented tools from UNESCO's STEM and Gender Advancement Methodology (SAGA).

- Institutional work done in pursuit of gender equality requires the allocation of **budgetary and human resources**. However, the willpower of the institutions is a strength in most of these bottom-up construction processes, which has allowed most institutions to make actual progress. In most cases, members of commissions and internal leaders or those who conduct diagnostic assessments and work teams addressing gender issues in the institution do not receive an additional budget to pay for their work. Instead, their workload increases. The role of women's groups within and between institutions is critical to appeal, legitimize, strengthen and give continuity to public policies with a gender perspective.

- The commitment of **top management** in the institutions and branches of government is essential to implement innovation strategies with a gender approach and was mentioned in a group of interviews as an asset. The support of top management in pursuing substantial transformations beyond discursive and regulatory aspects was critical to the success of the institutes that have made progress in addressing gender issues.

- **Institutional cooperation links** must be consolidated in LAC nations and regions to work on gender projects. In addition, it is necessary to create opportunities for training, regulations,

planning and impact monitoring. Some crucial aspects are potential regional connections, cooperation agencies, and national and regional S&T systems. The institutes have raised the need and priority of working regionally, with a view to the potential of creating and joining networks to build and socialize women-led S&T projects and institutional and technological innovations. The capacity to detect potential research and programs that strengthen gender equality in S&T institutions should also be expanded. It is essential to build a common agenda that supports the region and allows us to sustain strategies despite changes in institutional management. An example of this potential: in the interview with IICA's Gender and Youth Area,[31] a relevant project was mentioned. It identifies and classifies experiences to systematize success factors, methodology, networking, and identifying mechanisms that other projects can capitalize on in the same countries or other countries in the region. Uruguay's INIA brings another example with their joint workshop "Hacia la implementación de planes de equidad de género en instituciones de I+D" (Towards the implementation of gender equality plans in R&D institutions) in 2019 within a Horizon 2020 Project. Spain, Argentina, Uruguay, Mexico, Peru, and Austria participated.

Finally, the determining factors are grouped:

- **Low or non-existent awareness of gender equality in the organization**. This has been established with a comprehensive assessment of the organizations at different levels and, in several cases, of rural inhabitants. Impressions ranged from an oppressive "organizational culture," whether consciously or not, to institutional violence or denying the problem within organizations.

- **Lack of specific gender training for people who must assume institutional responsibility on the subject and, generally, for all the employees.** This was expressed in most of the interviews as a severe determining factor. The basic training of most professional courses does not include gender mainstreaming.

31 Under IICA's Medium-Term Plan for the Period 2022–2026, the gender and youth issue went from being addressed as a cross-cutting theme to being given prominence as a program.

Therefore, a researcher, agronomist, veterinarian or economist does not necessarily know about gender. Furthermore, several people interviewed mentioned how difficult it is to have highly-trained gender specialists in the institution. The interview with expert Mariana González-Pirez[32] highlights that it was tremendously difficult to find gender-trained human resources when the Inter-institutional Roundtable Women in Science, Innovation and Technology was created in Uruguay in 2016.

- **There is a low or non-existent budget allocated to gender equality work in the institutes**. This has also manifested as a massive gap between regulations and institutional discourse about specific actions that transform the institutional dynamics.
- **Lack of gender perspective towards future competencies (4.0)**. No documented approach connects innovation to the gender perspective or to evaluating the competencies required in the future and the need to work to develop them.

32 Mariana González Pirez is an expert in public policy evaluation and gender budgeting. She led the creation of the roundtable in Uruguay.

# IV. Conclusions

Agricultural S&T institutions in the Southern Cone are essential for regional development. The quality of scientific and technological innovation in the region and the possibility of improving its positioning and global competitiveness depend, to a large extent, on the capacities of these institutions. To strengthen these institutions, it is necessary to mainstream the gender perspective.

Mainstreaming gender in institutional dynamics goes beyond achieving the essential representation of the interests and guaranteeing the rights of women and the LGTBI+ collective. It entails reconstructing gender relations within organizations to ensure the realization of these interests and their impact on scientific and technological production. Developing research, technological development, and innovation policies that include the gender dimension and implementing them is necessary to overcome the current scenario and to foster the region's development and global positioning in the future. These developments and interventions are also essential for projects to be equally accessible to everyone through the organizations' technical assistance and rural outreach systems. This would prevent stereotypes and biased models.

Efforts in the Southern Cone are still in their early stages. The opportunity to develop cooperation links in the region and the nations is feasible because the institutional hierarchy of gender is high in several countries. Therefore, we can forecast optimistic work scenarios in the short term. In the region's INIAs, specific diagnostic experiences, gender mainstreaming efforts, and some systematized practices aimed at equality have been identified. With an eye on Agriculture 4.0, gender mainstreaming in government agencies must be accelerated. PROCISUR, through its primary document, guarantees the interaction and cooperation of all institutional stakeholders.

Mainstreaming gender in research and technological developments into the agenda of organizations adds value, more significant

opportunities and creativity in innovation. Following the strategies adopted in other regions (e.g., the Gendered Innovations project), this integration challenge *can help researchers and innovators in their awareness and training, deconstructing reference models* and redesigning more innovative gender–equitable standards.

# V. References


Alonso, L; Benotti, L; González, L; Maina, H; Martínez, L; Rajngewerc, M; Mata, A; Sánchez, J; Schilman, M; Halvorsen, A; Bordone, M; Busaniche, B. s. f. Una metodología para caracterizar sesgos y estereotipos nocivos en el procedimiento de lenguaje natural en AL (Internet). Córdoba, Argentina, Fundación Vía Libre. Available from https://www.vialibre.org.ar/wp-content/uploads/2023/03/EN_A-methodology-to-characterize-bias-and-harmfil-stereotypes-in-natural-language-processing-in-Latin-America_v2.pdf.

Amaral, N; Eng, N; Ospino, C; Pagés, C; Rucci, G; Williams, N. 2018. How Far Can Your Skills Take You? Understanding Skill Demand Changes Due to Occupational Shifts and the Transferability of Workers across Occupations. Washington, D. C., United States of America, IDB.

Azuara Herrera, O; Pagés, C; Rucci, G; Amaral, N; Ospino, C; Torres, J; González, S. 2019. The future of work in Latin America and the Caribbean What are the region's most in-demand occupations and emerging skills? Washington, D. C., United States of America, IDB.

Basco, A.; Lavena, C. 2019. Un potencial con barreras: la participación de las mujeres en el área de la ciencia y tecnología en Argentina. Washington, D. C., United States of America, IDB.

Bello, A. 2020. Las mujeres en ciencias, tecnología, ingeniería y matemáticas en ALC. Montevideo, Uruguay, UN Women.

Candela Soto, P. 2022. Las relaciones de género en la metrópoli global: equilibrios y contradicciones entre producción y reproducción. Ciudad Real, España, Universidad Castilla La Mancha.

Department of Labor of Catalonia. 2010. 10 porqués para una salud y seguridad laboral con perspectiva de género (en línea). Colección 10 XQ (Igualdad de las Mujeres en el Trabajo) 3. Barcelona, Spain. Available from http://istas.net/descargas/10XQ_Genere_cast.pdf.

European Commission, Directorate-General for Research and Innovation. 2020.Genderedinnovations2–Howinclusiveanalysiscontributestoresearch and innovation – Policy review (Internet). Luxemburg, Publications Office of the European Union. Available from https://op.europa.eu/en/publication-detail/-/publication/33b4c99f-2e66-11eb-b27b-01aa75ed71a1/language-en.

García Holgado, A; Camacho Díaz, A; García-Peñalvo, F. 2019. La brecha de género en el sector STEM en América Latina: una propuesta europea. Madrid, V Congreso Internacional sobre Aprendizaje, Innovación y Competitividad.

Piñeiro, M. 2003. El sistema institucional de innovación tecnológica agropecuaria en América Latina: instituciones y políticas públicas. Lima, Perú.

Ponce, T. 2022. Una vacuna contra el Covid-19 con enfoque de género, por favor (en línea). Latfem, Argentina. Disponible en https://latfem.org/una-vacuna-contra-el-covid-19-con-enfoque-de-genero-por-favor/.

Portinari, B. 2017. Las mujeres mueren más que los hombres por enfermedades cardiovasculares porque nunca les habían contado esos síntomas (en línea). El País newspaper, Spain. Available from https://elpais.com/elpais/2017/12/11/buenavida/1513009319_516500.html.

BBC World Editorial Staff. 2017. Marilyn Loden, la mujer que inventó la expresión `techo de cristal (Internet). Londres, Reino Unido. Available from https://www.bbc.com/mundo/noticias-42338736.

Reverter Bañón, S. 2011. La dialéctica feminista de la ciudadanía (en línea). Athenea Digital 11(3):121-136. Available from http://psicologiasocial.uab.es/athenea/index.php/atheneaDigital/article/view/758.

Rossi. A. 1965: Women in science: Why so few? Science 148 pages. 1196-1201.

Ruiz Cantero, MT. 2009. Sesgos de género en la atención sanitaria (en línea). Granada, España, Escuela Andaluza de Salud Pública. Nueva Salud Pública Series. Available from https://drive.google.com/file/d/1k9-KKPoz7sP2XQB0oDGGt_mws9hVJ72L/view?usp=drive_link.

Schwab, K. 2017. La cuarta revolución industrial. Barcelona, Spain, Editorial Debate.

Stads, G-J; Beintema, N; Pérez, S; Flaherty, K; Falconi, C. 2016. Agricultural Research in Latin America and the Caribbean. Washington, D. C., United States of America, ASTI, IDB.

Tannenbaum, C; Ellis, RP; Eyssel, F; Zoy, J; Schiebinger, L. 2019. Sex and gender analysis improves science and engineering Revista Nature (575):137-146.

Trigo, E; Mateo, N; Falconi, C. 2013. Innovación agropecuaria en América Latina y el Caribe: escenarios y mecanismos institucionales. Washington, D. C., United States of America, IDB.

UNESCO (United Nations Educational, Scientific and Cultural Organization, France). 2007. Science, technology and gender. Paris, France, Division for Science Policy and Development.

UNESCO (United Nations Educational, Scientific and Cultural Organization, France). 2018. Informe UNESCO: la ciencia, hacia 2030: informe regional de América Latina y el Caribe. Paris, France.

Van Oost, E. 2003. Materialized gender: How shavers configure the users' femininity and masculinity. *In* Oudshoorn, N; Pinch. T. eds. How Users Matter: The Co-Construction of Users and Technology. Cambridge, Massachusetts, Estados Unidos de América, MIT Press. p. 193-208.

Vitón, R; Castillo, A; López Teixeira, T. 2019. Agtech Innovation Map in Latin America and the Caribbean Washington, D. C., United States of America, IDB.