

Analysis of Research Performance Through a Gender Lens: A Focus on Canada

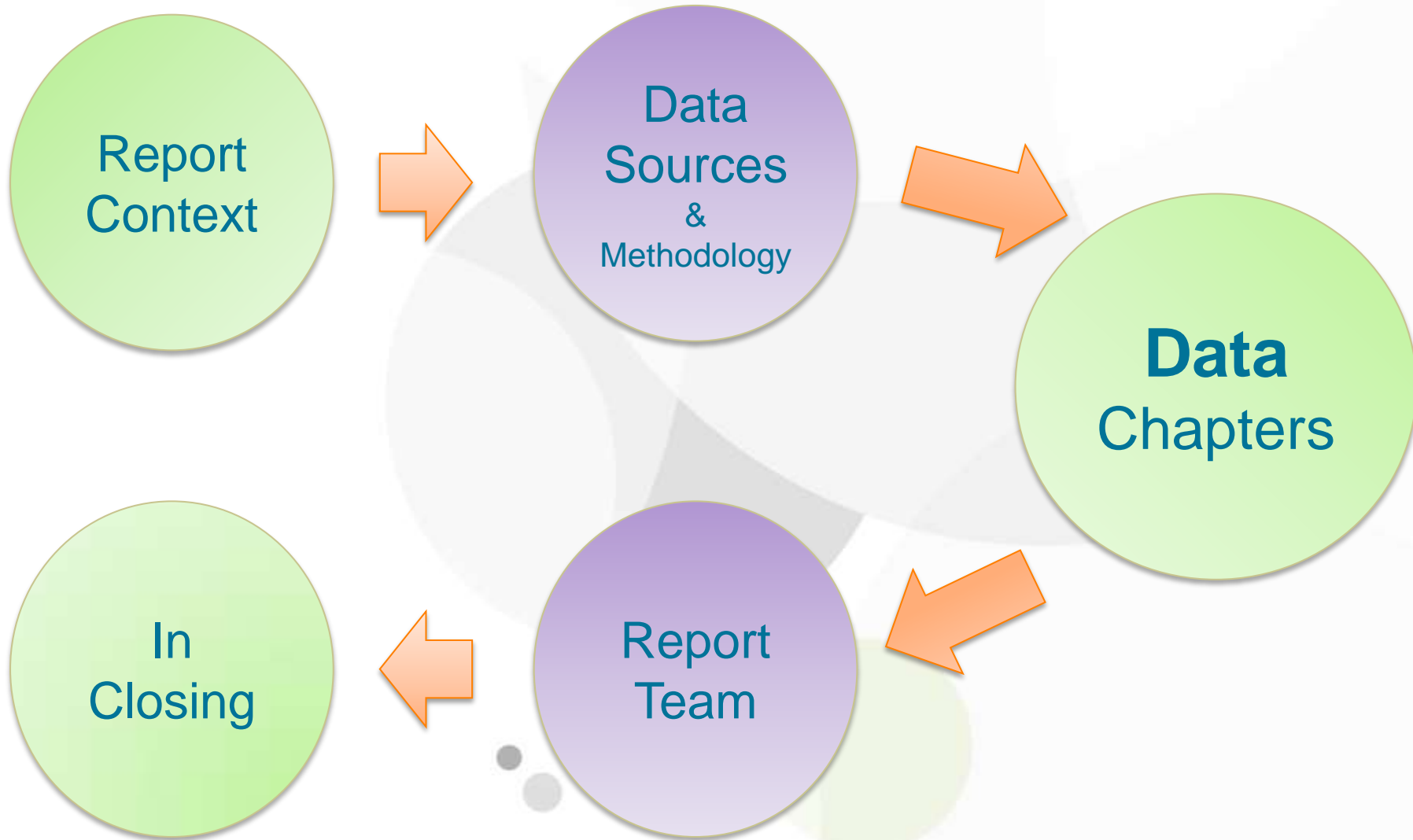
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On behalf of the report team

November 7, 2017 | Montréal, Québec – Canada | #ELSGENDER17 and #GS11NA



Presentation Roadmap



Report Context

Our Foundation

THE ELSEVIER FOUNDATION



Elsevier Foundation Awards for Early-Career Women Scientists in the Developing World



New Scholars Program:

10 years, 50 grants, ca \$2.5 million

Advancing women scientists: grants for family friendly policies, career skills, dual career issues, recognition awards, benchmarking studies & boosting professional visibility through childcare grants.

Elsevier and RELX Commitments



Elsevier Gender Working Group

- **Gender diversity** for journal editorial boards, speakers/panelists at Elsevier conferences, and award selection committees
- Address issues of **implicit bias in peer review**
- Enhanced editorial policies and guidance to authors on **reporting about sex & gender in research**
- **Promote studies** on i) sex & gender in research and ii) diversity in STEM
- Apply **analytics to gender issues**



A Call for Data

National Institutes of Health addresses the science of diversity

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Edited by Indir M. Verma, The Salk Institute for Biological Studies, La Jolla, CA, and approved August 26, 2015 (received for review May 14, 2015)

The US biomedical research workforce does not currently mirror the nation's population demographically, despite numerous attempts to increase diversity. This imbalance is limiting the promise of our biomedical enterprise for building knowledge and improving the nation's health. Beyond ensuring fairness in scientific workforce representation, recruiting and retaining a diverse set of minds and approaches is vital to harnessing the complete intellectual capital of the nation. The complexity inherent in diversifying the research workforce underscores the need for a rigorous scientific approach, consistent with the ways we address the challenges of science discovery and translation to human health. Herein, we identify four cross-cutting diversity challenges ripe for scientific exploration and opportunity: research evidence for diversity's impact on the quality and outputs of science; evidence-based approaches to recruitment and training; individual and institutional barriers to workforce diversity; and a national strategy for eliminating barriers to career transition, with scientifically based approaches for scaling and dissemination. Evidence-based data for each of these challenges should provide an integrated, stepwise approach to programs that enhance diversity rapidly within the biomedical research workforce.

diversity | scientific workforce | underrepresentation in science | culture | biomedical research

Despite longstanding efforts, diversifying the biomedical research workforce remains an elusive goal, and large sectors of the US population remain underrepresented. These sectors include several racial/ethnic groups; economically disadvantaged individuals; people with disabilities; and women. Certain racial/ethnic groups are represented only minimally in biomedical research: of the nation's scientific research faculty positions, 4% are African American, 4% are Hispanic, 0.2% are Native American, and 0.1% are Hawaiian/Pacific Islander (1). There has been little increase in representation of

Existing evidence suggests that enhancing and sustaining diversity requires an integrated set of interventions that—much like the task of biomedical research itself—relies on a reasoned, evidence-based approach that is rooted in the scientific method. Herein, we identify the need for scientific approaches that address four crosscutting diversity challenges: (i) research to support or refute evidence that diversity among scientists enhances quality and outputs of the research itself; (ii) evidence-based approaches to recruitment and training, including defining “effective research experiences and mentoring”; (iii) interventions that mitigate individual and

Challenge 1: Among Scientists, What Is the Impact of Diversity on the Quality and Outputs of Research?

A literature base outside biomedicine indicates that diversity has a variety of beneficial effects, but more research is needed to support or refute evidence that diversity among scientists enhances quality and outputs of the research itself. Many research scholars approaching diversity have done so from a wide range of fields outside of biomedicine, including sociology, psychology, economics, education, team science, leadership, career development, and others. This research has

“...solid body of evidence to understand the impacts of diversity...”

Valentine, H.A., and Collins, F.S. (2015). National Institutes of Health addresses the science of diversity. Proc. Natl. Acad. Sci. 112(40), 12240–12242.

“NSF will continue to advance equity through data-driven decision-making.”

EDITORIAL

Intentional equity

Over a decade ago, when I was chief scientist at the U.S. National Aeronautics and Space Administration, I spoke at a conference called Women and Science: Celebrating Achievements, Charting Challenges. I lauded women working in astrophysics, government, and science policy in the United States and elsewhere, but said that progress was mixed—the veneer of success for women across the sciences, and in science leadership, was too thin across the globe. What has changed since then? Cultural barriers, a lack of enlightened policies, and the need for role models and support systems still exist worldwide. However, today there is good reason to be optimistic. The international scientific community is coming together intentionally to acknowledge and tackle gender equity.

ing of leading industrial nations, is encouraging G7 nations to lead efforts in “inclusive innovation” to ensure that everyone reaps and benefits from science and technology. Further, the final G7 report encourages the development of “policy and working environments in which equal opportunity allows women to exert their abilities [and] advance their career prospects.” Such changes help STEM equality and will attract and retain talented women in STEM careers.

What about the United States? Women now earn about half of all science and engineering bachelor's degrees, yet they account for only 30% of the U.S. science and engineering workforce. In some STEM fields, such as mechanical engineering, the percentage of women is in the single digits. NSF will continue to advance equity through data-driven decision-making. Our Career-Life Balance Initiative, for example, mitigates factors that can negatively affect women's ability to carry out research, especially during the early years of their careers. NSF's ADVANCE program encourages universities to use institu-



Frances A. Córdoba is director of the U.S. National Science Foundation, Arlington, VA, USA.



“...global equity for women in science...is a call to action...”

stem forum (NSF) in Africa, where I was on a panel discussing women in science, technology, engineering, and mathematics (STEM) fields. Scientists, engineers, and

Córdoba, F.A. (2016). Intentional equity. Science 353(698), 427.

Information Analytics Expertise

Research Intelligence

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Our analytics team is experienced in serving policy makers, funders, and academic and corporate research institutions around the world. Our offerings range from simple, targeted reports to comprehensive multidimensional studies, as well as data delivery and web integration services to meet your research management needs.

Sample Reports

Gender in the Global Research Landscape

Critical issues related to gender disparity and bias must be examined by sound studies. Drawing upon our high-quality global data sources, analytical expertise, and unique gender disambiguation methodology, this report is an evidence-based examination of research performance worldwide through a gender lens. Covering 20 years, 12 geographies and all 27 Scopus subject areas, this report provides powerful insight and guidance on gender research and gender equality policy for governments, funders and institutions worldwide.



Sustainability Science in a Global Landscape

A report conducted by Elsevier in collaboration with SciDev.Net

This report contributes to the understanding of sustainability science as a research field and the dialogue between science and society in sustainable development. In this relatively young field, this study establishes a baseline, both in the definition and the understanding of sustainability science, from which we may follow its progression and trajectory. Six key themes that encompass the 17 UN Sustainability Development Goals are examined: Dignity, People, Prosperity, Planet, Justice and Partnership.



Mapping Gender in the German Research Arena

Equality is part of quality in science. Making full use of the potential of both women and men maximizes the quantity and, more importantly, quality of research. Despite current policies and regulations, there are prominent gaps between women and men in terms of the number of scientific researchers, decision-making positions held, and other aspects of career development such as informal networks of collaboration and access to funding.



America's Knowledge Economy: A State-by-State Review

Explores the comparative research strengths of US states, providing an understanding of the broader importance of research produced by public universities. This report helps inform the debate about academic research funding and provides a framework for identifying, showcasing, and aligning the expertise of research institutions with each states' policy goals.



Brain Science: Mapping the Landscape of Brain and Neuroscience Research

The report focuses on brain science research output on a national level, levels of collaboration within brain research, cross-disciplinary researcher mobility, and emerging trends and themes in brain research. It provides various stakeholders in brain research - funders, governments, universities, research institutions, and policy groups - with a resource that can help inform decisions about future research strategies and funding priorities, guide international coordination and collaboration, and steer policy and advocacy efforts.



A Decade of Development in Sub-Saharan African Science, Technology, Engineering, and Mathematics (STEM) Research

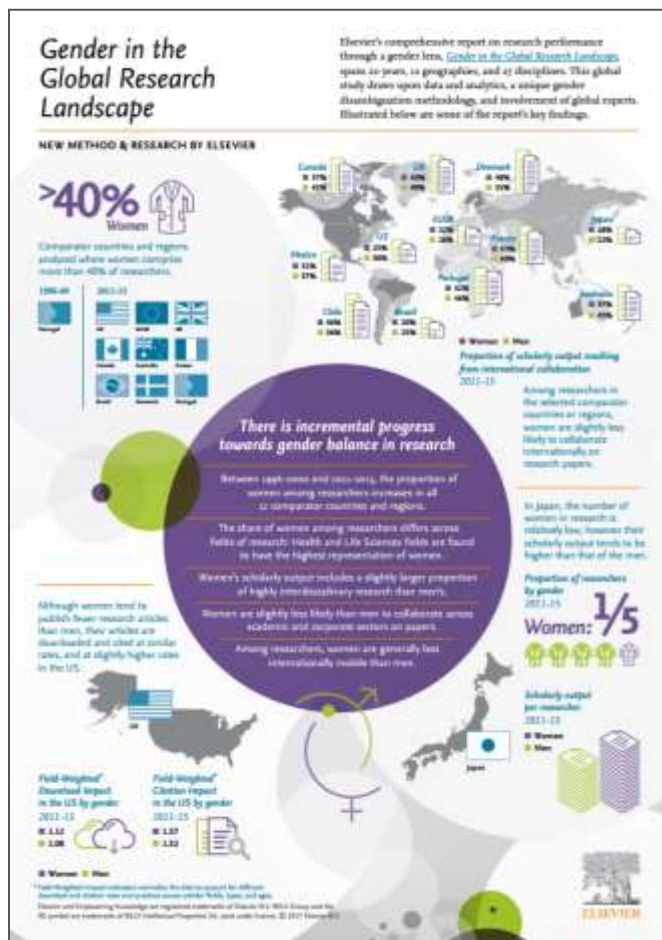
The World Bank and Elsevier partnered to examine and compare the research enterprise of sub-Saharan Africa from 2003 to 2013, with a special emphasis on research in STEM. This report focuses on research output and citation impact, regional and international research collaboration, and researcher mobility -- all important indicators of the strength of the subcontinent's research enterprise.



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Elsevier's Report



- Evidence-informed introduction
- Data chapters
 - Overview of research performance (outputs, quality, and impact) through a gender lens;
 - Gender comparison of social aspects of research, including leadership, collaboration, and mobility;
 - Snapshot of published gender research as a discipline
- Interviews with global experts and influencers for context

Data Sources & Methodology

Comparator Selection

- Global coverage
- Countries/regions with high research output
- Each with at least one comparable comparator
- Applicability of our gender disambiguation methodology
- At least two countries from each major region
- A practical limit in a single report given our analyses



Data Chapters: The Canada Perspective

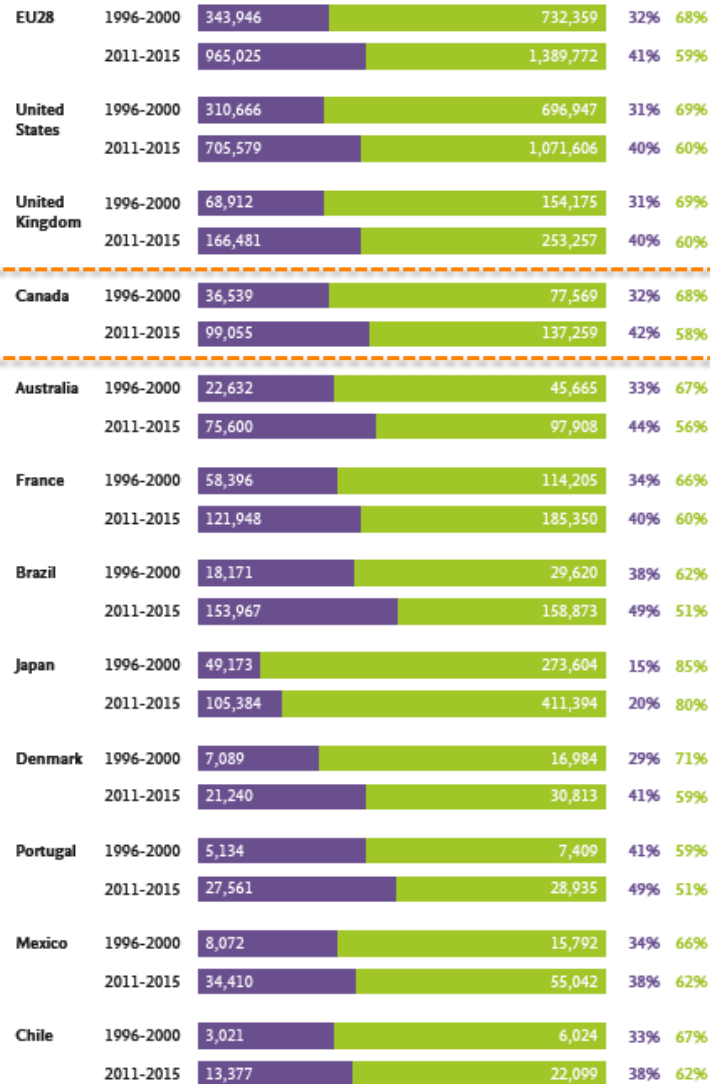


CHAPTER 1
The global research
landscape through
a gender lens

Proportion and Number of Researchers by Gender

■ Women ■ Men

PROPORTION OF WOMEN AND MEN
(AMONG NAMED GENDERED AUTHOR PROFILES)

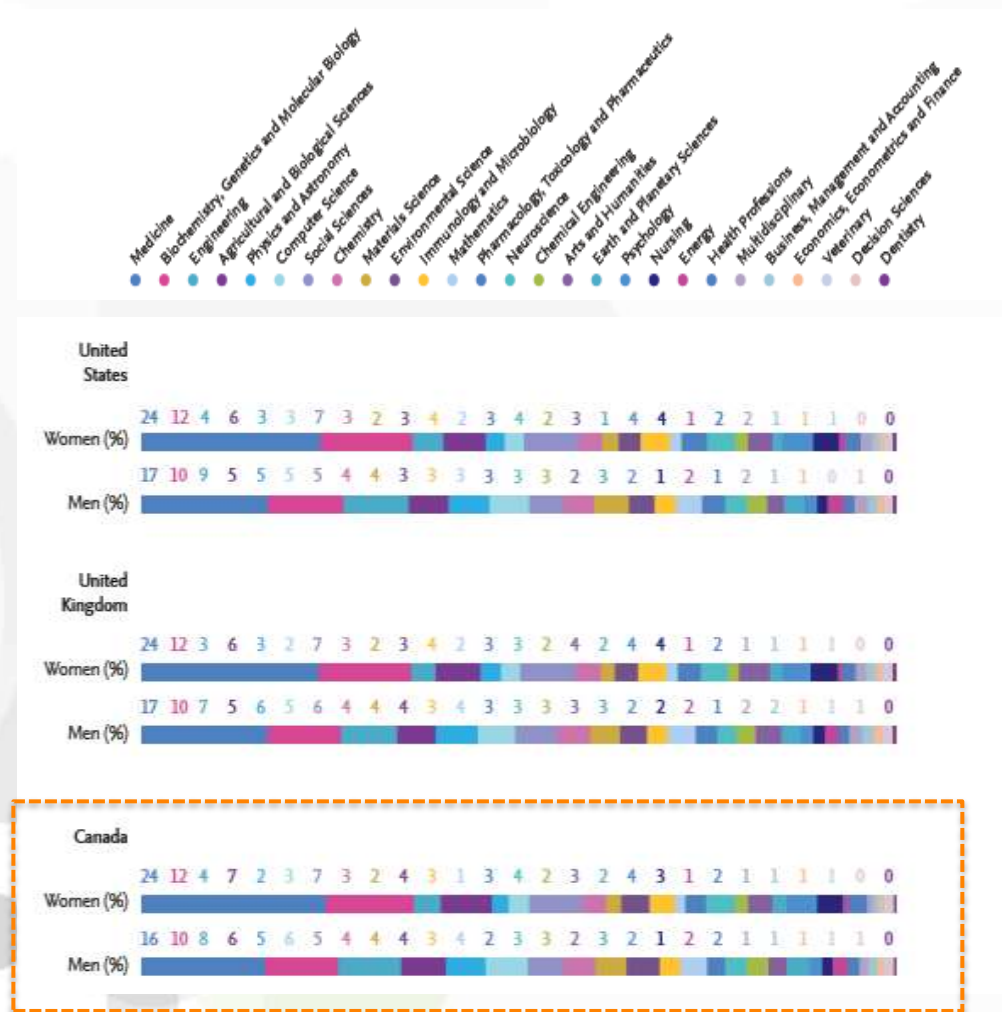


- **Purple** represents “women” and **green** “men”
- Researchers = Authors who have published **articles, reviews, and conference proceedings** indexed in Scopus
- Proportion of women among researchers and inventors is increasing
- The proportion of **women among researchers in Canada is 42%**, a 10% increase between the two time periods

Distribution of Canada Researchers Scholarly Output

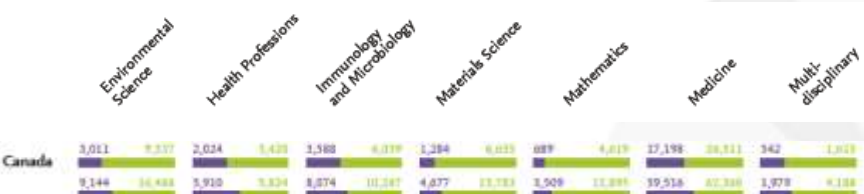
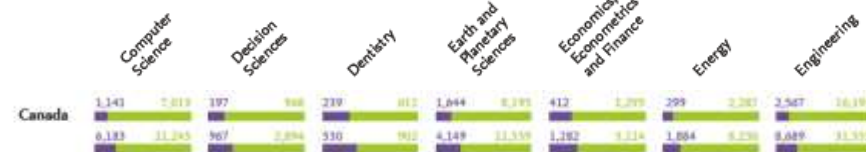
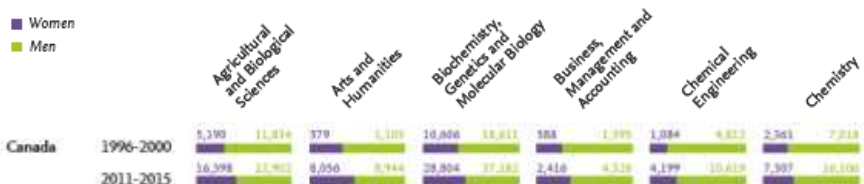
by subject area for each gender, 2011-2015

- 24% of women authors' scholarly output was in journals in the **Medicine** category, compared to 16% of men authors
- By contrast, 8% of men authors' scholarly output was published in journals belonging to the **Engineering** subject category compared to 4% of women authors



Proportion and Number of Canada Researchers

by gender and subject area



- Lower proportion of women among researchers for most comparators:

- Computer Science (23%)
- Engineering (22%)
- Mathematics (20%)
- Physics & Astronomy (22%)
- Materials Science (23%)

- Fields in which women comprise half of researchers:

- Social Sciences (50%)
- Health Professions (50%)

- Majority of researchers are women in:

- Nursing (62%)
- Psychology (60%)

■ Women ■ Men

SCHOLARLY OUTPUT PER RESEARCHER
(AMONG NAMED GENDERED AUTHOR PROFILES)



Scholarly Output Per Researchers

by gender and comparator

- Men publish slightly more papers on average than women
- Women see a small decline in average number of papers per researcher over time, whereas men see a small increase

Citation Impact

by gender and comparator

- Canada shows slightly higher FWCI values for men and women, higher for women in the US.
- In the UK and EU, the FWCI is about equal for men and women, higher for women in the US. Brazil, Portugal, Mexico, and Chile all show slightly higher FWCI values for men researchers than for women researchers.

■ Women ■ Men

FIELD-WEIGHTED CITATION IMPACT



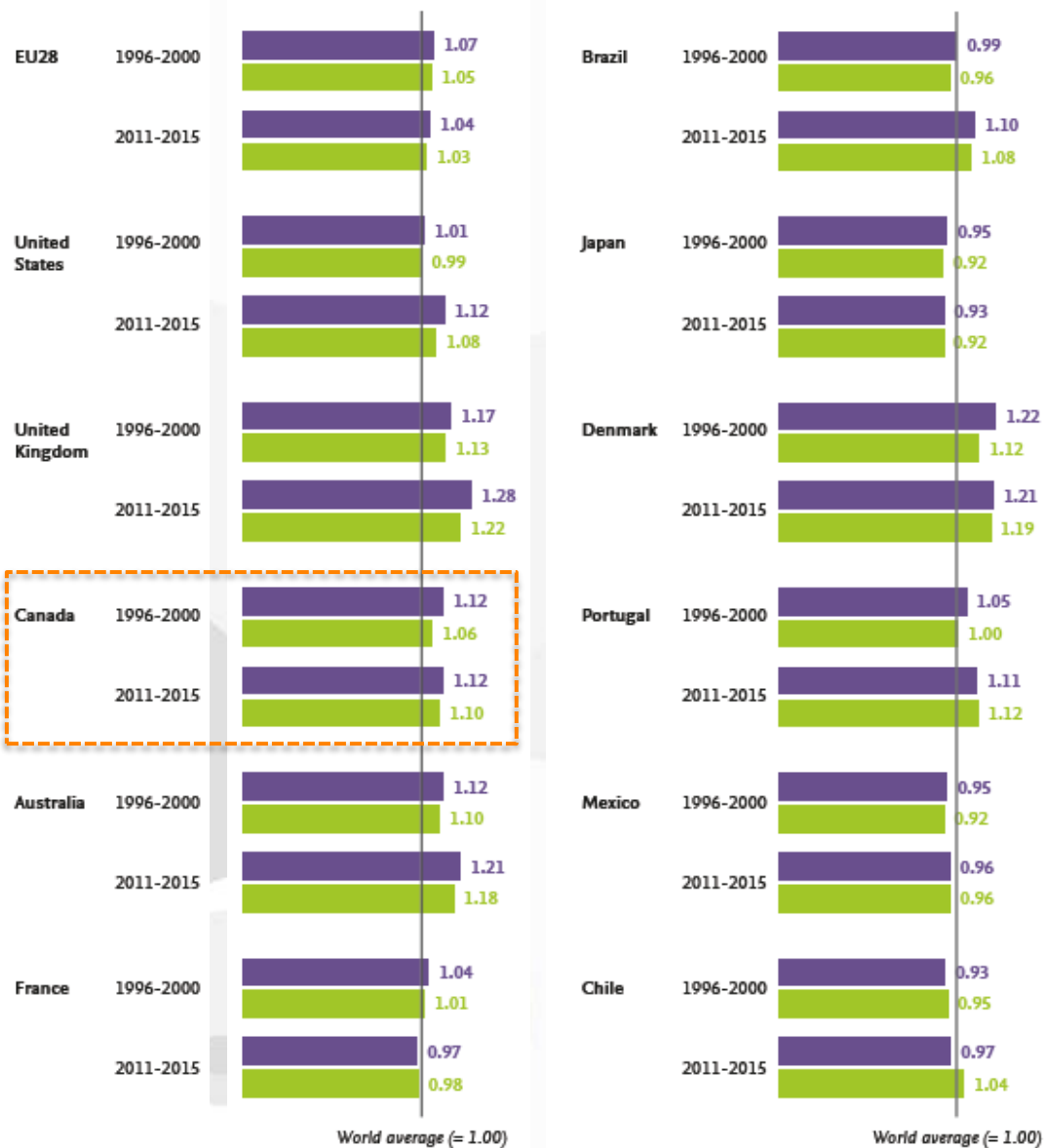
Download Impact

by gender and comparator

- FWDI values tend to be slightly higher for women than for men
- No evidence that the inequalities in the representation of women researchers across countries and fields and in their scholarly output affect how their research is read or built on by others

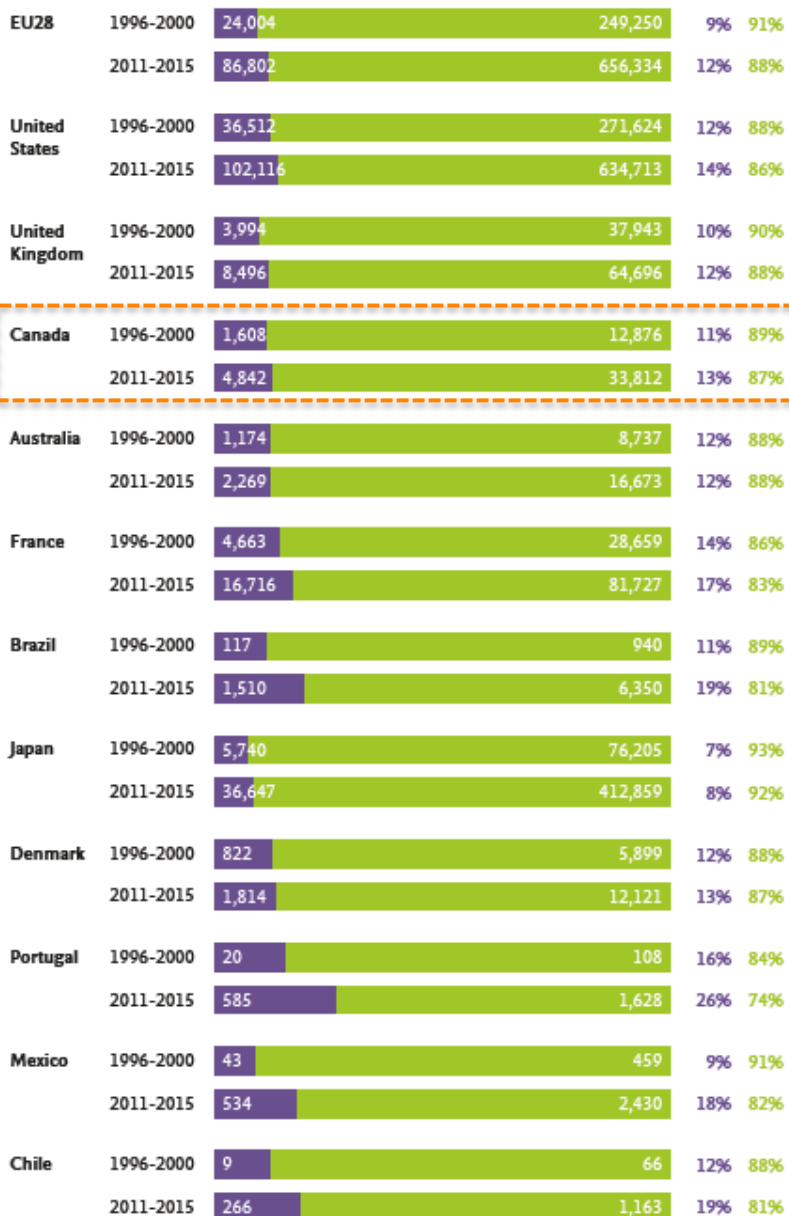
■ Women ■ Men

FIELD-WEIGHTED DOWNLOAD IMPACT



■ Women ■ Men

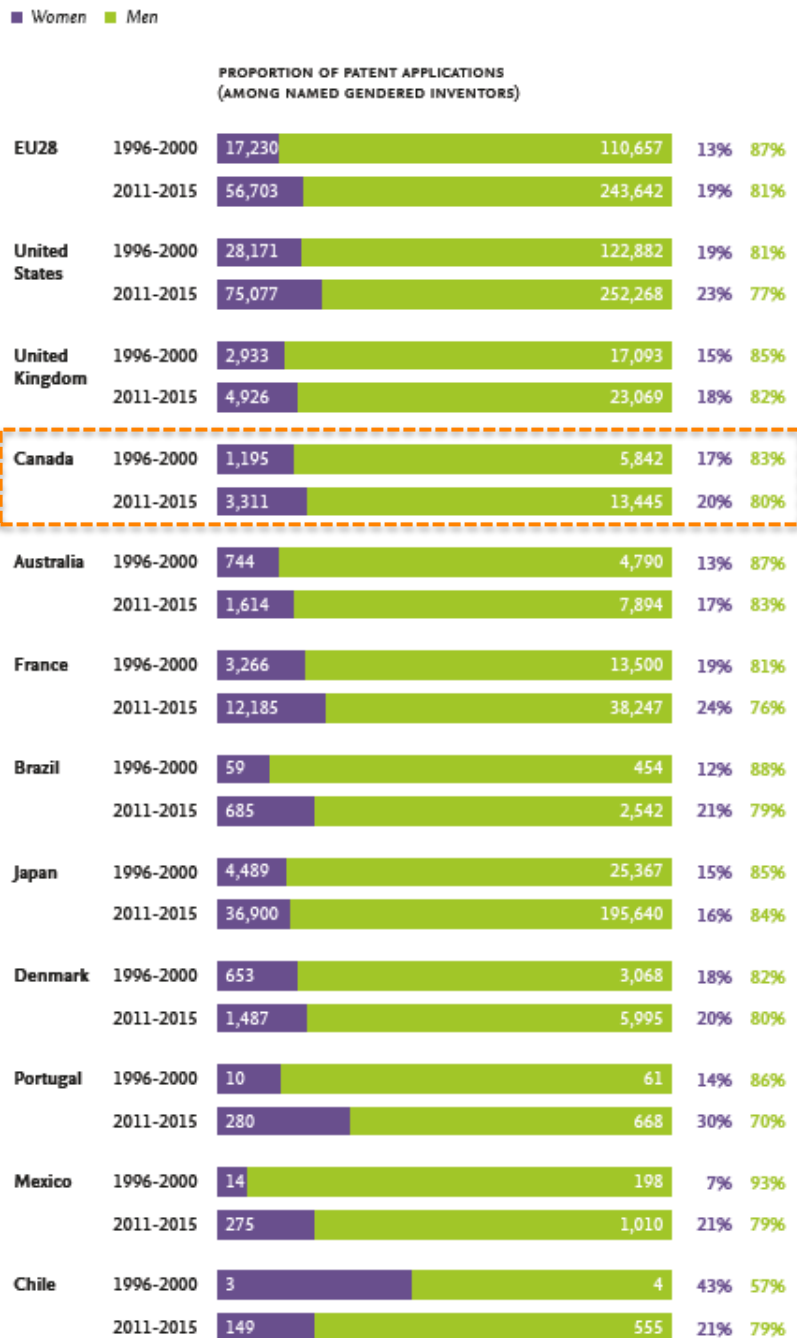
PROPORTION OF WOMEN AND MEN
(AMONG NAMED GENDERED INVENTORS)



Proportion and Number of Inventors

by gender and comparator

- Amongst inventors, women are generally under-represented
- 13% of women among inventors in 2011-2015, up from 11%
- The number of women named on patent applications is nearly 3X as high in 2011-2015
- For all reported comparators, there is an improvement in gender balance between the analyzed periods.



Proportion of Patent Applications by gender and comparator

- For Canada, the percentage of patent applications that include at least one woman among inventors increased from 17% to 20% in 2011-2015 (globally 19% to 28%)
- Higher proportion than the EU, UK, Australia, Brazil, Japan, Denmark, Mexico, Chile
- Observe an increase for all comparator countries and regions
- For most, the share of patents with at least one woman named among the inventors is about twice as high as the share of women among inventors, reflecting the high prolificacy of women in terms of patent applications

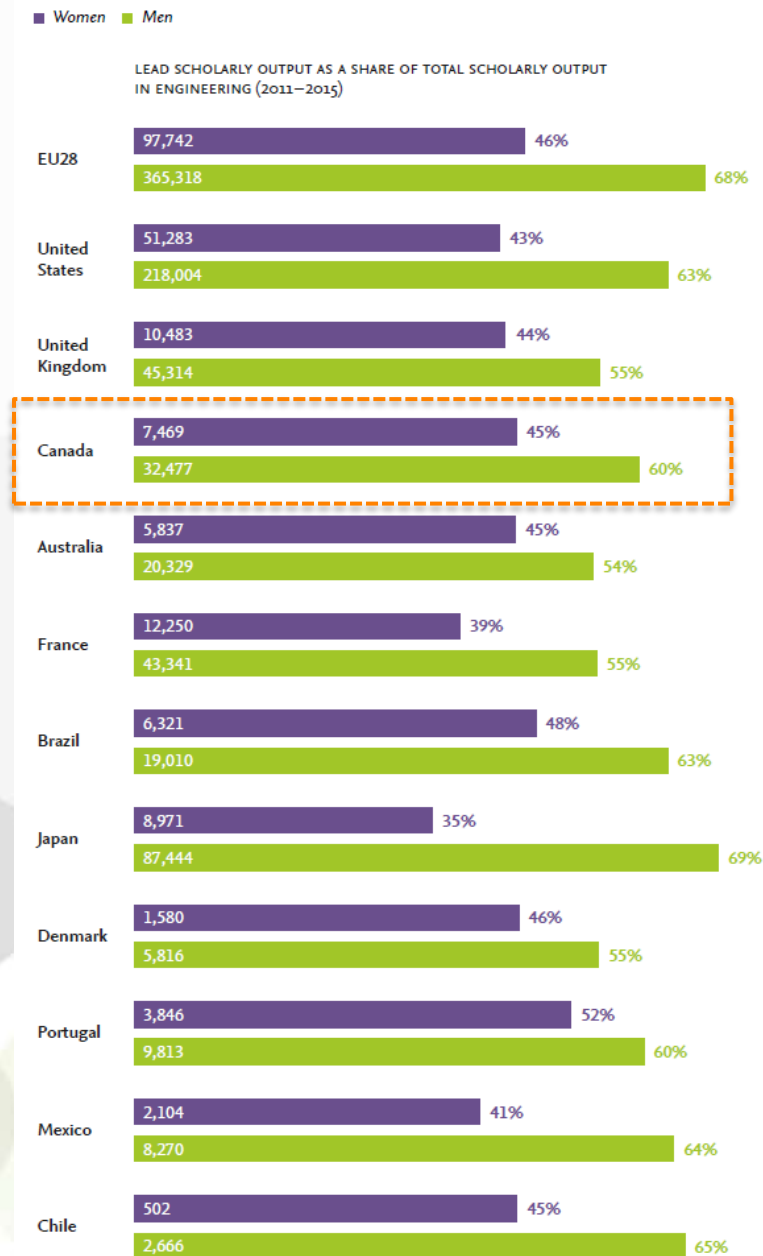
CHAPTER 2

Gender and research leadership, collaboration, interdisciplinarity, and mobility

Leadership

First & corresponding authorship *Engineering (2011-2015)*

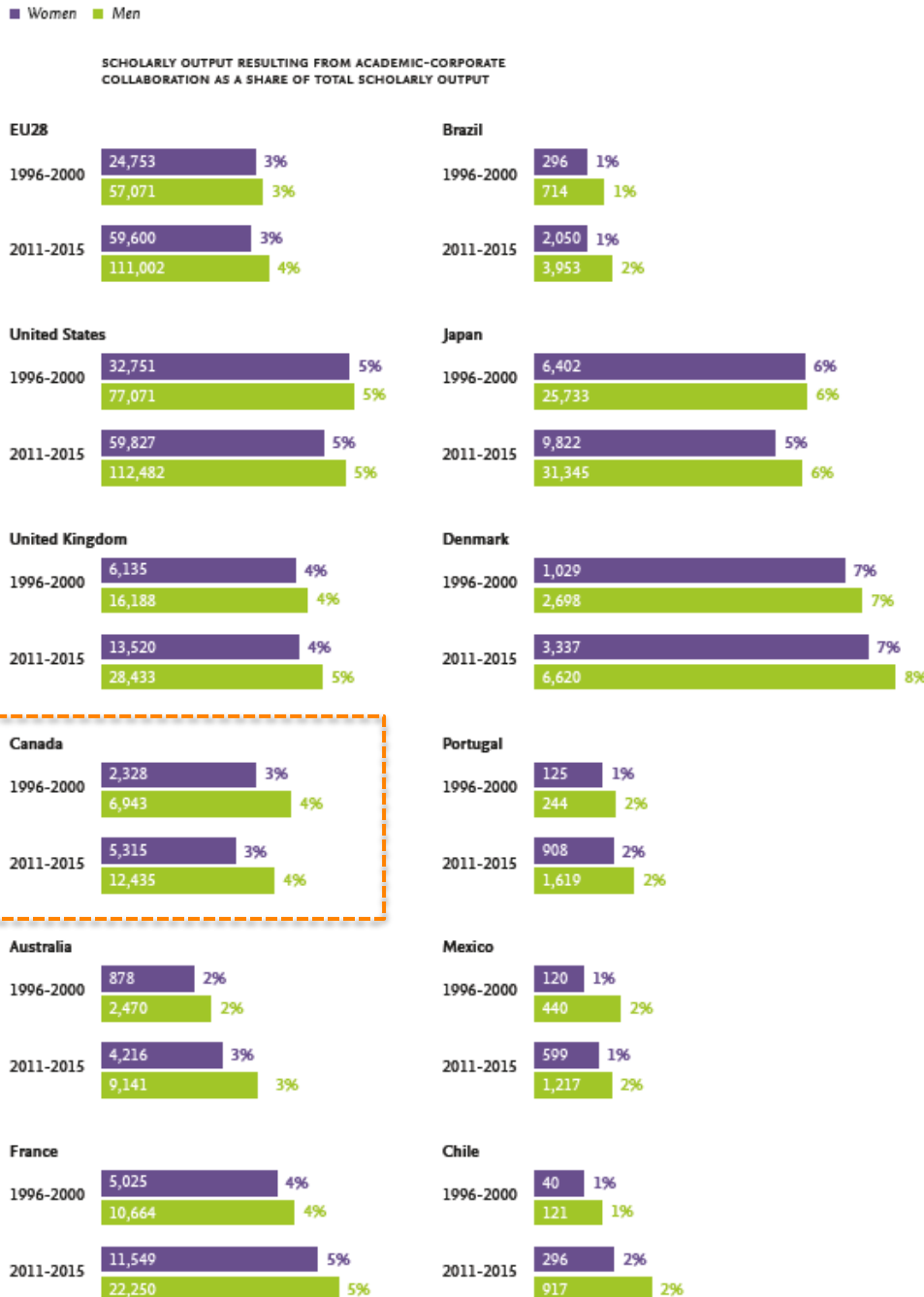
- Women researchers significantly outnumbered by men in engineering
- **When men appear as authors in Engineering papers, they are more likely to take the first or corresponding author position**
- In Canada, women are first or corresponding author on 15% fewer papers than men



Academic-Corporate Collaboration

- US has relatively medium shares of papers reflecting academic-corporate collaboration for both men and women (US has high shares)
- The proportion of scholarly output resulting from academic-corporate collaboration is slightly lower for women than men
- For most comparators, the proportion of cross-sector collaboration increases between periods for both men and women. For Canada, it remains similar for both genders

SCHOLARLY OUTPUT RESULTING FROM ACADEMIC-CORPORATE COLLABORATION AS A SHARE OF TOTAL SCHOLARLY OUTPUT



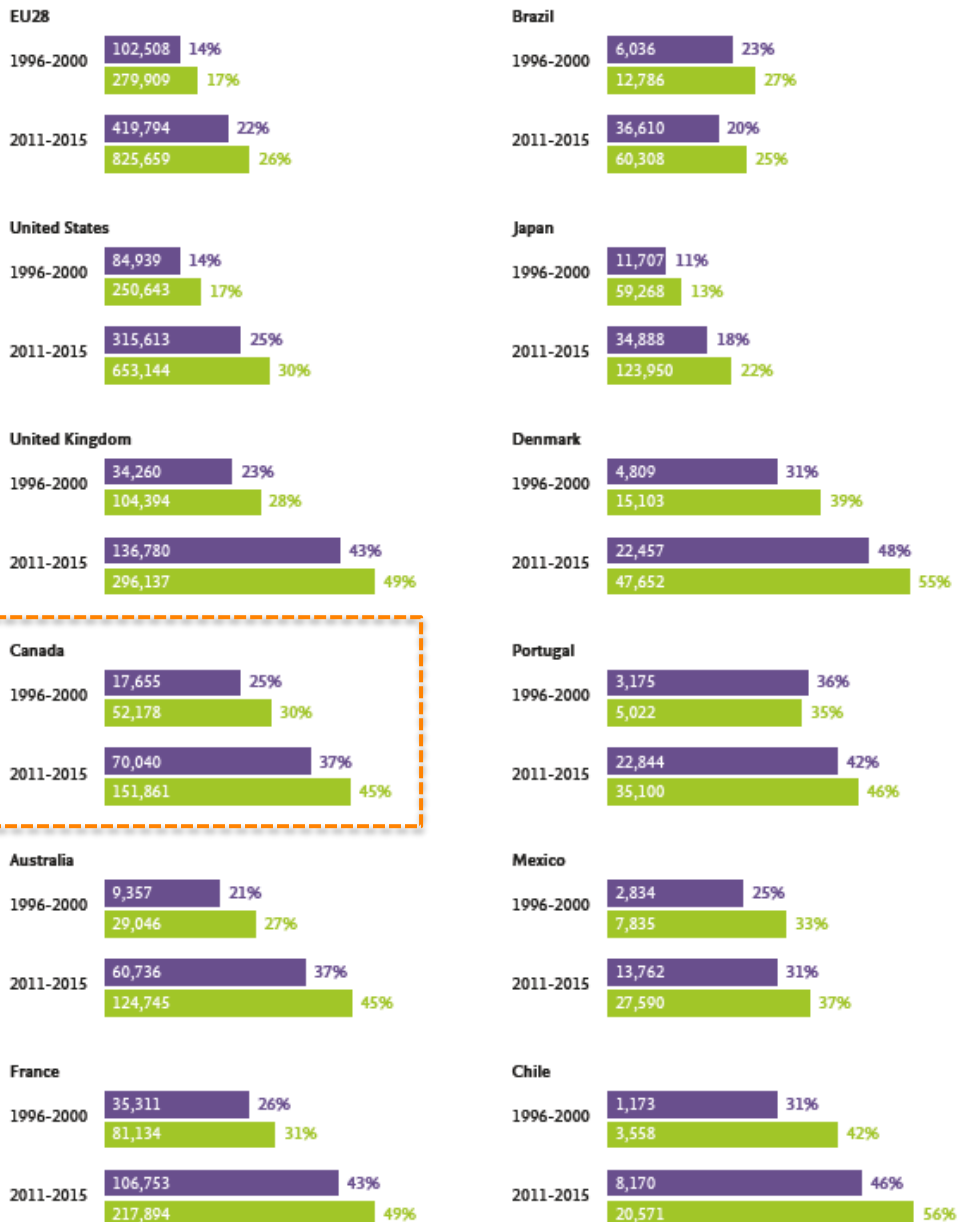
Interdisciplinary Research

- The proportion of output that belongs to the top 10% interdisciplinary output is 8% for women and 7% for men
- **Women tend to have the same or a slightly higher share than men of interdisciplinary research across all comparators**
- Highly interdisciplinary research represents a slightly larger share of women’s scholarly output than of men’s
- For most, the proportion decreases for women and increases for men between over time though



■ Women ■ Men

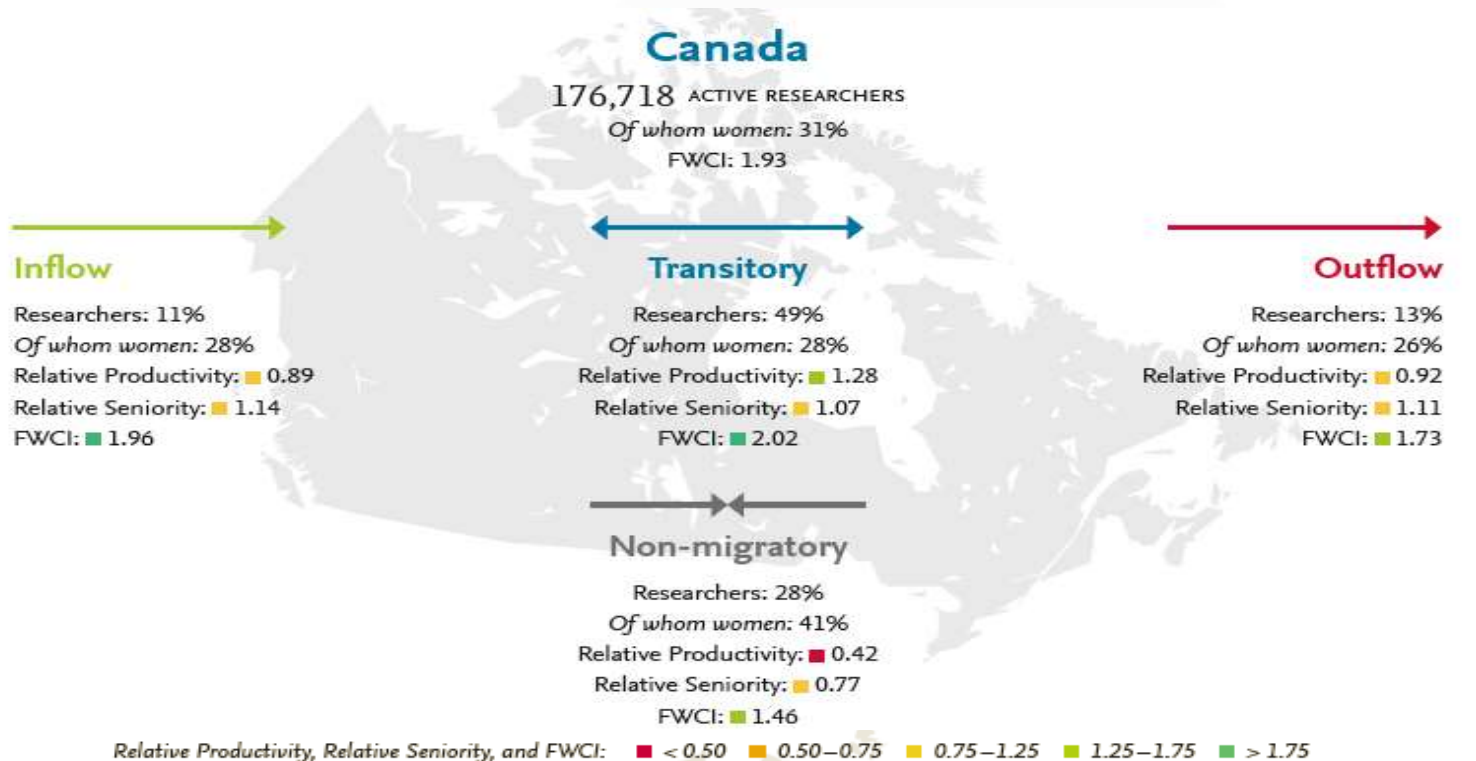
SCHOLARLY OUTPUT RESULTING FROM INTERNATIONAL COLLABORATION AS A SHARE OF TOTAL SCHOLARLY OUTPUT



International Collaboration

- Canada has relatively low shares of papers reflecting international collaboration for both women and men (opposite of the US)
- Scholarly output reflecting international collaboration increased for all comparators as a proportion of total scholarly output
- For all, women’s scholarly output is less likely to result from international collaboration than men’s

International Mobility of Women for Canada



- The proportion of women researchers classified as migratory is lower than the share of active women researchers overall whereas the share of non-migratory women researchers is higher than the share of women researchers overall.
- **This data indicate that women researchers in Canada may be less internationally mobile than men researchers.**
- The highest impact research for women comes from the transitory group. Impact is lowest for the non-migratory researchers.

Key Takeaways

- The proportion of women researchers in Canada is 42% overall.
- Women tend to specialize in the life and health sciences; men tend to specialize in the physical sciences.
- Women tend to publish slightly fewer papers than men on average; however, women's citation and download impact are similar to men's.
- Proportion of women among inventors is 13%, 20% of patent applications list a woman among their inventors.
- 8% of women's scholarly output belongs to the top 10% interdisciplinary papers, slightly more than men.
- Women seem to collaborate across the academic and corporate sectors on papers at a slightly lower rate than men.
- Women seem to collaborate internationally less than men; women also appear to be less internationally mobile than men.

Report Team

Global Advisers and Subject Experts

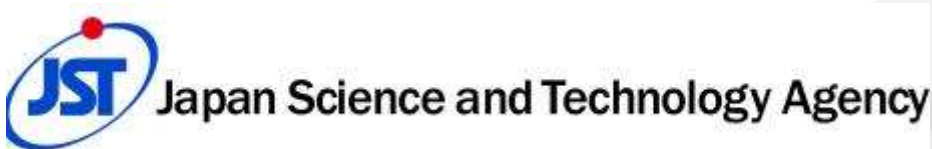
United States



EU



Asia Pacific



Expert Interviews

INTERVIEW



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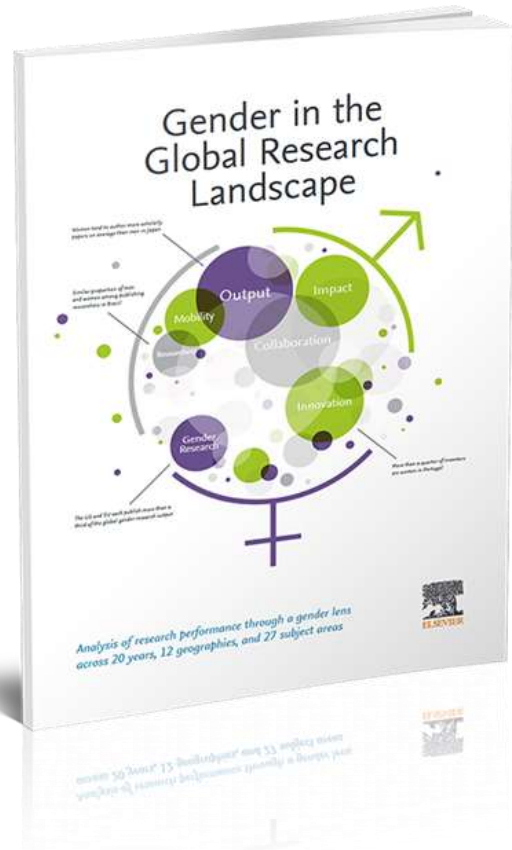


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In Closing

Report and Other Materials



- Download the **Report & Infographic**
 - https://www.elsevier.com/research-intelligence/resource-library/gender-report/_nocache – **Full Report**
 - <https://www.elsevier.com/research-intelligence/campaigns/gender-17> – **Infographics**
- Access the report's **Data**
 - <https://data.mendeley.com/datasets/bb3cjfgm2w/draft?a=142e523e-4b73-4829-99a8-ebb5c526c103> – on the **Mendeley Data** platform
- Access the report's **References**
 - <https://www.mendeley.com/community/gender-in-the-global-research-landscape/> – a public **Mendeley Group**, community resource for anyone to join and contribute
- Gender & Research **Resource Center**
 - <https://www.elsevier.com/connect/gender-and-science-resource-center> – **Dynamic resource** with information about gender and women in STEM activities, initiatives, and programs

Women's and Gender Studies Research Network (WGSRN)

Coming Soon to SSRN



- Launching with 4,000 working papers
- 16 Sub-areas:
 - **Gender in the Global Research Landscape**
 - Feminist Methodology and Research
 - Feminist Theory and Philosophy
 - Sexuality and Gender Studies
 - Gender and Social Protection
 - Women, History and Culture
 - Women and International Relations
 - Women and Psychology
 - Women and Work
 - Media, Gender and Identity
 - Sexual and Gender Based Violence
 - Women and Law
 - Women and Health
 - Gender, Politics and Justice
 - Gender, Arts, Literature and Music



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