

Original scientific paper

WOMEN'S INCLUSION IN RESEARCH: COMPARISON OF INVOLVEMENT IN RESEARCH FOR DEVELOPING AND DEVELOPED COUNTRIES

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Abstract

In this paper the issue of women's position in research was studied both for developing and developed countries. Women participation in research increased substantially in the past few decades. Globally, women make up 33.3% of researchers (in head counts), according to data from the UNESCO Institute for Statistics for 107 countries covering the years 2015–2018. Several countries are collecting and reporting sex-disaggregated data on researchers than 20 years ago. However, a large data gap remains. Further increase in the involvement of women in research is crucial both for the development of the research and for the empowerment of women by increasing their role in society.

This recantation is devoted to the comparison of involvement in research between European developed and developing countries in recent years. Examples from larger context have also been provided. There is no straightforward correlation between a country's wealth and its success in achieving gender parity in the research. Therefore, the origins of the differences are more complex than it is usually expected, which requires quite attentive study of the issue.

Keywords: status of women in research, gender gaps, academic careers

JEL classification: I24, J16, O15

INTRODUCTION

This work starts with a presentation of the status of women in research, presenting most important features for the considered issue. Particular attention is paid to developing countries, where are observed trends of increase of inclusion of women in research in the beginning of their carrier. Next, are identified gender gaps occurring in specific stages of research carrier. Particularly important issue is how the gaps change with time and what are the expectations for future reduction of gender gaps. Conclusions reflect the particularities of participation of women in research along with the differences between developed and developing countries.

To evaluate the women's inclusion in research, it is needed to explain why the analyses of women participation in research (Al Subeh and Alzoubi, 2020; Sugimoto and Larivière, 2023) is required.

First, making visible the contribution of women in research may create further motivation for entering academia, science, research and taking leadership roles in research teams (Bittner-Fessler, 2021; Steele and Challis, 2023).

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Second, further increase in the involvement of women in research is crucial both for the development of research (Sasson and Miedijensky, 2023) and for the empowerment of women by increasing their role in society.

Sex-disaggregated data on researchers are not being collected regularly by most countries. According to UIS (UNESCO Institute for Statistics), more countries are collecting and reporting sex-disaggregated data on researchers for more than 20 years ago, but still, a large data gap remains. Sex-disaggregated data on researchers are not being collected regularly by most countries in the Caribbean, Oceania, South Asia, Southeast Asia and sub-Saharan Africa, for instance, or by the populous countries of Bangladesh, Brazil, India and Nigeria. Moreover, UNESCO estimates exclude North America and China on account of the international incomparability of these data. The observed data gaps make it difficult to draw conclusions for most regions. According to UIS data: more women participating in research in developing countries (more than 50 %), many OECD countries have a low share of female researchers or less than the global average of 33 %. Therefore, there is no guaranteed correlation between a country's wealth and its success in achieving gender parity in research.

Relevant sets of official reliable data are used in the analysis in this work, using several indicators (doctorate holders in the working age population, participation of women in research and development in EU countries, as well as the proportion (%) of women among researchers, by sectors and the total).

1. ACTUAL STATUS OF WOMEN IN RESEARCH

In this section several important indicators determining the position of the women in research are presented.

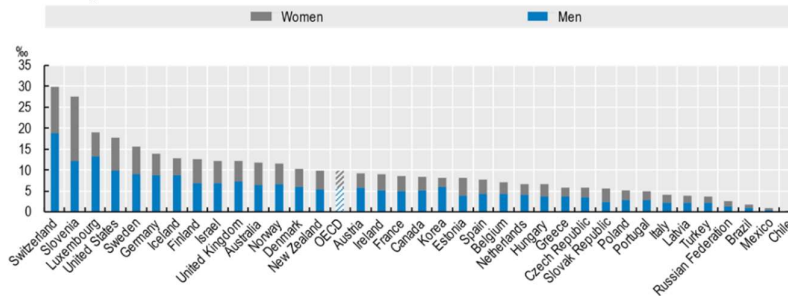


Figure 1. Doctorate holders in the working age population, 2016
 Source: OECD Science, Technology and Innovation Outlook 2018 - © OECD 2018,
https://doi.org/10.1787/sti_in_outlook-2018-en

Figure 1 presents OECD data for doctoral holders in the working age population for different countries. It is seen that on the top of the list are developed countries such as Switzerland, Slovenia, Luxemburg, United States, Sweden, and Germany. The figure reflects the cumulative development and hence it is expected developed countries to be highly positioned. It is seen that, except for Slovenia, participation of women in research in these countries is lower compared to men.

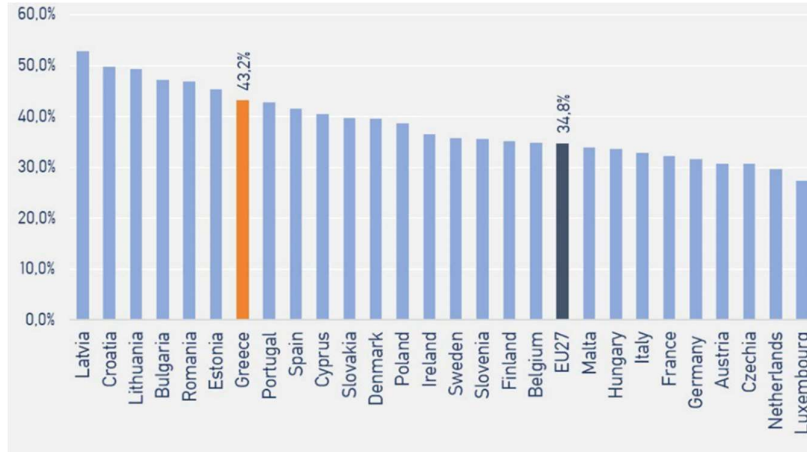


Figure 2. Participation of women in research and development (2020) EU countries
Source: <https://metrics.ekt.gr/en/women-rd>

Figure 2 illustrates the share (participation in %) of women in research and development for EU countries. Contrary to the figure for total number of researchers, the share is not the highest for most developed countries. On the top of the list are Latvia, Croatia, and Lithuania. Then follow much less developed countries such as Bulgaria and Romania, having between the highest percentages, much higher than the EU average (34.8 %, black bar).

It is to be noted that there is no straightforward correlation between a country's wealth and its success in achieving gender parity in participation in research and development (e.g. Bulgaria and Romania have between the highest values of women participation in research and development in EU, while Luxembourg has the lowest value).

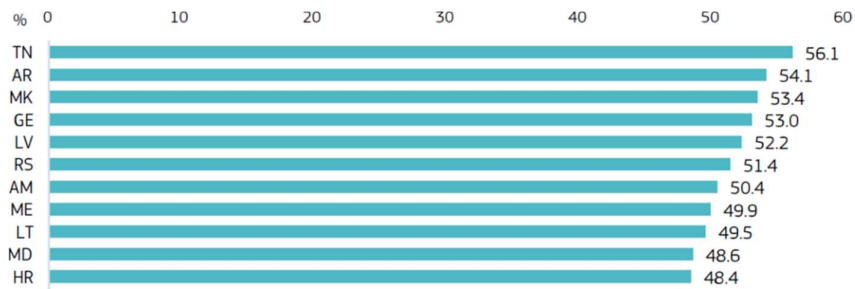


Figure 3. Proportion (%) of women among researchers, 2018, countries with highest proportion
Source: European Commission, Directorate-General for Research and Innovation, She figures 2021 – Gender in research and innovation – Statistics and indicators, Publications Office, 2021, <https://data.europa.eu/doi/10.2777/06090>

Only countries with the highest proportion of women among researchers are presented in Figure 3 to illustrate whether there is a connection with the development level. It is seen that the developing Southeastern European (SEE) countries (Macedonia - MK, Republic of Serbia - RS, Montenegro - ME) are between those on the top of the

list, with proportions higher than 50 %. Therefore, the overall participation of women in research is not directly connected to the level of economic development of the country.

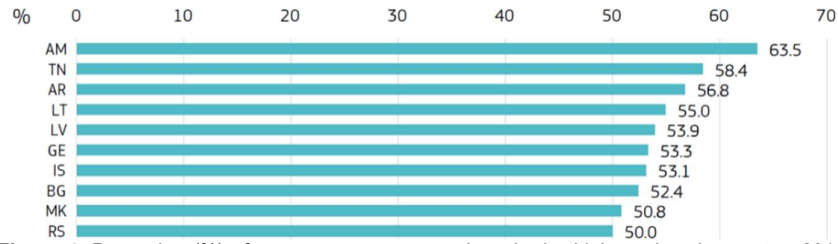


Figure 4. Proportion (%) of women among researchers in the higher education sector, 2018, Countries with highest participation

Source: European Commission, Directorate-General for Research and Innovation, She figures 2021 – Gender in research and innovation – Statistics and indicators, Publications Office, 2021, <https://data.europa.eu/doi/10.2777/06090>

Similarly, countries with top proportion of women among researchers in the higher education sector are displayed in figure 4. Again, there are several developing countries appearing in this group. It is seen that the proportions of women among researchers in the higher education sector can reach as high as 60 % values. Both developed (Island - IS, Latvia - LV, Lithuania - LT) and developing countries (Armenia - AR, Tunisia - TN, Macedonia - MK, Republic of Serbia - RS) are between the countries with highest participation of women among researchers in the higher education sector.



Figure 5. Proportion (%) of women among researchers in the government sector, 2018, Countries with highest participation

Source: European Commission, Directorate-General for Research and Innovation, She figures 2021 – Gender in research and innovation – Statistics and indicators, Publications Office, 2021, <https://data.europa.eu/doi/10.2777/06090>

In the government sector (Figure 5) developing countries are also represented on the top of the list, with Macedonia (MK) on the first position with 64.1% women participation among researchers in the government sector. Developing countries (Montenegro - ME, Republic of Serbia - RS) are between the countries with highest participation of women among researchers in the government sector.

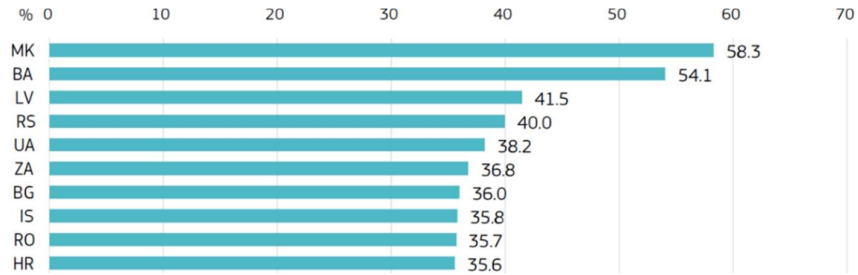


Figure 6. Proportion (%) of women among researchers in the business enterprise sector, 2018, Countries with highest participation

Source: European Commission, Directorate-General for Research and Innovation, She figures 2021 – Gender in research and innovation – Statistics and indicators, Publications Office, 2021, <https://data.europa.eu/doi/10.2777/06090>

As is seen from Figure 6, there are only two countries (Macedonia - MK, and Bosnia and Herzegovina - BA) where women are with more than 50% present in research in the business enterprise sector, for all developed countries participation is much lower than 50%. Thus, the business enterprise sector is a favorable environment for women researcher in less developed countries.

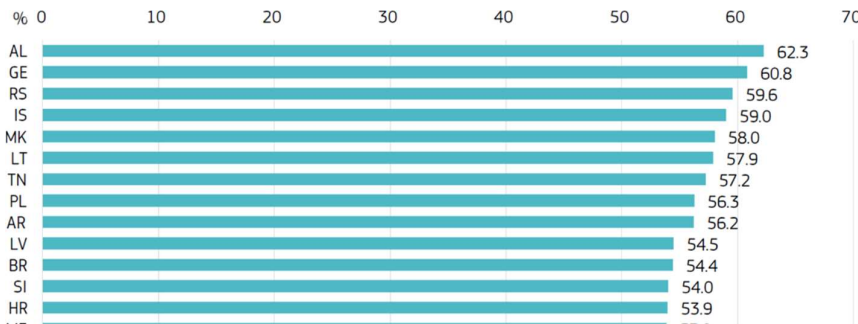


Figure 7. Proportion (%) of women among doctoral graduates, 2018, focus of developing countries

Source: European Commission, Directorate-General for Research and Innovation, She figures 2021 – Gender in research and innovation – Statistics and indicators, Publications Office, 2021, <https://data.europa.eu/doi/10.2777/06090>

Future improvement of the participation of women in research is supported by the actual trends of the inflow of new doctoral graduates. There are many countries with proportion of women higher than 50%, which is a basis for future improvement of overall participation of women in research. This is particularly the case with less developed countries (Albania - AL, Republic of Serbia - RS, Macedonia - MK) which display top values (over 58%) of proportion of women among doctoral graduates. This is a promising situation for decrease of the gender gap in research.

2. GENDER GAPS

Differential attention to researchers based on gender and field (González-Betancor and Dorta-González, 2023; Kuppler, 2022) leads to occurrence of gender gaps (Muscio and Vallanti, 2024). Further analysis of indicators determining the position of women in research provides information of gender gaps. These gaps are often very large.

First, the gender gap for women among heads of institutions in the Higher Education Sector is considered.

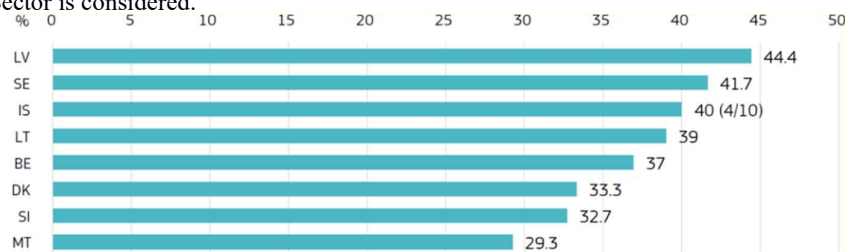


Figure 7. Proportion (%) of women among heads of institutions in the Higher Education Sector (HES), 2019

Significant gender gap is observed for all countries in Figure 7. The highest participation is for developed countries.

Despite increasing participation of women in research, there are significant gender gaps on the leading positions, such as higher education heads, where the highest participation level is 44.4 % for Latvia (LV), and most levels are below 40 %. It is to point out that the top values are for developed countries.

Next, the gender gaps for different grade (carrier levels) between men and women in typical academic carrier are presented and discussed.

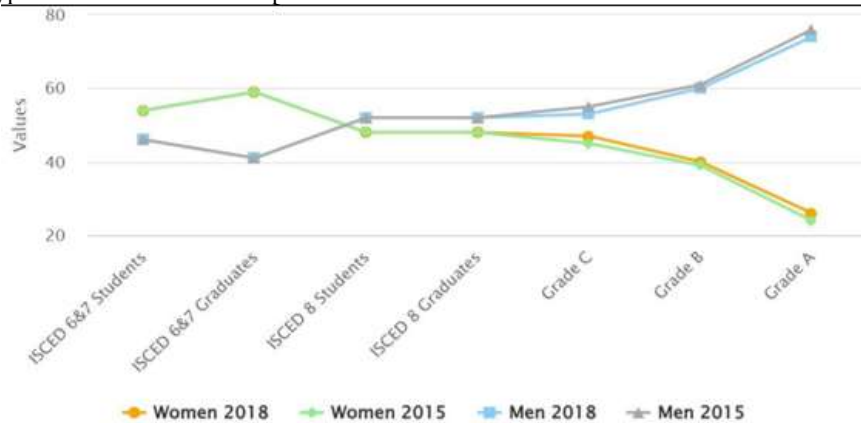


Figure 8. Participation of women in highest grades in EU-27

Source: European Commission, Directorate-General for Research and Innovation, She figures 2021 – Gender in research and innovation – Statistics and indicators, Publications Office, 2021, <https://data.europa.eu/doi/10.2777/06090>

Participation of women in highest grades is much lower than the participation of men. Small shrink of the gender gap is observed between 2015 and 2018.

Graphically the gender gaps for different grade (carrier levels) are shown in Figure 8. It is seen that the gap broadens with the increasing grade and attains exceptionally high values for the highest grade - A. It is seen that the gap lessens slightly between 2015 and 2018, but the change is too small to expect significant changes even on long term.

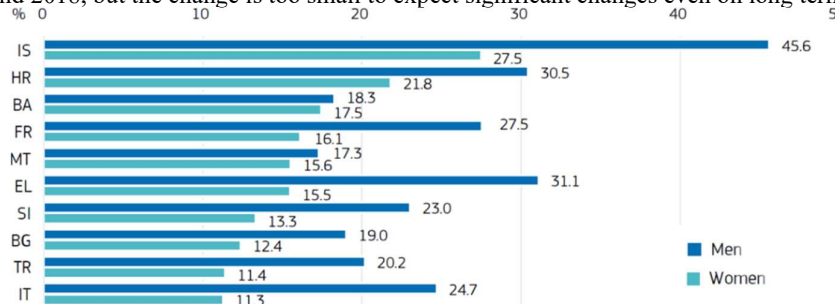


Figure 9. Proportion (%) of grade A staff among all academic staff, by sex, 2018, countries with highest proportion

Source: European Commission, Directorate-General for Research and Innovation, She figures 2021 – Gender in research and innovation – Statistics and indicators, Publications Office, 2021, <https://data.europa.eu/doi/10.2777/06090>

Trends of participation of women in grade A by country display marked differences (Figure 9). In the period 2015 to 2018 participation of women in grade A slightly increased in most of the countries, but in some of the countries with highest participation significant decrease has been observed. This again indicates that the reduction of the gap for the highest level will be a long-lasting process. Small increase of the proportion (%) of women among Grade A positions, from 2015 to 2018 occur. In Malta-MT and Romania-RO the trend is opposite.

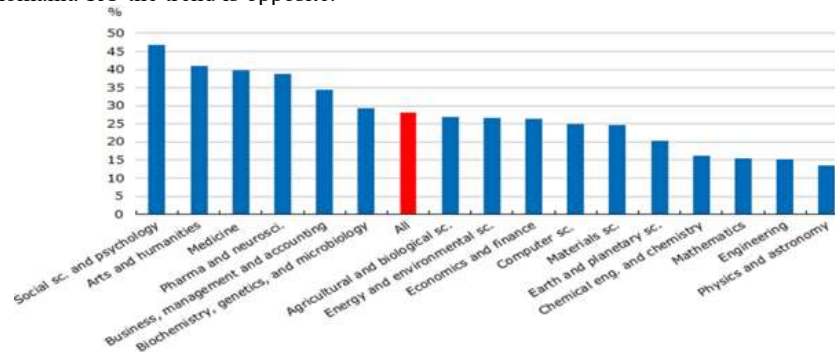


Figure 10. Women corresponding authors, by science field. Percentage of corresponding authors.

Note: Weighted estimates based on sampling weights adjusted for nonresponse.
Source: Bello, M. and F. Galindo-Rueda (2020), <https://doi.org/10.1787/1b06c47c-en>

There are gender gaps between the authors for all science fields, as presented by Figure 10. The smallest percentages of first authors are for Social Sciences and Psychology, and Arts and Humanities. The highest are for Engineering, and Physics and

Astronomy, where the women present less than 20 % of the authors. It is a deep gap and it last long without appropriate support for women.

Women are under-represented in the population of scientific authors Gender inequality is particularly true for researchers. Results from the latest OECD. International Survey of Scientific Authors (ISSA2) show that women are under-represented in research careers, as they are in many other sectors. On average across OECD countries, women comprise only around 40 percent of all researchers – ranking from 23 percent in Luxembourg to 56 percent in Lithuania – and they are considerably less likely to be in leadership positions.

Women authors earn on average 5 to 6 percent less than their male counterparts. This gap persists even though there is no evidence that women's research is of lower quality: the work of male authors is not more likely to be cited or be published in prestigious journals than that of female authors. The gender wage gap is particularly wide in engineering and computer sciences (nearly 27 percent), and regarding senior management positions (15 percent). This suggests that women are at a greater disadvantage in certain fields – typically those associated with more prestige and better pay.

3. EVOLUTION OF THE GAP IN THE GRADE A

It is important to know whether the existing gender gaps shrink or dipped with the time. As particularly indicative, the evolution of the gender gap in the grade A is further considered.

Changes that occurred between 2015 and 2018 are presented and discussed in this section.



Figure 11. Evolution of the proportion (%) of women among Grade A positions, 2015 vs. 2018, countries with highest proportions

Source: European Commission, Directorate-General for Research and Innovation, She figures 2021 – Gender in research and innovation – Statistics and indicators, Publications Office, 2021, <https://data.europa.eu/doi/10.2777/06090>

Trends of participation of women in grade A by country display marked differences (Figure 11). In the period 2015 to 2018 participation of women in grade A slightly increased in most of the countries, but in some of the countries with highest participation significant decrease has been observed. This again indicates that the reduction of the gap for the highest level will be a long-lasting process and well defined and organized policies are needed. Small increase of the proportion (%) of women among Grade A

positions, from 2015 to 2018 occur in some countries: Latvia-LV, Bulgaria -BG, Slovenia-SI, Croatia-HR.

In Malta (MT) and Romania (RO) a decrease of participation of women in grade A is observed in the period 2015 to 2018, but these countries had already attained high level of participation and even after the drop remain between countries with highest participation.

CONCLUSIONS

Based on the analysis in this work, following conclusions can be drawn:

There is no straightforward correlation between a country's wealth and its success in achieving gender parity in participation in research and development.

Developing countries display between the highest values of proportion of women among doctoral graduates.

Participation of women in highest grades is much lower than the participation of men.

A small shrink of the gender gap in highest grades is observed between 2015 and 2018 for some countries in EU-27.

Important increase in the participation of women in research is observed in last decades.

In many countries proportion of women among doctoral graduates is much higher than 50 %.

Nevertheless, large gender gap occurs in the highest grade (A)

Gender gap in the highest grade (A) only slowly decreases with the time.

In accordance with the observed trends, it is expected the gender gap in highest positions to last on long term, even for several decades in future.

Women are under-represented in the population of scientific authors.

Women authors earn on average 5 to 6 percent less than their male counterparts.

Women are less represented in the fields: Computer sciences, Mathematics, Engineering, Physics and Astronomy.

It is important to continue to work towards creating a more inclusive environment for girls and women in STEM education. STEM careers are often referred to as the jobs of the future, driving innovation, social wellbeing, inclusive growth, and sustainable development.

Based on the result of this work, it can be stressed that:

- Although the gender should not define your career path, it is a reality that women historically had to face.

- Women have made strides in pursuing careers in fields historically.

- It's time to close the gender gap in research!

To address gaps, creating a more inclusive research environment is needed.

Systemic changes and individual efforts are prerequisite for creating a more inclusive research environment. Here are some proposed steps to foster inclusivity of women in research:

1. Diverse Hiring Practices:

- Research institutions should actively recruit and hire women and other underrepresented groups.

- Implement blind recruitment processes to reduce bias.

2. Equal Opportunities:

- Ensure equal access to resources, funding, and mentorship for all researchers.
 - Encourage women to take leadership roles in research projects.
 - 3. Flexible Work Policies:
 - Provide flexible work hours and remote options to accommodate family responsibilities.
 - Support work-life balance for both men and women.
 - 4. Training and Education:
 - Conduct workshops on unconscious bias, diversity, and inclusion.
 - Train researchers to recognize and address gender-related challenges.
 - 5. Visibility and Representation
 - Highlight successful women researchers as role models.
 - Showcase their achievements through seminars, conferences, and publications.
 - 6. Networking and Support Groups:
 - Create networks for women researchers to connect, share experiences, and support each other.
 - Encourage participation in professional societies.
 - 7. Data Collection and Analysis:
 - Collect gender-disaggregated data to identify disparities.
 - Analyze research outcomes by gender to address gaps.
- By promoting diversity, we enhance the quality and impact of scientific discoveries.

REFERENCES

- Al Subeh, Zeinab Y., and Karem H. Alzoubi. 2020. Cultural and religious barriers influencing the participation of women in research: a study from Jordan. *Gender issues* 37(2): 173-186.
- Bittner-Fessler, A. 2021. It Does Matter: The Visibility of Women, with the Example of German Universities. In: Karim, A.A., R. Khalil, and A. Moustafa (eds) *Female Pioneers from Ancient Egypt and the Middle East*, Singapore: Springer.
- González-Betancor, Sara M., and Pablo Dorta-González. 2023. Does society show differential attention to researchers based on gender and field?. *Journal of Informetrics* 17(4): 101452-1–101452-14.
- Muscio, Alessandro, and Giovanna Vallanti. 2024. The gender gap in PhD entrepreneurship: Why balancing employment in academia really matters. *Research Policy* 53(1): 104907.
- Kuppler, Matthias. 2022. Predicting the future impact of Computer Science researchers: Is there a gender bias?. *Scientometrics* 127(11): 6695-6732.
- Sasson, Irit, and Shirley Miedijensky. 2023. Research Performance: A View of Research Self-Efficacy, Interest, and Gender. *Education Sciences* 13 (12): 1166-1–1166-15.
- Steele, Julie R., and John H. Challis. 2023. Pioneering women of the international society of biomechanics. *Journal of Biomechanics* 152: 111547-1–111547-11.
- Sugimoto, Cassidy R., and Vincent Larivière. 2023. *Equity for Women in Science*, Cambridge: Harvard University Press.