

Analysis of Research Performance Through a Gender Lens

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On behalf of the report team

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- **Overview & Key Findings**
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Report Context

A Strong Foundation

THE ELSEVIER FOUNDATION



GenderInSITE

Gender in science, innovation, technology and engineering

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



twas THE WORLD ACADEMY OF SCIENCES
for the advancement of science in developing countries

Global Initiatives



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Statement of Principles and Actions Promoting the Equality and Status of Women in Research

SUSTAINABLE DEVELOPMENT GOALS



1. <https://www.elsevier.com/research-intelligence/research-initiatives/sustainability-2015>
2. <https://www.elsevier.com/research-intelligence/research-initiatives/gender-2015>

A 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

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.

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

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 more. This review highlights

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

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.



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

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-



“...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 innovators from across the continent—women and men—gathered to share their research and ideas. The NEF is a platform for international data about recruitment and retention to develop

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

Information Analytics Expertise

Research Intelligence

Custom and Analytical Reports from Elsevier

Analytical Services provides accurate, unbiased analysis on research performance by combining high quality data sources with technical and research metrics expertise accrued over Elsevier's 130 years in academic publishing.

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.

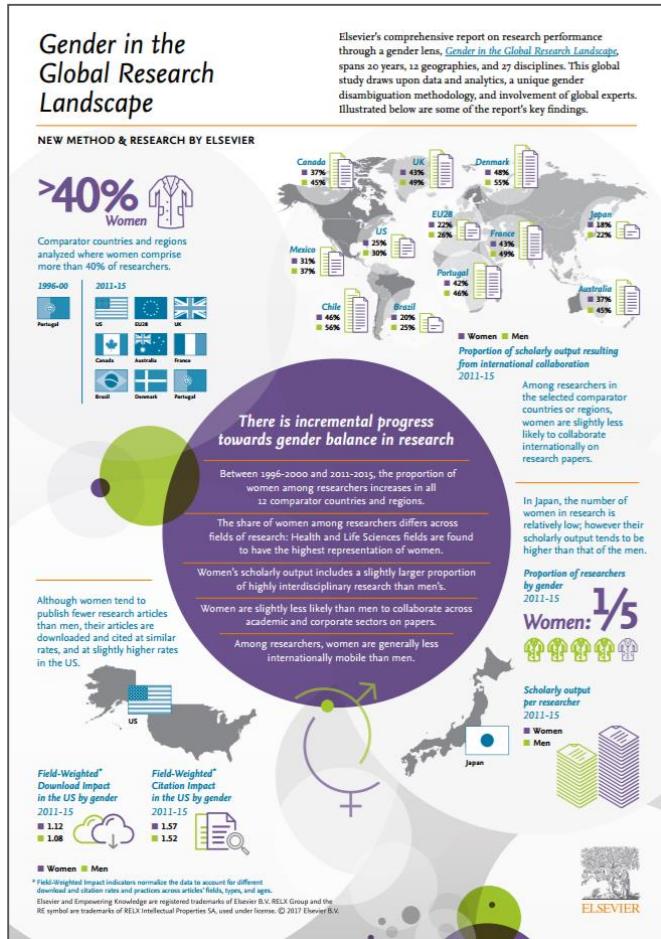


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Overview & Key Findings

The 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

Interviews

INTERVIEW



Miyoko O. Watanabe

*Deputy Executive Director, Office for Diversity and Inclusion,
Japan Science and Technology Agency (JST), Japan*

INTERVIEW



James Stirling

Provost, Imperial College, United Kingdom

INTERVIEW



Vladimir Šucha

*Director-General, Joint Research Centre
European Commission, European Union*

INTERVIEW



Londa Schiebinger

*The John L. Hinds Professor of History of Science and Director, Gendered Innovations in Science,
Health & Medicine, Engineering, and Environment, Stanford University, United States*

Key Findings: United States

- Proportion of women researchers in the US is **40%** (2011-2015)
- Women tend to specialize in **the life and health sciences**
- Women's citation and download impact is **very slightly higher** than men's
- Proportion of women among inventors is **14%**
- **23%** of patent applications list a women among their authors
- Women collaborate internationally **less than men**
- Women collaborate across the academic and corporate sectors at a **similar rate** to men
- **8%** of women's scholarly output belongs to the top 10% interdisciplinary papers

Methodology

Global Advisers and Subject Experts

United States



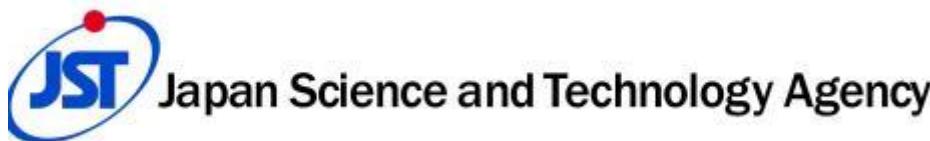
HARVARD
UNIVERSITY



EU



Asia Pacific

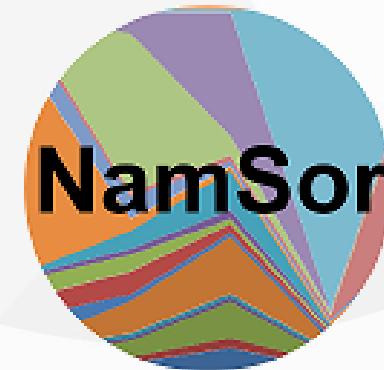
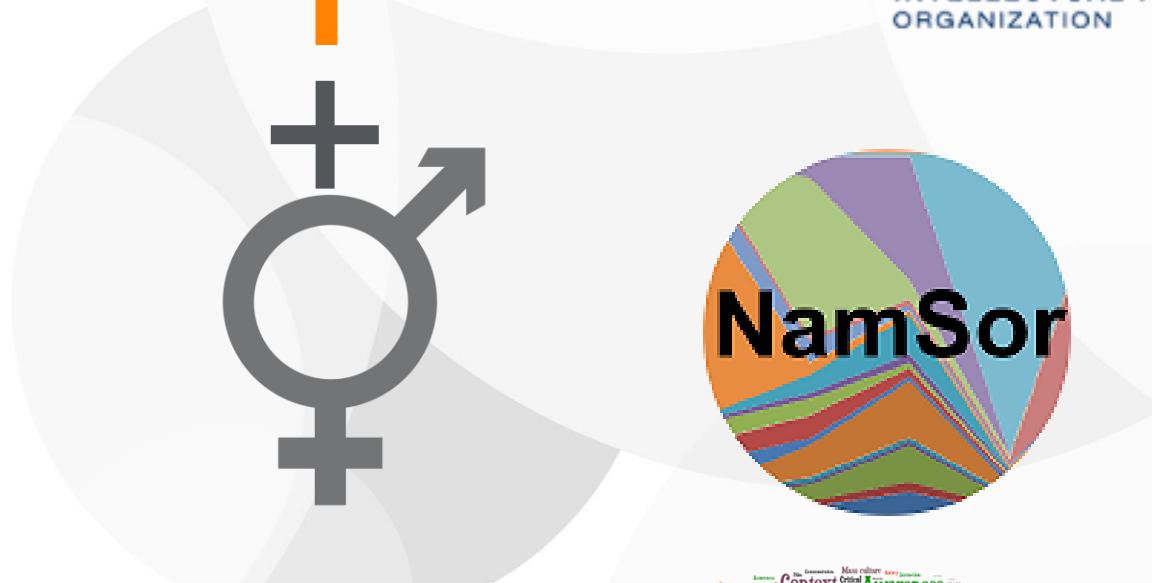


Gender Disambiguation Methodology

Scopus®



genderize.io



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



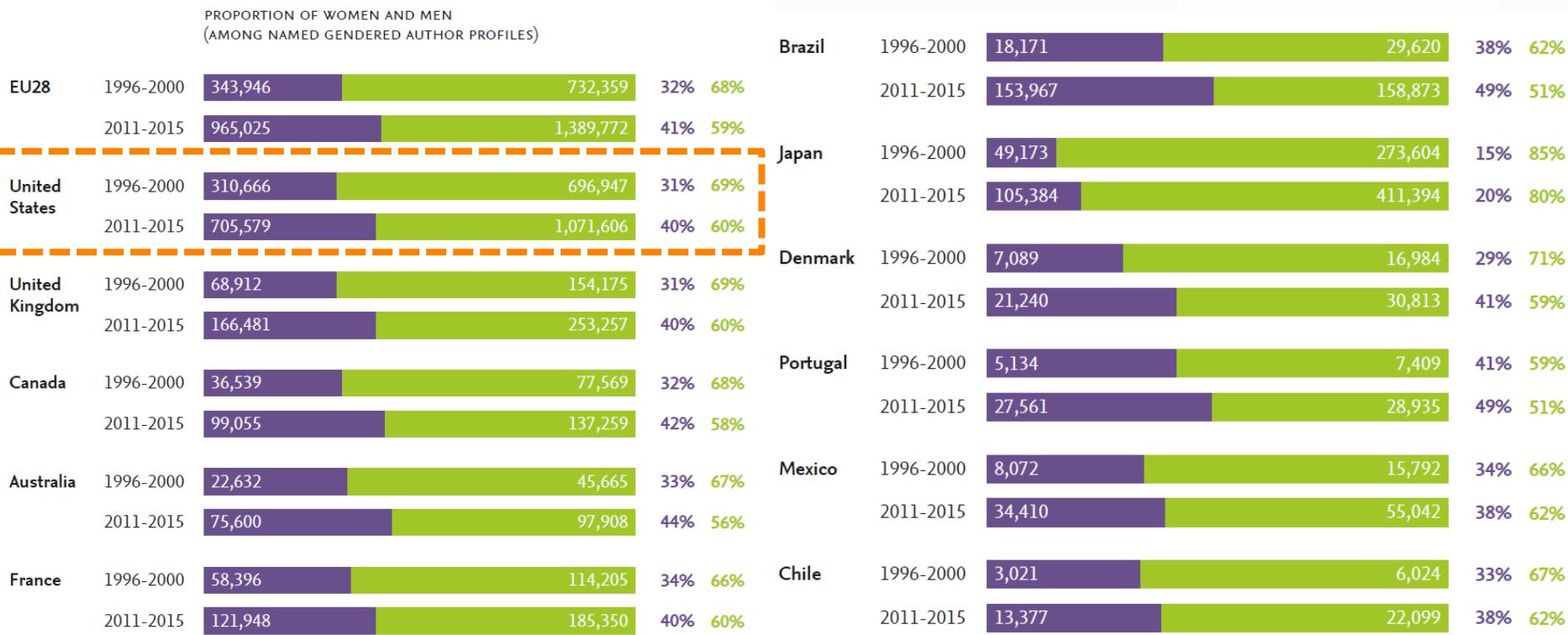
The Results



CHAPTER 1

The global research landscape through a gender lens

Proportion and Number of Researchers by Gender



- 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

■ Women ■ Men

Proportion and Number of US Researchers

by gender and subject area

- Lower **proportion of women** among researchers for most comparators:

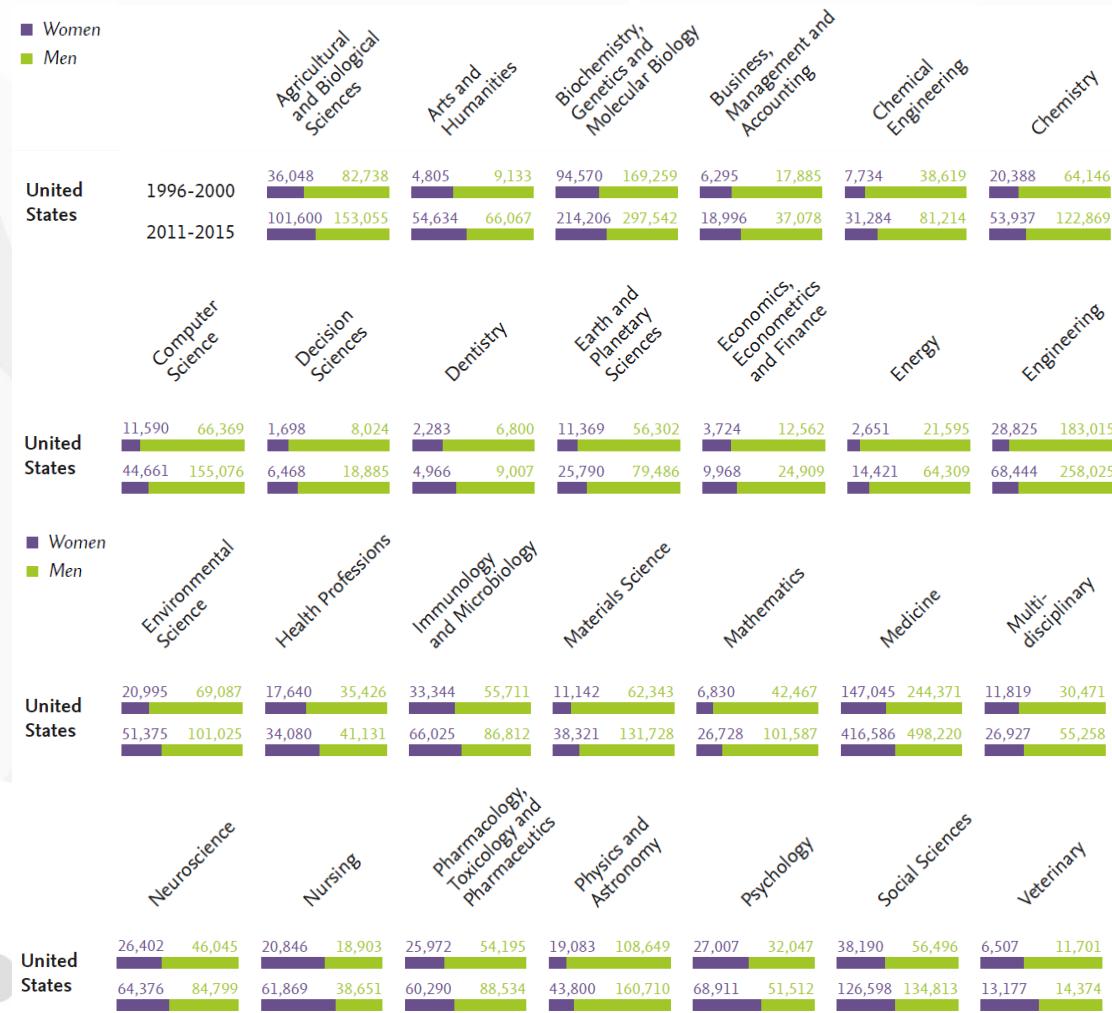
Energy (18%)
 Engineering (21%)
 Mathematics (21%)
 Physics & Astronomy (21%)

- 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



Citation Impact

by gender and comparator

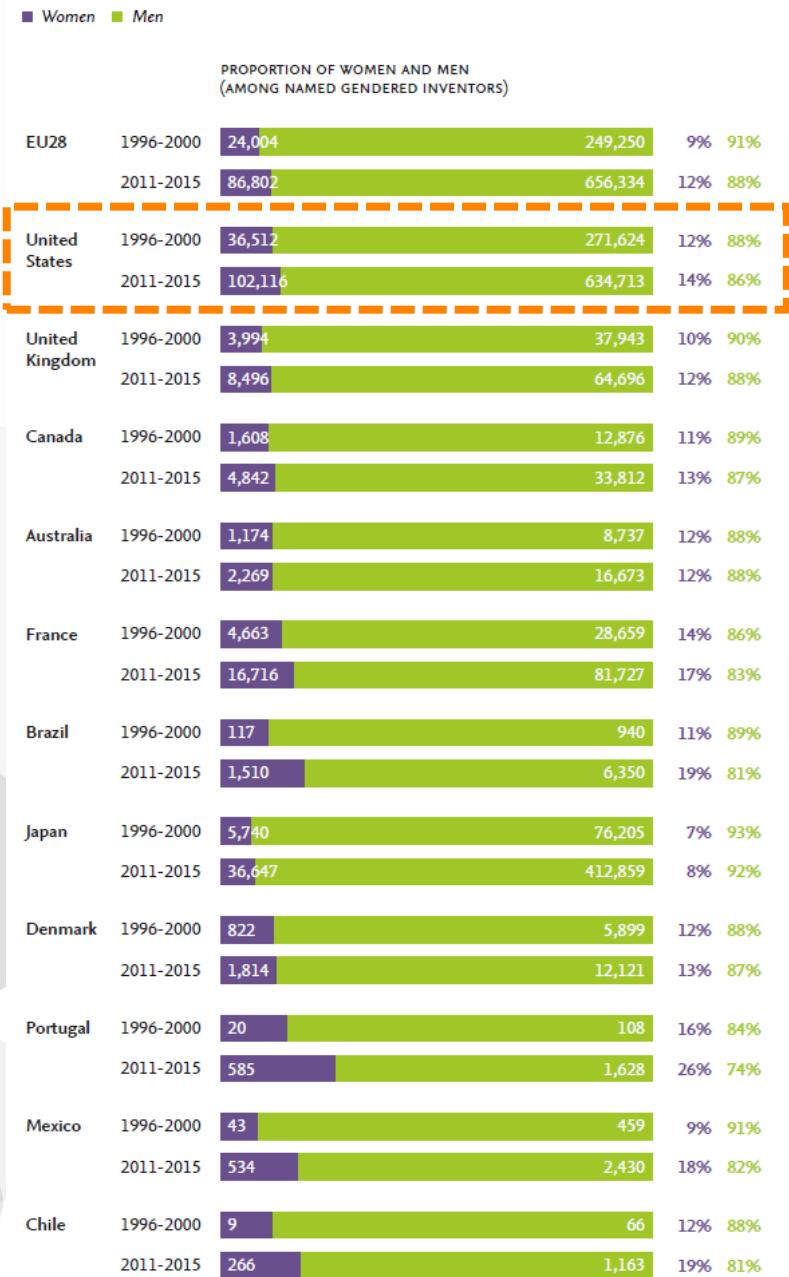
- Women and men tend to have similar citation and download rates
- The US is the only comparator country in which the FWCI for women is higher than for men
- In the UK and EU, the FWCI is about equal for men and women. Brazil, Portugal, Mexico, and Chile all show slightly higher FWCI values for men researchers than for women researchers.



Proportion and Number of Inventors by gender and comparator



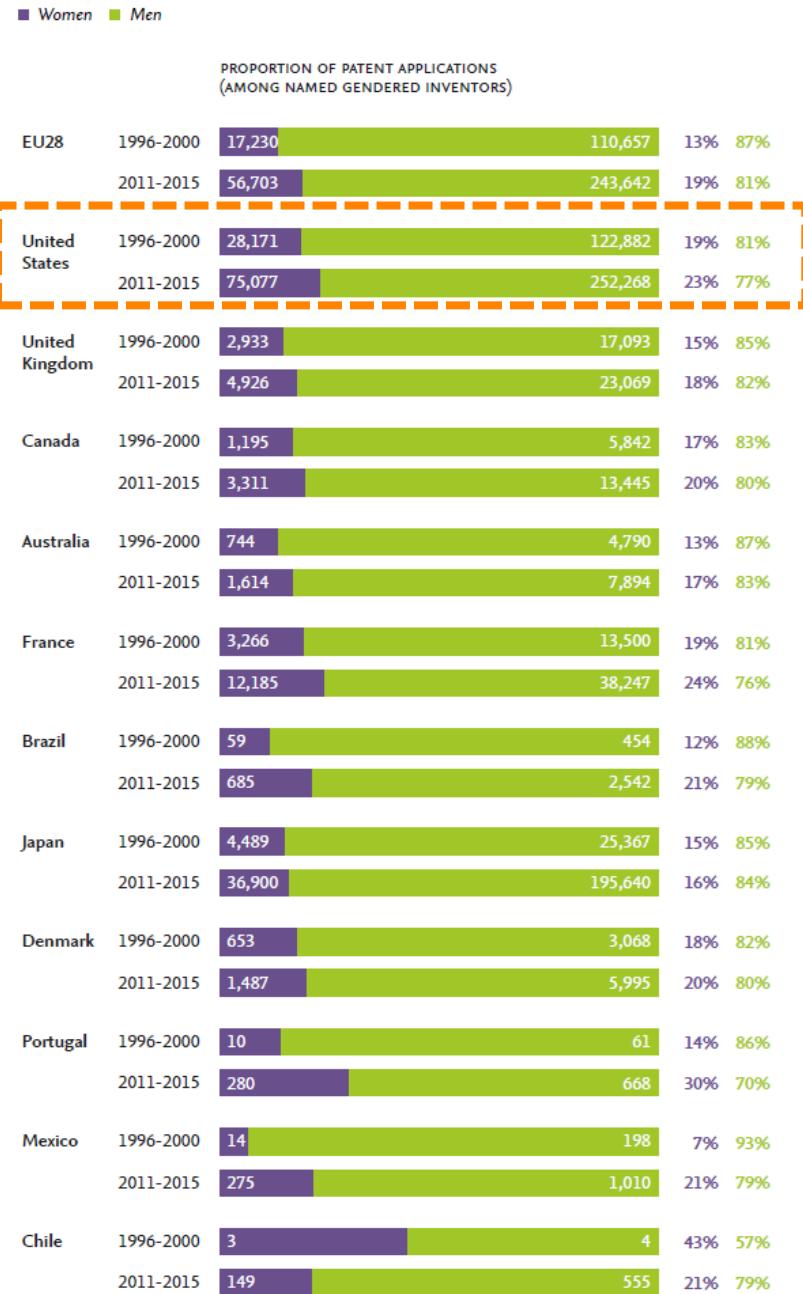
- Amongst inventors, women are generally under-represented: women represent no more than 26% (Portugal) of inventors in 2011-2015
- In the US, women represent 14% of inventors in 2011-2015, up from 12% in 1996-2000
- The number of women named on patent applications is nearly 3X as high in 2011-2015
-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

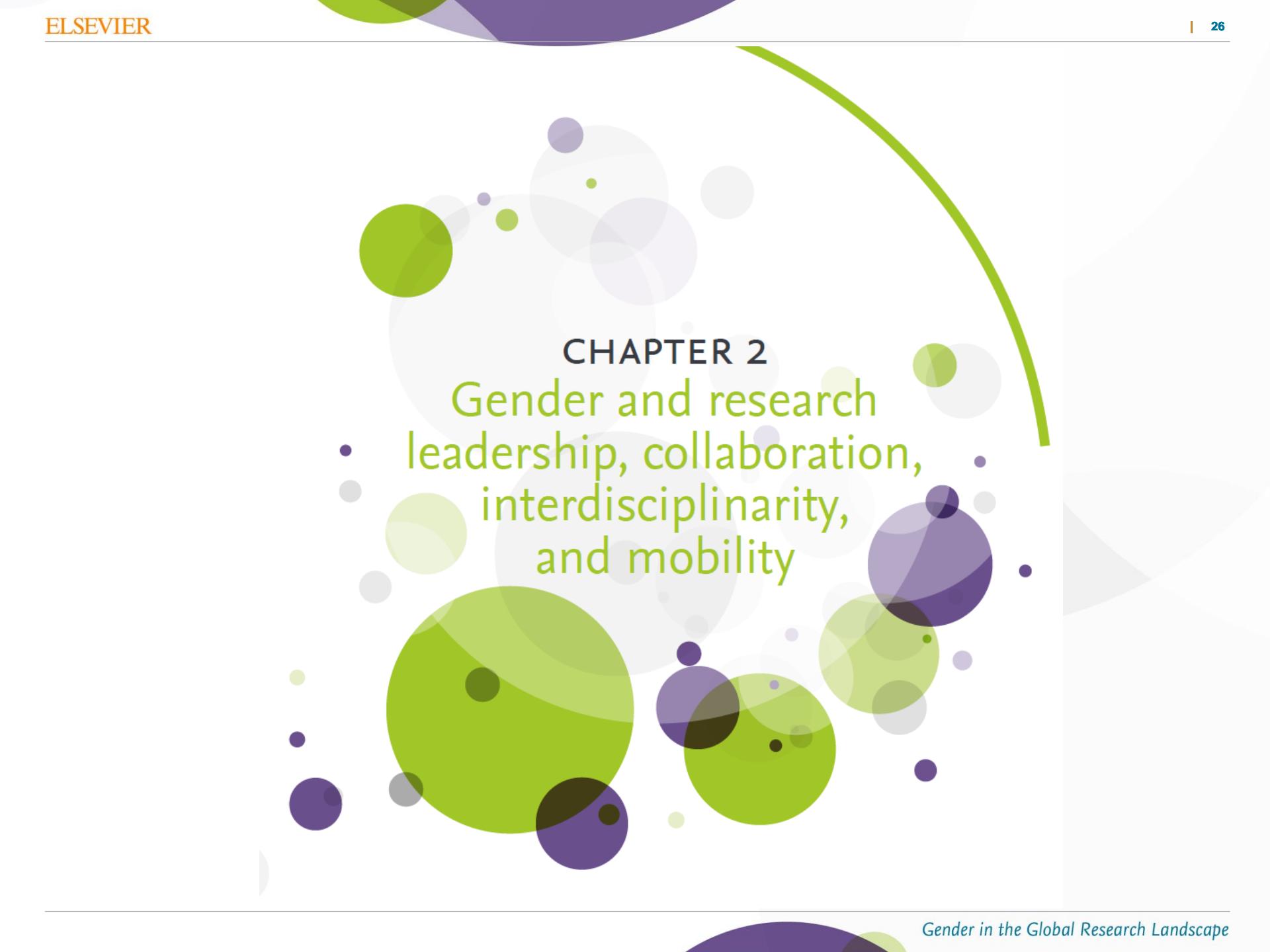


Proportion of Patent Applications by gender and comparator



- 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

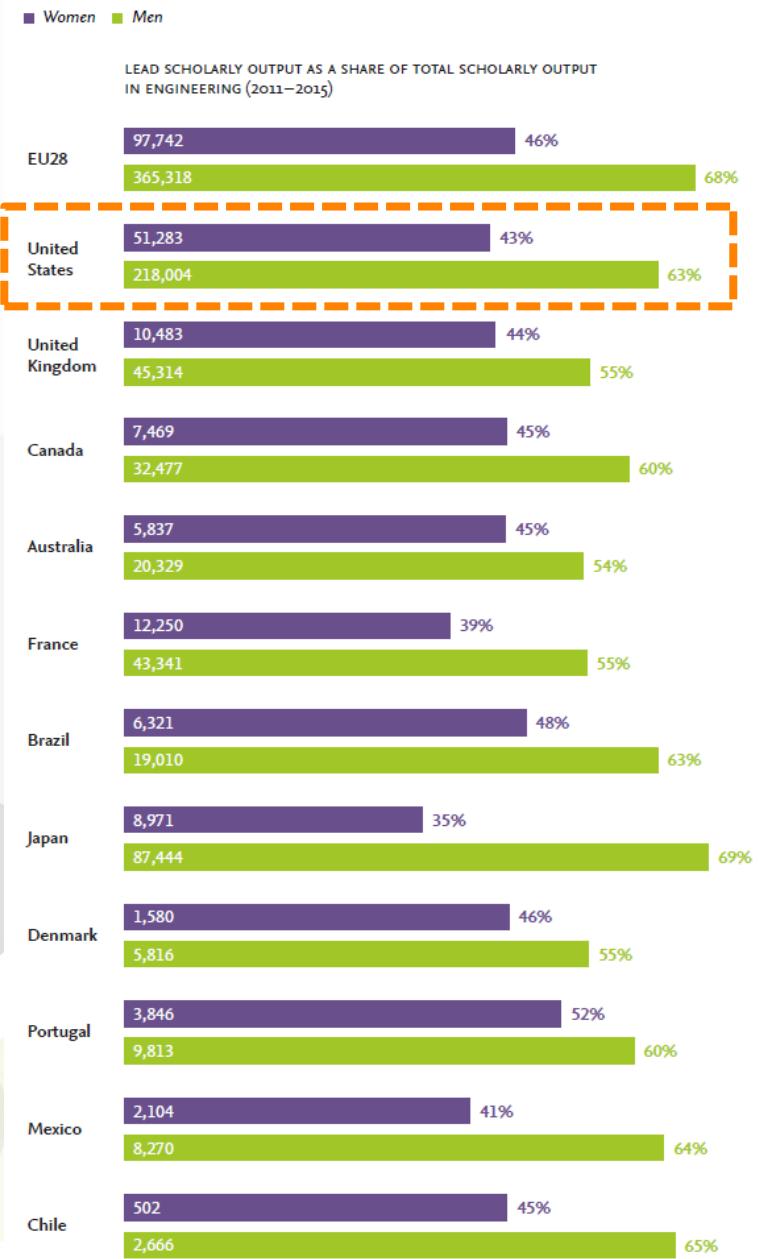
Gender and research leadership, collaboration, interdisciplinarity, and mobility

-

Leadership

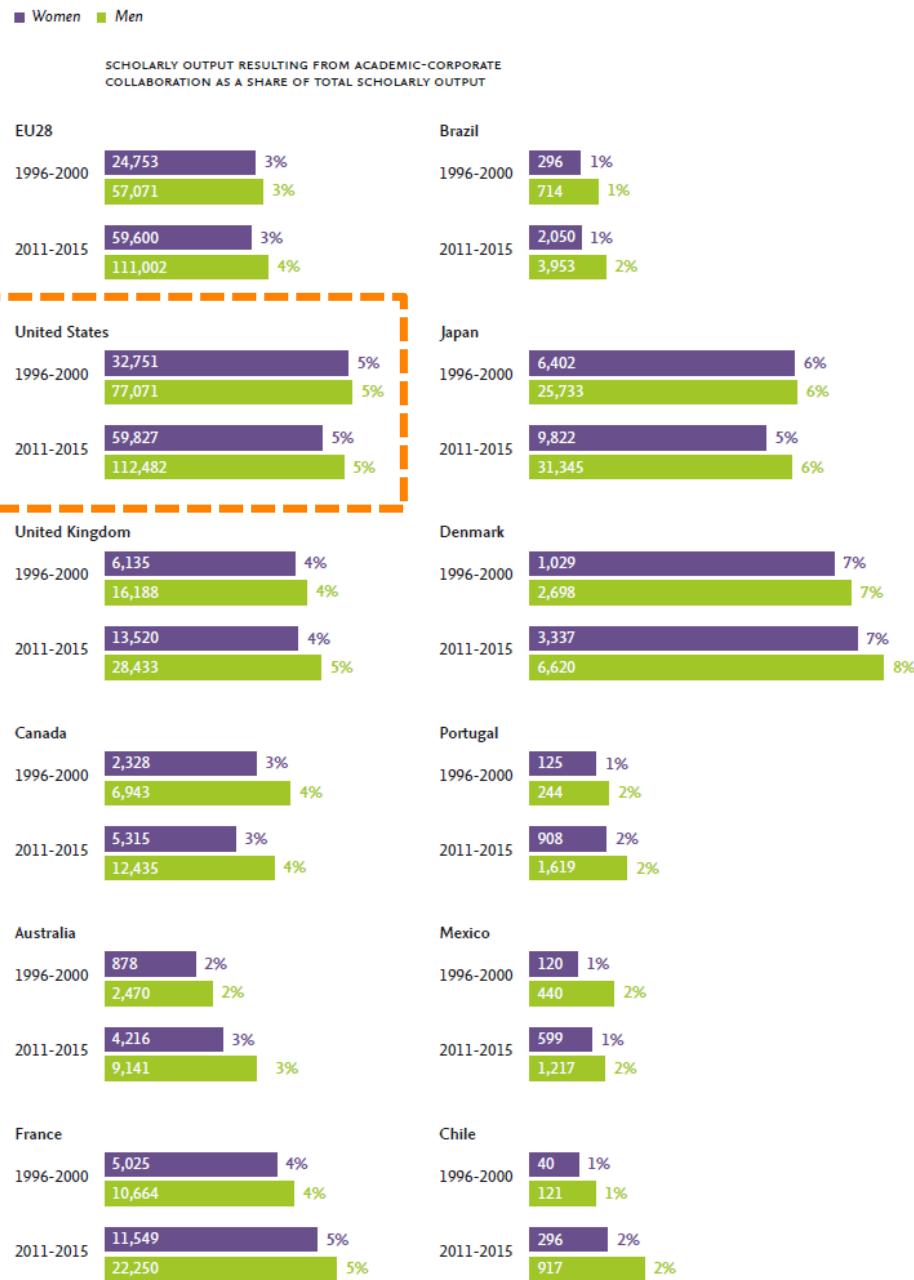
First & corresponding authorship Engineering (2011-2015)

- 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



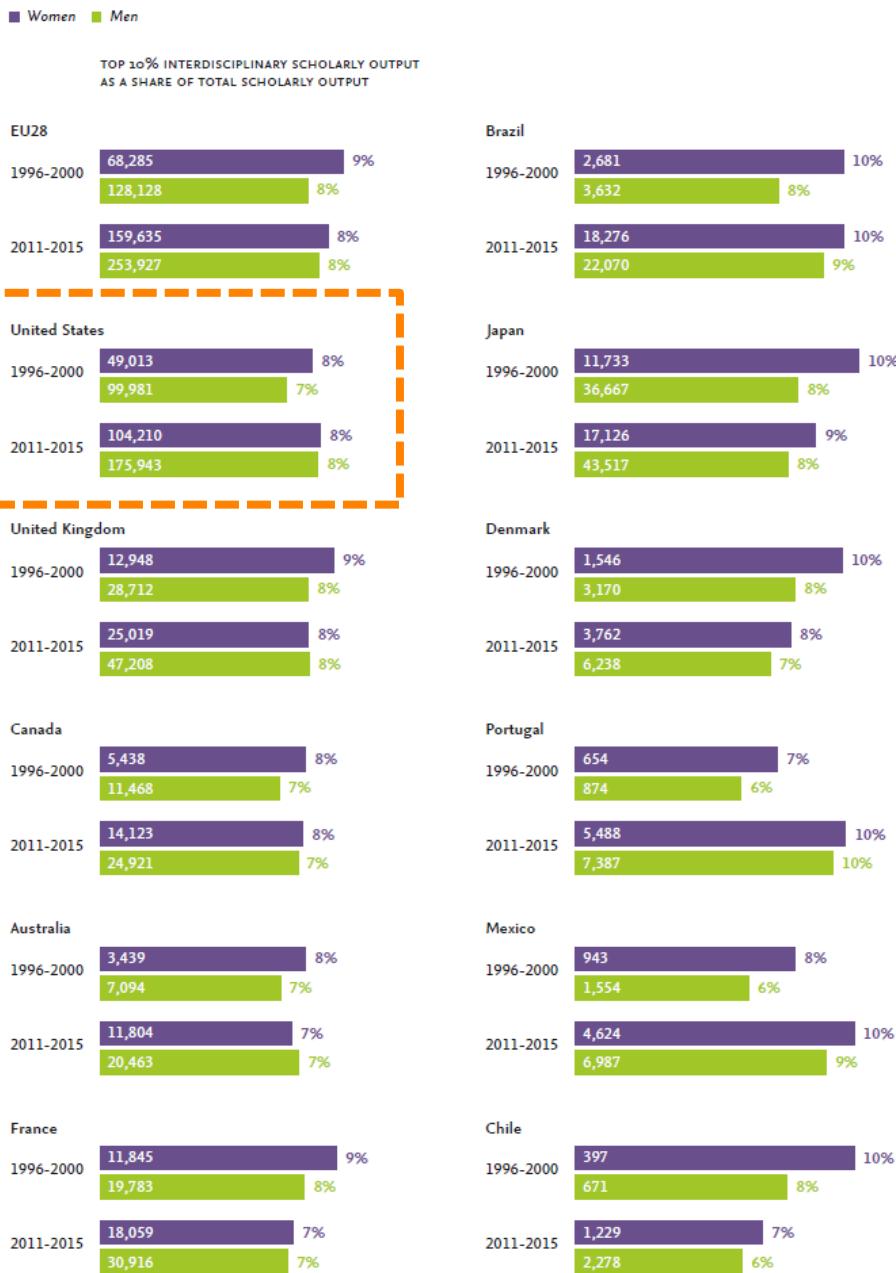
Academic-Corporate Collaboration

- 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
- For most comparators, the proportion of cross-sector collaboration increases slightly between periods for both men and women.



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 between over time

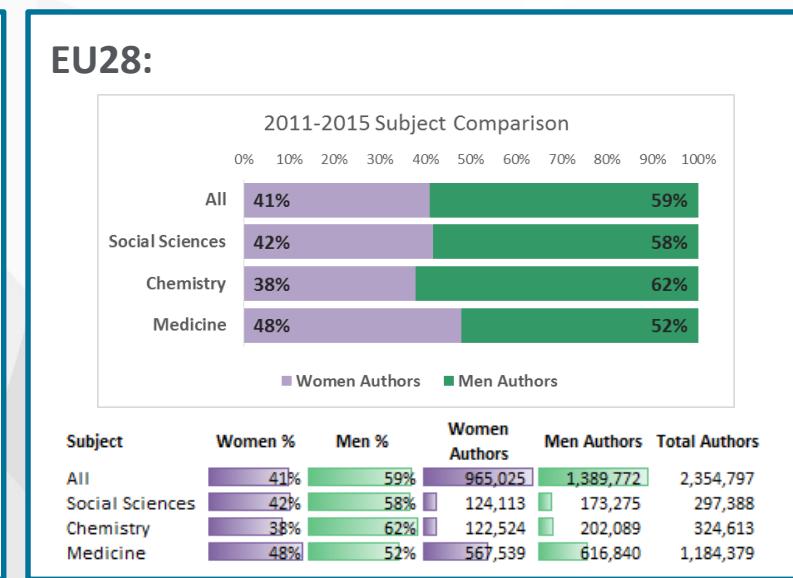
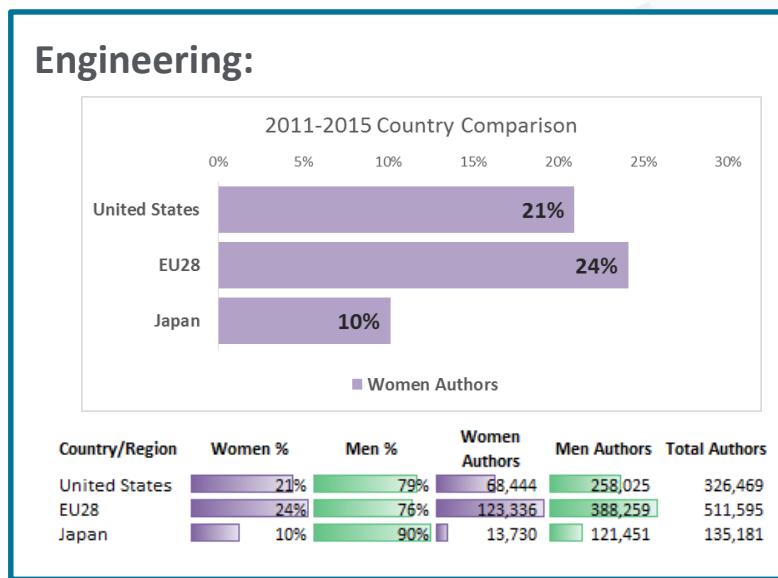


Next Steps & Additional Resources

STMJ Gender Graphing Tool

STMJ 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**.

Gender Working Group

Trans-business unit

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



Economic Dividends for Gender Equality (EDGE) Certification

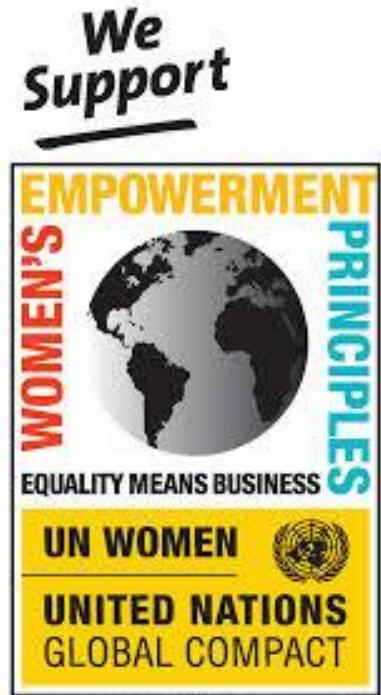


Elsevier > About > Press releases > Corporate social resp... > Elsevier Attains EDGE...

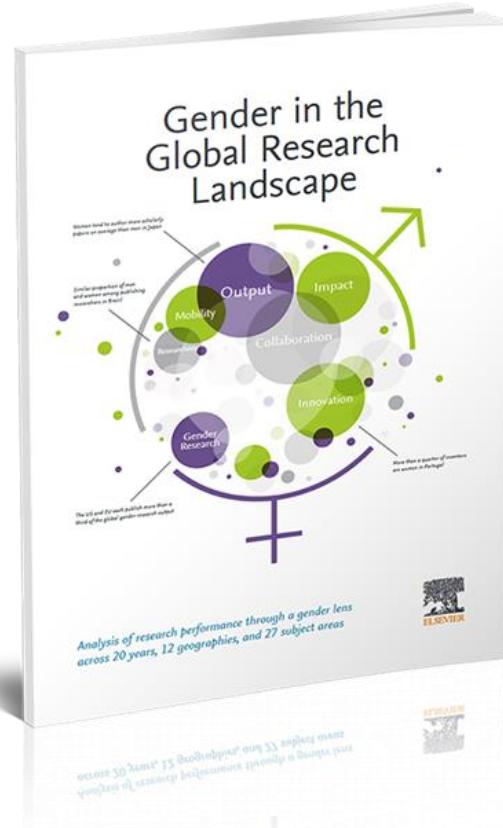
Elsevier Attains EDGE Assess Certification for Gender Equality

Reinforces commitment to maximizing talent, innovation and becoming a lead technology employer in gender equity

<https://www.elsevier.com/about/press-releases/corporate-social-responsibility/elsevier-attains-edge-assess-certification-for-gender-equality>



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 **Data**
 - The raw data behind the report is shared on the **Mendeley Data platform**
 - <https://data.mendeley.com/datasets/bb3cjfgm2w/draft?a=142e523e-4b73-4829-99a8-ebb5c526c103>
- Access the **References**
 - Public **Mendeley** group, a powerful community resource for anyone to join and contribute
 - <https://www.mendeley.com/community/gender-in-the-global-research-landscape/>
- Gender & Research Resource Center
 - **Dynamic resource** with information about gender and women in STEM activities, initiatives, and programs
 - <https://www.elsevier.com/connect/gender-and-science-resource-center>

Thank you!

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