https://doi.org/10.51408/issi2025_012

Gender Disparities in Academic Research: A Comparative Study of Armenia and Italy

Shushanik Sargsyan[1], Edita Gzoyan[2], Giovanni Abramo[3], Ciriaco Andrea D'Angelo[4]

[1]*shushaniksargsyan8@gmail.com*
Institute for Informatics and Automation Problems of NAS RA
1 Paruyr Sevak St, 0014, Yerevan (Republic of Armenia)

[2]*editagzoyan@gmail.com*
Institute for Informatics and Automation Problems of NAS RA
1 Paruyr Sevak St, 0014, Yerevan (Republic of Armenia)

[3]*giovanni.abramo@unimercatorum.it*
Universitas Mercatorum, Laboratory for Studies in Research Evaluation
Piazza Mattei 10, 00186 Rome (Italy)

[4]*dangelo@dii.uniroma2.it*
University of Rome "Tor Vergata", Dept of Business Engineering
Via del Politecnico 1, 00133 Rome (Italy)

Abstract

Gender disparities in academic research are a critical concern in the quest for equality in science and higher education. These disparities are evident in research output, citation impact, collaboration networks, and representation in senior academic roles, with women generally underrepresented and displaying lower performance metrics compared to men. However, the nature and extent of these gaps often differ across countries due to varying cultural and institutional contexts. This study examines gender differences in research performance in STEMM fields by comparing Armenia and Italy, two nations with distinct academic traditions and gender norms. Using 2017–2021 data from the Web of Science core collection, the proposed analysis encompasses over 3,600 Armenian and 27,000 Italian scientists, evaluating metrics such as publication counts, citation impact, and collaboration patterns at the individual level. The findings highlight how national contexts shape the gender gap in research performance, revealing unique barriers faced by female researchers in each setting. By investigating these disparities through a comparative lens, the study provides insights into the complex interplay between gender and geography in academic research. These insights aim to inform policy measures tailored to address gender-based inequities in diverse academic environments.

Introduction

Gender disparities in research performance and academic career advancement have become central issues in the discourse on equality in science and higher education (Larivière et al., 2013; Elsevier, 2020). These disparities manifest in various forms, including differences in research output, citation impact, collaboration networks, and representation in senior academic positions (Ceci & Williams, 2011; Bendels et al., 2018). While the general pattern of underrepresentation of women and lower research performance metrics compared to their male counterparts is well documented, the degree and nature of these disparities often vary significantly across countries and cultural contexts (UNESCO, 2019). Understanding these differences

is crucial for developing policies that address the unique barriers faced by female researchers, particularly in contexts where academic and research traditions vary widely (Huang et al., 2020).

This study provides a comparative analysis of gender differences in research performance between Armenia and Italy, two countries with distinct historical, cultural, and institutional backgrounds that shape academic norms and gender roles in different ways. Armenia, a post-Soviet country in the Caucasus region, is undergoing rapid socio-economic development, including increased attention to gender equality (Yeritsyan, 2019). However, Armenia still faces considerable challenges related to traditional gender roles, particularly in high-skill, male-dominated sectors (UNDP Armenia, 2020). In academia, the barriers faced by female researchers can be exacerbated by structural limitations in research funding, limited networking opportunities, and insufficient institutional support, which can impact their research performance and visibility in the academic community (van den Besselaar & Sandström, 2016).

In contrast, Italy is a Western European country with a well-established higher education system and more progressive gender equality policies, especially within academia (Bettio & Verashchagina, 2009). Despite this, Italy's academic sector exhibits a notable gender gap in terms of senior leadership positions, publication metrics, and research funding opportunities, particularly in fields like engineering and the physical sciences (Moscatelli et al., 2019). Italian female researchers often confront institutionalized biases and slower career progression, particularly as they approach senior academic ranks, contributing to gendered differences in research productivity and impact (Guarino & Borden, 2017; Mairesse & Pezzoni, 2015). Comparing Armenia and Italy thus allows one to analyze how gender disparities in research performance manifest across contrasting socio-cultural and academic environments (Abramo, Aksnes, & D'Angelo, 2021; Addis & Villa, 2003).

Research performance can be analyzed through a combination of quantitative indicators, including publication counts, citation impact, and collaboration patterns. These metrics provide insight into the scholarly productivity, influence, and networking capabilities of researchers and reveal potential barriers specific to gender (Bozeman & Corley, 2004). For instance, prior research has indicated that female researchers, on average, tend to have lower publication rates and citation impacts than male researchers, potentially due to unequal access to resources, disproportionate administrative and teaching responsibilities, and biases in peer review processes (Abramo, D'Angelo, & Rosati, 2016; Dworkin et al., 2020; Witteman et al., 2019). Additionally, gender differences in collaboration networks can influence access to co-authorship opportunities and interdisciplinary partnerships, both of which are critical for academic success and impact (Abramo, D'Angelo, & Di Costa, 2019; Caplar, Tacchella, & Birrer, 2017; Thelwall & Wilson, 2014).

The primary aim of this study is to compare gender differences in research performance between Armenia and Italy, focusing on three core aspects: (1) publication output, (2) citation impact, and (3) productivity. By analyzing these metrics across gender lines, this study seeks to identify the extent to which the gender

gap in research performance is influenced by the national context and to explore the underlying factors contributing to these differences. In doing so, it offers a nuanced understanding of how gender and geographical context interact to shape research performance (Aksnes, Rorstad, & Sivertsen, 2011).
Furthermore, this comparative study seeks to inform policymakers and academic institutions in Armenia, Italy, and beyond about potential interventions to promote gender equity in academia. For instance, differences in citation impact could indicate the need for policies that reduce barriers to accessing high-impact journals and conferences (Elsevier, 2020; Stoet & Geary, 2018). Ultimately, this research contributes to the broader goal of creating equitable academic environments where researchers of all genders can achieve their full potential.

Literature review

Gender disparities in academia have been widely documented across multiple dimensions, including research productivity, career advancement, and leadership positions. A growing body of research shows that female researchers often publish fewer papers than their male counterparts, achieve fewer citations, and have less access to collaborative networks, which collectively impact their academic influence and visibility (Larivière et al., 2013; Bendels et al., 2018). These disparities are typically attributed to a combination of structural, institutional, and cultural factors that hinder women's academic progression, such as unequal distribution of research funding, higher teaching or service burdens, and biases in publication and peer review processes (Ceci & Williams, 2011; Witteman et al., 2019).
Cross-national studies have increasingly highlighted that gender disparities in research performance are not universal but instead vary significantly by country, discipline, and institutional framework (Elsevier, 2020). For instance, countries with robust gender equality policies, such as those in Northern Europe, often exhibit smaller gender gaps in research output and impact compared to countries where such policies are less established (UNESCO, 2019).
This showed also during the COVID-19 pandemic. Differently from common belief, only in the Far East, women experienced a worse decrease in research output with respect to men. In the U.S. and China female and male scholars reduced their research output at a similar rate. In Europe, contrasting evidence emerged. In some countries (France, Netherlands and Switzerland) women were hurt more than men; in others (Germany and Spain) the opposite holds true, while in such countries as Italy, Sweden and U.K. gender differences are hardly noticeable (Abramo, D'Angelo, & Mele, 2022).
These variations emphasize the importance of contextual factors in shaping academic gender disparities and underscores the need for comparative studies to deepen our understanding of how different socio-cultural and institutional contexts contribute to these disparities.
Research output, typically measured by the number of publications, remains a key metric for academic success and is often influenced by gender. Studies consistently show that, on average, female academics publish fewer papers than their male colleagues, a disparity that has been observed across disciplines, including STEM

fields and social sciences (Aksnes, Rorstad, & Sivertsen, 2011; Huang et al., 2020). Various factors contribute to this gap, including differences in time allocation between research and other responsibilities such as teaching and administration, which often fall disproportionately on women (Guarino & Borden, 2017). Additionally, women in academia may face greater challenges in securing research funding, which directly affects their ability to conduct and publish high-quality research (van den Besselaar & Sandström, 2016).

Notably, recent research has examined the "leaky pipeline" phenomenon, wherein female representation in academia decreases at each successive career stage, especially in higher academic ranks (Alper & Gibbons, 2017). This effect is often pronounced in countries with traditional gender roles, where female academics may face greater cultural expectations around caregiving responsibilities, thereby limiting their time for research and collaboration. Armenia and Italy both experience significant "pipeline leakage," particularly in senior positions, though the underlying causes and extent of this trend differ between the two countries (Greska, 2023; Borrell-Damián & Rahier, 2019).

Citation-based metrics are widely used to assess research impact and visibility in the academic community. Studies show that female researchers generally receive fewer citations than male researchers, even after controlling for publication volume and field-specific citation rates (Dworkin et al., 2020). This disparity has been attributed to a range of factors, including potential biases in citation practices and the gendered dynamics of academic networks, which can affect the visibility and perceived impact of women's research (Caplar, Tacchella, & Birrer, 2017).

Gender differences in citation impact are also influenced by the nature of the journals where female researchers publish. Women are often underrepresented in high-impact journals and may experience greater difficulty in accessing these prestigious publication venues due to biases in the editorial process or fewer collaborative opportunities that lead to impactful research outputs (Addis & Villa, 2003). The Armenian context, where academic journal publishing is still developing, poses additional challenges for researchers, particularly for women, who may have limited access to international platforms with high visibility. In contrast, Italian researchers benefit from more established networks and access to high-impact publication venues, though significant gender gaps persist, particularly in STEMM disciplines[1], and among top scientists (Abramo, D'Angelo, & Caprasecca, 2009a; Abramo, D'Angelo, & Caprasecca, 2009b).

Collaboration is an increasingly vital component of academic success, as researchers who collaborate extensively tend to publish more and achieve higher citation rates (Mairesse & Pezzoni, 2015). However, studies indicate that women are often less integrated into influential academic networks and may have fewer opportunities for international and interdisciplinary collaboration (Bozeman & Corley, 2004). Limited access to collaboration networks can hinder women's research output and impact, contributing to the observed gender disparities in academic performance.

[1] Science, technology, engineering, mathematics, and medicine.

Research by Thelwall and Wilson (2014) suggests that women are more likely to collaborate within their institutions and less likely to engage in international collaborations, which tend to be more productive and impactful. This trend is especially relevant in countries with limited research infrastructure, such as Armenia, where collaborative opportunities with international peers may be constrained by institutional and funding limitations. In Italy, where the academic landscape is more globally integrated, female researchers face fewer structural barriers to international collaboration but still encounter challenges in forming and sustaining partnerships in male-dominated fields (Abramo, D'Angelo, & Murgia, 2013;).

The academic gender gap in Armenia reflects broader societal dynamics, as Armenia's recent post-Soviet transition has influenced both its educational infrastructure and gender norms in professional settings. Traditional gender expectations, combined with limited institutional support for women in research, contribute to gender disparities in research performance (Yeritsyan, 2019). Armenia's nascent efforts to address gender equality have yet to overcome these entrenched norms fully, and female researchers may experience significant structural and cultural barriers to academic success (UNDP Armenia, 2020).

Italy, on the other hand, is a Western European country where gender equality in academia has been progressively recognized and addressed through various policies. However, Italy's academic sector still reflects significant gender biases, especially in senior academic roles. Female representation decreases sharply in higher academic ranks, and Italian women researchers in science and engineering fields encounter particularly strong barriers to promotion and access to research funding (Bettio & Verashchagina, 2009; Moscatelli et al., 2019). Additionally, family-oriented cultural expectations in Italy often result in career interruptions for female researchers, which can negatively affect their research output and overall academic impact.

The findings from these studies underscore the importance of targeted policy interventions to address gender disparities in academia. Research suggests that policies that provide flexible career paths, support family-friendly work environments, and promote equitable access to research funding can reduce gender gaps in research output and impact (Stoet & Geary, 2018). Moreover, initiatives aimed at enhancing collaborative opportunities and mentorship programs can support female researchers in building stronger academic networks, thereby improving their access to high-impact publication channels and collaborative research opportunities.

In Armenia, policy efforts focused on building a more inclusive research environment and increasing access to international networks may benefit female researchers by alleviating structural limitations. For Italy, addressing gender disparities in senior academic roles and ensuring transparency in promotion and funding processes could promote gender equity at higher academic levels.

Data and methods

The census of Armenian scientists and their publication portfolio

We carried out the census of the research staff of the Armenian national science system, collecting names of professors and researchers: i) from the official websites of higher education institutions and research centres of the National Academy of Science of the Republic of Armenia (NAS RA); ii) sending official letters to the respective organizations with the request to provide the necessary information; and iii) harvesting the necessary information from the financing agreements of the research institutions of NAS RA, available on the web page of the Government.
Overall, we obtained microdata for 20 research organizations of the NAS RA and 14 universities involved in STEMM research, i.e. personal identifiers, affiliations, full names, gender, and academic rank. At the next stage we collected publications from Web of Science, having "Armenia" as affiliation country, and manually matching: i) the researchers' full names previously obtained with the author list; ii) the official affiliation with the bibliometric address list. Finally, we measured precision and recall of our bibliometric dataset, by manually checking data on a random sample.

The census of Italian scientists and their publication portfolio

The MUR maintains a database of university personnel. For each professor, this database provides information on their name and surname, gender, affiliation, discipline classification, and academic rank at the close of each year.[2] A similar database does not exist for public research institutions, which forces us to restrict the Italian census to professors only. For reasons of significance, our analysis is limited to those professors who held formal faculty positions for at least three years over the 2017-2021 period. The bibliometric dataset used to assess professors' output is extracted from the Italian Observatory of Public Research (ORP), a database developed and maintained by Abramo and D'Angelo and derived under license from the Clarivate Analytics Web of Science (WoS) Core Collection. Beginning from the raw data of the WoS, we first reconcile the author's affiliations, and then apply a complex algorithm to disambiguate the true identity of the authors. In ORP each publication is attributed to the university professors that produced it.[3]

Standardizing academic rank and classifying researchers by field

Since the dataset for Italy includes exclusively university professors, we will also use the term "professor" for all Armenian individuals. For this purpose, the ranks of the research staff of NAS RA institutions were matched to the equivalent academic rank as follows: Research director => Full professor; Senior researcher => Associate professor; Researcher => Assistant professor.
For benchmarking the two national systems, it is key to categorize each professor in the dataset into a specific scientific discipline. To achieve this, we utilized the WoS

[2] http://cercauniversita.cineca.it/php5/docenti/cerca.php, last accessed on 1 July 2024.
[3] The harmonic average of precision and recall (F-measure) of authorships, as disambiguated by the algorithm, is around 97% (2% margin of error, 98% confidence interval).

classification scheme and: 1) identified the WoS indexed publications of each professor under observation; 2) assigned to each publication the SC or SCs of the hosting journal; 3) classified each professor in the most recurrent SC in their publication portfolio.
A problem arises when the portfolio is limited to one or a few publications or when one observes more than one dominant SC. At this purpose, such analysis was carried out on an extended time window of eleven years (2010-2022). Residual cases of professors with more than one dominant SC were solved by randomly selecting one of the dominant SCs.

The final dataset

Because of the limited coverage of publications in the Arts and Humanities, for reasons of significance, we included in the analyses only professors in STEMM SCs (Larivière, Archambault, Gingras, Vignola-Gagné, 2006; Aksnes & Sivertsen, 2019). Moreover, after merging the datasets of the two countries, we included in the final dataset only those SCs (128 in all) with at least one Armenian and one Italian professor. The final dataset consists of 3617 Armenian and 27034 Italian professors. Their distribution per field[4] is shown in Table 1.

Table 1. Dataset of analysis.

Field	No. of SCs	No. of Armenian professors	No. of Italian professors
Biology	26	637 (17.6%)	5232 (19.4%)
Biomedical Research	12	387 (10.7%)	2863 (10.6%)
Chemistry	8	332 (9.2%)	1566 (5.8%)
Clinical Medicine	25	437 (12.1%)	5425 (20.1%)
Earth and Space Sciences	11	309 (8.5%)	2271 (8.4%)
Engineering	27	708 (19.6%)	5487 (20.3%)
Mathematics	3	250 (6.9%)	1496 (5.5%)
Physics	16	557 (15.4%)	2694 (10.0%)
Overall	128	3617	27034

In both countries, Engineering is the most represented field while Mathematics is the one with the fewest number of professors on staff. While the distribution by field is relatively similar between the two countries, the breakdown in the three academic ranks is very different. Full professors in the Italian dataset account for 31% of the total, compared to 12.5% for Armenia. In contrast, Italian assistant professors are 16.7% of the total, while for Armenia they are almost 60%.

[4] SCs are grouped in fields following a pattern previously published on the website of ISI Journal Citation Reports, but no longer available on the current Clarivate portal. There are no cases in which an SC is assigned to more than one field.

Measuring research performance

The comparative evaluation of the research performance of individual professors is proxied by an output-to-input productivity indicator named Fractional Scientific Strength (FSS),[5] defined as:

$$FSS_p = \frac{1}{\left(\frac{w}{2} + k\right)} \cdot \frac{1}{t} \sum_{i=1}^{N} c_i \; f_i \qquad [1]$$

where:

w = average yearly salary of the professor (we halve labor costs, assuming that 50 percent of professors' time is allocated to activities other than research);

k = average yearly capital available for research to the professor;

t = number of years of work by the professor in the period under observation;

N = number of publications by the professor in the period under observation;

c_i = impact of publication i (weighted average of the discipline-normalized citations received by publication i and the discipline-normalized impact factor of the hosting journal);[6]

f_i = fractional contribution of professor to publication i;[7]

As for the input factors (w and k), we relied on Abramo, Aksnes, & D'Angelo (2020, Table 4).

For each professor,[8] FSS is computed in absolute value and percentile rank, by comparison with the same data referring to all professors in the same subject category in the dataset.

The analysis will also be conducted through indicators that measure the different components of FSS and, more specifically, the output (O_p), the fractional output

[5] For a comprehensive explanation of the methodology, underlying theory, assumptions and limitations, as well as the input data source, we direct the reader to Abramo and D'Angelo (2014) and Abramo et al. (2020).

[6] This combination serves as the most accurate projection of future long-term citations for a publication (Abramo et al., 2019). Citations are adjusted to the mean of the distribution concerning all referenced publications from the same year and the Web of Science subject category (SC) of publication i. The journal's impact factor (IF), corresponding to the year of publication, is normalized relative to the average of the IF distribution of all journals in the same SC of publication i.

[7] In the field of life sciences in Italy, it is customary for authors to delineate their respective contributions to published research based on the order of names in the byline. In SCs related to these areas, we assign varying weights to each co-author depending on their position in the byline and the nature of the co-authorship (intra-mural or extra-mural). When the first and last authors are affiliated with the same university, each is attributed 40% of the citations, with the remaining 20% distributed among all other authors. If the first two and last two authors come from different universities, 30% of citations go to the first and last authors, 15% to the second and penultimate authors, and the remaining 10% is divided among all other contributors. These weighting values were determined with guidance from eminent Italian life sciences scholars and can be adjusted to align with various practices in other national contexts. In all other subject areas, fractional contribution is calculated as the inverse of the number of authors.

[8] As for the research staff of Armenian researchers working at NASRA institutes, we equate the research unit leader to full professor, senior researcher to associate professor, and researcher to assistant professor.

(FO_p) and average impact, as measured by standardized citations (AI_p), and hosting journals' standardized impact factors (JI_p). For this purpose, we will use the indicators described below.

$$O_p = \frac{N}{t} \quad [2]$$

$$FO_p = \frac{1}{t}\sum_{i=1}^{N} f_i \quad [3]$$

$$AI_p = \frac{1}{N}\sum_{i=1}^{N} cit_i \quad [4]$$

$$JI_p = \frac{1}{N}\sum_{i=1}^{N} if_i \quad [5]$$

With
N = number of publications by the professor in the period under observation;
f_i = fractional contribution of professor to publication *i;*
cit_i = year- and discipline-normalized citations received by publication *i*;
if_i = discipline-normalized impact factor of the hosting journal at the year of publication.

Results

The incidence of women in the research staff of the two countries

Table 2 and Figure 1 provide a comparative view of the gender distribution within the research staff of Armenia and Italy, categorized by academic rank and field. Notably, Armenia exhibits a higher overall representation of women in STEMM fields (52.0%) compared to Italy (35.8%). This trend is particularly evident in Biology and Biomedical Research, where the share of female researchers in Armenia exceeds 70%, whereas Italy reports approximately 50% female participation. Conversely, in male-dominated fields like Engineering and Physics, both countries show significantly lower female representation. In these fields, only 42.9% of Armenian researchers and 21.8% of Italian researchers are women in Engineering, and 28.9% (Armenia) and 19.0% (Italy) in Physics.

Interestingly, the concentration index (CI) reveals that women in Armenia are more proportionally represented across various fields compared to the national average, while Italy shows more pronounced disparities in female representation across disciplines. These data suggest systemic differences in how gender roles manifest in academic environments, with Armenian women achieving higher numerical participation but potentially facing other structural barriers.

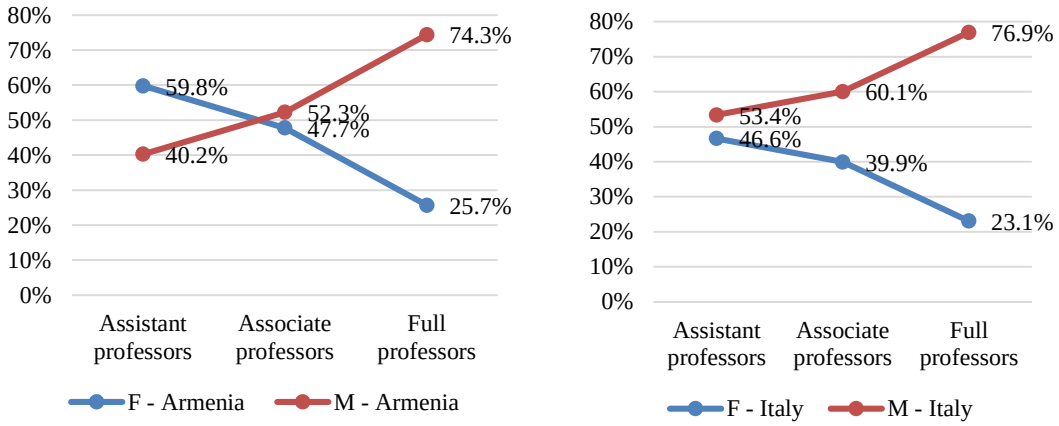

Figure 1. Research staff of the two countries in the dataset, by gender and academic rank.

Table 2. Share of female professors, by gender, country and field.

	Armenia		Italy	
Field	Share of females	CI*	Share of females	CI*
Biology	70.6%	1.358	49.6%	1.385
Biomedical Research	71.3%	1.371	48.4%	1.351
Chemistry	60.2%	1.158	44.7%	1.248
Clinical Medicine	60.9%	1.170	35.9%	1.003
Earth and Space Sciences	47.9%	0.921	35.1%	0.981
Engineering	42.9%	0.825	21.8%	0.608
Mathematics	30.8%	0.592	36.7%	1.024
Physics	28.9%	0.556	19.0%	0.531
Overall	52.0%		35.8%	

** concentration index, given by the share of female professors of a country in a given field divided by the share of female professors of that country overall. A value of 1.2 means that in the field, females are 20% more than their expected value measured at the overall country level.*

Output

Table 3 details the percentage of professors with at least one WoS publication during the 2017–2021 period. The data reveal stark contrasts in research output between Armenia and Italy. In Italy, the vast majority of professors (98.1%) have at least one WoS publication, with negligible gender differences across fields. In Armenia, however, the overall share is markedly lower at 28.3%, with significant variations by field and gender. For instance, while 39.1% of Armenian women in Physics have at least one publication, the percentage drops to just 15.6% in Mathematics. This pattern highlights not only a productivity gap between the two countries but also variations within Armenia that suggest field-specific challenges for female researchers.

The combination of financial limitations, lack of integration into international networks, language barriers, institutional publication practices, and broader societal inequalities likely explains the disparities in research output between Armenia and Italy.

Figures 2 and 3 further explore the Armenian context, showing how affiliation type and the number of affiliations correlate with publication activity. Women with multiple affiliations tend to exhibit higher publication rates, hinting at the potential role of collaborative opportunities in mitigating structural barriers to research output. Figure 4 underscores the disparity in publication activity by academic rank, with full professors in both countries demonstrating the highest productivity rates. However, the gender gap persists, particularly at senior levels in Armenia, suggesting entrenched structural challenges.

Table 3. Share of professors with at least one 2017-2021 WoS publication, by gender, country, and field.

	Armenia			Italy		
Field	F	M	Total	F	M	Total
Biology	22.2%	22.5%	22.3%	99.0%	98.9%	99.0%
Biomedical Research	27.2%	26.1%	26.9%	99.3%	98.9%	99.1%
Chemistry	33.0%	43.9%	37.3%	99.4%	99.2%	99.3%
Clinical Medicine	27.4%	31.0%	28.8%	98.1%	98.0%	98.0%
Earth and Space Sciences	19.6%	25.5%	22.7%	97.5%	97.4%	97.4%
Engineering	15.1%	18.6%	17.1%	98.0%	98.1%	98.1%
Mathematics	15.6%	35.8%	29.6%	93.3%	95.8%	94.9%
Physics	39.1%	50.8%	47.4%	95.7%	97.3%	97.0%
Overall	24.7%	32.3%	28.3%	98.1%	98.0%	98.1%

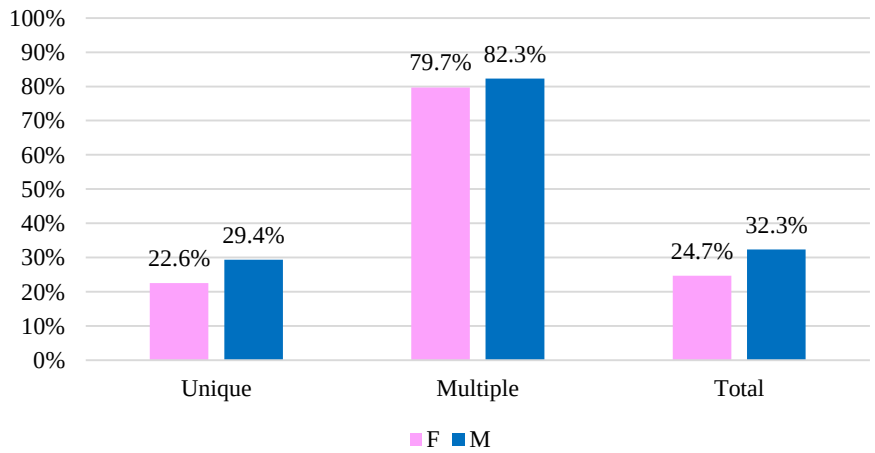

Figure 2. Share of Armenian professors with at least one 2017-2021 WoS publication, by gender and number of affiliations.

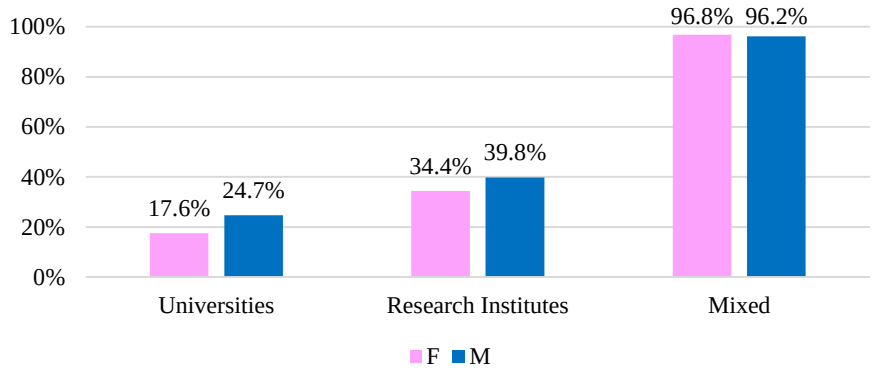

Figure 3. Share of Armenian professors with at least one 2017-2021 WoS publication, by gender and affiliation type.

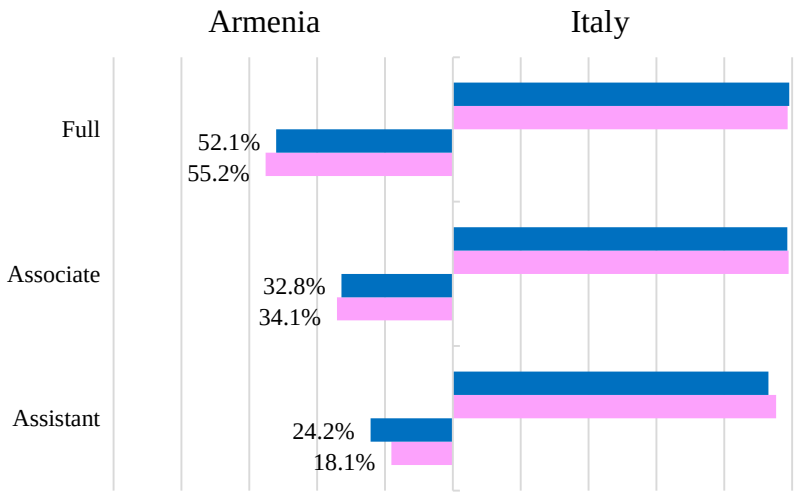

Figure 4. Share of professors with at least one 2017-2021 WoS publication, by gender, academic rank, and country.

Tables 4 and 5 provide insights into the yearly average output of professors (as measured by [2]) in both countries. Table 4 examines the entire dataset, while Table 5 focuses specifically on professors with at least one WoS publication. In Table 4, Italian professors exhibit significantly higher average yearly outputs compared to their Armenian counterparts across all fields. This difference is particularly pronounced in Clinical Medicine and Engineering, where Italian professors produce more than double the output of Armenian professors. Gender differences are also apparent, with male professors generally outperforming female professors in both countries. The only exceptions occur in Earth and Space Sciences (Armenia) and Physics (Italy).

Table 5 narrows the focus to active researchers, revealing gender disparities among those with at least one publication similar to those of the entire dataset. However, Armenia's gap between genders is lower than Italy's, in all fields but Mathematics and Physics.

Table 4. Yearly average 2017-2021 output of professors in the dataset, by gender, country, and field.

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.124	0.186		3.767	4.739	
Biomedical Research	0.159	0.202		5.530	8.502	
Chemistry	0.336	0.623		4.920	5.517	
Clinical Medicine	0.162	0.192		5.529	7.764	
Earth and Space Sciences	0.200	0.183		3.139	3.781	
Engineering	0.084	0.113		4.226	5.200	
Mathematics	0.091	0.325		1.746	2.208	
Physics	0.379	0.864		12.047	11.632	

Table 5. Yearly average 2017-2021 output of professors with at least one 2017-2021 WoS publication, by gender, country, and field.

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.560	0.829		3.804	4.790	
Biomedical Research	0.584	0.772		5.570	8.595	
Chemistry	1.018	1.417		4.949	5.562	
Clinical Medicine	0.592	0.619		5.639	7.926	
Earth and Space Sciences	1.021	0.717		3.220	3.881	
Engineering	0.557	0.611		4.313	5.299	
Mathematics	0.583	0.906		1.872	2.305	
Physics	0.968	1.702		12.588	11.955	

Fractional output

Tables 6 and 7 refine the analysis by focusing on fractional output (as measured by [3]), which adjusts for multi-authorship. With the exceptions of Clinical Medicine and Earth and Space Sciences, Armenian women exhibit lower fractional output compared to their male counterparts, even in fields with higher female participation, such as Biology and Biomedical Research. This suggests that while Armenian women are numerically well-represented in certain fields, their roles in collaborative projects may be less prominent, potentially limiting their overall fractional output. In contrast, in Italy, women's fractional output is always lower than men's across all fields, and differences between the two sexes are greater in Italy than in Armenia.

Table 6. Yearly average 2017-2021 fractional output of professors in the dataset, by gender, country and field.

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.023	0.037		0.618	0.803	
Biomedical Research	0.025	0.035		0.761	1.185	
Chemistry	0.080	0.143		0.825	0.996	
Clinical Medicine	0.031	0.029		0.847	1.204	
Earth and Space Sciences	0.046	0.033		0.638	0.781	
Engineering	0.020	0.034		0.963	1.209	
Mathematics	0.046	0.199		0.656	0.897	
Physics	0.103	0.205		0.787	0.976	

Table 7. Yearly average 2017-2021 fractional output of professors with at least one 2017-2021 WoS publication, by gender, country and field.

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.105	0.166		0.624	0.811	
Biomedical Research	0.092	0.136		0.767	1.198	
Chemistry	0.243	0.325		0.830	1.004	
Clinical Medicine	0.113	0.092		0.864	1.229	
Earth and Space Sciences	0.237	0.131		0.654	0.802	
Engineering	0.129	0.185		0.983	1.232	
Mathematics	0.297	0.555		0.703	0.937	
Physics	0.262	0.403		0.822	1.003	

Average impact

Tables 8 and 9 examine the average impact of professors' publication portfolios, measured by citation rates (as in [4]) and journal impact factors (as in [5]). Italian researchers, regardless of gender, outperform their Armenian counterparts in both metrics, reflecting Italy's more established academic infrastructure and global integration. In both countries, gender differences in average impact are field-dependent. For example, Armenian women in Clinical Medicine and Physics achieve higher average citation impacts than men, whereas their peers in Biomedical research and Biology show significantly lower averages. In contrast, Italian women in Biology, Chemistry, and Physics overcome men. This pattern underscores the interplay between field-specific norms and the visibility of women's research.

Table 8. Average impact of professors' publication portfolio, by gender, country, and field.

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.473	0.580		1.082	1.069	
Biomedical Research	0.326	0.651		1.084	1.093	
Chemistry	0.254	0.288		0.974	0.968	
Clinical Medicine	0.623	0.539		1.014	1.017	
Earth and Space Sciences	0.688	0.708		1.024	1.050	
Engineering	0.250	0.252		0.989	1.032	
Mathematics	0.286	0.292		0.883	0.951	
Physics	0.299	0.228		1.369	1.356	

Table 9. Average journal impact factor of professors' publication portfolio, by gender, country and field.

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.601	0.665		1.162	1.224	
Biomedical Research	0.474	0.557		1.137	1.143	
Chemistry	0.453	0.498		1.196	1.219	
Clinical Medicine	0.696	0.694		1.065	1.046	
Earth and Space Sciences	0.654	0.736		1.043	1.076	
Engineering	0.353	0.391		0.720	0.689	
Mathematics	0.405	0.386		0.947	0.944	
Physics	0.466	0.399		1.029	1.032	

Productivity

Figures 5 and 6 illustrate the distribution of research productivity (as measured by [1], transformed in percentiles), highlighting the disparities between Armenian and Italian professors and between genders within each country. Italian professors occupy higher productivity percentiles overall, with minimal gender differences. In Armenia, the distribution skews sharply, with a substantial proportion of women falling into lower productivity percentiles. However, among Armenian "productive" professors (those with at least one publication), the gender gap narrows slightly, suggesting that once structural barriers to productivity are overcome, women can achieve performance levels closer to those of their male counterparts.

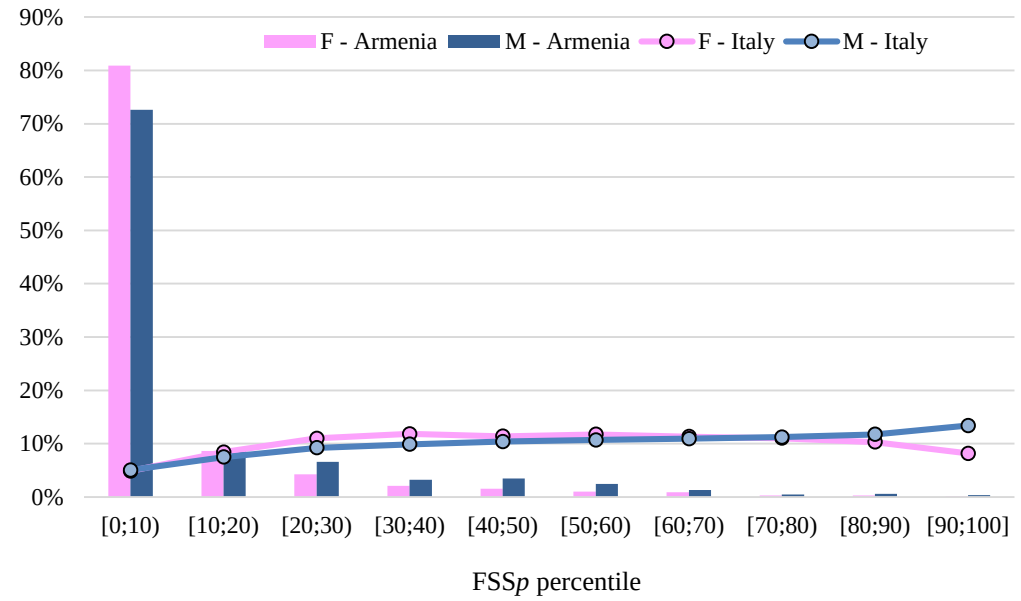

Figure 5. Distribution of 2017-2021 research productivity percentiles of Armenian and Italian professors, by gender.

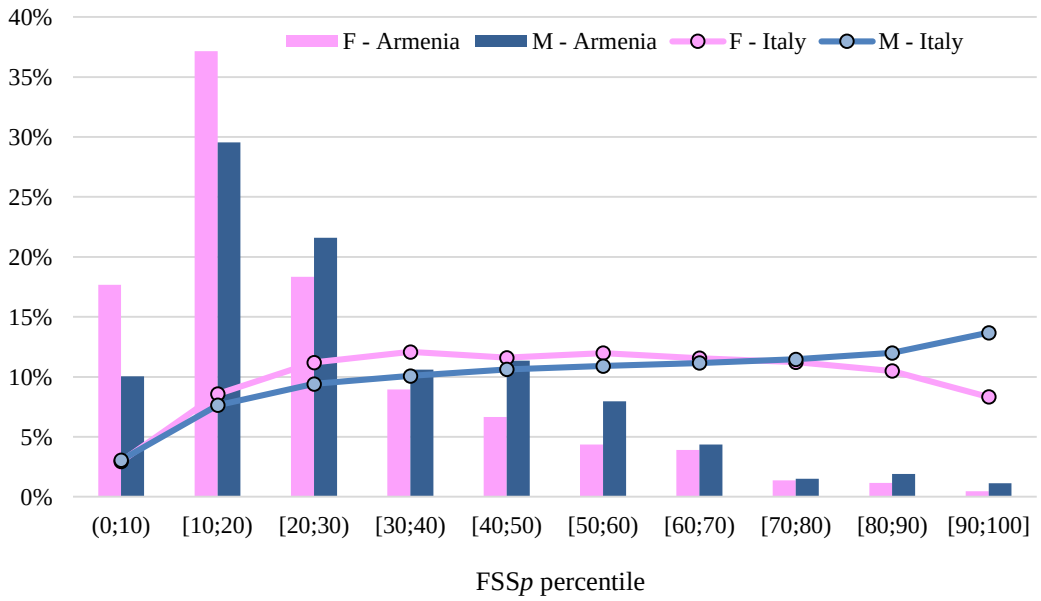

Figure 6. Distribution of 2017-2021 research productivity percentiles of Armenian and Italian "productive" professors, by gender.

Conclusions

This study has illuminated the complexities of gender disparities in academic research performance, using Armenia and Italy as case studies to explore how socio-cultural and institutional contexts influence the experiences of male and female researchers. The findings highlight not only the persistent gender gaps in both countries but also the ways these gaps differ due to structural and cultural factors.

Armenia presents a paradox: while it boasts a higher numerical representation of women in research (52 percent compared to Italy's 35.8 percent), this inclusivity does not translate into proportional research output or impact. Only 28.3 percent of Armenian researchers (with women consistently underrepresented in productive roles) have at least one WoS publication. In contrast, nearly all Italian professors (98.1%) are active in producing WoS-indexed publications, demonstrating a well-established academic system despite significant gender imbalances. These findings resonate with broader studies highlighting how numerical representation does not guarantee equity in access to resources or opportunities for advancement (Ceci & Williams, 2011; UNESCO, 2019).

In Italy, the research landscape demonstrates gendered hierarchies deeply embedded in academic structures. Women remain underrepresented in senior positions and produce fewer high-impact publications, consistent with global evidence showing that systemic biases, slower career progress, and disproportionate caregiving responsibilities hinder women's academic performance (Guarino & Borden, 2017; Abramo, D'Angelo, & Caprasecca, 2009). Nonetheless, Italian researchers benefit from robust academic networks and funding systems, which support higher productivity levels across genders compared to their Armenian counterparts.

The Armenian case, by contrast, underscores the challenges of a nascent research infrastructure compounded by traditional gender norms and systemic limitations, such as insufficient international collaboration and limited access to high-impact journals. Women, while numerically more represented in STEMM fields like Biology and Biomedical Research, face barriers in leadership roles and prominent collaborative opportunities. This finding aligns with studies from similar transitional contexts, where gender disparities are exacerbated by resource constraints and societal expectations (van den Besselaar & Sandström, 2016; Yeritsyan, 2019).

The results have significant implications for policy at both national and institutional levels.

In Armenia, interventions should prioritize enhancing research infrastructure and providing targeted support for women, such as mentorship programs, funding grants, and international exchange opportunities. Building capacity for international collaborations can mitigate structural barriers and increase the visibility of Armenian women researchers. This approach has proven effective in similar contexts, such as in Eastern Europe, where efforts to integrate into global research networks have reduced gender gaps (UNESCO, 2019).

In Italy, addressing the leaky pipeline in academic careers requires measures to ensure transparency in hiring, promotion, and funding allocation processes. Initiatives fostering work-life balance, such as flexible tenure-track models and family-friendly policies, could alleviate the career interruptions that

disproportionately affect women, as suggested by studies in other high-income countries (Borrell-Damián & Rahier, 2019; Stoet & Geary, 2018).

Both countries would benefit from fostering cross-disciplinary and international collaborations, particularly for women in male-dominated fields like Engineering and Physics, where barriers to entry and advancement are most pronounced. Research has shown that enhanced networking opportunities and visibility can significantly close productivity and impact gaps (Thelwall & Wilson, 2014; Caplar, Tacchella, & Birrer, 2017).

While this study provides valuable insights, several limitations must be acknowledged. The bibliometric analysis relies on WoS-indexed publications, potentially underestimating contributions in non-indexed or local-language journals, particularly in Armenia. Field-specific norms, such as collaborative practices and citation behaviors, may also influence the observed gender disparities and require further investigation. Moreover, cross-country comparisons are complicated by structural differences in academic systems—e.g., the broader inclusion of Armenian research staff versus the exclusive focus on university professors in Italy.

Future research should integrate qualitative methods to capture the nuanced interplay of cultural, institutional, and individual factors shaping gender disparities in academia. Comparative studies involving additional countries and disciplines could further elucidate how national policies and practices foster or hinder gender equity in academic research.

While numerical representation is an important starting point, achieving true gender equity in research requires systemic changes to address entrenched biases and structural barriers. The findings from this study contribute to a growing body of evidence advocating for targeted, context-sensitive interventions to create inclusive academic environments.

References

Abramo, G., & D'Angelo, C.A. (2014). How do you define and measure research productivity? *Scientometrics, 101*(2), 1129–1144.

Abramo, G., Aksnes, D.W., & D'Angelo, C.A. (2020). Comparison of research productivity of Italian and Norwegian professors and universities. *Journal of Informetrics, 14*(2), 101023.

Abramo, G., Aksnes, D.W., & D'Angelo, C.A. (2021). Gender differences in research performance within and between countries: Italy vs Norway. *Journal of Informetrics, 15*(2), 101144.

Abramo, G., D'Angelo, C.A., & Caprasecca, A. (2009a). Gender differences in research productivity: A bibliometric analysis of the Italian academic system. *Scientometrics, 79*(3), 517–539.

Abramo, G., D'Angelo, C.A., & Caprasecca, A. (2009b). The contribution of star scientists to overall sex differences in research productivity. *Scientometrics, 81*(1), 137–156.

Abramo, G., D'Angelo, C.A., & Di Costa, F. (2019). A gender analysis of top scientists' collaboration behavior: Evidence from Italy. *Scientometrics, 120*(2), 405–418.

Abramo, G., D'Angelo, C.A., & Felici, G. (2019). Predicting long-term publication impact through a combination of early citations and journal impact factor. *Journal of Informetrics, 13*(1), 32–49. https://doi.org/10.1016/j.joi.2018.11.003

Abramo, G., D'Angelo, C.A., & Mele, I. (2022). Impact of Covid-19 on research output by gender across countries. *Scientometrics, 127*(12), 6811–6826.
Abramo, G., D'Angelo, C.A., & Murgia, G. (2013). Gender differences in research collaboration. *Journal of Informetrics, 7*(4), 811–822.
Abramo, G., D'Angelo, C.A., & Rosati, F. (2016). Gender bias in academic recruitment. *Scientometrics, 106*(1), 119–141.
Addis, E., & Villa, P. (2003). The editorial boards of Italian economics journals: A gender analysis. *Feminist Economics, 9*(1), 75–84.
Aksnes, D.W., Rorstad, K., & Sivertsen, G. (2011). Are female researchers less cited? A large-scale study of Norwegian scientists. *Journal of the American Society for Information Science and Technology, 62*(4), 628–636.
Aksnes, D.W., & Sivertsen, G. (2019). A criteria-based assessment of the coverage of Scopus and Web of Science. *Journal of Data and Information Science, 4*(1), 1–21.
Alper, J., & Gibbons, A. (2017). The leaky pipeline in academia: Barriers to gender equality. *National Academies Press.*
Bendels, M.H.K., Müller, R., Brueggmann, D., & Groneberg, D.A. (2018). Gender disparities in high-quality research revealed by Nature Index journals. *PLOS ONE, 13*(1), e0189136.
Bettio, F., & Verashchagina, A. (2009). Gender segregation in the labour market: Root causes, implications, and policy responses in the EU. *European Commission's Expert Group on Gender Equality and Employment.*
Borrell-Damián, L., & Rahier, M. (2019). Women in university leadership: Subtle leaks in the pipeline to the top. *European University Association.* https://www.eua.eu/our-work/expert-voices/women-in-university-leadership-subtle-leaks-in-the-pipeline-to-the-top.html
Bozeman, B., & Corley, E. (2004). Scientists' collaboration strategies: Implications for scientific and technical human capital. *Research Policy, 33*(4), 599–616.
Caplar, N., Tacchella, S., & Birrer, S. (2017). Quantitative evaluation of gender bias in astronomical publications from citation counts. *Nature Astronomy, 1,* 0141.
Ceci, S.J., & Williams, W.M. (2011). Understanding current causes of women's underrepresentation in science. *Proceedings of the National Academy of Sciences, 108*(8), 3157–3162.
Dworkin, J.D., Linn, K.A., Teich, E.G., Zurn, P., Shinohara, R.T., & Bassett, D.S. (2020). The extent and drivers of gender imbalance in neuroscience reference lists. *Nature Neuroscience, 23*(8), 918–926.
Elsevier. (2020). *The research gender gap: Research performance by gender across 15 countries.* Elsevier Gender Report.
Guarino, C.M., & Borden, V.M.H. (2017). Faculty service loads and gender: Are women taking care of the academic family? *Research in Higher Education, 58*(6), 672–694.
Huang, J., Gates, A.J., Sinatra, R., & Barabási, A.-L. (2020). Historical comparison of gender inequality in scientific careers across countries and disciplines. *Proceedings of the National Academy of Sciences, 117*(9), 4609–4616.
Larivière, V., Archambault, É., Gingras, Y., & Vignola-Gagné, É. (2006). The place of serials in referencing practices: Comparing natural sciences and engineering with social sciences and humanities. *Journal of the American Society for Information Science and Technology, 57*(8), 997–1004.
Larivière, V., Ni, C., Gingras, Y., Cronin, B., & Sugimoto, C.R. (2013). Bibliometrics: Global gender disparities in science. *Nature, 504*(7479), 211–213.

Lena, G. (2023). Women in academia: Why and where does the pipeline leak, and how can we fix it? *MIT Science Policy Review, 4*, 102–109.
Mairesse, J., & Pezzoni, M. (2015). Does gender affect scientific productivity? Evidence from a large-scale French survey. *Revue économique, 66*(1), 65–113.
Moscatelli, M., et al. (2019). Academic career progressions and gender gaps: Italy in a European context. *Gender in Management, 34*(3), 233–249.
Stoet, G., & Geary, D.C. (2018). The gender-equality paradox in science, technology, engineering, and mathematics education. *Psychological Science, 29*(4), 581–593.
Thelwall, M., & Wilson, P. (2014). Gender differences in bibliometric indicators and implications for career development. *Journal of Informetrics, 8*(2), 292–305.
Tsakanova, G., Arakelova, E., Matevosyan, L., Petrosyan, M., Gasparyan, S., Harutyunyan, K., & Babayan, N. (2021). The role of women scientists in the development of ultrashort pulsed laser technology-based biomedical research in Armenia. *International Journal of Radiation Biology, 98*(3), 489–495. https://doi.org/10.1080/09553002.2021.1987566
UNDP Armenia. (2020). *Gender equality brief: Progress and challenges.* United Nations Development Programme Armenia.
UNESCO (2019). *Global Education Monitoring Report 2019: Gender report.* UNESCO Publishing.
UNESCO Institute for Statistics. (2020). *Fact sheet no. 60: Women in science.* Retrieved from http://uis.unesco.org/sites/default/files/documents/fs60-women-in-science-2020-en.pdf
van den Besselaar, P., & Sandström, U. (2016). Gender differences in research performance and its impact on careers: A longitudinal case study. *Scientometrics, 106*(1), 143–162.
Witteman, H.O., Hendricks, M., Straus, S., & Tannenbaum, C. (2019). Are gender gaps due to evaluations of the applicant or the science? A natural experiment at a national funding agency. *The Lancet, 393*(10171), 531–540.
Yeritsyan, S. (2019). Gender issues in higher education: Armenia's progress and ongoing challenges. *Armenian Journal of Social Sciences, 5*(2), 97–112.
Zazyan, M. (2009). Armenian women in physics. *AIP Conference Proceedings, 1119,* 77–78. https://doi.org/10.1063/1.3137915
Zazyan, M. (2019). Women physicists in Armenia: Why so few? In G. Cochrane, C. Singh, & N. Wilkin (Eds.), *Women in Physics: 6th IUPAP International Conference on Women in Physics, AIP Conference Proceedings 2109* (pp. 0500). American Institute of Physics.