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Increasing Diversity in STEM: issues and challenges from a gender perspective

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Federal University of Rio de Janeiro

Women for Science

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Beijing Declaration and Platform for Action
The Fourth World Conference on Women
Having met in Beijing from 4 to 15 September 1995

#75. […] Advanced study in science and technology prepares women to take an active role in the technological and industrial development of their countries, thus necessitating a diverse approach to vocational and technical training. Technology is rapidly changing the world and has also affected the developing countries. It is essential that women not only benefit from technology, but also participate in the process from the design to the application, monitoring and evaluation stages.

More than two decades thinking women and science

- In the radar since 1995
- Great change in the perception of the problem in recent years
- If initially it seemed that the changes would aim to improve the situation of the woman scientist, the last few years clearly indicate that a better gender equity is good for science
- It is also clear that punctual changes are important, but a real structural change has to be institutional
- And finally, the question of sex and gender is fundamental to scientific knowledge

Gender and Science – a new perspective

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From improving the condition of women to the recognition that diversity leads to better science

- Fix the numbers
- Fix the institutions
- Fix the knowledge

Londa Schiebinger https://genderedinnovations.stanford.edu/
John L. Hinds Professor of History of Science
Director, Gendered Innovations in Science, Health & Medicine, Engineering, and Environment

Measuring the problem

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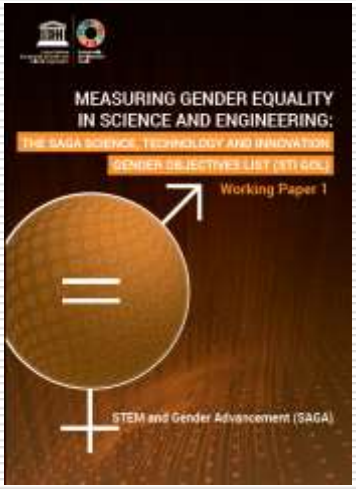
Indicators and Statistics

We value what we measure but we not always measure what we value



European Commission pioneered with **She Figures** since 2003

UNESCO **SAGA** project 2016-2019 – valuable work on indicators and relevant survey template

Gender Gap Project – ISC
Important suryvey data

Science Today

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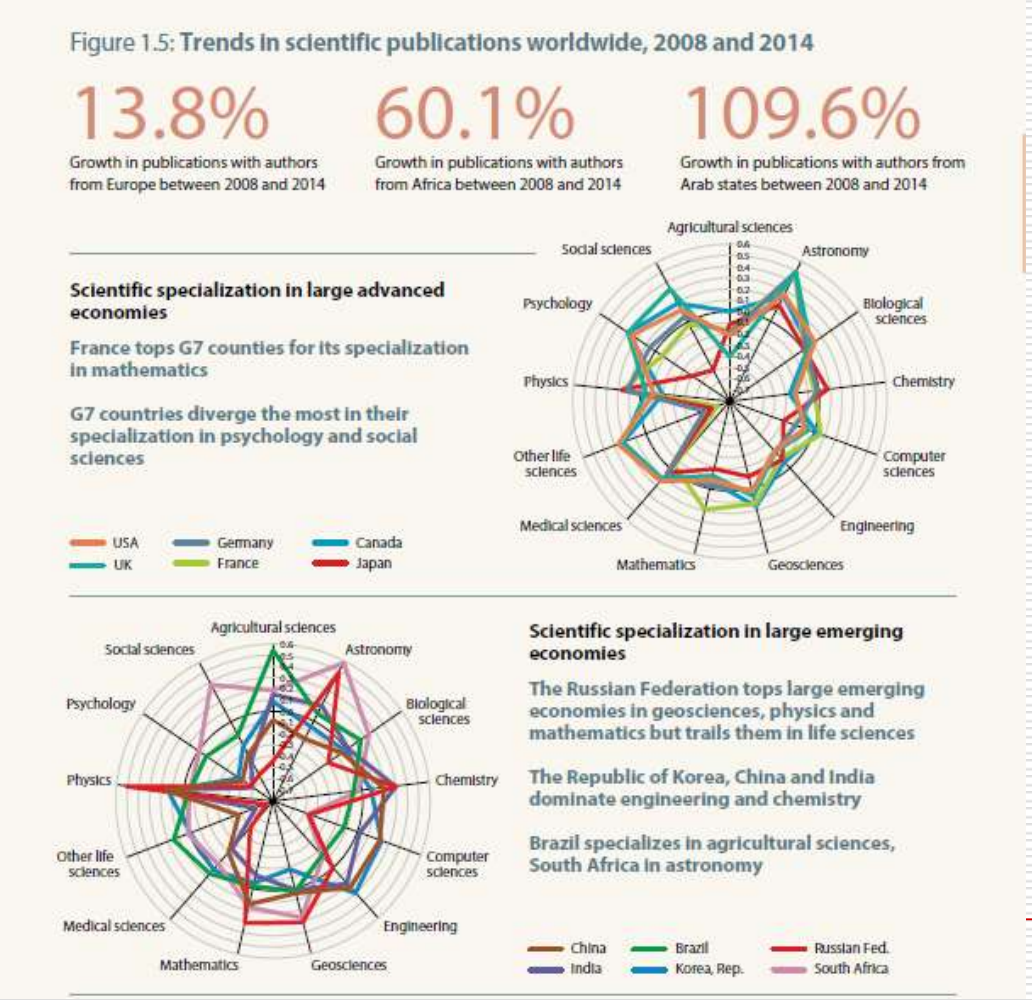
- Scientific research today is increasingly global
- Developed by an increasing number of countries.
- Deals with complex scientific challenges, that need new knowledge and new approaches – transdisciplinarity and new actors
- Problems that are very sensitive politically and economically, that frequently raise questions of equity and transparency.
- Critical relationship between global and local challenges and solutions

Internationalization of Science



New actors
New themes
New specializations

UNESCO World Science Report 2015

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Figure 8.9: **Scientific publication trends in Brazil, 2005–2014**

Growth in Brazilian publications has slowed slightly since 2008
Other countries are given for comparison

147
Publications per million inhabitants in 2008

184
Publications per million inhabitants in 2014

0.74
Average citation rate for Brazilian publications, 2008–2012; the G20 average is 1.02

UNESCO World Science Report 2015

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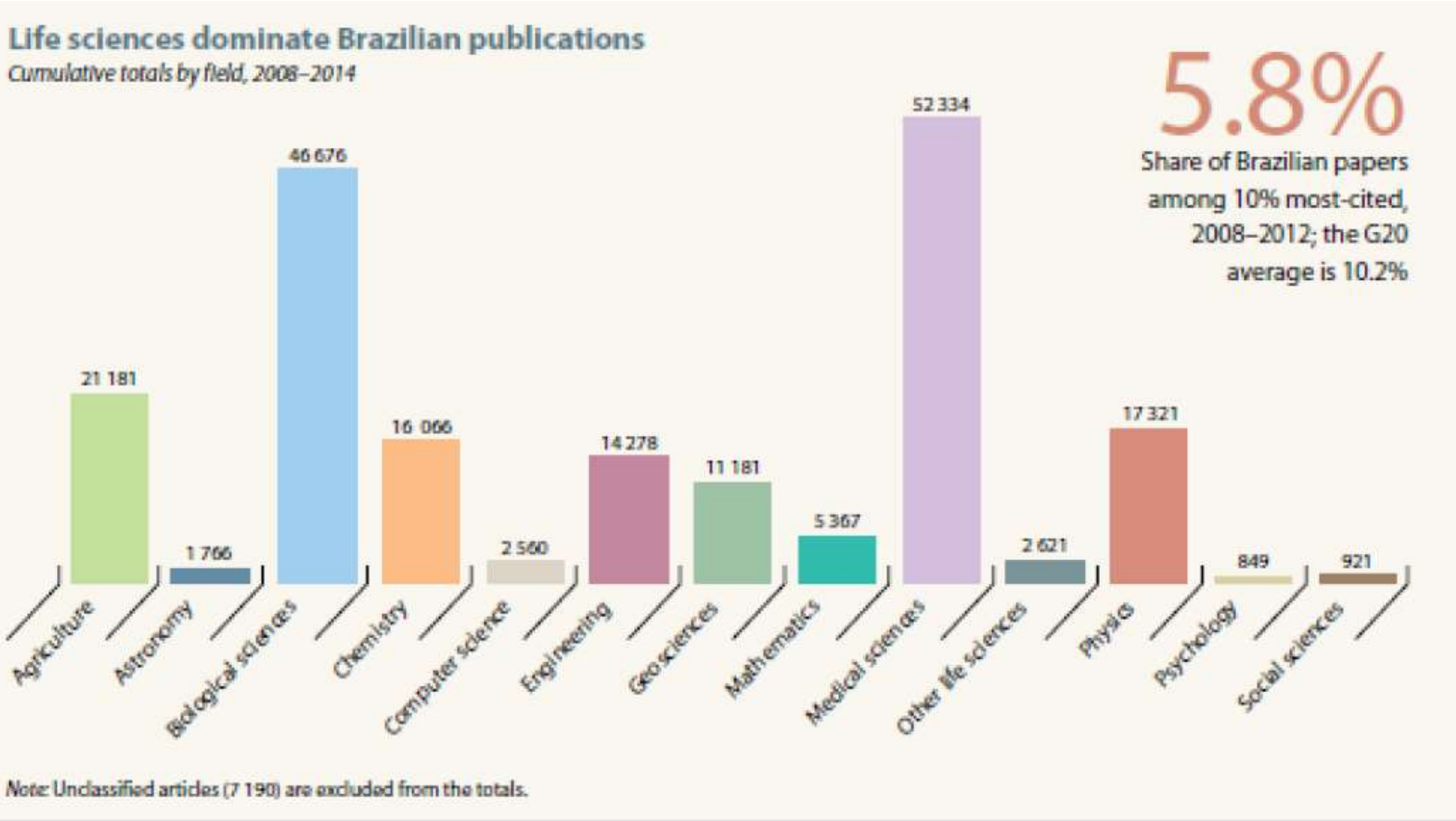

Specialization and disparities

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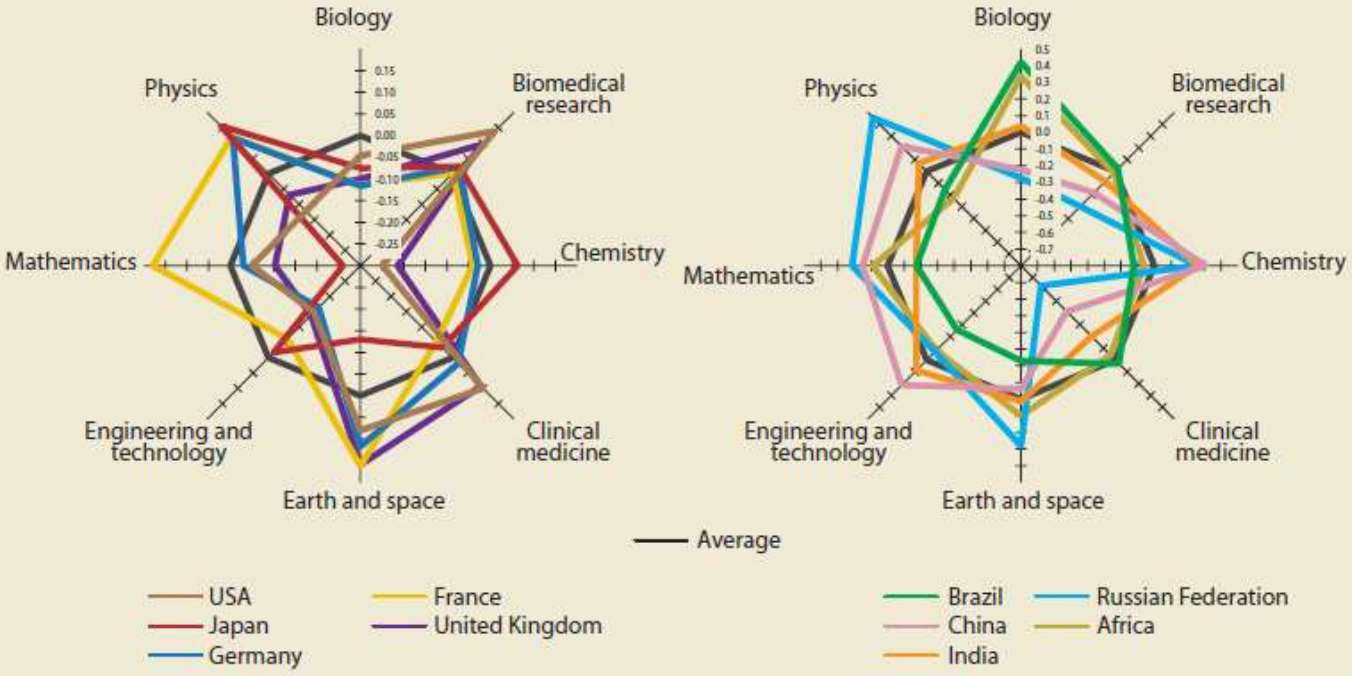
Figure 4: Scientific specialization of the Triad, BRIC countries and Africa, 2008



Source: UNU-MERIT based on data from Thomson Reuters (Scientific) Inc. Web of Science (Science Citation Index Expanded), compiled for UNESCO by the Canadian Observatoire des sciences et des technologies, May 2010

UNESCO World Science Report 2010 pp 9

A gender lens to internationalization

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How does the internationalization of science affect differently men and women?

What will we see if we apply a gender lens in this process?

Elsevier 2017
Gender in the Global Research Landscape

Gender in the Global Research Landscape 2017

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The proportion of women among researchers and inventors is increasing in all twelve comparator countries and regions over time.
CHAPTER 1

Women publish fewer research papers on average than men, but there is no evidence that this affects how their papers are cited or downloaded.
CHAPTER 1

Women are less likely than men to collaborate internationally on research papers.
CHAPTER 2

Women are slightly less likely than men to collaborate across the academic and corporate sectors on research papers.
CHAPTER 2

In general, women's scholarly output includes a slightly larger proportion of highly interdisciplinary research than men's.
CHAPTER 2

Among researchers, women are generally less internationally mobile than men.
CHAPTER 2

Gender research is growing in terms of size and complexity, with new topics emerging over time.
CHAPTER 3

The former dominance of the United States in gender research has declined as research activity in the European Union has risen.
CHAPTER 3

Institutions ➡ need of profound structural changes

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- Men and women do not experience or advance in scientific careers in the same way
- Scientific 'systems' and conventional understandings of leadership are ***not*** gender neutral: **they are oriented to accommodate men and their traditional roles and expectations**
- Dominant narratives about scientific leadership preclude women's needs and roles

Structural changes

Gender challenges of a scientific career:

- Qualification and training
- Recruitment
- Retention
- Advancement

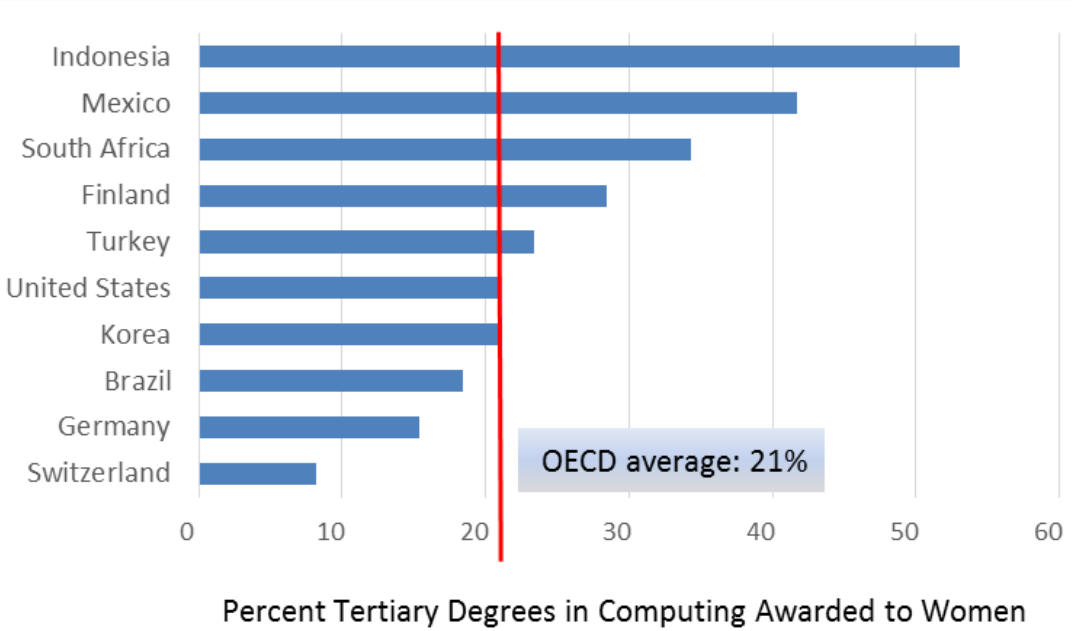
Qualification and training

Much progress in the Western world – in many countries women are the majority of university students

BUT

Concentrated in certain disciplines and lagging behind in others

Also situation is very different in other parts of the globe



Brazil % of Female PhD Graduates in STEM

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% of Women PhDs by Disciplinary areas	2000	2010	2014
Total all Areas	47.20	52.89	54.40
Agrarian Sciences	38.28	50.92	53.32
Biological Sciences	63.22	61.42	60.54
Health Sciences	51.91	63.26	66.11
Exact and Earth Sciences	35.26	34.27	36.43
Engineering	28.86	36.46	37.09
Multidisciplinary	45.45	52.96	55.40

Fontes: Coleta Capes 1996-2012 e Plataforma Sucupira 2013-2014 (Capes, MEC). Elaboração do CGEE.

% Female PhD Graduates within areas

	2000	2010	2014
Exact and Earth Sciences	35.26	34.27	36.43
Astronomy	-	12.50	35.71
Computer Science	29.17	22.00	25.00
Physics	25.88	17.32	24.11
Geosciences	29.23	42.70	38.86
Mathematics	24.62	28.00	23.71
Oceanography	47.06	57.89	45.83
Statistics	42.86	33.33	42.86
Chemistry	49.38	47.22	50.60

	2000	2010	2014
Engineering	28.86	36.46	37.09
Aerospatiale	50.00	28.57	20.59
Biomedical	14.29	53.33	41.67
Civil	35.44	42.77	42.33
Material and Metallurgy	33.70	49.55	48.73
Mining	22.22	25.00	60.00
Production Engineering	36.21	39.53	40.44
Transport	33.33	33.33	44.44
Electric	15.83	16.60	18.41
Mechanics	11.76	28.13	25.38
Naval and Oceanic	-	20.00	20.00
Nuclear	27.03	38.98	37.86
Chemical Engineering	35.14	56.12	57.92
Sanitary	66.67	68.89	62.90

Recruitment Retention Advancement

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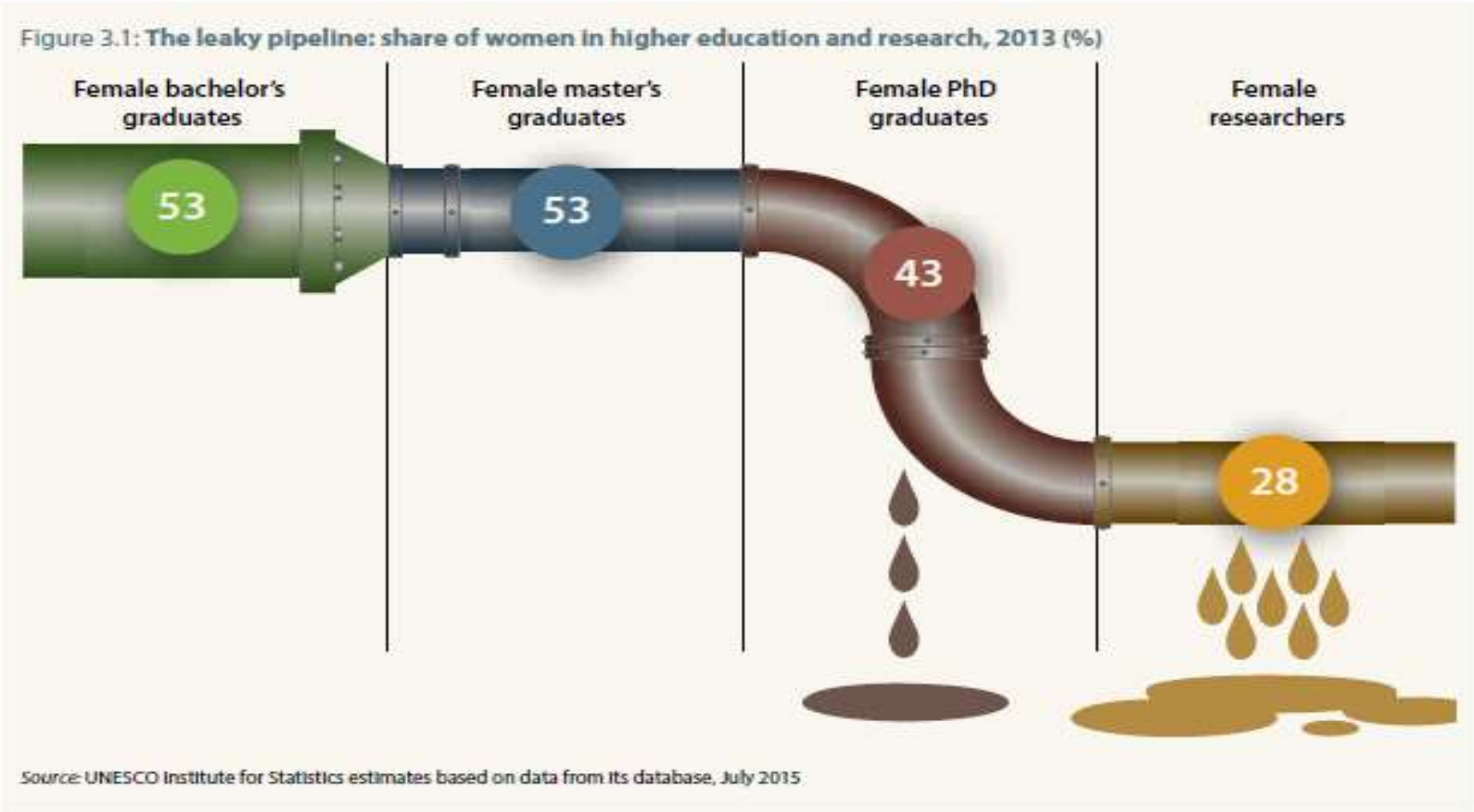
Leaky pipelines and crystal labyrinths



Recruitment

“Whatever the country, whatever the discipline, and whatever the proportion of women among the undergraduate population, men are selected disproportionately to their numbers in the recruitment pool at every stage of the career ladder". Teresa Rees, Final Report, Helsinki Group 2004

Retention and Advancement

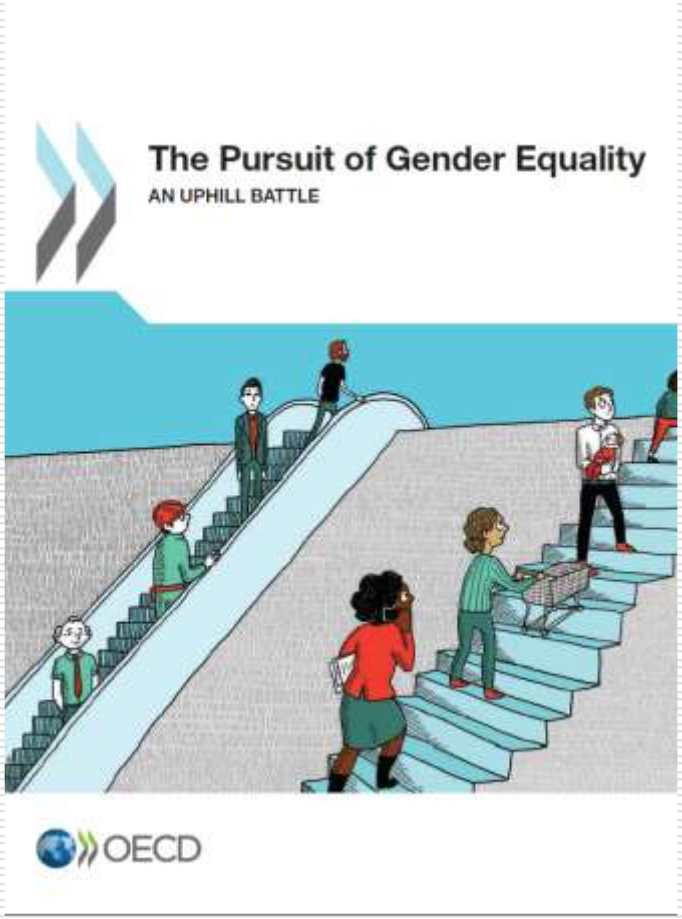
Glass ceilings and crystal labyrinths

- Networks
- Access to funds
- The construction of excellence
- Pay gap
- Managing work and family

Institutional cultures, culture and society, class, ethnicity, race, generation → intersectionality

Retention and Advancement

Brazil % of Women in different stages of the scientific career 2017	
Undergraduates students	57
Undergraduates Scholarships IC	55
MSc	52
PhD	50
Leaders of Research Groups	47
University Teachers	46
Research Scholarships	34
http://www.generonumero.media/infografico-os-caminhos-de-mulheres-e-homens-na-ciencia-brasileira/	



Barriers to advancement

A wealth of research identifies the causal factors hindering women's ascent to top leadership roles (Fraser 2016). Many of these are captured as metaphors such as:

`a lack of 'stretch assignments' for women (Fraser 2016);
'glass cliffs' (Haslam and Ryan 2008);
'sticky floors' (Caprile *et al*. 2015);
'polycarbonate ceilings' (Wren 2015);
'glass escalators' (Williams 1992);
'non-events' (Husu 2005);
'crystal' labyrinths (Eagly and Carli 2007);
'leaky pipelines' (Schiebinger 2002);
'chilly climates' (Dugan *et.al.* 2013).

Given all these barriers, how do women become leaders in science, and what pathways do they pursue to achieve seniority and recognition?

PROMOTING GHANGE- EU FRAMEWORK PROGRAMS

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Transforming institutions from inside?

Experience from a EU-funded structural change project to integrate gender in research and higher education

Maxime Forest, PhD
EGERA Scientific Coordinator
Senior Researcher and Lecturer, Sciences Paris

EFFECTIVE GENDER EQUALITY in RESEARCH and the ACADEMIA

SciencesPo.

ofce

This project has received funding from EU FP7

GenPORT

PB8 - Implementing gender equality plans in research performing organizations: How to innovate?

PROMOTING GHANGE : US UK JAPAN

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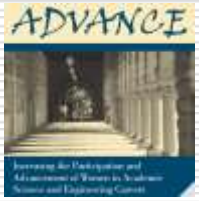
- **Athena SWAN** (Scientific Women's Academic Network) (United Kingdom, **1999**)
- **ADVANCE** (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers): Institutional Transformation (United States, **2001**)
- **MEXT** (Ministry of Education, Culture, Sport, Science, & Technology): Program to Support Female Researchers (Japan, **2**

Equality Challenge Unit

NSF

ADVANCE



Gender Equality Bureau Cabinet Office

MEXT MINISTRY OF EDUCATION, CULTURE, SPORTS, SCIENCE AND TECHNOLOGY-JAPAN

Athena SWAN

Initial funding — Program flexibility to adapt to the culture of each institution, and enable on-going data collection and reporting that can be benchmarked.

Learning from experience and forging ahead - from Advance to Sea Change

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AAAS
SEA CHANGE

"Once in a lifetime
the longed for tidal wave
of justice can rise up,
and hope and history rhyme.

So hope for a great sea-change
on the far side of revenge.
Believe that a further shore
is reachable from here."— SEAMUS HEANEY, THE CURE AT TROY

PATHWAYS TO SUCCESS
Women and Science www.genderinsite.net

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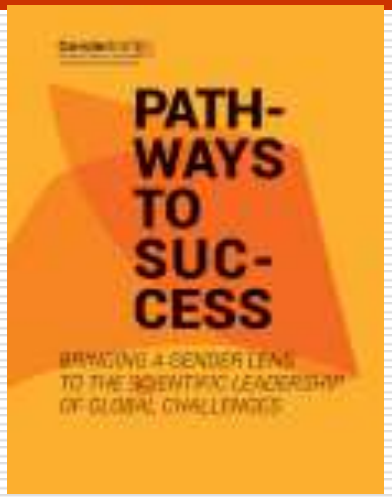

- We know that there is a problem
- We know less about successes
- Increasingly complex and globalised challenges require integrated, global responses and diverse leadership

"Each step up the ladder of the scientific research system sees a drop in female participation until, at the highest echelons of scientific research and decision-making, there are very few women left."

(Huyer 2015: 86)

"Women do not advance to the highest leadership positions in the same numbers, at the same rate, or through the same paths as male colleagues"

(Dugan *et al.* 2013: 7)

Pathways to Success

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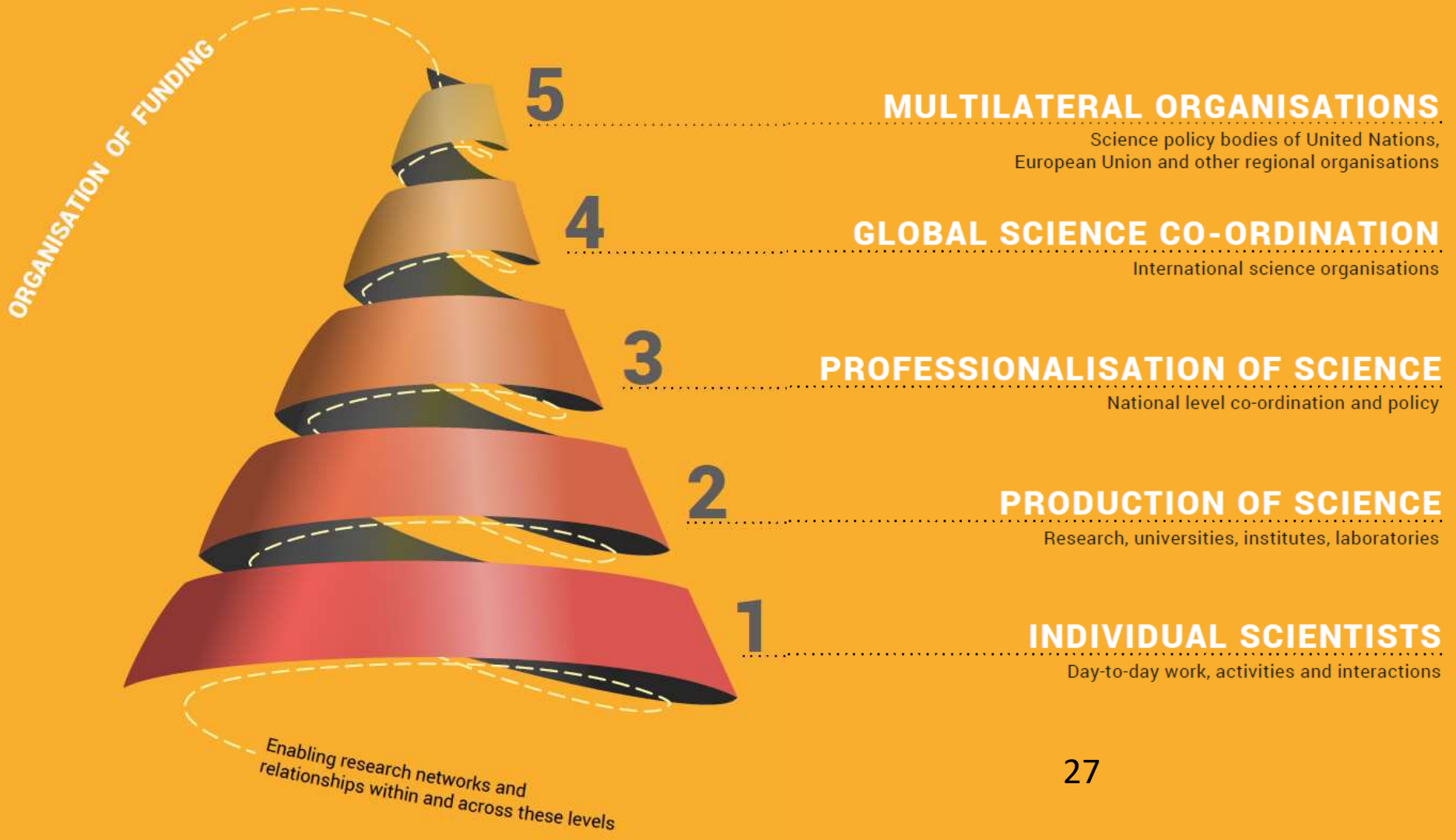
This report brings a different perspective:

- Recognises the vast amount of work that has already been done
- Looks at levels not usually looked at
- Looks at the difficulty of institutionalising policies
- Has an awareness of politics and power relations
- Highlights how the institutional and individual are intertwined

Pathways of Influence and Support



Knowledge ➡ gender perspective recognized

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Gender equal science is better Science

Carlos Moedas, European Commissioner
for Research Science and Innovation
12 May 2017

[…] The lack of an appropriate gender dimension in research design, implementation and organization can result in serious flaws and potentially harmful effects, thus limiting scientific excellence, creativity and benefits to society.

LERU 2015 Gendered Research and Innovation. Integrating Sex and Gender analysis into the research process.

Gender diversity and science

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Gender diversity leads to better science

Mathias Wullum Nielsen[a,1], Sharla Alegria[b], Love Börjeson[c], Henry Etzkowitz[d,1], Holly J. Falk-Krzesinski[e,f], Aparna Joshi[g], Erin Leahey[i], Laurel Smith-Doerr[j], Anita Williams Woolley[k], and Londa Schiebinger[a]

Fig. 1. When it comes to science collaborations, there's ample data to suggest that gender diversity pays a substantial research and productivity dividend. Image courtesy of Dave Cutler (artist).

Research and Gender

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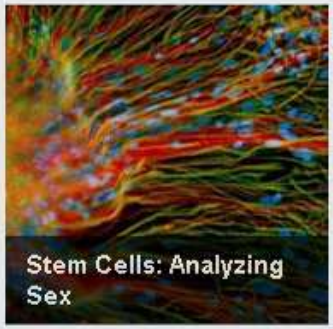
Does gender matter? Diversity leads to quality

Commentator Ben A. Barres from Stanford University asks what could be done to ensure women achieve their full potential and suggests a number of actions including: 1) enhancing leadership diversity in academic and scientific institutions. Diversity provides a substantially broader point of view, with more sensitivity and respect for different perspectives, which is invaluable to any organization. More female leadership is vital in lessening the hostile working environment that young women scientists often encounter, 2) diverse faculty role models are important so job searches must be open and fair in order to recruit top women scientists – search committees should not always be chaired by men, and the committee itself should be highly diverse. *Nature, 13 July 2006, Does gender matter? Ben A. Barres*

Gendered Innovations

in Science, Health & Medicine, Engineering, and Environment

FEATURED CASE STUDIES



Why Gendered Innovations?

"Gendered Innovations" employs methods of sex and gender analysis to create new knowledge.

Research and Gender

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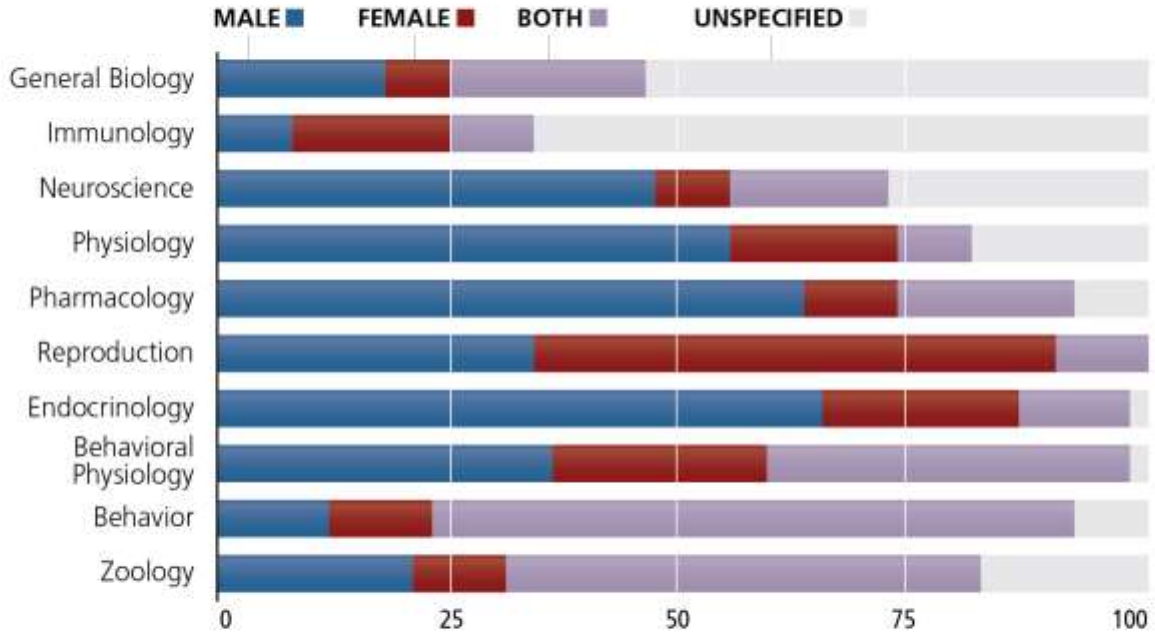
Proportion of Research Studies Using Male and/or Female Animals

From published journal articles within specified biomedical subfield, 2009



Adapted from:

Beery, A., & Zucker, I. (2011). Sex Bias in Neuroscience and Biomedical Research. *Neuroscience and Biobehavioral Reviews*, 35 (3), 565-572.

EU – Gendered Innovations How Gender Analysis contributes to Research

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BASIC SCIENCE

Animal Research: Designing Health and Biomedical Research

Brain Research: Analyzing How Sex and Gender Inter

Genetics of Sex Determination: Rethinking Conce and Theories

Stem Cells: Analyzing Se

HEALTH & MEDICINE

De-Gendering the Knee: Overemphasizing Sex Differences as a Problem

Heart Disease in Women: Formulating Research Questions

Osteoporosis Research in Men: Rethinking Standards and Reference Models

TRANSPORT

Human Thorax Model: Rethinking Standards and Reference Models

Information for Air Travellers: Participatory Research and Design

Pregnant Crash Test Dummies: Rethinking Standards and Reference Models

Public Transportation: Rethinking Concepts and Theories

ENGINEERING & TECHNOLOGICAL DEVELOPMENT

Exploring Markets for Assistive Technologies for the Elderly: Engineering Checklist

HIV Microbicides: Rethinking Research Priorities and Outcomes

Machine Translation: Analyzing Gender

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It is not enough to address women scientists´ challenges, or to amend organisations´policies, or to ensure a gender component of research in today´s global challenges. Rather, it is about connecting these steps to create multiple, reinforcing pathways to success.

***GenderInSITE - Pathways of Success.* 2017**
Report prepared by Linda Waldman (coord.), Alice Abreu, Becky Faith, Tabitha Hrynick, Inés Sánchez de Madariaga and Lucilla Spini.


рахмат
danke
謝謝
ngiyabonga
teşekkür ederim
Баярлалаа
спасибо
thank you
gracias
dank je
tapadh leat
bedankt
hvala
mauruuru
blagodaram
dziękuję
mochchakkeram
go raibh maith agat
obrigado
sagolun
sukriya
kop khun krap
taiku
arigatō
takk
dakujem
ありがとう
grazie
terima kasih
мерси
감사합니다
ευχαριστώ
merci