

Analysis of Research Performance Through a Gender Lens

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On behalf of the report team

December 6, 2017 | AUTM Women Inventors Committee Webinar | #ELSGENDER17

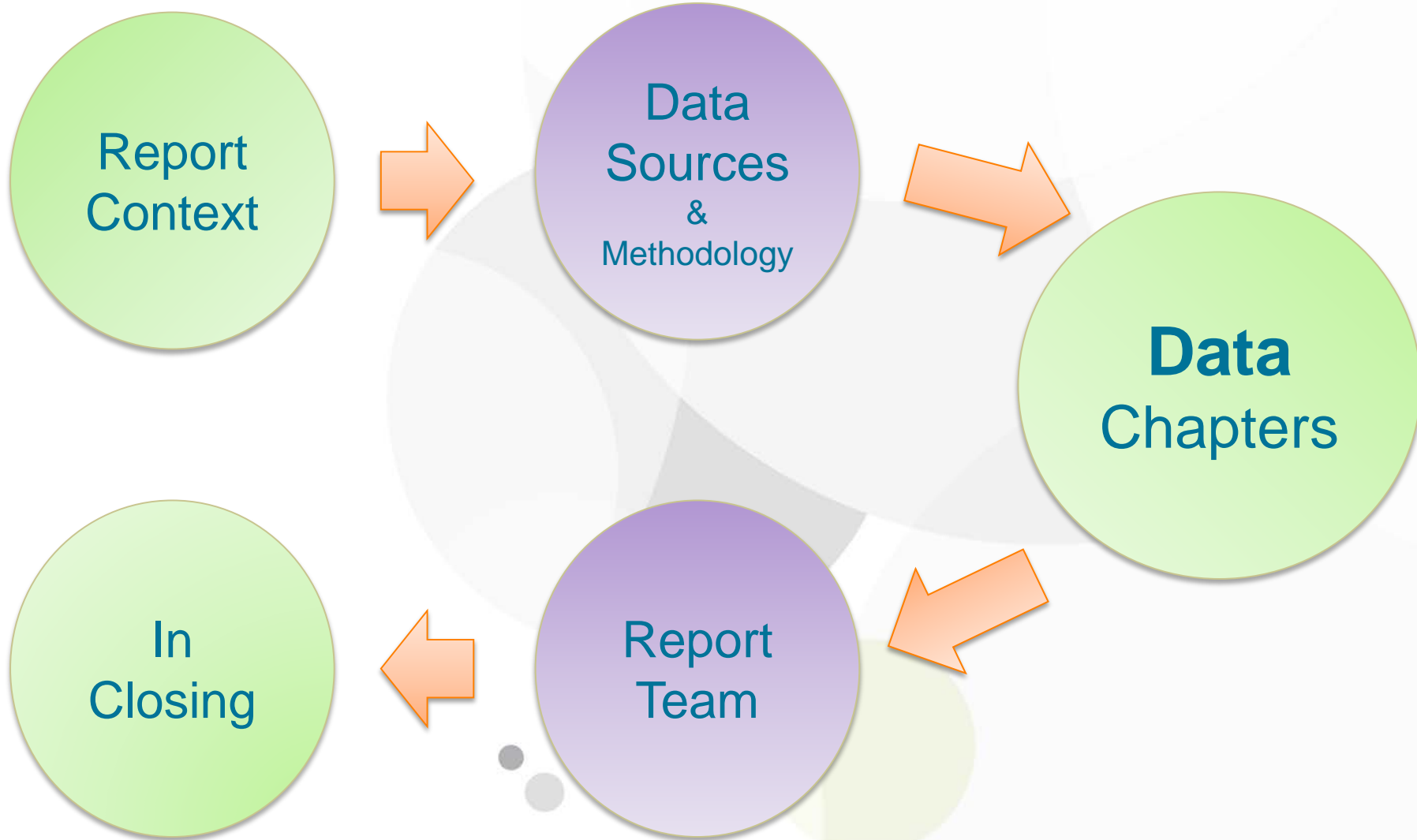


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*Gender in the
Global Research
Landscape*

Presentation Roadmap



Report Context

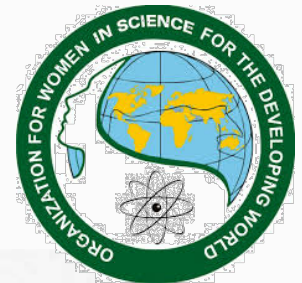
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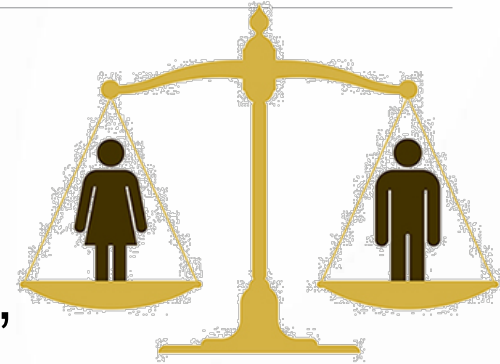
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Elsevier Gender Working Group



- **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 address gender issues**

Answering the Call for Data

National Institutes of Health addresses the science of diversity

Hannah A. Valentine^{a,1} and Francis S. Collins^b

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Edited by Inder 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.

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 accesses 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 institutional data about recruitment, retention, and development



France 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...”

stein Forum (NEF) 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.

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

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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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Data Sources & Methodology

www.elsevier.com/research-intelligence

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: A Focus on Innovation

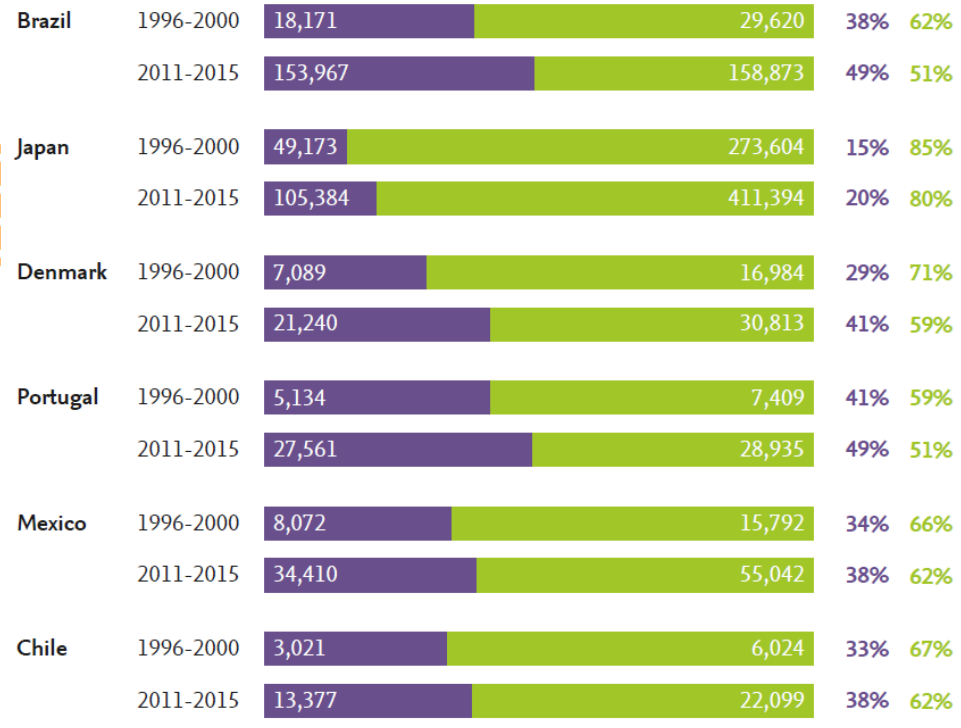
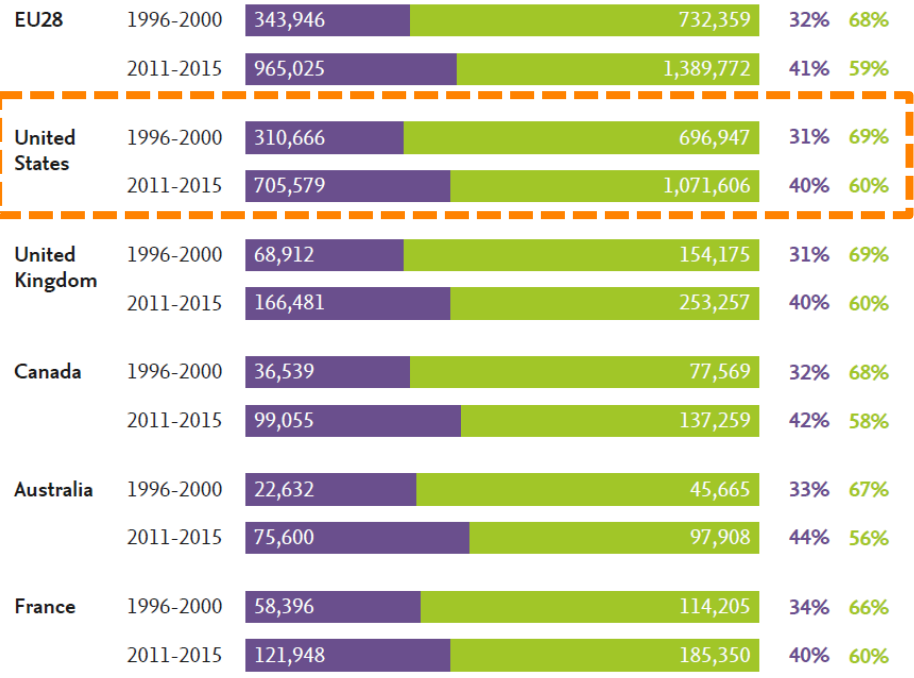
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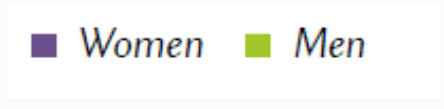
CHAPTER 1
The global research
landscape through
a gender lens

Proportion and Number of Researchers by Gender

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



- Proportion of women among researchers and inventors is increasing
- Women comprise more than 40% of researchers in nine regions in 2011-15
- In the US, **40%** of researchers are women, an increase of 9 percentage points since 1996-2000

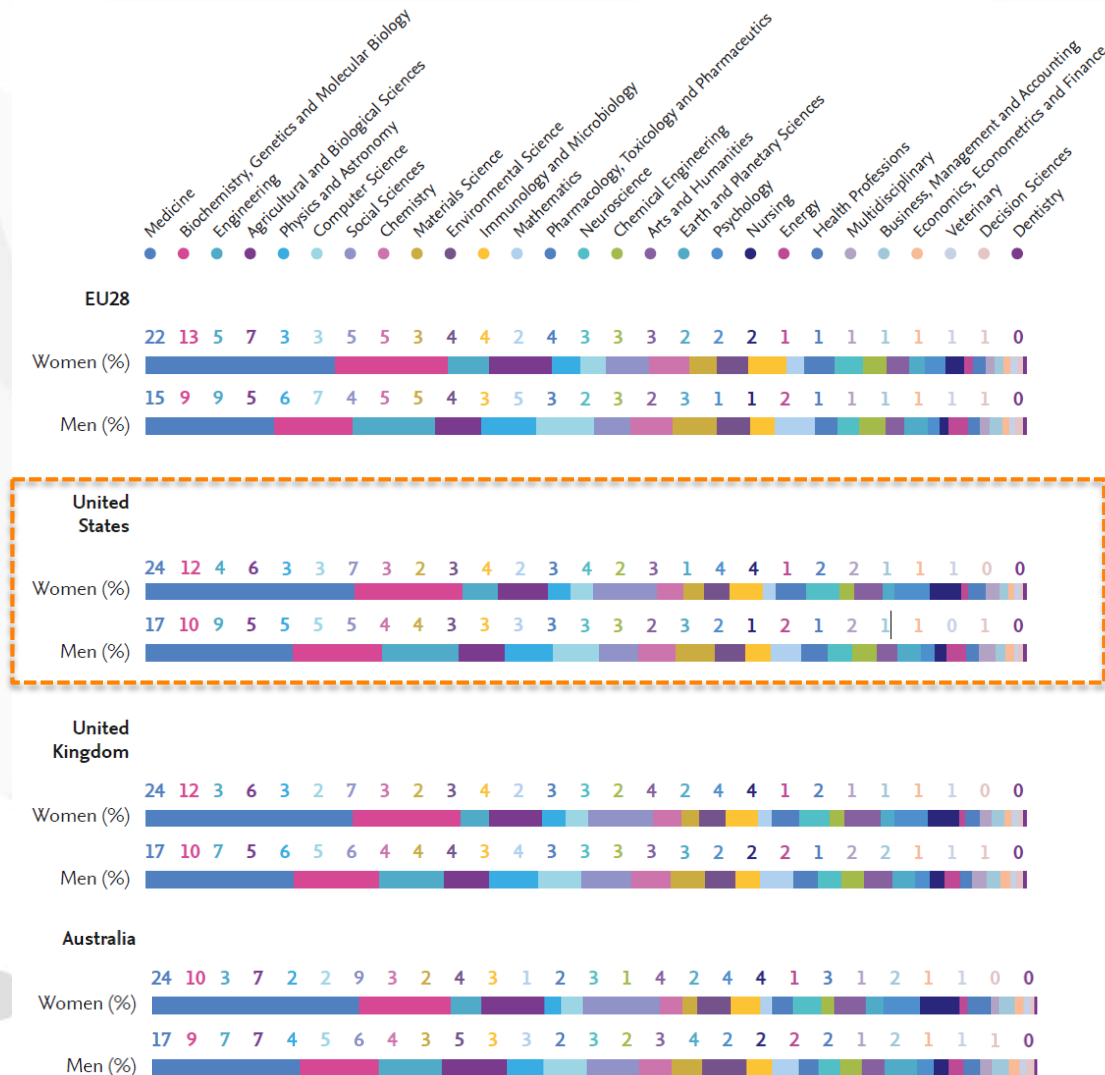


Researchers = Authors who have published articles, reviews, and conference proceedings indexed in Scopus

Distribution of US 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 17% of men authors
- By contrast, 9% 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 US Researchers

by gender and subject area

- Lower proportion of women among researchers for most comparators:

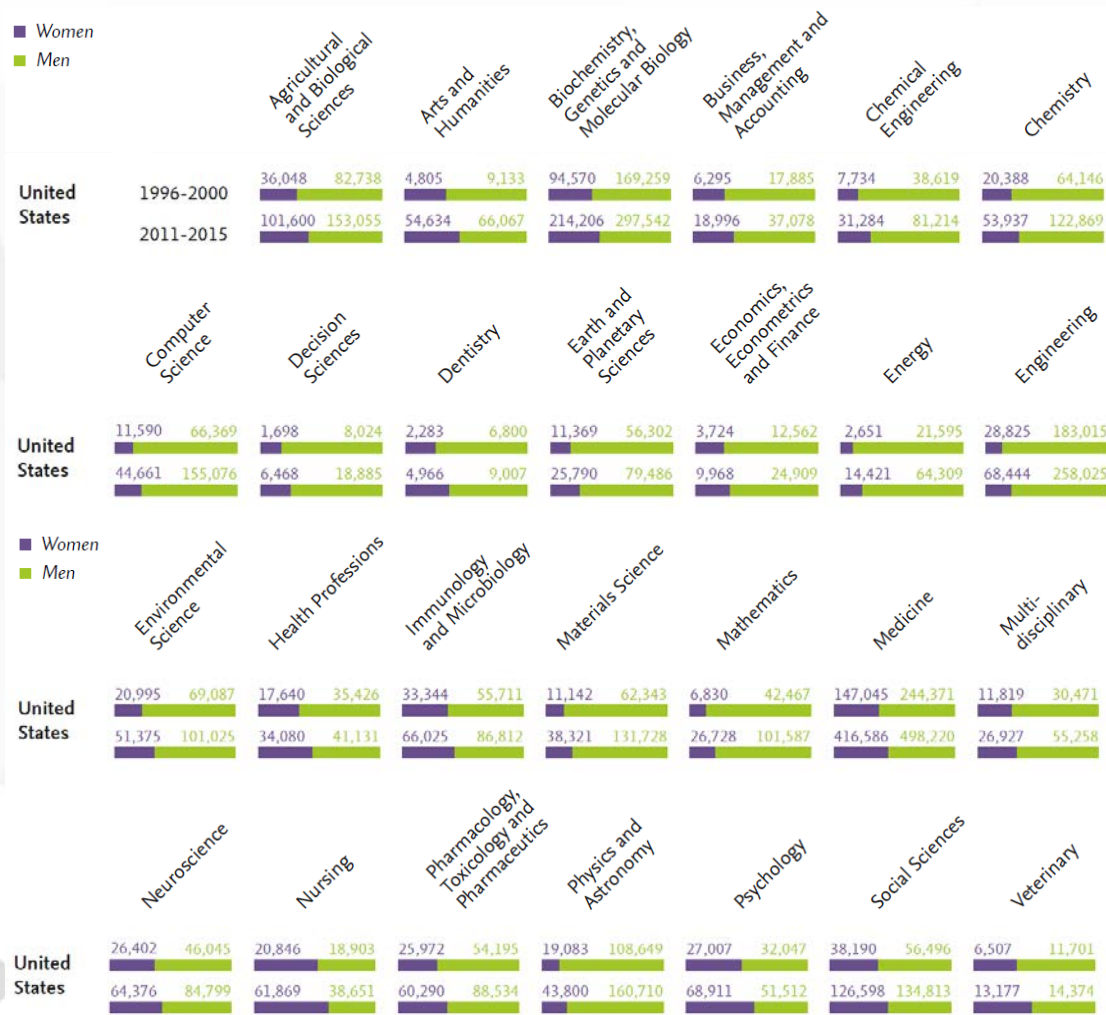
- Energy (18%)
- Engineering (21%)
- Mathematics (21%)
- Physics & Astronomy (21%)

- Majority of researchers are women in:

- Nursing (62%)
- Psychology (57%)

- Fields in which women comprise nearly half of researchers:

- Social Sciences (48%)
- Veterinary Sciences (48%)
- Medicine (46%)
- Health Professions (45%)
- Arts & Humanities (45%)



Scholarly Output Per Researchers

by gender and comparator

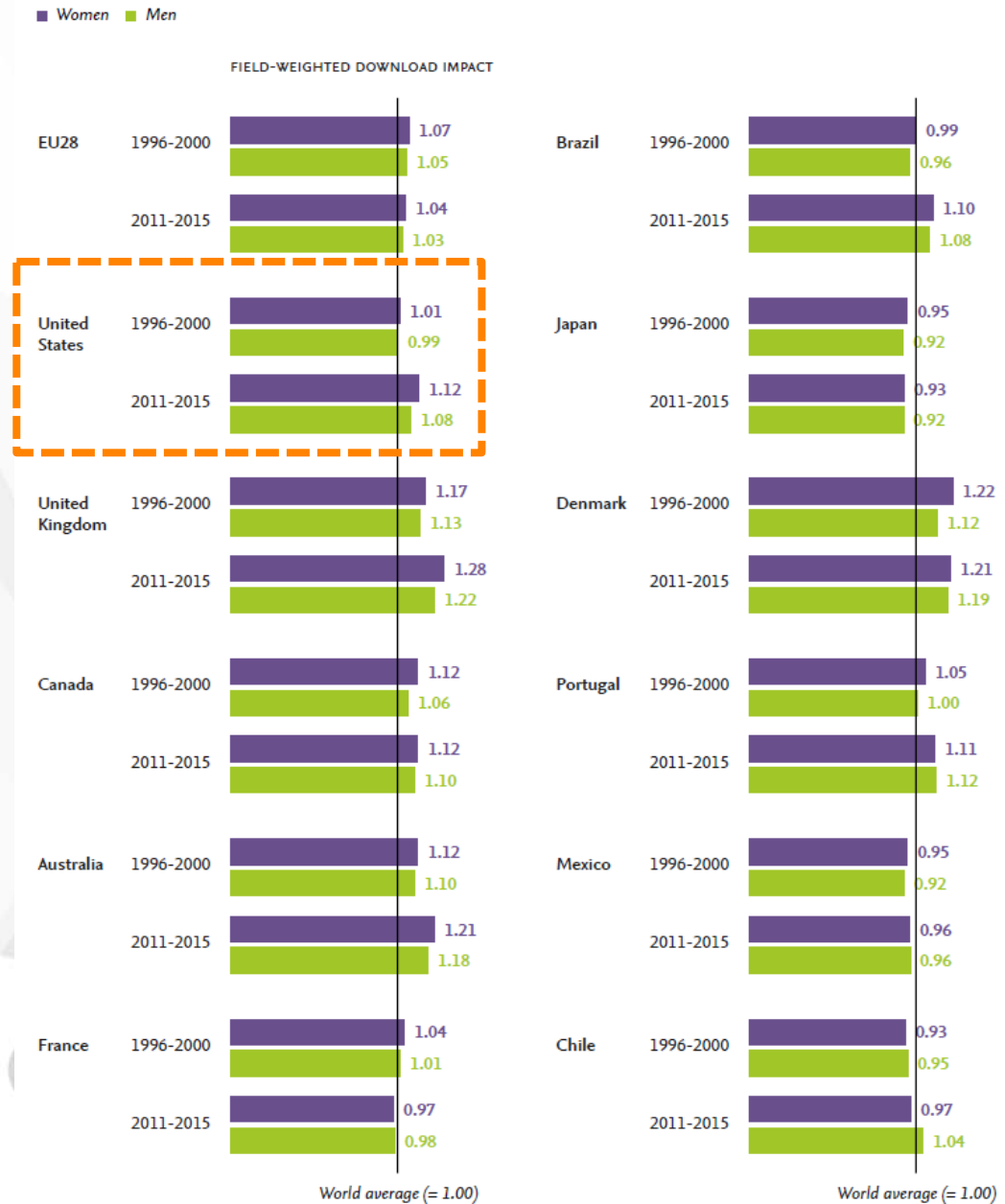
- Men publish slightly more papers on average than women in the majority of comparators and the US
- Both men and women see a minute decline in average number of papers per researcher over time



Download Impact

by gender and comparator

- The US is the only comparator country in which the FWDI for women is higher 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

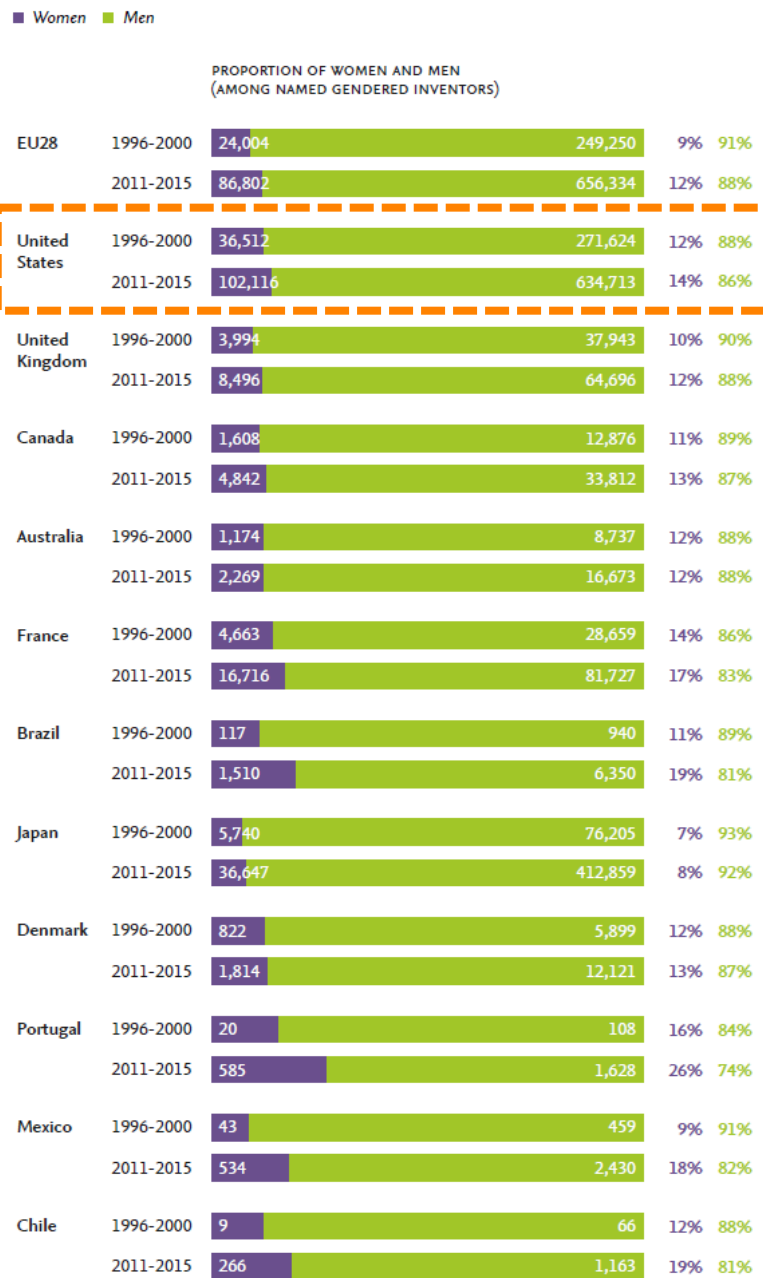


Proportion and Number of Inventors

by gender and comparator



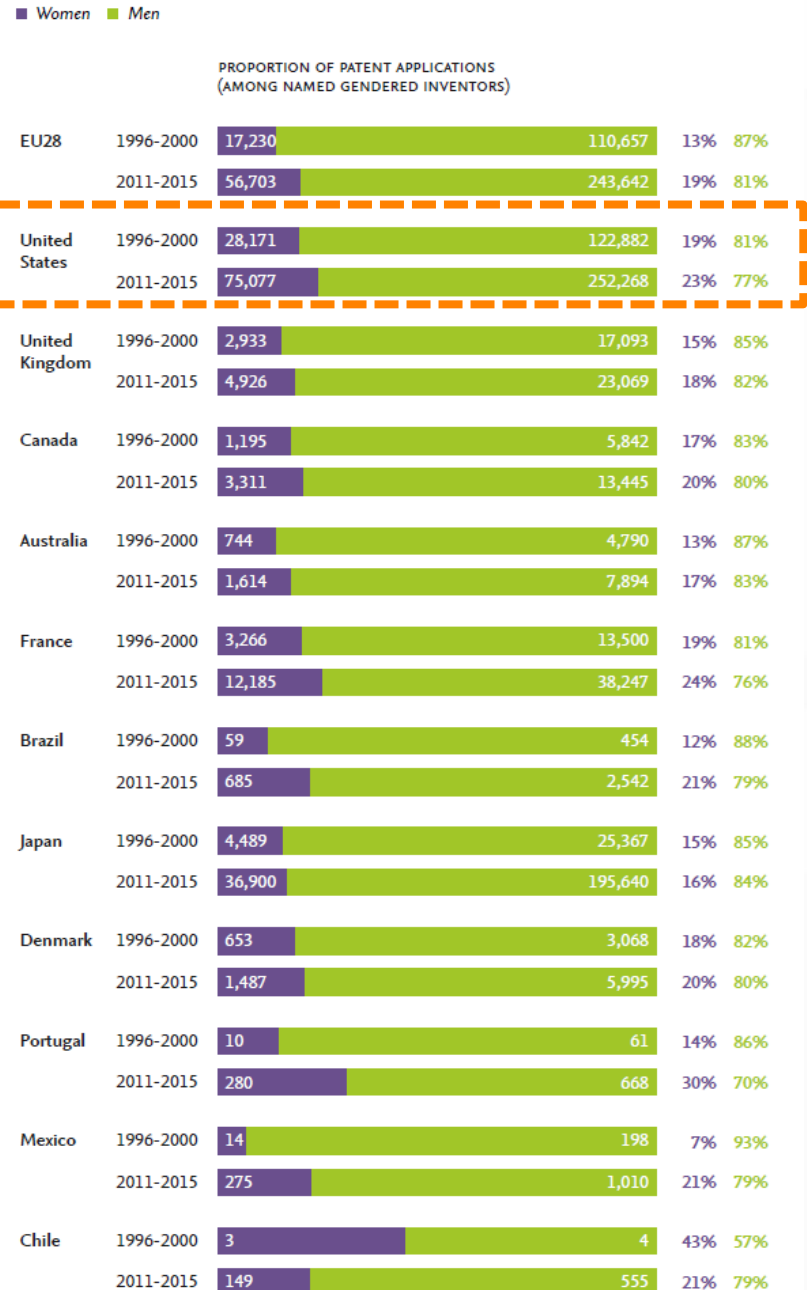
- Amongst inventors, women are **generally under-represented**: women represent no more than 26% (Portugal) of inventors in 2011-2015
- In the US, women represent 14% of inventors in 2011-2015, up from 12% in 1996-2000
- The number of women named on patent applications is nearly 3X as high in 2011-2015
- For all reported comparators, there is an improvement in gender balance between the analyzed periods

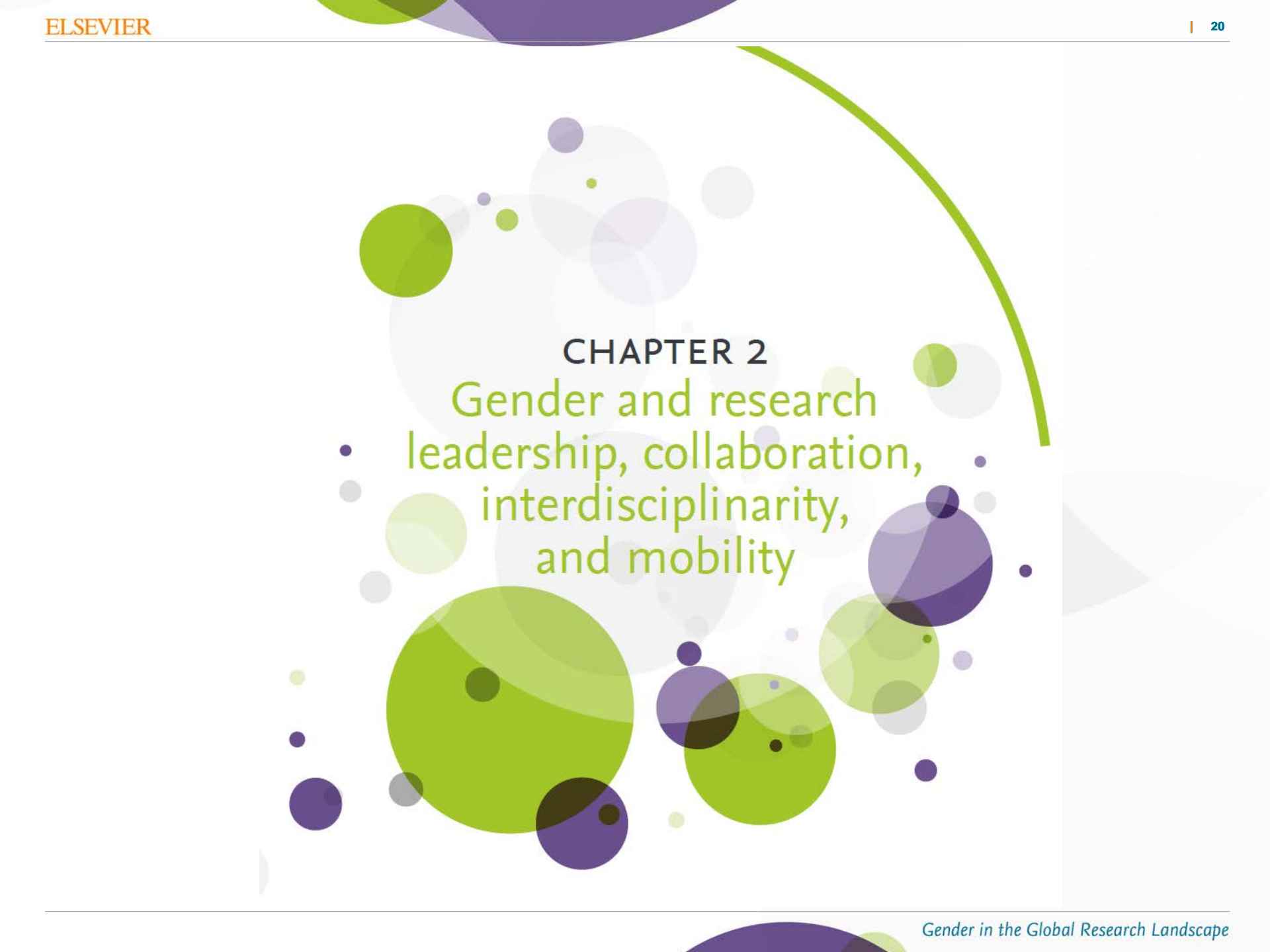


Proportion of Patent Applications by gender and comparator



- For the US, the percentage of patent applications that include at least one woman among inventors increased from 19% to 23% in 2011-2015 (globally 19% to 28%)
- Higher proportion than the EU, UK, Canada, 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



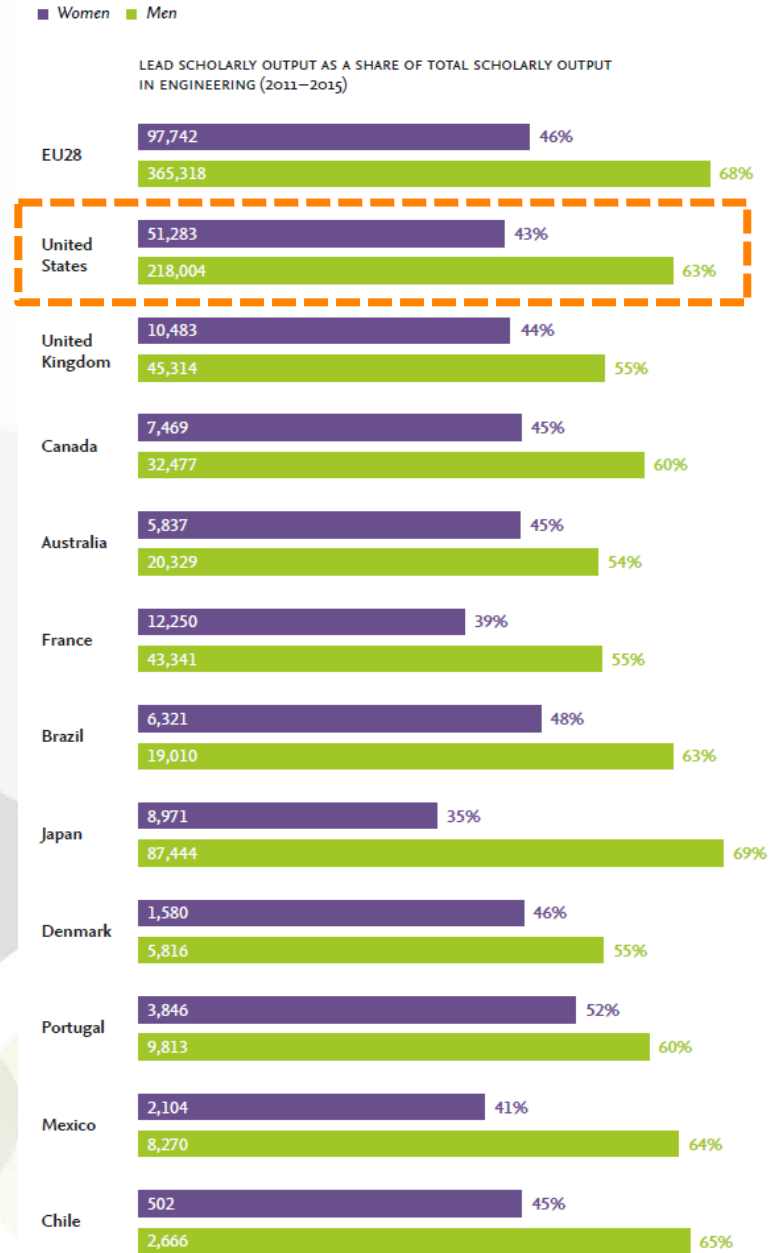


CHAPTER 2
Gender and research
leadership, collaboration,
interdisciplinarity,
and mobility

Leadership

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

- Women researchers significantly outnumbered by men in engineering: 79% of researchers in the US are men
- **When men appear as authors in Engineering papers, they are more likely to take the first or corresponding author position**
- In the US, women are first or corresponding author on 20% fewer papers than men

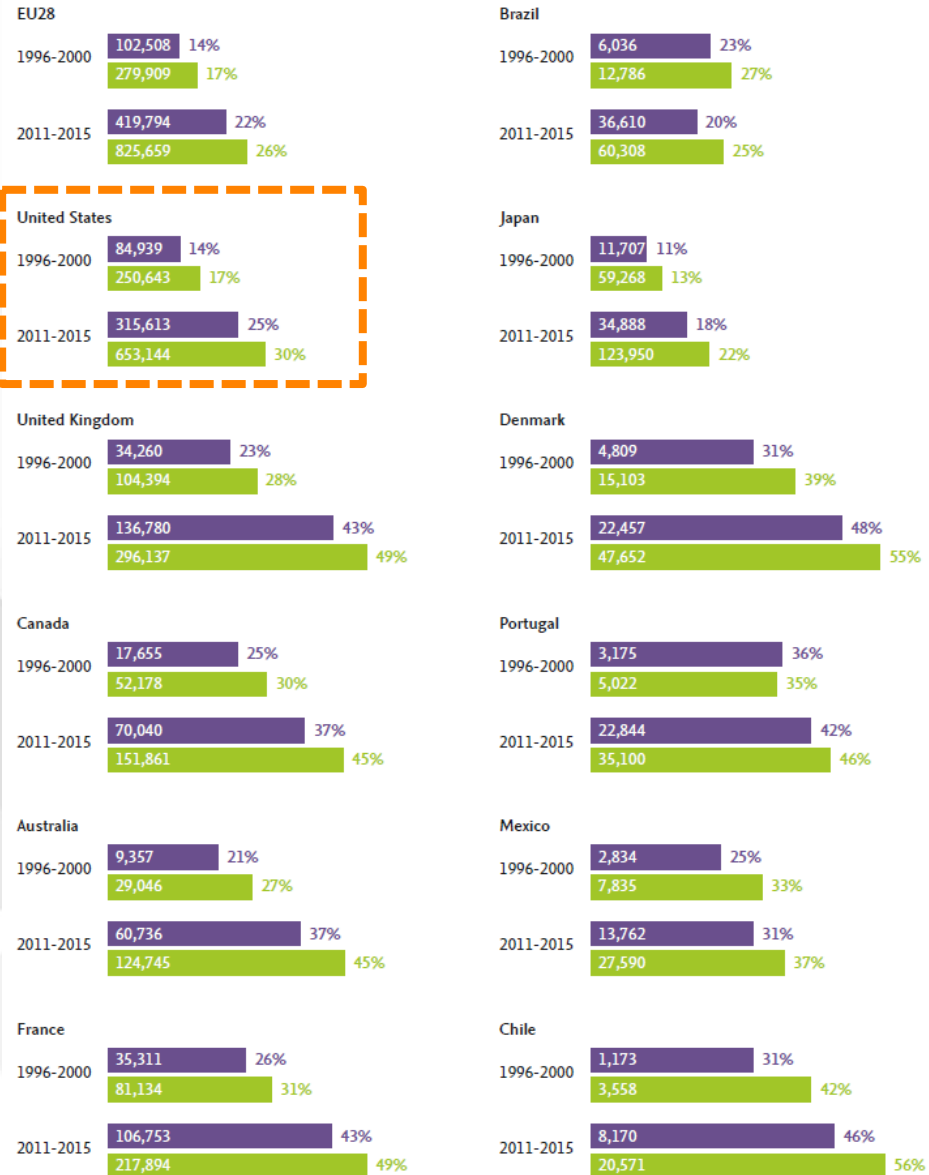


International Collaboration

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

■ Women ■ Men

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

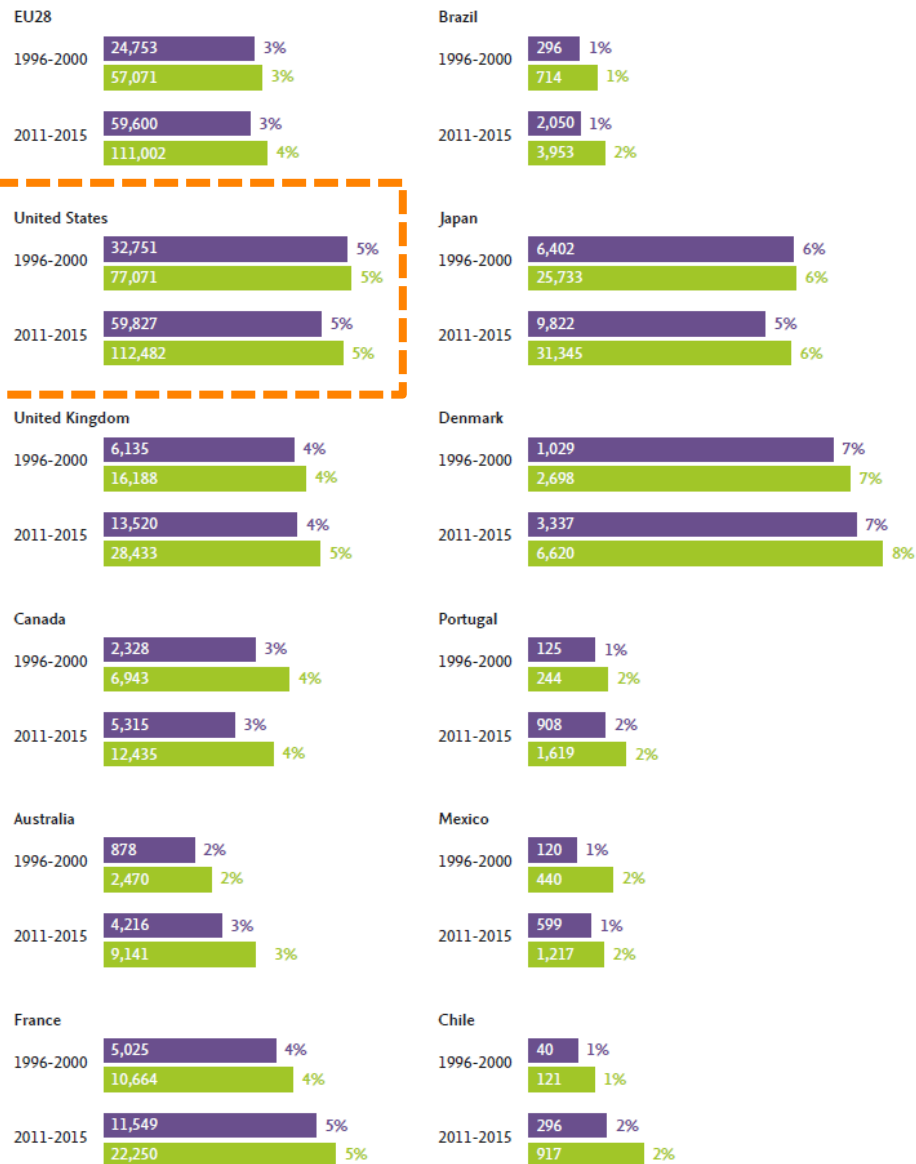


Academic-Corporate Collaboration

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

■ Women ■ Men

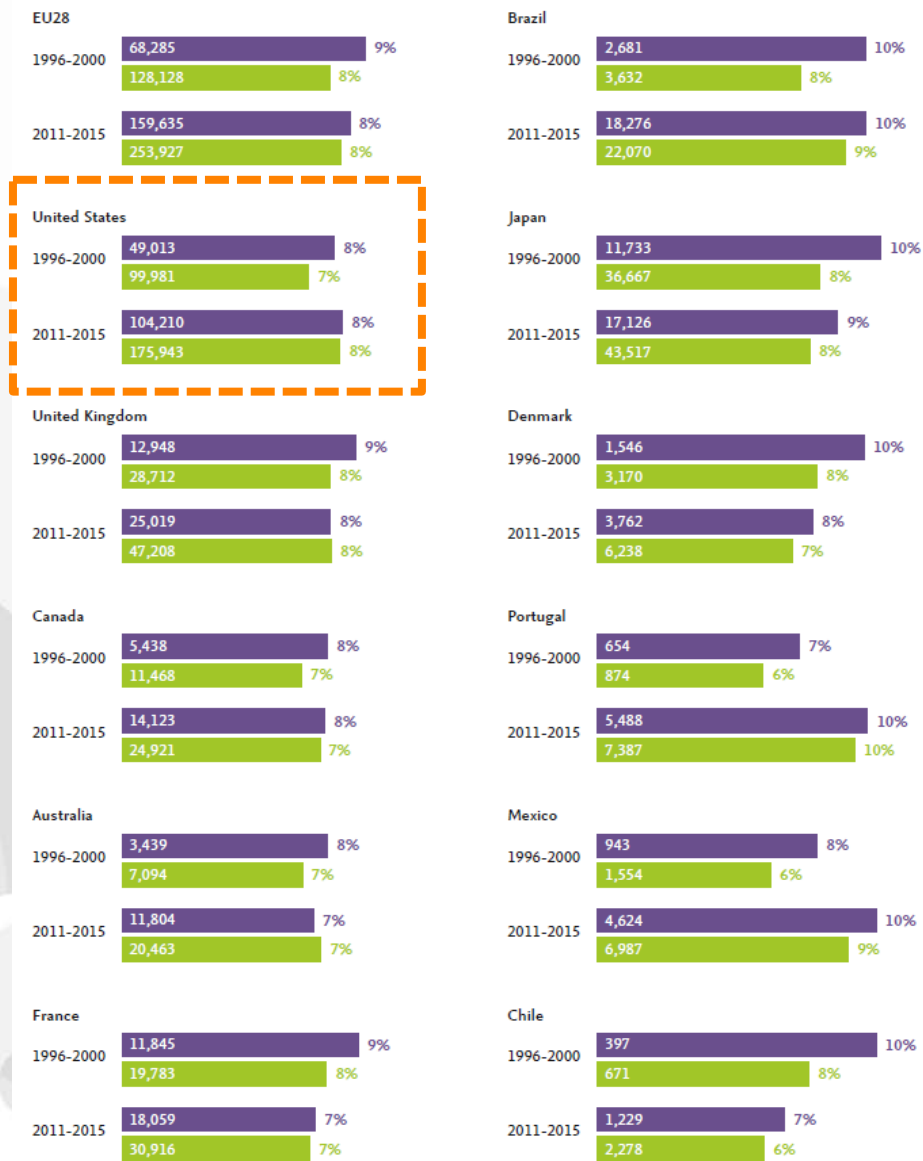
SCHOLARLY OUTPUT RESULTING FROM ACADEMIC-CORPORATE COLLABORATION AS A SHARE OF TOTAL SCHOLARLY OUTPUT



Interdisciplinary Research

- The proportion of output that belongs to the top 10% interdisciplinary output is 8% for both women and men in the US
- **Women tend to have the same or a slightly higher share than men of interdisciplinary research across all comparators**
- For most, the proportion decreases for women and increases for men over time

■ Women ■ Men
 TOP 10% INTERDISCIPLINARY SCHOLARLY OUTPUT AS A SHARE OF TOTAL SCHOLARLY OUTPUT



Knowledge Exchange Metrics

- Research articles cited in patents
- Patents citing published articles
- Patent citations received by an institution
- Downloads of articles by industry
- Top Industry Collaborators
- Top Potential Industry Collaborators
- Cross-sector Mobility



Economic Development Research Intelligence Solutions

Academic Executives

- Showcase basic and applied research capabilities to catalyze commercialization
- Map your research strengths to the specific needs of industries in your community
- Understand and quantify the impact of academic-industry collaboration at your institution

Economic Development Professionals

- Analyze your region's innovation ecosystem to prioritize policy and investment
- Provide an evidence-based view of your region's expertise for potential investors and employers
- Connect researchers and companies in your region based on complementary interests, expertise, and needs

Private Sector Leaders

- Identify and connect with leading academic research experts
- Strategically invest in cities and regions with relevant research, deep talent pools, and strong pipelines
- Map local research and innovation activity to discover the best potential partners in higher education



Report Team

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Global Advisers and Subject Experts

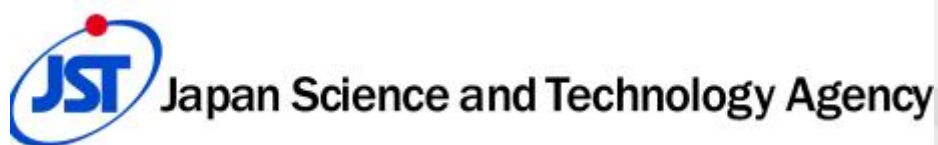
United States



EU



Asia Pacific



Expert Interviews

INTERVIEW



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INTERVIEW



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INTERVIEW



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INTERVIEW



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In Closing

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Report and Other Materials

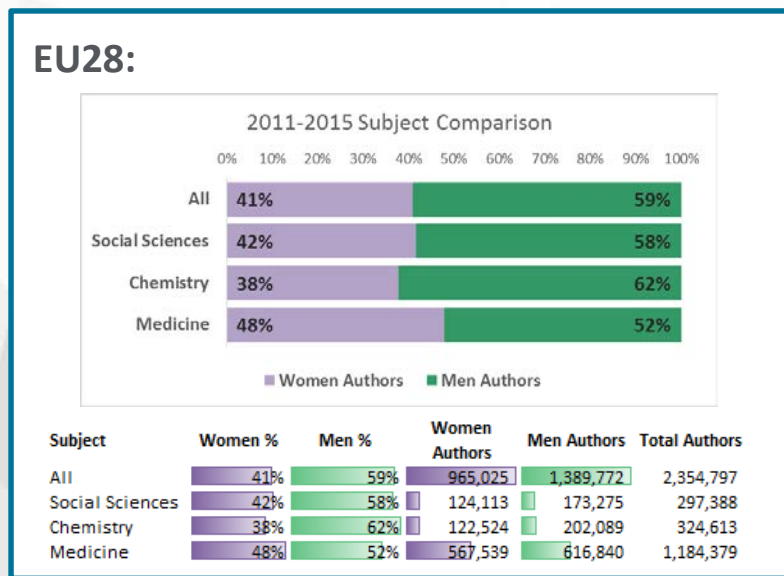
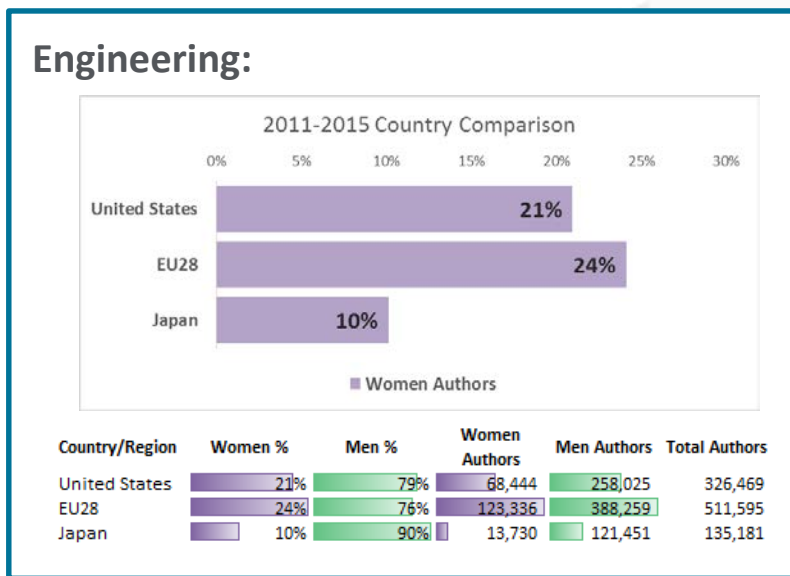


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 - <https://www.mendeley.com/community/gender-in-the-global-research-landscape/> – a public **Mendeley Group**, community resource for anyone to join and contribute
- Gender & Research **Resource Center**
 - <https://www.elsevier.com/connect/gender-and-science-resource-center> – **Dynamic resource** with information about gender and women in STEM activities, initiatives, and programs

Have Data, Use Data!

Elsevier publishers now have access to the **author data** used for the report + an **Excel-based graphing tool**.

Select and compare **subjects** and **countries/regions** of interest to see the representation of women and men among researchers (examples below):



- Access to the shares of women and men among researchers for **27 subject areas (ASJC 27)** across **43 countries/regions**
- Generate **charts and tables** showing comparisons of subjects/regions at the click of a button
- The tool provides subject-specific benchmarks to help us **analyse and contextualise gender balance on our editorial boards**.

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Thank you!

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