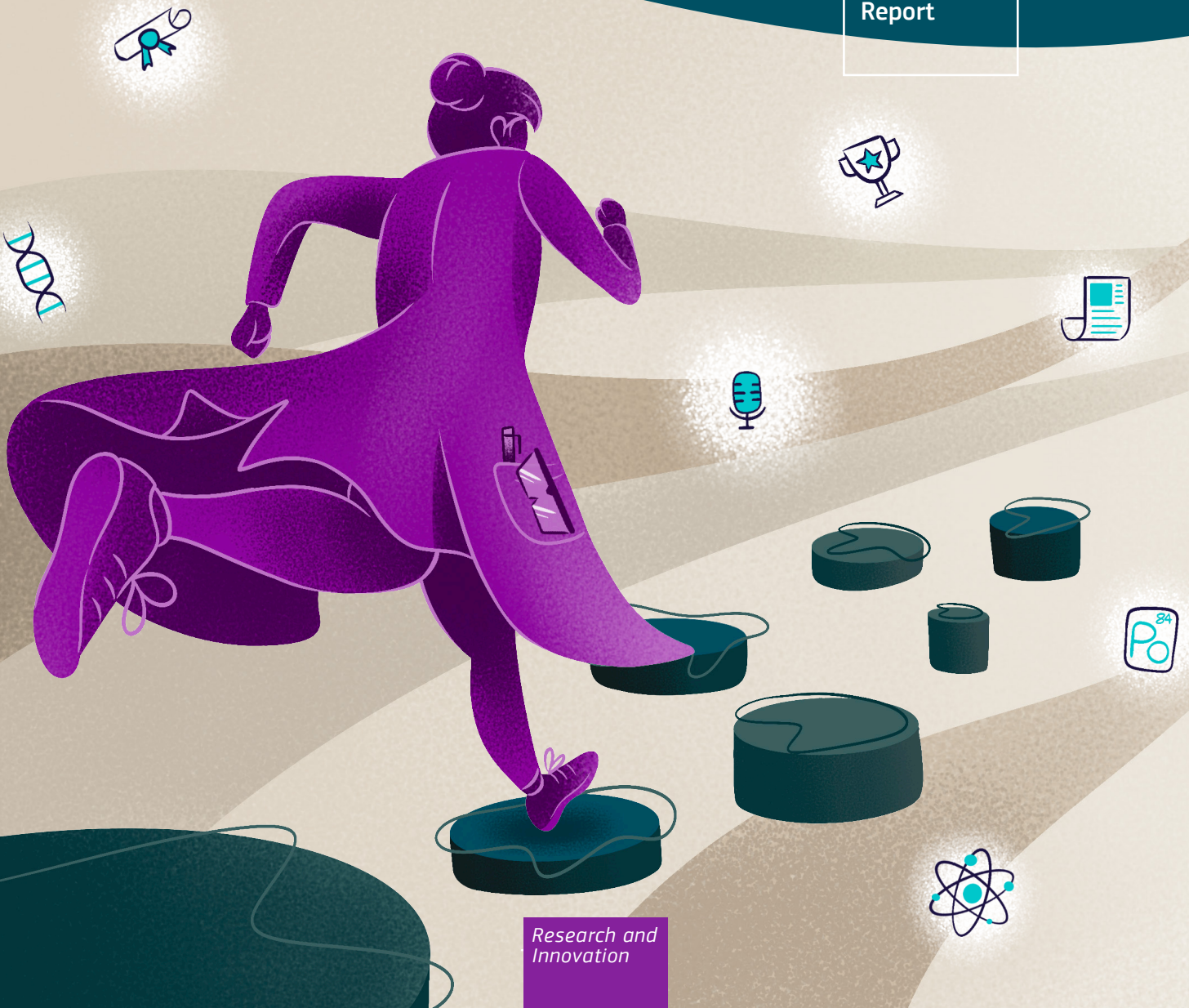European Commission

POLICY REPORT
SHE FIGURES
2024

Independent
Expert
Report

Research and
Innovation

She Figures 2024

Policy Report

ACKNOWLEDGEMENTS

DISCLAIMERS

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CONTENTS

INTRODUCTION

This policy report accompanies the She Figures 2024 publication, which presents gender statistics in research and innovation (R&I). The themes covered in the report are complementary to the She Figures 2024 chapters, with articles analysing the policy landscapes associated with R&I thematic areas and reflecting related data gaps. Each article includes in-depth and evidence-based analysis, providing informed policy conclusions.

This report includes four articles produced by leading experts on gender equality in R&I:

1. **Gender Equality Plans (GEPs) in research organisations and higher education institutions as a catalyst for transformative and sustainable change**. This article discusses the evolution of EU policy in relation to GEPs before exploring 66 GEPs to identify their progress towards advancing gender equality. Drawing on the insights of feminist institutionalism, this article assesses what further is required for the trajectory towards gender equality in research organisations and higher education to be sustained.

2. **Data collection and analysis for inclusive GEPs: Intersectional challenges and solutions for R&I institutions**. This article addresses the need for inclusive GEPs in research and innovation, with a focus on the challenges of collecting and analysing intersectional data for structural change. It discusses practical steps and offers guidance for intersectional data collection, highlights the significance of measurement and analysis from an intersectional perspective and introduces innovative methods for analysing intersectional data.

3. **Promoting inclusive gendered innovation through academic spin-offs.** This article explores the topic of academic spin-offs and inclusive gendered innovation in Europe, including the corresponding European policy framework in. Specifically, it explores data relevant to the innovative and entrepreneurship ecosystem, and highlights the importance of academic spin-offs as the intersection of higher education and entrepreneurship.

4. **Women's participation in research teams and uptake of discoveries in innovation and policy**. This article covers gender associations with outcomes measuring business potential and guiding principles for decision making, using multivariate regression models. With limited research on this specific area in R&I, it provides recommendations for relevant further research.

1. Gender Equality Plans in research organisations and higher education institutions as a catalyst for transformative and sustainable change

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Abstract

Gender Equality Plans (GEPs) play a pivotal role in shaping the European Union's commitment to fostering sustainable structural change in Research organisations regarding gender equality. This article considers the dynamic evolution of the EU policy surrounding GEPs, assesses the state of play with regards to GEPs following the requirements at EU level, and poses the question: What further can be done to deliver the transformative potential of GEPs, embed their sustainability and advance towards inclusiveness at greater speed? Drawing on the insights of feminist institutionalism, which highlights the relevance of informal practices as well as formal rules in shaping an organisational culture, the study considers 66 GEPs, supported by EU funding, to identify their progress towards advancing gender equality. It finds that the concentrated attention to addressing gender equality deficits in research organisations in these projects has had a positive impact. It finds evidence of incremental reform, or 'layering' as the dominant strategy for change, resulting in improvements in organisational policy, practices and culture. The article underscores the need for further reinforcement through inclusive gender equality for the trajectory towards gender equality in research organisations and higher education to be sustained. It makes policy recommendations arising from the analysis.

1.1. Introduction

In 2021, the Standing Working Group on Gender in Research and Innovation under the European Research Area and Innovation Committee (ERAC SWG GRI) compiled a report on Gender Equality Plans (GEPs) as a catalyst for change. In summary conclusions, the report noted that

…'it is of utmost importance to advance policy dialogue and coordination on issues related to GEPs, in particular the definition of a GEP and building a political consensus around the GEP definition, the monitoring of the uptake of GEPs in national R&I systems, and the monitoring and evaluation of GEP impact as well as capacity building and continued mutual learning and exchange at the policy level.' ([1])

Three years on, GEPs are the main instrument for addressing entrenched gender inequalities in both research performing and research funding organisations in the European Union, and are deployed to catalyse change in these complex institutional environments ([2]). Experience with GEP

([1]) European Research Area and Innovation Committee Standing Working Group on Gender in Research and Innovation (ERAC SWG) Taskforce on Gender Equality Plans, *Gender Equality Plans as a Catalyst for Change. Report from the Standing Working Group on Gender in Research and Innovation*, 2021, p. 4, ERAC 1202/21, https://data.consilium.europa.eu/doc/document/ST-1202-2021-INIT/en/pdf

([2]) Tzanakou, C., Clayton-Hathway, K. and Humbert, A.L., 'Certifying gender equality in research: Lessons learnt from Athena SWAN and Total E-Quality award schemes', *Frontiers in Sociology,* Vol. 6, 2021; Clavero, S. and Galligan, Y., 'Delivering gender justice in academia through gender equality plans? Normative and practical challenges', *Gender, Work & Organisation,* Vol. 28, No 3, 2021,

implementation now shows that a multi-level collaborative approach and alignment of effort between the national/regional (macro), institutions (meso), and situations (micro) offers the optimum prospect of delivering sustained change ([3]).

Substantial progress has been made, aided by the introduction of a new eligibility criterion under Horizon Europe requiring certain types of legal entities ([4]) to have in place a GEP for funding eligibility (applicable as of calls with deadlines from 2022 onwards) ([5]). This criterion, above all, has reinforced the role of GEPs as an instrument for institutional structural change.

It is now timely to consider **what further can be done to deliver the transformative potential of Gender Equality Plans, embed their sustainability and advance towards an inclusive equality at greater speed**? To address this question, this paper is organised as follows: section 3 discusses the background to this research – the evolution of EU policies on gender equality in research and innovation and the spread of GEPs as an instrument of change. This is followed by a discussion of the analytical approach adopted in this article, that of feminist institutionalism. This approach highlights the relevance of informal practices as well as formal rules in shaping an organisational culture. The section also discusses the strategies of 'layering' and 'displacement' employed by gender equality practitioners as they seek to effect institutional change. Next, the results of a review of 66 GEPs designed and put into effect between 2018 and 2023 are discussed. In the concluding section, summary observations of the potential for transformative and sustainable change are presented along with policy recommendations to the European Commission, national funding bodies and national ministries.

1.1.1. The evolution of gender equality policies in European research and innovation

Gender equality is a fundamental value of the European Union, and is one of the United Nations (UN) Sustainable Development Goals. In giving substance to these European and UN commitments, the promotion of gender equality is designated as a task and an activity of the Union. Attention to the promotion of gender equality in research and innovation dates from 1999 when the European Commission published the Communication *Women and Science. Mobilising women to enrich European research*, indicating clearly the strategic importance of this issue for the Union ([6]). The Helsinki Group on Women and Science was established in November 1999, following this Communication ([7]).

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pp.115-1132; Tardos, K. and Paksi, V., 'Diversity management and gender equality outcomes in research, development and innovation organisations: Lessons for practitioners', *Review of Sociology,* Vol. 28, No 4, 2019, pp. 166-190.

([3]) European Commission, *Impact of Gender Equality Plans across the European Research Area*, Luxembourg: Publications Office of the European Union, 2024 (forthcoming), p. 83.

([4]) Public bodies, such as research funding bodies, national ministries or other public authorities, including public-for-profit organisations; Higher education establishments, public and private; Research organisations, public and private.

([5]) Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee of the Regions, *A new ERA for Research and Innovation,* COM(2020) 628, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A628%3AFIN

([6]) Communication from the Commission, *Women and Science. Mobilising women to enrich European Research,* COM(1999) 76 final, http://aei.pitt.edu/13321/1/13321.pdf

([7]) Composed of national representatives involved in the promotion of women in scientific research in Member States and Associated Countries, the Helsinki Group was an expert advisory group to the Commission with a mandate to promote discussion and exchange of experiences on the measures and policies to encourage the participation of women in scientific research. It also provided sex-disaggregated statistics to assess the situation of women scientists in the member states and associated countries. It later became the Helsinki Group on Gender in Research and Innovation. Following a review of the European Research Area advisory structure,

Under the EU's 7th Framework Programme for Research (FP7), which began in 2007, the need for structural and institutional change to address persistent gender inequality in research and innovation – especially via gender equality plans - evolved. An 18-month project, 'Practicing Gender Equality in Science' (PRAGES, April 2008-Dec 2009), laid the foundation for subsequent GEP-focused projects by collecting good practices on gender equality in research performing institutions in European countries and benchmarking them against progressive initiatives worldwide ([8]).

Funding to specifically support the development of gender equality plans commenced in 2010 under the Science in Society (SiS) Programme Part of FP7, beginning with the projects 'The Gender in Science and Technology LAB' (GENIS LAB) ([9]) and 'INstitutional Transformation for Effecting Gender Equality in Research' (INTEGER) ([10]). Nine projects were supported to develop GEPs in this first call. The 2012 report of the Expert Group on Structural Change shifted focus away from building capacity among women scientists and researchers to addressing structural systemic barriers to gender equality such as opaqueness in decision-making, unconscious bias, cognitive errors in assessing merit, gender bias in scientific research, and the persistence of the gender pay gap and gendered workplace practices ([11]). This report pointed the direction for subsequent GEPs. The evolving legal, strategic, policy and practice framework on tackling the structural conditions leading to gender-based inequalities in research and innovation provided a basis for the European Commission Communication on the European Research Area (ERA) in 2012. This Communication sought to prioritise gender equality and gender mainstreaming in research and innovation ([12]). Three ERA objectives for gender equality were stated: gender balance in research teams, gender balance in decision-making, and the gender dimension in research. The Communication was reinforced in 2015, when the European Council adopted a set of conclusions on the advancement of gender equality in the ERA that called on Member States and research funding organisations (RFOs) to support research performing organisations (RPOs) revise or develop gender equality plans ([13]). As a result, two Member States adapted their existing policies and another 10 states introduced new ones ([14]).

Following the Council conclusions, the Horizon 2020 Science with and for Society (SwafS) funding programme supported an additional 21 projects to deliver greater gender equality. The GEPs

the Helsinki Group was terminated and replaced by the European Research Area and Innovation Committee (ERAC) Standing Working Group on Gender in Research and Innovation (SWG GRI) in 2017. Following a review of its mandate, the SWG GRI built on, and in some cases continued the work of the Helsinki Group. See: Linkova, M., *GENDERACTION Deliverable 5.2 Annual Reports to the Helsinki Group*, 2021, https://h2020.genderaction.eu/wp-content/uploads/2021/09/741466_D5-2_Reporting-to-SWG-GRI_submitted.pdf

([8]) 'Practicing Institutional Gender Equality in Science' (PRAGES), https://cordis.europa.eu/project/id/217754

([9]) 'The Gender in Science and Technology LAB' (GENIS LAB), https://cordis.europa.eu/project/id/266636/reporting; Linková, M. and Mergaert, L., 'Negotiating change for gender equality: identifying leverages, overcoming barriers', *Investigaciones Feministas (Feminist Research),* Vol. 12, No 2, 2021, pp. 297-308.

([10]) 'Institutional Transformation for Effecting Gender Equality in Research' (INTEGER), https://cordis.europa.eu/project/id/266638/reporting

([11]) European Commisson, *Structural change in research institutions: Enhancing excellence, gender equality and efficiency in research and innovation*, Report of the Expert Group on Structural Change, Luxembourg: Publications Office of the European Union, 2012.

([12]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions, *A Reinforced European Research Area Partnership for Excellence and Growth,* COM(2012) 392 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52012DC0392

([13]) Council of the European Union, *Council Conclusions: Advancing gender equality in the European Research Area*, 14846/15, 2015, https://data.consilium.europa.eu/doc/document/ST-14846-2015-INIT/en/pdf

([14]) European Commission, *Impact of Gender Equality Plans across the European Research Area*, Publications Office of the European Union, Luxembourg, 2024 (forthcoming), p. 26.

produced collectively created a critical mass of knowledge and analysis of the drivers of gender inequality in research and innovation, along with short, medium and long-term solutions to address this persistent inequality in science. This state-of-the-art knowledge on equality-promoting practices and institutional change was utilised by the European Commission and the European Institute for Gender Equality (EIGE) to co-develop the GEAR tool in 2016 - a step-by-step guide to designing and implementing GEPs, updated in 2020 and 2022 ([15]). In 2018, the Commission signalled that impact at national level would be a consideration from 2020, and encouraged national authorities to become involved in projects' advisory structures ([16]). Furthermore, Commission guidance on the development of GEPs emphasised that these are not static plans, but are intended as 'an ongoing process for improving gender equality to the benefit of the entire organisation', and follow an ever-adjusting cycle of audit, planning, implementation, monitoring and evaluation ([17]). Since this time period, the Commission introduced strengthened provisions for gender equality in Horizon Europe. These included specific funding for inclusive GEPs in research and innovation organisations across Member States and associated countries under the 'Widening Participation and Strengthening the European Research Area' part of the Programme; and funding was dedicated to gender studies and intersectional research, especially in Pillar II Cluster 2 – Culture, Creative and Inclusive Society. Attention was paid to ensuring gender balance in evaluation panels and other relevant advisory bodies, while gender balance among researchers involved in projects was strongly encouraged and was taken into account for equally-ranked proposals. The GEAR tool was promoted as an aid to the development of GEPs, while the GE Academy project offered capacity-building training resources and the ACT project supported the development of Communities of Practice to advance knowledge, collaborative learning and institutional change through GEPs. By 2021, over 200 research performing and research funding organisations had been supported to implement GEPs ([18]).

This policy context evolved in tandem with growth in the mobilisation of national ministries and RFOs to support the expanding institutional adoption of GEPs ([19]). The European Commission's Gender Equality Strategy 2020-2025 strengthened policy for gender equality in research and innovation in addition to signalling the upcoming requirement of GEPs from funding applicants to Horizon Europe ([20]). The Strategy adopted a dual approach of strengthened gender mainstreaming combined with targeted measures. Intersectionality was a cross-cutting principle in the implementation of the Strategy ([21]). The inclusion of intersectionality in a future gender equality policy framework was recommended in an evaluation report on the previous 2016-2019 strategy ([22]). In tandem, having a GEP in place was introduced as a mandatory requirement in 2020 for

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([15]) EIGE, *Gender Equality in Academia and Research – GEAR tool*, 2022, https://eige.europa.eu/gender-mainstreaming/toolkits/gear

([16]) European Commission, *Horizon 2020 Science with and for Society*: *Supporting research organisations to implement gender equality plans* (SwafS-09-2018-2019-2020), 2018, https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/swafs-09-2018-2019-2020

([17]) European Commission, Directorate-General for Research and Innovation, *Horizon Europe Guidance on Gender Equality Plans (GEPs)*, Publications Office of the European Union, Luxembourg, 2021, pp. 11-12.

([18]) European Commission, Directorate-General for Research and Innovation, *Gender equality: a strengthened commitment in Horizon Europe*, Publications Office of the European Union, Luxembourg, 2021.

([19]) European Commission, Directorate-General for Research and Innovation, *Horizon Europe Guidance on Gender Equality Plans (GEPs)*, Publications Office of the European Union, Luxembourg, 2021, p. 8.

([20]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions, *A Union of Equality: Gender Equality Strategy 2020-2025.*,COM(2020) 152final, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0152

([21]) Intersectionality is explained in the *Gender Equality Strategy 2020-2025* as 'the combination of gender with other personal characteristics or identities, and how these intersections contribute to unique experiences of discrimination'.

([22]) González Gago, E., *Evaluation of the strengths and weaknesses of the strategic engagement for gender equality 2016-2019*, European Commission, Directorate-General for Justice and Consumers, 2020, pp. 55, 65,

Horizon Europe funding eligibility as part of the plans for a new ERA (²³). This provision has accelerated the use of GEPs as an instrument for the promotion and delivery of greater gender equality in research and innovation, accompanied by an increase in supporting and facilitating actions such as trainings and workshops on GEPs, dedication of institutional resources to gender equality, and an increase in requests to National Contact Points in order for beneficiaries to comply with the eligibility criterion (²⁴).

By 2020, the Commission proposed a new European Research Area (ERA) for research and innovation that built on the achievements of the previous 20 years of ERA, and recognised that further improvements could be made in a number of key areas including gender equality. The new ERA planned to give more attention to the participation of women in Science, Technology, Engineering and Mathematics (STEM) fields, and foster entrepreneurship among women. Importantly, it described an inclusive approach to gender equality, through 'opening policy to intersections with other social categories, such as ethnicity, disability and sexual orientation, as well as gender-based discrimination and violence in R&I organisations'. It laid out a plan for a stronger ERA through four strategic objectives and 14 actions, including development of 'inclusive GEPs with Member States and stakeholders in order to promote EU gender equality in research and innovation' starting in 2021 (²⁵).

The 2021 Ljubljana Declaration on Gender Equality in Research and Innovation, presented by the Slovenian Presidency of the Council of the EU, reinforced the point that achieving gender equality was 'one of the core shared values of the new ERA'. It re-emphasised the importance of 'gender equality objectives, including gender equality in research careers, gender balance in decision-making and the integration of the gender dimension in research and innovation content'. The declaration further expanded this agenda in three major aspects: it identified the need to develop effective responses to gender-based violence; agreed an intersectional approach to gender equality; and recognised GEPs as the most significant policy instrument for achieving long-term and sustainable advancement towards institutional gender equality (²⁶). The declaration was endorsed by 35 parties, including member states, the European Commission, associated countries, accession countries and third countries (²⁷).

At the Competitiveness Council of November 2021, a new Pact and governance structure for the ERA was adopted which reaffirmed gender equality and inclusiveness as core values and

https://commission.europa.eu/document/download/4cf0f607-1993-4f6f-827e-5698ca0f6928_en?filename=strategic_engagement_2016-2019_evaluation.pdf

(²³) Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee of the Regions, *A new ERA for Research and Innovation,*. COM(2020) 628, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A628%3AFIN

(²⁴) Knapińska, A. and Chrobak-Tatara, M., *GENDERACTIONplus Deliverable 6.1 Benchmarking analysis of monitoring/evaluation of GEPs*, 2023, https://genderaction.eu/wp-content/uploads/2023/07/GENDERACTIONplus_D6.1_Benchmarking-analysis-of-monitoringevaluation-of-GEPs.pdf

(²⁵) Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee of the Regions, *A new ERA for Research and Innovation,* COM(2020) 628, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A628%3AFIN

(²⁶) Wroblewski, A., *GENDERACTIONplus Deliverable 5.1 First report on monitoring ERA action implementation at national level*, 2023, p. 12, https://genderaction.eu/wp-content/uploads/2023/09/GENDERACTIONplus_D5.1_First-report-on-monitoring-ERA-action-implementation-at-national-level.pdf

(²⁷) Slovenian Presidency of the Council of the European Union, *Ljubljana Declaration: Gender Equality in Research and Innovation,* 2021, https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/PSEU/Ljubljana-Declaration-on-Gender-Equality-in-Research-and-Innovation-_endorsed_final.pdf

principles for European research and innovation ([28]). This was further elaborated in the ERA Policy Agenda 2022-2024 with a specific action 'to promote gender equality and foster inclusiveness', taking note of the Ljubljana declaration. The Action was associated with four interlinked expected outcomes, one of which is the development of a 'policy coordination mechanism to support all aspects of gender equality through inclusive Gender Equality Plans and policies, and a dedicated EU network on their implementation' ([29]). In March 2023 a subgroup of the Commission Expert Group ERA Forum dedicated to Action 5 held its inaugural meeting. Entitled 'Inclusive Gender Equality in the European Research Area'. It has a mandate to support the implementation of Action 5 of the ERA Policy Agenda 2022-2024, and will follow up on the work of the ERAC Standing Working Group on Gender in Research and Innovation ([30]).

In 2022, a Commission Communication on the European Strategy for Universities observed that gender equality, diversity and inclusion have become more important for higher education, with the under-representation of staff from disadvantaged backgrounds, the persistence of gender gaps in study and research, and significant gender imbalances in top decision-making. Among the recommendations to build a more inclusive higher education area, the Commission called on Member States to adopt inclusive gender equality plans as a vehicle for institutional change ([31]). As of 2021, nine Member States (AT, DE, DK, ES, FI, FR, IE, PT, SE) and four Associated Countries (IL, IS, NO, CH) had a formal GEP requirement of their higher education institutions ([32]). A 2022 study conducted under GENDERACTIONplus ([33]) and research conducted as part of She Figures 2024 additionally identified national GEP requirements which apply to higher education institutions in Greece and Croatia, and mechanisms or policies to support GEP implementation in Czechia and Malta.

A specific strand devoted to strengthening the European Research Area was announced in 2023, with the objective of making it more competitive, resilient and appealing as a research area. It committed to undertaking three initiatives – a proposal on a Council Recommendation on a new European framework to attract and retain research, innovation and entrepreneurial talents in Europe; a new Charter for Researchers to include a better integration of gender equality and inclusiveness; and a European Competence Framework for Researchers to assist with researcher mobility ([34]). The subsequent Council Recommendation of 18 December 2023 on a European

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([28]) This was elaborated as follows: 'Ensure fair, open, inclusive and gender-equal career paths in research to facilitate systemic institutional and structural change in R&I funding and performing organisations; counteract gender-based violence and sexual harassment; remove inequities regardless of gender, racial or ethnic origin, religion or belief, disability, age or sexual orientation; monitor and evaluate national gender equality policies and plans in R&I' (Council of the European Union, *Council Recommendation on a Pact for Research and Innovation in Europe*, 13701/21, 2021, https://data.consilium.europa.eu/doc/document/ST-13701-2021-INIT/en/pdf).

([29]) Council of the European Union, *Conclusions on the future governance of the European Research Area,* 14126/21, 2021, https://data.consilium.europa.eu/doc/document/ST-14126-2021-INIT/en/pdf

([30]) The terms of reference of the ERA Action 5 subgroup 'Inclusive Gender Equality in the European Research Area (E03833/4)' are available at https://ec.europa.eu/transparency/expert-groups-register/screen/expert-groups/consult?lang=en&fromMainGroup=true&groupID=103813

([31]) Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee of the Regions *on a European Strategy for Universities,* COM(2022) 16final, https://education.ec.europa.eu/document/commission-communication-on-a-european-strategy-for-universities.

([32]) ERAC SWG GRI, *Gender Equality Plans as a Catalyst for Change*, ERAC 1202/21, 2021, p. 11, https://data.consilium.europa.eu/doc/document/ST-1202-2021-INIT/en/pdf

([33]) GENDERACTIONplus, *Deliverable reports*, 2023, https://genderaction.eu/wp-content/uploads/2023/07/GENDERACTIONplus_D6.1_Benchmarking-analysis-of-monitoringevaluation-of-GEPs.pdf

([34]) European Commission (2023b). *Proposal for a Council Recommendation on a European Framework to attract and retain research, innovation and entrepreneurial talents in Europe*. COM(2023) 436final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52023DC0436.

framework to attract and retain research, innovation and entrepreneurial talents in Europe recognised the need to address continuing gender inequalities in research careers, including the gender pay gap, career progression, gender biases in assessment, work-life balance and gender-based violence. It observed that each of these features, alone and in combination, contribute to the continuation of gendered inequalities in research careers and prevents the advancement of gender equality. It further recognised that women face specific barriers to pursuing research careers at early and mid-stages. It also noted that specific measures are required to address women's under-representation in STEM fields in research and innovation, and in higher education. In this regard, it referred to the European strategy for universities which proposed a manifesto on gender-inclusive STE(A)M education. The Council Recommendation proposed a specific focus on the promotion of women entrepreneurship and innovation, and on the creation of women-led university spin-offs. It also promoted the use of sustainable institutional change instruments, such as inclusive GEPs, as being among the actions identified to address these issues [35].

Because of the ongoing concentration of activity on delivering an equitable European Research Area, the data indicate improvements over time, though there is some way to go to achieve gender equality. Based on She Figures 2024 data, women comprise just over one-quarter (25.4 %) of self-employed professionals in science and engineering, information and communication technologies. In addition, women continue to be significantly under-represented in academic Grade A (full professor or equivalent) posts (29.7 %), lead just over one-quarter of European higher education institutions (26.4 %), and receive less research funding than men (-2.5 %). Furthermore, less than 2 % of scientific publications incorporate a gender dimension in their content [36].

The policy and practice environment in European research and innovation has evolved over the last decade to embedding the use of GEPs as an instrument of transformational change towards gender equality in research performing organisations, while encouraging research funding organisations, national ministries and regional or national agencies to implement supportive measures to facilitate that change. This evolution has shifted the focus from one of 'fixing women' to one that aims to address the structural causes of gender and intersectional inequalities in research and higher education – in other words, to 'fixing the institutions' [37]. Over the last decade, the European Union has legitimised gender equality as a goal of importance in its own right, and for generating excellence in research and innovation. Arguably, this direction goes further than institutional-fixing, as it also addresses the third dimension of gender mainstreaming, 'fixing the knowledge'. This provides gender equality advocates in the research and higher education environment with a strong policy and discursive framework with which to develop and implement GEPs as an instrument of institutional change towards gender equality.

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[35] Council of the European Union (2023). *Council Recommendation of 18 December 2023 on a European framework to attract and retain research, innovation and entrepreneurial talents in Europe* (C/2023/1640), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C_202301640.

[36] European Commission, Directorate-General for Research and Innovation, *S*he *Figures 2024,* Publications Office of the European Union, Luxembourg, 2024 (forthcoming).

[37] European Commission, *Structural change in research institutions: Enhancing excellence, gender equality and efficiency in research and innovation,* Report of the Expert Group on Structural Change, Publications office of the European Union, Luxembourg, 2012; Sangiuliano, M. and Cortesi, A. (Eds.), *Institutional Change for Gender Equality in Research: Lesson Learned from the Field*, Edizioni Ca'Foscari, Venice, 2019, p. 7.

1.2. Methodology

1.2.1. Feminist institutionalism and gender equality promotion

Two decades ago, disillusioned by the failure of gender mainstreaming to 'challenge and transform gender-biased public policies' in the European Union, former European Commission official on equal opportunities between women and men concluded that *'Feminist strategies may have to be revisited in terms of both modes of acting and modes of theorising. They may have to rely more on the knowledge of how power, structures and individuals interact and how this frames EU policies and discourse'* ([38]*).* Her insight is very much in line with the position taken by feminist institutionalists, who have focused on investigating power, inequality and gender by paying attention to women's different relationship to institutions than men's ([39]).

The concept places institutions at the core of gender-power relations and starts from the point of recognising the gendered nature of institutions, and questioning this reality. This opening position is seen as fundamental to understanding the unequal gendered distribution of power, and the effects that flow from this inequality ([40]).

Thus, feminist institutionalism combines a normative argument in respect of gender equality with an analytical approach that integrates gender, power, and institutional dynamics of inclusion and exclusion in formal and informal settings. This approach provides a framework with which to explore the capacity of GEPs to deliver sustainable change towards gender equality and has been widely adopted in the literature assessing this matter.

1.2.2. Gender Equality Plans as a tool for change

The study of the European Union as a contested site of gendered continuity and change now focuses on Gender Equality Plans (GEPs) as a tool for gender equality change and as a site of gender power dynamics. Using feminist institutionalist insights, scholars are exploring the extent to which GEPs can bring about multi-dimensional system change in RPOs to advance gender equality, and how RFOs and national agencies can support and facilitate this change ([41]). Along with feminist institutionalist studies in the public sphere, there is broad agreement that change towards gender equality in research organisations is a complex, contested matter ([42]). These

([38]) Stratigaki, M., 'Gender mainstreaming vs positive action: an ongoing conflict in EU gender equality policy', *European Journal of Women's Studies*, Vol. 12, No 2, 2005, pp. 181-182.

([39]) Driscoll, A. and Krook, M.L., 'Feminism and rational choice theory', *European Political Science Review,* Vol. 4, No 2, 2012, pp. 195-216; Mackay, F., Kenny, M. and Chappell, L., 'New institutionalism through a gender lens: Towards a feminist institutionalism?', *International Political Science Review,* Vol. 31, No 5, 2010, pp. 573-588; Krook, M.L. and Mackay, F. (Eds.), *Gender, Politics and Institutions,* Palgrave Macmillan, London, 2011.

([40]) Mackay, F., 'Conclusion: Towards a Feminist Institutionalism?' in Krook, M.L. and Mackay, F. (Eds.), *Gender, Politics and Institutions.* Palgrave Macmillan, London, 2011, pp. 181-182.

([41]) Tildesley, R., la Barbera, M.C. and Lombardo, E., '"What use is the legislation to me?" Contestations around the meanings of gender equality in legislation and its strategic use to drive structural change in university organisations', *Gender, Work & Organisation,* Vol. 30, No 6, 2023, pp. 1996-2013; Hodgins, M., O'Connor, P. and Buckley, L-A., 'Institutional change and organisational resistance to gender equality in higher education: An Irish case study', *Administrative Sciences,* Vol. 12, 2022, p. 59; Clavero, S. and Galligan, Y., 'Delivering gender justice in academia through gender equality plans? Normative and practical challenges', *Gender, Work & Organisation,* Vol. 28, No 3, 2021, pp. 1115-1132; Linkova, M . and Mergeart, L., 'Negotiating change for gender equality: identifying leverages, overcoming barriers', *Investigaciones Feministas,* Vol. 12, No 2, 2021, pp. 297-308*;* Verge, T., Ferrer-Fons, M. and González, J., 'Resistance to mainstreaming gender into the higher education curriculum', *European Journal of Women's Studies,* Vol. 25, No 1, 2018, pp. 86-101.

([42]) Kalpazidou Schmidt, E., Ovseiko, P.V., Henderson, L.R. and Kiparoglou, V., 'Understanding the Athena SWAN award scheme for gender equality as a complex social intervention in a complex system: analysis of Silver award action plans in a comparative

European-focused studies also address the influence of the external context in which research organisations are embedded. The exogenous forces of the societal culture, national laws and policy frameworks, imbued with their own gendered patterns and biases, shape and influence opportunities for advancing gender equality ([43]).

Transformational change towards gender equality is described by the European Union as **structural change practices in rules, regulations, organisational processes and cultures leading to the greater institutional inclusion of women researchers and decision-makers** ([44]). Inscribed in institutional GEPs, such change arises from the questioning of gendered assumptions upon which gendered roles, practices and processes are founded, and indeed call for the critiquing of the gendered assumptions embedded in interventions designed to address the status quo ([45]). Even if women reach parity with men in RPOs, there is no guarantee that those institutions will operate in a more egalitarian manner ([46]). Norm reframing and practice change takes time to become manifest. The pace is incremental, and slower than what change agents may wish, given the complexity of the layering and displacement processes at play ([47]). Transformational change that replaces/displaces long-held institutional narratives, challenges asymmetrical power relations inhibiting gender equality, and embeds ways of thinking and doing that reflect equality in gender relations calls for action on multiple systemic levels – national, institutional, and micro-situational within institutions ([48]). National legislative and policy frameworks shape the possibilities for change, as in the case of German national interventions to increase women's participation in science and women's share of professorial posts or the Irish national requirement of institutions to address gender inequality through adoption of the Athena Swan framework ([49]). However, there is growing scepticism of the ability of Athena Swan to displace long-held accepted gendered norms and practices. As the gender equality agenda for change becomes even more complex with the inclusion of the intersectional aspects of gender, privilege and power, the questioning of gendered assumptions in this context challenges the understanding

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European perspective', *Health Research Policy and Systems,* Vol. 18, 2020, pp. 1-21; Ní Laoire, C., Linehan, C., Archibong, U., Picardi, I. and Udén, M., 'Context matters: Problematising the policy-practice interface in the enactment of gender equality action plans in universities', *Gender, Work and Organisation,* Vol. 28, 2021, pp. 575-593; Cacace, M., Pugliese, F., Tzanakou, C., Müller, J., Denis, A. and Sangiuliano, M., 'Certifying complexity? The case of a European gender equality certification scheme for research-performing organisations', *Science and Public Policy,* 2023.

([43]) Tildesley, R., la Barbera, M.C. and Lombardo, E., 2023, *op. cit.*, p. 2009; Linkova, M . and Mergeart, L., 2021, *op. cit.*, p. 299.

([44]) European Commission, *Gender Equality Policies in Public Research. Based on a Survey Among Members of the Helsinki Group on Gender in Research and Innovation 2013,* Publications Office of the European Union, Luxembourg, 2014; Sangiuliano, M., Gorbacheva, E. and Canali, C., 'From planning to tailoring and implementing GEPs' in M. Sangiuliano and A. Cortesi (Eds.*), Institutional Change for Gender Equality in Research: Lesson Learned from the Field,* Edizioni Ca'Foscari, Venice, 2019, p. 60; Kalpazidou Schmidt, E. and Cacace, M., 'Setting up a dynamic framework to activate gender equality structural transformation in research organisations', *Science and Public Policy,* Vol. 46, No 3, 2019, p. 321.

([45]) Bührer, S., Kalpazidou Schmidt, E., Palmén, R. and Reidl, S., 'Evaluating gender equality effects in research and innovation systems', *Scientometrics,* Vol. 125, 2020, pp. 1461-1462; Ní Laoire, C., Linehan, C., Archibong, U., Picardi, I. and Udén, M., 2021, *op. cit.*.

([46]) Van den Brink, M. and Benschop, Y., 'Slaying the seven-headed dragon: The quest for gender change in academia', *Gender, Work & Organisation,* Vol. 19, 2012, pp. 71-92.

([47]) O'Mullane, M., 'Developing a theoretical framework for exploring the institutional responses to the Athena SWAN Charter in higher education institutions: a feminist institutionalist perspective', *Irish Journal of Sociology,* Vol. 29, No 2, 2021, pp. 227-228; Linkova, M . and Mergeart, L., 'Negotiating change for gender equality: identifying leverages, overcoming barriers', *Investigaciones Feministas,* Vol. 12, No 2, 2021, p. 305; European Commission, *Impact of Gender Equality Plans across the European Research Area*, Luxembourg: Publications Office of the European Union, 2024 (forthcoming), p. 91.

([48]) O'Connor. P. and Irvine, G., 'Multi-level state interventions and gender equality in higher level institutions: the Irish case', *Administrative Sciences,* Vol. 10, No 4, 2020, pp. 98-119.

([49]) Bührer, S., Kalpazidou Schmidt, E., Palmén, R. and Reidl, S., 2020, *op. cit.*; Drew, E., 'Navigating unchartered waters: Anchoring Athena SWAN into Irish HEIs', *Journal of Gender Studies,* Vol. 31, No 1, 2020, pp. 23-35.

of transformational change ([50]). These studies highlight the challenge of the task in shifting established institutional structures and cultures towards gender equality.

Sustainability is a requisite feature of any transformative change, which takes time to become embedded and routinised in institutions, narratives and system thinking. In the case of transformative GEPs, sustainability is related to the capacity of the GEPs to continue producing change in gender power relations and institutional cultures when the project funding ends ([51]). To sustain this transformation and advance gender equality requires continual promotion and monitoring to ensure longevity of impact ([52]).

It is typical to find that the gender equality agenda in RPOs is taken on by small groups of (mostly) women, largely on a voluntary basis ([53]). Research shows the value of Communities of Practice in supporting these change agents, through providing a site in which gender equality problems are related to structural power imbalances and gendered assumptions, and where practice can be shared, reflected upon, and renewed ([54]).

Drawing on the insights of feminist institutionalism, studies point to the process-driven nature of change in an RPO ([55]). As an institution responds to exogenous pressure to change (for example in addressing the requirement to demonstrate the integration of gender in research content), this 'in most cases entails layering whereby new gender equality actions are added to previously existing organisational logics', or occasionally the new gender practices – if sufficiently consensual – displace the previous way of doing business. Thus, a new organisational logic, the requirement for research projects to integrate a gender dimension in research and innovation content, is layered into the existing process of proposal-writing, researcher training, and evaluation of research. This results in a new process becoming embedded within a previously-existing process. This 'nested newness' ([56]) is a typical outcome of gender change in institutions that has some degree of transformational impact on the old logic. Furthermore, the instance of change creates the opportunity for gender equality advocates to frame the new logic in a manner that legitimates the process – it results in excellent science – and that advances the institutional gender equality discourse. However, there is a question as to the extent, and durability of such change. Organisational theory suggests that the layering of new practices onto old processes has a limited

([50]) O'Connor, P., 'Why is it so difficult to reduce gender inequality in male-dominated higher educational organisations? A feminist institutional perspective', *Interdisciplinary Science Reviews,* Vol. 45, No 2, 2020, pp. 207–228; Crimmins, G., Casey, S. and Tsouroufli, M., 'Intersectional barriers to women's advancement in higher education institutions rewarded for their gender equity plans', *Gender and Education,* Vol. 35, No 6-7, 2023, pp. 653-670.

([51]) Kalpazidou Schmidt, E. and Graversen, E.K., 'Developing a conceptual evaluation framework for gender equality interventions in research and innovation', *Evaluation and Programme Planning,* Vol. 79, 2020, p.101750.

([52]) Otero-Hermida, P. and Garcia-Mélon, M., 'Gender equality indicators for research and innovation from a responsible perspective: the case of Spain', *Sustainability,* Vol. 10, No 9, 2018, pp. 2980-3000.

([53]) O'Mullane, M., 'Developing a theoretical framework for exploring the institutional responses to the Athena SWAN Charter in higher education institutions: a feminist institutionalist perspective', *Irish Journal of Sociology,* Vol. 29, No 2, 2021, p. 220; Kalpazidou Schmidt, E., Ovseiko, P.V., Henderson, L.R. and Kiparoglou, V., 'Understanding the Athena SWAN award scheme for gender equality as a complex social intervention in a complex system: analysis of Silver award action plans in a comparative European perspective', *Health Research Policy and Systems,* Vol. 18, 2020, p. 17.

([54]) Thomson, O., Palmén, R., Reidl, S., Barnard, S., Beranek, S., Dainty, A.R.J. and Hassan, T.M., 'Fostering collaborative approaches to gender equality interventions in higher education and research: the case of transnational and multi-institutional communities of practice', *Journal of Gender Studies*, Vol. 31, No 1, 2022, pp. 36-54.

([55]) Linkova, M . and Mergeart, L., 2021, *op. cit.*, pp. 304-305.

([56]) Mackay, F., 'Nested newness, institutional innovation, and the gendered limits of change', *Politics & Gender*, Vol. 10, No 4, 2014, pp. 549-571.

effect, and that sustainable transformative change is possible only when 'core narratives' are displaced by new, equality-supporting discourses ([57]).

1.2.3. Analysis of GEPs

Every GEP is the outcome of an institutional negotiation, and reveals the extent to which solutions to gendered problems (e.g. the different career pipelines for women and men in academia) are agreed and layered or folded onto the status quo, and to what extent there is potential for shifting and displacing traditional gender power relations (e.g. the absence of women from decision-making, men's uptake of care/fatherhood, combatting harassment and gender-based violence). Meaningful change takes time to take root, so continued enhancement of gender equality is an important indicator of commitment to advancing gender-equal change. Twelve projects supporting the development of GEPs in RPOs and some RFOs and national agencies were funded under Horizon 2020 from 2018 and were either completed or were actively underway by 2024 (Table 1).

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[57] Ní Laoire, C., Linehan, C., Archibong, U., Picardi, I. and Udén, M., 2021, *op. cit*, p. 578.

Table 1: Selected Horizon 2020 GEP funded projects (implemented between 2018-2024)

Project	Title	Duration	Total Partners	GEP-implementing partners	Supporting partners
R-I-PEERS	Pilot experiences for improving gender equality in research organisations	01 May 18 - 31 Aug 22	10	7	3
SUPERA	Supporting the promotion of equality in research and academia	01 June 18 - 31 May 22	8	6	2
GEARING ROLES	Gender equality actions in research institutions to transform gender roles	01 Jan 19 - 31 Dec 22	10	6	4
GENDER SMART	Gender SMART science management of agriculture and life sciences including research and teaching	01 Jan 19 - 31 Dec 22	9	7	2
SPEAR	Supporting and implementing plans for GE in Academia and Research	01 Jan 19 - 30 Apr 23	11	9	2
EQUAL4EUROPE	Gender equality standards for AHMSSBL institutions throughout Europe	01 Jan 20 - 31 Dec 23	8	5	3
CALIPER	Linking research and innovation for gender equality	01 Jan 20 - 31 Dec 23	12	9	3
LeTSGEPS	Leading towards sustainable gender equality plans in research institutions-budgeting to counter gender discrimination	01 Jan 20 - 31 Dec 23	8	6	2
TARGETED MPI	Transparent and resilient gender equality through integrated monitoring planning and implementation	01 Sep 20 - 31 Oct 24	6	6	0
RESET	Redesigning equality and scientific excellence together	01 Jan 21 - 31 Dec 24	7	4	3
ATHENA	Implementing GEPs to unlock research potential of RPOs and RFOs in Europe	01 Feb 21 - 31 Jan 25	10	8	2
MINDtheGEPS	Modifying institutions by developing gender equality plans	01 Feb 21 - 31 Jul 25	10	7	3
TOTAL			109	80	29

Source: CORDIS, available at: https://cordis.europa.eu

While recognising that the allocation of European funding for GEPs is more extensive than Table 1 indicates, with a total of 30 projects focused on GEP design and implementation funded since 2008, the group of 12 projects in Table 1 constitute the first wave of concerted action to advance gender equality following the Commission intensification of support for GEPs. Following the Commission announcement in 2020 that having a GEP in place was an eligibility requirement for research funding, seven of these projects were initiated (EQUAL4EUROPE, CALIPER, LETSGEPS, ATHENA, RESET, TARGETED-MPI, MINDtheGEPs). Therefore, given the important momentum, this group of projects knew that they would be expected to deliver role model GEPs from which successive projects, and organisations could learn and progress.

Mindful of the importance of national context, and aware that universities and research institutes are not monolithic institutions ([58]), one of the aims of this article is to ascertain the extent to which GEPs in RPOs have the transformational potential to replace traditional gendered institutional narratives with alternative equality discourses, tackle gender power imbalances, and plan for sustainable cultural change. In addition, the article also considers the support provided by RFOs to this group, and the extent to which the RPOs GEPs have the ambition to influence the wider cultural and policy environment in which they are located.

The data for this analysis came from an initial identification of GEPs published on the website of all projects listed in Table 1. From this, the GEPs related to the institutional plans published in English were extracted, which yielded 66 plans. These plans were first screened for alignment with the five themes indicated by the European Commission as necessary for transformational and sustainable change in the institutional culture, with the proportion of actions relating to each of these themes identified. This measure was intended to give a sense of the weighting of institutional efforts.

The second stage involved a closer examination of the GEPs to assess the extent to which gendered assumptions relating to structure, policy and practice were questioned. Specifically, this led to an assessment of the following:

- **Structural change measures** (e.g. gender balance in decision-making, allocation of human and financial resources to gender equality actions, gender equality policy development) **that could support sustainability**. In addition, commitment to continuation of GEPs after the project had concluded was noted. This could be considered 'fixing the institution'.

- Measures designed to **address gender power asymmetries** through actions related to **work-life balance, recruitment and progression, and gender-based violence and sexual harassment** were gauged for their transformative potential through either layering (adding to or adapting internal regulations or policies) or displacement (the cancellation of an existing policy and replacement by one designed with gender equality in mind). This could be considered 'fixing the institutional culture' with the potential to have a transformative effect on institutional gender relations.

- The extent to which they sought to embed knowledge of gender equality through the **incorporation of gender in research and teaching**. The actions in this area have the potential for changing the institutional, and societal, narrative in a gender-inclusive direction.

([58]) Van den Brink, M. and Benschop, Y., 2012, *op. cit.* p.72.

- The extent to which the GEPs reached out to civil society partners, RFOs, regional and national agencies to share their experiences and **build external coalitions for advancing to gender equality** was examined.

- The GEPs of the few **RFO** project participants were assessed to consider the level of support they planned to provide RPOs to **move towards transformative institutional change.**

The third stage was the conduct of interviews with the project co-ordinator or other key person connected with these projects ([59]). The purpose of the interviews was to explore which thematic areas were relatively straightforward to address in the project in question, and which were more challenging. The intention was to understand if themes that called for the layering of policies or practices onto existing rules and processes were more likely to incur institutional consensus than themes that required a displacement of norms such as 'merit' or 'excellence', or challenged interpersonal gendered narratives, attitudes and gendered power. In addition, the interviewees were asked to consider if the project exerted influence on the research and higher education sector, and/or if sectoral policies or national policies created a climate of opportunity for partners' scope for advancing gender equality. The results are discussed in the following section.

1.3.   Results

The twelve projects funded from 2018 to 2023 covered 24 EU Member States and eight Associate Countries ([60]). Of the 24 EU countries, 10 were located in Central and Eastern Europe ([61]). Spain participated in nine of the 12 projects, while Belgium and Italy participated in seven projects (Figure 1).

([59]) Interviews were held with the coordinators/project managers of LETSGEPs, SPEAR, SUPERA, RESET and TARGETED-MPI. Individual interviews were also conducted with Cyprus University of Technology (GENDERSMART) and with Technological University Sofia (EUT+ Alliance, funded via ERASMUS+).

([60]) The EU Member States not included in these 12 projects were Latvia, Luxembourg and Malta.

([61]) Bulgaria, Czechia, Croatia, Estonia, Hungary, Lithuania, Poland, Romania, Slovakia, Slovenia.

Figure 1. Geographical distribution of GEP projects funded between 2018 and 2023, EU Member States
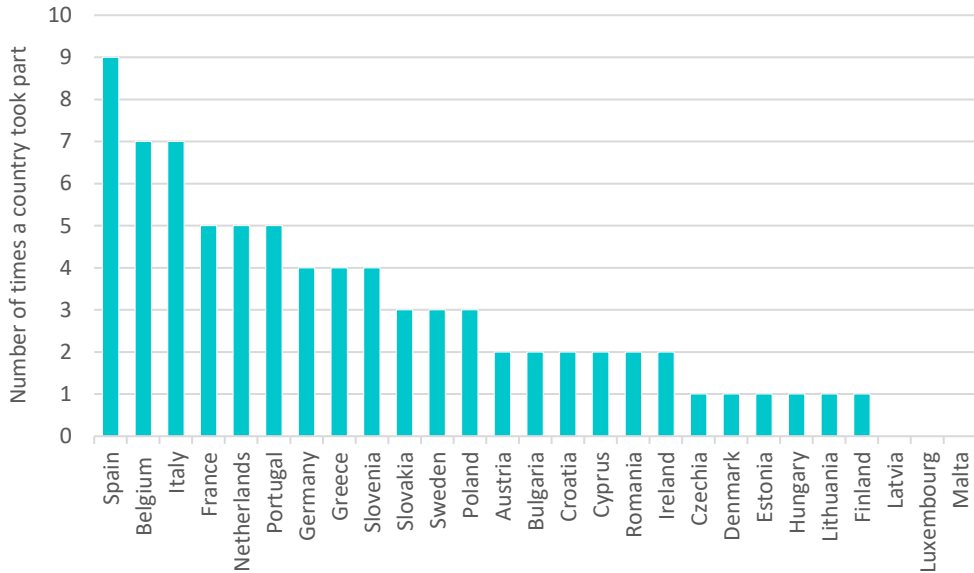
Significant effort was expended by a total of 109 partners, 80 (73 %) of whom were GEP implementing partners and 29 (27 %) were supporting partners. Of the 80 GEP-implementing partners, 69 (86 %) were RPOs, 8 (10 %) were RFOs and 3 (4 %) were non-RFO national ministries/agencies. Of the 80 GEPs produced, 66 were examined for this article. The remaining 14 were inaccessible either because they were not available on the project website, or because they were not available in English.

All projects addressed the five recommended thematic areas suggested by the European Commission: Work-life balance and organisational culture; Gender balance in leadership and decision-making; Gender equality in recruitment and career progression; Integration of the gender dimension in research and teaching content; and Measures against gender-based violence, including sexual harassment. Interventions to address the institutional culture and work-life balance most frequently appeared in the GEPs (42 %) followed by measures to support the integration of gender in research and teaching content (20 %) and actions promoting gender equality in recruitment and career progression (18 %). Fewer initiatives were devoted to gender balance in leadership and decision-making (10 %) and to addressing gender-based violence/sexual harassment (9 %). In addition to the recommended thematic areas, some projects were designed to implement other equality-focused interventions, such as transfer to market measures (1 %). (Figure 2)

Figure 2. Summary GEP actions
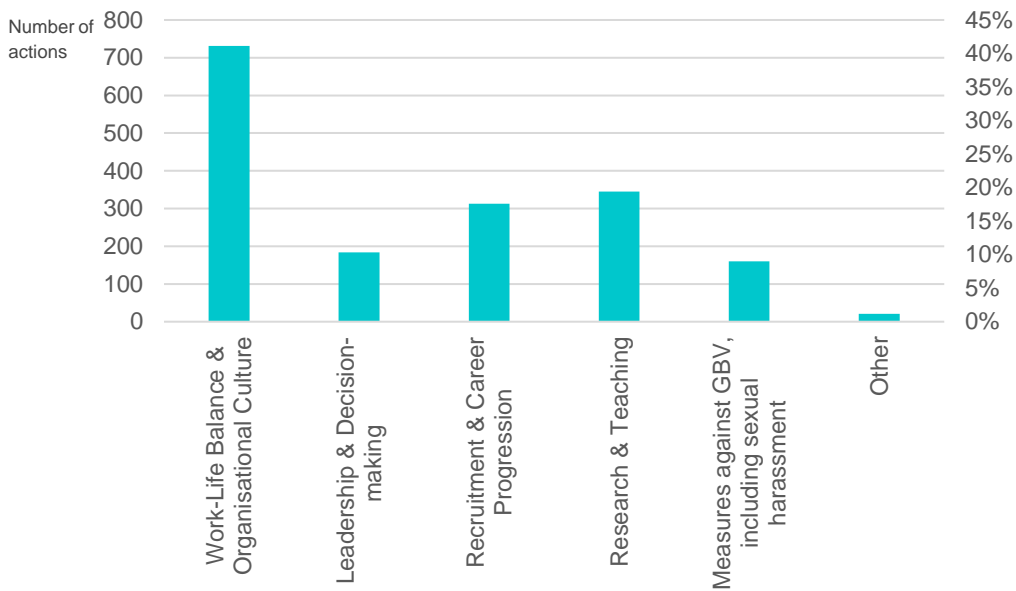
The projects demonstrated an increasing sophistication in their approach and analysis over the timespan (2018-2023). One project, LeTSGEPS added a focus on gender budgeting as an additional GEP theme. The project CALIPER included Transfer to Market as an additional area of action. Individual institutional GEPs occasionally added to the five core themes according to their institutional need with specific objectives, e.g. 'improving the use of gender-neutral language in organisation documents' (CTNI, RI-Peers); 'deepen themes of citizenship and equality' (U Coimbra, SUPERA), 'Remuneration' (CICYTEX, GENDERSMART). This indicates that the GEP thematic structure was sufficiently flexible to accommodate local conditions while remaining linked to the framework.

The GEPs conformed to the EU process requirements of being publicly available, having dedicated resources to implement the plan, have sex/gender disaggregated data on personnel (and students) along with a plan for annual reporting based on indicators, and provision for awareness raising/training on gender equality and unconscious bias.

When considered in the round, the projects demonstrate an extensive activation on the subject of gender equality, and a first time for doing so by many of the institutional partners involved. Indeed, this point is made in GEPs (e.g. University of Ljubljana, Slovenia – GEARING ROLES, Plovdiv University, Bulgaria – SPEAR, Slovak Academy of Sciences - ATHENA). This intensification of effort, involving rigorous attention to diagnosing and addressing gender inequality in higher education and research environments, along with institutional commitment to implementation, has the potential to deliver significant structural and cultural change in the European research and innovation landscape. The following sections consider this evaluation in more detail.

1.3.1. Addressing structural change

The projects were expected to advance GEPs as an instrument of structural, transformative institutional change. There was significant and consistent evidence of structural interventions in institutions to support the creation of GEPs, and continuation or development of these interventions in all plans. A typical first set of actions was the establishment of an institutional gender equality committee, the gathering of sex/gender disaggregated data (often for the first time), the designation of a gender equality coordinator or committee to oversee operational delivery of the GEP, and resources to enable this role to function (e.g. University of Rijeka, Croatia – SPEAR; Vytautas Magnas University, Lithuania – SPEAR, School Electrical and Computer Engineering, National Technical University Athens, Greece – CALIPER, University of Lodz, Poland - RESET). This early set of interventions became more embedded over time. Partners in the RESET project had a contractual obligation to establish a Gender Equality Board to design and develop each partner's GEP. The advantage of this requirement was that all RESET partners were obliged to put in place a mechanism within university structures for specifically addressing gender equality. Three partners (University of Porto, Portugal; Aristotle University of Thessaloniki, Greece; University of Bordeaux, France) later had a GEP action to institutionalise either the Gender Equality Board or a Gender Equality Office. The creation and later institutionalisation of an institutional Gender Equality Board became a routine matter in the later projects, ATHENA and MINDtheGEPs (e.g. Jožef Stefan Institute, Slovenia, University of Bucharest, Romania– ATHENA; University of Gdansk, Poland – MINDtheGEPs).

There is also awareness in some GEPs that the burden of solving the gender inequality problem should not rest with women, instead that it is a systemic challenge for the whole institution to address. This awareness is mostly present in institutions with some prior experience of addressing gender inequalities. An example is Salento University (Italy, CALIPER), where its previous efforts in the creation of an 'infrastructure for gender equality' provided the basis for advancing gender equality in the current GEP. In the Comenius University (Slovakia – EQUAL4EUROPE) GEP the systemic nature of structural change is recognised: *In contrast to previous approaches, which focused mainly on supporting women in science, the current policy shifts the emphasis towards institutions in which women (and men) carry out scientific research and foregrounds 'cultural and structural change'…This approach is based on the recognition that individual support for women is not sufficient and that it is necessary therefore to focus on the institution and a system in which scientific knowledge is generated.* Perhaps the most advanced articulation of a GEP addressing structural change is provided by two institutions, the University of Southern Denmark and Uppsala University in Sweden (SPEAR). Both adopt a full gender mainstreaming approach, with the University of Southern Denmark describing the GEP as a quality assurance framework 'in order to allow for maximal strategic direction combined with local endorsement and contextualised adaptation'.

In general, the GEPs indicate a commitment to continued implementation of the measures beyond the project life cycle (e.g. Mathematical Institute SANU, Serbia – LETSGEPS), regular evaluation and adjustment to take account of emerging gaps and areas of concern (e.g. Vytautus Magnus Lithuania-SPEAR), and commitment of human and financial resources for successful implementation (e.g. University of Salerno, Italy – RI-Peers, University of Gdansk, Poland - MINDtheGEPs). The continuing data requirements for monitoring and evaluation also become part of institutional practices, with data systems introduced or adapted to enable a continuing gender

analysis (e.g. Aristotle University of Thessaloniki, Greece – RESET; University of Torino, Italy – MINDtheGEPs; Jan Kowchanowski University, Kielce, Poland - ATHENA).

1.3.2. Addressing gender power asymmetries

A number of GEPs contained acknowledgements of gender power asymmetries, and the contribution of this dynamic to the perpetuation of gendered inequalities in their institutions. In an explicitly feminist analysis, for example, the CICYTEX research institution (Spain, GENDERSMART) described gendered power relations as '*the traditional patriarchal model of distribution and assignment of roles and stereotypes has produced a sexual division of the world and of work, assigning to each of the sexes different, segregated, and exclusive values, behaviours rights, spaces and times'*. The agricultural research organisation TEAGASC (Ireland, GENDERSMART) also recognised the gendered culture dominant in the sector: *Our long and deep history in the agriculture and food industry has resulted in Teagasc having a male-oriented gender culture*. Awareness of the impact of gendered informal rules and cultural bias in preventing gender equality, the Uppsala University GEP (Sweden, SPEAR) observes that *Implicit bias and informal power structures that cause gender inequality problems are well documented in research on gender equality in academia. Informal decision-making affects the opportunities of certain individuals and groups to have an influence and progress in their career*. The university's analysis of gender power imbalances and their negative effects as contributing factors to sexual harassment was repeated in a subsequent gender mainstreaming GEP (Uppsala University – MINDtheGEPs).

The issue of intersectionality was addressed in a small number of GEPs, reflecting the finding of the independent expert ERA Monitoring Report ([62]) of the challenge in converting acceptance of the approach into concrete policies and actions. The RESET project stands out, as it brought an intersectional approach to GEP development. This was clearly stated in the GEP of the University of Bordeaux (France) and the GEP of the University of Lodz (Poland). Other projects' articulations of intersectionality were linked to strong institutional commitments to equality. The Cyprus University of Technology (Cyprus – GENDERSMART) GEP, for example, *takes an active position in the fight against inequalities and stereotypes that are reproduced on the basis of intersectional aspects – gender, race, age, disability, sexuality, social-economic situation – with the aim of spreading knowledge, and promoting existing and institutionalising new policies to create an inclusive working and academic environment*. The Université Libre Brussels (Belgium – CALIPER) also takes account of intersectionality: *Within this GEP, intersectionality is considered a transversal strategy to design all actions of the plan. Hence, the GEP adopts a gender+ strategy: gender remains the main contemplated type of inequality but its interaction with other sources of inequality and grounds of discrimination is taken into account in the design and implementation of the GEP measures*. In addition, attention to gender stereotyping and unconscious bias is framed as awareness of gendered role expectations, and the need to counter these inequality-perpetuating behaviours and ways of thinking. Some GEPs refer to the blindness of the wider culture to gender role stereotypes, and the normalisation of women's home and family role in society (e.g. Plovdiv University, Bulgaria – SPEAR) ([63]). In the case of Plovdiv, there is an action to raise awareness of

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([62]) European Commission, *ERA Monitoring 2023 – 18-months-review of the implementation of the ERA Policy Agenda ('EU-level Report'),* Publications Office of the European Union, Luxembourg, 2023.
([63]) This point was also made in interview by the coordinator of SPEAR, Eva Sophia Meyers (University of Southern Denmark) and by a gender equality director in the Erasmus+-funded European University of Technology Alliance (EUT+) , Yoana Pavlova (Technological University of Sofia).

the institutional community on the matter, with the involvement of faculty from Psychology and Sociology.

In addition to the intersectional approaches, addressing gender equality in decision-making is key to tackling systemic gender power asymmetries. Gender equality in decision-making has indeed the potential to introduce transformative change. This is a thematic area in which data were readily available, and generally showed gender inequality in institutional decision-making forums. However, while the analysis was straightforward, and the ambitions for progress towards parity were clear in many GEPs, the implementing measures to achieve the targets for gender balance in decision-making focused on the standard long-term measures of addressing the pipeline, encouraging women to apply for open senior posts, and promoting leadership training opportunities to women (e.g. the European School of Management and Technology (ESMT), Berlin – EQUAL4EUROPE). Nonetheless, there were examples of interventions to advance gender balance in decision-making more rapidly than a developmental process would achieve. In some cases it involved changing the rules of competition for elected positions to achieve balanced representation of gender and other identities (University of Ruse Angel Kanchev, Bulgaria – ATHENA), limiting the number of mandates held by any individual decision-maker (Jožef Stefan Institute, Ljubljana, Slovenia – ATHENA), and promoting an equal representation of gender in lists for election to decision-making positions (University of Porto, Portugal – SPEAR). Other actions sought to ensure that there were sufficient qualified women with the potential to be decision-makers through a soft quota mechanism. RWTH (Aachen, Germany – SPEAR), for example aimed to regularly evaluate *The attainment of the equal opportunities quota according to the cascade model at the professorial level,* and the University of Torino (Italy, MINDtheGEPs) planned to incentivise the recruitment of female professors with an end-of-year organic points bonus. The cultural climate of senior board meetings was the target of action in the International Business School, Bulgaria (SPEAR), where it was intended to have a gender expert at governing bodies meetings to prevent gender bias in formal and informal decision-making. The ultimate purpose of these innovative actions is to displace the concept of decision-making being the preserve, and responsibility, of men, and replace it with acceptance of gender balance as the optimum condition for good decision-making.

Challenging dominant gender-based stereotypes and their enactment was also addressed through gender mainstreaming. In these rare instances, the GEPs got to the heart of the gender inequality. Uppsala University (Sweden, SPEAR), is an example, where the gender mainstreaming approach 'seeks to change the power structures identified within the University that prevent gender equality'. The GEP recognises not only implicit bias, but the informal power structures that accompany such bias. These instances indicate that institutional leaderships are knowledgeable on the gender power dynamics that lead to gender and intersecting inequalities, and wish to tackle these dynamics. While eliminating gender-based stereotypes, prejudices and practice that inhibit gender equality is a focus of all GEPs in this study, there is limited evidence of understanding the root cause as a structural one, embedded in society as well as the institution. This may have to do with the internal negotiation at play in the development of a GEP. Gender equality committees may indeed take a norm-critical approach but find resistance to their analysis from powerful institutional actors keen to preserve the gendered status quo. This resistance inhibited the ambition of GEPs

in Lithuania and Bulgaria, for example ([64]). Yet there are also counterbalancing examples, such as the GEP of the International Business School, Bulgaria (SPEAR) which openly embraces intersectionality and the critical questioning of norms, roles and power relations that it entails.

1.3.3. Addressing knowledge

The integration of the gender dimension in research and teaching content is a basic requirement of all GEPs. Many of the GEPs recognise that in order to make meaningful change, it is necessary to raise awareness on how gender inequalities are constructed and maintained. There are multiple examples of actions to that end. Universities with gender studies departments leverage this internal knowledge with specific actions to improve the gender dimension of curricula and research within the RPO (e.g. Central European University, Austria – SUPERA, Deusto U, Spain – GEARING ROLES, NOVA, Portugal - SPEAR). The University of Bordeaux (France, RESET) implemented actions to ensure sustainable change in research methodologies and content in terms of the integration of the gender dimension, sharing the RESET tools on Gender Impact Assessment with PhD students, researchers, and laboratories ([65]). Others focus on employee awareness-raising activities to deconstruct gender roles and address unconscious bias and stereotypes (e.g. Institute of Geography and Spatial Planning, University of Lisbon, Portugal – GEARING ROLES, Institute for Research in Biomedicine, Spain - LETSGEPS). The Faculty of Materials Science in the Slovak University of Technology (Slovakia – CALIPER) addresses this particular problem – the lack of interest in gender equality in research – by giving priority to doctoral theses and research projects that integrate a gender dimension.

Another aspect of addressing knowledge is in the area of action on sexual violence, harassment and gender-based violence. Knowledge in this thematic field is largely addressed through awareness-raising training. Indeed, this measure is the default action in GEPs, and some do not go further than committing to delivery of such training. Commitments to policy development and adoption are patchy. Yet, gender-based harassment and violence is the most personalised expression of gendered power hierarchies and imbalances, and occasional trainings alone will take time to change cultural behaviours. In contrast, a stand-out example of institutional commitment to preventing and eliminating sexual and gender-based harassment can be found in the plan of CICYTEX (Spain, GENDERSMART). The GEP has appended a detailed protocol on combatting sexual violence and harassment and addresses procedural matters in addition to policy.

Many GEPs had measures that indicated solid early stage actions in addressing the problem – such as establishing, or improving existing, reporting mechanisms, data collection and reporting on the nature and prevalence of sexual violence and harassment incidents, improving the availability of counselling services, and awareness-raising among the university community (e.g. Central European University, Austria-Hungary – SUPERA; Nova University Lisbon, Portugal – SPEAR). These actions are typical of a pragmatic 'layered' response, whereby the actions build on an existing foundation of anti-discrimination awareness. Some other GEPs recognised the existence of gender-based violence, and of university policies intended to manage complaints of this nature, but provided very modest actions to address the problem. In these cases, actions

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([64]) Interview with SPEAR co-ordinator, Eva Sophia Meyers; interview with Yoana Pavlova, Director of Gender Equality at Technological University Sofia, Bulgaria.

([65]) Email communication with RESET project manager, Ninon Junca.

included in revising an existing regulatory code, or relied on anti-discrimination training as a response to the issue. These weak actions demonstrate the challenge of opening norm- and behaviour-critical conversations in some institutional and cultural environments ([66]). The problem did not necessarily come from the limited understanding of the problem by the GEP development group, but with the lack of social recognition of this issue within the institution and in wider society.

There were also examples of strong measures, when the issue was carefully diagnosed and tackled with explicit, detailed actions (e.g University of Bordeaux, France – RESET; University of Southern Denmark – SPEAR, Nova University Lisbon, Portugal - SPEAR) ([67]). In such instances, core cultural assumptions and behaviours were subject to critical analysis supported by evidence from surveys and focus groups. The resulting institutional discussion shifted towards introducing a new norm of zero tolerance for sexual, gender and other forms of harassment backed by specific actions. As stated in the University of Southern Denmark GEP: *We actively, purposefully and continuously strive to be an organization free of sexism, unwanted sexual attention or other types of harassment.*

1.3.4. Influencing other organisations

The majority of GEPs focus on internal change. However, there are instances of actions from some institutions illustrating how they find support, and in turn seek to influence, measures to sustain and advance gender equality. In the LETSGEPs project, the University of Tirana (Albania) shared its GEP with other Universities in Albania to assist them progress on gender equality. In addition, the University of Tirana enlisted the support of external international experts through the United Nations Development Programme (UNDP) in Albania, and later shared the experience of developing a GEP with others in the Western Balkans region ([68]). The Working Group on Gender Equality at the Mathematical Institute of the Serbian Academy of Sciences and Arts (Serbia) sought support for a gender-balanced management board from the Ministry of Education, Science and Technological Development, and with representatives of the Serbian Academy of Sciences and Arts, as well as with internal decision-makers. The Ministry agreed to consider the gender structure of the MISANU board, and other government-funded agencies, before nominating their representative ([69]). More generally, the focus on gender budgeting in the LETSGEPs project lent itself to collaboration with external stakeholders – other universities, civil society organisations with expertise in gender budgeting, local authorities, and others.

In the SUPERA project, a webinar on engaging with external stakeholders drew on the experiences of partners in the related projects Gender-SMART and CALIPER, as all plans had external engagement activities. The need to overcome resistance to change from external institutions with significant influence on higher education led to close collaboration between the Lithuanian partners of the SPEAR project. The issue was the development of gender inclusive communication guidelines in Vytautas Magnus University (VMU). Although the measure was initially resisted by external actors, the working group in VMU collaborated with SPEAR partner Vilnius University, the Office of the Ombudsperson for Academic Ethics and Procedures in Lithuania, and other external

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([66]) Interview with SUPERA coordinator, Maria Bustelo, who stressed the importance of context in each case.

([67]) This view was confirmed in interviews with the RESET and SPEAR coordinators.

([68]) WBC-RRI.NET(2023). *From Strategy to Action: Lessons from Gender Equality Plans in the Western Balkans*. https://wbc-rri.net/from-strategy-to-action-lessons-from-gender-equality-plans-in-the-western-balkans/

([69]) Interview with Anna Maria Sansoni, UNIMORE, coordinating project manager for LETSGEPs.

networks to build a community of practice on the subject ([70]). Vilnius University (SPEAR) is actively engaging in other funded projects, such as UNISAFE and ACT, where norm-questioning and critical reflection underpin their outcomes.

As an example of the ultimate influence in an external environment, the leader of the Nova University GEP (SPEAR) was appointed Minister of Science, Technology and Higher Education for Portugal in March 2022 ([71]).

Research Funding Organisations (RFOs) and national agencies play an important role in influencing the higher education and research and innovation communities through role modelling good practice and implementing measures that require RPOs to integrate gender in applications for funding. Eight RFOs took part across the 12 projects considered in this study. The Estonian Research Council (Estonia – GEARING ROLES) devotes substantial sections of its GEP to raising awareness of gender bias, and the importance of gender equality among evaluation panel members, research application reviewers, and committee members. The GEP also addresses measures to improve gender balance among applicants and recipients of research grants, awards and funding. In this way, it socialises the importance of considering gender equality in research and innovation across all institutions. Similarly, the GEP of Agence Nationale de la Recherche (France – GENDERSMART) focuses on mainstreaming gender across the GEP themes, with training and awareness-raising actions directed at the research and innovation ecosystem. In addition, in attending to the advancement of gender equality within its own organisation, the ANR becomes a role model for other institutions. The GEP of the National Science Foundation (Georgia – CALIPER) positions the institution as a catalyst and an organiser of discussions on gender equality, attitudes, and responses, in the higher education and research environment. A similar role is recognised in the GAP of the Mathematical Institute SANU (Serbia – LETSGEPS).

RFOs can play an important part in raising and discussing issues of sexual harassment, and normalising this discourse, especially when the cultural context is resistant (e.g. in University of Tirana – LETSGEPs). The research funder UEFISCDI (Romania – CALIPER) has a four-action plan to address and eradicate gender violence in research and information directed at the wider R&I stakeholders, including RPOs. Another active influencer of the research and innovation ecosystem in its remit is the Agencia Canaria de Investigación, Innovación y Sociedad de la Información (ACIISI) (Canary Islands – ATHENA). This RFO responds to the low female employment rate in the Canaries (40 % in 2019-2020) and seeks to stimulate a greater inclusion of women in the local labour market by allocating bonus points to funding applications that envisage hiring women. In the procurement of public contracts, ACIISI awards bonus points for the contractors' commitment to promote equality between women and men, and specifically for the allocation of contract tasks to women that are of a non-administrative nature. In addition, RPOs in receipt of funding are required to have a protocol for the prevention and action against sexual and gender-based harassment. An RFO in another island region, the Regional Fund of Science and Technology of the Azores (Portugal – ATHENA) focused on an internal GEP, with the aim to serve as a model for other government agencies. There is an intent to delve below the surface of unconscious bias training to understand how historical, cultural and philosophical legacies

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([70]) Interview with Eva Sophia Meyers, coordinator for SPEAR.
([71]) Government of Portugal, Science, Technology and Higher Education, n.d., https://www.portugal.gov.pt/en/gc23/ministries/science-technology-and-higher-education; interview with Eva Sophia Meyers.

influence individual judgement and decision-making. This insightful action is uncommon across GEPs in the 12 projects studied.

1.4.   Discussion and recommendations

The above analysis shows that in a very short span of time (2018-2023), considerable progress has been made in the context of these projects to advance towards gender equality. There is ample evidence of **structural change practices in rules, regulations, organisational processes and cultures leading to the greater institutional inclusion of women researchers and decision-makers**. There is some uneven distribution of actions, indicating the extent to which some themes facilitated a relatively smooth integration to organizational processes, while others posed more challenges to institutional change. Specifically, the analysis shows that three thematic areas of actions – gender equality in recruitment and career progression, integration of the gender dimension in research and teaching content, and work-life balance and organisational culture – were more open to institutional consensus on actions. Two areas in particular – gender balance in leadership and decision-making, and measures against gender-based violence and sexual harassment – generally proved more resistant to substantive interventions.

Adopting a feminist institutionalist analytical lens, it is possible to explain this divergence. The three areas where change could be institutionally incorporated largely involved an incremental layering of new policies onto extant regulatory frameworks and provisions, or modified existing policies. The actions they promoted were largely of awareness-raising, better promotion of current measures, or additional measures within an acceptable range of institutional tolerance for reform. The two areas of institutional resistance - gender-based violence and decision-making - stem from their challenge to status quo gender power arrangements, on which it was more difficult to find institutional consensus. In essence, gender balance in decision-making and addressing gender-based violence are issues that confront deeply-held gendered cultural stereotypes. However, even among these power-related areas, many institutions adopted an incremental, long-term strategy for achieving the desired transformational change. There were also instances where the actions sought to displace old norms, processes and rules through a dialogue centred on power relations and the structural and cultural basis of existing unequal arrangements. In both thematic areas, institutional and cultural resistance to gender equality was most visible. This experience demonstrates the challenge of shifting the research and innovation cultures, and in some cases societal cultures, towards inclusive gender equality. In policy terms, it highlights the significant work required to deliver on gender-equal and respectful working environments to counteract gender-based violence, including sexual harassment, as required in ERA Action 5 for 2022-2024. There is ample scope for institutions and funding organisations to leverage relevant toolkits (eg UniSAFE toolkit), policy-enhancing measures (eg GenderSAFE tools) and templates (GENDERACTIONplus) to make significant progress towards zero tolerance on gender-based violence and sexual harassment.

Despite resistance, experienced in one form or another in each project, the GEPs represent a significant body of structural transformational change of the higher education and research and innovation landscape. The preceding review shows that transformative change towards equality involves a multi-level collaborative approach and alignment of effort between European/national/regional bodies and RFOs, in tandem with RPOs. *She Figures 2024* demonstrates that progress has been made in advancing towards gender equality. One can

reasonably expect further progress as the systemic changes in these GEPs take institutional hold. Yet, just as European policy on integrating gender in research and innovation has evolved over time, so too are GEPs. Progressing in tandem is important, and for GEPs that entails a shift to focusing on inclusive gender equality – bringing intersectionality and inclusive communication more centrally as themes into GEPs. The following recommendations are addressed to the macro-level actors – the European Commission, national RFOs and national ministries with a research and innovation portfolio – holding the policy and financial powers that enable RPOs deliver transformative and inclusive gender equality.

European Commission

1. Require that applications for funding in FP10 address each of the content-related (thematic) areas in the GEPs supplied in support of the applications.
2. A new Gender Equality Strategy to be put in place when the current Gender Equality Strategy ends in 2025. The new Strategy to contain a strong focus on inclusive gender equality, linked with and reflected at strategic level in the ERA policy agenda for 2025-2027.
3. Support, through the organisation of conferences at the European level, capacity-building, dialogue, and a sharing of the work undertaken on inclusive gender equality between national authorities, RFOs, and higher education institutions.
4. Consider a common framework for inclusive GEPs, which will provide the basis for a European-level recognition structure for institutional GEPs, drawing on the work of CALIPER and other EU-funded projects in which this topic is examined.
5. Require institutions to align their GEPs with other institutional work on recognised European initiatives, such as the HR Strategy for Researchers (HRS4R) and the European Charter for Researchers.
6. Require RPOs and RFOs to establish safe, inclusive and respectful environments through the adoption of a code of conduct on a zero-tolerance approach towards gender-based violence, including sexual harassment, and the development and implementation of comprehensive policies to effectively tackle gender-based violence.

National RFOs

1. Encourage and support critical analysis of the national culture, and research and innovation culture, with regard to inclusive gender equality.
2. Engage in active and sustained implementation of good practices supporting gender equality in the context of funding.
3. Visibly and actively promote a standard of inclusive gender equality to which RPOs must adhere, emulating the key themes of the European Commission (at a minimum).
4. Engage closely with the Commission, national ministries and RPOs to promote a shared understanding of inclusive equality in line with the ERA policy agenda.
5. Engage closely with the Commission, national ministries and RPOs to develop principles and guidelines for RPOs to operationalise intersectionality and inclusive equality in EU-funded research, and concrete policies and actions.

National ministries of science

1. Continue improving the legal and policy conditions to actively support gender equality in society and in research and innovation.
2. For publicly funded institutions, require adherence to an inclusive approach to gender equality, demonstrated in GEP form, in accordance with the key themes and processes of the European Commission
3. Periodically evaluate the effectiveness of RFOs in supporting RPOs to advance towards inclusive gender equality, possibly through commissioning independent international experts to undertake this evaluation.
4. Promote the importance of inclusive gender equality for a strong research and innovation sector. Link the case for inclusive GEPs to societal benefits, including reduction of the gender pay gap, greater economic prosperity, and contribution to the SDGs of inclusive education (SDG 4), gender equality (SDG 5), decent work and economic growth (SDG 8), reduced inequalities (SDG 10) and peace, justice and strong institutions (SDG 16).

1.5.   References

Bührer, S., Kalpazidou Schmidt, E., Palmén, R. and Reidl, S., 'Evaluating gender equality effects in research and innovation systems', *Scientometrics,* Vol. 125, 2020, pp.1459-1475, https://doi.org/10.3389/fsoc.2021.784446

Cacace, M., Pugliese, F., Tzanakou, C., Müller, J., Denis, A. and Sangiuliano, M., 'Certifying complexity? The case of a European gender equality certification scheme for research-performing organisations', *Science and Public Policy*, Oxford University Press, vol. 51(2), 2023, http://dx.doi.org/10.1093/scipol/scad069

Clavero, S. and Galligan, Y., 'Delivering gender justice in academia through gender equality plans? Normative and practical challenges', *Gender, Work & Organisation,* Vol. 28, No 3, 2021, pp.115-1132, https://doi.org/10.1111/gwao.12658

Council of the European Union, *Council Conclusions: Advancing gender equality in the European Research Area,* 14846/15, 2015, https://data.consilium.europa.eu/doc/document/ST-14846-2015-INIT/en/pdf

Council of the European Union, *Council Recommendation on a Pact for Research and Innovation in Europe*, 13701/21, 2021, https://data.consilium.europa.eu/doc/document/ST-13701-2021-INIT/en/pdf

Council of the European Union, *Conclusions on the future governance of the European Research Area,* 14126/21, 2021, https://data.consilium.europa.eu/doc/document/ST-14126-2021-INIT/en/pdf

Council of the European Union, *Council Recommendation of 18 December 2023 on a European framework to attract and retain research, innovation and entrepreneurial talents in Europe,* C/2023/1640, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C_202301640

Crimmins, G., Casey, S. and Tsouroufli, M., 'Intersectional barriers to women's advancement in higher education institutions rewarded for their gender equity plans', *Gender and Education,* Vol. 35, No 6-7, 2023, pp. 653-670, doi: 10.1080/09540253.2023.2238737.

Drew, E., 'Navigating unchartered waters: Anchoring Athena SWAN into Irish HEIs', *Journal of Gender Studies,* Vol. 31, No 1, 2020, pp. 23-35, doi: 10.1080/09589236.2021.1923463.

Driscoll, A. and Krook, M.L., 'Feminism and rational choice theory', *European Political Science Review,* Vol. 4, No 2, 2012, pp. 195-216, doi: 10.1017/S175577391100018X.

European Commission, Communication from the Commission: *Women and Science. Mobilising women to enrich European Research,* COM(1999) 76 final, http://aei.pitt.edu/13321/1/13321.pdf

European Commission, *Structural change in research institutions: Enhancing excellence, gender equality and efficiency in research and innovation,* Report of the Expert Group on Structural Change, Publications Office of the European Union, Luxembourg, 2012.

European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions, *A Reinforced European Research Area Partnership for Excellence and Growth*. COM(2012) 392 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52012DC0392

European Commission, *Gender Equality Policies in Public Research. Based on a Survey Among Members of the Helsinki Group on Gender in Research and Innovation 2013,* Publications Office of the European Union, Luxembourg, 2014.

European Commission, *Horizon 2020 Science with and for Society*: *Supporting research organisations to implement gender equality plans* (SwafS-09-2018-2019-2020), 2018, https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/swafs-09-2018-2019-2020

European Commission, Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee of the Regions: *A new ERA for Research and Innovation,* COM(2020) 628, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A628%3AFIN

European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions: *A Union of Equality: Gender Equality Strategy 2020-2025,* COM(2020) 152final, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0152

European Commission, Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee of the Regions on a *European Strategy for Universities,* COM(2022) 16final, https://education.ec.europa.eu/document/commission-communication-on-a-european-strategy-for-universities

European Commission, *ERA Monitoring 2023 – 18-months-review of the implementation of the ERA Policy Agenda ('EU-level Report')*, Luxembourg: Publications Office of the European Union, 2023.

European Commission, Proposal for a Council Recommendation on a European Framework to attract and retain research, innovation and entrepreneurial talents in Europe, COM(2023) 436final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52023DC0436

European Commission, *Impact of Gender Equality Plans across the European Research Area*, Publications Office of the European Union, Luxembourg, 2024 (forthcoming).

European Commission, Directorate-General for Research and Innovation, *Horizon Europe Guidance on Gender Equality Plans (GEPs)*, Publications Office of the European Union, Luxembourg, 2021.

European Commission, Directorate-General for Research and Innovation, *Gender equality: a strengthened commitment in Horizon Europe*, Publications Office of the European Union, Luxembourg, 2021.

European Commission, Directorate-General for Research and Innovation, *She Figures 2024: Gender in Research and Innovation: statistics and indicators,* Publications Office of the European Union, Luxembourg, 2024*.*

European Institute for Gender Equality (EIGE), *Gender Equality in Academia and Research – GEAR tool*, 2022, https://eige.europa.eu/gender-mainstreaming/toolkits/gear

European Research Area and Innovation Committee Standing Working Group on Gender in Research and Innovation (ERAC SWG GRI) Taskforce on Gender Equality Plans, *Gender Equality Plans as a Catalyst for Change. Report from the Standing Working Group on Gender in Research and Innovation,* ERAC 1202/21, 2021, https://data.consilium.europa.eu/doc/document/ST-1202-2021-INIT/en/pdf

González Gago, E., *Evaluation of the strengths and weaknesses of the strategic engagement for gender equality 2016-2019*, European Commission, Directorate-General for Justice and Consumers, Publications Office of the European Union, Luxembourg, 2019*.*

Hodgins, M., O'Connor, P. and Buckley, L-A., 'Institutional change and organisational resistance to gender equality in higher education: An Irish case study', *Administrative Sciences,* Vol. 12, 2022, p. 59, https://doi.org/10.3390/admsci12020059

Inclusive Gender Equality in the European Research Area (E03833/4), *Terms of Reference*, 2023, https://ec.europa.eu/transparency/expert-groups-register/screen/expert-groups/consult?lang=en&fromMainGroup=true&groupID=103813

Institutional Transformation for Effecting Gender Equality in Research (INTEGER), n.d., https://cordis.europa.eu/project/id/266638/reporting

Kalpazidou Schmidt, E. and Cacace, M., 'Setting up a dynamic framework to activate gender equality structural transformation in research organisations', *Science and Public Policy,* Vol. 46, No 3, 2019, pp. 321-338, doi: 10.1093/scipol/scy059.

Kalpazidou Schmidt, E. and Graversen, E.K., 'Developing a conceptual evaluation framework for gender equality interventions in research and innovation', *Evaluation and Programme Planning,* Vol. 79, 2020, p.101750, https//:doi.org/10.1016/j.evalprogplan.2019.101750

Kalpazidou Schmidt, E., Ovseiko, P.V., Henderson, L.R. and Kiparoglou, V., 'Understanding the Athena SWAN award scheme for gender equality as a complex social intervention in a complex system: analysis of Silver award action plans in a comparative European perspective', *Health Research Policy and Systems,* vol. 18, 2020, pp. 1-21, https://doi.org/10.1186/s12961-020-0527-x

Knapińska, A. and Chrobak-Tatara, M., GENDERACTIONplus *Deliverable 6.1 Benchmarking analysis of monitoring/evaluation of GEPs*, 2023, https://genderaction.eu/wp-content/uploads/2023/07/GENDERACTIONplus_D6.1_Benchmarking-analysis-of-monitoringevaluation-of-GEPs.pdf

Krook, M.L. and Mackay, F. (Eds.), *Gender, Politics and Institutions,* Palgrave Macmillan, London, 2011.

Linková, M. and Mergeart, L., 'Negotiating change for gender equality: identifying leverages, overcoming barriers', *Investigaciones Feministas,* Vol. 12, No 2, 2021, pp. 297-308, doi: 10.5209/infe.72319.

Linkova, M., *GENDERACTION Deliverable 5.2 Annual Reports to the Helsinki Group*, 2021, https://h2020.genderaction.eu/wp-content/uploads/2021/09/741466_D5-2_Reporting-to-SWG-GRI_submitted.pdf

Mackay, F., 'Conclusion: Towards a Feminist Institutionalism?' in Krook, M.L. and Mackay, F. (Eds.), *Gender, Politics and Institutions,* Palgrave Macmillan, London, 2011, pp. 181-196, https://doi.org/10.1057/9780230303911_11

Mackay, F., 'Nested newness, institutional innovation, and the gendered limits of change', *Politics & Gender*, Vol. 10, No 4, 2014, pp. 549-571, https://doi.org/10.1017/S1743923X14000415

Mackay, F., Kenny, M. and Chappell, L., 'New institutionalism through a gender lens: Towards a feminist institutionalism?', *International Political Science Review*, Vol. 31, No 5, 2010, pp. 573-588, doi: 10.1177/0192512110388788.

Ní Laoire, C., Linehan, C., Archibong, U., Picardi, I. and Udén, M., 'Context matters: Problematising the policy-practice interface in the enactment of gender equality action plans in universities', *Gender, Work and Organisation,* Vol. 28, 2021, pp. 575-593, doi: 10.1111/gwao.12594.

O'Connor, P., 'Why is it so difficult to reduce gender inequality in male-dominated higher educational organisations? A feminist institutional perspective', *Interdisciplinary Science Reviews,* Vol. 45, No 2, 2020, pp. 207–228, https://doi.org/10.1080/03080188.2020.1737903

O'Connor. P. and Irvine, G., 'Multi-level state interventions and gender equality in higher level institutions: the Irish case', *Administrative Sciences,* Vol. 10, No 4, 2020, pp. 98-119, doi:10.3390/admsci10040098.

O'Mullane, M., 'Developing a theoretical framework for exploring the institutional responses to the Athena SWAN Charter in higher education institutions: a feminist institutionalist perspective', *Irish Journal of Sociology,* Vol. 29, No 2, 2021, pp. 227-228, doi: 10.1177/0791603521995372.

Otero-Hermida, P. and Garcia-Mélon, M., 'Gender equality indicators for research and innovation from a responsible perspective: the case of Spain', *Sustainability,* Vol. 10, No 9, 2018, pp. 2980-3000, doi:10.3390/su10092980.

Practicing Institutional Gender Equality in Science (PRAGES), https://cordis.europa.eu/project/id/217754

Sangiuliano, M., 'Planning institutional change for gender equality in research: Reflections from a study on GEPs implementation in Europe' in M. Sangiuliano & A. Cortesi (Eds.), *Institutional*

Change for Gender Equality in Research: Lesson Learned from the Field, Edizioni Ca'Foscari, Venice, 2019, pp. 179-233.

Sangiuliano, M. and Cortesi, A. (Eds.), *Institutional Change for Gender Equality in Research: Lesson Learned from the Field*, Edizioni Ca'Foscari, Venice, 2019.

Sangiuliano, M., Gorbacheva, E. and Canali, C., 'From planning to tailoring and implementing GEPs' in M. Sangiuliano & A. Cortesi (Eds*.), Institutional Change for Gender Equality in Research: Lesson Learned from the Field*, Edizioni Ca'Foscari, Venice, 2019, pp. 59-73.

Slovenian Presidency of the Council of the European Union, *Ljubljana Declaration: Gender Equality in Research and Innovation,* 2021, https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/PSEU/Ljubljana-Declaration-on-Gender-Equality-in-Research-and-Innovation-_endorsed_final.pdf

Stratigaki, M., 'Gender mainstreaming vs positive action: an ongoing conflict in EU gender equality policy', *European Journal of Women's Studies*, Vol. 12, No 2, 2005, pp. 165-186, https://doi.org/10.1177/1350506805051236

Tardos, K. and Paksi, V., 'Diversity management and gender equality outcomes in research, development and innovation organisations: Lessons for practitioners', *Review of Sociology,* Vol. 28, No 4, 2019, pp. 166-190, https://doi.org/10.51624/SzocSzemle.2018.4.8

The Gender in Science and Technology LAB (GENIS LAB), https://cordis.europa.eu/project/id/266636/reporting

Thomson, O., Palmén, R., Reidl, S., Barnard, S., Beranek, S., Dainty, A.R.J. and Hassan, T.M., 'Fostering collaborative approaches to gender equality interventions in higher education and research: the case of transnational and multi-institutional communities of practice', *Journal of Gender Studies*, Vol. 31, No 1, 2022, pp. 36-54, https://doi.org/10.1080/09589236.2021.1935804

Tildesley, R., la Barbera, M.C. and Lombardo, E., '"What use is the legislation to me?" Contestations around the meanings of gender equality in legislation and its strategic use to drive structural change in university organisations', *Gender, Work & Organisation*, Vol. 30, No 6, 2023, pp. 1996-2013, doi: 10.1111/gwao.13039.

Transformation for Effecting Gender Equality in Research (INTEGER), https://cordis.europa.eu/project/id/266638/reporting

Tzanakou, C., Clayton-Hathway, K. and Humbert, A.L., 'Certifying gender equality in research: Lessons learnt from Athena SWAN and Total E-Quality award schemes', *Frontiers in Sociology,* Vol. 6, 2021, doi: 10.3389/fsoc.2021.784446.

Van den Brink, M. and Benschop, Y., 'Slaying the seven-headed dragon: The quest for gender change in academia', *Gender, Work & Organisation,* Vol. 19, 2012, pp. 71-92, https://doi.org/10.1111/j.1468-0432.2011.00566.x

Verge, T., Ferrer-Fons, M. and González, J., 'Resistance to mainstreaming gender into the higher education curriculum', *European Journal of Women's Studies,* Vol. 25, No 1, 2018, pp. 86-101, https://doi.org/10.1177/135050681668823

WBC-RRI.NET, *From Strategy to Action: Lessons from Gender Equality Plans in the Western Balkans,* 2023, https://wbc-rri.net/from-strategy-to-action-lessons-from-gender-equality-plans-in-the-western-balkans/

Wroblewski, A., *GENDERACTIONplus Deliverable 5.1 First report on monitoring ERA Action implementation at national level*, 2023, https://genderaction.eu/wp-content/uploads/2023/09/GENDERACTIONplus_D5.1_First-report-on-monitoring-ERA-action-implementation-at-national-level.pdf

2. Data collection and analysis for inclusive GEPs: Intersectional challenges and solutions for R&I institutions

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Abstract

This article addresses the need for inclusive gender equality plans in research and innovation, focusing on the challenges of collecting and analysing intersectional data for structural change. It proposes a re-evaluation of conventional steps involved in data collection on intersectional data and distinguishes between 'inclusion/inclusive' and 'intersectional' Gender Equality Plans (GEPs). The article emphasises the importance of adopting an intersectional approach and explores key questions and challenges within the intersectional data cycle. It discusses practical steps and offers guidance for intersectional data collection, including participatory processes, sampling strategies, and the use of qualitative methods. The article also highlights the significance of measurement and analysis from an intersectional perspective, addressing issues related to categorisation and measurement equivalence. Lastly, it introduces innovative methods for analysing intersectional data, such as multilevel intersectional modelling, to capture the complex interactions of intersecting social inequalities. By addressing these challenges and considerations, the article aims to enhance the understanding and application of intersectional data collection for inclusive Gender Equality Plans and achieving sustainable change towards greater equality and inclusion.

2.1.   Introduction

In the development, implementation, and evaluation of Gender Equality Plans (GEPs), the collection and monitoring of data play a crucial role. Data not only increase visibility but also help identify inequalities, prioritise interventions, and are essential for monitoring and evaluating the effectiveness of policies ([72]).

The policy context at the EU and international level increasingly stresses the importance of intersectionality for addressing social inequalities. Building a Union of Equality lies at the centre of the Commissions' agenda incorporating five key strategies addressing gender equality ([73]), combating racism ([74]), achieving LGBTIQ equality ([75]), as well as a strategy for the equality, inclusion and participation of Roma people ([76]) and persons with disabilities ([77]). For the European Research Area (ERA), Action 5 of the ERA Policy Agenda 2022-2024 emphasises the broadening of gender equality policies towards 'inclusiveness' and 'intersectionality', involving a shift from 'GEPs' to 'inclusive GEPs' ([78]). While these and other European Commission documents elevate the concepts of 'inclusive' or 'inclusiveness' to key dimensions of ERA policy-making, for example by introducing GEPs as an eligibility criterion for Horizon Europe funding, their usage remains somehow vague. 'Inclusion' and 'intersectionality', or 'inclusion' and 'diversity', are frequently used interchangeably referring to multiple socio-demographic categories while they are in fact different concepts ([79]). This contributes to the common perception that moving towards inclusive GEPs is a challenging task.

The following article contributes to the discussion developing and implementing inclusive GEPs by focusing on data collection and analysis. For example, the first step, typically involving an initial diagnostic already poses its own challenges as not all identity groups are considered to the same extent. Minoritised groups that are situated at the intersection of multiple identities (e.g. a transgender person from an ethnic minority) can easily remain invisible as they do not fit the recognised prototype of any identity group ([80]). Making the experiences of all intersecting identities visible is then often perceived as a difficult task given existing legal restrictions for data collection

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([72]) European Institute for Gender Equality (EIGE), *Roadmap to gender equality plans in research and higher education institutions. Success factors and common obstacles,* European Institute for Gender Equality, 2016, https://eige.europa.eu/sites/default/files/gear_roadmap_02_successfactors_obstacles_0.pdf

([73]) European Commission, *A Union of Equality: Gender Equality Strategy 2020-2025*, 2020, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0152

([74]) European Commission, *A Union of equality: EU anti-racism action plan 2020-2025,* Publications Office of the European Union, Luxembourg, 2020, https://op.europa.eu/s/zhrS

([75]) European Commission, *Union of Equality: LGBTIQ Equality Strategy 2020-2025,* Publications Office of the European Union, Luxembourg, 2020, https://bit.ly/3T68XZm

([76]) European Commission, *EU Roma strategic framework for equality, inclusion and participation for 2020-2030,* Publications Office of the European Union, Luxembourg, 2020, https://bit.ly/3V9QHAP

([77]) European Commission, *Union of Equality: Strategy for the rights of persons with disabilities 2021-2030,* Publications Office of the European Union, Luxembourg, 2021, https://data.europa.eu/doi/10.2767/31633

([78]) European Commission, *A new ERA for Research and Innovation,* COM(2020) 628), Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2777/605834

([79]) European Commission, *A Union of Equality: Gender Equality Strategy 2020-2025*, 2020, p. 16, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0152

([80]) Purdie-Vaughns, V. and Eibach, R. P., 'Intersectional invisibility: The distinctive advantages and disadvantages of multiple subordinate-group identities, *Sex Roles*, Vol. 59, No 5, 2008, pp. 377-391. https://doi.org/10.1007/s11199-008-9424-4

and methodological issues around possible disclosure. Thus, the danger is that the minoritised groups that would benefit most from inclusive GEPs remain invisible.

This article provides guidance and clarifications regarding the challenges related to data collection and analysis using an intersectional approach for the purpose of developing and implementing more inclusive GEPs. It addresses the meaning of related yet distinct concepts such as diversity, inclusion and intersectionality, while providing concrete suggestions and examples on data collection, legal considerations, research questions and analytical approaches that can be applied. It does so by combining feminist principles of intersectionality with principles of equality data collection. By distinguishing more clearly the critical demands of an intersectional approach from data protection issues, advancing towards inclusive GEPs becomes more feasible.

2.2. Intersectionality as key concept in understanding structural inequalities

At the outset, greater conceptual clarity is required for the different terminologies used, such as 'inclusion' or 'inclusive', but also 'diversity' and of course 'intersectionality'. Diversity can be understood as about socio-demographic (e.g. race [81], gender, sex, ethnicity, age, religious beliefs, sexual orientation, socio-economic status), or functional (e.g. educational attainment) characteristics linked to people, and how these shape similarities or differences between individuals. Inclusion is a participatory process, infused with feminist and social justice principles with a transformative aim, to achieve an inclusive outcome [82]. Intersectionality is an approach to understand and transform how the diversity characteristics of individuals combine and overlap and are tied to historical and structural relations of discrimination and privilege. Intersectionality is 'a form of resistant knowledge developed to unsettle conventional mindsets, challenge oppressive power, think through the full architecture of structural inequalities and asymmetrical life opportunities, and seek a more just world' [83]. The focus of intersectionality is not only on social inequalities (differences in status, treatment, and opportunities among individuals or groups within a society), but also on structural inequalities, that is how social inequalities are rooted in political, legal, and economic structures.

Intersectionality goes beyond the collection and analysis of disaggregated data because it is primarily geared towards the transformation of power relations and thus addressing structural inequalities. To do so, feminist scholars emphasise how social identities and their corresponding categories need to be deconstructed, are always related to other identities, and embedded in a specific social context, that involves historically grown, complex power relations [84]. Using an intersectional approach for inclusive GEPs also implies the incorporation of different dimensions of intersectionality throughout all stages of GEP design, implementation, and evaluation: power,

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[81] The European Union rejects theories which attempt to determine the existence of separate human races. The use of the terms "race" and "racial origin" does not imply an acceptance of such theories. See the Council Directive 2000/43/EC of 29 June 2000 implementing the principle of equal treatment between persons irrespective of racial or ethnic origin as well as the EU Anti-Racism Action Plan 2020-2025, p.1.

[82] Palmen, R. & INSPIRE Consortium, *Policy Brief INSPIRE vision* [Deliverable 2.3 INSPIRE Project]. INSPIRE Centre of Excellence, 2003, https://zenodo.org/records/10039559

[83] May, V. M., *Pursuing intersectionality, unsettling dominant imaginaries,* Routledge, Taylor & Francis Group, 2015, p. xi.

[84] Collins, P. H. and Bilge, S., *Intersectionality* (2nd edition), Polity Press, 2020, https://www.amazon.es/Intersectionality-Concepts-Patricia-Hill-Collins/dp/0745684491; Misra, J., Curington, C. V. and Green, V. M., 'Methods of intersectional research', *Sociological Spectrum*, Vol. 41, No 1, 2021, pp. 9-28, https://doi.org/10.1080/02732173.2020.1791772

relationality, complexity, social context, and deconstruction ([85]). In what follows, we briefly introduce these defining dimensions of intersectionality in more detail before describing how they should inform data collection and analysis.

1) Focus on power and oppression. Intersectionality is primarily concerned with understanding and transforming the complex power dynamics of social inequality ([86]). As such, it is a critical theory, revealing how power relations shape the 'construction of thought, experience, and knowledge' ([87]). Power relations are thereby conceived as having a structural, historical, institutional and cultural dimension of inequalities. Consequently, intersectionality targets racism and not solely race, sexism and not solely gender, i.e. the systemic and structural processes that sustain and reproduce social inequalities ([88]).

2) Relationality. Social inequalities are relational, constituting privilege and disadvantage as two sides of the same coin. '[o]ne group's privilege is not free-floating, but directly tied to another group's disadvantage', as when the privilege of white women renders invisible the disadvantages of black women ([89]). Relationality sharpens the view for discrimination and privilege between and within groups. It also recognises that the preservation of the already advantaged might be as important for the reproduction of inequalities as the marginalisation of the disadvantaged ([90]). While mapping structural inequalities, relationality reminds us that '[t]he name of the problem addressed is white supremacy and male dominance, or white male dominance, not race and sex classifications' ([91]). Intersectionality focuses on the often hierarchical relations among several social identities, rather than single categories.

3) Complexity. The relational quality of oppression leads to the recognition that the social world is complex. The idea that individuals have multiple roles and identities that give rise to overlapping experiences of exclusion and inclusion is at the heart of the complex nature of intersectionality. It concerns the non-reducible, non-additive quality of intersecting inequalities. Researchers contrast this complex understanding of overlapping inequalities with a segmented model of inclusion ([92]). In the latter, different social institutions are perceived as saturated with precisely one form of inequality. For instance, class is seen as most salient in relation to the economy, gender in relation

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([85]) Misra, J., Curington, C. V. and Green, V. M., 'Methods of intersectional research', *Sociological Spectrum*, Vol. 41, No 1, 2021, pp. 9-28, https://doi.org/10.1080/02732173.2020.1791772

([86]) Collins, P. H., 'Black feminist thought in the matrix of domination', *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*, Vol. 138, No 1990, 1990, pp. 221-238; Hunting, G. and Hankivsky, O., 'Cautioning Against the co-optation of intersectionality in gender mainstreaming', *Journal of International Development*, Vol. 32, No 3, 2020, pp. 430436, https://doi.org/10.1002/jid.3462; McCall, L., *Complex Inequality: Gender, Class, and Race in the New Economy*, Psychology Press, 2001.

([87]) Else-Quest, N. M. and Hyde, J. S., 'Intersectionality in Quantitative psychological research: I. Theoretical and epistemological issues', *Psychology of Women Quarterly*, *40*(2), 2016, p. 158, https://doi.org/10.1177/0361684316629797

([88]) British Columbia's Office of the Human Rights Commissioner, *Disaggregated demographic data collection in British Columbia: The grandmother perspective*, Office of the Human Rights Commissioner, 2020, https://bchumanrights.ca/wp-content/uploads/BCOHRC_Sept2020_Disaggregated-Data-Report_FINAL.pdf

([89]) Misra, J., Curington, C. V. and Green, V. M., 'Methods of intersectional research', *Sociological Spectrum*, Vol. 41, No 1, 2021, p. 12, https://doi.org/10.1080/02732173.2020.1791772

([90]) DiTomaso, N., *The American Non-Dilemma: Racial Inequality Without Racism,* Russell Sage Foundation, 2013.

([91]) MacKinnon, C. A., 'Intersectionality as method: A note', *Signs: Journal of Women in Culture and Society*, Vol. 38, No 4, 2013, p. 1023, https://doi.org/10.1086/669570

([92]) Choo, H. Y. and Ferree, M. M., 'Practicing Intersectionality in sociological research: A critical analysis of inclusions, interactions, and institutions in the study of inequalities', *Sociological Theory*, Vol. 28, No 2, 2013, pp. 129-149, https://doi.org/10.1111/j.1467-9558.2010.01370; Walby, S., Armstrong, J. and Strid, S., 'Intersectionality: Multiple inequalities in social theory', *Sociology*, Vol. 46, No 2, 2012, pp. 224-240, https://doi.org/10.1177/0038038511416164

to the family, and ethnicity in relation to the nation, all without considering how these inequalities intersect and interact.

4) Context matters. Context is key for understanding that inequalities are always located at specific sites, composed of spatial, geographic but also temporal and historical contexts. Yet, inequalities tend to only be considered at the individual level, failing to fully account for the structural, institutional, and historical nature of the context [93]. Experiences of exclusion and discrimination differ and change across national, regional, organisational contexts. As such, considering context holds the key for deciding on the purpose and priority for data collection. Instead of aiming to cover all dimensions of social discrimination equally, context can indicate which overlapping characteristics matter most where and when and what to prioritise as the most salient axes of power inequalities.

5) Deconstruction. Social categories are not naturally given, but are in flux and can be deconstructed, redrawn and reconceptualised. Deconstructing categories is thereby not only a discursive move, but also aims at breaking down differences upon which relations of social injustice are organised. Equality practitioners, scholars or policy makers need to keep in mind the range of diversity and difference within groups, which are always more granular and detailed as categories can capture and understand any effort at measuring these differences as imperfect but pragmatic tools that seek to achieve a transformative goal. Deconstructing has direct implications for data collection, as when respondents are able to describe their preferred identity in their own terms.

Intersectionality can be understood as encompassing the multiple inequalities shaped by different axes of power within diverse sets of social relations [94]. It is through the lens of intersectionality that we gain a comprehensive understanding of these structural inequalities. Central to this understanding is the examination of how gender interacts with other grounds of socio-demographic and functional diversity [95]. Approaching gender equality from an intersectional perspective thus recognises that different systems of power operating among gender and other social categories interact and reinforce each other.

2.3. Equality data from an intersectional perspective

Gathering data for designing or monitoring inclusive GEPs defies simple recipes. Although worries regarding legal restrictions or the definition of specific socio-demographic categories such as race appear to be the most pressing, these are best addressed as part of a broader, critical reflection on equality data for social justice. For a start, the central features of intersectionality need to be combined with core principles of equality data collection [96]. Several additional guidance

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[93] European Network Against Racism (ENAR), *Intersectional discrimination in Europe: Relevance, challenges and ways forward*, European Network against Racism, 2019, https://www.enar-eu.org/intersectional-discrimination-in-europe-relevance-challenges-and-ways-forward/

[94] Walby, S., Armstrong, J. and Strid, S., 'Intersectionality: Multiple inequalities in social theory', *Sociology*, Vol. 46, No 2, 2012, pp. 224-240, https://doi.org/10.1177/0038038511416164

[95] Humbert, A. L. and Guenther, E. A., 'Data with a (feminist) purpose: Quantitative methods in the context of gender, diversity and management', in V. Stead, C. Elliott and S. Mavin (Eds.), *Handbook of Research Methods on Gender and Management,* Edward Elgar Publishing, 2021, pp. 145-160, https://china.elgaronline.com/edcollchap/edcoll/9781788977920/9781788977920.00018.xml; Humbert, A. L., Strid, S., Tanwar, J., Lipinsky, A. and Schredl, C., 'The role of intersectionality and context in measuring gender-based violence in universities and research-performing organisations in Europe for the development of inclusive structural interventions', *Violence Against Women*, 2024, https://doi.org/10.1177/10778012241231773

[96] European Commission, *Guidelines on improving the collection and use of equality data,* European Commission, 2021, https://bit.ly/3Vc2G0G; European Commission and Makkonen, T., *European handbook on equality data 2016 revision.,*Publications

documents provided by the European Commission to help Member States improve their equality data collection efforts for LGBTIQ ([97]) and race and ethnic origin ([98]) underline the importance of collecting data across several specific dimensions of social discrimination ([99]). In fact, 'intersectionality' in terms of data disaggregation is often considered a core feature of equality data collection in line with other core features such as 'purposefulness' and 'do no harm', 'participatory process', 'self-identification', 'voluntary consent', and 'anonymity' ([100]). As will become apparent, the core principles of an intersectional approach and the core principles of equality data collection create a closely knit fabric in which the practical implications for research methods, data gathering, analytical techniques and the use and dissemination of data are entangled.

For a start, the principle of 'purposefulness' of data collection is strongly related to addressing power relations from an intersectional perspective. More data do not necessarily imply more justice, as they can also be used for more policing and stigmatisation ([101]). Critical reflections that approach the purpose of data collection and analysis are currently being developed across diverse fields of application, including 'data justice' for developing Artificial Intelligence applications ([102]), the use of open data and science for Indigenous communities ([103]) or guidelines for collecting diversity data in universities ([104]). Although these approaches differ in terms of their field of application and target audience, they coincide on the centrality of the *purpose* of data collection for the benefit of involved communities.

Specifying an explicit Theory of Change ([105]) before data collection starts is thus crucial. A Theory of Change outlines the sequence of events and actions expected to lead to a desired outcome. Consequently, it prompts practitioners to critically think about their monitoring needs in the light of

Office of the European Union, Luxembourg, 2016, https://publications.europa.eu/en/publication-detail/-/publication/cd5d60a3-094d-11e7-8a35-01aa75ed71a1/language-en; United Nations Human Rights Office, *A Human Rights Based Approach to Data - Leaving No One Behind in the 2030 Agenda for Sustainable Development: Guidance Note to Data Collection and Disaggregation,* United Nations, 2018, https://bit.ly/48Kl0RM

([97]) European Commission, *Guidance note on the collection and use of data for LGBTIQ equality,* Publications Office of the European Union, Luxembourg, 2023, https://data.europa.eu/doi/10.2838/398439

([98]) European Commission, *Guidance note on the collection and use of equality data based on racial or ethnic origin,* Publications Office of the European Union, Luxembourg, 2021a, https://data.europa.eu/doi/10.2838/06180

([99]) See further the *Compendium of Practices on Equality Data* published by the European Union Agency for Fundamental Rights https://fra.europa.eu/en/themes/equality-non-discrimination-and-racism/about-compendium

([100]) Baumann, A.-L., Egenberger, V. and Supik, L., *Erhebung von Antidiskriminierungsdaten in repräsentativen Wiederholungsbefragungen. Bestandsaufnahme und Entwicklungsmöglichkeiten,* Antidiskriminierungsstelle des Bundes, 2018, https://www.antidiskriminierungsstelle.de/SharedDocs/Downloads/DE/publikationen/Expertisen/Datenerhebung.html; Gyamerah, D., Bartel, D., Yıldırım-Calima, D., Andrades, E. M., Bremberger, T. and Aikinis, J. K., *Diskriminierung, Repräsentation und Empowerment: 12 Methoden zur Erhebung von Antidiskriminierungs- und Gleichstellungsdaten auf dem Weg zu Communities-basierten Monitorings (CBM),* Citizens of Europe + advd, 2022, https://citizensforeurope.org/publications/

([101]) Black Public Health Collective, *Race-based data is not racial justice,* Black Public Health Collective, 2020, https://blackpublichealth.ca/wp-content/uploads/2020/06/BPHC-Statement-on-Race-Based-Data_COVID-19_Policing.pdf

([102]) Leslie, D., Katell, M., Aitken, M., Singh, J., Briggs, M., Powell, R., Rincón, C., Chengeta, T., Birhane, A., Perini, A., Jayadeva, S. and Mazumder, A., *Advancing Data Justice Research and Practice: An Integrated Literature Review,* 2022, https://doi.org/10.5281/zenodo.6408304

([103]) Carroll, S. R., Garba, I., Figueroa-Rodríguez, O. L., Holbrook, J., Lovett, R., Materechera, S., Parsons, M., Raseroka, K., Rodriguez-Lonebear, D., Rowe, R., Sara, R., Walker, J. D., Anderson, J. and Hudson, M., 'The CARE principles for indigenous data governance', *Data Science Journal*, Vol. 19, 2020, pp. 43-43, https://doi.org/10.5334/dsj-2020-043

([104]) Rosenstreich, G., De Wit, K., Bekers, T., Botoko, C., Hagelin, A., Kuuppelomäk, P., Strzemecka, S. and Wallace, C., *Diversity Data Collection: Exploratory Mapping & Reflection,* Una Europa Diversity Council, 2022, https://una-europa.imgix.net/resources/Diversity-Data-Collection-Exploratory-Mapping-Reflection.pdf

([105]) Funnell, S. C. and Rogers, P. J., *Purposeful Programme Theory: Effective Use of Theories of Change and Logic Models,* John Wiley & Sons, 2011; Mason, P. and Barnes, M., 'Constructing Theories of Change: Methods and sources', *Evaluation*, Vol. 13, No 2, 2007, pp. 151-170, https://doi.org/10.1177/1356389007075221

already tested and recommended interventions, such as those available through the GEAR tool ([106]). For example, although implicit bias training is a standard intervention implemented by the majority of GEPs, research has shown that it is relatively ineffective to achieve behavioural- and structural change ([107]). A Theory of Change spells out how and through which interventions inequalities can be reduced and provides depth and interpretative purpose to the data collected. This concerns not only descriptive evidence on numerical representation, but more importantly how outcomes of privilege and inequalities differ across and within groups, for example, in terms of physical and mental health, violence, workloads, care strains among other.

Using a 'participatory process' strongly speaks to the intersectional principles of 'power' and 'social context'. To the degree that reciprocal and respectful relations exist at all stages of data gathering, analysis, use, storage and dissemination, inclusive data practices serve the goal of achieving data sovereignty and become themselves empowering ([108]). Addressing existing inequalities is also dependent on the identification of real needs among stakeholders which allows for the design of interventions that are relevant and meaningful, and hence can make real changes. Participation identifies opportunities but also helps to foresee possible risks and misuse of the data collected, avoiding and preventing further stigmatisation. This necessarily involves a reflection on the specific social context in which marginalisation occurs. Finally, participation before, during and after data collection helps questioning the implicit value assumptions inherent in research methods, indicators and outcomes. This serves the deconstructive principle of intersectionality, as misleading or irrelevant categories for describing minoritised groups can be detected, scrutinised and amended.

'Self-identification' is a third principle of equality data collection that speaks to several dimensions of intersectionality, mainly 'deconstruction', 'complexity' and 'relationality'. Encouraging self-identification is a first step to identify mismatches between existing/official categories, and those preferred by minoritised groups. The principle of 'self-identification' thus contributes to the deconstruction of existing categories and is also necessary for indicating multiple social identities, both in terms of privilege and discrimination.

2.4.   Types of data: which type for what purpose?

The European Handbook on Equality Data 2016 revision ([109]) provides a useful overview of different sources of equality data, including official surveys, census, administrative registers, complaints data, research, and diversity monitoring. We introduce briefly in what follows the main distinction between quantitative and qualitative data and furthermore, the distinction between survey-based versus administrative data.

([106]) European Institute for Gender Equality, *Gender equality in academia and research GEAR tool,* Publications Office of the European Union, Luxembourg, 2016.

([107]) Dobbin, F. and Kalev, A., 'Why diversity programmes fail', *Harvard Business Review*, Vol. 94, No 7, 2016, https://hbr.org/2016/07/why-diversity-programs-fail

([108]) British Columbia's Office of the Human Rights Commissioner, *Disaggregated demographic data collection in British Columbia: The grandmother perspective*, Office of the Human Rights Commissioner, 2020, p. 9, https://bchumanrights.ca/wp-content/uploads/BCOHRC_Sept2020_Disaggregated-Data-Report_FINAL.pdf

([109]) European Commission and Makkonen, T., *European handbook on equality data 2016 revision.,*Publications Office of the European Union, Luxembourg, 2016, https://publications.europa.eu/en/publication-detail/-/publication/cd5d60a3-094d-11e7-8a35-01aa75ed71a1/language-en

2.4.1. Qualitative and quantitative data

Although the focus of this paper is on the collection and analysis of quantitative data for inclusive GEPs, the role and use of qualitative methods needs to be mentioned, especially considering our broader ambition to use data for social transformation. Qualitative research such as interviews and observations, or action research, have historically been the main vehicle for feminist scholars to carry out intersectional research. There are two reasons for this. First, qualitative research starts from the premises that meaning and understanding are fundamental dimensions of human activity. The social world is a world in which people act according to the way they interpret their environment and make sense of it. Thus, addressing inequalities necessarily implies approximating this subjective dimension of 'being-in-the-world' by using narrative approaches, life stories or other methods that allow for an understanding of experiences of exclusion and inclusion across multiple categories such as gender and race. The focus on subjectivity and individual experiences thereby unveils how exclusion and inclusion are not additive phenomena, but acquire a distinct quality as social categories overlap in each persons lived experience. This focus on lived experience has brought about a clear preference for qualitative methodologies in most published studies on intersectionality ([110]).

Second, the preference for interpretative approaches and hence qualitative research by feminist scholars is further strengthened by an uneasy relationship with quantitative data. Historically, feminist thinkers have critically engaged with the epistemological claims to objective, universal knowledge often attached to quantitative data. Contrary to universalistic beliefs inherent in many branches of the natural sciences which focus on the discovery of laws that are independent of time and place, feminist scholars have highlighted the embodied and hence situated, historical, context-dependent and contingent nature of knowledge ([111]). Quantification builds upon and reinforces the dominance of numbers as the 'modern fact', providing a supposedly simple, neutral access to the world that is free of interpretation and only subject to eternal laws of mathematics ([112]).

However, quantification and its related practices such as benchmarking suggests an impartiality and objectivity that hides the political dimension inherent in measurement decisions. In this sense, from an intersectional perspective, quantitative methods create an 'ethical conundrum' ([113]), as their alleged superior capability to provide evidence often render minoritised communities and their experiences invisible (e.g. the small N problem, that is the difficulty to capture enough cases or participants that belong to multiple and nuanced social categories). The issue is precisely to recognise that the problem of discrimination and minoritisation is not dependent on the number of people concerned, and that quantitative data and techniques might obscure and harm because 'suddenly we get told "there aren't enough of you". The Black community faces that: "Well, there

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([110]) Beeckmans, J., Zanoni, P. and Van Laer, K., *Intersectional policies in Higher Education and Research: A scoping literature review* [Deliverable 2.1 INSPIRE Project], INSPIRE Centre of Excellence, 2023, https://zenodo.org/records/10033571; Rodriguez, J. K., Holvino, E., Fletcher, J. K. and Nkomo, S. M., 'The theory and praxis of intersectionality in work and organisations: Where do we go from here?', *Gender, Work & Organisation*, Vol. 23, No 3, 2016, pp. 201-222, https://doi.org/10.1111/gwao.12131; Spierings, N., 'The inclusion of quantitative techniques and diversity in the mainstream of feminist research', *European Journal of Women's Studies*, Vol. 19, No 3, 2012, pp. 331-347, https://doi.org/10.1177/1350506812443621

([111]) Harding, S., *The science question in feminism,* Cornell University Press, 1986; Harding, S., *Whose science? Whose knowledge?: Thinking from women's lives,* Cornell University Press, 1991.

([112]) Poovey, M., *A history of the modern fact: Problems of knowledge in the sciences of wealth and society* (3th ed.), University of Chicago Press, 2004.

([113]) Bowleg, L. and Bauer, G., 'Invited reflection: Quantifying intersectionality', *Psychology of Women Quarterly*, Vol. 40, No 3, 2016, pp. 337-341, https://doi.org/10.1177/0361684316654282

aren't enough of us because of you, right?'" ([114]). Overall, qualitative approaches have been dominant in intersectional research, showing how experiences of exclusion and privilege occur across multiple social categories. Doing interviews, focus groups or observations should therefore form part of any data monitoring approach.

2.4.2. Administrative versus survey-based data

Two main sources of quantitative data can be identified. On the one hand, data collection forms part of many administrative processes carried out by public administration or organisational entities. Labour contracts, registrations and records in official registers, courses or associations usually require personal information such as age, sex/gender, marital status among others. While this administrative data collection has the advantage of covering complete populations, for example all employees or students in an organisation, it has also several disadvantages when examined from an intersectional perspective. First, it is at odds with the principle of 'purposefulness': 'The focus in most universities is on fulfilling external reporting requirements rather than monitoring and promoting equity' ([115]). Data collection often appears as an end in itself, without a clear idea how it can support policy to benefit minoritised groups and structural change. The collection of several socio-demographic categories can thereby be seen as problematic from a data protection perspective, if its purpose is not clear. Second, administrative data collection is often conditioned by traditional and broad categories that are neither sensitive to context nor allow self-identification, and hence can differ from those accepted and/or understood by respondents ([116]). As a result, these categories tend to reproduce rather than address existing exclusionary practices. Third, administrative data are restricted, in most cases, to socio-demographic information and are thereby limited to 'counting heads', that is indicating the under-/over representation of specific groups ([117]). What remains invisible are the experiences of discrimination and minoritisation that are central to an intersectional perspective.

Survey-based data collection, in contrast, can capture experiences of working conditions, perceptions, and experiences of discrimination as well as their effects, for example in terms of mental or physical health. Consequently, survey-based data collection can become much more focused and purpose driven than administrative data, as it not only informs on numerical representation but also on the associated privileges and disadvantages that need to be addressed. Surveys carried out at the organisational level can be informed by a clear purpose that links data collection to targeted interventions. Surveys are also more flexible in terms of offering more context sensitive, and hence granular, self-identification categories for respondents. If they are grounded in an inclusive participatory process, these categories can be adapted to the specific geographical and organisational context and needs, which in turn increases the chances that the data are relevant and useful for change. However, survey-based data are not limited to the organisational

([114]) British Columbia's Office of the Human Rights Commissioner, *Disaggregated demographic data collection in British Columbia: The grandmother perspective*, Office of the Human Rights Commissioner, 2020, p. 18, https://bchumanrights.ca/wp-content/uploads/BCOHRC_Sept2020_Disaggregated-Data-Report_FINAL.pdf

([115]) Rosenstreich, G., De Wit, K., Bekers, T., Botoko, C., Hagelin, A., Kuuppelomäk, P., Strzemecka, S. and Wallace, C., *Diversity Data Collection: Exploratory Mapping & Reflection*, Una Europa Diversity Council, 2022, p. 63, https://una-europa.imgix.net/resources/Diversity-Data-Collection-Exploratory-Mapping-Reflection.pdf

([116]) Ibid., p. 50.

([117]) Humbert, A. L., Guenther, E. A. and Müller, J., 'Not simply "counting heads": A Gender Diversity Index for the team level', *Social Indicators Research,* 2021, https://doi.org/10.1007/s11205-021-02635-5

level but can equally target wider regional or national populations ([118]). Large scale surveys such as the European Social Survey ([119]) or the EU statistics on income and living conditions (EU-SILC) demonstrate that high quality, comparable and consistent data across time can be collected, given sufficient funds are available. Survey-based data collection hence have much to offer in terms of making legal data protection requirements more manageable while also serving the transformative purpose of intersectional principles.

2.5. Preparing for intersectional data collection

What makes the data collection and analysis intersectional is not simply the inclusion of multiple demographic categories. Adding other categories of discrimination such as socio-economic status or ethnic origin to gender is not sufficient. An intersectional approach involves a critical reflection of how these social categories are woven into the reproduction of social inequalities, for example, in the way they render visible certain identities and exclude others. Social inequalities are not only shaped by socio-demographic characteristics, but also by functional roles such as working under precarious contracts or being employed in a foreign country. Both socio-demographic and functional diversity can create minoritised statuses, alone or in their interactions.

Data collection also needs to be guided by a purpose that contributes ultimately to the improvement of people's lives. However, this is only feasible to the degree that intersectional principles inform all stages of the research process, including the design of research questions, the sampling strategy, and certainly the formulation of a Theory of Change that is based upon a careful analysis of the historical or organisational context.

2.5.1. Research design and research questions

The research design and research questions need to be initially informed by the organisational, geographic and historical context. Context provides guidance on which specific intersectional locations need attention during data collection. It is key for establishing priorities according to community needs instead of addressing all existing diversities in an abstract manner.

Exploratory analysis using qualitative methods are encouraged at an initial stage, as they are key for an inclusive participatory process. In the absence of existing reports, census or clearly articulated needs, several methods can be used in preparation of a more systematic data collection effort.

(1) Description of single case(s). The description and analysis of examples of personal experiences of exclusion can highlight contextual issues, intersectional location, antecedents and consequences of discrimination. They provide a first approximation of the possible scope and characteristics of discrimination in a given context. They also capture how individuals identify or disagree with existing identities. Descriptions can be based upon observations or interviews.

([118]) For an overview regarding the collection of anti-discrimination data in representative longitudinal surveys, for example in German, see Baumann, A.-L., Egenberger, V. and Supik, L., *Erhebung von Antidiskriminierungsdaten in repräsentativen Wiederholungsbefragungen. Bestandsaufnahme und Entwicklungsmöglichkeiten,* Antidiskriminierungsstelle des Bundes, 2018, https://www.antidiskriminierungsstelle.de/SharedDocs/Downloads/DE/publikationen/Expertisen/Datenerhebung.html

([119]) Available at: https://www.europeansocialsurvey.org/

Guiding questions illicit experiences of exclusion but also experiences of privilege. It is important thereby to not ask for single or main reasons of discrimination, as these occur precisely at the intersection of multiple dimensions of identity ([120]).

(2) Focus groups provide another, frequently used, exploratory approach to collect needs and experiences. The interaction of two or more participants allows to reflect upon individual experiences together and already arrive at a more systematic understanding of broader patterns of discrimination in a given context.

Guiding questions prompt participants to share experiences and explore commonalities and differences within their collective.

These initial exploratory findings provide an orientation on the historical context of minoritisation. They also provide a first impression of possible discrepancies between official, administrative data and the need for self-descriptions and the priorities of socio-demographic categories to be addressed. As such, an initial qualitative stage is best suited to apply an 'anticategorical approach' ([121]) as it deconstructs membership group and highlights the contingency and fuzzy boundaries of existing categories.

These initial exploratory analyses can provide a solid basis for the design of a more systematic, quantitative data collection effort, which aims at generating further evidence on the magnitude and distribution of social-structural inequalities. Possible study designs include within-group design and between-group designs ([122]). While the within-group design targets the experiences of discrimination at a specific intersectional location, it is the between-group comparison that opens the door to understandings of how the simultaneous membership of multiple groups shapes experiences of minoritisation, exclusion but also inclusion.

(3) Between-group design constructs relevant sub-groups and systematically compares differences and commonalities between these groups and their intersecting group memberships via a quantitative approach.

Guiding questions explore, for example, which forms of gender-based violence do women experience most, compared to men but also compared to other women that are younger (or older), belong to an ethnic minority (or majority).

Implementing a between-group design to tackle intersecting inequalities affects various aspects of the research process, notably the sampling strategy employed to ensure adequate statistical power, that is the ability to provide evidence on significant differences between groups when analysing data. Further guidance concerning research design is available in Box 1: Research design guidance.

([120]) Harnois, C. E., Bastos, J. L. and Shariff-Marco, S., 'Intersectionality, contextual specificity, and everyday discrimination: Assessing the difficulty associated with identifying a main reason for discrimination among racial/ethnic minority respondents', *Sociological Methods & Research*, 2020, https://doi.org/10.1177/

([121]) McCall, L., 'The complexity of intersectionality', *Signs: Journal of Women in Culture and Society*, Vol. 30, No 3, 2005, pp. 1771-1800, https://doi.org/10.1086/426800

([122]) Else-Quest, N. M. and Hyde, J. S., 'Intersectionality in Quantitative psychological research: I. Theoretical and epistemological issues', *Psychology of Women Quarterly*, *40*(2), 2016, p. 158, https://doi.org/10.1177/0361684316629797

Box 1: Research design guidance

Further guidance on questions of intersectional research design and questions is available from the following resources covering both quantitative and qualitative data.

- Guidance note on the collection and use of data for LGBTIQ equality ([123])

- Meet the Methods Series: Quantitative intersectional study design and primary data collection ([124])

- Unpacking intersectional approaches to data ([125])

- Intersectional approaches to equality research and data ([126])

- Working with data. Guidance and tools to help you gather and analyse equality data, and deal with small numbers ([127])

- Feminist Research Practice: A Primer ([128])

2.5.2. Legal frameworks and data protection

A widely shared concern in Europe is the view that the collection of personal sensitive data such as disability, race, religion, or ethnic origin is not legal, locking many European countries into 'a self-inflicted equality data paralysis' ([129]). While a strong precaution with the uncontrolled collection of sensitive data is certainly warranted – especially due to Nazi-Germany's historic misuse of census profiling during the holocaust – the current lack of equality data makes it difficult to address inequalities and discrimination. Overall, the current legislation on these matters across Europe can be characterised by a tension between the need for equality data on the one hand and the need for personal data protection on the other (see Box 2: Guidance on EU legal frameworks). Importantly, while this tension between data protection and providing evidence on inequalities does exist, it does not result in a definite prohibition to process data on race, ethnic origin, religion, sexual orientation, disability or health. Rather, existing legislation has put safeguards in place to

([123]) European Commission, *Guidance note on the collection and use of data for LGBTIQ equality,* Publications Office of the European Union, Luxembourg, 2023, https://data.europa.eu/doi/10.2838/398439

([124]) Canadian Institutes of Health Research (CIHR), and Bauer, G. R., *Meet the methods series: Quantitative intersectional study design and primary data collection*, Canadian Institutes of Health Research, 2021, https://cihr-irsc.gc.ca/e/52352.html

([125]) Global Partnership for Sustainable Development Data, *Unpacking intersectional approaches to data. A white paper produced by the Inclusive Data Charter, Champions and partners,* Global Partnership for Sustainable Development Data, 2021, https://www.data4sdgs.org/sites/default/files/file_uploads/JN_1286_IDC_KP_WhitePaper_24pp_A4.pdf

([126]) Christoffersen, A., *Intersectional approaches to equality research and data*, Equality Challenge Unit, 2017, http://www.ecu.ac.uk/wp-content/uploads/2017/04/Research_and_data_briefing_2_Intersectional_approaches_to_equality_research_and_data.pdf

([127]) Lawson, J., *Working with data. Guidance and tools to help you gather and analyse equality data, and deal with small numbers*, Equality Challenge Unit, 2016, https://www.advance-he.ac.uk/guidance/equality-diversity-and-inclusion/using-data-and-evidence/working-data

([128]) Hesse-Biber, S. N. (Ed.), *Feminist Research Practice: A Primer*, SAGE Publications, 2014.

([129]) Chopin, I., Farkas, L. and Germaine, C., *Ethnic origin and disability data collection in Europe: Measuring inequality - Combating discrimination,* Equality Data Initiative, Open Society Foundations, 2014, p. 18, https://www.opensocietyfoundations.org/uploads/d28c9226-bed7-4b1b-ac8b-4455f3c3451a/ethnic-origin-and-disability-data-collection-europe-20141126.pdf

guarantee that sensitive data are collected only under certain conditions, for certain purposes and protecting the privacy of participants.

Examining the German case more closely, for example, shows that data protection legislation explicitly prohibits the processing of personal sensitive data but subsequently defines exceptions to this rule: personal information on race, ethnic origin, religion can be collected if it has been provided on a voluntary basis, if it serves the interests of the affected person or public, or in case it is needed as evidence for legal claims ([130]). This approach mirrors European law, as specified in Article 9 of the General Data Protection Regulation ([131]) which prohibits in a similar fashion the processing of personal sensitive data (see Box 3: GDPR) – except for 10 clearly specified exceptions, including where explicit consent has been given or where processing is necessary, for example for scientific or historical research that is proportionate to the aim pursued and safeguards the fundamental rights and interests of the individuals involved. Making use of this legal framework, data on ethnic origin have recently been collected in Germany by a PhD student association of the Max Planck Gesellschaft, showing that almost one-quarter of German respondents identify as being from a racial or ethnic minority background ([132]). These and other initiatives are key to overcome the 'colour-blindness' and omission of racism in Europe ([133]).

Current European and national legal frameworks thus do not prohibit the collection of personal sensitive data. Rather, collection efforts need to be embedded in a careful reflection on how it complies with existing restrictions. Gathering sensitive equality data on the organisational level, for example, has both advantages and disadvantages in this regard. On the one hand, collecting data on sensitive issues is justified more easily at the organisational level as a participatory process helps to make data collection proportionate to its use. Collecting data closer to where it is generated and used provides a good starting point to make it relevant and thus beneficial to the target population involved. At the same time, collecting sensitive data at the organisational level can be more challenging in terms of protecting the anonymity of respondents when the sample is small as disclosure risks increase.

([130]) Baumann, A.-L., Egenberger, V. and Supik, L., *Erhebung von Antidiskriminierungsdaten in repräsentativen Wiederholungsbefragungen. Bestandsaufnahme und Entwicklungsmöglichkeiten,* Antidiskriminierungstelle des Bundes, 2018, https://www.antidiskriminierungsstelle.de/SharedDocs/Downloads/DE/publikationen/Expertisen/Datenerhebung.html

([131]) Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA Relevance), Pub. L. No. 2016/679 (2016). http://data.europa.eu/eli/reg/2016/679/2016-05-04/eng

([132]) Boytchev, H., 'Diversity in German science: Researchers push for missing ethnicity data', *Nature*, Vol. 616, No 7955, 2023, pp. 22-24, https://doi.org/10.1038/d41586-023-00955-9; Majev, P.-G., Vieira, R. M., Carollo, A., Liu, H., Stutz, D., Fahrenwaldt, A., Drummond, N. and Group 2020/2021, M. P. P. survey, *PhDnet Report 2020,* Max Planck Gesellschaft, 2021, https://doi.org/10.17617/2.3344273

([133]) European Network Against Racism (ENAR), *Intersectional discrimination in Europe: Relevance, challenges and ways forward*, European Network against Racism, 2019, https://www.enar-eu.org/intersectional-discrimination-in-europe-relevance-challenges-and-ways-forward/

Box 2: Guidance on EU legal frameworks for data collection

The European Commission has published several reports providing an overview of legal frameworks for equality data collection in general ([134]) and on specific topics such as racial or ethnic origin ([135]), ethnic origin and disability ([136]), or LGBTI people ([137]).

Box 3: GDPR - General Data Protection Regulation

Personal sensitive data, according to the GDPR include data revealing (a) racial or ethnic origin, political opinions, religious or philosophical beliefs; (b) trade-union membership; (c) genetic data, biometric data processed solely to identify a human being; (e) health-related data; (f) data concerning a person's sex life or sexual orientation.

2.5.3. Inclusive participatory process

Planning and organising data collection across multiple social categories needs to be a participatory process from the very beginning: 'nothing about us – without us' ([138]). Minoritised communities need to be meaningfully involved avoiding tokenist, top-down consultations in favour of a transformational inclusiveness that involves relations that are 'equitable, symmetrical, egalitarian and reciprocal' ([139]). A community-based, participatory approach is frequently identified as a central success factor to keep risks of further stigmatisation at a minimum and produce positive and relevant results before and during data collection ([140]). Along these lines, inclusion should not be understood as an outcome but primarily as a participatory, transformative process guided by non-negotiable core values such as feminism, care, social and epistemic justice, solidarity and democratic participation. Participation is key, especially from an equality data protection perspective, as it feeds centrally into the intersectional principle of transforming power relations.

([134]) European Commission, *Analysis and comparative review of equality data collection practices in the European Union: Legal framework and practice in the EU Member States,* Publications Office of the European Union, Luxembourg, 2017, https://data.europa.eu/doi/10.2838/6934

([135]) European Commission, *Guidance note on the collection and use of equality data based on racial or ethnic origin,* Publications Office of the European Union, Luxembourg, 2021, https://data.europa.eu/doi/10.2838/06180; Farkas, L. and European Commission, *Analysis and comparative review of equality data collection practices in the European Union: Data collection in the field of ethnicity,* Publications Office of the European Union, Luxembourg, 2017, https://data.europa.eu/doi/10.2838/447194

([136]) Chopin, I., Farkas, L. and Germaine, C., *Ethnic origin and disability data collection in Europe: Measuring inequality - Combating discrimination,* Equality Data Initiative, Open Society Foundations, 2014, p. 18, https://www.opensocietyfoundations.org/uploads/d28c9226-bed7-4b1b-ac8b-4455f3c3451a/ethnic-origin-and-disability-data-collection-europe-20141126.pdf

([137]) Ibid.

([138]) Baumann, A.-L., Egenberger, V. and Supik, L., *Erhebung von Antidiskriminierungsdaten in repräsentativen Wiederholungsbefragungen. Bestandsaufnahme und Entwicklungsmöglichkeiten,* Antidiskriminierungstelle des Bundes, 2018, p. 108, https://www.antidiskriminierungsstelle.de/SharedDocs/Downloads/DE/publikationen/Expertisen/Datenerhebung.html

([139]) Leslie, D., Katell, M., Aitken, M., Singh, J., Briggs, M., Powell, R., Rincón, C., Chengeta, T., Birhane, A., Perini, A., Jayadeva, S. and Mazumder, A., *Advancing Data Justice Research and Practice: An Integrated Literature Review,* 2022, p. 20, https://doi.org/10.5281/zenodo.6408304

([140]) Wallerstein, N., Oetzel, J. G., Sanchez-Youngman, S., Boursaw, B., Dickson, E., Kastelic, S., Koegel, P., Lucero, J. E., Magarati, M., Ortiz, K., Parker, M., Peña, J., Richmond, A. and Duran, B., 'Engage for equity: A long-term study of community-based participatory research and community-engaged research practices and outcomes', *Health Education & Behaviour*, Vol. 47, No 3, 2020, pp. 380-390, https://doi.org/10.1177/1090198119897075

These recommendations align with existing approaches to the design of GEPs, which emphasise the importance of diverse stakeholder participation from the very outset (EIGE 2016). For example, this is a central feature in the Athena SWAN certification for gender equality in the UK, which recommends setting-up a self-assessment team to drive the process. Guaranteeing a representative participatory process, however, is not an easy task. As minoritised groups are by definition less visible and harder to access, considerable effort can be required to build up this type of stakeholder involvement.

2.5.4. Recruitment of participants and sampling

Data collection from an intersectional approach specifically aims to capture experiences of minoritised groups that have often been invisible, which thus puts the spotlight on ensuring adequate recruitment. Outreach activities through associations, interest groups, NGOs or other might be first good step to get in contact with minoritised groups. For example, the *Afrocensus* that captured experiences of African and Afrodiasporic people in Germany involved Black communities in the design of its questionnaire as well as in its outreach activities which contributed to its success [141]. Similarly, organisation-level data collection efforts should reach out to bottom-up initiatives among minoritised staff and student groups to improve the relevance of collected data from the very outset. Public calls for participation, clearly visible points of contacts and addresses, or the provision of safe spaces can be helpful. Reaching out to minoritised groups is especially relevant from a quantitative perspective, where the statistical analysis of intersecting categories requires sufficiently large samples to generate evidence.

Deciding on an adequate sampling strategy that allows for statistical analysis across several categories is key for an intersectional analysis. An increase in sample size (oversampling) may be required depending on which intersections are of interest [142] For instance, if a study aims to examine the intersection of gender and race, oversampling may be necessary to ensure an adequate representation of individuals from racial minority groups and diverse gender identities. Sampling strategies can be either random or non-random, with random methods considered the gold standard of the scientific process because they help minimise bias and ensure that the sample chosen for a study is representative of the population from which it is drawn. Randomly selecting participants reduces the likelihood of systematic errors or confounding variables influencing the results, thus increasing the reliability and validity of the findings.

However, random sampling methods might not always represent all experiences and perspectives. Simple random sampling, for example, gives all individuals equal probability of being selected but may result in group sizes that are too small for any meaningful analysis for groups that are under-represented numerically. A stratified random sample, which involves dividing the population into distinct subgroups, and then randomly selecting samples from each subgroup, can mitigate this

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[141] Aikins, M. A., Bremberger, T., Aikinis, J. K., Gyamerah, D. and Yıldırım-Calima, D., *Afrozensus 2020: Perspektiven, Anti-Schwarze Rassismuserfahrungen und Engagement Schwarzer, afrikanischer und afrodiasporischer Menschen in Deutschland*, Each One Teach One (EOTO) e.V., 2021, https://afrozensus.de/

[142] Canadian Institutes of Health Research (CIHR), and Bauer, G. R., *Meet the methods series: Quantitative intersectional study design and primary data collection*, Canadian Institutes of Health Research, 2021, https://cihr-irsc.gc.ca/e/52352.html

problem by selecting the most pertinent characteristics, before under- or over-sampling from different groups to achieve sufficient representation ([143]).

Non-random sampling methods, such as purposive sampling, provide opportunities to ensure sufficient representation. Purposive sampling involves selecting participants based on specific criteria or characteristics, rather than randomly, focusing on individuals who possess desired qualities or experiences. It seeks to achieve sufficient representation and can be particularly useful when used for hard-to-reach populations. However, the use of non-random methods often comes at the expense of the possibility to generalise from the findings themselves ([144])

2.6.   Measuring

Research questions need to be translated into concepts that can be operationalised and eventually measured. The choice of categories is thereby highly contentious because they tend to stabilise, essentialise and reify differences and their associated power relations ([145]). Far from being self-evident ascriptions of group membership, socio-demographic categories are 'authentic instruments of inequality' ([146]) as they are woven into political, social and economic processes of exclusion and inclusion. Hence it is important to consult with minoritised groups from the outset on how their self-descriptions might differ from established categories of group membership. This is also especially relevant from a decolonial perspective, as existing categories used in official census mirror the interest the colonising power. Although this is at times difficult – as self-identifications and positions within these groups might diverge – it is a challenge that needs to be addressed to avoid the uncritical stabilisation of existing categories and the use of data that deepens existing discriminatory practices rather than promoting equality.

The concern here is about ensuring that there is no conflation between membership group 'uniformity' and 'unity' ([147]). To overcome this challenge and facilitate data collection and monitoring, some scholars have thus proposed temporarily stabilising categories and considering them as 'heuristic devices' ([148]). This approach aims to ensure that intersectionality is embraced as an 'analytical sensibility', shifting the focus from creating fixed categories of analysis to analysing the social dynamics and relationships between individuals. The goal is to examine the structures of inequalities rather than simply focusing on categories of identity. By adopting this

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([143]) Bryman, A., Bell, E., Reck, J. and Fields, J., *Social Research Methods,* Oxford University Press, 2022.

([144]) Bowleg, L. and Bauer, G., 'Invited reflection: Quantifying intersectionality', *Psychology of Women Quarterly*, Vol. 40, No 3, 2016, pp. 337-341, https://doi.org/10.1177/0361684316654282; Else-Quest, N. M. and Hyde, J. S., 'Intersectionality in Quantitative psychological research: I. Theoretical and epistemological issues', *Psychology of Women Quarterly*, *40*(2), 2016, p. 158, https://doi.org/10.1177/0361684316629797

([145]) Crenshaw, K., 'Mapping the margins: Intersectionality, identity politics, and violence against women of colour', *Stanford Law Review*, Vol. 43, No 1241, 1990; McCall, L., 'The complexity of intersectionality', *Signs: Journal of Women in Culture and Society*, Vol. 30, No 3, 2005, pp. 1771-1800, https://doi.org/10.1086/426800; Walby, S., Armstrong, J. and Strid, S., 'Intersectionality: Multiple inequalities in social theory', *Sociology*, Vol. 46, No 2, 2012, pp. 224-240, https://doi.org/10.1177/0038038511416164

([146]) MacKinnon, C. A., 'Intersectionality as method: A note', *Signs: Journal of Women in Culture and Society*, Vol. 38, No 4, 2013, p. 1023, https://doi.org/10.1086/669570

([147]) Hancock, A.-M., 'When multiplication doesn't equal quick addition: Examining intersectionality as a research paradigm', *Perspectives on Politics*, Vol. 5, No 1, 2007, pp. 63-79, https://doi.org/10.1017/S1537592707070065

([148]) Cho, S., Crenshaw, K. W. and McCall, L., 'Toward a field of intersectionality studies: Theory, applications, and praxis', *Signs: Journal of Women in Culture and Society*, Vol. 38, No 4, 2013, p. 786, https://doi.org/10.1086/669608

analytical sensibility, equality practitioners, researchers and policy makers can start to navigate the complexities of intersectionality while conducting data collection and analysis.

Measurement instruments need to be carefully calibrated, regardless of whether they are used in the natural or social sciences. This is especially relevant when it comes to measuring social or psychological constructs using an intersectional approach. Researchers distinguished between 'conceptual equivalence', 'measurement invariance', and 'intersectional measurement' ([149]). Conceptual equivalence assures that a given concept has the same meaning when used for in-between group comparisons. For example, using the term 'people of colour' can be misleading as the term works for White respondents, but might not capture experiences of discrimination for Black and Hispanic groups ([150]). 'Measurement invariance' in turn ensures that the psychometric properties of a given construct are the same when used with different samples of respondents and is vital for the validity of comparisons made between different groups. While it is common practice to validate translations of measurement scales, the same logic should be applied when using the same scale across different groups. Finally, 'intersectional measurement' is concerned with the development and validation of scales adapted to the experiences of under-represented minoritised groups and their membership of unique intersectional locations.

The Gendered Racial Microaggressions Scale (GRMS) was developed to capture subtle and everyday verbal, behavioural, and environmental expressions of oppression based on the intersection of one's race and gender ([151]). It is geared to capture specifically micro-aggressions of Black women. Another scale was developed specifically targeting microaggressions and overt forms of heterosexism against LGBQ students ([152]). This is just one among many measurement scales capturing discrimination against sexual minorities, with most presenting suboptimal psychometric properties ([153]). Most scales can be seen as having questionable content validity because they are not created in collaboration with sexual minorities. Other similar reviews and measurement scales also exist for religion ([154]), ageism ([155]), or race-related scales ([156]).

([149]) Else-Quest, N. M. and Hyde, J. S., 'Intersectionality in Quantitative psychological research: I. Theoretical and epistemological issues', *Psychology of Women Quarterly*, *40*(2), 2016, p. 158, https://doi.org/10.1177/0361684316629797

([150]) Marini, M., Waterman, P. D., Breedlove, E. R., Chen, J. T., Testa, C., Pardee, D. J., LeBlanc, M., Reisner, S. L., Oendari, A. and Krieger, N., 'Using implicit measures of discrimination: White, Black, and Hispanic participants respond differently to group-specific racial/ethnic categories vs. the general category "people of colour" in the USA', *Journal of Racial and Ethnic Health Disparities*, 2022, https://doi.org/10.1007/s40615-022-01353-z

([151]) Lewis, J. A. and Neville, H. A., 'Construction and initial validation of the Gendered Racial Microaggressions Scale for Black women', *Journal of Counseling Psychology*, Vol. 62, No 2, 2015, pp. 289-302, https://doi.org/10.1037/cou0000062

([152]) Woodford, M. R., Chonody, J. M., Kulick, A., Brennan, D. J. and Renn, K., 'The LGBQ Microaggressions on Campus Scale: A scale development and validation study', *Journal of Homosexuality*, Vol. 62, No 12, 2015, pp. 1660-1687, https://doi.org/10.1080/00918369.2015.1078205

([153]) Morrison, T. G., Bishop, C. J., Morrison, M. A. and Parker-Taneo, K., 'A psychometric review of measures assessing discrimination against sexual minorities', *Journal of Homosexuality*, Vol. 63, No 8, 2016, pp. 1086-1126, https://doi.org/10.1080/00918369.2015.1117903

([154]) Kawika Allen, G. E., Wang, K. T., Richards, P. S., Ming, M. and Suh, H. N., 'Religious Discrimination Scale: Development and initial psychometric evaluation,' *Journal of Religion and Health*, Vol. 59, No 2, 2020, pp. 700-713, https://doi.org/10.1007/s10943-018-0617-z

([155]) Ayalon, L., Dolberg, P., Mikulionienė, S., Perek-Białas, J., Rapolienė, G., Stypinska, J., Wilińska, M. and de la Fuente-Núñez, V., 'A systematic review of existing ageism scales', *Ageing Research Reviews*, Vol. 54, No 100919, 2019, https://doi.org/10.1016/j.arr.2019.100919

([156]) Hester, N., Axt, J. R., Siemers, N. and Hehman, E., 'Evaluating validity properties of 25 race-related scales', *Behaviour Research Methods*, Vol. 55, No 4, 2012, pp. 1758-1777, https://doi.org/10.3758/s13428-022-01873-w

2.6.1. Going beyond socio-demographic categories

Much of the challenge when it comes to the collection of multiple categories of social discrimination concerns the choice of adequate and sufficiently granular sub-categories. This is especially relevant in terms of addressing the intersectional dimensions of 'context' and 'deconstruction' together with the data protection principle of 'self-identification'. Ethnicity, race, but also disability and health issues are highly context sensitive. This not only refers to the specific sub-categories used but also to which degree respondents self-identify with these categories or are perceived by others as members of this group. Other categories used, such as age, language, educational attainment are arguably less context sensitive. The extant literature provides considerable guidance on using sub-categories that are more inclusive especially on gender [157], trans status [158], sexual orientation [159], or a combination of these [160]. The European Commission provides several guidance on the collection of equality data on racial and ethnic origin [161], as well as LGBTIQ [162]. While these guidelines are certainly useful, they cannot replace an inclusive participatory process.

From an intersectional perspective, it is now crucial to understand how group membership as captured through socio-demographic categories is tied to structural inequalities. Measuring numerical imbalances of any given category is only a first step to a more in-depth assessment how experiences of discrimination and inequalities between different groups differ and interact. Research on social inequalities has ceaselessly documented how gender and other dimensions of discrimination map onto social roles, norms, and power relations. One list of variables covers gender roles and associated behaviours beyond respondent's gender identity [163]. Complementing gender as a descriptive label, it is important to capture associated structural inequalities for example in terms of 'caregiver strain', limited 'time use' or 'work strain' which affect women disproportionately compared to men. Similar, the article proposes concrete questionnaire items to capture differences with regards to gender-related traits (competitive, risk taking, independence, communal, expressive), and gender relations (social support, discrimination, quality of family support). These diverse gender-related variables should then be examined in relation to certain outcomes of interest, for example in terms of job satisfaction, mental health, or

[157] Cameron, J. J. and Stinson, D. A., 'Gender (mis)measurement: Guidelines for respecting gender diversity in psychological research', *Social and Personality Psychology Compass*, Vol. 13, No 11, 2019, e12506, https://doi.org/10.1111/spc3.12506; Lindqvist, A., Sendén, M. G. and Renström, E. A., 'What is gender, anyway: A review of the options for operationalising gender', *Psychology & Sexuality*, Vol. 12, No 4, 2020, pp. 1-13, https://doi.org/10.1080/19419899.2020.1729844

[158] Pega, F., Reisner, S. L., Sell, R. L. and Veale, J. F., 'Transgender health: New Zealand's innovative statistical standard for gender identity', *American Journal of Public Health*, Vol. 107, No 2, 2017, pp. 217-221, https://doi.org/10.2105/AJPH.2016.303465

[159] Baker, K. E., Streed, C. G. and Durso, L. E., 'Ensuring that LGBTQI+ people count: Collecting data on sexual orientation, gender identity, and intersex status', *New England Journal of Medicine*, Vol. 384, No 13, 2021, pp. 1184-1186, https://doi.org/10.1056/NEJMp2032447

[160] National Academies of Sciences, Engineering, and Medicine, *Measuring Sex, Gender Identity, and Sexual Orientation* (edited by T. Becker), National Academies Press, 2022, https://doi.org/10.17226/26424; Suen, L. W., Lunn, M. R., Katuzny, K., Finn, S., Duncan, L., Sevelius, J., Flentje, A., Capriotti, M. R., Lubensky, M. E., Hunt, C., Weber, S., Bibbins-Domingo, K. and Obedin-Maliver, J., 'What sexual and gender minority people want researchers to know about sexual orientation and gender identity questions: A qualitative study', *Archives of Sexual Behaviour*, Vol. 49, No 7, 2020, pp. 2301-2318, https://doi.org/10.1007/s10508-020-01810-y

[161] European Commission, *Guidance note on the collection and use of equality data based on racial or ethnic origin,* Publications Office of the European Union, Luxembourg, 2021, https://data.europa.eu/doi/10.2838/06180

[162] European Commission, *Guidance note on the collection and use of data for LGBTIQ equality,* Publications Office of the European Union, Luxembourg, 2023, https://data.europa.eu/doi/10.2838/398439

[163] Nielsen, M. W., Stefanick, M. L., Peragine, D., Neilands, T. B., Ioannidis, J. P. A., Pilote, L., Prochaska, J. J., Cullen, M. R., Einstein, G., Klinge, I., LeBlanc, H., Paik, H. Y. and Schiebinger, L., 'Gender-related variables for health research', *Biology of Sex Differences*, Vol. 12, No 1, 2021, p. 23, https://doi.org/10.1186/s13293-021-00366-3

organisational outcomes such as career progression and experiences of discrimination ([164]). Although research on gender-related variables is currently developed and relatively advanced ([165]), this is not necessarily the case for other dimensions of discrimination such as ethnicity, race, religion, or sexual orientation.

In this context it is also worth mentioning the UniSAFE questionnaire ([166]), a standardised and comprehensive measurement tool for assessing gender-based violence across academic institutions. The questionnaire is open source, to facilitate widespread adoption and replication in future studies, thereby contributing to a growing body of comparable and cumulative data that can inform policy and intervention strategies in academia.

2.6.2. Useful tools for quality measurements

Measuring different socio-demographic categories as well as their most common associated variables and outcomes is a challenging task. In what follows, two existing tools are introduced that offer a standardised framework based upon the existing literature for practitioners.

The *Gender Equality Audit and Monitoring* (GEAM) ([167]) tool is a valuable resource for collecting comprehensive and reliable data pertaining to various dimensions of social discrimination within organisations. It encompasses categories such as gender, sex, ethnic minority status, nationality, disability/chronic illness, trans history, age, sexual orientation, and socio-economic status. In addition to socio-demographic variables, the GEAM captures working conditions and respondents' experiences and perceptions of discrimination within organisations ([168]). Importantly, the categories and constructs included in GEAM have been developed through a participatory process while being specifically tailored to the European context ([169]). Community participation has made it possible to translate the English version of the questionnaire in 14 other languages to date, including Spanish, Portuguese, French, German, Polish, Lithuanian, Greek, Ukrainian, Serbian, Turkish, Italian, Romanian, Slovenian, Bosnian. Although the associated constructs target mainly working conditions such as work-life balance, parental leave, or micro-aggressions as well as outcome related variables such as job satisfaction from a gender perspective, the results can be analysed from an intersectional perspective given the inclusion of eight socio-demographic dimensions. An innovative aspect also concerns the availability of the GEAM questionnaire as an open, shareable survey archive file, easily imported and deployed in any LimeSurvey platform. The GEAM is currently supported in the framework of the INSPIRE ([170]) project, a four-year EU-funded project aimed at establishing a European Centre of Excellence on inclusive gender equality

([164]) Canadian Institutes of Health Research (CIHR), and Bauer, G. R., *Meet the methods series: Quantitative intersectional study design and primary data collection*, Canadian Institutes of Health Research, 2021, https://cihr-irsc.gc.ca/e/52352.html

([165]) Díaz-Morales, J. F., Esteban-Gonzalo, S., Martín-María, N. and Puig-Navarro, Y., 'Spanish adaptation of the gender-related variables for health research (GVHR): Factorial structure and relationship with health variables', *Spanish Journal of Psychology*, Vol. 26, 2023, e25, https://doi.org/10.1017/SJP.2023.25

([166]) See https://zenodo.org/records/7220636

([167]) Available at: https://geam.act-on-gender.eu

([168]) Aldercotte, A., Caprile, M., Guyan, K., Malibha-Pinchbeck, M., Müller, J., Palmén, R. and Startin, C., *ACT - Gender Equality Audit and Monitoring (GEAM) - Version 2*, Zenodo, 2021, https://doi.org/10.5281/zenodo.5348197

([169]) Guyan, K., Aldercotte, A., Müller, J., Caprile, M. and Torrado, S. Y., 'The development of the Gender Equality Audit and Monitoring survey', in R. Palmen and J. Müller (Eds.), *A Community of Practice Approach to Improving Gender Equality in Research*, Routledge, 2022, pp. 44-63, https://doi.org/10.4324/9781003225546-3

([170]) https://www.inspirequality.eu/

in research and innovation. During the project duration (2022-2026), consortium partners will develop and test a new module designed to capture student experiences, including instances of sexual violence and harassment.

The *Diversity Minimal Item Set* (DiMIS) ([171]) is a tool that has been recently developed in the context of health research ([172]). It offers a solution to the selection of social categories, especially in terms of their adaptability for country and language contexts. The item set defines questions and adequate sub-categories for gender, sex, age, socio-economic status, sexual orientation, ethnicity, religion, disability, country of birth, and language(s). It also includes measures for associated variables such as care responsibilities and mental and physical health. Country-level experts adapt these items into specific languages and cultural contexts. For example, while the English version for the UK asks about ethnic-racial identity offering 'Black, Black British, Caribbean or African' among several other answer options, the German version includes 'Afrodeutsch', 'Türkisch-deutsch' and the Spanish version includes 'Magrebi' among other categories, each mirroring important national migrant populations. In addition to providing context-sensitive sub-categorisations for selected socio-demographic variables, the DiMIS also eases the burden of translating answer options reliably across different languages. Consequently, it paves the way for collecting diversity data in a consistent way across different languages while making collected data comparable across studies - the same socio-demographic variables can now be explored in relation to diverse (health) outcomes across time and space.

2.7.   Analysing intersectional data

An intersectional perspective emphasises that race, class, gender, and other dimensions of social discrimination are not isolated or independent, but rather intersect and interact, resulting in intricate social inequalities ([173]). Regression analysis with interaction terms has been commonly employed to analyse the relationship between two or more variables–and their interaction –and a given outcome. Such methods for example allow for the inclusion of variable such as gender identity or ethnic origin, with the goal of providing prediction of the effects of, for instance, being a woman (gender identity), being White (ethnic origin) and being a White woman (gender x ethnic origin). However, this method has limitations when it comes to simultaneously analysing a large number of categories as the number of variables and their interactions can rapidly grow in size.

To address this, alternative methods have emerged to move away from the dominant approach of additive variable-centred analysis of intersectional quantitative data. These innovative methods are essential for capturing the systemic and structural nature of intersecting social inequalities and offer new insights into understanding intersectional inequalities, including the complex interactions at both intra-categorical and inter-categorical levels ([174]).

([171]) The DiMIS is available at https://gender.charite.de/en/measures/

([172]) Stadler, G., Chesaniuk, M., Haering, S., Roseman, J., Straßburger, V. M., Martina, S., Aisha-Nusrat, A., Maisha, A., Kasia, B., Theda, B., Pichit, B., Marc, D., Sally, D. M., Ruth, D., Ilona, E., Marina, F., Paul, G., Denis, G., Ulrike, G. and Mine, W., 'Diversified innovations in the health sciences: Proposal for a Diversity Minimal Item Set (DiMIS)', *Sustainable Chemistry and Pharmacy*, Vol. 33, No 101072, 2023, https://doi.org/10.1016/j.scp.2023.101072

([173]) Collins, P. H., 'Intersectionality's definitional dilemmas', *Annual Review of Sociology*, Vol. 41, No 1, 2015, pp. 1-20, https://doi.org/10.1146/annurev-soc-073014-112142

([174]) Bauer, G. R., Churchill, S. M., Mahendran, M., Walwyn, C., Lizotte, D. and Villa-Rueda, A. A., 'Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods', *SSM - Population Health*, Vol. 14, No

2.7.1. Small N and disclosure control

When collecting and analysing data across multiple socio-demographic groups, the number of respondents that pertain to several groups can become small, which has implications both in terms of protecting their anonymity as well as drawing inferences from a statistical point of view [175]. It is important to note that the small numbers problem so characteristic to an intersectional approach is not a sign to give up, but rather a sign of the particular challenge of overlapping minoritisation and invisibility to be addressed [176].

Statistical Disclosure Control (SDC) is a critical field in statistics and data analysis that deals with protecting sensitive or confidential data in general but particularly for small N [177]. The main principles of SDC revolve around balancing the need for data utility with the necessity of preserving individual privacy. Central to SDC, for example, is the concern with the threshold to adopt to prevent disclosure, or methods to modify and adjust data in a way that prevents reidentification of individuals, while still retaining the statistical validity and usefulness of the data. Key SDC techniques include suppressing cell values beyond a certain threshold, masking values to ensure anonymity such as in total rows or columns, or aggregating data into broader categories (see Box 4: HESA rounding strategy). Other methods adhering to SDC standards typically involve making greater use of modelling and inferential techniques, rather than descriptive techniques, as they allow for generalisation based on the data while not relying on single data points or observations. When applying SDC standards in intersectional research, which often involves analysing data across multiple dimensions of identity like race, gender, and socio-economic status, the challenge is to preserve the nuanced understanding of these intersections while still protecting privacy.

> **Box 4: Higher Education Statistics Agency rounding strategy**
>
> The Higher Education Statistics Agency in the UK [178] proposes the following rounding strategy:
>
> - All numbers are rounded to the nearest multiple of 5
> - Any number lower than 2.5 is rounded to 0

100798, 2021, https://doi.org/10.1016/j.ssmph.2021.100798; Else-Quest, N. M. and Hyde, J. S., 'Intersectionality in quantitative psychological research: II. Methods and mechniques', *Psychology of Women Quarterly*, Vol. 40, No 3, 2016, pp. 319-336, https://doi.org/10.1177/0361684316647953; Haynes, C., Joseph, N. M., Patton, L. D., Stewart, S. and Allen, E. L., 'Toward an understanding of intersectionality methodology: A 30-year literature synthesis of Black women's experiences in higher education', *Review of Educational Research*, Vol. 90, No 6, 2020, pp. 751-787, https://doi.org/10.3102/0034654320946822

[175] Christoffersen, A., *Data protection and anonymity considerations for equality research and data*, Advance HE, 2018, https://www.advance-he.ac.uk/knowledge-hub/data-protection-and-anonymity-considerations-equality-research-and-data; Hughes, M. M. and Dubrow, J. K., 'Intersectionality and women's political empowerment worldwide', in A. C. Alexander, C. Bolzendahl and F. Jalalzai (Eds.), *Measuring Women's Political Empowerment across the Globe: Strategies, Challenges and Future Research,* Springer International Publishing, 2018, pp. 77-96, https://doi.org/10.1007/978-3-319-64006-8_4; Wullert, K., Gilmartin, S. and Simard, C., 'The mistake companies make when they use data to plan diversity efforts', *Harvard Business Review*, 2019, https://hbr.org/2019/04/the-mistake-companies-make-when-they-use-data-to-plan-diversity-efforts

[176] Armstrong, M. A. and Jovanovic, J., 'The intersectional matrix: Rethinking institutional change for URM women in STEM', *Journal of Diversity in Higher Education*, Vol. 10, No 3, 2017, pp. 216-231, https://doi.org/10.1037/dhe0000021

[177] Griffiths, E., Greci, C., Kotrotsios, Y., Parker, S., Scott, J., Welpton, R., Wolters, A. and Woods, C., *Handbook on Statistical Disclosure Control for Outputs,* Safe Data Access Professionals Working Group, 2019, https://doi.org/10.6084/M9.FIGSHARE.9958520

[178] Lawson, J., *Working with data. Guidance and tools to help you gather and analyse equality data, and deal with small numbers*, Equality Challenge Unit, 2016, https://www.advance-he.ac.uk/guidance/equality-diversity-and-inclusion/using-data-and-evidence/working-data

As the following sections will show, other techniques that go beyond frequentist approaches are available. These approaches, which focus on estimating probabilities and making inferences based on the frequency or proportion of observed data, allow for the analysis of data from an intersectional perspective and consider the complex interactions between multiple social categories.

2.7.2. Regression and interaction

Methods to adopt an intersectional lens using quantitative methods typically rely on cross-tabulations, difference in means or regression analysis. For example, two categorical variables such as gender and academic grade (from grade A to D) can be examined to determine whether women and men are equally represented at all levels, or whether there are unequal career progressions due to vertical segregation. Difference in means can be examined in the context of determining average pay (a numerical variable) among women and men. This might be reported as an absolute difference for some variables, though in the case of pay, it is more usual to express this difference as a ratio of women's pay relative to men's. Simple regression models can extend these methods to a wider range of explanatory variables. For instance, pay can be examined in relation to a number of factors, such as gender, age, subject area, etc. More complex modelling procedures can also be employed. For instance, in the context of analysing gender pay gaps, researchers often decompose these gaps into explained and unexplained components. Regression methods, such as the Kitagawa or Oaxaca-Blinder decomposition techniques, are used to break down the observed differences. The explained component accounts for differences in characteristics (such as education, experience, and occupation), while the unexplained component captures variations in how those characteristics are valued or treated.

These methods are often associated with suitable measures of statistical significance, e.g. Chi-square tests of association or t-tests ([179]). However, adopting an intersectional perspective within quantitative methods remains challenging ([180]). Challenges include how, for example, cross-tabulations may become increasingly disclosive as more categories are added, how descriptive methods or simple multivariate methods fail to account or control for other relevant variables, or how these methods often focus on means to the detriment of heterogeneity, or how regression models are necessarily limited by the number of additive or multiplicative terms that can be added ([181]).

([179]) Christoffersen, A., *Intersectional approaches to equality research and data*, Equality Challenge Unit, 2017, http://www.ecu.ac.uk/wp-content/uploads/2017/04/Research_and_data_briefing_2_Intersectional_approaches_to_equality_research_and_data.pdf

([180]) Saperstein, A. and Westbrook, L., 'Categorical and gradational: Alternative survey measures of sex and gender', *European Journal of Politics and Gender*, Vol. 4, No 1, 2021, pp. 11-30, https://doi.org/10.1332/251510820X15995647280686

([181]) Hancock, A.-M., 'When multiplication doesn't equal quick addition: Examining intersectionality as a research paradigm', *Perspectives on Politics*, Vol. 5, No 1, 2007, pp. 63-79, https://doi.org/10.1017/S1537592707070065; Merlo, J., 'Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) within an intersectional framework', *Social Science & Medicine*, Vol. 203, 2018, pp. 74-80, https://doi.org/10.1016/j.socscimed.2017.12.026; Spierings, N., 'The inclusion of quantitative techniques and

2.7.3. Multilevel intersectional modelling

Recent and innovative methodological methods have emerged for a better integration of intersectionality as a theoretical lens and quantitative methods. This involves using multi-level methods to take intersectionality into account, often called the MAIHDA (Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy) approach ([182]). The approach's key idea is that individuals are not necessarily independent from each other, as assumed typically, but instead that their experiences are going to be shaped by their membership of different sets of social relations, constructed along various diversity characteristics such as race, gender, and socioeconomic status. Evans illustrates this point eloquently, explaining that 'individuals may share something concrete – like a neighbourhood – they may also share something abstract, like a common set of social exposures associated with their intersectional social identities' ([183]).

The use of intersectional multi-level modelling can also be useful expanded to take context into account. This may be done by supplementing individual level variables with variables located at the organisational or national level ([184]). Examples of such variables include the existence and/or coverage of policy documents, budget allocation to gender equality work, among others. Adding context into account can also be realised by extending intersectional multi-level modelling to intersectional cross-classified models, whereby organisational and/or national contexts can be specified in the modelling as levels in their own right. Recognising context is an integral part of intersectional analytical approaches, recognising that the influence of the broader context on individual experiences, paying attention to the relationship between actors, institutions and societies ([185]).

diversity in the mainstream of feminist research', *European Journal of Women's Studies*, Vol. 19, No 3, 2012, pp. 331-347, https://doi.org/10.1177/1350506812443621

([182]) Evans, C. R., Williams, D. R., Onnela, J.-P. and Subramanian, S. V., 'A multilevel approach to modeling health inequalities at the intersection of multiple social identities', *Social Science & Medicine*, Vol. 203, 2018, pp. 64-73, https://doi.org/10.1016/j.socscimed.2017.11.011; Merlo, J., 'Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) within an intersectional framework', *Social Science & Medicine*, Vol. 203, 2018, pp. 74-80, https://doi.org/10.1016/j.socscimed.2017.12.026

([183]) Evans, C. R., Williams, D. R., Onnela, J.-P. and Subramanian, S. V., 'A multilevel approach to modeling health inequalities at the intersection of multiple social identities', *Social Science & Medicine*, Vol. 203, 2018, p. 67, https://doi.org/10.1016/j.socscimed.2017.11.011;

([184]) Bauer, G. R., Churchill, S. M., Mahendran, M., Walwyn, C., Lizotte, D. and Villa-Rueda, A. A., 'Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods', *SSM - Population Health*, Vol. 14, No 100798, 2021, https://doi.org/10.1016/j.ssmph.2021.100798; Spierings, N., 'The inclusion of quantitative techniques and diversity in the mainstream of feminist research', *European Journal of Women's Studies*, Vol. 19, No 3, 2012, pp. 331-347, https://doi.org/10.1177/1350506812443621

([185]) Anthias, F., 'Rethinking social divisions: Some notes towards a theoretical framework', *Sociological Review*, Vol. 46, No 3, 1998, pp. 505-535, https://doi.org/10.1111/1467-954X.00129; Humbert, A. L., Strid, S., Tanwar, J., Lipinsky, A. and Schredl, C., 'The role of intersectionality and context in measuring gender-based violence in universities and research-performing organisations in Europe for the development of inclusive structural interventions', *Violence Against Women*, 2024, https://doi.org/10.1177/10778012241231773; Weldon, S. L., 'The structure of intersectionality: A comparative politics of gender', *Politics & Gender*, Vol. 2, No 2, 2006, pp. 235-248, https://doi.org/10.1017/S1743923X06231040

2.7.4. Latent class analysis

Latent class analysis (LCA) is a well-established analytical technique to extract meaningful groups from data ([186]) ([187]). In contrast to the variable centred techniques that start from existing social categories (and their interaction), LCA is a person-centred approach that starts from an analysis of the response pattern. Sub-groups of individuals emerge inductively precisely based upon their shared experience of discrimination as collected through their response pattern across multiple indicators ([188]). Responses are 'latent' because they do not map neatly onto socio-demographic categories but constitute an underlying pattern that identifies sub-groups. Although LCA has been around and used since the 1970s, its potential for intersectional analysis only recently has been recognised more explicitly. LCA and related clustering approaches are appealing for an intersectional approach as it speaks to the complex and non-additive nature of inequalities: group membership is determined via shared experiences of discrimination that are perfectly suited to capture compounding effects of multiple inequalities.

Using LCA, researchers showed how discrimination and bullying experiences among Boston adolescents in the US falls into four distinct groups: a group with few discrimination experiences (51 % of respondents), a group of adolescents experiencing mainly racial discrimination (33 %), one group with sexual orientation discrimination (7 %) and a fourth group which experiences racial and weight discrimination (7 %) leading to higher incidences of bullying ([189]). The LCA in this example shows how experiences of discrimination and associated outcomes differ across four distinct groups, identifying a sub-group where race and weight intersect in terms of stronger bullying experiences. Other researchers have used LCA to show, for example how mental health outcomes differ at the intersection of race, sexual orientation, class, and trans identity ([190]), or how academic and non-academic outcomes differ at the intersection of race/ethnicity, gender and socio-economic status ([191]) or age and ethnicity ([192]).

([186]) Collins, L. M. and Lanza, S. T., *Latent Class and Latent Transition Analysis,* John Wiley & Sons, Inc., 2009, https://doi.org/10.1002/9780470567333; Magidson, J., Vermunt, J. K. and Madura, J. P., 'Latent Class Analysis', in *SAGE Research Methods,* SAGE Publications Ltd, 2020, https://doi.org/10.4135/9781526421036

([187]) Several variants exist, the most common being: Latent Class Analysis using categorical variables, Latent Profile Analysis using continuous variables, and Latent Transition Analysis using longitudinal data.

([188]) Bauer, G. R., Mahendran, M., Walwyn, C. and Shokoohi, M., 'Latent variable and clustering methods in intersectionality research: Systematic review of methods applications', *Social Psychiatry and Psychiatric Epidemiology*, Vol. 57, No 2, 2022, pp. 221-237, https://doi.org/10.1007/s00127-021-02195-6

([189]) Garnett, B. R., Masyn, K. E., Austin, S. B., Miller, M., Williams, D. R. and Viswanath, K., 'The intersectionality of discrimination attributes and bullying among youth: An applied Latent Class Analysis', *Journal of Youth and Adolescence*, Vol. 43, No 8, 2014, pp. 1225-1239, https://doi.org/10.1007/s10964-013-0073-8

([190]) Budge, S. L., Thai, J. L., Tebbe, E. A. and Howard, K. A. S., 'The intersection of race, sexual orientation, socioeconomic status, trans identity, and mental health outcomes', *The Counselling Psychologist*, Vol. 44, No 7, 2016, pp. 1025-1049, https://doi.org/10.1177/0011000015609046

([191]) Bécares, L. and Priest, N., 'Understanding the influence of race/ethnicity, gender, and class on inequalities in academic and non-academic outcomes among eighth-grade students: Findings from an intersectionality approach', *PLOS ONE*, Vol. 10, No 10, 2015, e0141363, https://doi.org/10.1371/journal.pone.0141363

([192]) Wanka, A., Wiesböck, L., Allex, B., Mayrhuber, E. A.-S., Arnberger, A., Eder, R., Kutalek, R., Wallner, P., Hutter, H.-P. and Kolland, F., 'Everyday discrimination in the neighbourhood: What a 'doing' perspective on age and ethnicity can offer', *Ageing & Society*, Vol. 39, No 9, 2019, pp. 2133-2158, https://doi.org/10.1017/S0144686X18000466

2.7.5. Qualitative Comparative Analysis

Qualitative Comparative Analysis (QCA) offers yet another alternative to carry out an intersectional analysis. QCA is a research approach based upon set-theoretic principles, developed initially by Charles R. Ragin ([193]). It stands between traditional qualitative (small-N) and quantitative (large-N) research, with a special focus on analysing the complex interplay of conditions that lead to certain outcomes, such as poverty for example.

QCA is a case-oriented research strategy, in part invented in response to the limitations of variable centred approaches to intersectionality. As such it speaks directly to the intersectional principles of context, complexity, and a theory of change to address power relations Case studies are key for understanding social phenomena in context, where parts of a case constitute a coherent whole that needs to be explored as such ([194]). Complexity is thereby foregrounded by exploring how the contribution of several conditions to a specific outcome might change in the presence of absence of other factors. Importantly, using QCA as a method involves an explicit formulation how and why certain conditions contribute to an outcome. As the construction of sets is informed by the best available knowledge which conditions (e.g. parental leave policies, equality policies) contribute to a given outcome (e.g. women's labour market participation), QCA necessarily involves a theory on how to achieve change ([195]). QCA thus aligns well with feminist thinking about social phenomena as inherently complex, local and historically contingent ([196]).

QCA has the potential for an intersectional approach ([197]), as race, class and education can combine in different ways to produce poverty. Applying this technique, the authors analyse how Whites experience overlapping and reinforcing advantages, while Blacks experience overlapping and reinforcing disadvantages that remain invisible when using traditional quantitative techniques. In another example application of QCA, litigation defeat before the European Court of Human Rights regarding the right of religious manifestation was shown to have a strong intersectional element: all cases brought before the court by Muslim women (nationals of the country addressed by the complaint) were defeated ([198]). This constitutes 30 % of all defeated cases, showing a strong intersectional component between gender, nationality and religion.

([193]) Ragin, C. C., *The comparative method: Moving beyond qualitative and quantitative strategies,* University of California, 1987; Ragin, C. C., *Fuzzy-set social science*, University of Chicago Press, 2000.

([194]) Ragin, C. C., *The comparative method: Moving beyond qualitative and quantitative strategies: with a new introduction,* University of California Press, 2014.

([195]) Schneider, C. Q. and Wagemann, C., *Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis*, Cambridge University Press, 2012, https://doi.org/10.1017/CBO9781139004244

([196]) Ciccia, R., 'Qualitative Comparative Analysis as a tool for concept clarification, typology building, and contextualised comparisons in gender and feminist research', *Politics & Gender*, Vol. 12, No 3, 2016, https://doi.org/10.1017/S1743923X16000374; Hancock, A.-M., 'Empirical intersectionality: A tale of two approaches', *UC Irvine Law Review*, Vol. 3, No 2, 2013, p. 259; Spierings, N., 'The inclusion of quantitative techniques and diversity in the mainstream of feminist research', *European Journal of Women's Studies*, Vol. 19, No 3, 2012, pp. 331-347, https://doi.org/10.1177/1350506812443621

([197]) Ragin, C. C. and Fiss, P. C., *Intersectional Inequality,* University of Chicago Press, 2017, https://press.uchicago.edu/ucp/books/book/chicago/I/bo24957423.html; Ragin, C. C. and Fiss, P. C., 'A set-analytic approach to intersectionality', *Social Science Research*, Vol. 120, 2024, e103002, https://doi.org/10.1016/j.ssresearch.2024.103002

([198]) Castillo-Ortiz, P., Ali, A. and Samanta, N., 'Gender, intersectionality, and religious manifestation before the European Court of Human Rights', *Journal of Human Rights*, Vol. 18, No 1, 2019, pp. 76-91, https://doi.org/10.1080/14754835.2019.1581054

2.7.6. Relief maps

Relief Maps [199] are a tool for studying the geographies of intersectionality, as they make visible the relationship between power structures (the social), lived experience (the psychological) and places (the geographical). Taking the spatial dimension as a central part of the analysis, Relief Maps show how the relationship between power structures varies depending on places and illustrate how individuals navigate and experience these places with regards to different dimensions of their identity such as gender, sexuality, ethnicity, class and age. Relief Maps aim to take the potentialities of intersectionality and minimise its limitations: they intend to disrupt homogeneous categories while pointing towards the material and emotional consequences of oppression and privilege.

Relief Maps have been used to show how oppression and privilege are simultaneously experienced while differing across geographic locations such as home, public spaces, or other indoor spaces such as cafes or sport gyms among others [200]. Relief Maps is a research methodology that is currently further developed in the framework of the ERC Starting Grant *Intermaps* (2022-2027) available as an online application [201] open to public use.

2.8. Recommendations for moving towards intersectional data

Based on our review of the literature we recommend the following set of actions to advance in the collection, measuring and analysis of intersectional data for inclusive GEPs in R&I.

EU and national policy makers should:

- Invest in capacity building to enhance understanding and application of intersectional data collection and analysis.

- Promote mechanisms that facilitate the collection of context-specific yet comparable data regarding different socio-demographic categories such as ethnicity, race, gender, migration status among others.

- Support the use and continued improvement of bottom-up, organisation-level data collection initiatives that encourage local ownership and data utilisation.

Equality- and data collection practitioners in research performing organisations should:

- Address power by understanding how data can help to change the unjust distribution of privilege and disadvantage within the organisation. Consider how data collection could aggravate existing inequalities.

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[199] Rodó-de-Zárate, M., 'Developing geographies of intersectionality with Relief Maps: Reflections from youth research in Manresa, Catalonia', *Gender, Place & Culture*, Vol. 21, No 8, 2014, pp. 925-944, https://doi.org/10.1080/0966369X.2013.817974

[200] Ibid.

[201] See https://reliefmaps.upf.edu/

- Engage in participatory processes with diverse groups within the organisation to prepare, collect and analyse equality data and thus ensure representation of intersecting social inequalities.

- Make use of existing equality data collection instruments such as the GEAM, DiMIS, or UniSafe questionnaires ([202]) that guarantee high-quality, comparable data.

- Go beyond additive approaches and adopt innovative analytical methods such as multilevel intersectional modelling, latent class analysis or Qualitative Comparative Analysis.

Researchers and data experts involved in large scale, cross-country surveys should:

- Re-evaluate standard, minimal socio-demographic categories to allow for more context specific, fine-grained, and hence relevant answer categories.

- Incorporate multiple socio-demographic categories beyond gender and age into surveys to capture intersecting social inequalities as well as related outcome-variables.

- Revise existing measurement items to consider their validity and reliability across diverse socio-demographic minoritised groups such as ethnic minority women.

2.9. Concluding remarks

Inclusive GEPs are based upon an inclusive participatory process to design and implement interventions that transform existing power relations. By using an intersectional approach, it can better address and navigate the complex dynamics of power and inequalities within organisations, including within research and innovation. However, adopting an intersectional approach presents its own set of challenges. Questions arise about which measurement categories should be empirically considered and which sets of social relations should be prioritised, among other complexities.

This article has addressed some of these challenges by combining the principles of equality data collection with the core ideas of intersectionality. It has argued that data collection needs to be purpose driven – to reduce inequalities and achieve social justice. An inclusive participatory process thereby is key to ground these broad, overarching goals into specific, context sensitive needs. 'Without a well-defined and articulated process and purpose, there is more risk of disaggregated data doing harm. Multiple voices emphasise that collecting data on social determinants of inequalities without structural change can perpetuate inequity' ([203]).

([202]) See https://zenodo.org/records/7220636

([203]) British Columbia's Office of the Human Rights Commissioner, *Disaggregated demographic data collection in British Columbia: The grandmother perspective*, Office of the Human Rights Commissioner, 2020, p. 9, https://bchumanrights.ca/wp-content/uploads/BCOHRC_Sept2020_Disaggregated-Data-Report_FINAL.pdf

While a concern for power and inequalities is certainly not new, the aim to consider multiple intersecting dimensions of social discrimination increases concerns for legal and statistical challenges to the point of 'equality data paralysis' ([204]). Along these lines, we have argued for the use of organisational based survey methods that are suitable to address more carefully existing legal data protection requirements. They offer convincing starting points for collecting equality data that are relevant because they are purpose driven and adapted to each organisational context through a participatory process. Organisational surveys are easily coupled to 'voluntary consent' statements and allow for self-identification, which should be part of any research. In addition, concerns of 'anonymity' can be addressed via the application of Statistical Disclosure Control standards.

Existing tools such as the DiMIS or the GEAM provide effective instruments to ease some of the burden for selecting, adapting and translating socio-demographic categories to different languages and cultural contexts. The GEAM, in addition, captures important gender-related variables such as experiences of micro-aggressions, care responsibilities, and discrimination experiences which can be explored at the intersection of ethnic minority status, gender, sex, nationality, disability/chronic illness, trans history, age, sexual orientation and socio-economic status. Together with an increasing number of dedicated scales for specific minoritised groups, the measurement of inequalities produces ever more granular and solid evidence.

Much of the potential of the new analytical approaches of disaggregated data is still to be explored and applied. As our analytical techniques progress, capacity building for using regression with interaction terms, multilevel intersectional modelling, Latent Class Analysis, Qualitative Comparative Analysis, or Relief Maps becomes more important than ever.

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Box 5: Practical steps for intersectional data collection and analysis

The following list summarises the main steps described in similar guidance documents listed in Box 1: Research design guidance (see section 2.5.1). To develop inclusive Gender Equality Plans (GEPs) and collect intersectional data, relevant stakeholders should:

Step 1a: Understand which intersections are relevant in your context. Based upon the scientific literature, existing data, current events and/or the historical, social and institutional factors of the organisation, try to understand the relations of exclusion and inclusion, discrimination and privilege among people. Understanding the context requires Step 1c, engagement with communities.

Step 1b: Build capacity by providing training and resources to stakeholders on intersectionality and inclusive data collection methods, including the importance of disaggregated data and the ethical considerations involved.

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([204]) Chopin, I., Farkas, L. and Germaine, C., *Ethnic origin and disability data collection in Europe: Measuring inequality - Combating discrimination,* Equality Data Initiative, Open Society Foundations, 2014, https://www.opensocietyfoundations.org/uploads/d28c9226-bed7-4b1b-ac8b-4455f3c3451a/ethnic-origin-and-disability-data-collection-europe-20141126.pdf

Step 1c: **Engage with communities**. Engage diverse perspectives by involving a diverse range of stakeholders, including individuals with intersecting identities across race, ethnicity, gender identity, sexual orientation, disability, socioeconomic status, religion, and age. Exploratory, qualitative interviews should be used at this stage. Foster community collaboration and partnerships with community organisations, advocacy groups, and experts in intersectionality to leverage their expertise and ensure that GEPs and data collection efforts are relevant and effective.

Step 2: Address power. Data collection should be geared towards changing existing power relations. This involves making data collection and analysis participatory from start to finish; be clear about the purpose of data collection, its potential risks and how it can address real needs and contribute to change; explore how disadvantage and privilege impact people's lives (e.g. health effects, job satisfaction among others); make your approach to change explicit by formulating a Theory of Change (specifying the sequence of events to achieve a given outcome and impact; is there any evidence to draw upon?). Remember: data collection and analysis are but one element of a broader struggle for structural change.

Step 3: Design adequate research. Specify concrete research questions and the range of intersecting identities to be covered during data collection (e.g. women with different ethnic background or different socioeconomic status). Decide on a corresponding sampling strategy and adequate measurement instruments (e.g. GEAM, DiMIS). Is there a need to use specific measurement scales for intersecting identities (e.g. The Gendered Racial Microaggressions Scale)? Make sure that measurement items are adapted to local language and context, appropriate and valid across minoritised groups (requires Step 1a). Be sure to include open-ended questions about experience.

Step 4: Implement robust protocols for data privacy and protection, particularly when collecting sensitive information related to intersecting identities, to uphold ethical standards and safeguard the rights and dignity of individuals. Store result data in password protected files. Before sharing data, consider guidelines for disclosure control to protect confidentiality and privacy of respondents.

Step 5: Analyse and interpret data from an intersectional perspective, using non-additive approaches such as regression with interaction terms, Latent-class analysis, Multilevel intersectional modelling, or Qualitative Comparative Analysis. Involve statistical experts to facilitate this type of analysis as well as target communities for the substantial interpretation. Intersecting effects should be explored in relation to the identified needs and divergent outcomes, for example in terms of health effects, work strain, job satisfaction among others.

Step 6: Design interventions to address detected needs and inequalities. Regularly monitor and assess the effectiveness of GEPs and data collection practices in promoting gender equality and addressing intersectional inequalities, using feedback mechanisms and indicators that capture diverse experiences and outcomes.

2.10. References

Aikins, M. A., Bremberger, T., Aikinis, J. K., Gyamerah, D. and Yıldırım-Calima, D., *Afrozensus 2020: Perspektiven, Anti-Schwarze Rassismuserfahrungen und Engagement Schwarzer, afrikanischer und afrodiasporischer Menschen in Deutschland,* Each One Teach One (EOTO) e.V., 2021, https://afrozensus.de/

Aldercotte, A., Caprile, M., Guyan, K., Malibha-Pinchbeck, M., Müller, J., Palmén, R. and Startin, C., *ACT - Gender Equality Audit and Monitoring (GEAM) - Version 2,* Zenodo, 2021, https://doi.org/10.5281/zenodo.5348197

Anthias, F., 'Rethinking social divisions: Some notes towards a theoretical framework', *Sociological Review*, Vol. 46, No 3, 1998, pp. 505-535, https://doi.org/10.1111/1467-954X.00129

Armstrong, M. A. and Jovanovic, J., 'The intersectional matrix: Rethinking institutional change for URM women in STEM', *Journal of Diversity in Higher Education*, Vol. 10, No 3, 2017, pp. 216-231, https://doi.org/10.1037/dhe0000021

Ayalon, L., Dolberg, P., Mikulionienė, S., Perek-Białas, J., Rapolienė, G., Stypinska, J., Willińska, M. and de la Fuente-Núñez, V., 'A systematic review of existing ageism scales', *Ageing Research Reviews*, Vol. 54, No 100919, 2019, https://doi.org/10.1016/j.arr.2019.100919

Baker, K. E., Streed, C. G. and Durso, L. E., 'Ensuring that LGBTQI+ people count: Collecting data on sexual orientation, gender identity, and intersex status', *New England Journal of Medicine*, Vol. 384, No 13, 2021, pp. 1184-1186, https://doi.org/10.1056/NEJMp2032447

Bauer, G. R., Churchill, S. M., Mahendran, M., Walwyn, C., Lizotte, D. and Villa-Rueda, A. A., 'Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods', *SSM - Population Health*, Vol. 14, No 100798, 2021, https://doi.org/10.1016/j.ssmph.2021.100798

Bauer, G. R., Mahendran, M., Walwyn, C. and Shokoohi, M., 'Latent variable and clustering methods in intersectionality research: Systematic review of methods applications', *Social Psychiatry and Psychiatric Epidemiology*, Vol. 57, No 2, 2022, pp. 221-237, https://doi.org/10.1007/s00127-021-02195-6

Baumann, A.-L., Egenberger, V. and Supik, L., *Erhebung von Antidiskriminierungsdaten in repräsentativen Wiederholungsbefragungen. Bestandsaufnahme und Entwicklungsmöglichkeiten,* Antidiskriminierungstelle des Bundes, 2018, https://www.antidiskriminierungsstelle.de/SharedDocs/Downloads/DE/publikationen/Expertisen/Datenerhebung.html

Bécares, L. and Priest, N., 'Understanding the influence of race/ethnicity, gender, and class on inequalities in academic and non-academic outcomes among eighth-grade students: Findings from an intersectionality approach', *PLOS ONE*, Vol. 10, No 10, 2015, e0141363, https://doi.org/10.1371/journal.pone.0141363

Beeckmans, J., Zanoni, P. and Van Laer, K., *Intersectional policies in Higher Education and Research: A scoping literature review* [Deliverable 2.1 INSPIRE Project], INSPIRE Centre of Excellence, 2023, https://zenodo.org/records/10033571

Black Public Health Collective, *Race-based data is not racial justice,* Black Public Health Collective, 2020, https://blackpublichealth.ca/wp-content/uploads/2020/06/BPHC-Statement-on-Race-Based-Data_COVID-19_Policing.pdf

Bowleg, L. and Bauer, G., 'Invited reflection: Quantifying intersectionality', *Psychology of Women Quarterly*, Vol. 40, No 3, 2016, pp. 337-341, https://doi.org/10.1177/0361684316654282

Boytchev, H., 'Diversity in German science: Researchers push for missing ethnicity data', *Nature*, Vol. 616, No 7955, 2023, pp. 22-24, https://doi.org/10.1038/d41586-023-00955-9

British Columbia's Office of the Human Rights Commissioner, *Disaggregated demographic data collection in British Columbia: The grandmother perspective*, Office of the Human Rights Commissioner, 2020, https://bchumanrights.ca/wp-content/uploads/BCOHRC_Sept2020_Disaggregated-Data-Report_FINAL.pdf

Bryman, A., Bell, E., Reck, J. and Fields, J., *Social research methods,* Oxford University Press, 2022.

Budge, S. L., Thai, J. L., Tebbe, E. A. and Howard, K. A. S., 'The intersection of race, sexual orientation, socioeconomic status, trans identity, and mental health outcomes', *The Counselling Psychologist*, Vol. 44, No 7, 2016, pp. 1025-1049, https://doi.org/10.1177/0011000015609046

Cameron, J. J. and Stinson, D. A., 'Gender (mis)measurement: Guidelines for respecting gender diversity in psychological research', *Social and Personality Psychology Compass*, Vol. 13, No 11, 2019, e12506, https://doi.org/10.1111/spc3.12506

Canadian Institutes of Health Research (CIHR), and Bauer, G. R., *Meet the methods series: Quantitative intersectional study design and primary data collection*, Canadian Institutes of Health Research, 2021, https://cihr-irsc.gc.ca/e/52352.html

Canadian Institutes of Health Research (CIHR), Pilote, L., Raparelli, V. and Norris, C. M., *Meet the methods series: Methods for prospectively and retrospectively incorporating gender-related variables in clinical research*, Canadian Institutes of Health Research (CIHR), 2021, https://cihr-irsc.gc.ca/e/52608.html

Carroll, S. R., Garba, I., Figueroa-Rodríguez, O. L., Holbrook, J., Lovett, R., Materechera, S., Parsons, M., Raseroka, K., Rodriguez-Lonebear, D., Rowe, R., Sara, R., Walker, J. D., Anderson, J. and Hudson, M., 'The CARE principles for indigenous data governance', *Data Science Journal*, Vol. 19, 2020, pp. 43-43, https://doi.org/10.5334/dsj-2020-043

Castillo-Ortiz, P., Ali, A. and Samanta, N., 'Gender, intersectionality, and religious manifestation before the European Court of Human Rights', *Journal of Human Rights*, Vol. 18, No 1, 2019, pp. 76-91, https://doi.org/10.1080/14754835.2019.1581054

Cho, S., Crenshaw, K. W. and McCall, L., 'Toward a field of intersectionality studies: Theory, applications, and praxis', *Signs: Journal of Women in Culture and Society*, Vol. 38, No 4, 2013, pp. 785-810, https://doi.org/10.1086/669608

Choo, H. Y. and Ferree, M. M., 'Practicing Intersectionality in sociological research: A critical analysis of inclusions, interactions, and institutions in the study of inequalities', *Sociological Theory*, Vol. 28, No 2, 2013, pp. 129-149, https://doi.org/10.1111/j.1467-9558.2010.01370.

Chopin, I., Farkas, L. and Germaine, C., *Ethnic origin and disability data collection in Europe: Measuring inequality - Combating discrimination,* Equality Data Initiative, Open Society

Foundations, 2014, https://www.opensocietyfoundations.org/uploads/d28c9226-bed7-4b1b-ac8b-4455f3c3451a/ethnic-origin-and-disability-data-collection-europe-20141126.pdf

Christoffersen, A., *Intersectional approaches to equality research and data*, Equality Challenge Unit, 2017, http://www.ecu.ac.uk/wp-content/uploads/2017/04/Research_and_data_briefing_2_Intersectional_approaches_to_equality_research_and_data.pdf

Christoffersen, A., *Data protection and anonymity considerations for equality research and data*, Advance HE, 2018, https://www.advance-he.ac.uk/knowledge-hub/data-protection-and-anonymity-considerations-equality-research-and-data

Ciccia, R., 'Qualitative Comparative Analysis as a tool for concept clarification, typology building, and contextualised comparisons in gender and feminist research', *Politics & Gender*, Vol. 12, No 3, 2016, https://doi.org/10.1017/S1743923X16000374

Collins, L. M. and Lanza, S. T., *Latent Class and Latent Transition Analysis,* John Wiley & Sons, Inc., 2009, https://doi.org/10.1002/9780470567333

Collins, P. H., 'Black feminist thought in the matrix of domination', *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*, Vol. 138, No 1990, 1990, pp. 221-238.

Collins, P. H., 'Intersectionality's definitional dilemmas', *Annual Review of Sociology*, Vol. 41, No 1, 2015, pp. 1-20, https://doi.org/10.1146/annurev-soc-073014-112142

Collins, P. H. and Bilge, S., *Intersectionality* (2nd edition), Polity Press, 2020, https://www.amazon.es/Intersectionality-Concepts-Patricia-Hill-Collins/dp/0745684491

Crenshaw, K., 'Mapping the margins: Intersectionality, identity politics, and violence against women of colour', *Stanford Law Review*, Vol. 43, No 1241, 1990.

Díaz-Morales, J. F., Esteban-Gonzalo, S., Martín-María, N. and Puig-Navarro, Y., 'Spanish adaptation of the gender-related variables for health research (GVHR): Factorial structure and relationship with health variables', *Spanish Journal of Psychology*, Vol. 26, 2023, e25, https://doi.org/10.1017/SJP.2023.25

DiTomaso, N., *The American Non-Dilemma: Racial Inequality Without Racism,* Russell Sage Foundation, 2013.

Dobbin, F. and Kalev, A., 'Why diversity programmes fail', *Harvard Business Review*, Vol. 94, No 7, 2016, https://hbr.org/2016/07/why-diversity-programs-fail

Dobbin, F. and Kalev, A., *Getting to Diversity: What Works and What Doesn't,* Belknap Press, 2022.

Else-Quest, N. M. and Hyde, J. S., 'Intersectionality in quantitative psychological research: I. Theoretical and epistemological issues', *Psychology of Women Quarterly*, Vol. 40, No 2, 2016, pp. 155-170, https://doi.org/10.1177/0361684316629797

Else-Quest, N. M. and Hyde, J. S., 'Intersectionality in quantitative psychological research: II. Methods and mechniques', *Psychology of Women Quarterly*, Vol. 40, No 3, 2016, pp. 319-336, https://doi.org/10.1177/0361684316647953

European Commission, *Analysis and comparative review of equality data collection practices in the European Union: Legal framework and practice in the EU Member States,* Publications Office of the European Union, Luxembourg, 2017, https://data.europa.eu/doi/10.2838/6934

European Commission, *A new ERA for Research and Innovation,* COM(2020) 628), Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2777/605834

European Commission, *A Union of equality: EU anti-racism action plan 2020-2025,* Publications Office of the European Union, Luxembourg, 2020, https://op.europa.eu/s/zhrS

European Commission, *EU Roma strategic framework for equality, inclusion and participation for 2020-2030,* Publications Office of the European Union, Luxembourg, 2020, https://bit.ly/3V9QHAP

European Commission, *Union of Equality: LGBTIQ Equality Strategy 2020-2025,* Publications Office of the European Union, Luxembourg, 2020, https://bit.ly/3T68XZm

European Commission, *A Union of Equality: Gender Equality Strategy 2020-2025*, 2020, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0152

European Commission, *Guidance note on the collection and use of equality data based on racial or ethnic origin,* Publications Office of the European Union, Luxembourg, 2021, https://data.europa.eu/doi/10.2838/06180

European Commission, *Guidelines on improving the collection and use of equality data,* European Commission, 2021, https://bit.ly/3Vc2G0G

European Commission, *Union of Equality: Strategy for the rights of persons with disabilities 2021-2030,* Publications Office of the European Union, Luxembourg, 2021, https://data.europa.eu/doi/10.2767/31633

European Commission, *Guidance note on the collection and use of data for LGBTIQ equality,* Publications Office of the European Union, Luxembourg, 2023, https://data.europa.eu/doi/10.2838/398439

European Commission and Makkonen, T., *European handbook on equality data 2016 revision.,*Publications Office of the European Union, Luxembourg, 2016, https://publications.europa.eu/en/publication-detail/-/publication/cd5d60a3-094d-11e7-8a35-01aa75ed71a1/language-en

European Institute for Gender Equality (EIGE), *Roadmap to gender equality plans in research and higher education institutions. Success factors and common obstacles,* European Institute for Gender Equality, 2016, https://eige.europa.eu/sites/default/files/gear_roadmap_02_successfactors_obstacles_0.pdf

European Institute for Gender Equality, *Gender equality in academia and research GEAR tool,* Publications Office of the European Union, Luxembourg, 2016.

European Network Against Racism (ENAR), *Intersectional discrimination in Europe: Relevance, challenges and ways forward*, European Network against Racism, 2019, https://www.enar-eu.org/intersectional-discrimination-in-europe-relevance-challenges-and-ways-forward/

Evans, C. R., Williams, D. R., Onnela, J.-P. and Subramanian, S. V., 'A multilevel approach to modeling health inequalities at the intersection of multiple social identities', *Social Science & Medicine*, Vol. 203, 2018, pp. 64-73, https://doi.org/10.1016/j.socscimed.2017.11.011

Farkas, L. and European Commission, *Analysis and comparative review of equality data collection practices in the European Union: Data collection in the field of ethnicity,* Publications Office of the European Union, Luxembourg, 2017, https://data.europa.eu/doi/10.2838/447194

Funnell, S. C. and Rogers, P. J., *Purposeful Programme Theory: Effective Use of Theories of Change and Logic Models,* John Wiley & Sons, 2011.

Garnett, B. R., Masyn, K. E., Austin, S. B., Miller, M., Williams, D. R. and Viswanath, K., 'The intersectionality of discrimination attributes and bullying among youth: An applied Latent Class Analysis', *Journal of Youth and Adolescence*, Vol. 43, No 8, 2014, pp. 1225-1239, https://doi.org/10.1007/s10964-013-0073-8

Global Partnership for Sustainable Development Data, *Unpacking intersectional approaches to data. A white paper produced by the Inclusive Data Charter, Champions and partners,* Global Partnership for Sustainable Development Data, 2021, https://www.data4sdgs.org/sites/default/files/file_uploads/JN_1286_IDC_KP_WhitePaper_24pp_A4.pdf

Griffiths, E., Greci, C., Kotrotsios, Y., Parker, S., Scott, J., Welpton, R., Wolters, A. and Woods, C., *Handbook on Statistical Disclosure Control for Outputs,* Safe Data Access Professionals Working Group, 2019, https://doi.org/10.6084/M9.FIGSHARE.9958520

Guyan, K., Aldercotte, A., Müller, J., Caprile, M. and Torrado, S. Y., 'The development of the Gender Equality Audit and Monitoring survey', in R. Palmen and J. Müller (Eds.), *A Community of Practice Approach to Improving Gender Equality in Research,* Routledge, 2022, pp. 44-63, https://doi.org/10.4324/9781003225546-3

Gyamerah, D., Bartel, D., Yıldırım-Calima, D., Andrades, E. M., Bremberger, T. and Aikinis, J. K., *Diskriminierung, Repräsentation und Empowerment: 12 Methoden zur Erhebung von Antidiskriminierungs- und Gleichstellungsdaten auf dem Weg zu Communities-basierten Monitorings (CBM),* Citizens of Europe + advd, 2022, https://citizensforeurope.org/publications/

Hancock, A.-M., 'When multiplication doesn't equal quick addition: Examining intersectionality as a research paradigm', *Perspectives on Politics*, Vol. 5, No 1, 2007, pp. 63-79, https://doi.org/10.1017/S1537592707070065

Hancock, A.-M., 'Empirical intersectionality: A tale of two approaches', *UC Irvine Law Review*, Vol. 3, No 2, 2013, p. 259.

Harding, S., *The science question in feminism,* Cornell University Press, 1986.

Harding, S., *Whose science? Whose knowledge?: Thinking from women's lives,* Cornell University Press, 1991.

Harnois, C. E., Bastos, J. L. and Shariff-Marco, S., 'Intersectionality, contextual specificity, and everyday discrimination: Assessing the difficulty associated with identifying a main reason for discrimination among racial/ethnic minority respondents', *Sociological Methods & Research*, 2020, https://doi.org/10.1177/

Haynes, C., Joseph, N. M., Patton, L. D., Stewart, S. and Allen, E. L., 'Toward an understanding of intersectionality methodology: A 30-year literature synthesis of Black women's experiences in higher education', *Review of Educational Research*, Vol. 90, No 6, 2020, pp. 751-787, https://doi.org/10.3102/0034654320946822

Hesse-Biber, S. N. (Ed.), *Feminist Research Practice: A Primer*, SAGE Publications, 2014.

Hester, N., Axt, J. R., Siemers, N. and Hehman, E., 'Evaluating validity properties of 25 race-related scales', *Behaviour Research Methods*, Vol. 55, No 4, 2012, pp. 1758-1777, https://doi.org/10.3758/s13428-022-01873-w

Hughes, M. M. and Dubrow, J. K., 'Intersectionality and women's political empowerment worldwide', in A. C. Alexander, C. Bolzendahl and F. Jalalzai (Eds.), *Measuring Women's Political Empowerment across the Globe: Strategies, Challenges and Future Research,* Springer International Publishing, 2018, pp. 77-96, https://doi.org/10.1007/978-3-319-64006-8_4

Humbert, A. L. and Guenther, E. A., 'Data with a (feminist) purpose: Quantitative methods in the context of gender, diversity and management', in V. Stead, C. Elliott and S. Mavin (Eds.), *Handbook of Research Methods on Gender and Management,* Edward Elgar Publishing, 2021, pp. 145-160, https://china.elgaronline.com/edcollchap/edcoll/9781788977920/9781788977920.00018.xml

Humbert, A. L., Guenther, E. A. and Müller, J., 'Not Simply "counting heads": A Gender Diversity Index for the team level', *Social Indicators Research,* 2021, https://doi.org/10.1007/s11205-021-02635-5

Humbert, A. L., Strid, S., Tanwar, J., Lipinsky, A. and Schredl, C., 'The role of intersectionality and context in measuring gender-based violence in universities and research-performing organisations in Europe for the development of inclusive structural interventions', *Violence Against Women*, 2024, https://doi.org/10.1177/10778012241231773

Hunting, G. and Hankivsky, O., 'Cautioning Against the co-optation of intersectionality in gender mainstreaming', *Journal of International Development*, Vol. 32, No 3, 2020, pp. 430436, https://doi.org/10.1002/jid.3462

Kawika Allen, G. E., Wang, K. T., Richards, P. S., Ming, M. and Suh, H. N., 'Religious Discrimination Scale: Development and initial psychometric evaluation,' *Journal of Religion and Health*, Vol. 59, No 2, 2020, pp. 700-713, https://doi.org/10.1007/s10943-018-0617-z

Lawson, J., *Working with data. Guidance and tools to help you gather and analyse equality data, and deal with small numbers*, Equality Challenge Unit, 2016, https://www.advance-he.ac.uk/guidance/equality-diversity-and-inclusion/using-data-and-evidence/working-data

Leslie, D., Katell, M., Aitken, M., Singh, J., Briggs, M., Powell, R., Rincón, C., Chengeta, T., Birhane, A., Perini, A., Jayadeva, S. and Mazumder, A., *Advancing Data Justice Research and Practice: An Integrated Literature Review,* 2022, https://doi.org/10.5281/zenodo.6408304

Lewis, J. A. and Neville, H. A., 'Construction and initial validation of the Gendered Racial Microaggressions Scale for Black women', *Journal of Counseling Psychology*, Vol. 62, No 2, 2015, pp. 289-302, https://doi.org/10.1037/cou0000062

Lindqvist, A., Sendén, M. G. and Renström, E. A., 'What is gender, anyway: A review of the options for operationalising gender', *Psychology & Sexuality*, Vol. 12, No 4, 2020, pp. 1-13, https://doi.org/10.1080/19419899.2020.1729844

MacKinnon, C. A., 'Intersectionality as method: A note', *Signs: Journal of Women in Culture and Society*, Vol. 38, No 4, 2013, pp. 1019-1030, https://doi.org/10.1086/669570

Magidson, J., Vermunt, J. K. and Madura, J. P., 'Latent Class Analysis', in *SAGE Research Methods,* SAGE Publications Ltd, 2020, https://doi.org/10.4135/9781526421036

Majev, P.-G., Vieira, R. M., Carollo, A., Liu, H., Stutz, D., Fahrenwaldt, A., Drummond, N. and Group 2020/2021, M. P. P. survey, *PhDnet Report 2020,* Max Planck Gesellschaft, 2021, https://doi.org/10.17617/2.3344273

Marini, M., Waterman, P. D., Breedlove, E. R., Chen, J. T., Testa, C., Pardee, D. J., LeBlanc, M., Reisner, S. L., Oendari, A. and Krieger, N., 'Using implicit measures of discrimination: White, Black, and Hispanic participants respond differently to group-specific racial/ethnic categories vs. the general category "people of colour" in the USA', *Journal of Racial and Ethnic Health Disparities*, 2022, https://doi.org/10.1007/s40615-022-01353-z

Mason, P. and Barnes, M., 'Constructing Theories of Change: Methods and sources', *Evaluation*, Vol. 13, No 2, 2007, pp. 151-170, https://doi.org/10.1177/1356389007075221

May, V. M., *Pursuing intersectionality, unsettling dominant imaginaries,* Routledge, Taylor & Francis Group, 2015.

McCall, L., *Complex Inequality: Gender, Class, and Race in the New Economy*, Psychology Press, 2001.

McCall, L., 'The complexity of intersectionality', *Signs: Journal of Women in Culture and Society*, Vol. 30, No 3, 2005, pp. 1771-1800, https://doi.org/10.1086/426800

Merlo, J., 'Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) within an intersectional framework', *Social Science & Medicine*, Vol. 203, 2018, pp. 74-80, https://doi.org/10.1016/j.socscimed.2017.12.026

Misra, J., Curington, C. V. and Green, V. M., 'Methods of intersectional research', *Sociological Spectrum*, Vol. 41, No 1, 2021, pp. 9-28, https://doi.org/10.1080/02732173.2020.1791772

Morrison, T. G., Bishop, C. J., Morrison, M. A. and Parker-Taneo, K., 'A psychometric review of measures assessing discrimination against sexual minorities', *Journal of Homosexuality*, Vol. 63, No 8, 2016, pp. 1086-1126, https://doi.org/10.1080/00918369.2015.1117903

National Academies of Sciences, Engineering, and Medicine, *Measuring Sex, Gender Identity, and Sexual Orientation* (edited by T. Becker), National Academies Press, 2022, https://doi.org/10.17226/26424

Nielsen, M. W., Stefanick, M. L., Peragine, D., Neilands, T. B., Ioannidis, J. P. A., Pilote, L., Prochaska, J. J., Cullen, M. R., Einstein, G., Klinge, I., LeBlanc, H., Paik, H. Y. and Schiebinger, L., 'Gender-related variables for health research', *Biology of Sex Differences*, Vol. 12, No 1, 2021, p. 23, https://doi.org/10.1186/s13293-021-00366-3

Palmen, R. & INSPIRE Consortium, *Policy Brief INSPIRE vision* [Deliverable 2.3 INSPIRE Project]. INSPIRE Centre of Excellence, 2003, https://zenodo.org/records/10039559

Pega, F., Reisner, S. L., Sell, R. L. and Veale, J. F., 'Transgender health: New Zealand's innovative statistical standard for gender identity', *American Journal of Public Health*, Vol. 107, No 2, 2017, pp. 217-221, https://doi.org/10.2105/AJPH.2016.303465

Poovey, M., *A history of the modern fact: Problems of knowledge in the sciences of wealth and society* (3th ed.), University of Chicago Press, 2004.

Purdie-Vaughns, V. and Eibach, R. P., 'Intersectional invisibility: The distinctive advantages and disadvantages of multiple subordinate-group identities, *Sex Roles*, Vol. 59, No 5, 2008, pp. 377-391. https://doi.org/10.1007/s11199-008-9424-4

Ragin, C. C., *The comparative method: Moving beyond qualitative and quantitative strategies,* University of California, 1987.

Ragin, C. C., *Fuzzy-set social science*, University of Chicago Press, 2000.

Ragin, C. C., *The comparative method: Moving beyond qualitative and quantitative strategies: with a new introduction,* University of California Press, 2014.

Ragin, C. C. and Fiss, P. C., *Intersectional Inequality,* University of Chicago Press, 2017, https://press.uchicago.edu/ucp/books/book/chicago/I/bo24957423.html

Ragin, C. C. and Fiss, P. C., 'A set-analytic approach to intersectionality', *Social Science Research*, Vol. 120, 2024, e103002, https://doi.org/10.1016/j.ssresearch.2024.103002

Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA Relevance), Pub. L. No. 2016/679 (2016). http://data.europa.eu/eli/reg/2016/679/2016-05-04/eng

Rodó-de-Zárate, M., 'Developing geographies of intersectionality with Relief Maps: Reflections from youth research in Manresa, Catalonia', *Gender, Place & Culture*, Vol. 21, No 8, 2014, pp. 925-944, https://doi.org/10.1080/0966369X.2013.817974

Rodriguez, J. K., Holvino, E., Fletcher, J. K. and Nkomo, S. M., 'The theory and praxis of intersectionality in work and organisations: Where do we go from here?', *Gender, Work & Organisation*, Vol. 23, No 3, 2016, pp. 201-222, https://doi.org/10.1111/gwao.12131

Rosenstreich, G., De Wit, K., Bekers, T., Botoko, C., Hagelin, A., Kuuppelomäk, P., Strzemecka, S. and Wallace, C., *Diversity Data Collection: Exploratory Mapping & Reflection,* Una Europa Diversity Council, 2022, https://una-europa.imgix.net/resources/Diversity-Data-Collection-Exploratory-Mapping-Reflection.pdf

Saperstein, A. and Westbrook, L., 'Categorical and gradational: Alternative survey measures of sex and gender', *European Journal of Politics and Gender*, Vol. 4, No 1, 2021, pp. 11-30, https://doi.org/10.1332/251510820X15995647280686

Schneider, C. Q. and Wagemann, C., *Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis*, Cambridge University Press, 2012, https://doi.org/10.1017/CBO9781139004244

Spierings, N., 'The inclusion of quantitative techniques and diversity in the mainstream of feminist research', *European Journal of Women's Studies*, Vol. 19, No 3, 2012, pp. 331-347, https://doi.org/10.1177/1350506812443621

Stadler, G., Chesaniuk, M., Haering, S., Roseman, J., Straßburger, V. M., Martina, S., Aisha-Nusrat, A., Maisha, A., Kasia, B., Theda, B., Pichit, B., Marc, D., Sally, D. M., Ruth, D., Ilona, E., Marina, F., Paul, G., Denis, G., Ulrike, G. and Mine, W., 'Diversified innovations in the health sciences: Proposal for a Diversity Minimal Item Set (DiMIS)', *Sustainable Chemistry and Pharmacy*, Vol. 33, No 101072, 2023, https://doi.org/10.1016/j.scp.2023.101072

Suen, L. W., Lunn, M. R., Katuzny, K., Finn, S., Duncan, L., Sevelius, J., Flentje, A., Capriotti, M. R., Lubensky, M. E., Hunt, C., Weber, S., Bibbins-Domingo, K. and Obedin-Maliver, J., 'What sexual and gender minority people want researchers to know about sexual orientation and gender identity questions: A qualitative study', *Archives of Sexual Behaviour*, Vol. 49, No 7, 2020, pp. 2301-2318, https://doi.org/10.1007/s10508-020-01810-y

United Nations Human Rights Office, *A Human Rights Based Approach to Data—Leaving No One Behind in the 2030 Agenda for Sustainable Development: Guidance Note to Data Collection and Disaggregation,* United Nations, 2018, https://bit.ly/48Kl0RM

Walby, S., Armstrong, J. and Strid, S., 'Intersectionality: Multiple inequalities in social theory', *Sociology*, Vol. 46, No 2, 2012, pp. 224-240, https://doi.org/10.1177/0038038511416164

Wallerstein, N., Oetzel, J. G., Sanchez-Youngman, S., Boursaw, B., Dickson, E., Kastelic, S., Koegel, P., Lucero, J. E., Magarati, M., Ortiz, K., Parker, M., Peña, J., Richmond, A. and Duran, B., 'Engage for equity: A long-term study of community-based participatory research and community-engaged research practices and outcomes', *Health Education & Behaviour*, Vol. 47, No 3, 2020, pp. 380-390, https://doi.org/10.1177/1090198119897075

Wanka, A., Wiesböck, L., Allex, B., Mayrhuber, E. A.-S., Arnberger, A., Eder, R., Kutalek, R., Wallner, P., Hutter, H.-P. and Kolland, F., 'Everyday discrimination in the neighbourhood: What a 'doing' perspective on age and ethnicity can offer', *Ageing & Society*, Vol. 39, No 9, 2019, pp. 2133-2158, https://doi.org/10.1017/S0144686X18000466

Weldon, S. L., 'The structure of intersectionality: A comparative politics of gender', *Politics & Gender*, Vol. 2, No 2, 2006, pp. 235-248, https://doi.org/10.1017/S1743923X06231040

Woodford, M. R., Chonody, J. M., Kulick, A., Brennan, D. J. and Renn, K., 'The LGBQ Microaggressions on Campus Scale: A scale development and validation study', *Journal of Homosexuality*, Vol. 62, No 12, 2015, pp. 1660-1687, https://doi.org/10.1080/00918369.2015.1078205

Wullert, K., Gilmartin, S. and Simard, C., 'The mistake companies make when they use data to plan diversity efforts', *Harvard Business Review*, 2019, https://hbr.org/2019/04/the-mistake-companies-make-when-they-use-data-to-plan-diversity-efforts

3. Promoting inclusive gendered innovation through academic spin-offs

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Abstract

This policy article explores the landscape of academic spin-offs and inclusive gendered innovation in Europe. It defines key terms, outlines the European policy framework and demonstrates how academic spin-offs, although not a direct policy focus, contribute to promoting inclusive gendered innovation.

In the absence of European data on academic spin-offs, this policy article explores data relevant to the innovation and entrepreneurship ecosystem. Data from She Figures 2024 show that women are underrepresented among inventors (9 %) and authors in academic-corporate collaboration teams (26 %), and in 2022, the self-employment rate among women was 9 %, compared to 16 % for men. Gender gaps are identified in capital investment of tech start-ups, where all-men founding teams dominate (82 % of all investment, compared to 15 % of mixed gender and 3 % of all-women teams), and in venture capital leadership, with women comprising only 16 % of general partners.

An increasing body of academic literature relates to academic spin-offs, but a gender inclusive and systematic perspective to academic spin-offs and the European innovation ecosystem has thus far been overlooked. Similarly, inspiring good practices in establishing spin-offs across Europe are emerging, but often fail to recognise the inequalities underpinning the wider innovation and entrepreneurship ecosystem.

This policy article highlights that data and indicators on academic spin-offs should be designed and collected with a gender-inclusive and systematic lens across micro, meso and macro levels to ensure that future policies and interventions can contribute to tapping into European deep tech talent and building a European innovation and entrepreneurship ecosystem that is open, inclusive and nurturing for all.

3.1. Introduction

Academic spin-offs are at the intersection of higher education, research, innovation and entrepreneurship. They can play a pivotal role in commercialising and valorising research, translating it into innovation outputs and providing opportunities for staff in universities to commercialise knowledge and enhance entrepreneurial skills. As part of research and innovation (R&I) ecosystems, they can become mechanisms for strengthening intersectoral collaboration, intersectoral mobility and researchers' careers.

An academic spin-off – also referred to as spin-out – is defined as:

> 'a company expressly established to develop or exploit IP [intellectual property] created by a Research Performance Organisation (RPO) and with a formal contractual relationship for the use of this IP' [205].

The concept of an academic or university spin-off is employed when a company is founded within an RPO with the aim of implementing the knowledge generated through the research and development efforts of academics [206]. The terms 'spin-offs and 'spin-outs' are used interchangeably in the academic sector. Start-ups can sometimes be confused with academic spin-offs, but the key difference is their approach to IP. Accordingly, a startup is defined as:

> 'a newly registered company that is founded by PRO [Publicly Funded Research Organisations] students or employees but that is not directly involved with the exploitation of intellectual property generated within that PRO' [207].

The lack of systematic data was highlighted two decades ago, yet a comparative and systematic approach to European academic spin-offs remains lacking [208]. In the absence of European systematic and cross-national data on academic spin-offs, this policy article highlights relevant gender data and gender gaps in the European R&I ecosystem, using EU and additional sources on innovation, entrepreneurship, and technology. Both academic spin-offs and the R&I ecosystem need to be explored from a gender dimension lens so as to contribute towards inclusive gendered innovation.

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[205] European Commission, Joint Research Centre (JRC), Campbell, A., Cavalade, C., Haunold, C. et al., *Knowledge transfer metrics – Towards a European-wide set of harmonised indicators*, Publications Office of the European Union, Luxembourg, 2020, p. 21, https://data.europa.eu/doi/10.2760/907762

[206] Miranda, F. J., Chamorro, A. and Rubio, S., 'Re-thinking university spin-off: A critical literature review and a research agenda', *Journal of Technology Transfer*, Vol. 43, No 4, 2018, pp. 1007-1038.

[207] European Commission, Joint Research Centre, Campbell, A., Cavalade, C., Haunold, C. et al. *Knowledge transfer metrics – Towards a European-wide set of harmonised indicators,* Publications Office of the European Union, Luxembourg, 2020, p. 21, https://data.europa.eu/doi/10.2760/907762

[208] European Commission, Directorate-General for Enterprise and Industry, *University spin-outs in Europe – Overview and good practice*, Publications Office of the European Union, Luxembourg, 2002.

Incorporating a gender dimension in R&I content, and inclusive gendered innovation

The integration of a gender dimension in R&I content ([209]) is among the reinforced gender equality requirements for Horizon Europe, the EU's Framework Programme for Research and Innovation for 2021-2027. This entails the integration of sex and gender analysis across all stages of the R&I cycle, from developing research questions to considering the needs of users in technological innovations. The EU is increasingly emphasising intersectionality, establishing it as a horizontal principle for the implementation of the EU Gender Equality Strategy 2020-2025. Accordingly, the gender dimension foregrounds sex and gender while recognising the need for intersectional approaches to capture how sex, gender, racial or ethnic origin, age, socioeconomic status, sexual orientation, disability and their intersections shape inequalities and the experiences of marginalised people.

Gendered Innovations, an initiative supported by the European Commission, has highlighted the benefits of gender and inclusive analysis ([210]). These include: adding value to quality of R&I; encouraging researchers and innovators to challenge stereotypes; better understanding of diverse user needs and behaviours; and enhanced societal relevance of innovation by considering more inclusive innovation processes ([211]). In addition to innovation processes, inclusiveness has gained ground in EU gender equality efforts as a participatory process – rather than an outcome – underpinned by and promoting values such as fairness, justice, care and democracy ([212]). Inclusiveness aims to engage and provide opportunities for everyone – especially people from marginalised communities – to be heard and valued and to contribute to decisions and activities that could lead to change.

A recent review notes that available information on gendered innovations is inconsistent and fragmented ([213]). It suggests a conceptual broadening to inclusive gendered innovations (IGI), which is defined as follows.

> 'IGI mainstreams sex, gender and intersectional analysis in the R&D [research and development] and innovation development processes aiming at promoting inclusive gender equality. The IGI approach considers how broader societal influences, such as unconscious bias, gender relations, and intersecting inequalities already present in institutional frameworks and organisational structures, as well as local context, affect

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([209]) An umbrella term covering the integration of sex and/or gender analysis in the design and delivery of R&I to foster excellence and ensure that R&I outputs benefit everyone in society and are adapted to people's needs and behaviours. Integrating the gender dimension in R&I content is mandatory by default for RIA/A actions in Horizon Europe and is evaluated under the 'excellence' award criterion.

([210]) European Commission, Directorate-General for Research and Innovation, *Gendered innovations – How gender analysis contributes to research,* Report of the expert group 'Innovation through gender', Publications Office of the European Union, Luxembourg, 2013, https://data.europa.eu/doi/10.2777/11868; European Commission, Directorate-General for Research and Innovation, *Gendered innovations 2 – How inclusive analysis contributes to research and innovation – Policy review*, Publications Office of the European Union, Luxembourg, 2020, https://data.europa.eu/doi/10.2777/316197

([211]) Tannenbaum, C., Ellis, R. P., Eyssel, F., Zou, J. And Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, No 7781, 2019, pp. 137-146. According to the Gendered Innovations report: adds value to research in terms of excellence, creativity and business opportunities; helps researchers and innovators to question gender norms and stereotypes, and rethink standards and reference models; leads to an in-depth understanding of diverse gender needs, behaviours and attitudes; addresses the diverse needs of EU citizens and thereby enhances the societal relevance of the knowledge, technologies and innovations produced; contributes to the production of goods and services better suited to new markets.

([212]) Palmén, R. L. and Inspire Project Consortium, *D2.6 policy brief INSPIRE vision*, Zenodo., 2023, https://doi.org/10.5281/zenodo.10039559

([213]) Chaves, P. and Benschop, Y., *D2.1a KSH deepening & sustaining change*, Zenodo, 2023, https://doi.org/10.5281/zenodo.10032961

This policy article provides an opportunity to look at how a gender dimension lens on academic spin-offs can lead to policy and data recommendations fostering IGI. In the scope of this article, the 'gender dimension lens' encompasses both gender representation and the integration of a gender dimension in the content of R&I. Representation indicators showing the participation of women and marginalised groups in R&I and academic spin-offs are useful, but they are often absent, not comparable at EU level, or insufficient. They need to be complemented with indicators that capture how the content of R&I is gender inclusive across all stages of research and academic spin-offs – as an outcome of academic research being commercialised – in order to contribute towards IGI. Academic spin-offs must be situated within the broader entrepreneurship and innovation ecosystem ([215]). An inclusive ecosystem approach (see Section 3.4) enables systematic exploration of gender and intersectionality across the R&I process.

This policy article examines the following questions in relation to academic spin-offs and IGI:

1. How are European policy agendas and initiatives relevant to academic spin-offs?

2. What is known about academic spin-offs in the context of entrepreneurship and innovation ecosystems? To what extent have European academic spin-offs been explored from an inclusive gendered innovation perspective?

3. What data and policy recommendations emerge when academic spin-offs are explored through a gender dimension and inclusive gendered innovation lens?

3.2. EU policy priorities and initiatives relevant to academic spin-offs and IGI

There is a favourable European policy framework in relation to strengthening IGI, as reflected in the policy priorities, commitments and initiatives in the new European Strategy for Universities (ES4U), the New Innovation Agenda, the European Research Area (ERA) framework, the EU valorisation policy, and the EU Gender Equality Strategy 2020-2025. These lay the foundations for a strong and inclusive innovation and entrepreneurship ecosystem where academic spin-offs and IGI can flourish.

([214]) Karaulova, M., Wienand, C., Walker, D., Bührer, S., Reidl, S. and Yorulmaz, M., *Gendered Innovations*, D2.1e, Zenodo, 2023, p. 45, https://doi.org/10.5281/zenodo.10033625
([215]) There is no widely agreed definition but this policy article draws on two definitions: 1) Enterpnership ecosystem as 'a set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organisations (e.g. firms, venture capitalists, business angels, banks), institutions (universities, public sector agencies, financial bodies) and entrepreneurial processes (e.g. the business birth rate, numbers of high growth firms, …) which formally and informally coalesce to connect, mediate and govern the performance within the local entrepreneurial environment' (Mason and Ross, 2014, p. 5); and 2) innovation ecosystem as 'the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors' (Grandstrand and Holgerson, 2020, p. 3).

The EU Gender Equality Strategy 2020-2025 aims to challenge gender stereotypes, close gender gaps in the labour market, ensure equal participation across all sectors of the economy, address gender pay and pension gaps, achieve gender balance in decision-making, and end gender-based violence. It combines targeted measures and strengthens gender mainstreaming efforts to advance gender equality. Gender mainstreaming involves systematically incorporating a gender perspective into EU policy design across all areas. This approach is reflected in the multiannual financial framework (MFF) [216], which now monitors gender-relevant expenditure in EU funding programmes. Structures such as a Commissioner for Equality and a Task Force for Equality, composed of representatives from all Commission services and the European External Action Service (EEAS), have been introduced by the European Commission to further support gender equality initiatives. The Strategy also recognises the role of R&I in advancing gender equality, promoting gender balance, conducting gender responsive research and monitoring progress in R&I policy and practice. It targets the integration of a gender dimension in EU funding supporting actions to promote women's labour market participation and work-life balance, women's entrepreneurship and innovation, and participation in investment, as well as to address gender segregation in certain professions.

There is a comprehensive approach across European policies and initiatives that complement and reinforce the objectives of the EU Gender Equality Strategy 2020-2025. The new ES4U calls for strengthening the representation of women and girls in science, technology, engineering and mathematics (STEM) from education to research to innovation, with a manifesto for gender-inclusive STEAM (science, technology, engineering, art, mathematics) education and careers [217] and nurturing future women researchers and innovators (supported by various ERA policies and initiatives). It also emphasises supporting incubators within European higher education institutions (HEIs) and acknowledges the challenge of attracting and retaining diverse talent, particularly in STEM fields where women are underrepresented.

The diverse talent challenge is a focal point of the New European Innovation Agenda, which prioritises cultivating the diverse deep tech talent crucial to start-ups and academic spin-offs. The new wave of deep tech innovation is rooted in cutting edge science, technology and engineering, and Europe aspires to be a global leader, building on Europeans' entrepreneurial mindset, scientific excellence, the strength of the single market, the strong industrial base, financial power, and democratic societies. The New European Innovation Agenda has a key role to play in driving economic growth, addressing societal challenges, strengthening Europe's global competitiveness, promoting sustainability and inclusivity, supporting R&D, and driving digital transformation. Prioritising innovation and collaboration requires the use of EU talent, and the Agenda highlights the importance of supporting women innovators for a strong European R&I ecosystem.

This emphasis on talent is evident in the Strategic Innovation Agenda 2021-2027, together with the new strategy of the European Institute of Technology and Innovation (EIT). The EIT strategy commits to nurturing a new generation of entrepreneurs and innovators, addressing

[216] European Commission, *Gender mainstreaming*, n.d., https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/horizontal-priorities/gender-equality-mainstreaming_en#:~:text=The%20Commission%20has%20developed%20a,commitment%20undertaken%20in%20its%20gender

[217] European Commission, Directorate-General for Research and Innovation, *EU support to strengthen gender equality in STEM*, Publications Office of the European Union, Luxembourg, 2023, https://op.europa.eu/en/publication-detail/-/publication/d5caa77b-a833-11ed-b508-01aa75ed71a1/language-en/format-PDF/source-280296996

entrepreneurial gender disparities and enhancing sustainable innovation ecosystems across Europe.

Similarly, the ERA Policy Agenda 2022-2024 ([218]) sets priorities where academic spin-offs and IGI can also contribute to developing new research careers that enhance: intersectional mobility and talent circulation within the ERA (priority action 4), gender equality and inclusiveness (priority action 5), knowledge valorisation (priority action 7), and building stronger R&I ecosystems (priority action 17).

The European valorisation policy aims to ensure that 'data, research results and innovation are transformed into sustainable products, processes and services that bring economic value and benefit society' ([219]), using intellectual assets and diverse individual talent and creating synergies with the New European Innovation Agenda. Academic spin-offs and start-ups can play a key role in the valorisation of R&I because they provide opportunities to develop creative and entrepreneurial skills in RPOs and support knowledge commercialisation. The guiding principles of knowledge valorisation – with equality, diversity and inclusion as one of those principles – are envisaged to support European strategies and actions, such as the updated Industrial Strategy for Europe, the EU Intellectual Property Action Plan, the initiatives of the European Green Deal, and the EU Standardisation Strategy ([220]).

Some Member States are progressing in introducing strategies for gender equality in R&I, but key challenges persist, notably in women's progression into more senior positions and the integration of the gender dimension in research programmes ([221]). At national and European level, policies and policy documents on innovation and entrepreneurship are gender blind ([222]), which can significantly hinder the opportunities available to women, particularly if those policies and associated programmes lack a gender and intersectional perspective. For example, systemic barriers exist in accessing EU and national governmental funding, as the latter primarily focus on men-dominated fields (e.g. Information and Communications Technology (ICT), digitalisation, deep tech and wider STEM topics) ([223]). By contrast, sectors where women are more represented (e.g. care, education, services, social enterprises) do not receive the same attention ([224]). Given

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([218]) European Commission, Directorate-General for Research and Innovation, *European Research Area Policy Agenda 2022-2204*, 2021, https://research-and-innovation.ec.europa.eu/system/files/2021-11/ec_rtd_era-policy-agenda-2021.pdf

([219]) European Commission, Directorate-General for Research and Innovation, *EU valorisation policy: making research results work for society*, n.d., https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/eu-valorisation-policy_en

([220]) Proposal for a Council Recommendation on the guiding principles for knowledge valorisation, COM/2022/391 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A391%3AFIN&qid=1660055341349

([221]) European Commission, Directorate-General for Research and Innovation, *ERA progress report 2016 – The European Research Area – Time for implementation and monitoring progress*, Publications Office of the European Union, Luxembourg, 2017, https://data.europa.eu/doi/10.2777/992170

([222]) GENDERACTIONplus, *Benchmarking and assessment report on guidelines for sex/gender analysis*, Deliverable 4.1, 2023, https://genderaction.eu/wp-content/uploads/2023/06/101058093_GENDERACTIONplus_D4.1_Benchmarking-and-assessment-report-on-guidelines-for-sex-gender-analysis.pdf

([223]) Lundvall, B. Å., 'Scope, style, and theme of research on knowledge and learning societies', *Journal of the Knowledge Economy*, Vol. 1, 2010, pp. 18-23; GENDERACTION, *D 5.1 Report on "Strategic advice for enhancing the gender dimension of Open Science and Innovation Policy," Deliverable 5.1, 2019,* https://www.genderportal.eu/sites/default/files/resource_pool/genderaction_report-5.1_d11_osoi.pdf

([224]) GENDERACTION, *D 5.1 Report on "Strategic advice for enhancing the gender dimension of Open Science and Innovation Policy," Deliverable 5.1*, 2019, https://www.genderportal.eu/sites/default/files/resource_pool/genderaction_report-5.1_d11_osoi.pdf; Amble, N., Axelsen, P. and Snerthammer, L. K., 'Innovation in public care', in *Research Handbook on Gender and Innovation*, Edward Elgar Publishing, 2016, pp. 151-169; Alsos, G. A., Ljunggren, E. and Hytti, U., ,Gender and innovation: State of the art and a research agenda', *International Journal of Gender and Entrepreneurship*, Vol. 5, No 3, 2013, pp. 236-256.

that academic spin-offs must demonstrate commercial value (^{225}) and often rely on research knowhow and technological assets, they are mainly driven by high technology and economic value, rather than addressing the needs of marginalised groups.

IGI initiatives at European level

The EU policies and agendas described above demonstrate a comprehensive framework where academic spin-offs and IGI can flourish, accompanied by concrete actions and initiatives that support the role of women innovators and researchers. Horizon Europe offers grants and funding for academic spin-offs through the European Innovation Council (EIC) Accelerator and the EIT. The EIT encourages collaboration and provides financial support, mentorship, and networking opportunities. The European Investment Fund (EIF) facilitates access to finance and private investments. The EU's Start-up Europe initiative supports events, mentorship programmes, and a network of incubators spanning Europe. To safeguard spin-off innovations, IP rights frameworks have been reinforced, with assistance available from the European Patent Office and Intellectual Property Helpdesks. No dedicated initiatives target academic spin-offs and gender equality specifically, but several European efforts – which also capture academic spin-off activity –promote IGI:

- EIC-led initiatives promote gender equality, including a target of 40 % women-led companies invited to pitch their projects, a target of 50 % women members of advisory structures, and the EU prize for women innovators, which recognises women entrepreneurs who are successful in developing disruptive, impactful and inspiring innovation activities.

- EIC-led targeted measures promote the participation of women in innovation, including the WomenTechEU pilot in 2021, which provided funding avenues for deep-tech innovations to women entrepreneurs. A second call for WomenTechEU was launched in 2022 with an increased budget of EUR 10 million, supporting 134 women-led deep tech companies (15+ academic spin-offs) with initial funding, coaching and mentoring (^{226}). Currently, a new call is open with 12 million EUR being invested in equity free-grants to support 160 women led deep tech companies (^{227}).

- EIT's Women2Invest programme supports women to increase their knowledge of venture capital (through training and paid internship) and helps inventors to access a pool of talented women interested in investment.

- European Investment Bank (EIB) has developed a gender action plan (GAP) to foster women's entrepreneurship and investment in relevant regional social priorities, such as the Care Economy. It aims to adopt a gender-sensitive approach in due diligence guidance and processes along the full project cycle, integrate a gender perspective in design, implementation, operation and monitoring of projects, and undertake sector-

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(^{225}) Vohora, A., Wright, M. and Lockett, A., 'Critical junctures in the development of university high-tech spinout companies', *Research Policy*, Vol. 33, No 1, 2004, pp. 147-175.

(^{226}) European Innovation Council and SMEs Executive Agency (EISMEA), *Second edition of WomenTechEU supports 134 female-led deep-tech companies with an increased budget of 10 million euro'*, 2023, https://eismea.ec.europa.eu/news/second-edition-womentecheu-supports-134-female-led-deep-tech-companies-increased-budget-10-million-2023-04-14_en

(^{227}) WomenTechEU, *Supporting women leading deep tech startups from Europe to grow into tomorrow's tech leaders*, n.d., https://womentecheurope.eu

wide studies on promotion of women entrepreneurship in the R&D and high-tech innovation sectors ([228]).

- A pilot Innovation Gender and Diversity Index is currently being developed. This aims to provide systematic information on startups, scale-ups, corporate, the EIC, investors and funding bodies, market actors and policymakers across Europe, with indicators on gender and diversity for all EU Member States and the United Kingdom (UK).

- RPOs and public institutions are required to have a gender equality plan (GEP) in order to be eligible for Horizon Europe funding. The gender dimension is one of five recommended areas in the GEP criterion, addressing the integration of sex and/or gender analysis across the R&I process, from setting research priorities to commercialising research and developing innovative products.

- Since the 6th EU Framework Programme, the European Commission has required grantees applying for funding to include a gender dimension in research (now mandatory for Horizon Europe funding) ([229]). Applicants are asked to describe how sex and/or gender analysis is taken into account in the project's R&I content ([230]). This innovative practice encourages researchers to consider sex, gender and intersectional dimensions throughout, from setting research priorities to research outputs that can be translated to innovation and commercialisation outputs, such as patents and academic spin-offs.

3.3. What do the data show?

While there is a supportive European policy framework and many initiatives to facilitate academic spin-offs and IGI, pertinent information and data remain limited, especially from a gender-inclusive perspective. Analysis of spin-out outcomes and impact should go beyond economic indicators to capture other aspects of development, such as sustainability and welfare, health, life expectancy, job satisfaction ([231]). Capturing information on academic spin-offs (number, sector of activity, stage of maturity, actor involvement) and academic entrepreneurship outcomes is significant. However, it is also crucial to capture data from an inclusive lens across micro, meso and macro levels of the wider ecosystems, as suggested by academic literature in the next section. Due to the lack of systematic European data on academic spin-offs, this section focuses on relevant data and statistics that provide an insight into the European innovation ecosystem, drawing from European statistical data sources (She Figures) and additional sources.

([228]) EIB, *EIB Group Gender Action Plan,* 2018, https://www.eib.org/attachments/strategies/eib-group-gender-action-plan-2018-2019-en.pdf

([229]) This section is mandatory in grant applications, except for topics identified in the work programme as not requiring the integration of the gender dimension into R&I content.

([230]) The guidance also suggests: 'If you do not consider such a gender dimension to be relevant in your project, please provide a justification'; European Commission, *Gendered Innovations 2*, 2020, https://ec.europa.eu/info/news/gendered-innovations-2-2020-nov-24_en

([231]) Miranda, F. J., Chamorro-Mera, A. and Rubio, S., 'Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention', *European Research on Management and Business Economics*, Vol. 23, No 2, 2017, pp. 113-122.

She Figures (2024)

She Figures indicators show persistent gender gaps in inventorships, scientific publications and academic- corporate collaboration:

- **Women are underrepresented among inventors**. In the EU, women make up only 9 % of inventors, compared to a global average of 12 %. However, countries like Portugal, Croatia, Spain, and Lithuania, report higher proportions of women inventors, exceeding 15 %. Despite efforts, there has been little change in the proportion of women holding patents over the past decade.

- **Women inventorships have increased but still vary across technology areas.** Although there is increase in women applicants across all technology areas (based on International Patent Classification (IPC)), disparities persist. In sectors like chemistry and metallurgy, women account for 21 % of inventorships, while in mechanical engineering and construction, this figure drops to just 3 %.

- **Only 5 % of inventorship teams are gender balanced.** Inventors' teams remain similar to She Figures 2021. During 2018-2021, most teams were men-only or men-majority (more than 90 %) while only a small fraction of all patent applications (4 %) comprised solely or mostly women. Finally, only 5 % of teams were gender balanced, similar to the global rate of 6 %.

- **Women are less likely to be active authors but there is no gender difference in impact of citations.** The gender disparity extends to scientific authorship, where women are less likely to be active authors, especially as they advance in seniority across all fields of R&D. While both men and women start with comparable publication rates early in their careers, women tend to publish less than men as they progress. However, there is no gender difference in the impact of citations. Only 16 % of authorship teams exhibit gender balance, with the majority comprising 60 % or more men, accounting for 31 % of all teams.

- **Fewer women than men are authors in academic-corporate collaboration teams.** At EU level, women comprise an average of 26 % of authors on academic-corporate collaboration teams, a slight increase from 22 % compared to She Figures 2021. No countries have achieved gender balance.

Additional sources

Gender gaps in entrepreneurship and self-employment

A 2023 report from the Organisation for Economic Co-operation and Development (OECD) and the European Commission on women's entrepreneurship and self-employment in the Member States and OECD countries uses data from the EU Labour Force Survey (EU-LFS) and the Global Entrepreneurship Monitor ([232]) to show that:

([232]) OECD/European Commission, *The Missing Entrepreneurs 2023: Policies for Inclusive Entrepreneurship and Self-Employment*, OECD Publishing, Paris, 2023, https://doi.org/10.1787/230efc78-en

- **Women exhibit lower levels of activity than men in initiating and managing new businesses**. About 6 % of women in the EU (compared to 8 % of men) and 9 % of women in OECD countries (compared to 11 % of men) were actively working on a start-up or managing a new business (<42 months old) over the period 2018-2022. Among the EU Member States, women were most active in starting and managing new businesses in Latvia and the Netherlands between 2018 and 2022. A high proportion of women in Latvia reported starting their business because they could not find employment.

- **The gender gap in self-employment is slowly closing**. The self-employment rate among women in the EU is 9 %, compared to 16 % for men (2022 data). The gender gap in self-employment fell by 6 % overall in the EU over the last decade, and decreased in 21 Member States. While these trends suggest progress in closing the gender gap in entrepreneurship, the gap has nevertheless increased substantially over the past decade in Croatia, Estonia, Latvia, Poland and Slovakia.

- **Gender gaps among self-employed people**. Self-employed women in the EU are about 30 % less likely than men to be employers (2022 data). Self-employed women in the EU are, on average, younger than self-employed men. 55 % of self-employed women are aged 25-49 years old, compared to 50 % of self-employed men (2022 data).

- **Barriers such as self-perceived fear of failure and skills gaps hinder women in business creation**. Nearly half of women in the EU report that a fear of failure prevents them from starting a business, compared to slightly more than 40 % of men. Women are about 75 % as likely as men to report that they have the necessary skills for starting business, indicating both skills gaps and self-confidence gaps.

Gender gaps in technology in the EU

A 2023 study on the state of EU tech identifies gender gaps in the share of capital investment across different gender composition, stages of maturity, venture capital leadership, and perceptions of the equality of the EU tech ecosystem ([233]).

- **Gender gaps in capital investment**: As of 2023, most capital investment in tech start-ups is still dominated by all-men founding teams, accounting for 82 % of all investments. Mixed gender founding teams receive 15 % of the funding, while all-women teams receive only 3 %, representing a marginal increase of 1 percentage point (pp) since 2019.

- **Gender gaps in stage of maturity**: Differences across stages of maturity reveal a healthier distribution at the pre-seed stage, with 8 % of funding going to women-led teams and 21 % to mixed teams. These shares decrease significantly in subsequent stages of fundraising.

- **Gender gaps in venture capital leadership**: Gender diversity remains a challenge within venture capital firms, particularly among general partners, who hold the highest decision-making positions. Studies indicate that women general partners are inclined to invest in women-led teams, suggesting that increasing the number of women in general

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([233]) Atomico, *State of European Tech 23*, 2023, https://stateofeuropeantech.com/

partner roles could boost funding for mixed and women-only founding teams. However, the current representation of women among general partners is low, at just 16 %.

- **Gender gaps in perceptions of the EU tech ecosystem**: There are stark contrasts in experiences, particularly among women, with a majority (55 %) expressing a lack of belief in equal treatment compared to only one-third (31 %) of men.

Gender gaps and deep tech in the EU

A Deep Tech report in 2023 ([234]) provides insights into spin-offs, highlighting the numbers of valuable deep tech companies that began as academic spin offs and noting that most deep tech startups in Europe and the United States (US) were developed based on patents. Across Europe, most deep tech funding has been allocated in the UK (EUR 3.04 billion), France (EUR 2.86 billion), and Sweden (EUR 2.86 billion), while deep tech hubs are emerging in Stockholm (EUR 2.86 billion – mega-rounds), London (EUR 1.34 billion), Paris (EUR 1.34 billion), Grenoble (EUR 1.07 billion – mega-rounds), and Munich (EUR 627 million). The UK, Germany and Switzerland lead the way for deep tech spin-out value, with ETH Zurich, University of Oxford and University of Cambridge the topmost universities in Europe. The UK, Germany and France hold the most active patents, while Catholic University Leuven, University of Oxford and Technische Universität Dresden have the highest patent activity across European universities. The report highlights that 95 % of existing patents remain inactive and are commercialised (i.e. find their way into companies and products).

- **Gender gaps in investment of women-founded deep-tech start-ups across Europe:** Despite the increasing emergence of women founders of deep tech startups across Europe since 2016 (8 %), only 10 % of venture capital funding is directed towards European deep tech start-ups with at least one woman founder in 2023.

- **Women-founded scale-ups demonstrate high value growth but are still underrepresented in terms of overall scale up value:** Women-founded scale-ups have surpassed the European average in value growth since 2017, increasing their value nearly sevenfold and growing 1.2 times as fast as their competitors over the past five years. Most of this value (73 %) is concentrated in the UK, France, and Germany, where women-founded scale-ups represent around 12 % of the overall scale-up value. In contrast, Finland, Italy, and Portugal exhibit slightly more diverse value distribution in their scale-up ecosystems ([235]).

Europe has favourable conditions to become a deep tech hub, with top academic institutions conducting fundamental research, high graduation rates in STEM and business, strong public support for deep tech at European and national level, and positive public discourse about the influence of science and technology. The report highlights that there is variation in equity for spin-offs across Europe, with much higher equity required in the UK and a burdensome EU regulatory framework that can stifle innovation. For inclusive innovation ecosystem, the report recommends: a unified, harmonised and founder-friendly approach for spin-offs across Europe, including streamlining procedures; incentivising Technology Transfer Offices (TTOs) and establishing a

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([234]) Jacobs, S., Franzeskides, C., Leitner, L., Autret, N., Chiavarini, L. *The 2023 European Deep Tech Report*, 2023, https://dealroom.co/uploaded/2023/09/The-European-Deep-Tech-Report-2023.pdf

([235]) Ibid.

common framework for valuing IP; encouraging entrepreneurship by fostering a cultural shift towards risk-taking, facilitating collaboration between researchers and start-ups; reviewing innovation regulation to prevent stifling early innovation; and promoting diversity across founders and investors through education, equal opportunity, visibility of role models, and support to individuals with what is required for success.

Data on women-founded start-ups

In the absence of academic spin-off data, the women founders rankings ([236]) provide insights into the highest numbers of women founders and startups established, together with the amount of capital raised by different universities globally ([237]). It identifies 49 universities where most women founders of startups with advanced degrees – excluding MBAs – are based, 11 of which are located in Europe (eight in the UK). Cambridge, Oxford, the London School of Economics (LSE), HEC Paris, and Imperial College London stand out as institutions where most women founders with advanced degrees originate (see Table 1). However, as this table shows, women account for a small proportion of the total number of founders, number of companies and capital raised even in these institutions.

Table 1 Women graduate founders' rankings in European universities, 2023

University	Women founder count (Total founder count)	Women founder company count (Total founder company count)	Women founder capital raised (EUR) (Total founder capital raised (EUR))
University of Cambridge	170 (1 156)	158 (961)	4.05 billion (26.16 billion)
University of Oxford	152 (981)	134 (827)	1.29 billion (26.91 billion)
LSE	104 (504)	102 (481)	1.05 billion (8.92 billion)
HEC Paris	64 (409)	60 (357)	548.28 million (6.03 billion)
Imperial College London	61 (679)	56 (562)	393.64 million (9.70 billion)

([236]) Where companies have more than one founder and each one can attend multiple universities, the same company or founder might be counted in more than one university. This report focuses on the graduate category, where founders have an advanced degree, other than an MBA.

([237]) Data provided by PitchBook, which produces annual university rankings, including global venture capital investment and educational information on founders of startups, encompassing more than 150 000 individuals. The 2023 university rankings are derived from an analysis of founders whose startups received initial venture funding between 1 January 1 2013 and 1 September 2023, identifying the top 50 universities globally, https://pitchbook.com/news/articles/pitchbook-female-founders-university-rankings

University of London	43 (213)	40 (195)	603.99 million (4.44 billion)
University of Edinburgh, Scotland	36 (218)	34 (196)	299.16 million (3.46 billion)
Lund University	35 (251)	30 (194)	273.29 million (2.50 billion)
University College London	31 (238)	28 (208)	203.79 million (4.00 billion)
Royal College of Art	29 (N/A) ([238])	27 (N/A)	130.26 million (N/A)
Uppsala University	26 (165)	24 (126)	364.32 million (1.204 billion)

In Europe, a steady increase is evident in venture capital funding for women-founded or co-founded companies since 2008, with women-led funds and incubators for women founders established in recent years. Initially, European venture capital deal flow by female (co)founded companies was modest, with 134 deals and EUR 35 million capital invested in 2008. However, this figure has shown consistent growth, peaking in 2021 at 3 353 deals and EUR 15.2 billion invested. Despite a slight decline, the numbers in 2023 remain notable, at 2 466 deals and EUR 10.88 billion invested.

The percentage of women-founded and co-founded venture capital deals has seen a significant increase, rising from 2.7 % and 7.5 %, respectively, in 2008, to 5.3 % and 20.4 %, respectively, in 2023, marking their highest levels yet. Across countries, most deals for women (co-)founded companies are reported in the UK, France, Germany, Spain, Sweden and Switzerland.

3.4. Literature view on academic spin-offs through a gender and intersectional lens

In the scientific literature, academic spin-offs have been the subject of increased scholarly attention in the past 20 years, reflected in the growing number of systematic literature reviews on academic entrepreneurship and the wider innovation ecosystem ([239]).

([238]) Royal College of Art features in the top 49 universities globally for women founders with advanced degrees, but is not included in the top 50 European universities (European rankings) for founders of startups with advanced degrees.

([239]) Terán-Pérez, B. M., Lafarga, C. V. and Félix, A. M., 'Emprendimiento académico y spin-off universitario: Una revisión sistemática de la literatura', *Revista Perspectiva Empresarial*, Vol. 7, No 1, 2020, pp. 87-103; Mathisen, M. T. and Rasmussen, E., 'The development, growth, and performance of university spin-offs: A critical review', *Journal of Technology Transfer*, Vol. 44, No 6, 2019, pp. 1891-1938; Secundo, G., Rippa, P. and Cerchione, R., 'Digital academic entrepreneurship: A structured literature review and avenue for a research agenda', *Technological Forecasting and Social Change*, Vol. 157, 2020, e120118; Miranda, F. J., Chamorro, A., and Rubio, S., 'Re-thinking university spin-off: A critical literature review and a research agenda', *Journal of Technology Transfer*,

However, the literature on academic spin-offs is largely limited to national studies and a small number of comparative surveys on spin-offs in Italy, Spain, Germany, Poland that do not often capture spin-off data systematically. There are limited studies looking at gender representation in academic spin-offs ([240]) and academic entrepreneurship ([241]). These show the underrepresentation of women in academic spin-offs ([242]), with a 2019 study finding that only 13 % of academic spin-offs across the UK have a woman founder ([243]), and 17 % in 2023 ([244]). Similar proportions are documented in Switzerland, with women comprising 14 % (2019) and 17 % (2021) of academic spin-offs or startup founders. Understanding this underrepresentation of women necessitates exploring the broader innovation and entrepreneurship ecosystem with an inclusive lens, as suggested by the inclusive innovation ecosystem framework ([245]). This framework is useful to investigate academic spin-offs and academic entrepreneurship ([246]) across micro, meso and macro levels – and their interactions - from a gender-inclusive perspective that encompasses both representation (in research and academic workforce, founders) and research content (how gender should be considered from research ideas to methodologies to outputs and commercialisation).

At **micro level**, individual attitudes, skills, choices and behaviours can be central to pursuing entrepreneurship and innovation activities. These can be internal factors relating to the entrepreneur, such as their skills and entrepreneurial intentions, or they can influence the actions of gatekeepers such as investors. Women's readiness to pursue entrepreneurial opportunities is influenced by a combination of personal motivation, attitudes, and the supportive nature of their environment ([247]). Apart from lower entrepreneurial intention and behaviour of women academics

Vol. 43, No 4, 2018, pp. 1007-1038; Perkmann, M., Salandra, R., Tartari, V., McKelvey, M. and Hughes, A., 'Academic engagement: A review of the literature 2011-2019', *Research Policy*, Vol. 50, No 1, 2021, e104114.

([240]) Lauto, G., Salvador, E. and Visintin, F., 'For what they are, not for what they bring: The signaling value of gender for financial resource acquisition in academic spin-offs', *Research Policy*, Vol. 51, No 7, 2022, e104554; Civera, A. and Meoli, M., 'Empowering female entrepreneurs through university affiliation: Evidence from Italian academic spinoffs', *Small Business Economics*, Vol. 61, No 3, 2023, pp. 1337-1355.; Sciarelli, M., Landi, G. C., Turriziani, L. and Tani, M., 'Academic entrepreneurship: Founding and governance determinants in university spin-off ventures', *Journal of Technology Transfer*, Vol. 46, 2021, pp. 1083-1107; Rosa, P. and Dawson, A., 'Gender and the commercialisation of university science: Academic founders of spinout companies', *Entrepreneurship and Regional Development*, Vol. 18, No 4, 2006, pp. 341-366; Griffiths, H., Grisoni, L., Manfredi, S., Still, A. and Tzanakou, C., *The spinout journey: Barriers and enablers to gender inclusive innovatio*n, 2020.

([241]) Poggesi, S., Mari, M., De Vita, L. and Foss, L., 'Women entrepreneurship in STEM fields: Literature review and future research avenues', *International Entrepreneurship and Management Journal*, Vol. 16, 2020, pp. 17-41; Jennings, J. E. and Brush, C. G., 'Research on women entrepreneurs: Challenges to (and from) the broader entrepreneurship literature?', *Academy of Management Annals*, Vol. 7, No 1, 2013, pp. 663-715.

([242]) Griffiths, H. and Humbert, A. L., *Gender and university spinouts in the UK: Geography, governance and growth,* Oxford: Oxford Brookes University Centre for Diversity Policy Research and Practice. Report produced as part of the EPSRC funded project 'Promoting Equality, Diversity and Inclusion in University Spinout Companies – A Case for Action' (EP/S010734/1) as part of their Inclusion Matters initiative, 2019, p. 3; Rosa, P. and Dawson, A., 'Gender and the commercialisation of university science: Academic founders of spinout companies', *Entrepreneurship and Regional Development*, Vol. 18, No 4, 2006, pp. 341-366; Abreu, M. and Grinevich, V., 'Gender patterns in academic entrepreneurship', *Journal of Technology Transfe*r, Vol. 42, 2017, pp. 763-794.

([243]) Griffiths, H. and Humbert, A. L., 2019, *op. cit.*, p. 3.

([244]) Beauhurst, *Spotlight on Spinouts*, 2023, https://www.beauhurst.com/research/spotlight-spinouts-2023/

([245]) Cukier, W., Gagnon, S., Dalziel, M., Grant, K., Laplume, A., Ozkazanc-Pan, B. and Saba, T., 'Women entrepreneurship: Towards an inclusive innovation ecosystem', *Journal of Small Business & Entrepreneurship*, Vol. 34, No 5, 2022, pp. 475-482, https://doi.org/10.1080/08276331.2022.2066436

([246]) Academic entrepreneurship is "defined as the process universities adopt to achieve their entrepreneurial configuration[…] academic entrepreneurship includes activities such as University's research collaborations with industry, patent applications, idea spin-offs into new firms, entrepreneurial education of highly skilled individuals and business incubators" (Secundo, G., Rippa, P. and Cerchione, R., 'Digital academic entrepreneurship: A structured literature review and avenue for a research agenda', *Technological Forecasting and Social Change*, Vol. 157, 2020, p.1). Academic entrepreneurship is a broad term which can be manifested in different ways, such as patenting, spin off/spin out firms, licensing, consulting and advisory firms (Klofsten and Jones-Evans, 2000).

([247]) Cukier, W., Mo, G. Y. and Francis, J., 'Women's entrepreneurship in the inclusive innovation ecosystem in Canada', in B. Owalla, T. Vorley and H. Lawton Smith (Eds.), *Gender, diversity and innovation: Concepts, policies and practice*, Edward Elgar Publishing, 2022, pp. 223-238; Gabarret, I., Vedel, B. and Decaillon, J., 'A social affair: Identifying motivation of social entrepreneurs', *International Journal of Entrepreneurship and Small Business*, Vol. 31, No 3, 2017, pp. 399-415; Bae, T. J., Qian, S., Miao, C. and Fiet, J. O., 'The relationship between entrepreneurship education and entrepreneurial intentions: A meta-analytic review', *Entrepreneurship Theory and Practice*, Vol. 38, No 2, 2014, pp. 217-254.

(²⁴⁸), care and family responsibilities are a barrier to women engaging in academic entrepreneurship ([249]). While women are portrayed as risk averse ([250]), research shows that other factors intersecting with gender, such as career stage, family and personal circumstances, affect perceptions of risk ([251]).

Women entrepreneurs face challenges in accessing the necessary support and resources, including 'relatable' mentors ([252]), training ([253]) and networking ([254]). Women might also be more concerned about the ethics of research commercialisation and thus opt not to engage ([255]). Motivation behind academic entrepreneurship seems to vary, including financial necessity for PhDs ([256]) and financial gain ([257]), but a desire to address 'real world problems' and contribute to society is also documented ([258]). A UK study found that women founders of academic spin-offs are motivated to pursue a spin-out in search of freedom and flexibility compared to the lab-constrained academic careers in STEM, suggesting an opportunity to consider alternative career paths ([259]).

Women are underrepresented in STEM fields where spin-offs and academic entrepreneurship are more common compared to arts and the humanities ([260]). In addition, women are more likely to be in junior and lower-ranked academic positions ([261]). Consequently, they tend to focus on

([248]) Goel, R. K., Göktepe-Hultén, D. and Ram, R., 'Academics' entrepreneurship propensities and gender differences', *Journal of Technology Transfer*, Vol. 40, 2015, pp. 161-177; Haeussler, C. and Colyvas, J. A., 'Breaking the ivory tower: Academic entrepreneurship in the life sciences in UK and Germany', *Research Policy*, Vol. 40, No 1, 2011, pp. 41-54; Abreu, M. and Grinevich, V., 'Gender patterns in academic entrepreneurship', *Journal of Technology Transfer*, Vol. 42, 2017, pp. 763-794.

([249]) Busolt, U. and Kugele, K. , 'The gender innovation and research productivity gap in Europe', *International Journal of Innovation and Sustainable Development*, Vol. 4, No 2-3, 2009, pp. 109-122.

([250]) Miranda, F. J., Chamorro-Mera, A. and Rubio, S., 'Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention', *European Research on Management and Business Economics*, Vol. 23, No 2, 2017, pp. 113-122.

([251]) Griffiths, H., Grisoni, L., Manfredi, S., Still, A. and Tzanakou, C., *The spinout journey: Barriers and enablers to gender inclusive innovation*, 2020.

([252]) Rosa, J. M. and Sylla, D., 'A comparison of the performance of majority female-owned and majority male-owned small and medium-sized enterprises', *Innovation, Science and Economic Development Canada*, 2016; Griffiths, H., Grisoni, L., Manfredi, S., Still, A. and Tzanakou, C., *The spinout journey: Barriers and enablers to gender inclusive innovation*, 2020.

([253]) Elliott, C., Mavriplis, C. and Anis, H., 'An entrepreneurship education and peer mentoring program for women in STEM: Mentors' experiences and perceptions of entrepreneurial self-efficacy and intent', *International Entrepreneurship and Management Journal*, Vol. 16, No 1, 2020, pp. 43-67.

([254]) McGowan, P., Cooper, S., Durkin, M. and O'Kane, C., 'The influence of social and human capital in developing young women as entrepreneurial business leaders', *Journal of Small Business Management*, Vol. 53, No 3, 2015, pp. 645-661.

([255]) Murray, F. and Graham, L., 'Buying science and selling science: gender differences in the market for commercial science', *Industrial and Corporate Change*, Vol. 16, No 4, 2007, pp. 657–689; Abreu, M. and Grinevich, V., 'Gender patterns in academic entrepreneurship', *Journal of Technology Transfer*, Vol. 42, 2017, pp. 763-794.

([256]) Rizzo, U., 'Why do scientists create academic spin-offs? The influence of the context', *Journal of Technology Transfer*, Vol. 40, 2015, pp. 198-226.

([257]) Hayter, C. S., 'Public or private entrepreneurship? Revisiting motivations and definitions of success among academic entrepreneurs', *Journal of Technology Transfer*, Vol. 40, 2015, pp. 1003-1015.

([258]) Miranda, F. J., Chamorro-Mera, A. and Rubio, S., 'Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention', *European Research on Management and Business Economics*, Vol. 23, No 2, 2017, pp. 113-122.; Griffiths, H., Grisoni, L., Manfredi, S., Still, A. and Tzanakou, C., *The spinout journey: Barriers and enablers to gender inclusive innovation*, 2020.

([259]) Tzanakou, C. and Manfredi, S., *Women and spinouts: A framework for higher education institutions to gender-inclusive academic entrepreneurship*, University Press, 2021; Griffiths, H., Grisoni, L., Manfredi, S., Still, A. and Tzanakou, C., *The spinout journey: Barriers and enablers to gender inclusive innovation*, 2020.

([260]) European Commission, Directorate-General for Research and Innovation, *She Figures*, 2024.

([261]) Ibid.

publications and progressing their academic careers [262] rather than commercialising their research, a task often overlooked in workload models and academic career paths [263].

Academic entrepreneurship appears to mitigate gender differences in business and wider entrepreneurship. Firstly, both women and men academics demonstrate similar skills in spin-offs [264]. Secondly, the growth rate of academic spin-offs is comparable [265]. However, 'the processes, structures and discourses of academic entrepreneurship are gendered' [266] and are accompanied by gendered experiences [267]. Women, particularly those from ethnic minority backgrounds and early career researchers, report that intersectional biases and stereotypes impact the perceived legitimacy of their knowledge and experience by actors in the entrepreneurship ecosystem [268].

At **meso level**, various conditions can nurture entrepreneurial success, including investors, incubators, networks and educational institutions. While European RPOs have become more entrepreneurial through the support of national and EU programmes to commercialise their research and contribute to innovation [269], gender bias is evident within their entrepreneurial ecosystems [270]. Educational institutions often perpetuate gender stereotypes in their curricula and teaching methods on entrepreneurship [271], with the entrepreneur image still perceived as masculine. Socially constructed stereotypes about sex/gender attributes and characteristics are identified as a key factor influencing entrepreneurial intentions [272]. The introduction of training and activities on sex/gender and intersectional dimension in research content in European RPOs as part of their GEPs has the potential to mitigate stereotypes and biases and create more societally relevant outputs [273], but information on their impact is lacking. Research funding organisations (RFOs) have taken steps to integrate the gender dimension in their funding processes and evaluation criteria, but these remain limited and do not encompass the entire funding process of RFOs [274].

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[262] Poggesi, S., Mari, M., De Vita, L. and Foss, L., 'Women entrepreneurship in STEM fields: Literature review and future research avenues', *International Entrepreneurship and Management Journal*, Vol. 16, 2020, pp. 17-41.

[263] Tzanakou, C. and Manfredi, S., *Women and spinouts: A framework for higher education institutions to gender-inclusive academic entrepreneurship*, University Press, 2021; Griffiths, H., Grisoni, L., Manfredi, S., Still, A. and Tzanakou, C., *The spinout journey: Barriers and enablers to gender inclusive innovation*, 2020.

[264] Rosa, P. and Dawson, A., 'Gender and the commercialisation of university science: Academic founders of spinout companies', *Entrepreneurship and Regional Development*, Vol. 18, No 4, 2006, pp. 341-366.

[265] Rodríguez-Gulías, M. J., Fernández-López, S. and Rodeiro-Pazos, D., 'Gender differences in growth of Spanish university spin-offs', *Gender in Management: An International Journal*, Vol. 33, No 2, 2018, pp. 86–103.

[266] Fältholm, Y., Abrahamsson, L. and Källhammer, E., 'Academic entrepreneurship: gendered discourses and ghettos', *Journal of Technology Management & Innovation*, Vol. 5, No 1, 2010, pp. 51-63.

[267] Karataş-Özkan, M. and Chell, E., 'Gender inequalities in academic innovation and enterprise: a Bourdieuian analysis', *British Journal of Management*, Vol. 26, No 1, 2015, pp. 109-125.

[268] Griffiths, H., Grisoni, L., Manfredi, S., Still, A. and Tzanakou, C., *The spinout journey: Barriers and enablers to gender inclusive innovation*, 2020.

[269] Clauss, T., Moussa, A. and Kesting, T., 'Entrepreneurial university: A stakeholder-based conceptualisation of the current state and an agenda for future research', *International Journal of Technology Management*, Vol. 77, No 1-3, 2018, pp. 109-144.

[270] Giuri, P., Grimaldi, R., Kochenkova, A., Munari, F. and Toschi, L., 'The effects of university-level policies on women's participation in academic patenting in Italy', *Journal of Technology Transfer*, 2018, pp. 1-29.

[271] Berglund, K., Lindgren, M. and Packendorff, J., 'Responsibilising the next generation: Fostering the enterprising self through de-mobilising gender', *Organisation*, Vol. 24, No 6, 2017, pp. 892-915.

[272] Gupta, V. K., Turban, D. B., Wasti, S. A. and Sikdar, A., 'The role of gender stereotypes in perceptions of entrepreneurs and intentions to become an entrepreneur', *Entrepreneurship Theory and Practice*, Vol. 33, No 2, 2009, pp. 397-417.

[273] European Commission, Directorate-General for Research and Innovation, *Gendered innovations 2 – How inclusive analysis contributes to research and innovation – Policy review*, Publications Office of the European Union, Luxembourg, 2020, https://data.europa.eu/doi/10.2777/316197

[274] Håkansson, S. Y. and Sand, J., *The gender dimension in research and innovation: Results from a global survey on research funding organisations*, Swedish Secretariat for Gender Research, University of Gothenburg, 2021.

Gender disparities in accessing financial resources are well-documented, with pervasive biases within financial organisations hindering women from qualifying for loans or securing investments ([275]). Incubators and accelerators provide valuable entrepreneurial resources, including training, networks, investors and mentors. However, they often fail to address the specific needs of women, as their processes, policies and cultures tend to exclude them ([276]). Women's limited access to networks and funding are identified as key barriers that limit women's entrepreneurship ([277]). Yet a recent study found that women perform better in crowdfunding and are perceived as more capable in launching such campaigns compared to men, especially in male-stereotyped categories ([278]).

At **macro level**, cultural biases, societal experiences, governmental mandates, physical infrastructure and depictions in the media all pose barriers to IGI. Gender biases are deeply ingrained in how innovation and entrepreneurship have historically been portrayed ([279]), with men more likely to be associated with technology-driven ventures ([280]). These cultural stereotypes influence the formulation of policies and practices, many of which – historically – are shaped by men for men. This perpetuates a masculine discourse that normalises men as the entrepreneurial standard, while positioning women as 'other', suggesting a deficit perspective of women's entrepreneurship and innovation ([281]). Policies and programmes on innovation and entrepreneurship often prioritise high growth and export-based businesses ([282]) rather than social and community goals, making them more likely to exclude women and marginalised groups ([283]).

([275]) Cukier, W. and Chavoushi, Z. H., 'Facilitating women entrepreneurship in Canada: The case of WEKH', *Gender in Management: An International Journal*, Vol. 35, No 3, 2020, pp. 303-321; Eddleston, K. A., Ladge, J. J., Mitteness, C. and Balachandra, L., 'Do you see what I see? Signaling effects of gender and firm characteristics on financing entrepreneurial ventures', *Entrepreneurship Theory and Practice*, Vol. 40, No 3, 2016, pp. 489-514; Vershinina, N., Rodionova, Y. and Marlow, S., 'Does an entrepreneur's gender matter for credibility and financing of SMEs?', in *Female Entrepreneurship in Transition Economies: Trends and Challenges*, Palgrave Macmillan, 2015, pp. 87-111.

([276]) Orser, B., Elliott, C. and Cukier, W., *Strengthening ecosystem supports for women entrepreneurs*, Telfer School of Management, University of Ottawa, 2019; Cukier, W. and Chavoushi, Z. H., 'Facilitating women entrepreneurship in Canada: The case of WEKH', *Gender in Management: An International Journal*, Vol. 35, No 3, 2020, pp. 303-321.

([277]) Kuschel, K., Ettl, K., Díaz-García, C. and Alsos, G. A., 'Stemming the gender gap in STEM entrepreneurship – Insights into women's entrepreneurship in science, technology, engineering and mathematics', *International Entrepreneurship and Management Journal*, Vol. 16, No 1, 2020, pp. 1-15; Poggesi, S., Mari, M., De Vita, L. and Foss, L., 'Women entrepreneurship in STEM fields: Literature review and future research avenues', *International Entrepreneurship and Management Journal*, Vol. 16, 2020, pp. 17-41.

([278]) Seigner, B. D. C., Milanov, H. and McKenny, A. F., 'Who can claim innovation and benefit from it? Gender and expectancy violations in reward-based crowdfunding', *Strategic Entrepreneurship Journal*, Vol. 16, No 2, 2022, pp. 381-422.

([279]) Schumpeter, J. A., *The Theory of Economic Development,* Harvard University Press, 1934; Hébert, R. F. and Link, A. N., A History of Entrepreneurship, Routledge, 2009.

([280]) Eddleston, K. A., Ladge, J. J., Mitteness, C. and Balachandra, L., 'Do you see what I see? Signaling effects of gender and firm characteristics on financing entrepreneurial ventures', *Entrepreneurship Theory and Practice*, Vol. 40, No 3, 2016, pp. 489-514; Marlow, S. and McAdam, M., 'Gender and entrepreneurship: Advancing debate and challenging myths; exploring the mystery of the under-performing female entrepreneur', *International Journal of Entrepreneurial Behaviour & Research*, Vol. 19, No 1, 2013, pp. 114-124; Lindholm Dahlstrand, Å. and Politis, D., 'Women business ventures in Swedish university incubators', *International Journal of Gender and Entrepreneurship*, Vol. 5, No 1, 2013, pp. 78-96; Blake, M. K. and Hanson, S., 'Rethinking innovation: Context and gender', *Environment and Planning A*, Vol. 37, No 4, 2005, pp. 681-701.

([281]) Marlow, S. and McAdam, M., 'Gender and entrepreneurship: Advancing debate and challenging myths; exploring the mystery of the under-performing female entrepreneur', *International Journal of Entrepreneurial Behaviour & Research*, Vol. 19, No 1, 2013, pp. 114-124; Foss, L. and Henry, C., 'Doing gender in innovation: A thematic review and critique of the literature', in Research Handbook on Gender and Innovation, Edward Elgar Publishing, 2016, pp. 17-48.

([282]) Foss, L., Henry, C., Ahl, H. and Mikalsen, G. H., 'Women's entrepreneurship policy research: A 30-year review of the evidence', *Small Business Economics*, Vol. 53, 2019, pp. 409-429.

([283]) Cukier, W., Gagnon, S., Dalziel, M., Grant, K., Laplume, A., Ozkazanc-Pan, B. and Saba, T., 'Women entrepreneurship: Towards an inclusive innovation ecosystem', *Journal of Small Business & Entrepreneurship*, Vol. 34, No 5, 2022, pp. 475-482, https://doi.org/10.1080/08276331.2022.2066436

Studies have applied an intersectional lens to academic entrepreneurship to explore gender and seniority, age and ethnicity ([284]), but research remains limited in number of studies and scope. Academic literature also lacks comprehensive recommendations, highlighting the need for increased opportunities for career progression ([285]) and gender equality programmes in universities ([286]).

Overall, academic literature shows ongoing inequalities in academia and the wider entrepreneurship and innovation ecosystem where academic spin-offs operate, calling for greater efforts toward structural and cultural change at both the macro and meso levels to foster inclusivity. Despite RPOs' efforts and commitments to gender equality and inclusiveness, more work needs to be done to mitigate biases and overcome barriers to create a more inclusive environment in academia, research and innovation. Such innovative and diverse environments are essential for building gender-inclusive innovation ecosystems ([287]) and developing 'breakthrough innovative solutions across the continent that will inspire the world' ([288]).

3.5. Good practices and initiatives at national level

Across the Member States, academic spin-offs have become a more common phenomenon and some good practices can be highlighted ([289]). Gender is considered as part of the following efforts:

- **Austria:** the Austrian Phoenix Founders Award is a prize given by *Austria Wirtschaftsservice* (AWS). It recognises startups, spin-offs and prototype development, and shows how the successful transfer of knowledge from research institutions strengthens the economics of innovation in Austria ([290]).

- **Austria:** the Spin-off Fellowships programme of the Federal Ministry of Education, Science and Research (BMBWF) is designed to support academic researchers and students with ideas to establish their own companies. It envisages developing and commercialising the IP held in Austrian universities and research institutions to form the basis for new start-ups. Fellows receive further training, coaching and mentoring via a network of knowledge transfer centres. It started in 2017 and a second call closed in September 2023 ([291]).

- **Austria:** the FEMtech Research Projects were launched in 2008 and are funded by the Austrian Research Promotion Agency (FFG) to incentivise companies to introduce gender equality measures when collaborating with research institutes. Beneficiaries are

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([284]) Rosa, P. and Dawson, A., 'Gender and the commercialisation of university science: Academic founders of spinout companies', *Entrepreneurship and Regional Development*, Vol. 18, No 4, 2006, pp. 341-366; Karataş-Özkan, M. and Chell, E., 'Gender inequalities in academic innovation and enterprise: A Bourdieuian analysis', *British Journal of Management*, Vol. 26, No 1, 2015, pp. 109-125.

([285]) Abreu, M. and Grinevich, V., 'Gender patterns in academic entrepreneurship', *Journal of Technology Transfer*, Vol. 42, 2017, pp. 763-794.

([286]) Karataş-Özkan, M. and Chell, E., 'Gender inequalities in academic innovation and enterprise: A Bourdieuian analysis', *British Journal of Management*, Vol. 26, No 1, 2015, pp. 109-125.

([287]) Tzanakou, C. and Manfredi, S., *Women and spinouts: A framework for higher education institutions to gender-inclusive academic entrepreneurship*, University Press, 2021.

([288]) The New European Innovation Agenda, 2022, https://ec.europa.eu/commission/presscorner/detail/en/IP_22_4273

([289]) European Commission, Directorate-General for Research and Innovation, Kalff-Lena, S., *Towards a policy dialogue and exchange of best practices on knowledge valorisation – Report about the results of the survey,* Publications Office of the European Union, Luxembourg, 2021, https://data.europa.eu/doi/10.2777/457841

([290]) Austrian Phoenix Founders Award, n.d., https://www.aws.at/en/austrian-phoenix-founders-award/

([291]) FFG, Spin-off Fellowships, n.d., https://www.ffg.at/en/program/spin-fellowships-0

primarily enterprises and research institutions already considering gender issues in their R&I activities.

- **Belgium:** the Gemma Frisius Fund provides seed capital at the early stages of the development of innovative, research-based spin-off companies. Investment is not restricted to a specific technology domain, but covers every opportunity in which the knowledge, technology or IP of KU Leuven can be exploited. It was established in 1997 as a joint venture between KU Leuven, KBC Private Equity and BNP Paribas Fortis Private Equity [292].

- **Denmark:** the Open Entrepreneurship Initiative connects experienced entrepreneurs with researchers to explore new opportunities either entrepreneurial (spin-out or startup) or intrapreneurial (within the university, company or organisation) [293].

- **Cyprus:** Cyprus Seeds is a non-profit organisation aiming to commercialise innovative academic research. It helps to develop Cypriot technology spin-offs and supports researchers by providing funding for commercialisation, entrepreneurial networking, mentoring and networking. It started in 2019 and is currently in its third cycle (2022-2024) [294].

- **Greece:** Enter Go Grow (EGG) is a business accelerator running since 2013 with the support of Eurobank Greece and Corallia of the Athena Research and Innovation Centre in Information, Communication, and Knowledge Technologies. EGG offers startups and scientific teams opportunities for financing, mentoring, networking, and exporting activities through two platforms, one for startups and one for scale-ups.

- **France:** the government, along with Bpifrance, has launched an Innovation Competition, i-PhD (complementing previous innovation competitions such as the i-Lab and I-Nov), which targets young researchers or Doctoral students who wish to pursue entrepreneurship and develop innovative and technological companies based on their research. The winners have access to funding and support (mentoring, coaching) along with networking (network of the winners).

- **Spain:** the *Agencia Estatal de Investigación* (AEI) ensures that a gender dimension is considered across all stages of the funding cycle. AEI mandates the inclusion of sex and gender analysis and provides guidelines for applicants and evaluators. Formal assessment procedures are in place, including training modules for evaluators. It also monitors the impact of integrating the gender dimension into research projects. While most requests for proposals require the integration of the gender dimension, inadequate monitoring often makes it challenging to verify whether this integration has been effectively implemented. AEI not only evaluates whether the gender dimension has been integrated but also examines the methods and extent of its integration, enabling it to capture research outputs such as academic spin-offs.

- **Sweden:** the Swedish Governmental Agency for Innovation Systems (Vinnova) plays a crucial role in advancing sustainable growth by financing R&D that aligns with societal needs and improves the efficiency of innovation systems. Vinnova fosters collaboration

[292] KU Leuven Research and Development Tech Transfer Office, Gemma Frisius programme, n.d., https://lrd.kuleuven.be/en/spinoff/gemma-frisius-fund
[293] Open Entrepreneurship, n.d., https://open-entrepreneurship.com/about-oe/
[294] Cyprus Seeds, n.d., https://cyprusseeds.com

among various entities within the R&I ecosystem, including companies, universities, and research institutions. Vinnova actively supports efforts to address gender inequalities and enhance innovation effectiveness: in 2023, one initiative specifically targeted the integration of gender equality into digital technology development within Swedish industries.

Beyond the EU

- **UK:** the SETsquared Partnership is a business incubator and enterprise partnership comprising six UK universities (Bath, Bristol, Cardiff, Exeter, Southampton, Surrey) with support programmes that help to commercialise research ideas.

- **UK:** RisingWISE is an enterprise course programme developed by women for early career women researchers from the Universities of Oxford and Cambridge working closely with industry. It aims to enhance the leadership, negotiation and self-efficacy skills of women researchers and support them in pursuing entrepreneurship opportunities in STEM subjects.

- **Switzerland:** a collaboration ([295]) between Swiss universities brings together gender equality objectives with promoting innovation and development of academic spin-offs by women. Through the involvement of investors, industry, innovation centres, knowledge and technology transfer offices, and gender and diversity experts, it aims to support universities in training and developing skills on entrepreneurship and research commercialisation.

3.6. Recommendations

Data recommendations

Data on academic spin-offs are very limited or unsystematic. Researchers on inclusive ecosystems observe that, 'deciding what and how to measure has a profound impact on who gets included and excludes and how we define success' ([296]). For example, apart from representation indicators, analysis of spin-off outcomes and impact should go beyond economic indicators to capture other aspects of development, such as sustainability and welfare, health, life expectancy and job satisfaction ([297]). Currently, data on spin-offs are frequently restricted by paywalls, limiting accessibility as well as hindering research and dissemination. There is a clear need for more systematic data collection and analysis at both national and European levels. Alongside an open

([295]) FemSpin, *Promoting spin-off activities of female academics*, n.d., www.femspin.ch

([296]) Cukier, W., Gagnon, S., Dalziel, M., Grant, K., Laplume, A., Ozkazanc-Pan, B. and Saba, T., 'Women entrepreneurship: Towards an inclusive innovation ecosystem', *Journal of Small Business & Entrepreneurship*, Vol. 34, No 5, 2022, p, 230, https://doi.org/10.1080/08276331.2022.2066436

([297]) Miranda, F. J., Chamorro-Mera, A. and Rubio, S., 'Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention', *European Research on Management and Business Economics*, Vol. 23, No 2, 2017, pp. 113-122.

data policy, this effort should align with the FAIR principles ([298]) to effectively capture and publicly share the following indicators:

- Number of academic spin-offs by country.

- Number of academic spin-offs by sector.

- Representation of women and people belonging to intersectional groups as founders/co-founders or members of boards (e.g. gender, age, gender identity, disability, socioeconomic background, refugee/migrant status, where possible collecting intersectional data).

- Representation of women and intersectional groups in the investment/venture capital community.

- Research commercialisation and academic entrepreneurship activity by sex/gender, intersectional identities (licensing, IP, consulting, etc.).

- Gender and intersectionality dimension in academic spin-offs.

- Number of academic spin-offs where gender and intersectional dimension is reported in the research content.

- Evidence of participatory approaches in development of research and/or academic spin-offs from women and intersectional marginalised groups.

- Outcomes of academic spin-offs
    — Economic indicators: growth, profit, jobs generated.
    — Social indicators: social relevance and impact, meeting societal marginalised needs, contribution towards IGI.

- Impact assessment of academic spin-out outcomes (products/processes) from a gender- and intersectional-inclusive lens to determine whether spin-out activities/outcomes are gender-sensitive.

This approach may facilitate the establishment of national, and ultimately European, publicly accessible registers of spinouts.

Recommendations to stakeholders

Several recommendations are provided for different stakeholder groups as a starting point to make academic spin-offs and the European innovation and entrepreneurship ecosystem more gender-inclusive.

RPOs

- RPOs should review their processes and structures for academic entrepreneurship to ensure equal access and support for all individuals, regardless of age, gender, ethnic identity or other individual characteristics.

([298]) According to the FAIR principles, the data should be: Findable; Accessible; Interoperable; Re-usable. For further details, see the FAIR principles website: https://www.go-fair.org/fair-principles.

- RPOs can support institutional change by implementing inclusive and meaningful GEPs to create more gender-sensitive and inclusive environments for academic entrepreneurship and innovation.

- RPOs need to collect data and monitor activities related to academic entrepreneurship and innovation, such as patent applications and academic spin-offs through a gender and intersectional lens.

- RPOs should explicitly acknowledge and reward academic entrepreneurship in terms of workload and career progression. They should also consider developing alternative career paths related to academic entrepreneurship and research commercialisation, which could promote intersectoral mobility and increase representation of women in the business enterprise sector.

- RPOs should clearly communicate institutional policies and information on academic entrepreneurship, including financial sources and supports available.

- RPOs should provide academic entrepreneurship training with a gender dimension for identifying gender and intersectional inequalities among researchers and staff in TTOs and other units involved in academic entrepreneurship activities.

- RPOs, TTOs and incubators can play a significant role in providing networks for academic founders. However, these networks need to be more diverse to ensure access to 'relatable' mentors who understand the challenges faced by academic founders.

- Fostering relationships and networks with entrepreneurs, business communities and industries is essential to developing an inclusive ecosystem. Access to these networks should be provided to all academics and researchers, particularly those in the early career stages.

RFOs

- Explicitly define criteria that require applicants to demonstrate how their research – especially prototypes and commercialisation – can meet the needs of marginalised groups.

- Promote participatory approaches by involving women and people from marginalised communities in setting research priorities and future funding initiatives.

- Establish evaluation criteria for R&I projects that include considerations such as the gender dimension in R&I content, intersectionality, participatory approaches, and gender diversity in teams.

- Fund impact assessments of commercialised research, including monitoring the academic spin-out activity in relation to marginalised groups.

- Systematically collect data on R&I projects funded, with a focus on those leading to academic entrepreneurship and innovation, from a gender and inclusive lens.

Venture capital/investors

- Venture capital funding and industrial funding should reconsider priorities and criteria for funding academic spin-offs. They need to move beyond solely assessing commercial value and technological advancement and recognise the societal value and relevance of academic spin-offs in promoting IGI.

- Venture capital firms and investor communities should review their processes and structures to ensure equal access and support for all individuals, regardless of age, gender, ethnic identity or other individual characteristics.

EU and national policymakers and authorities

- Systematic efforts are needed at European and national level to collect and publicly share data on academic entrepreneurship and spin-offs, as well as on broader innovation concepts, such as inventorships, disaggregated by gender, intersectional characteristics, scientific field, sector, country and outputs. Implementing an open data policy and adhering to FAIR principles is key for ensuring wide accessibility and usability.

- Policies and funding programmes for academic spin-offs should consider women-dominated sectors (care, public sector and civil society) even if they may not meet profit or technology targets. Such sectors are societally relevant and contribute to inclusive growth and societal well-being. Programmes should establish criteria beyond profit and economic outcomes to capture their social and cultural impact.

- Policies and programmes should promote and require the inclusion of women and marginalised groups in the co-creation and co-production of R&I activities, including academic spin-offs. These groups should be considered both creators and users of such activities, as evidenced by the social and economic costs when they are excluded.

- The gender dimension should be encouraged across applications in all funding programmes (across the entire Horizon Europe, including ERC, Marie Sklodowska-Curie) and expanded to include innovation, entrepreneurship, and investment funding.

- A systematic review with a gender and intersectional lens is required to examine the governance, human resource policies, organisational culture, practices and performance metrics of organisations at the meso level of the ecosystem (financial institutions, business support organisations, incubators, educational institutions). Understanding engagement within the ecosystem is crucial for identifying gaps and strategies to meet the needs of diverse entrepreneurs and move towards inclusivity. New activities that are more responsive to women and marginalised groups, such as crowdfunding, micro-grants, sponsorship, should be introduced and integrated into the ecosystem.

- RPOs, reviewers for RFOs and investment communities should undergo training to approach innovation from various perspectives, including gender and intersectional dimensions.

- Stakeholders involved in setting up innovation projects must ensure the integration of sex/gender analysis to guarantee that innovative processes benefit all segments of the population without bias.

- There is a need to review, broaden and change masculine concepts of entrepreneurship and innovation, both within academic entrepreneurial ecosystems and beyond. Adopting a gender-inclusive perspective requires revisiting how innovation is interpreted, designed, implemented, used and measured. This approach should be mainstreamed across national and European policies and programmes, as well as within the policies, programmes and practices of RPOs, RFOs, investment and venture capital stakeholders and other stakeholders in the entrepreneurship and innovation ecosystem.

- Rethink how entrepreneurship and innovation is viewed largely in technological terms and start measuring impact in social, as well as economic, terms. National and European programmes and policies should be reconsidered to benefit equally all individuals interested in pursuing entrepreneurship and innovation.

3.7. Concluding remarks

Academic spin-offs are at the intersection of higher education, R&I and entrepreneurship. They can play a pivotal role in commercialising and valorising research, enhancing innovation, and strengthening entrepreneurial skills for researchers. Academic spin-offs are important mechanisms for strengthening intersectoral collaboration, intersectoral mobility and researchers' careers, thus contributing towards building stronger R&I ecosystems.

The comprehensive European policy framework can contribute towards developing a more inclusive European innovation and entrepreneurship ecosystem. While academic spin-offs are not a direct focus of this framework, there are synergies and benefits from being part of such an ecosystem that can further promote IGI. At the heart of the policy framework, innovation and gender equality are key priorities, as reflected in European agendas and strategies (e.g. EU Gender Equality Strategy 2020-2025, New European Innovation Agenda). The prioritisation of innovation in current and future EU challenges such as sustainable economic growth, decarbonisation, digitalisation, open strategic autonomy and economic security requires a high degree of new technologies, products and services, and thus needs a strong innovation ecosystem. Europe aspires to be a leader in innovation, with an emphasis on deep tech, building on Europeans' entrepreneurial mindset, scientific excellence, the strength of the single market, the strong industrial base, financial power and democratic societies. An important condition for fulfilling this mission is to ensure that diverse talent is nurtured and developed across research, technology, innovation and entrepreneurship. This can be achieved through strengthening gender equality and inclusiveness, as reflected in the European initiatives and activities that aim to build a strong European research and innovation ecosystem.

In the absence of systematic, comparable European data on academic spin-offs, relevant data capturing the European entrepreneurship and innovation ecosystem show some progress towards IGI, but more needs to be done, as substantial gender gaps persist in inventorship, academic authorship, self-employment, founding startups, attracting investment, and venture capital leadership.

A brief literature review from an inclusive ecosystem perspective suggests some underlying reasons for these gender gaps. While there are good national and European-level practices and initiatives to strengthen gender representation and the gender dimension in R&I processes, this policy article makes several recommendations for more systematic and gender-inclusive approaches to academic spin-offs to mitigate systemic barriers such as biases, stereotypes, masculine images of innovators and entrepreneurs, etc.

Flagship initiatives such as WomenTechEU pave the way in demonstrating that despite their underrepresentation in tech, women can lead projects on breakthrough deep tech innovation, helping to change the narrative about leadership in tech and innovation. More of these narratives are urgently needed, particularly in the context of academic spin-offs where there is untapped potential for women and marginalised groups to be at the forefront of excellent scientific research, deep tech innovation and entrepreneurship arenas.

3.8. References

Abreu, M. and Grinevich, V., 'Gender patterns in academic entrepreneurship', *Journal of Technology Transfer,* Vol. 42, 2017, pp. 763-794.

Alsos, G. A., Ljunggren, E. and Hytti, U., ,Gender and innovation: State of the art and a research agenda', *International Journal of Gender and Entrepreneurship,* Vol. 5, No 3, 2013, pp. 236-256.

Amble, N., Axelsen, P. and Snerthammer, L. K., 'Innovation in public care', in *Research handbook on gender and innovation,* Edward Elgar Publishing, 2016, pp. 151-169.

Bae, T. J., Qian, S., Miao, C. and Fiet, J. O., 'The relationship between entrepreneurship education and entrepreneurial intentions: A meta-analytic review', *Entrepreneurship Theory and Practice,* Vol. 38, No 2, 2014, pp. 217-254.

Berglund, K., Lindgren, M. and Packendorff, J.,' Responsibilising the next generation: Fostering the enterprising self through de-mobilising gender', *Organisation,* Vol. 24, No 6, 2017, pp. 892-915.

Blake, M. K. and Hanson, S., 'Rethinking innovation: Context and gender', *Environment and Planning A,* Vol. 37, No 4, 2005, pp. 681-701.

Busolt, U. and Kugele, K., 'The gender innovation and research productivity gap in Europe', *International Journal of Innovation and Sustainable Development,* Vol. 4, No 2-3, 2009, pp. 109-122.

Chaves, P. and Benschop, Y., *D2.1a KSH deepening & sustaining change*, Zenodo, 2023, https://doi.org/10.5281/zenodo.10032961

Civera, A. and Meoli, M., 'Empowering female entrepreneurs through university affiliation: Evidence from Italian academic spinoffs', *Small Business Economics,* Vol. 61, No 3, 2023, pp. 1337-1355.

Clauss, T., Moussa, A. and Kesting, T., 'Entrepreneurial university: A stakeholder-based conceptualisation of the current state and an agenda for future research', *International Journal of Technology Management,* Vol. 77, No 1-3, 2018, pp. 109-144.

Cukier, W., Gagnon, S., Dalziel, M., Grant, K., Laplume, A., Ozkazanc-Pan, B. and Saba, T., 'Women entrepreneurship: Towards an inclusive innovation ecosystem', *Journal of Small Business & Entrepreneurship,* Vol. 34, No 5, 2022, pp. 475-482, https://doi.org/10.1080/08276331.2022.2066436

Cukier, W., Mo, G. Y. and Francis, J., 'Women's entrepreneurship in the inclusive innovation ecosystem in Canada', in B. Owalla, T. Vorley, & H. Lawton Smith (Eds.), *Gender, diversity and innovation: Concepts, policies and practice*, Edward Elgar Publishing, 2022, pp. 223-238.

Cukier, W. and Chavoushi, Z. H., 'Facilitating women entrepreneurship in Canada: The case of WEKH', *Gender in Management: An International Journal,* Vol. 35, No 3, 2020, pp. 303-321.

Eddleston, K. A., Ladge, J. J., Mitteness, C. and Balachandra, L., 'Do you see what I see? Signaling effects of gender and firm characteristics on financing entrepreneurial ventures', *Entrepreneurship Theory and Practice,* Vol. 40, No 3, 2016, pp. 489-514.

Elliott, C., Mavriplis, C. and Anis, H., 'An entrepreneurship education and peer mentoring program for women in STEM: Mentors' experiences and perceptions of entrepreneurial self-efficacy and intent', *International Entrepreneurship and Management Journal,* Vol. 16, No 1, 2020, pp. 43-67.

European Commission, Directorate-General for Research and Innovation, *ERA progress report 2016 – The European Research Area – Time for implementation and monitoring progress,* Publications Office of the European Union, Luxembourg, 2017, https://data.europa.eu/doi/10.2777/992170

European Commission, Directorate-General for Research and Innovation, Barjak, F., Perrett, P., Es-Sadki, N., *Knowledge transfer study 2010-2012 – Final report*, Publications Office of the European Union, Luxembourg, 2014, https://data.europa.eu/doi/10.2777/31336

European Commission, Directorate-General for Research and Innovation, *Fact sheet, valorisation – Making results work for society*, Publications Office of the European Union, Luxembourg, 2019.

European Commission, Joint Research Centre, Campbell, A., Cavalade, C., Haunold, C. et al., *Knowledge transfer metrics – Towards a European-wide set of harmonised indicators,* Publications Office of the European Union, Luxembourg, 2020, https://data.europa.eu/doi/10.2760/907762

European Commission, Directorate-General for Research and Innovation, *Gendered innovations 2 – How inclusive analysis contributes to research and innovation – Policy review*, Publications Office of the European Union, Luxembourg, 2020, https://data.europa.eu/doi/10.2777/316197

European Commission, Directorate-General for Research and Innovation, Kalff-Lena, S., *Towards a policy dialogue and exchange of best practices on knowledge valorisation – Report about the results of the survey,* Publications Office of the European Union, Luxembourg, 2021, https://data.europa.eu/doi/10.2777/457841

European Commission, Joint Research Centre, Campbell, A., Cavalade, C., Haunold, C. et al., *Knowledge transfer metrics – Exploration of composite indicators for knowledge transfer: Phase 2*, Publications Office of the European Union, Luxembourg, 2022, https://data.europa.eu/doi/10.2760/077637

European Commission, Directorate-General for Research and Innovation, *Gendered innovations – How gender analysis contributes to research – Report of the expert group 'Innovation through gender'*, Publications Office of the European Union, Luxembourg, 2013, https://data.europa.eu/doi/10.2777/11868

European Commission, Directorate-General for Enterprise and Industry, *University spin-outs in Europe – Overview and good practice,* Publications Office of the European Union, Luxembourg, 2002.

European Patent Office (EPO), *Women's participation in inventive activity: Evidence from EPO data,* 2022, https://www.epo.org/service-support/publications.html?pubid=244#tab3

Fältholm, Y., Abrahamsson, L. and Källhammer, E., 'Academic entrepreneurship: gendered discourses and ghettos', *Journal of Technology Management & Innovation,* Vol. 5, No 1, 2010, pp. 51–63.

Foss, L. and Henry, C., 'Doing gender in innovation: A thematic review and critique of the literature', in *Research handbook on gender and innovation,* Edward Elgar Publishing, 2016, pp. 17-48.

Foss, L., Henry, C., Ahl, H. and Mikalsen, G. H., 'Women's entrepreneurship policy research: A 30-year review of the evidence', *Small Business Economics,* Vol. 53, 2019, pp. 409-429.

Gabarret, I., Vedel, B. and Decaillon, J., 'A social affair: Identifying motivation of social entrepreneurs', *International Journal of Entrepreneurship and Small Business,* Vol. 31, No 3, 2017, pp. 399-415.

GENDERACTION, *D 5.1 Report on "Strategic advice for enhancing the gender dimension of Open Science and Innovation Policy,"* Deliverable 5.1, 2019, https://www.genderportal.eu/sites/default/files/resource_pool/genderaction_report-5.1_d11_osoi.pdf

GENDERACTIONplus, *Benchmarking and assessment report on guidelines for sex/gender analysis,* Deliverable 4.1, 2023, https://genderaction.eu/wp-content/uploads/2023/06/101058093_GENDERACTIONplus_D4.1_Benchmarking-and-assessment-report-on-guidelines-for-sex-gender-analysis.pdf

Goel, R. K., Göktepe-Hultén, D. and Ram, R., 'Academics' entrepreneurship propensities and gender differences', *Journal of Technology Transfer,* Vol. 40, 2015, pp. 161-177.

Grandstrand, O. and Holgerson, M. *Innovation ecosystems: A conceptual review and a new definition, Technovation, Volumes 90–91,* 2020, https://doi.org/10.1016/j.technovation.2019.102098 .

Griffiths, H. and Humbert, A. L., *Gender and university spinouts in the UK: Geography, governance and growth,* Oxford: Oxford Brookes University Centre for Diversity Policy Research and Practice, 2019, p. 3.

Griffiths, H., Grisoni, L., Manfredi, S., Still, A. and Tzanakou, C., *The spinout journey: Barriers and enablers to gender inclusive innovation*, 2020.

Gupta, V. K., Turban, D. B., Wasti, S. A. and Sikdar, A., 'The role of gender stereotypes in perceptions of entrepreneurs and intentions to become an entrepreneur', *Entrepreneurship Theory and Practice,* Vol. 33, No 2, 2009, pp. 397-417.

Haeussler, C. and Colyvas, J. A., 'Breaking the ivory tower: Academic entrepreneurship in the life sciences in UK and Germany', *Research Policy,* Vol. 40, No 1, 2011, pp. 41-54.

Håkansson, S. Y. and Sand, J., *The gender dimension in research and innovation: Results from a global survey on research funding organisations*, Swedish Secretariat for Gender Research, University of Gothenburg, 2021.

Hayter, C. S., 'Public or private entrepreneurship? Revisiting motivations and definitions of success among academic entrepreneurs', *Journal of Technology Transfer,* Vol. 40, 2015, pp. 1003-1015.

Hébert, R. F. and Link, A. N., *A History of Entrepreneurship*, Routledge, 2009.

Jacobs, S., Franzeskides, C., Leitner, L., Autret, N., Chiavarini, L. *The 2023 European Deep Tech Report*, 2023, https://dealroom.co/uploaded/2023/09/The-European-Deep-Tech-Report-2023.pdf

Jennings, J. E. and Brush, C. G., 'Research on women entrepreneurs: Challenges to (and from) the broader entrepreneurship literature?', *Academy of Management Annals,* Vol. 7, No 1, 2013, pp. 663-715.

Karataş-Özkan, M. and Chell, E., 'Gender inequalities in academic innovation and enterprise: A Bourdieuian analysis', *British Journal of Management,* Vol. 26, No 1, 2015, pp. 109–125.

Karaulova, M., Wienand, C., Walker, D., Bührer, S., Reidl, S. and Yorulmaz, M., *Gendered innovation*, D2.1 INSPIRE, 2023.

Klofsten, M and Jones-Evans, D., *Comparing academic entrepreneurship in Europe – the case of Sweden and Ireland*, *Small Business Economics 14, 299–309*, 2000

Kuschel, K., Ettl, K., Díaz-García, C. and Alsos, G. A., 'Stemming the gender gap in STEM entrepreneurship – Insights into women's entrepreneurship in science, technology, engineering and mathematics', *International Entrepreneurship and Management Journal,* Vol. 16, No 1, 2020, pp. 1-15.

Lauto, G., Salvador, E. and Visintin, F., 'For what they are, not for what they bring: The signaling value of gender for financial resource acquisition in academic spin-offs', *Research Policy,* Vol. 51, No 7, 2022, e104554.

Lindholm Dahlstrand, Å. and Politis, D., 'Women business ventures in Swedish university incubators', *International Journal of Gender and Entrepreneurship,* Vol. 5, No 1, 2013, pp. 78-96.

Lundvall, B. Å., 'Scope, style, and theme of research on knowledge and learning societies', *Journal of the Knowledge Economy,* Vol. 1, 2010, pp. 18-23.

Marlow, S. and McAdam, M., 'Gender and entrepreneurship: Advancing debate and challenging myths; exploring the mystery of the under-performing female entrepreneur', *International Journal of Entrepreneurial Behaviour & Research,* Vol. 19, No 1, 2013, pp. 114-124.

Marlow, S. and Swail, J., 'Gender, risk and finance: Why can't a woman be more like a man?', *Entrepreneurship & Regional Development,* Vol. 26, No 1-2, 2014, pp. 80-96.

Mathisen, M. T. and Rasmussen, E., 'The development, growth, and performance of university spin-offs: A critical review', *Journal of Technology Transfer,* Vol. 44, No 6, 2019, pp. 1891-1938.

McGowan, P., Cooper, S., Durkin, M. and O'Kane, C., 'The influence of social and human capital in developing young women as entrepreneurial business leaders', *Journal of Small Business Management,* Vol. 53, No 3, 2015, pp. 645-661.

Miranda, F. J., Chamorro-Mera, A. and Rubio, S., 'Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention', *European Research on Management and Business Economics,* Vol. 23, No 2, 2017, pp. 113-122.

Miranda, F. J., Chamorro, A. and Rubio, S., 'Re-thinking university spin-off: A critical literature review and a research agenda', *Journal of Technology Transfer,* Vol. 43, No 4, 2018, pp. 1007-1038.

Murray, F. and Graham, L., 'Buying science and selling science: gender differences in the market for commercial science', *Industrial and Corporate Change,* Vol. 16, No 4, 2007, pp. 657-689.

Organisation for Economic Co-operation and Development (OECD), *University-industry collaboration: New evidence and policy options,* OECD Publishing, Paris, 2019.

OECD/European Commission, *The Missing Entrepreneurs, Policies for Inclusive Entrepreneurship and Self-Employment*, OECD Publishing, Paris, 2023, https://doi.org/10.1787/230efc78-en

Orser, B., Elliott, C. and Cukier, W., *Strengthening ecosystem supports for women entrepreneurs*, Telfer School of Management, University of Ottawa, 2019.

Palmén, R. L. and Inspire Project Consortium, *D2.6 policy brief INSPIRE vision*, Zenodo, 2023, https://doi.org/10.5281/zenodo.10039559

Perkmann, M., Salandra, R., Tartari, V., McKelvey, M. and Hughes, A., 'Academic engagement: A review of the literature 2011-2019', *Research Policy,* Vol. 50, No 1, 2021, e104114.

Poggesi, S., Mari, M., De Vita, L. and Foss, L., 'Women entrepreneurship in STEM fields: Literature review and future research avenues', *International Entrepreneurship and Management Journal,* Vol. 16, 2020, pp. 17-41.

Rizzo, U., 'Why do scientists create academic spin-offs? The influence of the context', *Journal of Technology Transfer,* Vol. 40, 2015, pp. 198-226.

Rodríguez-Gulías, M. J., Fernández-López, S. and Rodeiro-Pazos, D., 'Gender differences in growth of Spanish university spin-offs', *Gender in Management: An International Journal,* Vol. 33, No 2, 2018, pp. 86-103.

Rosa, J. M. and Sylla, D., *A comparison of the performance of majority female-owned and majority male-owned small and medium-sized enterprises,* Innovation, Science and Economic Development Canada, 2016.

Rosa, P. and Dawson, A., 'Gender and the commercialization of university science: Academic founders of spinout companies', *Entrepreneurship and Regional Development,* Vol. 18, No 4, 2006, pp. 341-366.

Schumpeter, J. A., *The Theory of Economic Development,* Harvard University Press, 193.

Sciarelli, M., Landi, G. C., Turriziani, L. and Tani, M., 'Academic entrepreneurship: Founding and governance determinants in university spin-off ventures', *Journal of Technology Transfer,* Vol. 46, 2021, pp. 1083-1107.

Secundo, G., Rippa, P. and Cerchione, R., 'Digital academic entrepreneurship: A structured literature review and avenue for a research agenda', *Technological Forecasting and Social Change,* Vol. 157, 2020, e120118.

Seigner, B. D. C., Milanov, H. and McKenny, A. F., 'Who can claim innovation and benefit from it? Gender and expectancy violations in reward-based crowdfunding', *Strategic Entrepreneurship Journal,* Vol. 16, No 2, 2022, pp. 381-422.

Tannenbaum, C., Ellis, R. P., Eyssel, F., Zou, J. and Schiebinger, L., ,Sex and gender analysis improves science and engineering', *Nature,* Vol. 575, No 7781, 2019, pp. 137-146.

Terán-Pérez, B. M., Lafarga, C. V. and Félix, A. M., 'Emprendimiento académico y spin-off universitario: Una revisión sistemática de la literatura', *Revista Perspectiva Empresarial,* Vol. 7, No 1, 2020, pp. 87-103.

Tzanakou, C. and Manfredi, S., *Women and spinouts: A framework for higher education institutions to gender-inclusive academic entrepreneurship,* University Press, 2021.

Vershinina, N., Rodionova, Y. and Marlow, S., 'Does an entrepreneur's gender matter for credibility and financing of SMEs?', in *Female entrepreneurship in transition economies: Trends and challenges,* Palgrave Macmillan, 2015, pp. 87-111.

Vohora, A., Wright, M. and Lockett, A., 'Critical junctures in the development of university high-tech spinout companies', *Research Policy,* Vol. 33, No 1, 2004, pp. 147-175.

4. Women's participation in research teams and uptake of discoveries in innovation and policy

Henrique Pinheiro, Rachel Herbert, Danielle Dong, Andrew Plume and David Campbell

Abstract

How do the research findings of women and men researchers contribute to technological innovation and policy? How could their respective contribution to such outcomes be optimised to ensure society fully benefit from gender diversity in knowledge creation? This article explores these questions within the sciences in general, with particular attention on the significant patterns in publications pertinent to the EU's green and digital transitions. The scientific literature has already explored gender associations with research outputs and scientific impact. However, there is little work intended to capture gender associations with outcomes measuring business potential and guiding principles for decision-making. To assess the relative contributions of women and men to such outcomes, multivariate regression models are deployed to estimate gender differences in the uptake of scientific publications in patents (technological innovation) and policy-related literature. These models are designed to account for potential confounders, such as seniority of research teams, team size, cross-disciplinarity, funding, sectoral affiliation of authors, scientific discipline, and publication year. The results indicate that an increased representation of women on a research team is linked with decreased uptake of research findings in patents and with increased uptake in health-related policy. Given the scarcity of research on such associations, further research is recommended to 1) confirm these findings in areas relevant to the twin transition, and 2) deepen understandings of the underlying causes and implications through qualitative research. Although such research is essential to defining effective interventions, the new knowledge gathered in this policy article allows the formulation of specific recommendations to address these gender gaps. These recommendations are built on key explanatory variables associated with the likelihood of publications being cited by patents and policy documents.

4.1.   Introduction

This policy article complements the main She Figures 2024 study, which provides a comprehensive picture of gender disparities in numbers of researchers, productivity, scientific impact, and women's participation in patent generation across different countries and fields of science. It investigates gender differences in the uptake of discoveries with potential to generate business value and establish guiding principles for public policy. The research questions are:

How do the research findings of women and men researchers contribute to technological innovation and policy?

How could their respective contribution to such outcomes be optimised to ensure society fully benefit from gender diversity in knowledge creation?

Publications cited by patents are used as a proxy for the relevance of the publication to technological innovation (i.e. to inventions with business potential). Publications cited in the policy-related literature, provided by the Overton database (see Section 4.3.1), are used as a proxy for the potential of research publications to inform guiding principles for public policies. Like most quantitative indicators in the field of science studies, these outcome variables have limitations: not all publications contributing to technological innovation will be cited by patents, and not all patents citing publications will support commercially viable products. Nevertheless, it is reasonable to assume that a publication cited by a patent is more likely to have contributed to technological innovation and, ultimately, to commercially viable product(s). Similarly, not all publications cited in the policy-related literature will have informed a policy or any government action, while publications that are not cited might still have informed public policy. Nevertheless, it is reasonable to assume that such an outcome is more likely for the former group of publications. Based on these assumptions, the outcome variable selection acknowledges the need to expand the coverage and range of available information on linkages between publications, patents and products, as well as between publications, policy-related documents and actual policies/actions. However, these limitations are more likely to result in an underestimation of the relationships reported here, as some of the positive true outcomes may go unnoticed.

This policy article also examines how various factors interact with these outcome variables, aiming to identify leverage points for decision-makers. These insights could then be used to improve the contributions of both women and men to research outcomes. These factors (e.g. seniority of research teams, team size, cross-disciplinarity) cover several dimensions relevant to the highly interconnected new European Innovation Agenda and European Research Area (ERA) ([299]).

The research questions are addressed in the dataset formed by all fields of research. An additional attempt is made to explore the association of gender composition of research teams with targeted outcomes in the context of the EU's green and digital transitions. For example, the New European Innovation Agenda highlights that the objectives of the twin transition require regulatory frameworks that can foster experimentation and innovation to address the urgent challenges

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([299]) European Union, *A new European innovation agenda,* Publications Office of the European Union, Luxembourg, 2022, https://doi.org/10.2777/066273; European Union, *A pact for research and innovation in Europe,* Publications Office of the European Union, Luxembourg, 2022, https://doi.org/10.2777/56361

imposed by changing environmental and technological realities ([300]). The twin transition is reflected in Horizon Europe, which contains two clusters dedicated to funding initiatives to address these challenges (cluster 4: digital, industry and space; cluster 5: climate, energy and mobility). Accordingly, publications are grouped into thematic datasets, capturing publications relevant to the United Nations Sustainable Development Goal, SDG 13 ([301]) (relevant to the green transition), artificial intelligence (AI) (relevant to the digital transition) and the intersection of SDG 13 and AI (relevant to the contribution of digital technologies to the green transition). While the regression models could not be robustly deployed in these areas due to lack of statistical power, descriptive patterns are nevertheless reported in each case.

Section 4.2 introduces the background to the paper, including a review of the literature. Section 4.3 presents the methodology, introducing the database, variables and quantitative methods used in the study. Section 4.4 presents the results, with separate subsections on the uptake of scientific publications in patents and in policy. Section 4.5 highlights and interprets the main findings in light of the literature reviewed. Finally, policy recommendations are presented in Section 4.6.

4.2. Background

Gender balance in research teams of scientific publications is becoming more prevalent, yet remains a challenge. From 2000 to 2019, the share of research teams including both women and men researchers increased across all team sizes in the field of medicine worldwide. For example, among teams of four researchers, the share including both women and men increased from approximately 60 % in 2000 to 70 % in 2019 ([302]). However, the authors reported that gender-diverse teams were still underrepresented across all team sizes in 2019. Women are still underrepresented among researchers, with She Figures 2024 reporting that only one-third (33.7 %) of European researchers (all fields of research considered) are women ([303]).

Studies have shown several benefits linked to gender balance in research teams ([304]). Women influence the nature and approach of research, as well as the research questions posed. For example, in the management field, women are more likely to adopt employee-centred perspectives in their publications compared to men, while the inclusion of women within teams correlates with a higher inclusion of sex-based or gender-based analysis. The same study highlighted that women tend to identify the relevant expertise of team members more precisely, ensuring full use of the potential of team members.

([300]) European Union, *A new European innovation agenda,* Publications Office of the European Union, Luxembourg, 2022, https://doi.org/10.2777/066273

([301]) SDG 13: Take urgent action to combat climate change and its impacts. https://sdgs.un.org/goals/goal13

([302]) Yang, Y., Tian, T. Y., Woodruff, T. K., Jones, B. F. and Uzzi, B., 'Gender-diverse teams produce more novel and higher-impact scientific ideas', *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 119, No 36, 2022, e2200841119, https://doi.org/10.1073/pnas.2200841119

([303]) European Commission, Directorate-General for Research and Innovation, *She Figures 2024,* Publications Office of the European Union, Luxembourg, 2024 (forthcoming).

([304]) Nielsen, M. W., Alegria, S., Börjeson, L., Etzkowitz, H., Falk-Krzesinski, H. J., Joshi, A. and Schiebinger, L., 'Gender diversity leads to better science', *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 114, No 8, 2017, pp. 1740-1742, https://doi.org/10.1073/PNAS.1700616114

Scientific productivity is often considered as a measure of research success. Mixed-gender teams tend to produce a greater number of publications [305]. Additionally, gender balance and a diversity of disciplines within a research team foster interdisciplinary collaboration, which in turn leads to higher numbers of publications [306].

While these studies showcase some research benefits of gender balance, the relationship between the gender composition of teams and the scientific impact of the resulting research is more complex, with no consistent pattern across the existing literature. One study used multivariate regression to test the relationship between the gender diversity of teams taking part in a United States (US) National Institute of Health project and citation impact [307]. The results did not indicate a significant relationship between these variables. Similarly, another study found that the gender balance of research teams did not affect their scientific impact in management science [308].

There is a need for a more nuanced examination of this question, as other studies have found different results. For example, an earlier study found that among working groups in ecology, publications with women in both first and last author positions received very slightly more citations than those without women in either or both positions. However, as the proportion of woman authors increased, the number of citations tended to drop [309]. Another study focusing on teams in medical journal articles found that mixed-gender teams produced significantly more highly cited papers compared to teams composed solely of men or women [310].

Research has looked at the interplay between gender and novelty [311]. For example, mixed-gender teams produce significantly more novel papers than same-gender teams [312]. Controlling for author, journal, subfield and institutional characteristics, this finding was present for all team sizes and is most significant where teams are gender-balanced. The results cannot be attributed to some hypothetical drivers that could potentially explain such a relationship, such as broader topical expertise of mixed-gender teams or gender homophily in citation behaviours. This led the authors to conclude that the gender balance within teams plays a more crucial role in fostering research novelty than previously thought.

The literature review for this study found no research examining the connection between the gender composition of teams and the observed economic or societal impact of research. Some studies have explored gender differences in research goals (i.e. types of research questions addressed) to understand how research interests may be driven by gendered perspectives on the resulting societal and scientific impacts. One study found differences in the way women and men researchers engage with and value research: women rate societal progress as a more important

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[305] Ibid.; Xu, H., Gupta, C., Sembay, Z., Thaker, S., Payne-Foster, P., Chen, J. and Ding, Y., 'Cross-team collaboration and diversity in the Bridge2AI Project', ACM Web Conference 2023 - Companion of the World Wide Web Conference, *WWW 2023*, pp. 790-794, https://doi.org/10.1145/3543873.3587579

[306] Specht, A. and Crowston, K., 'Interdisciplinary collaboration from diverse science teams can produce significant outcomes', *PLoS ONE*, Vol. 17, No 11, 2021, https://doi.org/10.1371/JOURNAL.PONE.0278043

[307] Xu, H., Gupta, C., Sembay, Z., Thaker, S., Payne-Foster, P., Chen, J. and Ding, Y., 2023, *op. cit.*

[308] Nielsen, M. and Börjeson, L., 'Gender diversity in the management field: Does it matter for research outcomes?' *Research Policy*, Vol. 48, No 7, 2019, pp. 1617-1632, https://doi.org/10.1016/J.RESPOL.2019.03.006

[309] Campbell, L. G., Mehtani, S., Dozier, M. E. and Rinehart, J., 'Gender-heterogeneous working groups produce higher quality science', *PLoS ONE*, Vol. 8, No 10, 2013, 79147, https://doi.org/10.1371/JOURNAL.PONE.0079147

[310] Yang, Y., Tian, T. Y., Woodruff, T. K., Jones, B. F. and Uzzi, B., 2022, *op. cit.*

[311] Conceptually defined in a similar way as interdisciplinarity (see DDR in the Methodology section).

[312] Yang, Y., Tian, T. Y., Woodruff, T. K., Jones, B. F. and Uzzi, B., 2022, *op. cit.*

motivation than men, and publications with women in first author position have higher online abstract views, which the authors considered a proxy for societal impact. The authors reported the differences as small, but that would still warrant further investigation ([313]).

While there is little to no research on how the diversity of research teams affects innovation or economic outcomes, there is substantial evidence examining this relationship in the industry sector. Among manufacturing firms in China, gender diversity of research and development teams increases innovation efficiency – which is measured by the capacity to generate new product sales per unit of research and development (R&D) investment ([314]). Another study examined research and development projects from small and medium-sized enterprises (SMEs) and start-ups in South Korea and found an inverted U-shaped relationship between the gender diversity of teams and patent applications, with patenting increasing from a low to moderate level of diversity, but declining thereafter ([315]).

This study looks at the relationship between gender and research of relevance to technological innovation and policy, aiming to provide insights for decision makers and future EU policies related to the high-tech industry. Such policies could, for example, lead to greater participation of women in R&D-intensive businesses, with the social benefits of research and innovation (R&I) originating from mixed-gender teams (as well as helping to close gender gaps in the labour market). They could also work towards greater gender balance in decision-making and politics. These are all urgent objectives, reflected in EU initiatives such as the EU Gender Equality Strategy 2020-2025 ([316]). Increasing the representation of women in science is an objective of the New European Innovation Agenda, with strong emphasis on promoting women entrepreneurship. The Horizon Europe Framework Programme targets at least 50 % women in advisory bodies and gender balance within research teams serves as a ranking criterion for proposals with the same score.

The research questions are also explored in the context of the EU's green and digital transition, which is highly relevant in the context of the new European Innovation Agenda and new ERA.

4.3. Methodology

This report uses a data-driven approach to investigate potential relationships between the gender composition of research teams in peer-reviewed scientific publications and their subsequent use in technological innovation (patents) and in public policy (policy-related literature).

4.3.1. Data sources

Elsevier's Scopus database is the main source to retrieve metadata on scientific publications (e.g. publication year, document type, research area (subfield/topic), composition of research team)

([313]) Zhang, L., Sivertsen, G., Du, H., Huang, Y. and Glänzel, W., 'Gender differences in the aims and impacts of research', *Scientometrics*, Vol. 126, No 11, 2021, pp. 8861-8886, https://doi.org/10.1007/S11192-021-04171-Y

([314]) Xie, L., Zhou, J., Zong, Q. and Lu, Q., 'Gender diversity in R&D teams and innovation efficiency: Role of the innovation context', *Research Policy*, Vol. 49, No 1, 2020, 103885, https://doi.org/10.1016/J.RESPOL.2019.103885

([315]) Yoo, H. S., Jung, Y. L. and Jun, S. P., 'The effects of SMEs' R&D team diversity on project-level performances: evidence from South Korea's R&D subsidy programme', *R&D Management*, Vol. 53, No 3, 2023, pp. 391-407, https://doi.org/10.1111/RADM.12575

([316]) European Commission, *A Union of Equality: Gender Equality Strategy 2020-2025*, 2020, https://eige.europa.eu/thesaurus/terms/1263

(see Table 1) (^{317}). Scopus includes abstracts and citation information from more than 90 million records, covering all fields of science and technology, including Social Sciences, and Arts and the Humanities. For this study, Scopus was filtered to focus on peer-reviewed scientific publications to ensure high quality outputs and original scientific contributions. Publication records from the following types of sources were used: book series, conference proceedings, and journals. Of book series and journals, only document types of articles, conference papers, reviews, and short surveys were included, while, for conference proceedings, only those classified as articles, reviews, and conference papers were used. Additional filters included removing sources without valid International Standard Serial Number (ISSN). Throughout this paper, these records are collectively referred to as 'publications' or 'papers'.

The publications obtained needed to be linked to other sources to gather information on their citations in patents and policy-related documents. The LexisNexis patent database (^{318}), covering more than 100 patent offices worldwide, was used to quantify the translation of knowledge to innovation. This was measured through patent citations of the scientific literature, with a focus on the US and European markets, as well as international patent applications through the patent cooperation treaty (PCT) process of the World Intellectual Property Organization.

The Overton database (^{319}), which indexes more than 1.65 million policy documents, was used to document the translation of knowledge to the decision-making sphere. These policy documents include white papers, parliamentary transcripts, and other classes of documents, mostly prepared by government, intergovernmental organisations, think tanks, and charities. About half of these documents cite academic or scholarly publications, and just over two million distinct journal-based publications are cited by at least one policy document in the database. A qualitative assessment of these citations by Science-Metrix revealed that while they 'should not be interpreted as indicative of advanced policy outcomes of research directly reaching the legislative or executive processes, they can be seen as achievements in contributing to the first stages of these processes, at the intersection between governance and academia' (^{320}). For Overton, the product was already fully matched to Scopus through the Digital Object Identifier (DOI) of publications. As such, any citation from a policy-related document to scientific publications established based on the common DOIs recorded on both databases were considered in the present study.

Once publications were matched to patents and policy-related documents, two binary outcome indicators were produced for each publication to capture their citation status in patents (1 if cited at least once; 0 otherwise) and in policy-related documents (1 if cited at least once; 0 otherwise). The conversion of the citation counts into a binary score for each publication is justified in the current context of rare and skewed citation events, with most publications not being cited, and a few of them receiving a large number of citations. In this situation, the large number of citations to only a few publications are more likely to distort the results of the current analyses, due to outlier effects, than to provide a precise measure of the relevance of each publication to technology or

(^{317}) Scopus data on 1 August 2023.

(^{318}) A data source from LexisNexis, part of Elsevier's parent company, RELX.

(^{319}) Full description of this database provided by Szomszor, M. and Adie, E., 'Overton: A bibliometric database of policy document citations', *Quantitative Science Studies*, Vol. 3, No 3, 2022, pp. 624-650, doi: https://doi.org/10.1162/qss_a_00204

(^{320}) Pinheiro, H., Vignola-Gagné, E. and Campbell, D., 'A large-scale validation of the relationship between cross-disciplinary research and its uptake in policy-related documents, using the novel Overton altmetrics database', *Quantitative Science Studies*, Vol. 2, No 2, 2021, pp. 616-642, https://doi.org/10.1162/qss_a_00137

policy. In other words, it may not be reasonable to assume that a publication receiving 100 citations is 100 times more relevant to technology or policy than a publication receiving only one citation.

4.3.2. Thematic datasets

The research questions in this article address the sciences in general (combining all research fields), while also exploring possible associations of gender with targeted outcomes in certain areas that are central to the EU's twin transition (SDG 13, AI, and the intersection of SDG 13 and AI). The datasets of publications for SDG 13 and AI were built using a two-step approach, with the initial step consisting of keyword-based queries in the titles, abstracts and author keywords of publications in Scopus, for filtering relevant publications to each theme. This initial step is then complemented by AI algorithms intended to expand this initial set of publications, by identifying other publications semantically similar to the ones filtered in the first step. This approach enabled a high degree of precision (>90 %) and recall (>80 %). Both datasets were produced as part of other projects for the European Commission. The intersection of SDG13 and AI consists of publications classified in both areas ([321]).

4.3.3. Study period

Given the number of co-variates included in the multivariate regression models (see Section 4.3.5), a large dataset was required. The sample size needed in a multivariate regression model generally increases with the number of co-variates. This is because as the number of predictors (co-variates) increases, more data are required to estimate the parameters accurately and avoid overfitting. Additionally, some of the continuous co-variates are skewed, as is the distribution of observations across many groups of the categorical predictors, such as groups (i.e. bins) by team size and seniority. As a result, the number of observations across all cells of the multivariate cross-tabulation can rapidly become too small. To maximise the number of observations, the dataset was designed to gather information on papers published since 2001.

Given the nature of the two outcome variables of interest – citation of publications in patents and in policy-related documents – it was necessary to restrict the data to publications from 2001 to 2018. Following the publication year of a paper, time must elapse before a sufficient share of 'positive' outcomes (uptake in patents and in policy-related documents) become available to reliably investigate the factors that may influence these outcomes; otherwise, there may be too many false negatives even though the study models control for the year of publication. In addition, the length of the minimal citation window necessary to reliably assess the regression coefficients of the selected co-variates increases with the rarity of the 'positive' outcomes. As knowledge translation in patents and policy-related documents constitute rare events, it was estimated that publications had to have accumulated citations over a period of at least five years (including publication year) to be included in the analysis ([322]). Error! Not a valid bookmark self-reference. shows how quickly the share of publications cited in patents and policy-related documents

([321]) Approach to the SDGs is similar to the approach for AI, https://elsevier.digitalcommonsdata.com/datasets/9sxdykm8s4/4; Kashnitsky, Y., Roberge, G., Mu, J., Kang, K., Wang, W., Vanderfeesten, M. and Labrosse, I., *Evaluating approaches to identifying research supporting the United Nations Sustainable Development Goals*, 2022, https://arxiv.org/abs/2209.07285v6

([322]) At the time of writing, Scopus was complete up to 2022.

diminishes as the length of the citation window decreases (i.e. moving towards more recent years). Data related to papers published after 2018 are included in Error! Not a valid bookmark self-reference. to show that after 2018 in the sciences in general, the share of publications cited in patents decreased to below 1 %, while the share of publications cited in policy-related documents decreased to below 5 %. For patents, the trends were largely similar for SDG 13 and AI, while policy uptake was much larger for SDG 13 and less pronounced for AI. As a result, 41 million publication records from 2001 to 2018 were extracted from Scopus for this study (see Error! Not a valid bookmark self-reference.).

Figure 1: Trends in the share of publications cited by patents and policy-related documents, 2001–2022
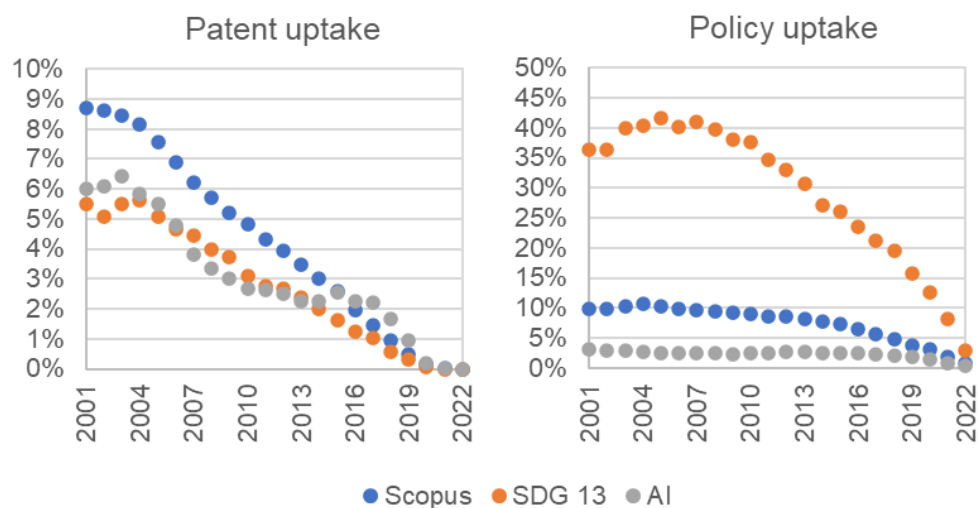
Notes: Scopus includes publications from all research domains; SDG 13 includes publications relevant to SDG 13, climate action, and AI includes publications relevant to research on AI.

4.3.4. Gender inference

To enable at-scale analysis of gender, the NamSor API was used to infer the binary gender of authors on approximately 41 million publications ([323]). The same approach has been used to infer the gender of authors in scientific publications and inventors in patents since She Figures 2015. In this study, the gender assignation rule followed the same criteria as defined in She Figures 2024: authors are classified as man or woman if the probability of their being a man or a woman, as provided by NamSor, based on their names, exceeds 85 %. A recent study tested the impact of changes in this gender assignation rule in a multivariate analysis investigating the relationship

between gender and interdisciplinarity. Their sensitivity analysis using several model specifications demonstrated that the results are robust to changes in the gender assignation rule ([324]).

4.3.5. Multivariate regression

The data analysis in the next section begins with an overall characterisation of the main variables by looking at basic (bivariate) relationships among variables. This exploratory exercise introduces the key variables in the multivariate statistical models to estimate the relationships between gender (of co-authors in publications) and patent/policy uptake. These multivariate models account for other characteristics of scientific publications such as seniority, cross-disciplinarity levels, areas of science, type of publications, year, team size, sector of co-authors (academic or private), geographical affiliation of co-authors, and European Commission funding. The results of multivariate regression models are presented separately for each outcome variable: the uptake of scientific publications in patents, and the uptake of scientific publications in policy-related literature.

The multivariate approach relies on logistic regression to assess the association between the presence of women in research teams (main explanatory variable) and the probability of a research paper being cited by patents or by the policy-related literature (explained variables). Different model specifications were tested to assess the robustness of the main findings reported in this study. These tests assessed the impact on the main study findings of including/excluding variables, or assessed whether the main results (all papers) were consistent with estimates based on subsets of papers by research area, sector, or region of co-authors. Only the key results are presented in this study. Table 1 presents the variables included in the analysis.

Table 1: Variables used to assess gender differences in the extent to which scientific publications are cited by patents or policy-related documents

Variable	Description
Cited in patents	1 if the scientific publication was cited by at least 1 patent (0 otherwise)
Cited in policy-related documents	1 if the scientific publication was cited by at least 1 policy-related document (0 otherwise)
Seniority of co-authors	1: All early career researchers (ECR) (baseline) 2: ECR with mid-career researchers 3: ECR with senior researchers 4: All mid-career researchers 5: Mid-career researchers with senior researchers

([324]) Pinheiro, H., Durning, M. and Campbell, D. 'Do women undertake interdisciplinary research more than men, and do self-citations bias observed differences?', *Quantitative Science Studies*, Vol. 3, No 2, 2022, pp. 363-392, https://doi.org/10.1162/qss_a_00191

Variable	Description
	6: All senior researchers Note: ECR: 0-5 years since first publication; Mid: 6-10 years; Senior: 10+ years
Participation of women among co-authors	Categories defined based on the share of women among co-authors. Main analysis is based on publications with 3-5 co-authors (i.e. the largest set of publications). The bins from no women to all women co-authors are associated with the following shares of women among a paper's co-authors (see Section 4.4.1): 0: 0 %: no women among co-authors 1:]0 %, 20 %]: (publications with 1 woman of 5 co-authors) 2:]20 %, 40 %]: (2 women of 5 co-authors; 1 woman of 3 or 4 co-authors) 3:]40 %, 60 %[: (2 women of 4 co-authors) 4: [60 %, 80 %[: (3 women of 5 co-authors; 2 women of 3 co-authors; 3 women of 4 co-authors) 5: [80 %, 100 %[: (4 women of 5 co-authors) 6: 100 %: all co-authors are women
Disciplinarity diversity of references (DDR)	Assess the cross-disciplinary level of a publication based on the disciplines of publications included in the reference list of each publication [325]
Disciplinarity diversity of authors (DDA)	Assess the diversity of disciplinary backgrounds of co-authors in publications [326]
Number of co-authors	Number of co-authors of the publication
Publication year	Publication year of the scientific publication

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[325] Pinheiro, H., Vignola-Gagné, E. and Campbell, D., 'A large-scale validation of the relationship between cross-disciplinary research and its uptake in policy-related documents, using the novel Overton altmetrics database', *Quantitative Science Studies*, Vol. 2, No 2, 2021, pp. 616-642, https://doi.org/10.1162/qss_a_00137

[326] Ibid.

Variable	Description
Private sector collaboration	1 if at least 1 co-author of the publication is affiliated with a private institution (0 otherwise)
All authors from private sector	1 if all co-authors of the publication are affiliated with private institutions (0 otherwise)
Type of document	Each publication is classified as 1 type of document (article, conference paper, or review article)
EU funding	1 if the publication was supported by the European Commission (0 otherwise). This variable is based on Scopus (i.e. authors' acknowledgement of funders in publications) and CORDIS data (list of Framework Programme (FP)-supported publications matched to Scopus). Given the study period, it mostly includes publications funded under FP6, FP7 and H2020 although it could include publications funded by earlier FPs
Subfields	Each publication is assigned to 1 subfield relying on the Science-Metrix classification ([327]). Subfields of publications are included as 'fixed-effects', accounting for discipline-specific characteristics that may influence the probability of a publication being cited by a patent or a policy-related document
Research topics	Each publication is assigned to 1 topic cluster ([328]). These are finer-grain (compared to subfields) and mutually exclusive groupings of highly cohesive publications sharing common research topics. The share of publications cited in patents or in policy (depending on the variable of interest) by topic cluster is included as a control variable in the main model to account for existing differences in the extent to which different topics are relevant to technological innovation or decision-making

The multiple regression models help to rule out the variables included as controls as the underlying factors behind the coefficients estimated for the main variables of interest. For example, the negative association between the presence of women in publications and uptake in patents is not explained by the higher proportion of women among early-career researchers (ECRs) compared to the proportion of women among senior researchers, nor by any gender differences in the remaining model co-variates (see Section 4.4.2.1).

Despite efforts to account for a wide range of potential confounders, gender differences may not be intrinsically due to gender but, rather, to other factors not included in the models. For example, while the regression models control for disciplines and fine-grain research topics, these categories

([327]) Rivest, M., Vignola-Gagné, E. and Archambault, É., 'Article-level classification of scientific publications: A comparison of deep learning, direct citation and bibliographic coupling', PLoS ONE, Vol. 16, 5 May 2021, e0251493, https://doi.org/10.1371/journal.pone.0251493

([328]) Klavans, R. and Boyack, K. W., 'Research portfolio analysis and topic prominence', *Journal of Informetrics*, Vol. 11, No 4, 2017, pp. 1158-1174, https://doi.org/10.1016/J.JOI.2017.10.002; Elsevier, SciVal Support Centre, n.d., https://service.elsevier.com/app/answers/detail/a_id/31479/supporthub/scival/

may not fully control for the differences in relevance to technological innovation or decision-making of specific research questions. Another possibly underlying explanatory factor could be that men appear more frequently on publications that are very relevant to patents (or policy) within a specific topic.

Interpretation of the coefficients from a logistic regression may not be very intuitive, particularly with limited familiarity with statistical terminology. In essence, estimates from these models refer to changes in the odds-ratio of the outcome variable after a 'unit change' in the explanatory variable, where the odds-ratio is defined as the probability of a publication to be cited divided by one minus this same probability (p/(1-p)). For ease of understanding, the coefficients of the regression models used here have been converted to changes in probabilities followed by a unit change in the predictors. Specific guidelines on interpretation are provided together with the results.

4.4. Results

4.4.1. Descriptive statistics

4.4.1.1. Patent and policy uptake in the sciences in general

Table 2 summarises the dataset of scientific publications used to examine gender differences in the uptake of scientific publications in patents and policy-related literature. Research publications covering all fields of science are grouped according to their number of co-authors. Publications with three, four or five co-authors are most common, comprising 40 % of the dataset. The share of publications cited in policy and patents increases considerably with team size (as shown in the last two columns of the table below). Table 2 also presents the average share of authors by gender in research publications. There is a non-negligible share of co-authors whose gender could not be assigned because the probabilities computed by NamSor did not provide enough signal for disambiguating gender of authors with enough certainty (20.3 %, designated 'unknown'). Excluding these 'unknowns' cases, men considerably outnumber women in research teams of scientific publications across all groups, representing an average of 70 % of authorships. Of all publications considered in the analysis, 3.7 % include only authors whose gender is categorised as 'unknown'.

In the multivariate regression models, more emphasis was placed on the group of publications with between three and five co-authors. Here, the focus is on the patterns that matter most, i.e. those that pertain to the most common co-authorship groups (see Table 2). The consideration here is that mixing publications of different group sizes in a single regression model would combine publications from a wide range of team sizes that may not be directly comparable. It would, for example, compare single-author publications with publications involving large research teams that may address more complex research questions with larger investments. Focusing the analysis on publications with three to five authors cover a high proportion of all publications available and limits the complexities of comparing different group sizes. The main regression models were tested in the other group of publications and the findings generally converged with those observed for publications with three to five co-authors.

Table 2: Main variables used to assess gender differences in the extent to which scientific publications are cited by patents or policy-related documents (sciences in general), 2001-2018

Nº of authors	Publications		Average share (%) of authorships by gender			Share (%) cited by	Share (%) cited by
	Count	Share (%)	Women*	Men*	Unknown*	policy	patents
1 author	6 920 155	19.8	27	73	26	7	2
2	7 908 815	22.6	28	72	19	7	4
3-5	13 899 971	39.8	29	71	14	8	5
6-10	4 267 398	12.2	33	67	11	11	8
11-20	583 204	1.7	33	67	10	17	13
21+	90 611	0.3	31	69	15	22	12
N/A	1 275 998	3.7	N/A	N/A	100.0	4	2
Total	**34 946 152**	**100**	**29.6**	**70.4**	**20.3**	**8.2**	**4**

Notes: No of authors refers to authors classified as women or men; it excludes, according to the procedures described in this study. For example, group '1 author' refers to publications with 1 author classified as women or men. The share of woman and man authorships was computed excluding the share of authorships referring to authors who gender could not be identified by NamSor ('unknown').

Table presents the share of publications with uptake in patents and in the policy-related literature, by team size and by share of women's participation in publications for all research fields combined. For both patent and policy uptakes, the descriptive results suggest that the larger the team, the more pronounced the uptake. These results suggest that when conducting multivariate analyses of the determinants of patent and policy uptake, team size should be considered as an important predictor. Indeed, team size can act as a confounding variable in relation to other factors, such as gender, affecting these outcomes.

There is a slight signal that mixed-gender teams may favour the uptake of scientific publications in patents. Higher shares of uptake in patents are observed in the two groups with more than 0 % and less than 40 % women, depending on the size of the team. For example, among teams of 6-10 authors, the share of publications cited by patents increased from 7.3 % (all-men team) to 8.7 % (some women co-authors). As more women are included, the uptake increases to 9.5 %. Uptake then decreases as more women are included among co-authors, with the group of only-women publications displaying the lowest shares of uptake in patents.

The data show that, in scientific publications, the share of publications cited by policy increases as the participation of women increases. This holds for all team sizes. Even when compared to mixed-gender teams, all-women publications stand out favourably for this indicator.

However, the data reported in Table do not account for possible confounders, such as research discipline, the exact number of authors on a publication, or the cross-disciplinarity level of the research team. For example, in all groups including six or more researchers, the average number of authors in publications is higher in the second bin, by women participation, compared to all-men teams. As such, it is possible that the higher patent uptake observed in bins 1 and 2 (in relation to bin 0) is simply explained by the larger size of teams in these groups, or by other co-variates not accounted for here. Section 4.4.1.2 presents descriptive trends that somewhat control for team size, the participation of women in publications, and disciplinary differences. The regression models presented there account for the effect of a larger set of key co-variates and should provide

a more reliable estimate of the relationship between the presence of women in publications and uptake in patents and in policy-related documents.

Table 3: Gender differences in the share of publications cited by patents and policy-related documents (sciences in general), 2001-2018

Uptake in:	Nº of authors	Bin (share of women authors)						
		0: 0%	1:]0%, 20%]	2:]20%, 40%]	3:]40%, 60%[	4: [60%, 80%[	5: [80%, 100%[	6: 100%
Patent	1 author	1.7	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	0.9
	2	3.7	*N/A*	*N/A*	3.3	*N/A*	*N/A*	2.0
	3-5	4.9	6.5	5.1	4.9	4.1	4.0	2.3
	6-10	7.3	8.7	9.5	8.5	6.7	4.4	2.6
	11-20	8.4	11.7	15.8	14.6	10.3	5.3	1.9
	21+	5.7	7.4	18.2	17.6	8.5	1.6	0*
Policy	1 author	8.1	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	10.1
	2	7.8	*N/A*	*N/A*	10.2	*N/A*	*N/A*	13.3
	3-5	6.4	8.8	9.1	10.2	12.2	14.7	15.9
	6-10	7.4	9.9	12.3	13.8	15.8	17.6	20.1
	11-20	10.4	14.6	18.1	19.0	21.5	25.6	26.8
	21+	11.1	16.2	25.8	29.3	34.7	40.8	0*

Notes: Only four all-women publications in the 21+ group; definitions of the bins (of women participation) are presented in Table 1.

4.4.1.2. Normalised patent and policy uptake in the sciences in general and in research pertaining to SDG 13 and AI

Figure 2 and Figure 3 present the subfield normalised share of patent and policy uptake, respectively, by share of women's participation in publications for the most common team size (three to five co-authors) in the sciences in general, in SDG 13, in AI, and AI research in the context of climate change (i.e. intersection of SDG 13 and AI). Using the most common team size somewhat controls for team size.

For the uptake of publications with three to five co-authors in patents, the general pattern suggests that publications with higher technological relevance (i.e. cited by patents) include lower shares of women among co-authors (see Figure 2). Mixed-gender teams may be beneficial to knowledge translation to innovation for teams larger than five authors, especially in the sciences in general. In SDG 13, AI, and SDG 13–AI, the pattern is less clear, likely due to the lack of sufficient observations (data not shown due to space constraints). Compared to the entire period under analysis, data for 2013-2018 suggest a similar picture, with uptake in patents decreasing with greater numbers of women co-authors of publications.

For the uptake of publications with three to five co-authors in policy, there is a clear increase in knowledge transfer as the representation of women on teams in the sciences in general increases (see Figure 3). A similar pattern is observed for AI, although the trend is less clear. In SDG 13, the normalised rate of uptake appears relatively stable across bins of women representation. This may be attributable to the overall high relevance of research to decision-making in this area, where close to 30 % of papers from 2001 to 2018 received at least one policy citation. In other words, the policy relevance of SDG 13 publications may remain similarly high regardless of gender differences

in research approach or thematic focus. When SDG 13 is intersected with AI, there is more variation across bins, without a clear pattern. The observed fluctuations are likely attributable to the small number of data points in this dataset. Where volume of data suffice, patterns across other team sizes are quite similar (data not shown due to space constraints). The plot for 2013-2018 shows a similar pattern to those for the entire period, suggesting that the overall relationship between uptake in policy-related documents and gender composition of teams is somewhat stable across the period.

Figure 2: Normalised share of publications cited by patents, by share of women authors for papers with 3-5 co-authors, 2001-2018, 2013-2018
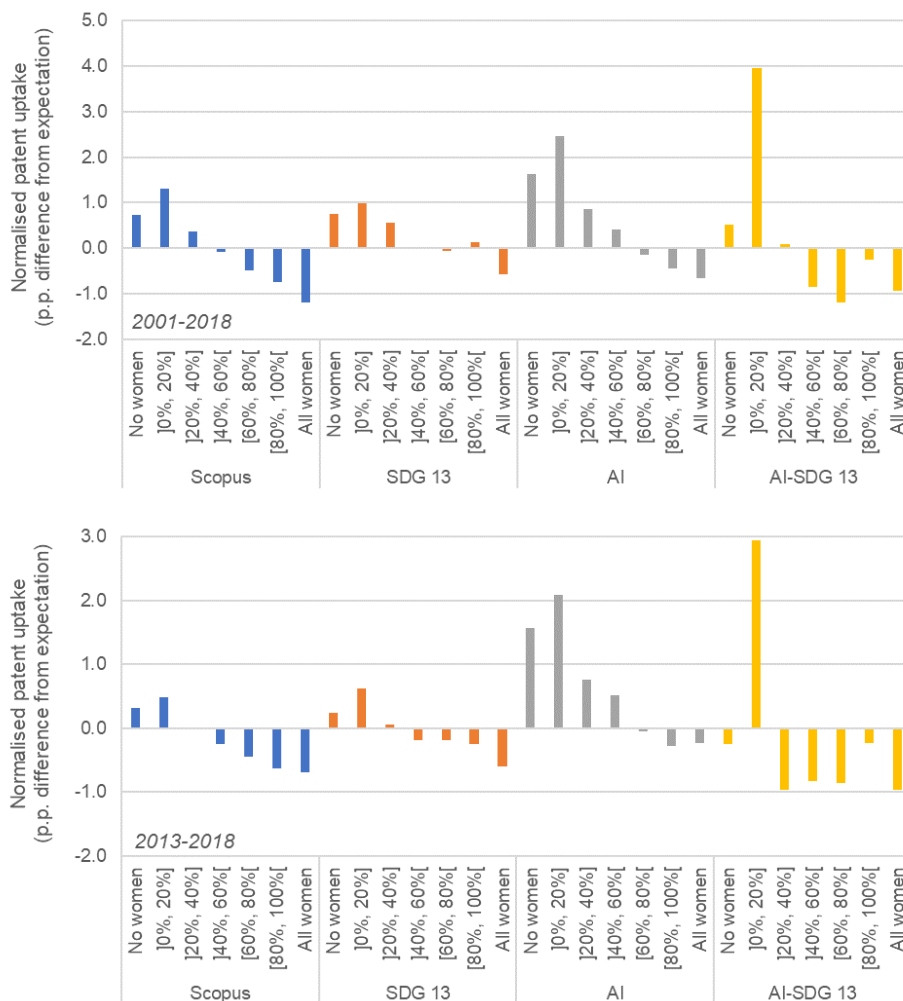
Notes: pp = percentage points. The pp departures from expectations are normalised by subfields, effectively controlling for disciplinary differences in the relevance of publications to technological innovation. The direction of the square brackets indicates if the close boundary value is included or not in the interval. For example, the group]20%, 40%] does not contain the publications with exact 20% of women authors, but it does include those with exact 40% of women authors. The publications with exact 20% of women authors are included in the prior group, indicated by]0%, 20%].

Figure 2 and Figure 3 do not control for several other co-variates that have been shown to influence the translation of knowledge to innovation (i.e. seniority, DDR, cross-sectoral collaboration and funding, see Section 4.4.2.1) and policy (i.e. seniority, DDA, cross-sectoral collaboration and funding, see Section 4.4.2.2).The multivariate regressions in Sections 4.4.2.1and 4.4.2.2 could not be reliably applied to SDG 13, AI and SDG 13–AI due to too few observations. The more co-variates included in a multivariate regression model, the larger the dataset required (see Section 4.3.3). This requirement is exacerbated by skewing in some of the continuous co-variates and the distribution of observations across the many groups of the categorical predictors. While the reliability of the findings could be tested for the sciences in general (see Section 4.4.2), further work is needed to assess their robustness in SDG 13, AI, and SDG 13–AI.

Figure 3: Normalised share of publications cited by policy-related documents, by share of woman authors for papers with 3-5 co-authors, 2001-2018, 2013-2018
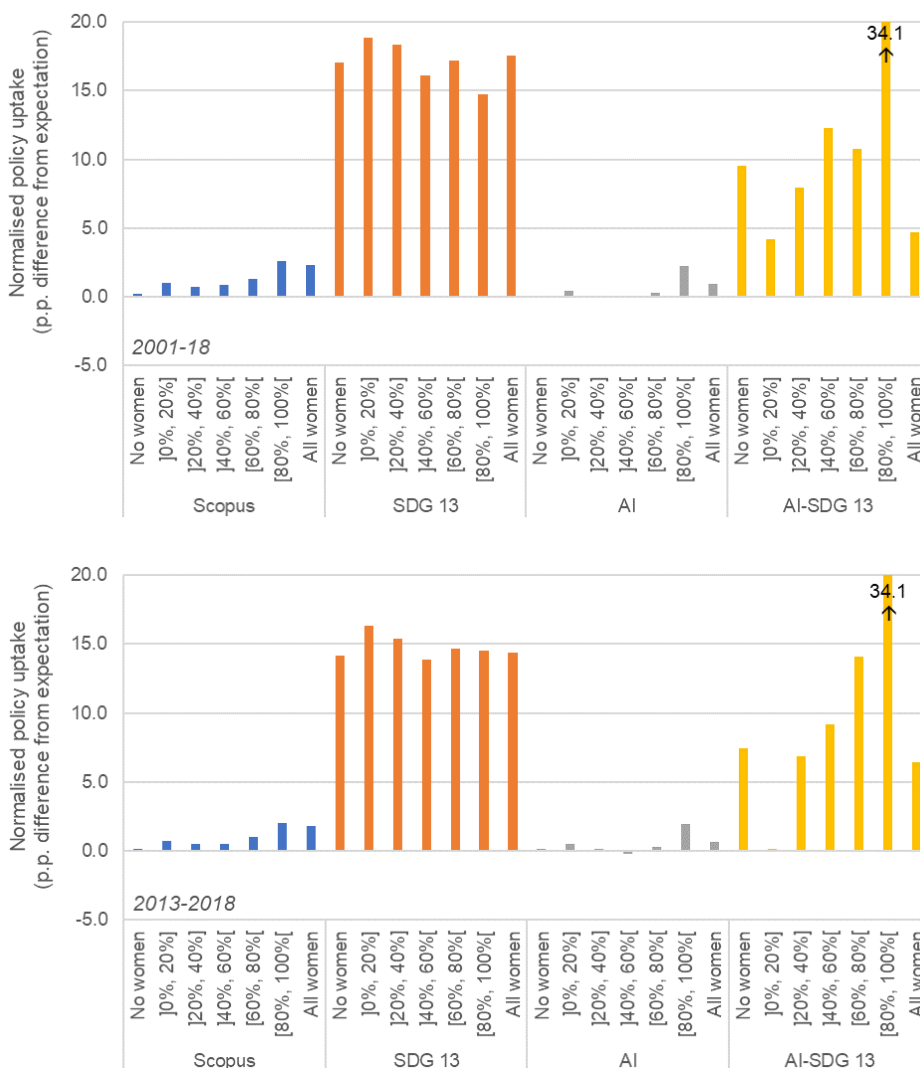
Notes: pp = percentage points. The pp departures from expectations are normalised by subfields, effectively controlling for disciplinary differences in the relevance of publications to policy.

4.4.2. Multivariate regression (sciences in general)

This section reports the gender differences in the shares of scientific publications with uptake in patents and in the policy-related literature after accounting for the possible effect of co-variates. These models include a set of potential confounders (see Table 1) and should be interpreted as the gender differences in the variable of interest that could not be attributed to the possible confounding effect of those other variables. As the outcome variables (uptake in policy and in patents) are binary (i.e. assume values of 0 or 1), logistic regression is used to estimate the effect of gender on uptake in policy and in patents.

These models include control variables for different aspects of publications and research teams. The scientific discipline, year, and type of publication are included to account for differences in the levels of uptake in patents and in policy. At the level of research teams, control variables account for the effect of cross-disciplinary research (DDA, DDR), team size, seniority of research teams, sector of affiliation of co-authors, EU funding, and uptake share in patents or policy of other publications with similar content, as identified by Scopus research topics. While the inclusion of these variables should help to identify their influence as drivers of gender differences in the outcome variables, the estimated gender differences may still be partly explained by these factors, due to inherent limitations in the operationalisation of control variables. For example, the variable for EU funding only indicates whether or not a publication was supported by the European Commission and does not capture differences in funding levels.

The results are presented in graphs, reporting the probabilities of scientific publications being cited by patents or policies, and compared to baseline probabilities ([329]). Some graphs include bars showing the distribution of publications by share of women's participation.

4.4.2.1. Uptake in patents

This section presents the main results of the regression models used to estimate the relationship between the gender composition of scientific publications and the uptake in patents, after controlling for papers' characteristics (co-variates). Figure 4 provides six plots summarising the key findings related to the uptake of publications in patents. The first four provide estimates of the effect of the gender composition of research teams on patent uptake for different publication team sizes. The remaining two plots provide estimates of the effect of other variables of interest in patent uptake.

Publications from research teams mostly composed of men (bins 0 and 1) demonstrate higher probabilities of being cited in patents, compared to research teams mostly composed of women (bins 5 and 6). For example, in plot a), the share of publications cited in patents when all researchers are men (baseline group, for analytical purposes, represented by a dashed line against which all other groups are compared) is 4.8 %. Based on this model, the estimated probability for all-women research teams, controlling for all variables included in the model, is 3.1 %, 1.7 pp less than all-men publications. The results for other team sizes are similar, constituting robust evidence of a gender gap in the uptake of scientific publications in patents. A less clearcut signal is observed in plots b), c) and d), with a slight increase in the chances of being


([329]) The probabilities reported here are derived from the original coefficients of the logistic regressions, which are less intuitive for interpretation, as they refer to changes in odds-ratio (p/(1-p)) in the outcome variables after a unit change in the explanatory variables. For ease of understanding, these coefficients are converted to probabilities for a given baseline probability (displayed in each graph).

cited by patents when a few women are included in publications, compared to all-men teams (this result is not statistically significant for publications with three to five co-authors, but is significant for the remaining team sizes). For example, plot c) shows that the chances of being cited in patents increases for bin 1 and 2 (in relation to bin 0) among publications with 11-20 authors, after which it decreases as women's representation in research teams grows. This indicates potential benefits of gender diversity in research teams.

Plot e) in Figure 4 also shows the relevance of seniority (regardless of gender) for a publication to be cited by patents. The baseline group is the publications from research teams composed only of ECR. All remaining groups show higher probabilities of being cited by patents. Finally, plot f) shows that the variables cross-disciplinarity (DDR), EU funding, and presence of co-authors from the private sector (private sector colab) are positively associated with the probability of a publication being cited in patents.

Figure 4: Results of main regression models on the relationship between the gender composition of research teams (plus other co-variates) and publications cited by patents, 2001-2018
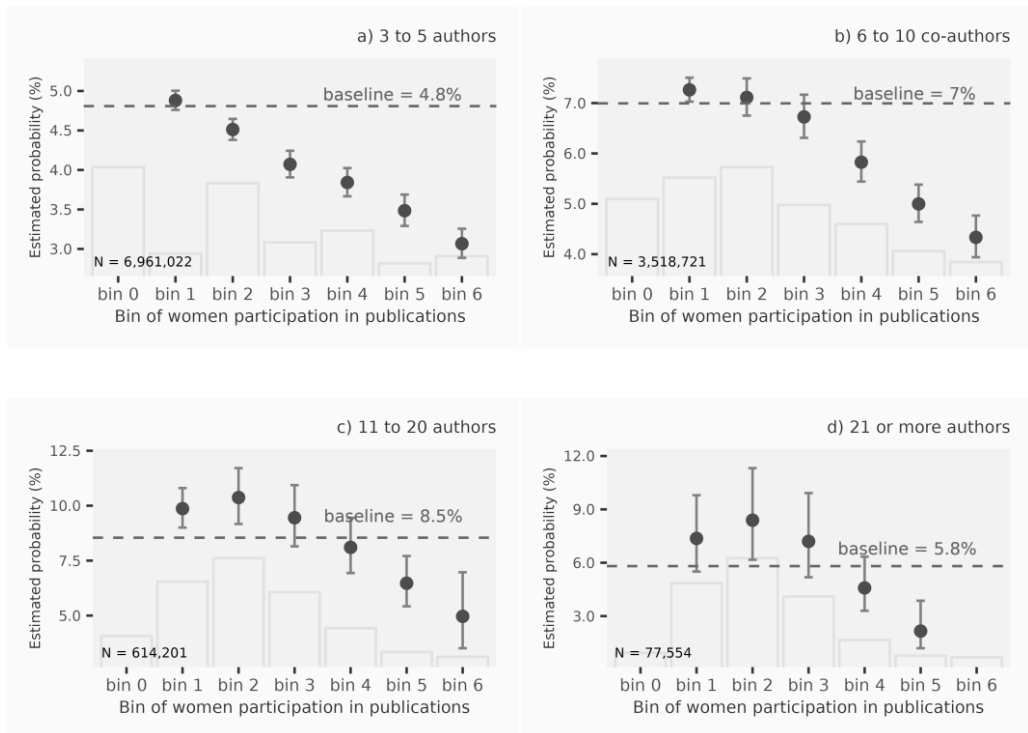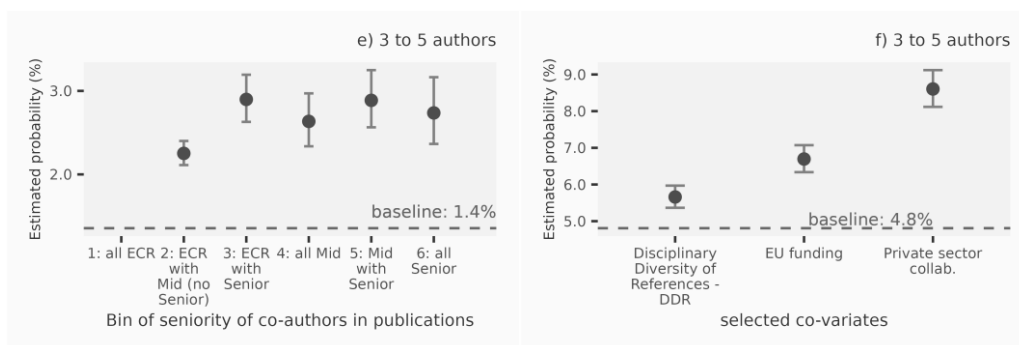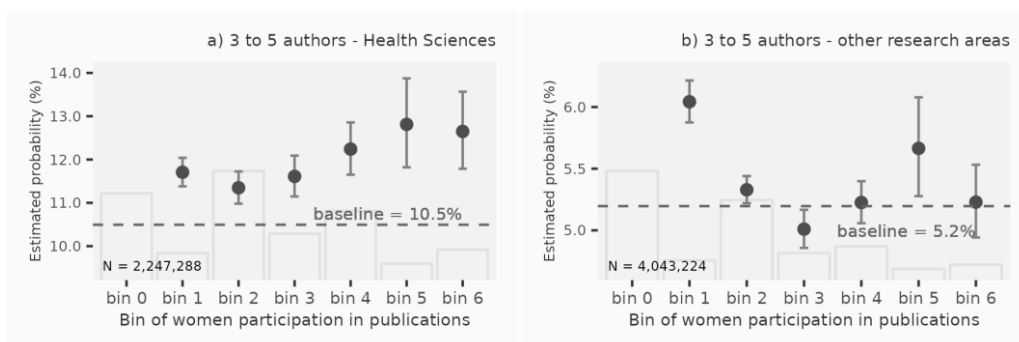
Notes: Bars in some plots relate to the distribution of papers in the group. In each figure, baseline values are presented as references for interpretation of probabilities. In plots a) to e), the baseline refers to the share of publications cited by patents in the first group of publications (bin 0 or all ECR) and in plot f), it refers to the average share of publications cited by patents in publications with three to five authors. In plot d), there is no estimate for bin 6 (all women publications) due to a very small number of publications in this group. Bins are defined based on the participation of women on research teams, with bin 0 representing 'all-men teams', bin 6 representing 'all-women teams', and bins 1 to 5 mixed-gender teams, with the share of women increasing from bin 1 to 5.
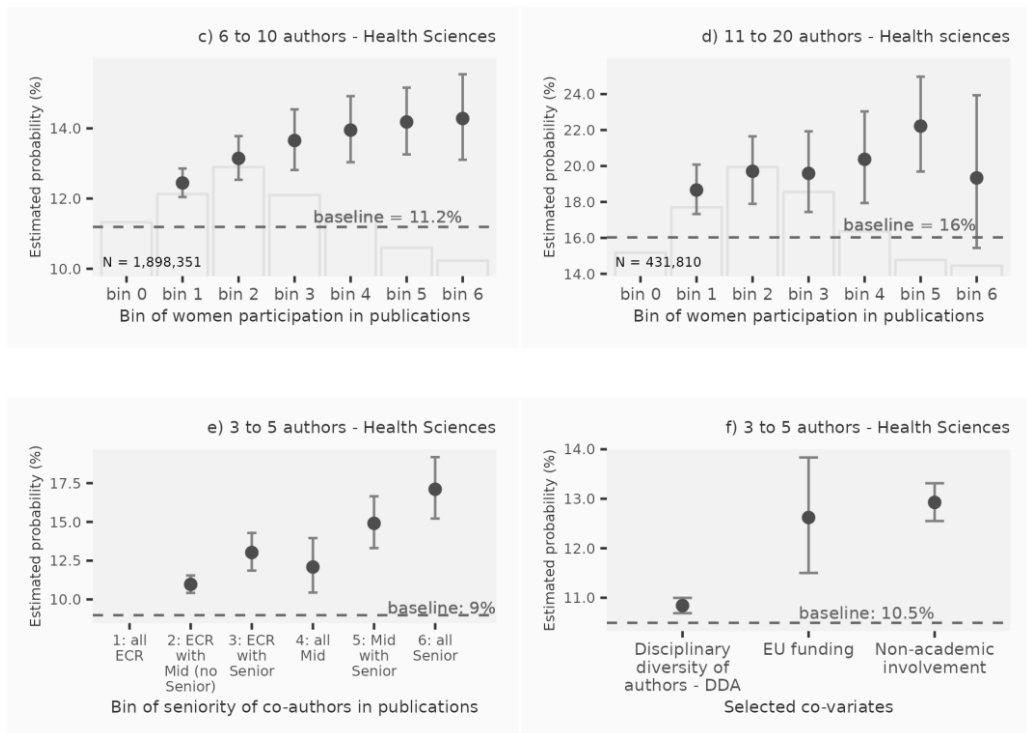
4.4.2.2. Uptake in the policy-related literature

The relationship between women's participation in research teams and uptake in policy-related literature is more nuanced than that of patents. Figure 5 shows that the meaningful relationship between gender diversity and policy is apparent only in the Health Sciences domain ([330]) (plots a, c, and d). A model excluding publications in the Health Sciences domain is shown in plot b), illustrating that no clear pattern is otherwise observed (models based on publications in each domain examined individually are not shown, as no patterns emerge). The overall trend in plots a), c), and d) suggests a positive association between women's participation in scientific publications and dissemination in the policy-related literature. There are several instances where higher participation of women in publications does not lead to an increase in the probability of being cited by policy-related literature (e.g. a slight decrease in plot a) between bin 1 and 2), but these are exceptions and are not statistically robust.

Figure 5: Results of main regression models on the relationship between gender composition of research teams (plus other co-variates) and uptake in policy-related literature, 2001-2018

([330]) Five domains in the Science-Metrix classification scheme: Applied Sciences, Economic and Social Sciences, Natural Sciences, Health Sciences, and Arts and the Humanities.

c) 6 to 10 authors - Health Sciences

d) 11 to 20 authors - Health sciences

e) 3 to 5 authors - Health Sciences

f) 3 to 5 authors - Health Sciences

Notes: Bars in some plots relate to the distribution of papers in the group. In each figure, baseline values are presented as references for interpretation of probabilities. In plots a) to e), the baseline refers to the share of publications cited by patents in the first group of publications (bin 0 or all ECR) and in plot f), it refers to the average share of publications cited by patents in publications with three to five authors. In plot d), there is no estimate for bin 6 (all-women publications) due to a very small number of publications in this group.

Plot e) shows the relationship between seniority of research teams and uptake in policy. It demonstrates that publications with only ECRs are less likely to be cited in policy documents in the Health Sciences domain compared to all other groups of publications. 'All-senior publications' is the group with the highest chance of being cited in policy documents. Finally, plot f) shows the impact of cross-disciplinary research teams, EU funding, and the presence of authors from non-academic sectors on increasing the chances of citation in policy documents.

4.5.   Discussion

The multivariate models illustrate that an increased representation of women on research teams is positively correlated with decreased uptake of research findings in patents (sciences in general), and with their increased uptake in health-related policy. The multivariate models included control variables characterising several aspects of research publications and their research teams that, based on prior studies, may be the root causes of a gender bias in the two selected outcome variables [331]. This approach facilitated a deeper understanding of gender biases in these research

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[331] Andersen, J. P., Schneider, J. W., Jagsi, R. and Nielsen, M. W., 'Gender variations in citation distributions in medicine are very small and due to self-citation and journal prestige', *ELife*, Vol. 8, 2019, https://doi.org/10.7554/eLife.45374; Chawla, D. S., 'Men cite themselves more than women do', *Nature*, Vol. 535, No 7611, 2016, p. 212, https://doi.org/10.1038/nature.2016.20176; Huang, J.,

outcomes by answering questions such as: Within a given discipline, and accounting for variables such as year, team size, and seniority, does the uptake of discoveries in innovation and policy still differ as a function of gender? If so, what 'uncontrolled' factors might explain observed differences?

Inclusion of these controls proved useful in isolating a fraction of the gender differences in scientific uptake in patents and policy that is unlikely attributable to gender (see Section 5.2). For example, plot a) in Figure 4 shows that all-women publications remain 1.7 pp less likely to be cited in patents compared to all-men publications after controlling for confounders. These confounders absorb part of the gender difference: in a model excluding any control variable, the corresponding difference is 2.5 pp (data not shown). A similar result is observed for the uptake in policy documents. Compared to all-men publications, all-women publications are 2.2 pp more likely to be cited in policy documents after controlling for the selected confounders. In a model excluding any control variable, this difference is 8.1 pp (data not shown).

The larger difference here is likely attributable to women being proportionately more present in disciplines with closer relevance to social progress (or policy-making), i.e. in disciplines where the share of publications cited in policy-related documents is higher, such as health- or SSH-related fields. This is consistent with earlier findings that women have a stronger tendency to engage in research aiming for social progress ([332]).

Although variation in the extent to which women are underrepresented across scientific disciplines ([333]) likely explain a large share of the gender differences in the 'uncontrolled' models, the gender differences that remain in the full models are unlikely to be attributable to this factor or to any of the other control variables in the models. Potential root causes of the remaining gender differences are described below and used in formulating policy recommendations to maximise the contribution of women and men to two research outcomes (technological innovation and decision-making), benefitting society.

The seniority levels of co-authors, a publication's cross-disciplinarity, the availability of EU funding, and the presence of co-authors from non-academic institutions (particularly from the private sector, in the case of patents) are positively associated with the uptake of research findings in patents and policy, in line with earlier findings ([334]). Additionally, several models were tested to assess the interplay between gender differences and these variables, with no notable differences. For example, regression models restricted to subsets of publications in the same seniority groups, or

Gates, A. J., Sinatra, R. and Barabási, A. L., 'Historical comparison of gender inequality in scientific careers across countries and disciplines', *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 117, No 9, 2020, pp. 4609-4616, https://doi.org/10.1073/PNAS.1914221117/-/DCSUPPLEMENTAL; King, M. M., Bergstrom, C. T., Correll, S. J., Jacquet, J. and West, J. D., 'Men set their own cites high: Gender and self-citation across fields and over time', *Socius: Sociological Research for a Dynamic World*, Vol. 3, 2017, 237802311773890, https://doi.org/10.1177/2378023117738903; Mishra, S., Fegley, B. D., Diesner, J. and Torvik, V. I., 'Self-citation is the hallmark of productive authors, of any gender', *PLoS ONE*, Vol. 13, No 9, 2018, e0195773, https://doi.org/10.1371/journal.pone.0195773

([332]) Zhang, L., Sivertsen, G., Du, H., Huang, Y. and Glänzel, W., 'Gender differences in the aims and impacts of research', *Scientometrics*, Vol. 126, No 11, 2021, pp. 8861-8886, https://doi.org/10.1007/S11192-021-04171-Y

([333]) European Commission, Directorate-General for Research and Innovation, *She Figures 2021*, Publications Office of the European Union, Luxembourg, 2021, https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/she-figures-2021_en

([334]) Campbell, D., Struck, B., Tippett, C. and Roberge, G., 'Impact of multidisciplinary research on innovation', *16th International Conference of the International Society for Scientometrics and Informetrics (ISSI),* 2017, pp. 16-20, http://www.science-metrix.com/sites/default/files/science-metrix/publications/issi2017_paper_153_d_campbell_impact_multidisciplinarity.pdf; Pinheiro, H., Vignola-Gagné, E. and Campbell, D., 'A large-scale validation of the relationship between cross-disciplinary research and its uptake in policy-related documents, using the novel Overton altmetrics database', *Quantitative Science Studies*, Vol. 2, No 2, 2021, pp. 616-642, https://doi.org/10.1162/qss_a_00137

showing similar sectoral affiliation, or including EU authors, or the gender variable interacting with the cross-disciplinarity indicators, do not alter the main findings. Nevertheless, these models confirm that such variables are important determinants of uptake in patents and policy and should be considered in the design of public policies involving the use of scientific evidence in patents and decision-making.

Increased representation of women on research teams decreases the uptake of research findings, after controlling for potential confounders. In addition, more senior teams and teams involving the private sector meaningfully and positively contribute to knowledge transfer. Data show that women are more severely underrepresented in later research career stages [335] and among corporate research authors (data not shown). Additionally, women and men tend to collaborate/train more with same gender colleagues [336]. Therefore, fostering greater connections between women and senior corporate researchers [337], regardless of their gender, could prove effective at gradually increasing the relevance of discoveries by woman researchers in innovation and/or the participation of women in innovation (in the private sector).

This recommendation is further justified by the finding that in larger teams (six or more researchers), mixed-gender publications have the highest probability of patent uptake [338]. Having women on teams thus increases the odds of ideas being innovation-ready, possibly because the incorporation of different gender perspectives produces greater novelty [339], which in the case of innovation could translate into better or more inclusive solutions to practical problems faced by industry. The greater decrease in uptake as teams become mostly composed of women (compared to mostly all-men teams) may be attributable to the underrepresentation of women in innovation [340]

This recommendation can be implemented in the EU through the Framework Programme for R&I, which positively influences the uptake of research findings in innovation. This effect may be attributable to the FP's emphasis on collaboration across countries, disciplines, and sectors (in particular with the private sector). Adding mechanisms to promote the participation of women (in particular ECRs) in academic-private collaboration with senior mentors (from both sectors) could improve the subsequent participation of women in innovation in the private sector, as well as harnessing the added value of different gender perspectives on problems of relevance to industry.

A greater representation of women on research teams is positively associated with greater knowledge transfer in health-related fields. As clinical/practice guidelines represent a substantial share of policy documents citing scientific literature in health research, it may be that, within a given discipline, women researchers have a greater propensity towards clinical and/or patient-

[335] European Commission, Directorate-General for Research and Innovation, *She Figures 2021*, *op. cit*.

[336] Research collaboration networks (Kwiek and Roszka, 'Gender-based homophily in research: A large-scale study of man-woman collaboration', *Journal of Informetrics*, Vol. 15, No 3, 2021, p.101171.) and research mentorship networks (unpublished results by study team) have been shown to be gender-homophilic.

[337] Or with senior (regardless of sector) and corporate (regardless of seniority) researchers.

[338] The lack of a control variable capturing the technology relevance/aim of a publication in a given research field may result in the underestimation of the effect of mixed-gender teams on the likelihood of patent uptake if women are underrepresented in this type of research. If the share of technology-relevant publications decreases as more women are included in research teams, bin 2 of women's participation (plot c, Figure 1) would contain a lower share of publications aimed at technological progress, compared to bins 0 and 1. As such, part of the effect of mixed-gender teams in patent uptake would be absorbed by the lower share of publications aimed at technological progress in mixed-gender teams (compared to all-men publications).

[339] Yang, Y., Tian, T. Y., Woodruff, T. K., Jones, B. F. and Uzzi, B., 2022, *op. cit*.

[340] European Commission, Directorate-General for Research and Innovation, *She Figures 2021*, *op. cit*.

oriented research than more basic science. This raises the question of the implications of these study findings on the provision of gender-balanced guidance for medical practice. Although the share of women medical students and doctors is within range of gender parity (40-60 %) in several European countries, men remain vastly overrepresented among full professors and senior doctors ([341]). As more senior teams positively increase policy uptake in health-related fields, the possibility of gender differences in medical practice may not be a cause of concern, as the influences of gender and seniority tend to offset each other.

Further qualitative investigation is needed to better understand the implications of the study findings on the provision of gender-balanced guidance for medical practice. Meanwhile, including researchers at a range of career stages could create a place for mentorship to facilitate ECRs learning the approaches needed to create policy-relevant research outputs in health-related fields. This could be in the context of collaboration with women in multisectoral settings for clinical and/or patient-oriented research, notably within European Commission-funded research, which is positively associated with policy uptake in health research.

Controlling for all potential confounders in a regression analysis is rarely perfect, especially in complex social systems such as the R&I ecosystem. The pattern described here, of decreasing patent uptake, or increasing policy uptake, with increased representation of women on research teams could be due to a variety of 'uncontrolled' factors that could interact with gender. For example, it may be that, within a given field of research, women emphasise a different type of research problem that is less directly applicable to technological innovation, or that is more directly applicable to policy guidance. While the models used here account for finer-grained research topics (based on citation network analysis), these features are unlikely to fully differentiate publications that are more oriented towards technological progress (patent uptake) or clinical or patient-oriented research (policy uptake). Publications from the same research topics could be oriented towards basic or applied research. Scaling the operationalisation of a variable to capture research aims is challenging and not feasible within the scope of this study.

The strong underrepresentation of women in inventorship may also explain the knowledge transfer to innovation ([342]), paired with inventors' strong tendency to self-cite in patents. Given the scarcity of prior literature testing such hypotheses, more research is recommended to identify the causes and consequences of such differences. This will help to refine the recommendations of this study (see Section 4.6) towards maximising the contribution of women to findings with business potential and the contribution of men to guiding principles for health-related issues.

While the descriptive patterns observed in publications of relevance to the EU's green and digital transitions appear consistent with a decreased uptake of knowledge in innovation as the representation on women increases on teams, further research is needed to confirm this association in areas such as SDG 13, AI, and their intersection. This is because the available data does not allow this association to be reliably tested while controlling for all relevant confounders. In terms of policy uptake, the descriptive data for SDG 13 and SDG 13 intersected

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([341]) Kuhlmann, E., Ovseiko, P. V., Kurmeyer, C., Gutiérrez-Lobos, K., Steinböck, S., von Knorring, M. and Brommels, M., 'Closing the gender leadership gap: A multi-centre cross-country comparison of women in management and leadership in academic health centres in the European Union', *Human Resources for Health*, Vol. 15, No 1, 2017, pp. 1-7, https://doi.org/10.1186/S12960-016-0175-Y/FIGURES/2

([342]) European Commission, Directorate-General for Research and Innovation, *She Figures 2021*, *op. cit.*

with AI do not suggest the presence of a positive association between the rate of uptake and the share of women on teams, as demonstrated for the sciences in general (largely driven by the Health Sciences). While this positive association may be present in AI, further confirmatory work is needed, given the lack of sufficient data to test it statistically after controlling for relevant confounders.

Prior to deriving some policy recommendations from the above quantitative findings, it is useful to highlight potential limitations inherent to the present work. The operationalisation of complexes concepts, such as those discussed in this work, into indicators usually relies in proxies that can lead to oversimplification of the concepts being measured. As mentioned earlier, the share of publications cited by patent and in the policy-related literature are used to measure, respectively, the relevance of publications to technological innovation and the potential of publications to inform guiding principles for public policy. This way of measuring these outcomes does not allow, for example, for assessing the intensity of the relevance of each publication to technological innovation or public policy. However, these choices were made due to the rareness and skewedness of citation events from patents and from the policy-related literature. In addition, the correlations reported in this study may not be interpreted as causation, unless supported by other studies aimed at investigating further the causal direction of such relationships. Good practice suggests triangulation among findings from different studies prior to implementing the policy-recommendations provided in the next section.

4.6.   Policy recommendations

This section summarises the policy recommendations stemming from the quantitative results of this study. The recommendations are in line with some policies and initiatives already in place at EU level, such as WomenTechEU ([343]) and the European Innovation Council (EIC) Women Leadership Programme ([344]). Despite these initiatives to address gender disparities in science, their number and diversity in terms of, for example, implementing bodies and scope of intervention (e.g. across career stages, countries/regions, sectors) may not suffice to address the gender gaps. These recommendations could spur additional and complementary policies implemented at different levels by different actors, including governments, universities and research funding organisations. As the specific design of such policies is contingent on a series of factors, notably available resources and specific environmental contexts, the recommendations are high-level, indicating the types of policies that could help to address some of the gender gaps described in this study.

Recommendation 1: Address the scarcity of research assessing the relationship between gender and factors known to promote knowledge valorisation, such as uptake of publications into patents and policies. This study partly addresses this issue, highlighting a negative relationship between women's participation in publications and uptake in patents (with mixed-gender teams having a positive effect for some team sizes), and a positive association with uptake in policy documents in the Health Sciences domain. While this is a first step to demonstrate the need for specific mechanisms aimed at addressing the lower uptake in patents, and possibly the higher uptake in health-related policy documents, of publications including more women, there

([343]) WomenTechEU website, n.d., https://womentecheurope.eu/

([344]) European Innovation Council, EIC Women Leadership Programme, n.d., https://eic.ec.europa.eu/eic-funding-opportunities/business-acceleration-services/eic-women-leadership-programme_en

is a need to deepen the understanding of such a relationship, including causes and implications. Further research is needed to test whether these associations are at play in other areas, such as those pertaining to the EU's twin transition. Funding further research, particularly qualitative research, will gather information to address these knowledge gaps and design/improve better informed policies. This recommendation partially reflects one existing call from the Digital Europe Programme, 'DIGITAL-2024-ADVANCED-SKILLS-06-WOMEN – Girls and Women in Digital' ([345]), which aims to identify and address a specific type of gender bias in research and innovation. However, the call aims to identify obstacles and solutions for supporting women in information and communications technology (ICT) careers and, as such, does not directly correspond to the types of biases described in this article. Rather, the recommendation targets research oriented towards improving the understanding of factors driving gender differences in research uptake in patent and policy-related documents, regardless of the area of study. Such an initiative could be inspired by the specific objectives of the Girls and Women in Digital call. In this case, a call in line with the current recommendation would aim at identifying obstacles encountered by women in research with higher business potential, proposing actions to overcome such barriers, and fostering a network of experts to inform the Commission on best practices.

The relationship between gender and factors that promote knowledge valorisation could also be investigated as part of evaluations of existing programmes and policies. For example, research assessments could include specific criteria to evaluate whether mechanisms are in place to reduce the gender gap in areas that promote knowledge valorisation. This might involve assessing incentives for creating diverse research teams in fields that are likely to lead to patents. More specific interventions to address some identified gender gaps could already be in development (see below).

Recommendation 2: Address the lower uptake of knowledge from women in patents through programmes to attract women to research of greater technological relevance. These programmes can be adopted at different levels, from local initiatives at universities to broader programmes at the level of large funding agencies. A complementary approach is to rely on other factors known to promote uptake of research in patents, such as seniority and affiliation with the private sector. This could be achieved by promoting research integrating women ECRs with senior researchers and/or researchers from the private sector (regardless of gender). As the presence of senior and private sector researchers positively correlates with uptake in patents, these actions could increase the participation of women ECRs in research with technology relevance and also prepare them for a career in the private sector or academia. Similar policies are already in place and should be maintained and, perhaps, expanded ([346]). A distinctive aspect of the current recommendation is the interaction of early career women researchers with senior researchers, notably from the private sector, which may not be so central in existing and similar initiatives.

- **Recommendation 2.1: Attract and retain women in such knowledge spaces through greater availability of woman role models and mentors**. These role models usually consist of women researchers in later stages of their careers, who are recognised for the importance and quality of their contributions to their research fields

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([345]) Digital Europe Programme, *Call for proposals*, 2024, https://www.euro-access.eu/_media/file/400_call-fiche_digital-2024-advanced-skills-06_en.pdf

([346]) The volume of these initiatives is better addressed in evaluations of existing policies, as highlighted by recommendation #1.

(^{347}). The intervention should also integrate mechanism(s) to reduce the drop-out rate of women as they progress in technology-relevant fields.

- **Recommendation 2.2: Leverage the observed benefits of mixed-gender teams producing research with higher uptake in patents**. Funding mechanisms promoting mixed-gender teams in the context of research for the high-tech industry could increase the likelihood of the resulting findings being taken up in innovation, due to their greater novelty or applicability to both genders (^{348}).

- **Recommendation 2.3:** In the EU, these recommendations could be implemented through the FP by **promoting the participation of women (particularly ECRs) in academic-private collaboration with senior mentors**. Initiatives such as the MSCA Staff Exchanges (^{349}) are in line with the current recommendation and can the bridge early-career research conducted by women and senior counterparts working in the private sector. This could help to improve the subsequent participation of women in innovation in the private sector, as well as harnessing the added value of different gender perspectives on problems relevant to industry.

Recommendation 3: Research projects including researchers at a range of career stages could create a place for mentorship so that ECRs learn the approaches necessary to create policy-relevant research outputs in health-related fields. This could be in the context of collaboration with women in multi-stakeholder settings for clinical and/or patient-oriented research, notably in the context of EU-funded research, which is positively associated with policy uptake in health research.

(^{347}) Due to gender homophily in research mentorship networks, which is more pronounced where women are more underrepresented (unpublished results by the study team).
(^{348}) Nielsen, M. W., Alegria, S., Börjeson, L., Etzkowitz, H., Falk-Krzesinski, H. J., Joshi, A. and Schiebinger, L., 2017, *op. cit.*
(^{349}) European Commission, *Marie Sklodowska-Curie Actions: MCSA Staff Exchanges 2024*, 2024, https://marie-sklodowska-curie-actions.ec.europa.eu/calls/msca-staff-exchanges-2024

4.7.   References

Andersen, J. P., Schneider, J. W., Jagsi, R. and Nielsen, M. W., 'Gender variations in citation distributions in medicine are very small and due to self-citation and journal prestige', ELife, Vol. 8, 2019, https://doi.org/10.7554/eLife.45374

Campbell, D., Struck, B., Tippett, C. and Roberge, G., 'Impact of multidisciplinary research on innovation', *16th International Conference of the International Society for Scientometrics and Informetrics (ISSI),* 2017, pp. 16-20, http://www.science-metrix.com/sites/default/files/science-metrix/publications/issi2017_paper_153_d_campbell_impact_multidisciplinarity.pdf

Campbell, L. G., Mehtani, S., Dozier, M. E. and Rinehart, J., 'Gender-heterogeneous working groups produce higher quality science', *PLoS ONE*, Vol. 8, No 10, 2013, 79147, https://doi.org/10.1371/JOURNAL.PONE.0079147

Chawla, D. S., 'Men cite themselves more than women do', Nature, Vol. 535, No 7611, 2016, p. 212, https://doi.org/10.1038/nature.2016.20176

Digital Europe Programme, *Call for proposals*, 2024, https://www.euro-access.eu/_media/file/400_call-fiche_digital-2024-advanced-skills-06_en.pdf

Elsevier, SciVal Support Centre, n.d., https://service.elsevier.com/app/answers/detail/a_id/31479/supporthub/scival/

European Commission, *A Union of Equality: Gender Equality Strategy 2020-2025*, 2020, https://eige.europa.eu/thesaurus/terms/1263

European Commission, *Marie Sklodowska-Curie Actions: MCSA Staff Exchanges 2024*, 2024, https://marie-sklodowska-curie-actions.ec.europa.eu/calls/msca-staff-exchanges-2024

European Commission, Directorate-General for Research and Innovation, *She Figures 2021,* Publications Office of the European Union, Luxembourg, 2021, https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/she-figures-2021_en

European Commission, Directorate-General for Research and Innovation, *She Figures 2024*, Publications Office of the European Union, Luxembourg, 2024 (forthcoming).

European Innovation Council, EIC Women Leadership Programme, n.d., https://eic.ec.europa.eu/eic-funding-opportunities/business-acceleration-services/eic-women-leadership-programme_en

European Union, *A new European innovation agenda*, Publications Office of the European Union, Luxembourg, 2022, https://doi.org/10.2777/066273

European Union, *A pact for research and innovation in Europe*, Publications Office of the European Union, Luxembourg, 2022, https://doi.org/10.2777/56361

Huang, J., Gates, A. J., Sinatra, R. and Barabási, A. L., 'Historical comparison of gender inequality in scientific careers across countries and disciplines', *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 117, No 9, 2020, pp. 4609-4616, https://doi.org/10.1073/PNAS.1914221117/-/DCSUPPLEMENTAL

Kashnitsky, Y., Roberge, G., Mu, J., Kang, K., Wang, W., Vanderfeesten, M. and Labrosse, I.,

Evaluating approaches to identifying research supporting the United Nations Sustainable Development Goals, 2022, https://arxiv.org/abs/2209.07285v6

King, M. M., Bergstrom, C. T., Correll, S. J., Jacquet, J. and West, J. D., 'Men set their own cites high: Gender and self-citation across fields and over time', *Socius: Sociological Research for a Dynamic World*, Vol. 3, 2017, 237802311773890, https://doi.org/10.1177/2378023117738903

Klavans, R. and Boyack, K. W., 'Research portfolio analysis and topic prominence', *Journal of Informetrics*, Vol. 11, No 4, 2017, pp. 1158-1174, https://doi.org/10.1016/J.JOI.2017.10.002

Kuhlmann, E., Ovseiko, P. V., Kurmeyer, C., Gutiérrez-Lobos, K., Steinböck, S., von Knorring, M. and Brommels, M., 'Closing the gender leadership gap: A multi-centre cross-country comparison of women in management and leadership in academic health centres in the European Union', *Human Resources for Health*, Vol. 15, No 1, 2017, pp. 1-7, https://doi.org/10.1186/S12960-016-0175-Y/FIGURES/2

Kwiek & Roszka, 'Gender-based homophily in research: A large-scale study of man-woman collaboration', *Journal of Informetrics*, Vol. 15, No 3, 2021, p.101171.

Mishra, S., Fegley, B. D., Diesner, J. and Torvik, V. I., 'Self-citation is the hallmark of productive authors, of any gender', *PLoS ONE*, Vol. 13, No 9, 2018, e0195773, https://doi.org/10.1371/journal.pone.0195773

Nielsen, M. and Börjeson, L., 'Gender diversity in the management field: Does it matter for research outcomes?', *Research Policy*, Vol. 48, No 7, 2019, pp. 1617-1632, https://doi.org/10.1016/J.RESPOL.2019.03.006

Nielsen, M. W., Alegria, S., Börjeson, L., Etzkowitz, H., Falk-Krzesinski, H. J., Joshi, A. and Schiebinger, L., 'Gender diversity leads to better science', *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 114, No 8, 2017, pp. 1740-1742, https://doi.org/10.1073/PNAS.1700616114

Pinheiro, H., Durning, M. and Campbell, D. 'Do women undertake interdisciplinary research more than men, and do self-citations bias observed differences?', *Quantitative Science Studies*, Vol. 3, No 2, 2022, pp. 363-392, https://doi.org/10.1162/qss_a_00191

Pinheiro, H., Vignola-Gagné, E. and Campbell, D., 'A large-scale validation of the relationship between cross-disciplinary research and its uptake in policy-related documents, using the novel Overton altmetrics database', *Quantitative Science Studies*, Vol. 2, No 2, 2021, pp. 616-642, https://doi.org/10.1162/qss_a_00137

Rivest, M., Vignola-Gagné, E. and Archambault, É., 'Article-level classification of scientific publications: A comparison of deep learning, direct citation and bibliographic coupling', *PLoS ONE*, Vol. 16, 5 May 2021, e0251493, https://doi.org/10.1371/journal.pone.0251493

Science-Metrix, *Development of bibliometric indicators to measure women's contribution to scientific publications*, Science-Metrix, Montreal, Section 2, 2018, https://namsor.app/files_to_download_p/science-metrix_bibliometric_indicators_womens_contribution_to_science_report.pdf

Specht, A. and Crowston, K., 'Interdisciplinary collaboration from diverse science teams can produce significant outcomes', *PLoS ONE*, Vol. 17, No 11, 2021, https://doi.org/10.1371/JOURNAL.PONE.0278043

Szomszor, M. and Adie, E., 'Overton: A bibliometric database of policy document citations',

Quantitative Science Studies, Vol. 3, No 3, 2022, pp. 624-650, doi: https://doi.org/10.1162/qss_a_00204

Xie, L., Zhou, J., Zong, Q. and Lu, Q., 'Gender diversity in R&D teams and innovation efficiency: Role of the innovation context', *Research Policy*, Vol. 49, No 1, 2020, 103885, https://doi.org/10.1016/J.RESPOL.2019.103885

Xu, H., Gupta, C., Sembay, Z., Thaker, S., Payne-Foster, P., Chen, J. and Ding, Y., 'Cross-team collaboration and diversity in the Bridge2AI Project', *ACM Web Conference 2023 - Companion of the World Wide Web Conference, WWW,* 2023, pp. 790-794, https://doi.org/10.1145/3543873.3587579

Yang, Y., Tian, T. Y., Woodruff, T. K., Jones, B. F. and Uzzi, B., 'Gender-diverse teams produce more novel and higher-impact scientific ideas', *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 119, No. 36, 2022, e2200841119, https://doi.org/10.1073/PNAS.2200841119/SUPPL_FILE/PNAS.2200841119.SAPP.PDF

Yoo, H. S., Jung, Y. L. and Jun, S. P., 'The effects of SMEs' R&D team diversity on project-level performances: evidence from South Korea's R&D subsidy programme', *R&D Management*, Vol. 53, No 3, 2023, pp. 391-407, https://doi.org/10.1111/RADM.12575

Zhang, L., Sivertsen, G., Du, H., Huang, Y. and Glänzel, W., 'Gender differences in the aims and impacts of research', *Scientometrics*, Vol. 126, No 11, 2021, pp. 8861-8886, https://doi.org/10.1007/S11192-021-04171-Y

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The She Figures 2024 Policy Report complements the She Figures 2024 main study by providing an in-depth analysis of key issues relating to gender equality in research and innovation (R&I). While the main study presents comprehensive gender statistics in R&I, the Policy Report expands on these findings by analysing policy landscapes, addressing thematic areas, and identifying data gaps relevant to gender equality.

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