Dag W. Aksnes
Fredrik N. Piro
Kristoffer Rørstad

Gender gaps in international research collaboration

A bibliometric approach

Borås, 09.11.18

NIFU

Background

- Several previous studies have shown that women on average publish fewer publications than men

- Can similar gender differences be found also when it comes to international research collaboration?

- The results of previous studies are inconclusive
  - most studies being based on survey responses
  - some bibliometric studies using Web of Science or Scopus

- She figures (2015): At EU-28 level, women and men corresponding authors participate with similar frequency in international scientific co-publications

Background

- Co-authorship data commonly used for providing indicators of scientific collaboration
- When two or more researchers jointly write an article, this reflects that the research underlying the paper has involved collaboration
- By definition a publication is internationally co-authored if it has authors from more than one country
- Bibliometrics can provide unique and systematic insight into the extent and structure of scientific collaboration

Mapping policies for surface water protection zones on forest land in the Nordic-Baltic region: Large differences in prescriptiveness and zone width

By: Ring, E (Ring, Eva)[1]; Johansson, J (Johansson, Johanna)[2]; Sandstrom, C (Sandstrom, Camilla)[3]; Bjarnadottir, B (Bjarnadottir, Brynhildur)[4]; Finer, L (Finer, Leena)[5]; Libiete, Z (Libiete, Zane)[6]; Lode, E (Lode, Elve)[7,8]; Stupak, I (Stupak, Inge)[9]; Saetersdal, M (Saetersdal, Magne)[10]

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Abstract

The forest landscape across the Nordic and Baltic regions hosts numerous lakes and watercourses, which must be included in forest management. In this study, national policy designs regarding protection zones for surface waters on forest land were reviewed and compared for the Nordic countries, Estonia and Latvia. The focus was how each country regulates protection zones, whether they are voluntary or mandatory, and the rationale behind adopting a low or high degree of prescriptiveness. Iceland and Denmark had a low degree of policy prescriptiveness, whereas Norway, Estonia and Latvia had a high degree of prescriptiveness. Sweden and Finland relied to a large extent on voluntary commitments. The prescribed zone widths within the region ranged from 1 m to 5 km. The results indicated that land-use distribution, forest ownership structure and historical and political legacies have influenced the varying degrees of prescriptiveness in the region.

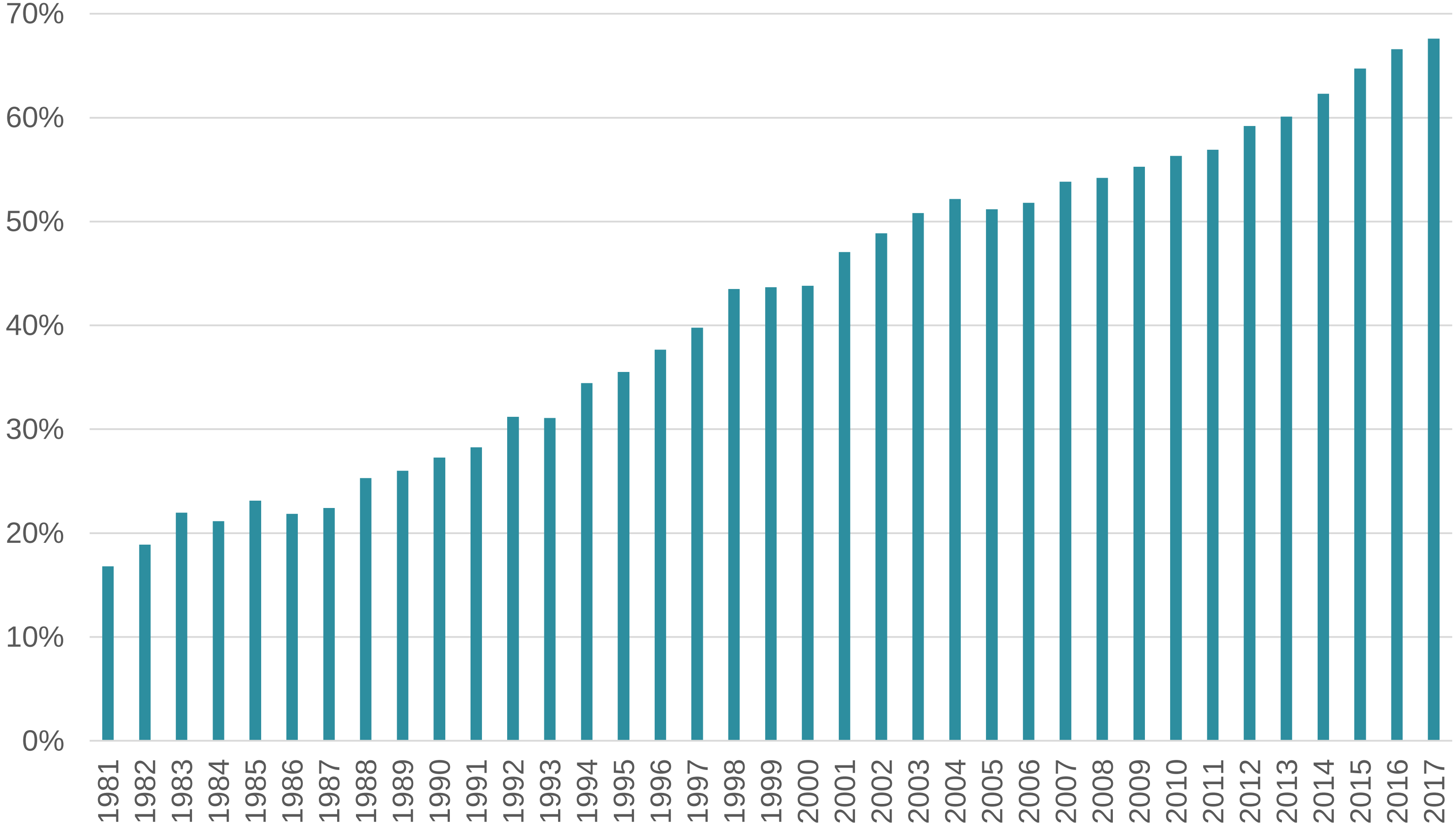
Keywords

Author Keywords: Buffer; Certification; Forestry; Guidelines; Legislation; Riparian
KeyWords Plus: MANAGEMENT; STREAMS; METAANALYSIS; HARVEST; BUFFERS; LITTER; EXPORT; AREAS

Author Information

Reprint Address: Ring, E (reprint author)
Forestry Res Inst Sweden, Skogforsk, Uppsala Sci Pk, S-75183 Uppsala, Sweden.
Addresses:
[1] Forestry Res Inst Sweden, Skogforsk, Uppsala Sci Pk, S-75183 Uppsala, Sweden
+ [2] Sodertorn Univ, Environm Studies, Alfred Nobels Alle 7, S-14189 Huddinge, Sweden
+ [3] Umea Univ, Dept Polit Sci, S-90187 Umea, Sweden
[4] Univ Akureyri, IS-600 Akureyri, Iceland
[5] Nat Resources Inst Finland Luke, Yliopistokatu 6, Joensuu 80100, Finland
[6] LSFRI Silava, Rigas St 111, LV-2169 Salaspils, Latvia

Proportion of articles with international co-authorship, Norway



Data source: Web of Science, SCIE, SSCI, A&HCI

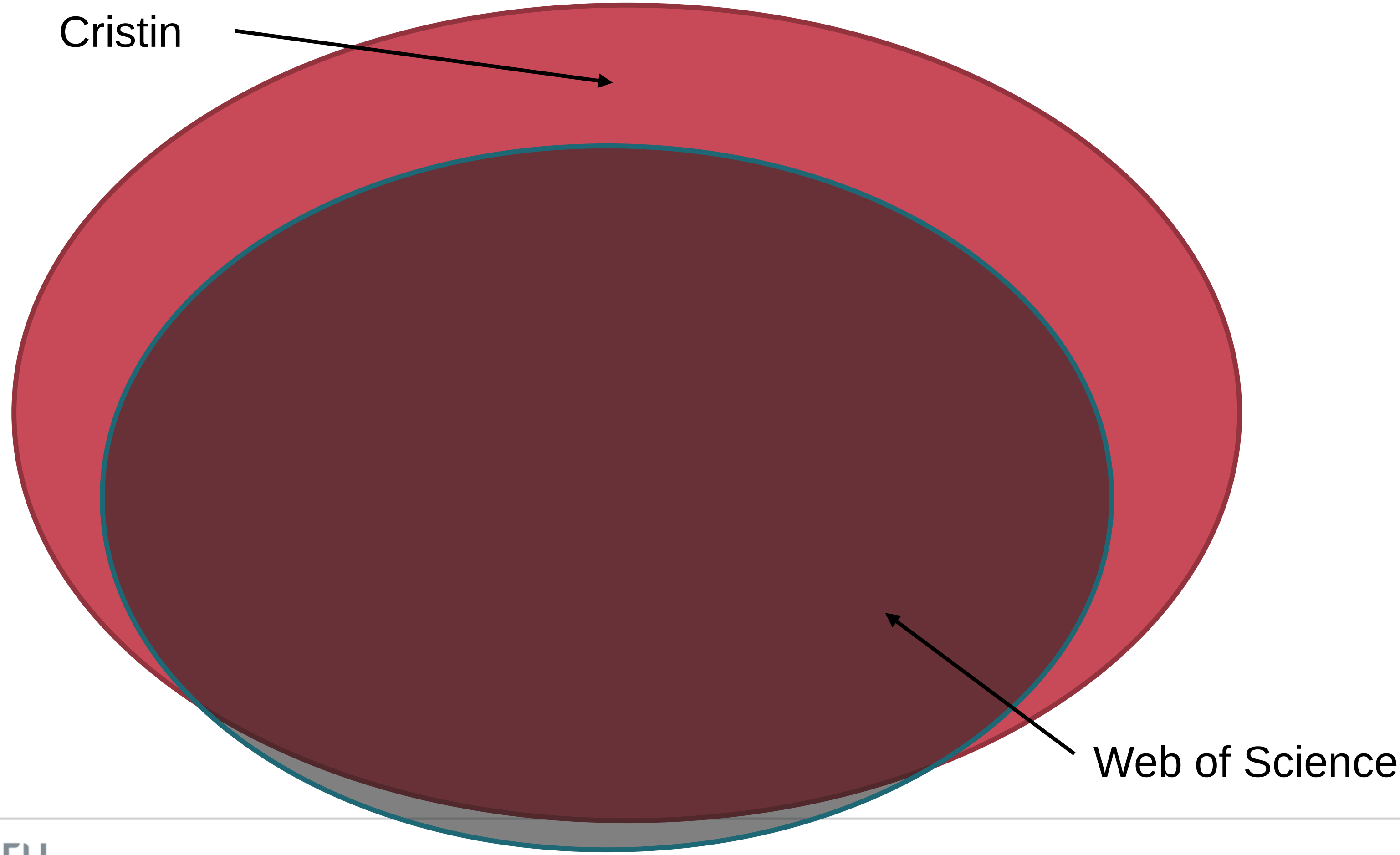
Purpose of present study

- Filling a knowledge gap in the understanding of gender differences in international research collaboration by comparing international paper co-authorship among men and women
- Differences at the level of domains and disciplines
- Differences in respect to academic position and productivity of the researchers

This study – data source

- Cristin database
  - Developed as part of a current research information system for all public research institutions in Norway
  - Has a complete coverage of all peer-reviewed scientific and scholarly publication output, including books, edited volumes and conference series

Coverage of scientific and scholarly publishing – Cristin versus Web of Science



This study – data

- Data material consisting of 5554 researchers at the four largest universities in Norway
  - University of Oslo, University of Bergen, the Arctic University of Norway and the Norwegian University of Science and Technology

- Included personnel: professors, associate professors, post docs and PhD-candidates with at least one publication during the time period

- Publication output during the period 2015-2017, in total almost 44,000 publications

Distribution of researchers and publications by fields and gender

	Number of researchers			Number of publications		
Major fields	Men	Women	Total	Men	Women	Total
Humanities	420	363	783	2,009	1,445	3,454
Social sciences	513	522	1,035	2,709	2,357	5,066
Natural sciences	902	408	1,310	10,815	3,016	13,831
Technology	662	183	845	6,545	1,572	8,117
Medical and health sciences	747	834	1,581	7,719	5,454	13,173
Total	3,244	2,310	5,554	29,797	13,844	43,641

- Female researchers constitute 42 % of the study population, while they only account for 32 % of the publications

- The female shares of the researchers vary greatly by field
  - Highest in Medical and health sciences (53 %), Social sciences (50 %) and Humanities (46 %)
  - Considerably lower in Natural sciences (31 %) and Technology (22 %)

Differences at the level of disciplines

Understanding Patterns of International Scientific Collaboration

Terttu Luukkonen
Academy of Finland
Olle Persson
Inforsk, University of Umeå, Sweden
Gunnar Sivertsen
Institute for Studies in Research and Higher Education, Norway

International scientific collaboration has increased both in volume and importance. In this article, the authors study the interpretation of macro-level data on international coauthorship collaboration. They address such questions as how one might explain country-to-country differences in the rates of international coauthorship, networks of international scientific collaboration among countries, and patterns of international collaboration in scientific fields. Attention is drawn to cognitive, social, historical, geopolitical, and economic factors as potential determinants of the observed patterns. They present a methodology that gives one a measure, independent of size, of countries' propensities to collaborate internationally.

The first collaborative scientific paper was published in 1665,[1] and the number of collaborative papers has increased ever since, first slowly, then dramatically after the middle of the eighteenth century. Beaver and Rosen noted collaborative linkages across national borders as early as the nineteenth century.[2] These linkages increased toward the end of the century, and international collaboration has grown in importance throughout the present century.

AUTHORS' NOTE: A preliminary version of this article was presented at the International Conference on Science and Technology Indicators (Bielefeld, Germany, 10-12 June 1990) and will be published in the conference proceedings. The Academy of Finland, Inforsk, the Institute for Studies in Research and Higher Education, and the Nordic Science Policy Council (under the aegis of the Nordic Council of Ministers) supported this study. We gratefully acknowledge comments by Diana Hicks, Jussi Huttunen, Phoebe A. Isard, Stephen Isard, Ben R. Martin, Geoff Oldham, C. Marciano da Silva, James E. F. Skea, Robert Tijssen, and Thomas G. Whiston.

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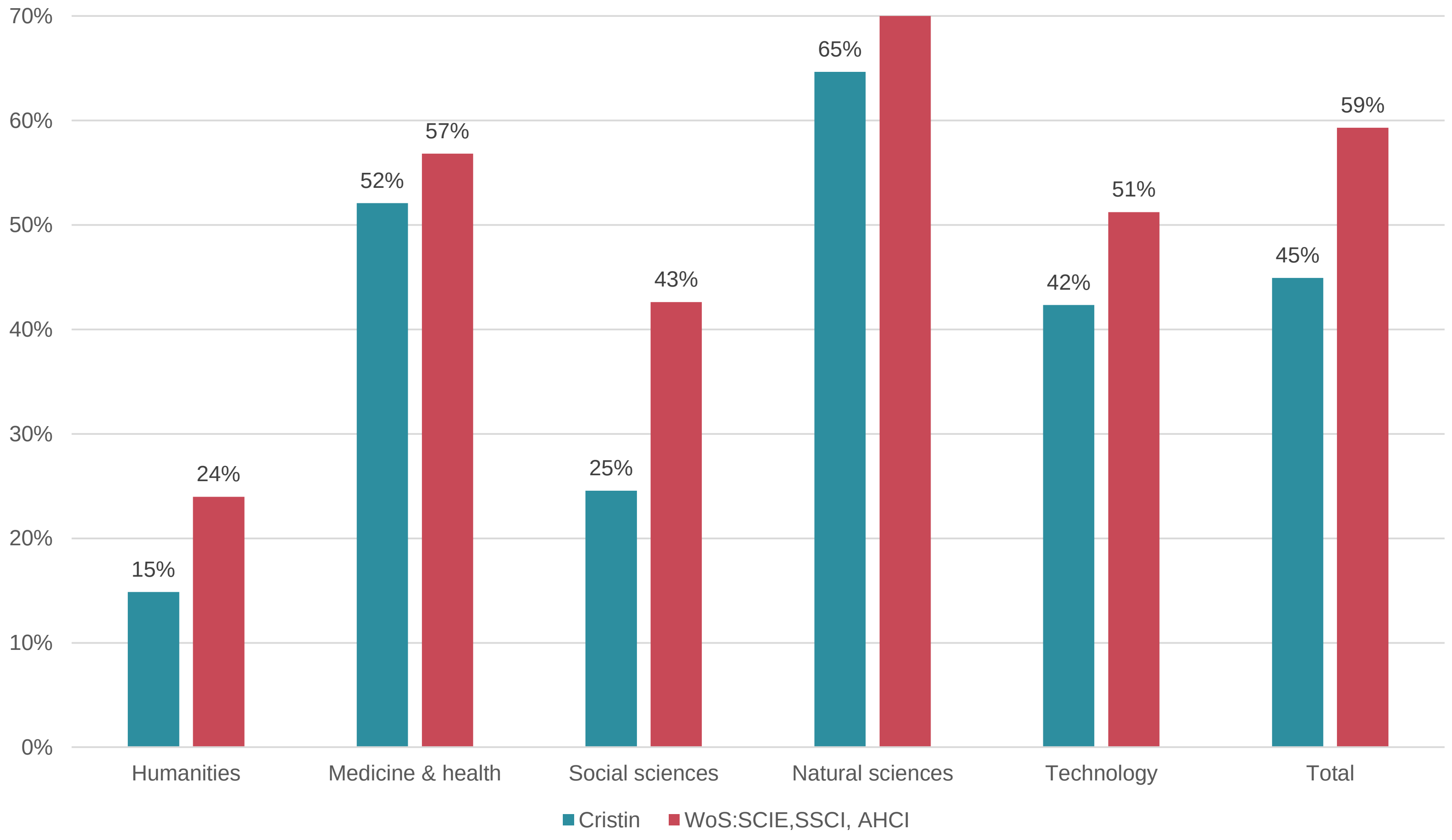
Table 1. Percentage of Papers with International Institutional Coauthorships

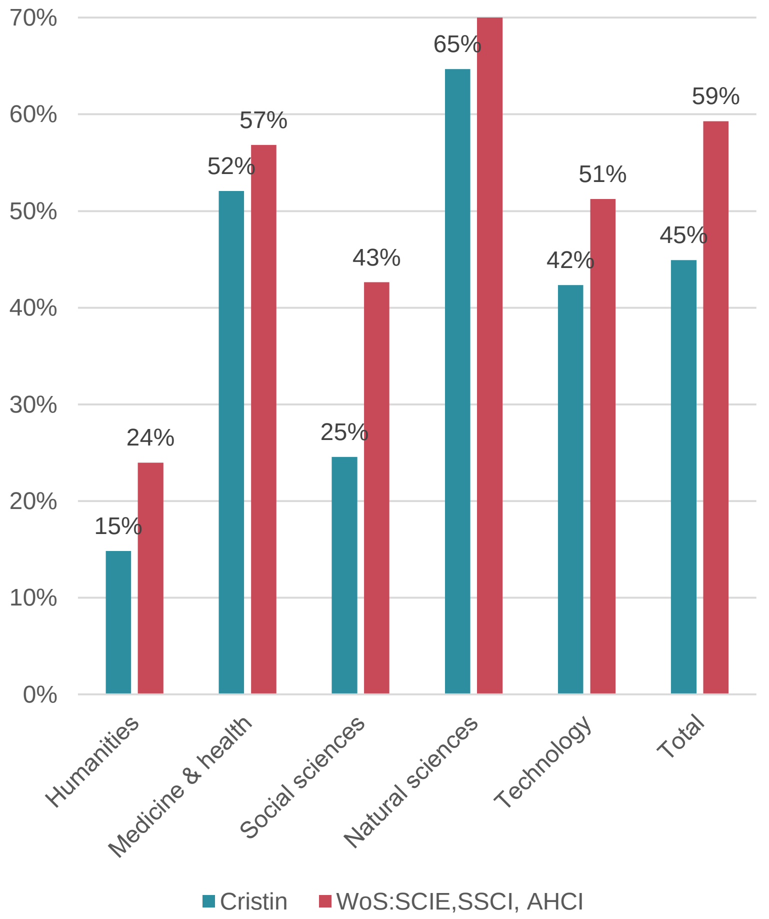
	CHI 1973 Fixed Journal Set[a]		CHI 1981 Fixed Journal Set[a]
Subject Area	*1973*	*1983*	*1981-86*
Earth and space	5.38	11.80	11.09
Mathematics	5.47	10.78	11.35
Physics	4.39	9.45	9.79
Biomedicine	3.51	6.93	7.22
Biology	3.01	5.84	5.77
Chemistry	2.42	5.37	5.68
Engineering and technology	2.04	5.16	5.69
Clinical medicine	2.47	4.77	4.98

Proportion of internationally co-authored publications 2015-2017, by domain and data source. Publication set underlying this study.



What explains the field differences?

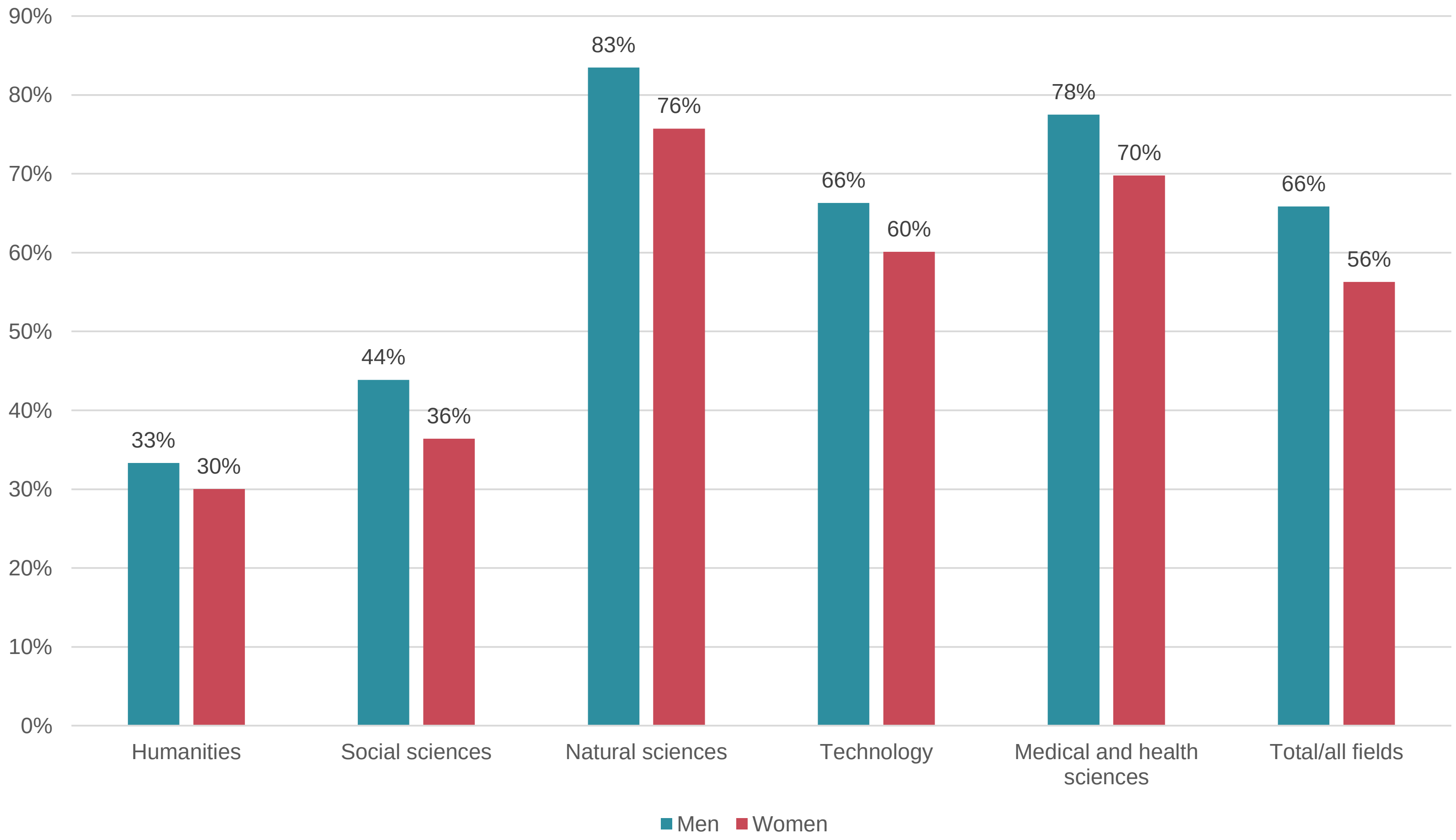
- Some disciplines to a larger extent address phenomena of primarily local or national interest. International collaboration will be more limited in these areas
- Differences in the role of collaboration and work in research groups generally
- Co-authorship practices. In humanities the majority of the publications have one author only



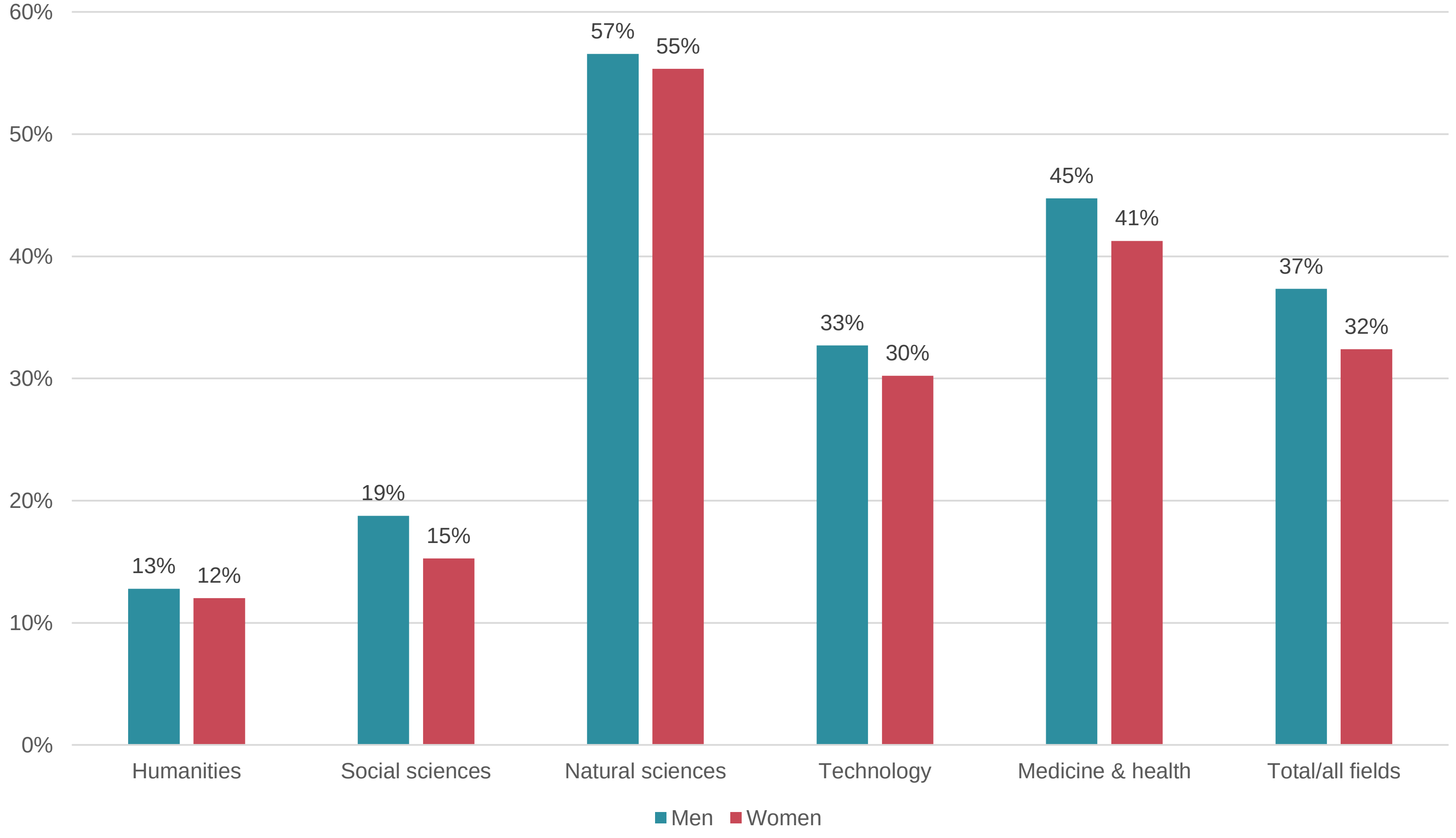
Several alternatives for measuring international collaboration at the level of individuals

- A. For each individual, calculate whether they have published at least one publication involving international co-authorship
  - Indication of whether they have been involved in international collaboration at all
- B. For each individual, calculate the proportion of publications involving international co-authorship
  - E.g. if a person has published 4 articles and 3 have international co-authorship, the proportion is 75%
  - Indication of the degree of international collaboration
- C. Other methods, where the unit for analysis is aggregated units (groups) and not the individual researchers

Proportion of researchers involved in international collaboration by fields and gender (method A)



Average proportion of international co-authorship per individual by fields and gender (method B)



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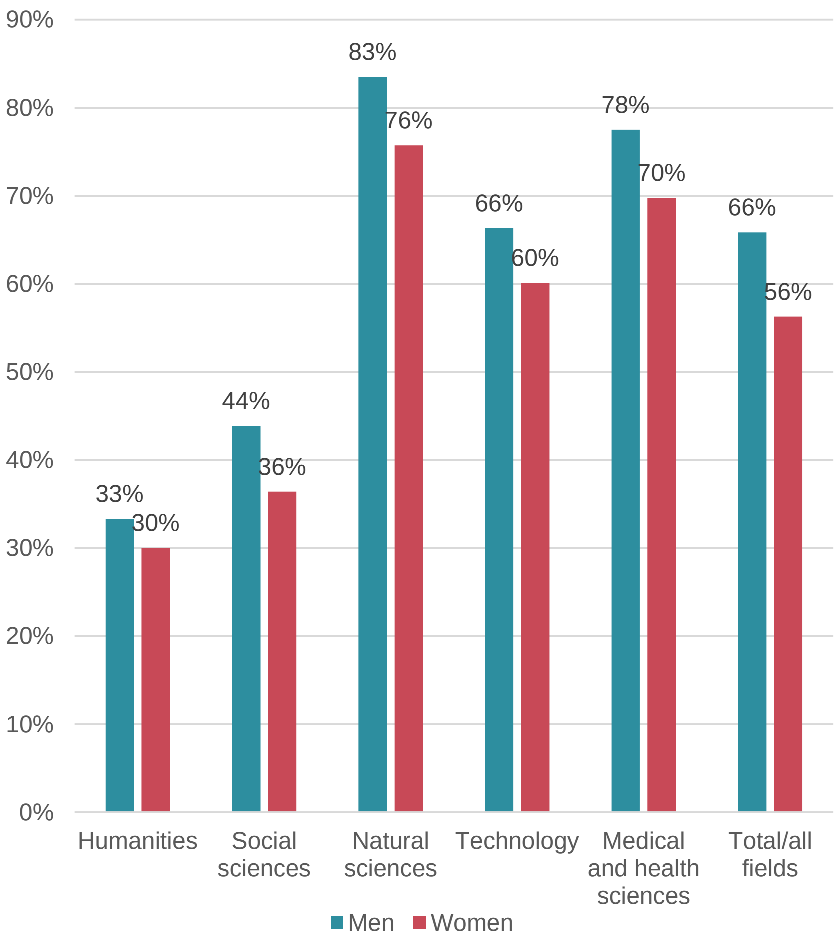

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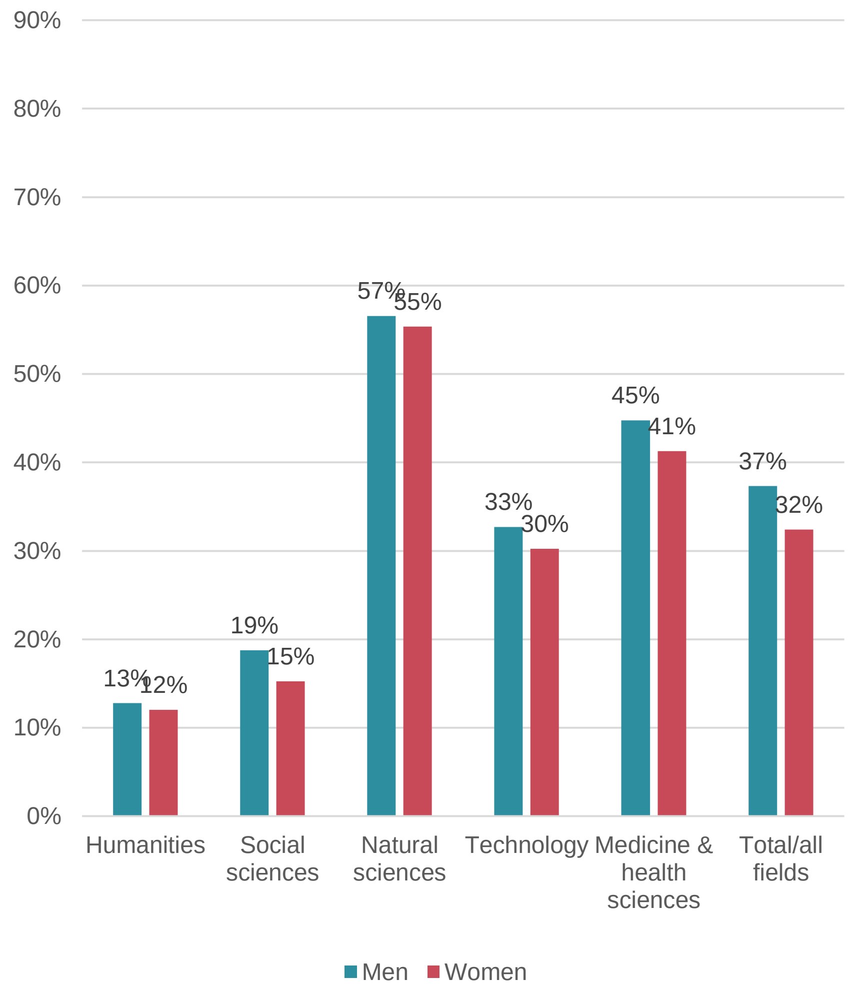
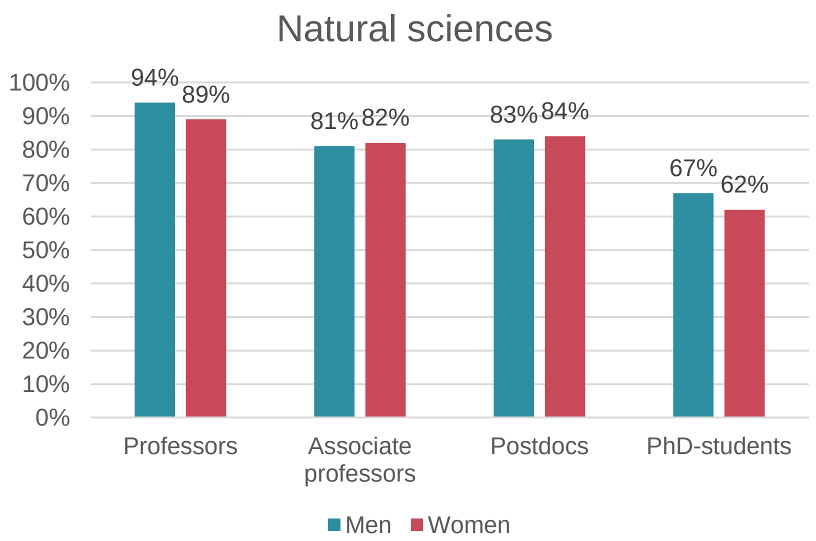
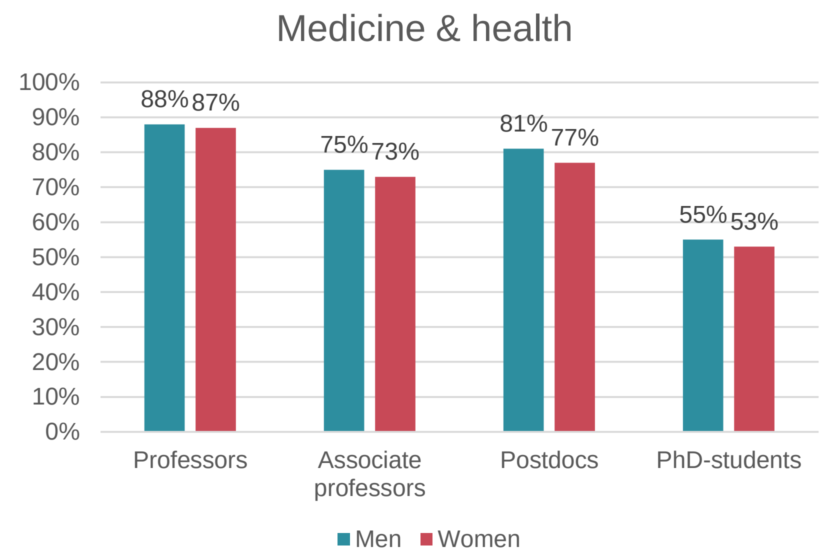
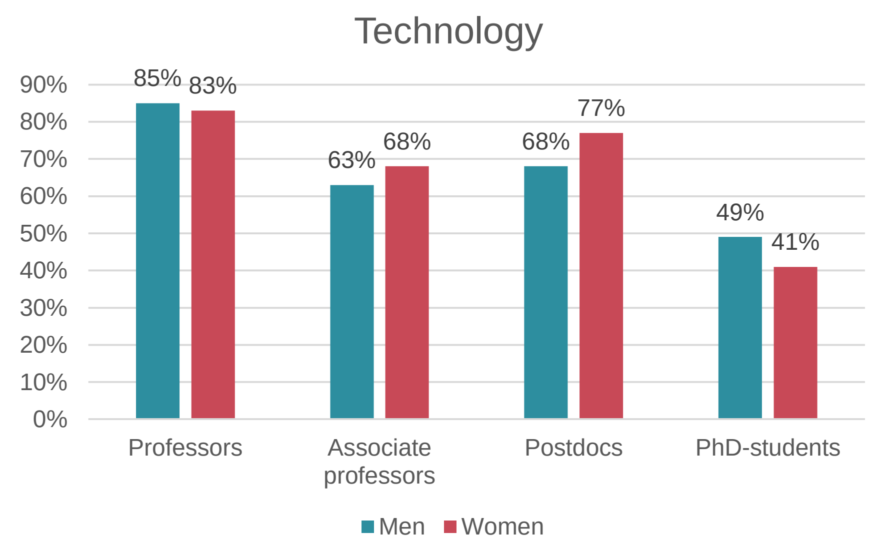


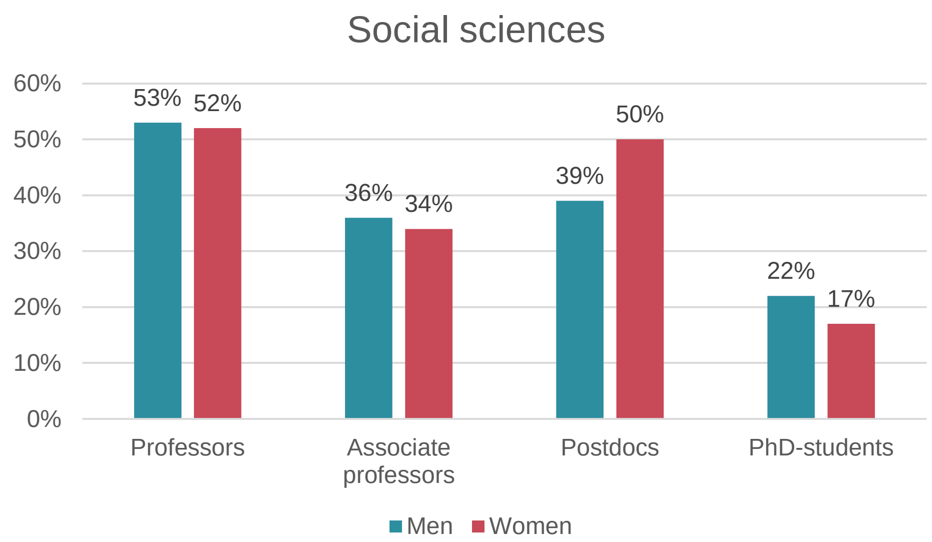
Proportion of researchers involved in international collaboration by fields and gender and position (method A)

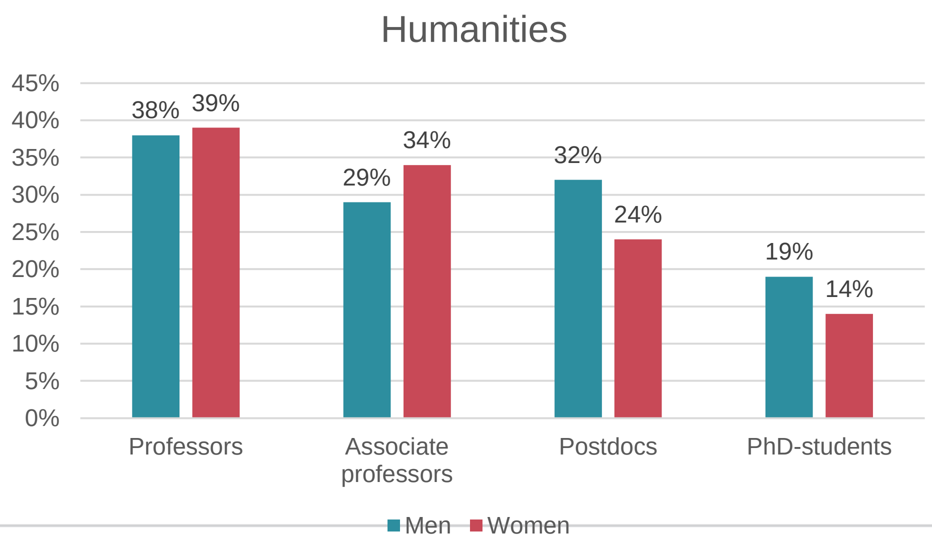




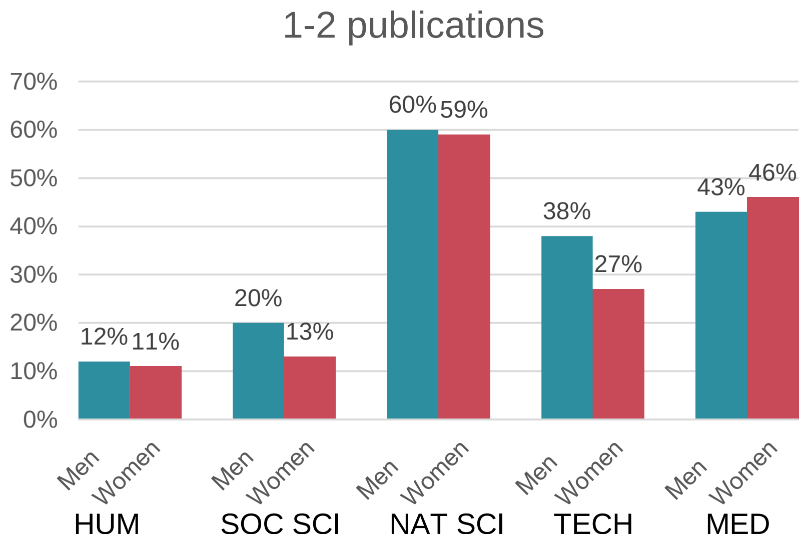


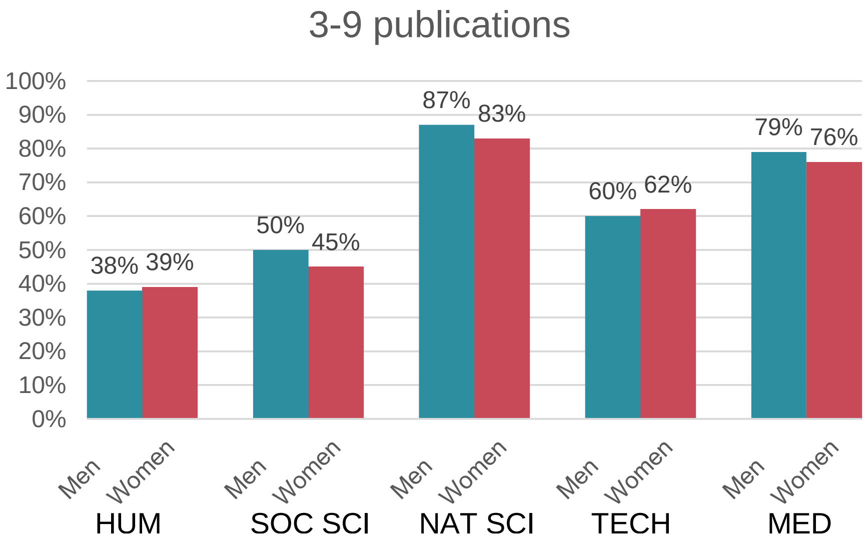
Proportion of researchers involved in international collaboration by fields and gender and position (method A)

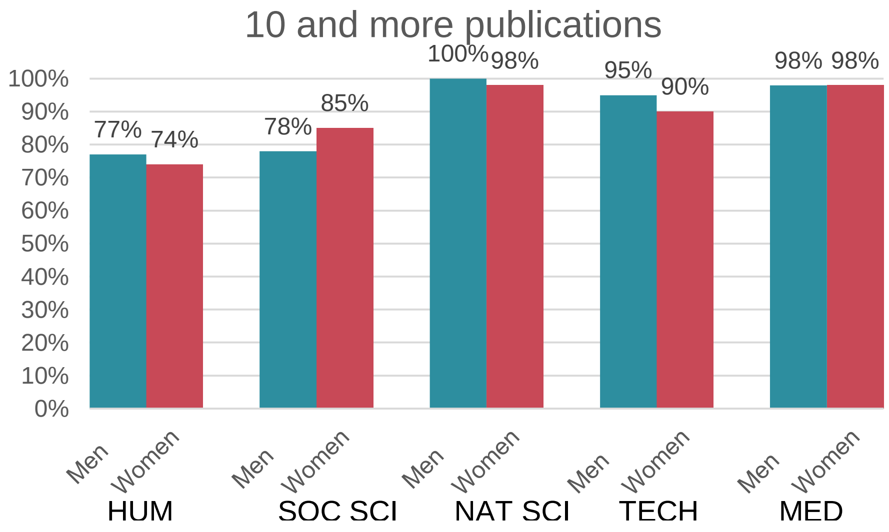




Proportion of researchers involved in international collaboration by fields and gender and productivity (method A)







Gender Difference Collaboration Index (GDCI)

- Constructed a combined indicator, a Gender Difference Collaboration Index (GDCI) :

$$GDCI = \left(\frac{m\ int}{m} * \frac{\sum_{n=1}^{m}\left(\frac{pub\ int_n}{pub\ tot_n}\right)}{m}\right) - \left(\frac{w\ int}{w} * \frac{\sum_{n=1}^{w}\left(\frac{pub\ int_n}{pub\ tot_n}\right)}{w}\right)$$

- A measure that takes both factors simultaneously into account

- The GDCI varies between -1 (complete gender difference in favor of women) to 1 (complete gender difference in favor of men)

- Size adjusted GDCI: GDCI adjusted for sample size
  - GDCIs multiplied with the number of observations. Presented in percentages of total GDCIs. For example, a very high gender inequality (e.g. high GDCI) based on a very small sample (e.g., n=40), adds very little explanation to the total inequality, whereas a low/modest inequality (e.g. GDCI) in a very large sample (e.g. n=500), may add much explanation for the total gender inequality.

Gender Difference Collaboration Index (GDCI) across fields, and publication productivity

	1-2 publications		3-9 publications		10+ publications	
	GDCI	Size adjusted GDCI	GDCI	Size adjusted GDCI	GDCU	Size adjusted GDCI
Humanities	0.000		0.000		-0.006	-0.5 %
Social sciences	+0.015	+5.6 %	0.024	+12.2 %	-0.034	-4.2 %
Natural sciences	+0.016	+6.3 %	-0.009	-5.0 %	0.000	
Technology	+0.068	+13.1 %	-0.020	-7.4 %	0.021	+5.4 %
Medicine & health	-0.019	-8.4 %	0.022	+14.9 %	0.041	+17.0 %
Total	+0.025	+40.6 %	+0.017	+23.4 %	+0.055	+36.0 %

- In the group of less productive researchers (1-2 publications) we find the highest source of gender inequality.
- The gender inequality is much higher among the most productive researchers compared to the middle group (3-9 publications).

Main findings

- The study shows that there are distinct gender differences in international research collaboration in Norway at an overall level
- However, women and men are not equally distributed. Women account for higher proportions of personnel with lower academic ranks and with lower publication productivity
- As a consequence the gender differences are smaller when academic position and productivity are taken into account
- Still, in the majority of fields, academic positions and productivity categories, shares of international collaboration are slightly higher for men than for women
- Much of the gender imbalance stems from researchers with just 1-2 publications, and especially from researchers in recruitment positions