

Gender in the Portugal Research Arena: A Case Study in European Leadership

Foreword

With this report, Elsevier offers an insightful look into how Portugal is advancing regarding the situation of women and men in research. At the same time, this work points to persisting gender gaps in research that require stronger transformative efforts and reveals how these gaps tend to mimic and perpetuate structural inequalities between women and men.

The report shows how Portugal has come a long way and leads in a range of indicators, including the aggregate number of women researchers, namely in STEM areas. However, the share of women participating in information and communications technology (ICT)-related areas of research remains very low. Also, although women comprise more than 50% of doctoral graduates, scientists, engineers and tertiary educated and employed professionals, they still make up less than 30% of heads of institutions in the higher education sector.

Elsevier's analysis becomes even more relevant in these difficult times, as the impact of the COVID-19 crisis continues to unfold. We know that women working in highly specialised sectors, such as research, have been particularly affected. The increase in unpaid care and domestic work during lockdowns and confinement has strongly affected their availability to submit publications, research applications and projects, as well as their research hours. Thus, it is critical that research on the impact of COVID-19 maintains a gender perspective. In this context, I promoted the launch of a special call for research projects on the gender impact of the COVID-19 pandemic, which will provide critical information to support the development of public policies.

It is with deep appreciation that I thank Elsevier for this very important contribution. I am certain it is, and will continue to be, a driver for change.

Rosa Monteiro
Secretary of State for Citizenship and Equality, Portugal

Preface

At Elsevier, our mission is to help researchers and health professionals advance science and improve healthcare outcomes through quality information and analytics. We are committed to support the communities we serve in tackling the challenges outlined by the UN Sustainable Development Goals, including gender inequality. Last year, as we marked the 5th anniversary of the SDGs, we launched Elsevier's Inclusion & Diversity Advisory Board¹ together with my co-chair, *The Lancet*² Editor-in-Chief Dr. Richard Horton. Together with our Advisory Board and our internal Gender Equity Taskforce, we have identified several areas where we can make meaningful contributions: Improving the representation and participation of women in the research ecosystem, embedding the sex and gender dimension in research and supporting the career progression of women researchers in academic and professional life. For all these goals, having an evidence-based foundation is essential to understanding the greatest obstacles to and opportunities for advancing gender equity in science.

In 2020, we published [*The Researcher Journey through a Gender Lens: An Examination of Research Participation, Career Progression and Perceptions Across the Globe*³](#), our third such report, which examined gender representation and participation across 26 disciplines within the EU28 and 15 countries around the world. It revealed that while the overall representation of women in research is clearly improving, inequality remains across geographies and research disciplines, and in terms of awarded grants, patents, and collaborations. Throughout our analyses, one country stood out as leading among European countries in terms of the representation of women in research, particularly for early career researchers - **Portugal**.

This led us to undertake the ***Gender in the Portugal Research Arena: A Case Study in European Leadership***, for a data-led look at the dynamics underlying Portugal's leading edge. Together with distinguished academic leaders in Portugal, we have worked to put into context quantitative analyses with policy perspectives, insights, and best practices. Our goal is to contribute insights from the experience of one country to inform policy and inspire targeted initiatives among policy makers, research leaders and funders around the world to achieve gender equity in research.

I strongly believe that for organisations, institutions, systems or countries to move the needle on gender equity, and indeed all dimensions of diversity, requires advocacy and collaboration, supported by evidence-based policies, measurement and accountability. I hope that lessons learned from the Portugal experience can contribute to our collective efforts to create a fair system of opportunities and progression for all people working in research around the world. This becomes even more important, as Rosa Monteiro, Portugal's Secretary of State of Citizenship and Equality has pointed out, given the compounding factor of the pandemic to inequalities in research ecosystem.

Kumsal Bayazit

CEO, Elsevier

Executive Summary

Elsevier strives to make a lasting impact on the societal challenges of our times by harnessing the full contribution of all stakeholders in the global research and healthcare community. Promoting gender diversity and inclusion in research through an evidence-based, data-informed approach is a critical part of this ongoing effort. We apply this approach to our processes and initiatives and are increasingly focused on the many ways gender needs to be addressed and accounted for, from issues affecting equity in the research workforce to inclusion of sex- and gender-based analyses in scientific studies. As a global organisation, we can investigate these issues on both a worldwide scale and at various regional levels.

Previous analytics reports examining gender in the research workforce – Elsevier’s 2020 global gender report, *The Researcher Journey Through a Gender Lens: An Examination of Research Participation, Career Progression and Perceptions Across the Globe*³, and the European Commission *She Figures 2018*⁴ report (on which Elsevier served as a partner) – shined a spotlight on **Portugal’s leadership** in terms of women’s higher level of representation in research compared with the EU28 as a whole and individual European countries. The analyses derived from those earlier studies and presented within this new report, ***Gender in the Portugal Research Arena: A Case Study in European Leadership***, showcase a series of findings relevant to understanding both gender diversity *and* inclusion in research for Portugal, relative to regional comparators. The data and analyses, contextualised by new expert insights, lay out a path whereby Portugal can continue to expand its leadership efforts towards all around greater gender equity in the research workforce as well as serve as a source of learning and inspiration for other European countries and elsewhere in the world.

The quantitative analyses in this report offer key findings that highlight areas of advancement in gender diversity and inclusion and uncover additional opportunities Portugal can lead on moving forward.

Key findings

Advances		Opportunities	
	<p>Women represent nearly 50% of active authors in Portugal, the closest to gender parity for all EU28 countries. Women are highly represented across the life sciences and health sciences fields, and in Chemistry, Chemical Engineering and Psychology.</p>		<p>Accelerated change toward greater gender diversity across remaining physical sciences & engineering fields where women remain the most underrepresented despite gains over time.</p>
	<p>In Portugal, women researchers are likely to continue publishing over time. This uniquely stable continuity matches the that seen among men and is an important indicator of career retention. Portugal is the only European country in which women did not leave research at a higher rate than men over time.</p>		<p>Closing the gap in earnings between women and men, specifically in jobs related to scientific research and development, and moving women to more stable employment contracts.</p>
	<p>Women researchers in Portugal are most highly represented among authors with a short publication history, indicating the greatest gender equity among earlier career researchers. Even amongst senior researcher cohorts, Portugal has a higher overall representation of women than other European countries.</p>		<p>Addressing systematic gender bias in the research ecosystem that negatively impacts women when they are in leadership roles.</p>
	<p>In Portugal, women comprise more than 50% of doctoral graduates, scientists, engineers and tertiary educated and employed professionals, demonstrating gender parity (equal representation) across scientific career pathways.</p>		<p>Increasing the percentage of women in top tier positions at higher education institutions to accelerate gains in gender equality.</p>

Portugal's leadership, evident in the advances highlighted above, is the result of many deliberate steps, the result of specific policy initiatives and a coordinated approach to targeted interventions. Such efforts are combined with a longstanding commitment to strong early education STEM interventions, research on gender equality, addressing topics such as violence against women and preventing sexual harassment in research, as well as funding higher education institutions to implement work-life balance and gender equity plans to support both women and men. Interviews with key opinion leaders included in this report provide context to the quantitative analyses and highlight key initiatives that are driving the advances in gender equity in Portugal. The interviews also provide insight into what more can be done to ensure future progress in areas of opportunity.

Key initiatives

Drivers of Portugal's leadership in gender equality in research

- Changes come from the top and are embedded in the national culture.
- Policymakers look to gender researchers for information to guide policies and to support evaluation.
- Portugal has continuously financed scholarships for girls in science since the 1980s.
- STEM fields have been opened to more women through alliances with universities and research centres and through increased national funding.
- Outreach and awards, such as the L'Oréal Portugal – Medals of Honour for Women in Science, raise awareness of the need to fully include women in science.
- Legislation impacts policy; for example, a pioneer law established a minimum 40% threshold for women and men in candidate lists for elective decision-making bodies in public higher education institutes, whereby the first two candidates cannot be of the same sex.

Forward-looking efforts to accelerate greater gender diversity and inclusion in research

- Funding research into critical policy areas, such as the economic impact of gender inequality, including the pay gap, horizontal segregation and unequal division of unpaid care and domestic work.
- Defining gender equality criteria in the assessment and accreditation of higher education institutes and study programmes.
- Working with and funding various higher education institutions to implement work-life balance management systems within their internal practices that support both women and men.
- Incentivising more girls to choose engineering and ICT areas of study, through practical exercises, mentoring and equal pay work experiences.
- Renewing the commitment to topics such as violence against women, including preventing sexual harassment in research.

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Introduction

“The sea is dangerous and its storms terrible, but these obstacles have never been sufficient reason to remain ashore...”

— Ferdinand Magellan, XVI century Portuguese Explorer

Elsevier conducted an analysis of gender in the global research landscape, the results of which were presented in 2020 in [*The Researcher Journey Through a Gender Lens: An Examination of Research Participation, Career Progression and Perceptions Across the Globe*](#)³. One of the findings that stood out in that report related to Portugal: of all European countries analysed (and almost all countries in other regions as well), Portugal was the closest to gender parity in terms of women’s representation in research (48%). Moreover, Portugal exhibited the largest percentage increase in women’s representation – an impressive 10% – over the last two decades, which puts the country at the leading edge of closing the gender gap in research.

This new report, ***Gender in the Portugal Research Arena: A Case Study in European Leadership***, combines analyses from our 2020 global gender report with additional quantitative findings excerpted from the European Commission’s *She Figures 2018* report⁴, on which Elsevier participated as one of the data partners. In addition, through a series of interviews, we invited key opinion leaders from academia and government to provide qualitative perspectives of the compiled findings and share insights regarding the policy landscape in Portugal that contributed to Portugal’s position.

This report thus presents a comprehensive perspective regarding the smaller gender gap measured in Portugal. It looks across multiple dimensions of the research workforce to assess authors and research output, impact and citation patterns, career pathways and retention and pay and working conditions in Portugal, the EU28 and a small number of individual comparator countries, disaggregating issues of gender *diversity* and gender *inclusion*.

By offering an evidence-based and contextualised understanding of gender in research within Portugal, this report also identifies opportunities where Portugal can continue to lead through further study to better understand remaining gender inequities in research and inform additional forward-looking policies.

*Details regarding the methodology of the analyses herein can be found in the appendices of [*The Researcher Journey Through a Gender Lens: An Examination of Research Participation, Career Progression and Perceptions Across the Globe*](#)³ and the Handbook for the [*She Figures 2018*](#)⁴.*

Throughout this report, the following acronyms are used: PRT, Portugal; DNK, Denmark; ITA, Italy; EU28, an aggregate regional comparator that includes Portugal, Denmark, Italy and 25 additional European Union countries, including the UK.

Chapter 1

Quantitative analyses of Portugal and comparators



1.1 Gender differences in author distribution

Women represent nearly half of all researchers in Portugal, which makes it a leader within the EU28

Analyses from Elsevier's global gender report from 2020, *The Researcher Journey Through a Gender Lens*³, reveal a high percentage of women researchers in Portugal (PRT) – as measured in terms of the number of active authors. The country is a leader within the EU28 (an aggregate regional comparator that includes Portugal, Denmark, Italy and 25 other European Union countries, including the UK) with regards to gender diversity; women account for 48% of researchers during the period 2014–2018, the closest to gender parity for all countries investigated and the EU28 overall. In addition, Portugal exhibits the largest gain in the number of women researchers, increasing nine percentage points from 39% to 48% since the earlier period 1999–2003. FIGURE 1-1 demonstrates that the representation of women researchers in 2014–2018 is greater than the EU28 overall and when compared to two European countries within the EU28 used as benchmark comparators, Denmark (DNK) and Italy (ITA).

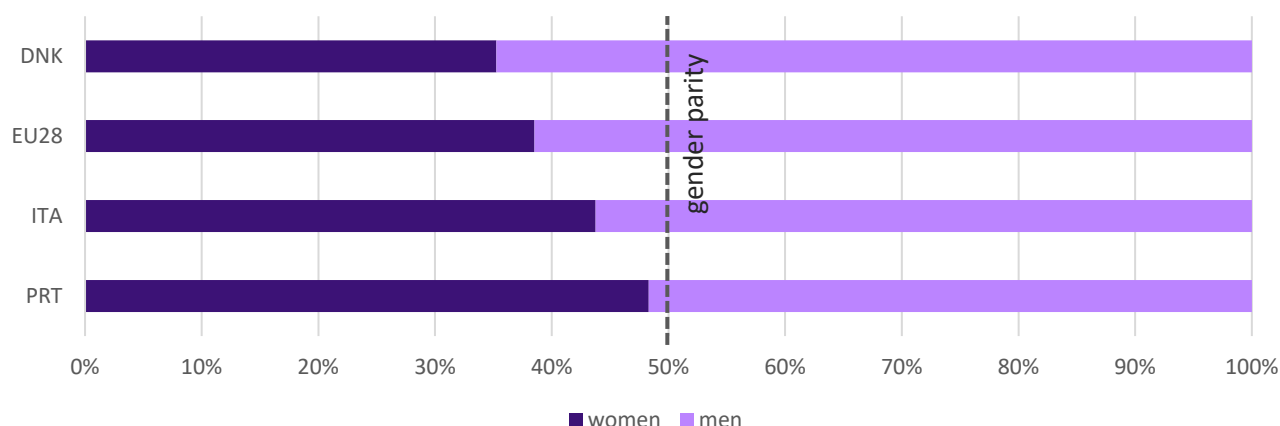


FIGURE 1-1

The percentage of women and men among researchers in Portugal and comparators during the period 2014–2018.

Source: Scopus and NamSor.

Portugal’s gender representation varies across fields, but still consistently leads all European comparators

The percentage of women represented among researchers in Portugal is highest across all health sciences and life sciences fields, and lowest for physical sciences; a similar pattern is observed in all other countries in *The Researcher Journey Through a Gender Lens*³. Subject areas with some of the highest percentages of women researchers in Portugal include nursing, dentistry, medicine, immunology and pharmacology. Portugal has also reached gender parity in chemistry, chemical engineering and environmental science within the physical sciences, ahead of the EU28 overall and individual EU countries. However, as is the case across the EU28, women in Portugal are underrepresented within the physical sciences overall. FIGURE 1-2 breaks down the percentage of women and men researchers in select physical sciences subject areas of physics & astronomy, engineering, mathematics and computer science, highlighting research areas where Portugal would be well-served to focus its attention to accelerate growth and address the lack of gender diversity.

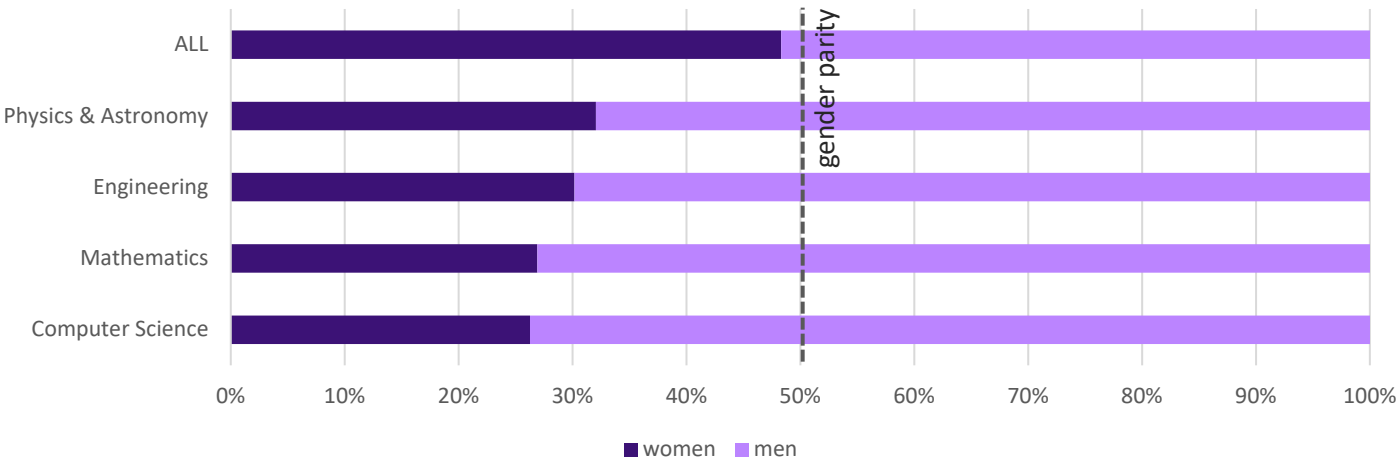


FIGURE 1-2
The percentage of women and men among researchers in all research and selected subject areas in the physical sciences in Portugal during the period 2014–2018.
Source: Scopus and NamSor.

Representation of women across selected physical sciences subject areas is greater in Portugal than the EU28 and individual comparator countries

FIGURE 1-3 compares the representation of women researchers in Portugal and Italy (the country with metrics most similar to Portugal in *The Researcher Journey Through a Gender Lens*³), Denmark (the country with metrics least similar to Portugal) and the EU28 as a whole. Despite a lower representation of women in Portugal in the selected subject areas within the physical sciences than for all subject areas in aggregate, the gap in these subjects is still less accentuated in Portugal compared to the three selected comparators.

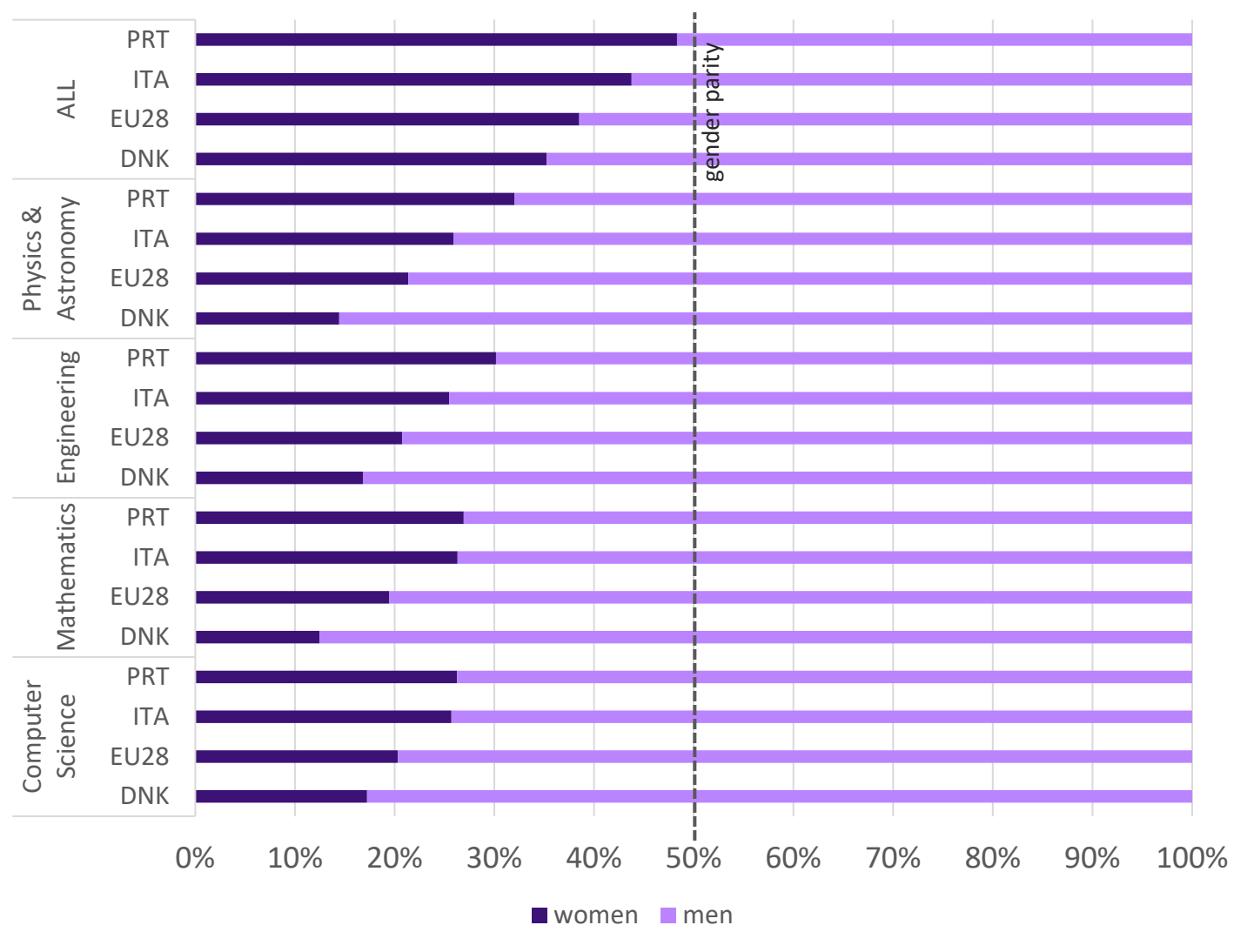


FIGURE 1-3
The percentage of women and men researchers in all research and selected subject areas within the physical sciences in Portugal and comparators during the period 2014–2018.

Source: Scopus and NamSor.

The comparison of countries across different subject areas of the physical sciences suggests that the higher representation of women researchers in Portugal is not the result of differential field or subject specialisation across countries. That is, Portugal has not achieved greater gender diversity simply because it has more researchers in fields or subject areas that tend to have a higher representation of women.

FIGURE 1-3 and *The Researcher Journey Through a Gender Lens*³ demonstrate that Portugal is genuinely at the leading edge of gender diversity across STEM fields with regard to the high level of women researchers relative to the EU28 as a whole and other individual EU countries (and countries in other regions), despite the need for increased women's representation in the physical sciences.

In Portugal, the gender gap is largest among more senior researcher cohorts and shrinks among earlier career cohorts across all subject areas

The classification of authors based on their career stage reveals other sources of imbalance in the gender ratios of authors (FIGURE 1-4). In this analysis, the year of first publication is used as a proxy for research career stage. The data show that women are less represented among researchers (active authors) who began their publishing careers prior to 2003, the most senior—or oldest—cohort. Regardless of subject area, the gender gap narrows for earlier career researchers, with no gap observed among the most junior—or youngest—cohort of researchers, those who first started publishing between 2014 and 2018.

Focusing on the physical sciences subject areas reveals that women are consistently less represented among the four selected areas in all cohorts. As observed for the aggregate of all subject areas, the gender gap is also larger across physical science subject areas among the more senior cohorts.

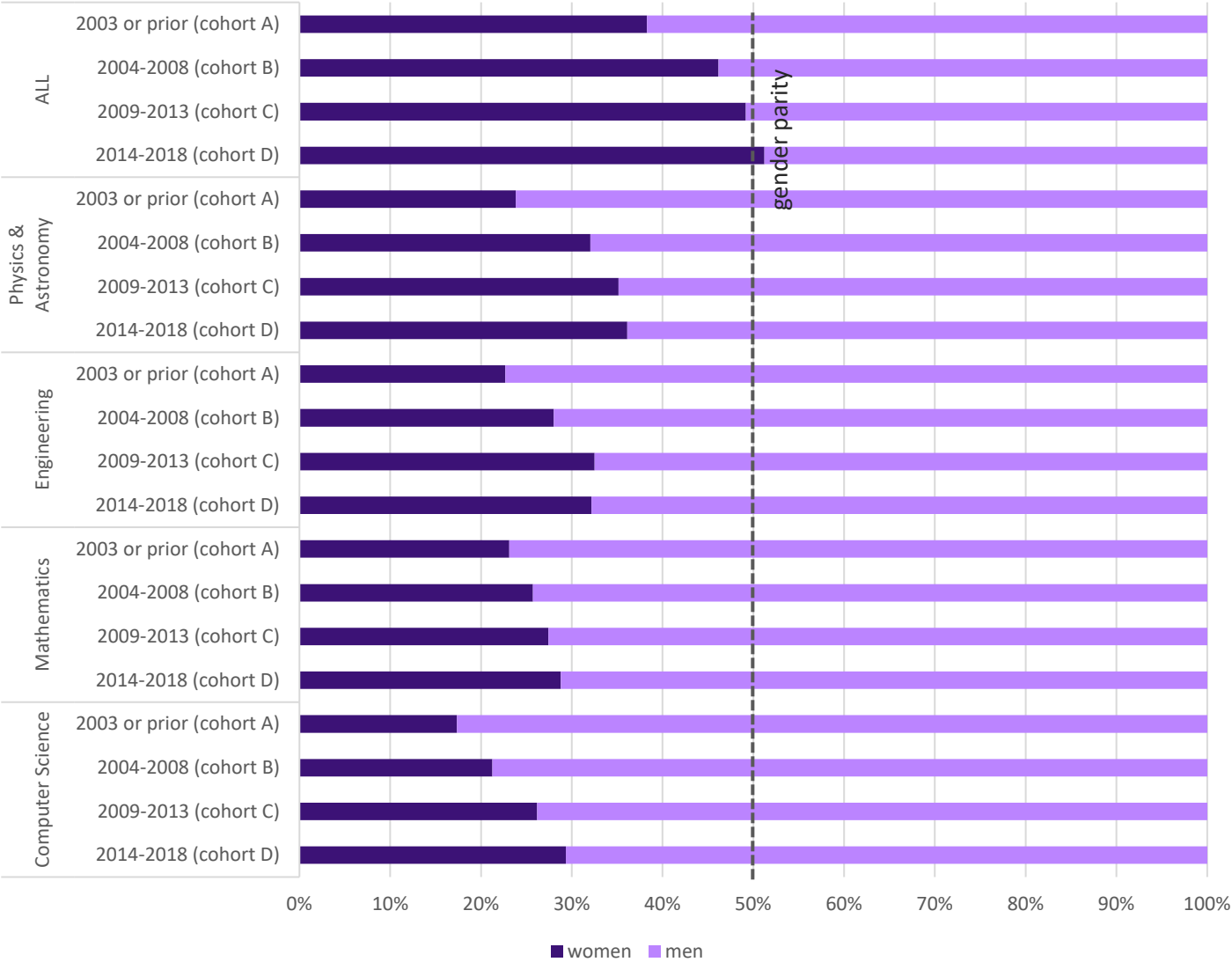


FIGURE 1-4
The percentage of women and men among researchers in Portugal during the period 2014–2018 disaggregated based on seniority cohort and subject. Seniority cohorts are defined based on the year of first publication as follows: cohort A first published in the year 2003 and prior (representing the most senior, or oldest, cohort); cohort B first published in the years from 2004 to 2008 (inclusive); cohort C first published in the years 2009 to 2013 (inclusive); and cohort D first published in the years 2014 to 2018 (inclusive, representing the most junior, or youngest, cohort). Subjects shown are all subjects in aggregate (ALL) and selected subjects in the physical sciences.
Source: Scopus and NamSor.

The relatively low representation of women researchers who have been publishing for longer (e.g., cohort A, most senior, oldest cohort) may reflect a low representation of women in this cohort from the start (i.e., in the year of first publication, women represented a low percentage of the author population) or that these women were less likely to continue publishing than men over time. To explore this further, the percentage of women and men researchers who continued to publish over time was assessed from the first year of publication until 2018 (FIGURE 1-5). Two cohorts were selected for analysis: women and men who first published in 1999 (later career stage) and those who first published in 2009 (earlier career stage). The data show that the percentage of women and men researchers in Portugal remained stable at 43% women over a 20-year period from 1999 to 2018. Among the early-career cohort, the percentage of women is similarly stable over a 10-year period at an even higher percentage of 48%, which is just below parity. This suggests that the low percentage of women researchers in the more senior cohorts (cohorts A and B in FIGURE 1-4) results from fewer women authors entering research compared to the present. It also suggests that in Portugal, the rate of publishing abandonment (a proxy indicator for those who leave research) is equivalent among women and men researchers. This instance of gender representation stability over time is noteworthy: Portugal is unique because it is the only EU28 country examined in which women did not leave research more rapidly than men over time.³

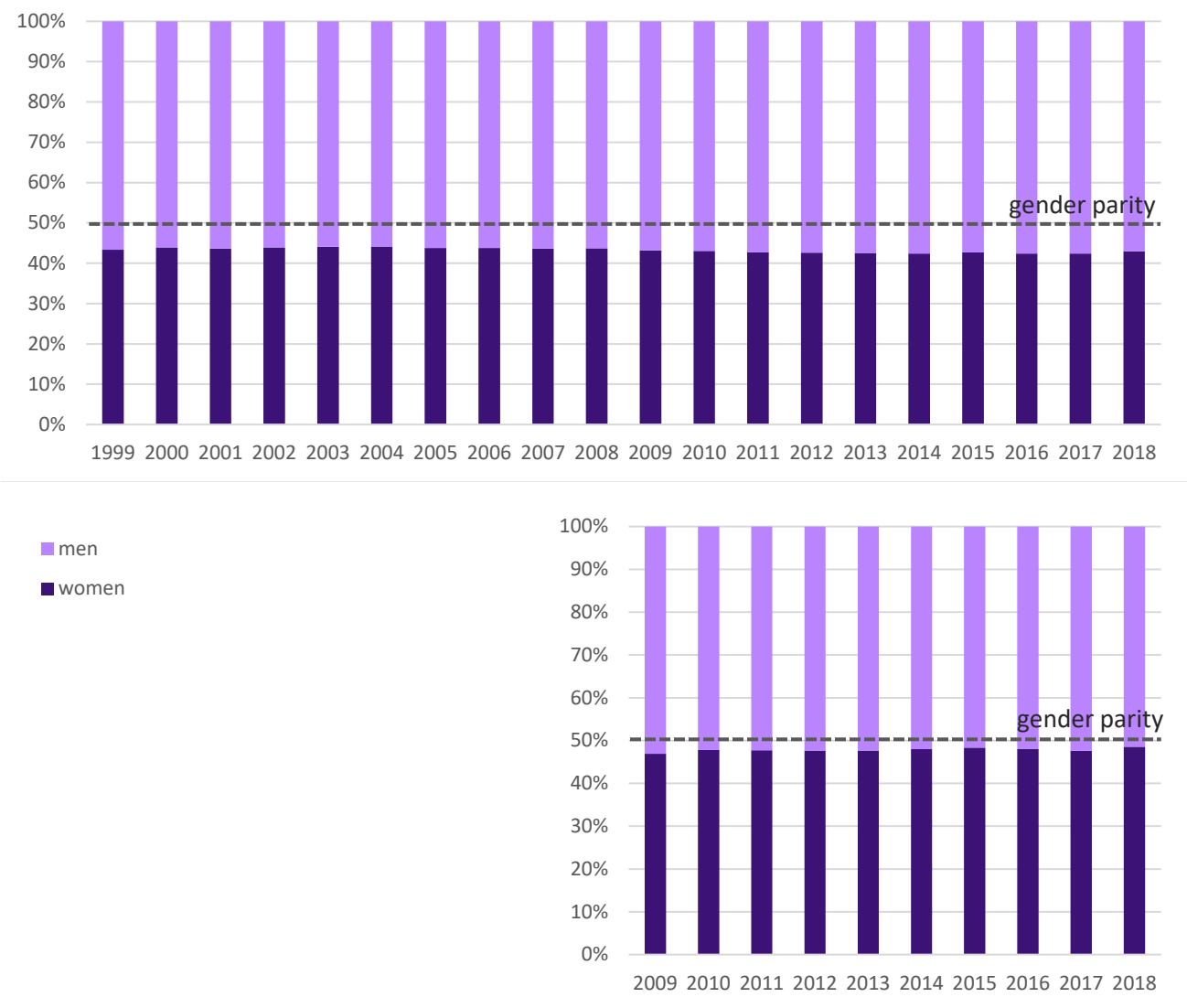


FIGURE 1-5
The percentage of women and men among two cohorts of researchers in Portugal, those in a later career stage (first published in 1999, top chart) and earlier career stage (first published in 2009, bottom chart). Percentage shown is indicative of researchers publishing in that year or in any subsequent year until 2018.
Source: Scopus and NamSor.

Across STEM subject areas, there is gender parity amongst doctoral graduates in Portugal, but that trend is not continued further along the career pathway

Data shown in the preceding sections and figures are based on active authors, which is used as a proxy for researchers. However, not all researchers publish. Therefore, it is valuable to assess author data by comparing it with data based on other statistics that pertain to the research workforce. Data from the European Commission report, *She Figures 2018*⁴, was used to provide context to and validate the author data above. FIGURE 1-7 shows the landscape of women's representation across STEM jobs and roles in Portugal.

In Portugal, women comprise more than 50% of doctoral graduates, scientists, engineers and tertiary educated and employed professionals. 44% of researchers overall are women. However, only 30% of heads of institutions in the higher education sector are women, a steep decrease in the inclusion of women further along in the career pathway. These findings are consistent with what we observe among active authors, particularly when disaggregating authors into more senior and early-career researcher cohorts (based on year of first publication).

The percentage of women among heads of institutions in the higher education sector is lower than the percentage of women in the most senior cohort of authors – those who first published on or before 2003. To examine this observed gap between women's representation among senior authors versus heads of institutions, future studies should further disaggregate the most senior cohort of authors. This approach will more accurately and narrowly reflect the population of heads of institutions in the higher education sector. For example, authors who first published from 1995 to 1999 might be more strongly represented among the heads of institutions in the higher education sector. The relationship between the two variables is likely complex and worthy of future investigation. For example, if women are discouraged from pursuing careers in academia because women are underrepresented as heads of higher educational institutions, this may result in a lower proportion of women among more senior authors.

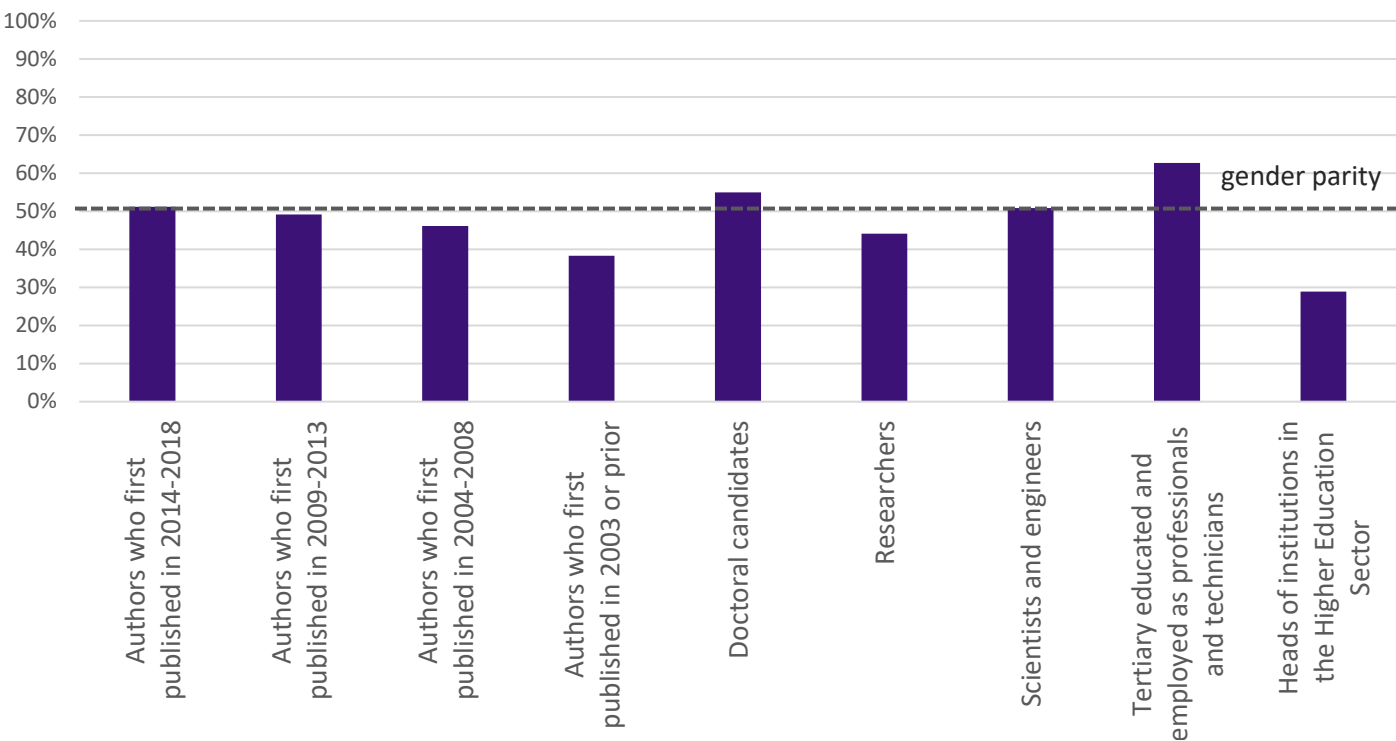


FIGURE 1-6
Percentage of women authors and percentage of women among STEM worker categories in Portugal. Author data reflects authors actively publishing from 2014 to 2018 with varying years of first publication; other data are from *She Figures 2018*.
Source: Scopus, NamSor and She Figures 2018⁴.

In Portugal, women’s representation in STEM worker categories exceeds that of the EU28

The percentage of women in Portugal across various STEM worker categories exceeds the EU28 average, as well as those of the comparator countries Italy and Denmark (except for the percentage of women among scientists and engineers; Portugal and Denmark are very similar in that category). These data further demonstrate that Portugal performs better than the EU28 and European comparator countries in terms of women’s representation across various STEM worker categories. Where further improvement is still needed, particularly in senior roles and in the physical sciences, Portugal should actively consider opportunities to accelerate change within the country to remain at the leading edge of gender diversity within the EU.

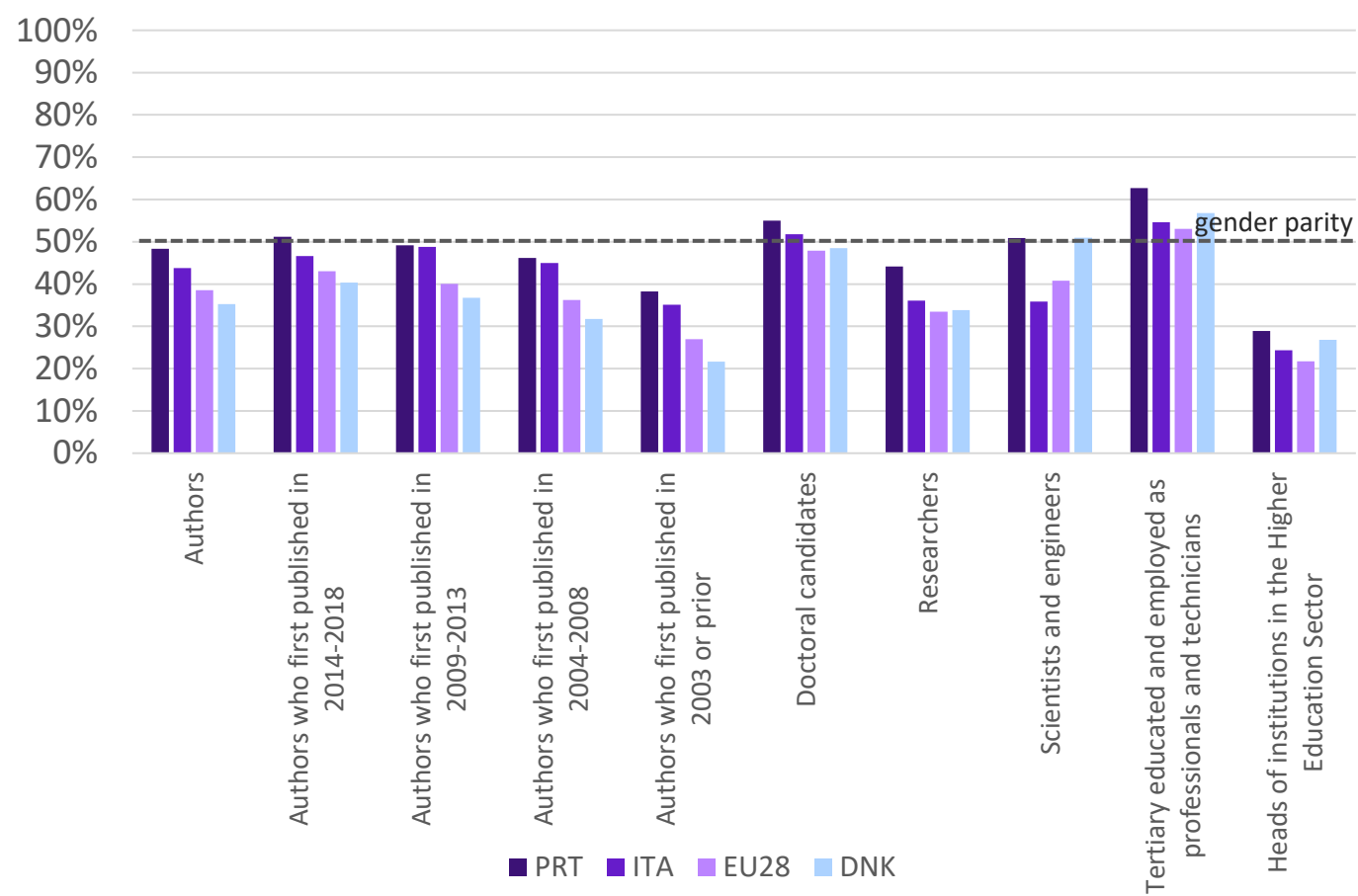


FIGURE 1-7
Percentage of women among authors and workers in selected STEM worker categories in Portugal and selected comparators. Author data reflects authors actively publishing from 2014 to 2018; other data are from *She Figures 2018*.
Source: Scopus, NamSor and She Figures 2018⁴.

1.2 Gender differences in research output

Despite gains in representation, opportunity for greater gender *inclusion* in publication exists in Portugal

FIGURE 1-9 presents the average number of publications authored by women and men in Portugal during the period 2014–2018. Among all researchers in any authorship position, women authored fewer publications than men. The gap is the largest for the most senior cohort (cohort A, those who first published in 2003 or prior), where women authored 5.4 fewer publications than men. This gap diminishes greatly when assessing publication output where the author had a leadership role (i.e., was first, last or corresponding author). This discrepancy in the gender difference in average publication output based on authorship position suggests that the large gap is the result of a difference in publications authored as a “middle author.” Since each paper can have only one first, one last and one corresponding author, but unlimited co-authors in “middle author” positions, the higher publication output gap observed among authors in any authorship position may be the result of men engaging in or being included in more collaborative research efforts. Conversely, women researchers may accrue fewer publications as co-authors if they are excluded from collaborations or elect not to be involved in collaborative efforts. The networks of women and men can also influence the number of publications that authors are included in; those with a large number of contacts or very prolific contacts in their network may be more likely to be included as co-authors in more publications. These data point to the need for women to be adequately afforded leadership roles as authors on research articles and to be equally included in collaboration efforts.

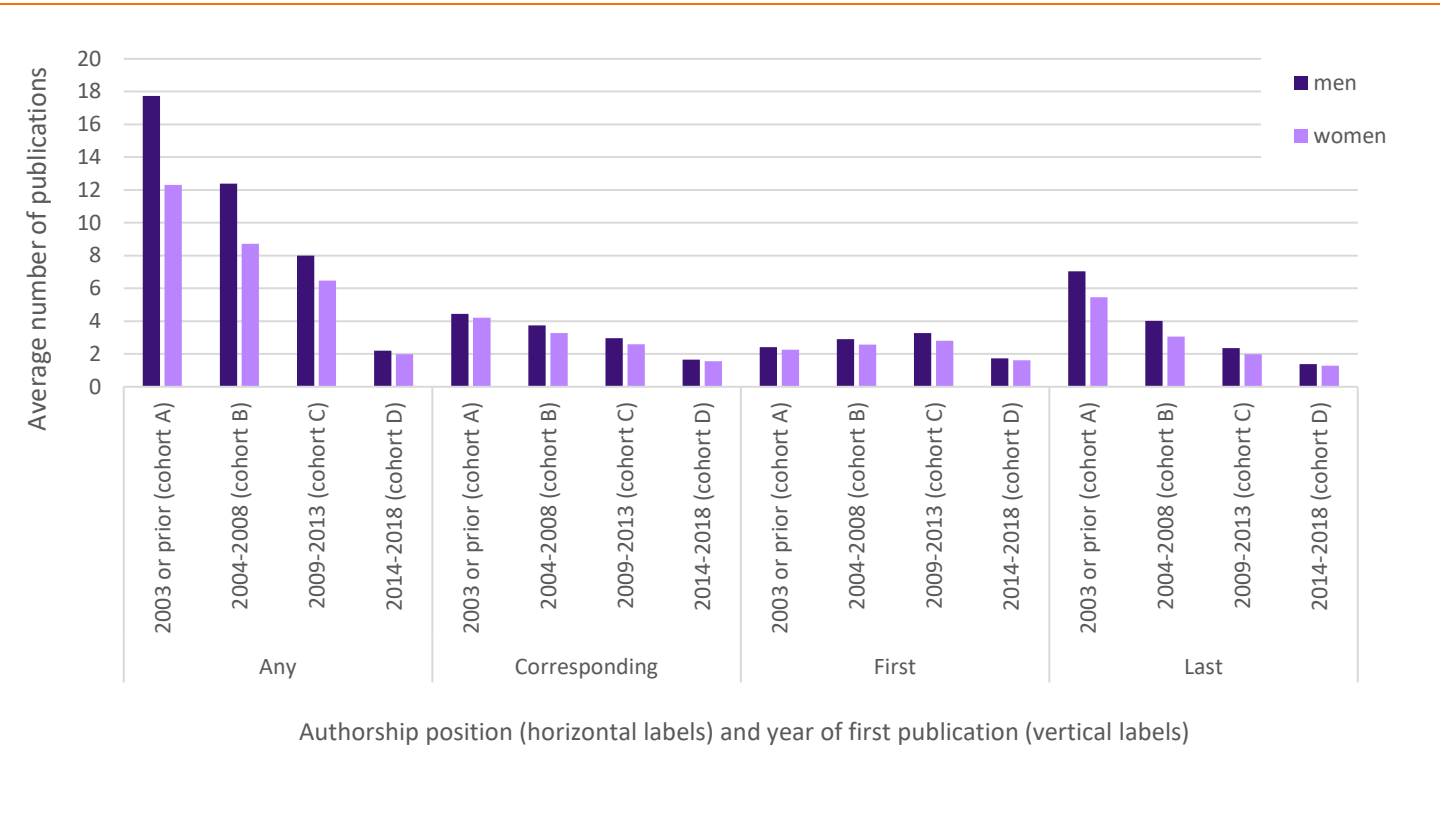


FIGURE 1-8
The average number of publications by women and men researchers in Portugal.
Data are based on the average number of publications by authors during the period 2014–2018, disaggregated according to authorship position and year of author’s first publication.
Source: Scopus and NamSor.

Portugal has the smallest gender publication output gap compared to comparators

To compare the publication gap between women and men across various countries, it is important to account for inter-country differences in publication output. To do this, we calculated the ratio of the average number of publications authored by men to the average number of those authored by women (mathematically, the average number of publications by men divided by the average number of publications by women) for each country examined. In this way, we account for country-to-country differences in publishing culture that lead all researchers in any given country to publish more or less, on average, than researchers in other countries. Results in figure 1-10 show that the observed gap in publication output for men and women in Portugal is smaller than that of any other comparator among the

earliest career cohorts (cohort C and cohort D) and across all authorship positions (except for the most senior cohort (cohort A) of any authors, where the gender gap is slightly wider for Portugal).

Since the number of published articles, which is a proxy for research productivity, is one factor driving the progression of academic careers, taking into account the above differences may be crucial for designing more inclusive promotion and tenure processes in universities.

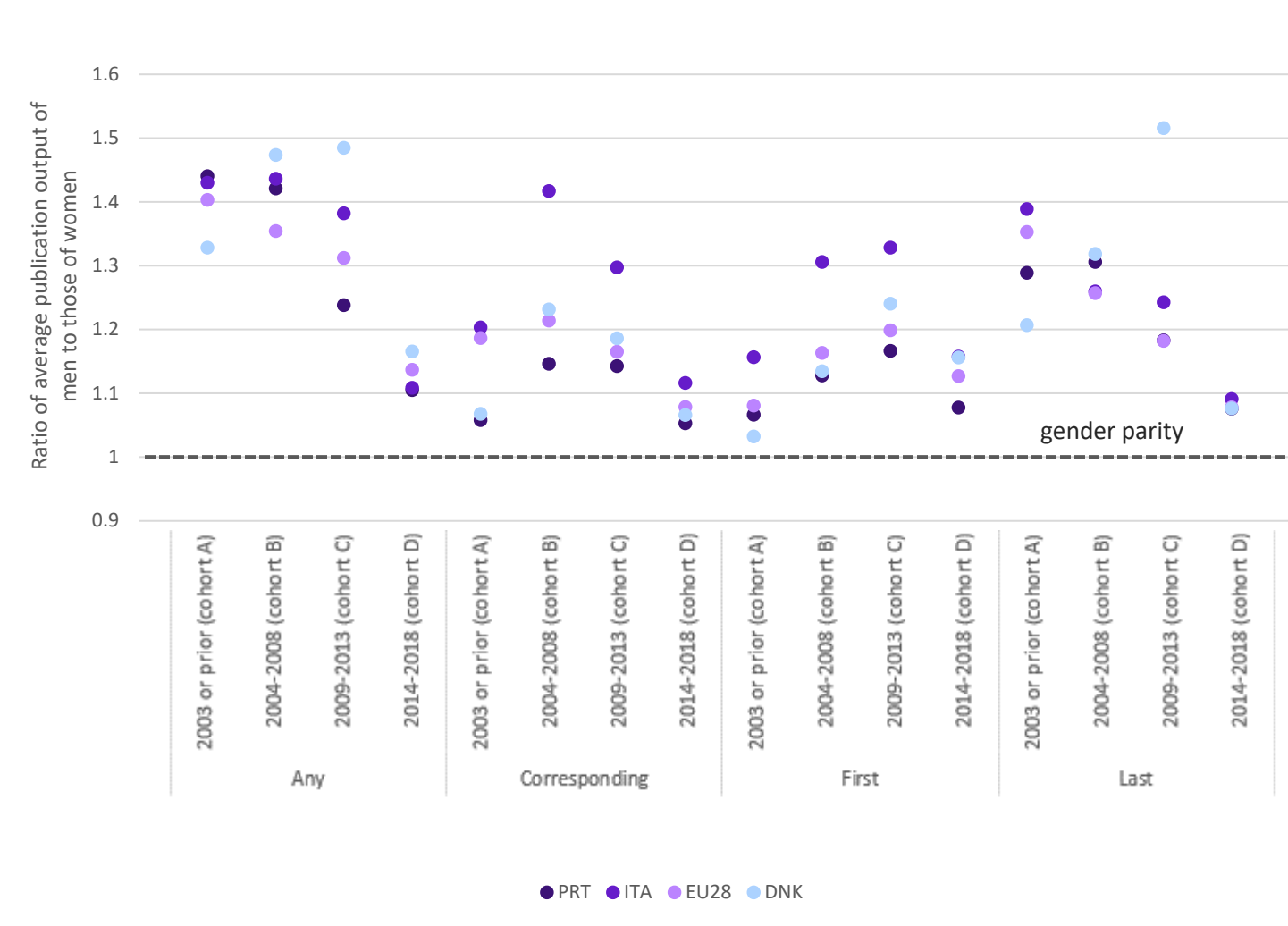


FIGURE 1-9
The ratio of the average number of publications authored by men researchers to those by women researchers in Portugal and comparators. Data are based on average number of publications by authors during the period 2014–2018, disaggregated according to authorship position and year of author’s first publication.
Source: Scopus and NamSor.

1.3 Gender differences in citations

In Portugal, the impact of women and men's research is similar, but women are cited less when in senior author positions

Impact is often measured by the citations a research article accrues as such citations can signal that others are building upon that work. For our analyses³, we employed a normalised metric called field-weighted citation impact (FWCI) to study research impact across different subject areas. FIGURE 1-11 shows that the FWCI among men and women authors in Portugal in any authorship position is equivalent, indicating no gender difference in research impact.

A more nuanced understanding is gained when we look at citation impact disaggregated by author position, which reveals a lower FWCI for women when they are lead authors. On average, women have a lower FWCI than men, particularly when they are first or last authors. Factors not captured in the chart could help explain the difference in citations accrued by women compared to men when they are first or last authors. For example, because citations are correlated with author count, if men tend to be lead authors on publications with a higher number of authors, it could potentially account for some of the observed gender gap. Alternatively, systematic implicit gender bias could result in women being cited less when their leadership role is explicitly delineated by authorship position.

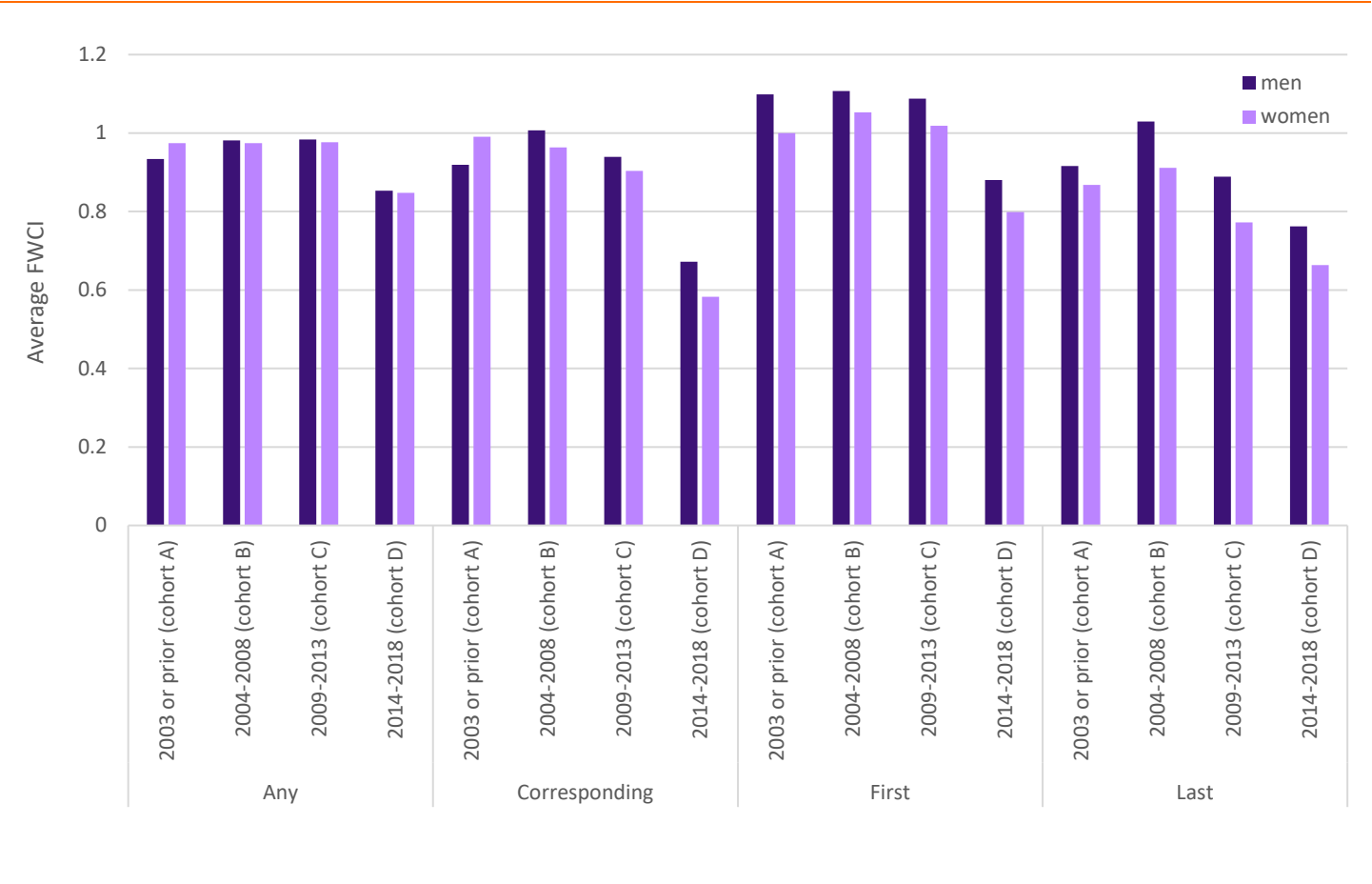


FIGURE 1-10
The average FWCI of publications by women and men. Data are based on publications by authors in Portugal during the period 2014–2018, disaggregated according to authorship position and author’s year of first publication.
Source: Scopus and NamSor.

FIGURE 1-12 shows that the gender citation gap is larger among last authors in Portugal relative to comparators selected for analysis. However, the gap is smaller in Portugal than selected comparators among corresponding and first authors.

Because citation-related metrics are used as criteria for progression in scientific careers in Portugal and across the EU, further investigation of the drivers of the observed gender differences is likely to offer valuable insight to improve gender diversity in across the spectrum of research careers.

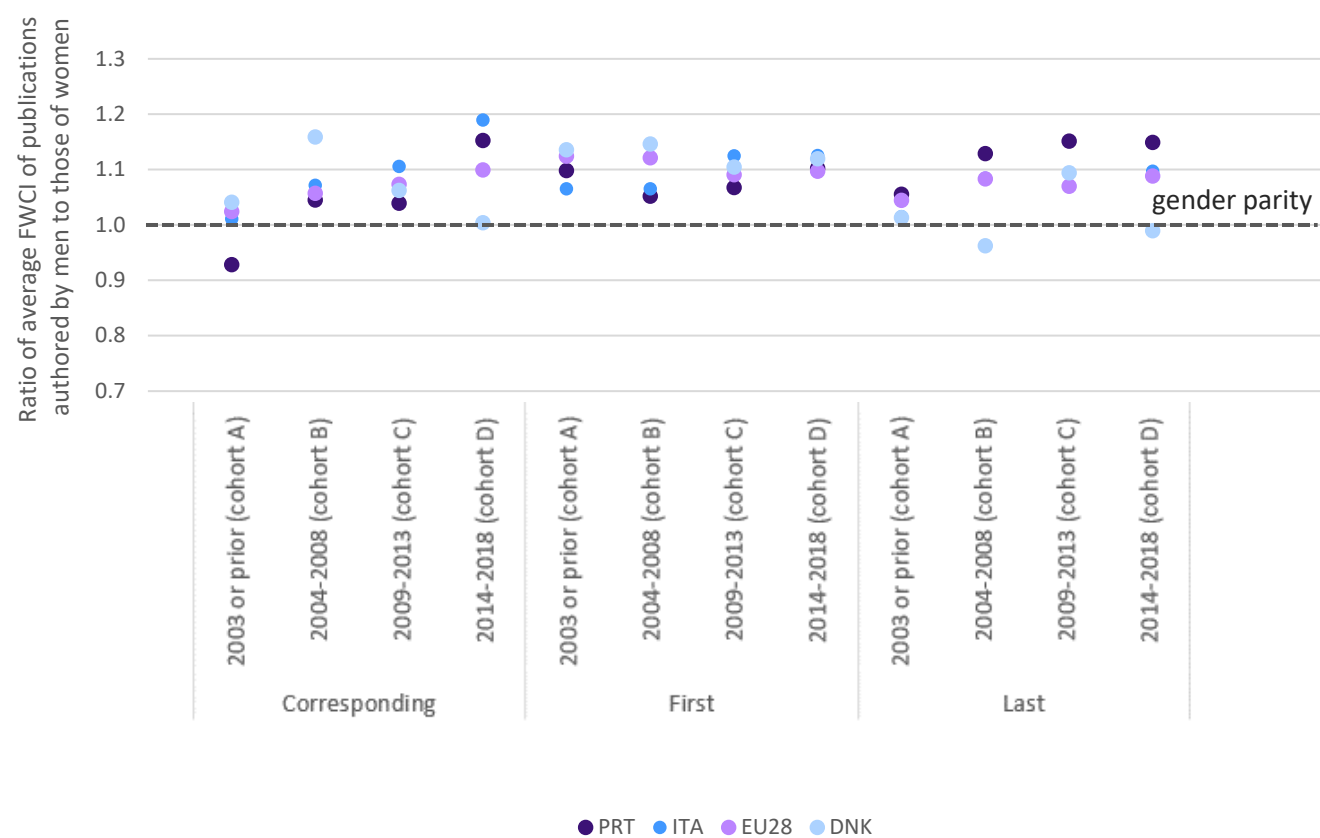


FIGURE 1-11
The ratio of average FWCI (normalised impact) for publications authored by men to that for publications authored by women. Data are based on average number of publications by authors during the period 2014–2018, disaggregated according to authorship position and year of author’s first publication.
Source: Scopus and NamSor.

1.4 Gender differences in pay and working conditions

Portugal performs better than the EU28 overall in terms of gender pay gap, despite inequity of earnings in science jobs

Portugal's gender pay gap is smaller than that of the EU28 and Denmark, although larger than that for Italy (FIGURE 1-13). Various factors could underlie the observed differences. Except for Denmark, the gender pay gap observed in jobs related to scientific research and development mirrors the gender pay gap observed in the total economy. Future studies could investigate whether gender pay gaps of a similar magnitude are observed within the same research areas and roles but across different career stages, and to examine pay differences in fields where women are underrepresented versus fields where they are more well-represented. The findings of such studies would inform more specific policy development and targeted interventions designed to tackle the gender pay gap at an accelerated pace.

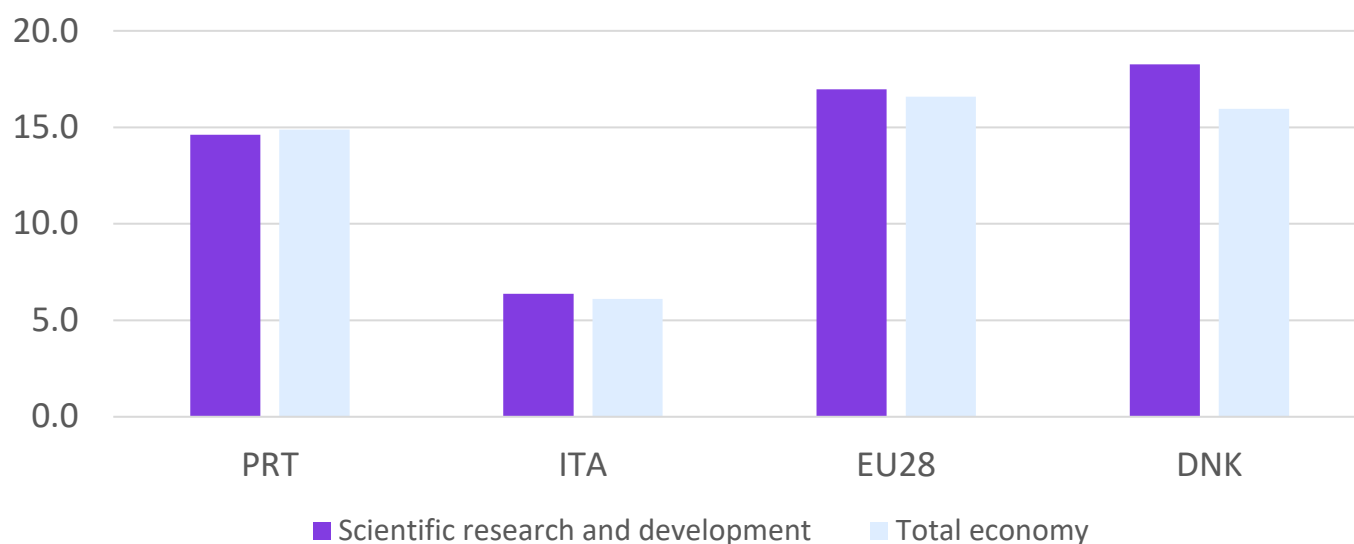


FIGURE 1-12

Gender pay gap (%) in the economic activity area of 'scientific research & development' (NACE Rev. 2, Division 72) and in the total economy, by age group, 2014.

Source: *She Figures 2018*⁴.

By assessing participation of women in top tier positions in academic careers relative to women’s overall representation, the Glass Ceiling Index is a useful metric to measure gender inclusion. FIGURE 1-14 shows that in Portugal, as well as in the comparators, women are less likely to be in top tier academic positions. The Glass Ceiling Index is slightly higher in Portugal relative to comparators, suggesting that the high level of representation of women among researchers in Portugal (FIGURE 1-1) does not automatically translate to increased inclusion in top tier academic positions.

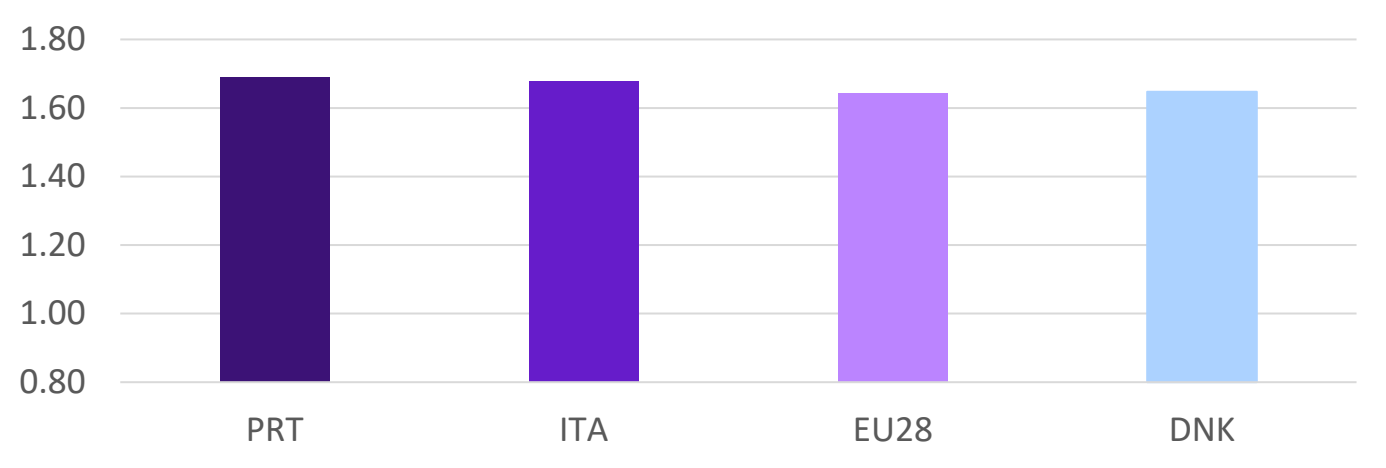


FIGURE 1-13
Glass Ceiling Index, which represents the ratio of women in top tier positions in academic careers relative to representation of women overall.
Source: She Figures 2018⁴.

FIGURE 1-15 further examines gender inclusion in research. The data, also from the *She Figures 2018* report², show that in Portugal, 80% more women than men (ratio of women to men is 1.8) work under precarious contracts, defined as those without contracts, with fixed term contracts of up to one year or with other non-fixed term, non-permanent contracts. Moreover, Portugal has a higher percentage of women with precarious working contracts than the EU28 and the two comparator countries. These findings further demonstrate disparity with regard to gender inclusion.

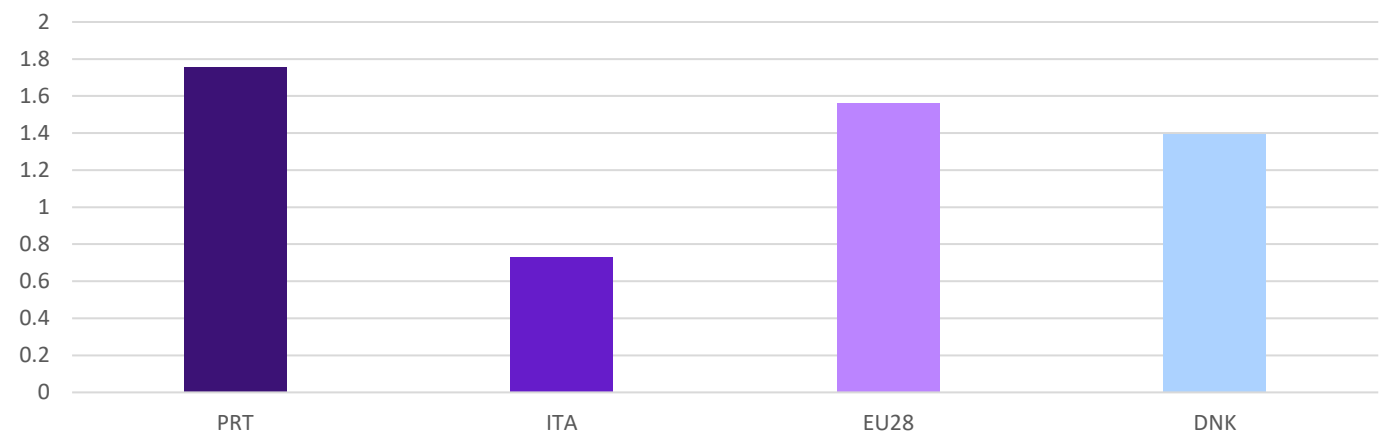
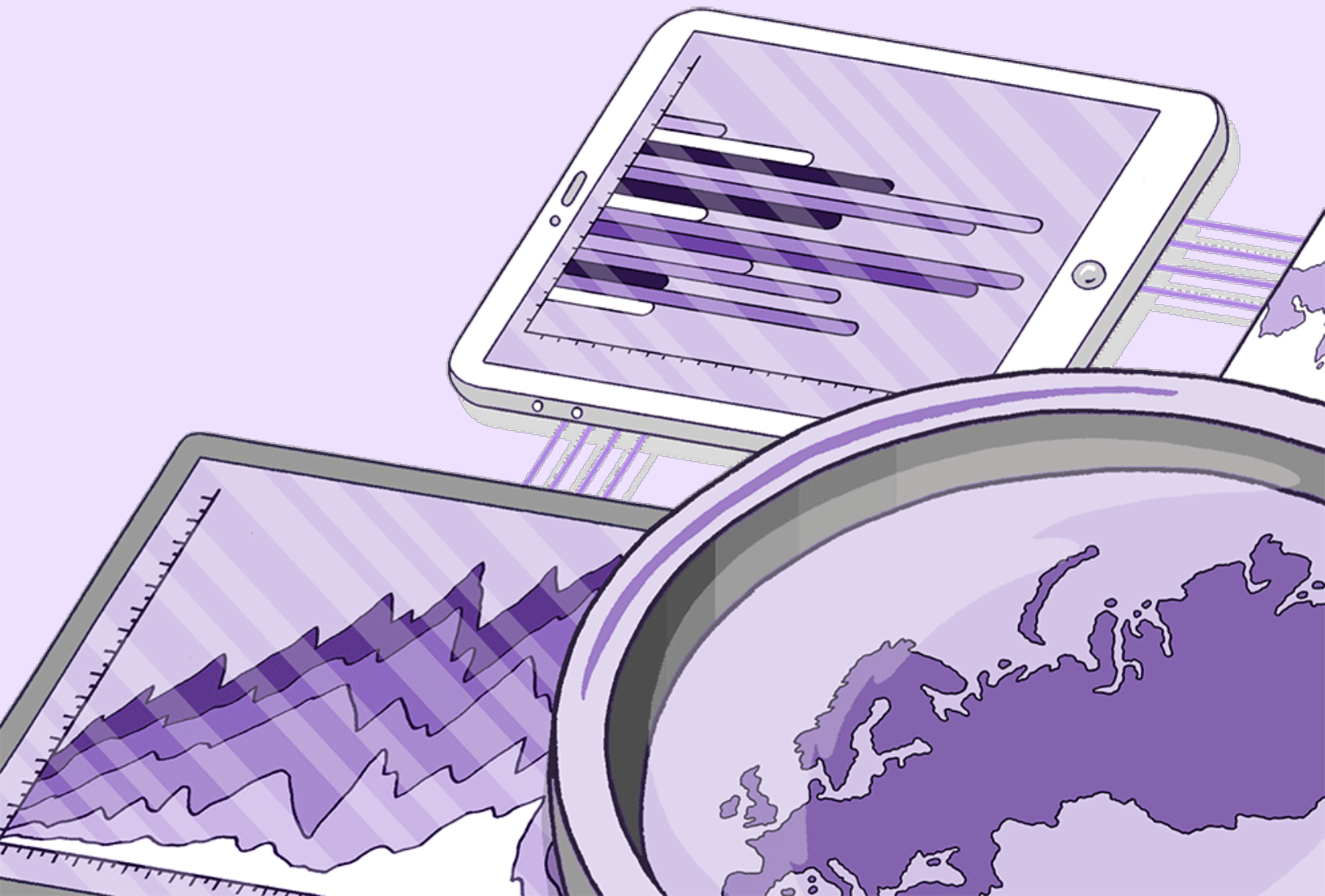


FIGURE 1-14
Ratio of women to men among researchers in the higher education sector working under precarious working contracts (without contracts, with fixed term contracts of up to one year or with other non-fixed term, non-permanent contracts), 2016.
Source: She Figures 2018⁴.

Chapter 2

Key opinion leader interviews



2.1 Rosa Monteiro

Secretary of State for Citizenship and Equality,
Portugal

What information / insight from the report do you find particularly interesting and important for policymakers and institutional leaders to consider in Portugal or in a specific subject area(s)?

The latest report gives us a positive picture of gender diversity progress in research, in terms of authors of academic publications, grant recipients and patent applicants, with significant variation across countries. This seems to accompany women's increased participation in the labour market as well as women outpacing men in terms of academic attainment. However, we also see that research reproduces structural gender inequality patterns. For example, the segregation of women and men per subject area reproduces patterns of horizontal segregation, with an over-representation of women authors in areas such as nursing and psychology and of men in areas such as the physical sciences. Likewise, having men with longer publication histories and established international networks is a reflection of career interruptions and the reality that women still shoulder a much larger share of unpaid care work than men over the life course, with gender gaps in terms of pay and vertical segregation.

How would you describe the current state of gender diversity in global research, compared with five years ago, and its impact on research and/or researchers globally?

The COVID-19 pandemic is having a disproportionate negative impact on women researchers and in academia, with the long-term impacts still to unfold. Women working in highly specialised, demanding and competitive sectors, such as research, have been particularly affected. The increase in unpaid care and domestic work during lockdowns and confinement translated into a reduction in the number of articles submitted for publication, research applications and projects and research hours among women researchers, jeopardising their careers. Moreover, a lack of women researching COVID-19 will affect the way future public policies are perceived and shaped. This comes at a time when, in more recent years, we have witnessed some emerging trends that put gender research and gender studies into question on a

global scale, from denying accreditation and funding, to censorship and policing, mostly on the basis of everything but scientific reasoning.

Portugal stands out in some indicators in this context, with the proportion of women researchers above the EU average (43% vs 34%). The total number of researchers increased from 28,000 in 2013 to 37,000 in 2018, with the proportion of women increasing from 47% to 49% in the same period, though at a slower pace.

According to data from the Portuguese Foundation for Science and Technology (2019), in 309 R&D Units, 53% of researchers are women (though they make up only 32% of R&D Unit coordinators). Looking at the proportions of women with funded research contracts, we see it is 56% of junior researchers, 53% of assistant researchers, 43% of principal researchers and 20% of coordinator researchers. There is also a majority and increasing proportion of women with PhD scholarships, from 55.4% in 2010 to 58.5% in 2019, which is expected to impact the future landscape of women in research. As principal investigators of funded projects, the share of women increased from 42% to 45% from 2015 to 2019 in all projects; however, in international projects (mostly European) this proportion has been lower, from 27.4% in 2015 to 36% in 2019. In national panels for PhD scholarships, there has been gender equality for the last two years (women were 50.2% of panel evaluators and 50.8% panel chairs); however, this was not seen in international panels.

These numbers are positive; however, they also point to a need for improvement. There are other numbers that worry us, and they are, in Portugal, a reflection of patterns of systemic gender inequalities, such as the digital gender gap. From 1999 to 2019, the share of women information and communications technology (ICT) graduates decreased from 26% to 21.3%. Women ICT specialists comprise only 0.9% of total female employment, and only 15.7% of ICT specialists and 20.2% of scientists and engineers in high-technology sectors. At 15 years of age, less than 1% of girls in Portugal wish to become ICT professionals (e.g., software developers, application programmers), compared with 6% of boys (OECD, 2019⁵).

What value do data and an evidence base offer as tools to policymakers and institutional leaders to address issues of gender diversity and equity?

Our scientific culture increasingly assumes a knowledge society where knowledge is and must be at the core of understanding societal challenges and defining solutions, providing data, analysis, technology, tools, etc. We need to counter disinformation and growing attacks against scientific evidence, and to assume policy areas as technical areas and not mere opinions. We need to recognise scientific knowledge

and research as a condition to assess, evaluate and act, and the only way to avoid biases and ensure impactful policies.

For example, Portugal has been invested in producing robust knowledge and data on the gender-based impact of the COVID-19 pandemic, which is also a priority of the Portuguese Presidency of the Council of the European Union. We requested that the European Institute for Gender Equality (EIGE) produce a targeted research note on the socioeconomic impact of COVID-19 on gender equality. We also requested that the European Economic and Social Committee produce an opinion on teleworking and gender equality. Through the Portuguese Foundation for Science and Technology (FCT), we are funding 15 projects on understanding national gender impacts of the pandemic on the labour market, on gender stereotypes and on violence against women and domestic violence.

Given the diversity of perceptions on gender issues, what do you consider to be the most important factors that influence progress toward equity for women and men in research?

We need to remove the invisible barriers that lead to indirect discrimination against women. Several segregation structures persist, including gender stereotypes that continue to keep women away from what is perceived to be the rational (vs. emotional) domains, which causes segregation in terms of research areas. There remains a significant invisibility of women researchers in area thought as “male” subject areas, and vertical segregation connected to leaky pipelines, work-life balance difficulties, unequal division of unpaid care and domestic work, instability of research careers and lesser involvement of women in research networks and informal networks.

Are there initiatives, policies or interventions that have emerged within Portugal and/or other countries in the last three to five years that you feel have impacted progress and should be monitored to assess impact?

We assume gender equality in scientific development and technological development as a key objective of our national equality and non-discrimination strategy, aligned with the European Commission’s Gender Equality Strategy 2020–2025. Very importantly, the new Horizon Europe strengthens the tools to achieve these objectives, from requiring gender as an R&D dimension; to the obligation for higher education institutions (HEI) to have gender equality plans and allocate specific funds for gender equality plans, gender studies and intersectional research; to promoting gender balance in evaluation panels, consultative bodies and research teams.

In 2019, following a Government legislative proposal, our national parliament passed a pioneer law establishing a minimum 40% threshold for women and men in candidate lists for elective decision-making bodies in public HEI, whereby the first two candidates cannot be of the same sex, which entered into force in 2020. I am positive that this law will induce transformation, not only as a numerical change but also as an organisational qualitative leap in our HEI landscape. It is a very positive sign to register a trending transformation of our national research and HEI landscape, albeit at a gradual pace, to address persistent gender inequities. Several HEIs are developing gender equality plans that include targets in terms of gender balance in decision making positions and measures to induce organisational change, promote gender studies and mainstream a gender dimension into research.

Moreover, the Portuguese government has been developing a close dialogue with research institutions at different levels in the area of gender equality. Notably, in terms of organisational change, we are working with and funding various HEI to implement work-life balance management systems within their internal practices. Moreover, we are funding several research projects in critical policy areas, such as the economic impact of gender inequality dimensions, including the pay gap, horizontal segregation and unequal division of unpaid care and domestic work, as well as for defining gender equality criteria in the assessment and accreditation of HEI and study programmes. HEI projects are also being funded to support on-the-ground interventions; for example, implementing an information management system and creating a certification system for the entire national network of support services for domestic violence victims.

Also, we are strongly committed to combatting horizontal segregation in educational and professional paths. As State Secretary for Citizenship and Equality, in 2017, I implemented the programme *Engenheiras por 1 Dia*, which is now part of the National Digital Transition Action Plan. It targets lower secondary and secondary students to challenge gender stereotypes and incentivise more girls to choose engineering and ICT areas of study, through practical exercises, mentoring and work experiences. It has already engaged around 10,000 students and almost 100 partners across the country, including schools, tech companies, HEI and other stakeholders such as municipalities, foundations and associations.

Also, part of the digital transition action plan, the Portugal INCoDe.2030 initiative is an integrated public policy initiative aimed at enhancing digital competences, and includes five axes: inclusion, education, qualification, specialisation and research. In 2020, a programme coordinator was appointed to mainstream the objective of equality between women and men. Already, the Program Upskill has reached 40% of women among the programme beneficiaries who were integrated in companies in the area of programming. The programme “I am digital” aims to reach 50% of women among the 1M beneficiaries who will be digitally capacitated. In November 2019, the Portuguese government and HEI signed an agreement for the years 2020–2023, in which HEI commit to combatting horizontal segregation in the labour market through programmes aiming to deconstruct gender stereotypes. Finally, our national recovery and resilience plan assumes this objective and establishes several measures to promote more women in ICT-related areas, including among graduates.

2.2 Analia Maria Cardoso^a and Paula Campos Pinto^b

University of Lisbon

How would you describe the current state of gender diversity in research compared to five years ago? What is the landscape in Portugal now compared to five years ago, generally and specifically?

Paula Campos Pinto: In general, I think there is more competition in Portugal, with more attention being paid to publishing in English in highly ranked international journals. In the social sciences, the long-time preference was to publish books in Portuguese, but the landscape is changing. Publishing in English can be difficult because not everyone is fluent and there are extra costs for revising the paper before submission to the journal. Research centres try to support that cost, but it just adds a layer of complexity for Portuguese researchers who are now required to publish internationally.

Analia Maria Cardoso Torres: I would add that in Portugal, and even in Europe, the introduction of the United Nations Sustainable Development Goals applied some outside pressure to change with regard to gender equality. Directors in higher education felt that they had to do something to meet these goals.

At the same time, there was a more local focus on the societal impact of science and research in Portugal. We are at a moment where gender equality issues are highly visible in Portugal and policies are being targeted to address equality issues. Interest in the topic of gender equality has been increasing since 2015, but much more so in the last four years. We need to make the most of this moment and focus on ensuring the sustainability of gender equality in research.

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^b Associate Professor, Sociology and Founder and Coordinator of the Observatory on Disability and Human Rights, Institute of Social and Political Sciences, University of Lisbon

Has the government introduced specific policies to support gender equity in research in the last five years?

Analia Maria Cardoso Torres: Yes, there have been initiatives aimed at opening up the STEM fields to more women through alliances with universities and research centres and through increased funding. We also see a renewed commitment to addressing topics such as violence against women and the introduction of gender equality plans in universities.

Paula Campos Pinto: Analia is coordinating a government-supported project on gender equality specifically in higher education institutions in Portugal, assessing gender gaps and coming up with recommendations for closing them. We have already assembled data and we are starting our analyses, interviewing stakeholders in higher education institutions in Portugal and preparing case studies with students, teaching staff, non-teaching staff and management.

I mention it because this project was pre-selected—the Portuguese government approached us with general guidelines and asked that we submit a specific project proposal on gender equality in research at higher education institutions in Portugal.

Analia Maria Cardoso Torres: The funding was specifically targeted for gender equality research in higher education, but it came out of a need for informed policymaking.

Would you say that Portugal is unique or more advanced than other countries in Europe in terms of the involvement of the government in gender equity initiatives?

Analia Maria Cardoso Torres: This interest in gender equality in research is relatively new. Portugal has actually been behind other countries in this regard. We established the first research centre on gender studies at the University of Lisbon years after similar centres had been set up in other countries. Now we are trying to catch up when it comes to gender equality. It has been more of a ground-up effort, with policies put in place as an answer to the movement, rather than the policies driving the movement. The first women who had an active role in research were highly visible and encouraged other women to enter research, and then the policies to support women started to appear.

How would you explain the fact that Portugal has so many more publications from women?

Analia Maria Cardoso Torres: Portugal started focusing on education, specifically higher education, to try and catch up with other European countries. Portugal had a Minister of Science and Technology (Mariano Gago) who established, especially since 1995, an institutional scheme for systematic funding of scientific research, including social sciences, through what is now named the Foundation for Science and Technology, the FCT. And he made a difference even at the European level, as he was directing the Initiative for Science in Europe, one of the main tools for the launching of what is now the ERC, the European Research Council. In Portugal, he specifically directed a policy that provided scholarships for PhDs and funding for research grants, convening international panels for the evaluation of research projects and research centres. This policy really benefited my generation of women researchers and earning a PhD became normalised among the generation that I trained—all of my students were supported with scholarships and grants.

But only a small percentage of these women continued their careers in higher education. It is highly competitive; publication is required, and these careers are precarious. We have many well-trained PhDs and postdocs who are not able to find placement in higher education or in research centres and are not being absorbed into Portugal's limited private research sector, so many are leaving research. We are seeing this loss more among women than men.

Paula Campos Pinto: What happens is that women enter a research field in high numbers, but they need to publish in order to get a stable position at a higher education institution or research centre. In the report, there is a comparison of the number of first publications at different points in time. Women are over-represented in terms of publishing in the early stages of their careers, because they are in precarious positions and having a good publishing record will help them to get a secure position. Many do not achieve that goal and end up leaving research.

Do policymakers look at scientific research in gender equity to inform their decisions on gender equality?

Paula Campos Pinto: I think so, yes.

Analia Maria Cardoso Torres: Yes, policymakers also come to us for policy evaluation. There are people who have been doing this research for a long time in Portugal, and policymakers look to them for information to guide policies and to help with evaluation.

One thing that I am very afraid of is the current situation many researchers are in and how we can sustain the progress Portugal has made in gender equity in scientific research. It really depends on the scientific field, but in some areas, we are losing brain power in Portugal as researchers leave for other countries. If there are no research companies providing positions, we can only offer a research grant or a postdoc position, which are precarious.

Portugal is now trying to use contracts that guarantee a position for five to six years. But it is highly competitive, with many researchers applying for a single available post. There is so much pressure to win one of these contracts—sometimes researchers will just give up and try another path in their lives. Portugal has reached a critical mass, and now we need to provide some stability so that researchers can build their careers.

What would you say is the most important intervention to preserve gender equality in research?

Analia Maria Cardoso Torres: While these research contracts are a good idea, the problem is that they are publicly funded. Even if the government wanted to do more, these policies are being contested, with pushback from the Minister of Finance.

Paula Campos Pinto: I would add that while it is necessary to open opportunities for people to enter the system, it is also important to create the conditions to ensure that men and women have the same opportunities when they are in the system. Women still have a very unequal share of unpaid work in terms of domestic work, childcare and so on. It's not just a matter of getting women into the system; once they get in, there is a need to ensure women are not left dealing with a more difficult situation with a bigger burden of work.

Analia Maria Cardoso Torres: Our gender research studies have made a huge impact on the country and its policy and laws. It can be intrinsically rewarding to know your research has had a societal impact on gender equity, but it's a shame that these changes may not be sustainable.

We have an overall positive view—that all the work that has been done has made an impact and that people inside the system are continuing to slowly change it from within—not every country can say they have done this. But we can also say that it's not enough and that we can also lose what we have created.

It's also important to underline that some of the limits we are facing are not within the capacity of the government to fix. There are constraints on spending, for example. But all of these pressures put researchers in a very difficult position.

The same trends that apply to publications in Portugal also apply to awarded grants and patents. Does this say anything about women also driving research innovation? Are you surprised, or did you expect to see this?

Paula Campos Pinto: The same drive that women have to succeed, to develop a curriculum, to do the work, is driving the higher numbers of publications, grants and patents. Young women are highly engaged and try hard to do their best. They are making a huge effort, but because of the precarity of the work conditions and the unfair division of nonpaid labour, women are more heavily burdened overall.

Analia Maria Cardoso Torres: In Portugal, we are just seeing the first wave of students entering university from working class backgrounds. This happened 20 years earlier in Italy and Spain. These students have the motivation to study and move beyond where their parents are in society. This is not as easy for women as it is for men, so the expectations are higher, and they have to work harder.

If the government successfully addressed the issues that cause the extra burden on women, would gender parity become a reality, or would it move even more towards the side of women?

Paula Campos Pinto: I'd say that it would move more towards the side of women. My husband works in the private sector, and he noted that highly prepared, very bright women, with better CVs than men, enter his field, but those women do not move into higher positions.

In the public sector, policies such as maternity leave must be followed, while the private sector may have the same policies, but follow them unevenly. As a result, more women tend to work in the public sector, where some of their rights might be better protected. If there were more conditions and more policies that address these barriers, I think women would go even further in their careers.

Do you think there's anything that Portugal could teach or inspire other European countries on this topic?

Analia Maria Cardoso Torres: From the researchers' point of view, it is very important to have a good relationship with people in the system who are developing and implementing policies. Scientists are driven to make discoveries that will change minds and improve lives. When scientists start their careers, they think about how science can benefit people and the world. We need to think of policymakers as people who can help us create that change, to think through how things can be improved. Researchers should not only share their knowledge with policymakers, but also listen to policymakers and understand the constraints they face.

Researchers are caught between the pressures to publish, receive grant funding and achieve a more stable position while still remembering the reason they started doing science – to improve society and the world. It's a fight of two visions.

Do you think Portugal is at an advantage as a smaller community because there is a closer connection between research and government?

Analia Maria Cardoso Torres: Of course. It is also important to have the shared perspective that science has a larger societal impact, and that the entire region or country can benefit from policies that sustain gender equality in research. But it also depends on governmental political orientation, the type of policies they launch and if those policies include gender mainstreaming and gender equality as targets to achieve.

Paula Campos Pinto: Because the spirit in Portugal is one of cooperation, it helps being a small community.

2.3 Maria da Graça Carvalho

Member of the European Parliament (MEP)

Portugal has focused on gender diversity in general for many years. In your opinion, when did focus on this topic start and why was it considered so important? When did this feed through to research?

In the 1980s, the research leadership in Portugal—particularly José Mariano Gago, who was president of what would become the Foundation for Science and Technology and then became minister of Science and Technology—was very conscious of the role of women in research. When Portugal joined the European Union in 1986, we began awarding high numbers of scholarships for women to pursue their PhDs, and later postdoctoral fellowships, at universities in the UK, US, Germany and Switzerland. We wanted to create and build a research community in Portugal that specifically included women. For the most part, this policy has continued. In recent years, as in other periods of crisis, we have experienced a “brain drain” as these trained researchers decline to return to Portugal. But the consistent financing of scholarships for women in research has made a big difference.

Another longstanding focus in Portugal is on engaging very young children in science. Portugal created a network of Ciencia Viva museums across the country to reach the public, but in particular young people. Ciencia Viva also leads programmes that bring science into the schools. In addition, Portugal publicly recognises the achievements of famous scientists, women scientists, and this visibility has created a culture that celebrates the work of women in science. In fact, some of the most important research organisations in Portugal are now led by women: Leonor Beleza at the Champalimaud Foundation, Isabel Mota of the Gulbenkian Foundation and Helena Pereira as president of the Foundation for Science and Technology. These role models are important.

One phenomenon that I’ve noticed is that once we reached a critical mass in the number of women entering university in research, it was much easier for them to continue and succeed, which then encourages other women toward a research career. When I studied mechanical engineering, there were only two women in my class of 120. As those numbers increased, women no longer felt as isolated, and felt included as part of the group.

Portugal never moved toward quotas in research or university careers. Instead, we took a positive approach by starting early and incentivising careers in science with scholarships. It takes time and

consistency, over several decades, to achieve cultural change. We have been very successful in attracting women into research in biotechnology, chemistry and the health sector. Among medical doctors, the majority are women. Some professional organisations have been advocating for a more balanced approach, but I have resisted calls for quotas.

Are there initiatives, policies or interventions that have emerged within Portugal and/or field in the last three to five years that you feel have impacted progress and should be monitored to assess impact?

While we have been very successful in attracting women to research careers, we have been less focused on career development. Interventions are needed to address issues such as the leaky pipeline and the pay gap. We have near parity in pay between women and men among younger researchers, but this starts decreasing along their career in a very striking way. With the financial crisis in Portugal, and now the pandemic, our public institutions have not been able to recruit as much—in fact, a career in research has become quite precarious, particularly for women, who are more likely than men to abandon a research career.

What value do data and an evidence base offer as tools to policymakers and institutional leaders to address issues of gender diversity and equity?

It is very important to have the data because it can help policymakers design policies to address the problems that persist. Though Portugal is doing well in attracting women to careers in research by investing in their training, the country and society will not benefit if these women researchers do not have the conditions they need to succeed. We really need to look at these data to understand and address these problems.

Given the diversity of perceptions on gender issues, what do you consider to be the most important factors that influence progress toward equity for women and men in research?

The question of confidence is very important. The report's finding that women publish less based on the stage of their career may be related to family responsibilities, but I think it is also linked to confidence. I have found that women are less confident than men in publishing their work, and they are less confident in giving public lectures and interviews, which are required for exams, advancement and high-level posts. Men are also more likely than women to apply for a post, even if they are not qualified. This lack of confidence means that women are not able to demonstrate their full potential as scientists.

Also, men benefit from networking in a way that women do not. Fewer women in Portugal are directors or heads of universities because the system continues to depend on personal contacts and networking. I experienced this in my training and though it might be getting better, issues with networking continue to affect career advancement for women.

What combination of interventions do you think are necessary to accelerate greater equity for women and men in research?

The Foundation for Science and Technology has begun offering training for skills such as interviewing, but we need more interventions that address the confidence issue. Overall, Portugal needs to apply the same kind of attitude toward career development that we have applied in attracting women to careers in science.

What information/insight from the report do you find particularly interesting and important for policymakers and institutional leaders to consider in Portugal or in a specific subject area(s)?

Portugal, Brazil and Argentina performed very well in the report. These countries all have very traditional societies. It could be that from a very early age, girls understand that the way to carve out a position in society is by doing well in school. I come from a very traditional region in the south of Portugal, and I made a conscious decision early on to be a good student. To be the best student. In fact, girls in Portugal

consistently perform better in school than boys at all levels. I have heard the same from women researchers in Turkey, where women have excelled in physics, engineering and maths, and now are heads of some institutions. They feel that the way out of a very conservative society is to be the best in class.

Trends identified from scientific publications are confirmed for both awarded grants and even more so when analysing patents. What does this say about a gender innovation gap?

I expected to see this because women in Portugal are doing more fundamental research than applied research. We still do not have a significant number of women represented in the digital area. In addition, most researchers in Portugal remain in the public sector, rather than being hired in the private sector. We will need to push the investment we have made in our researchers so that the private sector can also benefit.

Thinking about the future of gender diversity and equity in research globally, where do you think Portugal will be in 10 years' time and what organisational and/or cultural issues do you think will influence change most significantly?

We need to address the family-work balance, but this will be very difficult, especially in countries where women traditionally take care of the family. We need to boost women's confidence, so they are successful as their careers progress, so that we do not lose the investments made in the early stages of their career.

What could other countries learn from Portugal's policy choices? What recommendations would you propose to other policy makers?

At a very young age, girls decide what they want to do, or even more, what they don't want to do. So it's important to start engaging children and young girls in science very early and consistently. But interventions need to address the entire career pathway, from training to recruitment to later stages of career development and advancement. The leaky pipeline, the glass ceiling, the pay gap – all these phenomena require policies that are consistent and sustained over years and decades.

2.4 Bernard Magenhann

Deputy Director-General, Joint Research Centre,
European Commission

Can you describe the role of the Joint Research Centre and its efforts in the area of gender equity in research?

As the science and knowledge service in the European Commission, the Joint Research Centre (JRC)⁶ employs some 2,000 scientists and technicians at six sites across Europe (in Belgium (2), Germany, Italy, Netherlands and Spain). By the end of 2019, women represented 39% of JRC staff. We make continuous efforts to meet the European Commission's targets for gender balance, notably in management positions.

We integrate gender into our policy support research too. For example, we collect data on diversity and female representation in Artificial Intelligence and work with our partners in the Justice and Consumers Directorate-General and the European Agency for Gender Equality to monitor the Commission's Gender Equality Strategy 2020–2025⁷.

We are very much supported by Commissioner Gabriel, who is responsible for European Innovation, Research, Culture, Education and Youth. She is determined to step-up efforts on gender equality and give more support to talented women in research and innovation. Commissioner Gabriel is also committed to ensuring that the gender dimension is fully integrated into EU research and innovation programmes. For example, she launched the #EUwomen4future⁸ campaign, featuring extraordinary women active in research, innovation, education, culture and sport.

How would you describe the current state of gender diversity in global research compared to five years ago, and its impact on research and/or on researchers globally?

The situation has improved over time—we are better off today than we were five years ago—but the pace of change is slow and that is not so encouraging. The COVID-19 pandemic has also interrupted the pace of progress, and to a certain extent, it has set progress back. This was highlighted by the European Commission at this year's International Women's Day, where it presented its 2021 report on gender equality in the EU, based in part on analyses we performed⁹.

To give a snapshot, we saw that the rate of publications by female authors decreases over their career. While, on average, women outnumber men at the student and graduate levels, and we reach broad gender balance at the PhD level, their distribution in the different scientific fields of study is uneven. In the STEM fields, this trend is even worse, and international research organisations face difficulties in attracting an equal number of women and men.

There are likely persistent gender stereotypes at work here. To some extent, organisations are not just recruiting the researcher, but also the researcher's family. Unfortunately, the career of male partners is still dominant when families must make a choice to move for a career or job. This is probably one of the reasons why it is so challenging to recruit women researchers in international science careers and there remains a gender imbalance, particularly in higher-level management positions.

Are there initiatives, policies or interventions that have emerged within Portugal and/or other countries in the last three to five years that you feel have impacted progress and should be monitored to assess impact?

Portugal's share of female researchers in the government and higher education sectors was around 44% during 2010–2019, which is significantly higher than the 32% average for EU27. I think the good results in Portugal are driven by policy measures that were adopted at all levels—nationally, regionally, at universities and research organisations, private foundations and companies¹⁰. Portugal has tried, with some success, to embed gender equality as part of everyday normal life. This effort was led by the Portuguese Minister of Science and Technology, who was “walking the talk” and driving the implementation of these measures from the highest level of the government.

At university level, Portugal also established gender equality plans for students, which can have an impact at the early stage of a research career. Although getting these plans approved was challenging, they have contributed to an overall awareness in Portugal of the importance of gender diversity and equity and a normalisation of women in science. Finally, Portugal focused on outreach to raise awareness of women in science and change the thinking about gender equity in research.

Similar initiatives have had the same goal. For example, in 2004, the L'Oréal Portugal – Medals of Honour for Women in Science was launched as a partnership between UNESCO's National Commission and the national Foundation for Science and Technology. This initiative recognised and supported female early-stage scientists to pursue their research projects in health and environment. Since its creation, more than 50 female scientists in Portugal have received the medal.

Going beyond Portugal, I would say that one commonality is that these messages on gender equality must come from the top. Clearly, the overall research environment would benefit greatly by being more gender balanced. One measure that I would very much support is to make women in science more visible to the public, notably to children and students, for example, by having more women who work in STEM visible in the media. It is also important that we see women among the top scientists in the world; it is hugely impactful that the latest Nobel Prize in Chemistry was given to two outstanding female scientists who work in gene technology (Emmanuelle Charpentier and Jennifer A. Doudna).

At the European Commission too, Commissioner Gabriel is dedicated to promoting gender equality, including as part of Horizon Europe and via the aforementioned #EUWoman4Future campaign she launched⁸. This initiative is strongly supported by the Commission's President, Ursula von der Leyen¹¹.

These efforts make a great impact on attitudes toward gender equity in science.

What value do data and an evidence base offer as tools to policymakers and institutional leaders to address issues of gender diversity and equity?

Sound scientific evidence and data are at the core of what we do at the JRC. It is incredibly important to provide policymakers with relevant, independent, evidence-based knowledge to inform their work. On gender, JRC gathers data on the current state of gender equality, and what is working or not working in certain areas, for use by policymakers. We also monitor policy, providing data on whether it is having the desired impact.

At the moment, I look forward to tracking the impact of New Generation EU¹², a €750 billion recovery package to help repair the economic and social damage caused by the coronavirus pandemic, which was agreed on by European leaders as part of a €1.8 trillion EU budget for the period 2021–2027. Of the many aspects in this package, the potential new job opportunities that Europe's twin green and digital transitions will open up is hugely important. These will be the jobs of the future for our children. We have an opportunity to think proactively about how to achieve gender equity and spark interest among young girls and women in pursuing these new jobs.

At the same time, we need to maintain the gains we have already made in other sectors. For example, the health sector in Europe is close to achieving gender balance, but what about tomorrow? How has the pandemic affected gender equity in this sector and what policies are needed to keep the gains we've made?

Given the diversity of perceptions on gender issues, what do you consider to be the most important factors that influence progress toward equity for women and men in research?

It is clear that gender-balanced teams share different ideas and bring a diversity of thinking that enriches the final outcome of the work. Lack of diversity on a research team results in less impactful outcomes. Did you know, for example, that voice recognition systems perform worse for women than for men? This is a consequence of not enough women working in AI. There are many other such examples of the negative effect of gender imbalance among researchers.

I see two fundamental and related issues that influence a lack of diversity in research and could be addressed. The first is a deficit model, where the culture, the education system, the societal attitudes, lead women to think that science and research is not for them. A few years ago, we did an analysis¹³ for policymakers on the interest in STEM fields among young boys and girls. We found that 29% of 15-year-old boys, but only 10% of girls, aspire to a STEM-related occupation in Europe. Beyond this, we also found that women are less likely than men to apply to management positions. It's not clear why, but women may feel they don't have access to certain positions within an organisation.

The second is caused by formal or informal legal, political and social obstacles that negatively affect women. This is a system-level bias that makes an organisation less open or welcoming to women, where not all the functions of an organisation are made accessible to them. When this leads to organisations with no women in top management positions, you not only lose the benefits of diversity in thinking, but it is also less likely that women will feel comfortable seeking a position in that organisation.

Policies and interventions can move us toward more sustained gender equality and diversity in universities and research institutes, as well as companies. But it will take a combination of strategies, promoted from the top, that move down through every level to promote an inclusive culture and practice and support female researchers through their careers. As I mentioned before, the European Commission takes this very seriously, as evidenced in its EU Gender Equality Strategy 2020–2025¹⁴, which calls for a gender-equal Europe, as well as the Gender Action Plan III (GAPIII)¹⁵ for external EU actions. We can also look to Portugal and consider how to apply their initiatives consistently and broadly across Europe.

What information/insight from the report do you find particularly interesting and important for policymakers and institutional leaders to consider in Portugal or a specific subject area(s)?

At least two things came out from the report that I feel are very important. While women are highly represented among authors in Portugal, this high representation is not consistent across subject areas. Women are under-represented in the physical sciences, although their representation exceeds the EU28 average. This seems to show a persistence of gender stereotypes and the continuing need to focus on STEM. Indeed, STEM remains one of the most markedly segregated fields of work and one where the pace of improvement is very slow. We can have action plans and promote gender equity policies, but at the end of the day, if we do not tackle the origin of the problem, things will not change.

The second point is that the ratio of women to men amongst authors in Portugal has remained stable over the last nine years, which is not the case elsewhere. What has Portugal done differently to keep this ratio stable? It would be interesting to dig more into what Portugal is doing to see how they achieve this sustained effect.

What could other countries learn from Portugal's policy choices? What recommendations would you propose to other policy makers?

I think the recipe for success in Portugal has been their plan of gender equity policies implemented at all levels—national, regional, local— applied consistently over time, combined with outreach and communication efforts to promote the idea that women can have successful careers as researchers, as well as celebrating the achievements of women in science. It was also important that these changes came from the top, to embed the idea within the culture that gender equity is important.

Overall, I was really impressed by what Portugal has done and what they have achieved, and I think it can be a good example for other countries.

Thinking about the future of gender diversity and equity in research globally, where do you think Portugal will be in 10 years' time and what organisational and/or cultural issues do you think will influence change most significantly?

Looking ahead, how can we achieve full gender equality? It really requires that the idea, that the value of gender equity, becomes embedded in society. It needs to become normal and logical that a woman makes the same salary as a man for the same work. At some point, gender equity interventions and enforcement will no longer be needed, because the concept will have become normalised. If Portugal succeeds at this, in 10 years, I would expect to see maintenance of gender balance without the need for an action plan or targeted promotion. That's the ultimate objective for other countries too.

To end on a positive note, the culture is changing and that is good. My generation normalised working very long hours in the office and on weekends. I meet young people today who are looking for a good work-life balance in their careers. It will take time, and there is a generation gap, but attitudes are changing. We happen to be in a unique situation, created by the COVID-19 pandemic, which had a particularly negative effect on women. As we come out of the pandemic, I hope we will see new HR policies that allow more teleworking and more flexibility for working families. I hope organisations start to normalise teleworking as an option, with benefits in terms of a better work-life balance. The pandemic was incredibly disruptive, but it also gives us an opportunity to understand what wasn't working and how things can be improved moving forward.

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