Europäisches Patentamt
European Patent Office
Office européen des brevets

Advancing women in STEM

A data-driven assessment of the gender gap across Europe’s innovation ecosystem

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Abbreviations

IP	Intellectual property
PROs	Public research organisations
EPO	European Patent Office
EP	European patent
R&D	Research and development
WPI	Women participation index
WIR	Women inventor rate
EU	European Union
EIT	European Institute of Innovation and Technology

Countries

AL	Albania
AT	Austria
BE	Belgium
BG	Bulgaria
CH	Switzerland
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GB	United Kingdom
GR	Greece
HR	Croatia
HU	Hungary
IE	Ireland
IS	Iceland
IT	Italy
LI	Liechtenstein
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
ME	Montenegro
MK	North Macedonia
MT	Malta
NL	Netherlands
NO	Norway
PL	Poland
PT	Portugal
RO	Romania
RS	Serbia
SE	Sweden
SI	Slovenia
SK	Slovakia
SM	San Marino
TR	Türkiye
US	United States
EU	European Union

Foreword by the President

Europe is living through a decisive decade. Our prosperity and security will increasingly depend on the technologies we develop – and on our ability to turn ideas into industrial strength. In that context, who innovates matters. Europe cannot afford to leave talent on the sidelines.

Yet, persistent gender gaps still run through the innovation system. While women represent a growing share of advanced STEM graduates, they remain under-represented among inventors, founders and decision-makers in science and technology. This is more than an equality challenge: it is a competitiveness challenge. When participation is uneven, Europe's innovation potential is constrained – and so is our capacity to grow.

Closing these gaps is therefore a strategic imperative. It is also an opportunity. Greater inclusion is a direct route to a larger pool of skills, stronger teams and better outcomes. The benefits would be felt across research, patenting and entrepreneurship.

At the European Patent Office, we are at the forefront of Europe's innovation ecosystem. It is where innovators protect and valorise their inventions, and where patent information becomes a resource for investment, policy and technology strategy. We see the gender gap clearly in the evidence. We also see the momentum for change. That is why the EPO has acted: internally, by making gender equality a core driver of our Strategic Plan 2028 and tracking progress through our KPI on women examiners. Our own female examiner population is around 25% and we are constantly improving in our new recruitments, going up to 31% last year. We also see encouraging trends in our Young Professionals (YP) programme, where the proportion of women is usually above 50%.

Externally, we are sharing intelligence that can inform better decisions. This study is part of that commitment. Through the EPO Observatory on Patents and Technology, we bring patent intelligence into Europe's wider debates on growth and competitiveness. Evidence is the starting point for action. Our earlier study in 2022 helped to quantify women's participation in inventive activity and to track trends over time. This report takes the next step by broadening the lens from inventorship alone to the wider pathways that shape participation and progress across the innovation pipeline.

Several features make this analysis particularly valuable. First, it connects the dots between research, patenting and entrepreneurship, rather than treating them as separate worlds. Second, it looks beyond entry into innovation to what happens next. The data suggest a nuanced picture in deep tech: newer firms show higher shares of women founders, indicating that new cohorts of startups are becoming more diverse. Yet, women's representation appears to decrease at later funding stages, pointing to barriers to scaling. Third, the report supports more targeted measures by showing where gaps are largest, where the gender "pipeline" leaks, and where interventions are most likely to deliver results.

Importantly, this work has been built with relevant partners. It has benefited from close co-operation with the participating 22 national patent offices. Their contributions reflect the diversity of national contexts and the range of initiatives already underway. The report also contains contributions from key European stakeholders, including the European Commission (DG Research and Innovation), the European Institute of Innovation and Technology, the European Institute for Gender Equality, the Institute of Professional Representatives before the European Patent Office and the Equalize programme from the USA. These institutions all collaborated providing specific input on their programmes. The report also features profiles from members of the European Inventor Network, who we thank for their support and their participation in this project.

The policy agenda on competitiveness rightly puts skills and R&D talent at its centre. This report is intended as a practical contribution to that agenda. It strengthens the evidence base, highlights roadblocks that persist and supports more effective, targeted measures – so that Europe can unlock the full innovation potential of women across education, research, patenting and entrepreneurship.

Executive Summary

Women account for almost half of Europe's workforce and a growing number of doctoral graduates in science, technology, engineering and mathematics (STEM) – around 37% in the European Union (EU) – highlighting their growing presence in highly skilled and knowledge-intensive roles (EIGE, 2025; SheFigures, 2025). Yet, as shown in the European Patent Office's (EPO) 2022 study on women's participation in inventive activity, only around 13% of inventors named in European patent applications in 2019 within Europe were women, underscoring a persistent gender gap. At a time when Europe is placing R&D talent at the centre of its competitiveness agenda, this topic is especially timely. The European Commission is now shaping its EU Action Plan for Women in Research, Innovation and Start-ups, and this report provides the evidence base needed to turn that ambition into targeted action.

The present study explores this "leaking pipeline" issue, whereby the share of women tends to decline along the pathway from university enrolment in STEM disciplines, through progression to PhD and other STEM doctorates, and further still in the transition to R&D personnel, researchers, and ultimately to patenting. This pattern suggests that women face increasingly pronounced barriers when advancing in STEM-linked and technology-driven careers, and implies that a sizeable pool of innovation potential remains untapped in Europe.

Building on the findings of the first EPO study on women inventors, the present report develops new indicators and offers fresh perspectives on the role of women in Europe's innovation landscape. It tracks long-run trends in women's participation as inventors and extends the analysis to women in the patent profession, who provide essential services within the European patent system and shape how inventive activity is supported and protected. The report also examines the participation of women as founders in technology-based startups, where similar under-representation patterns are observed, suggesting that gender gaps extend across different segments of the innovation chain. In addition, it investigates the leaking pipeline specifically among women PhD graduates in STEM, asking to what extent the technological relevance, field distribution and knowledge-type of research outputs from women scientists can help explain their weaker transition from academia into higher-impact innovative roles.

As part of the work programme of the EPO's Observatory for Patents and Technology, this study aims to provide a comprehensive, evidence-based analysis of women's participation across key segments of the European innovation ecosystem, including deep-dive analyses for individual EPO member states whenever data quality permits. By combining longitudinal patent indicators with PhD, labour market and startup data, it seeks to support policymakers, industrial actors and research organisations in monitoring progress towards greater gender equality and designing more effective, targeted measures to unlock the full innovation potential of Europe.

Outline of key findings:

A. Gender gap in patenting

Patents are a key instrument for protecting and valorising new technologies and are widely used as an indicator of inventive activity. In this context, the contribution of women — not only as inventors but also more broadly to the patent ecosystem, for example as patent examiners and patent attorneys — is an important dimension of Europe's innovation landscape.

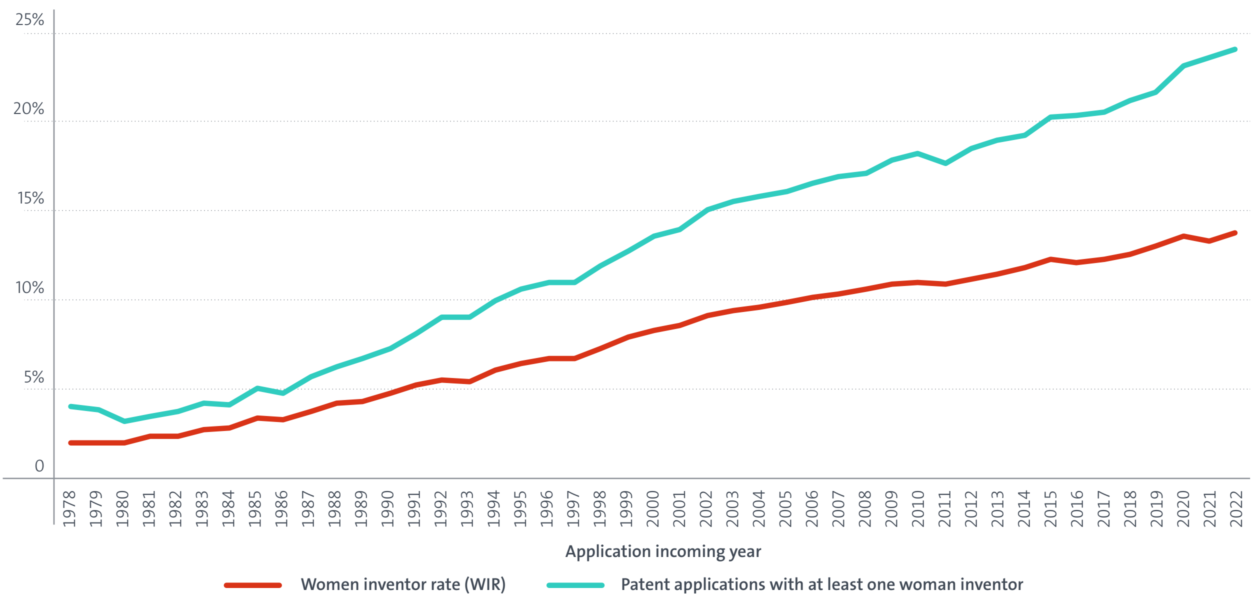
KF1 Women's participation in European inventorship is rising, but the gap remains wide.

Women's participation in patenting at the EPO has increased steadily over the past decades, but at a relatively linear pace. The main indicator, the women inventor rate (WIR) – defined as the share of women inventors out of all inventors listed on European patent applications in a given period – rose from around 2% in the late 1970s to around 13% in 2019, and further to only 13.8% in 2022, indicating that the gender gap remains substantial over the entire period.

Despite slow overall convergence, some positive trends emerge. A complementary indicator – measuring the share of European patent applications that list at least one woman among the inventors on a given application – shows that women's participation through team-based patenting has expanded more rapidly than their representation as individual inventors. The share of European patent applications naming at least one woman as an inventor increased from less than 4% around 1980 to 21.6% in 2019 and 24.1% in 2022, widening the difference to WIR and pointing to a faster growing role of women in collaborative inventor teams. Moreover, women's participation has risen notably in Food chemistry, Pharmaceuticals, Digital communication, IT methods for management and Computer technology. Small corporate applicants show the fastest WIR growth, while among young star inventors the gender gap nearly disappears. In addition, Europe's most innovative regions exhibit lower gender gaps than national averages, suggesting leading innovation clusters provide more inclusive environments.

Figure E1

Women's participation in patenting at the EPO in EPO countries, 1978–2022



Source: EPO - PATSTAT

KF2 Technology mix and applicant type drive WIR differences across EPO member states, yet significant national patterns persist.

Across EPO member states, the women inventor rate (WIR) increased between 2013–2017 and 2018–2022 in most countries, although the changes are generally moderate. Portugal recorded the highest WIR in the 2018–2022 period at 29.3% among countries with at least 1 000 inventors in that period, followed by Spain (24.1%) and Türkiye (21.2%).

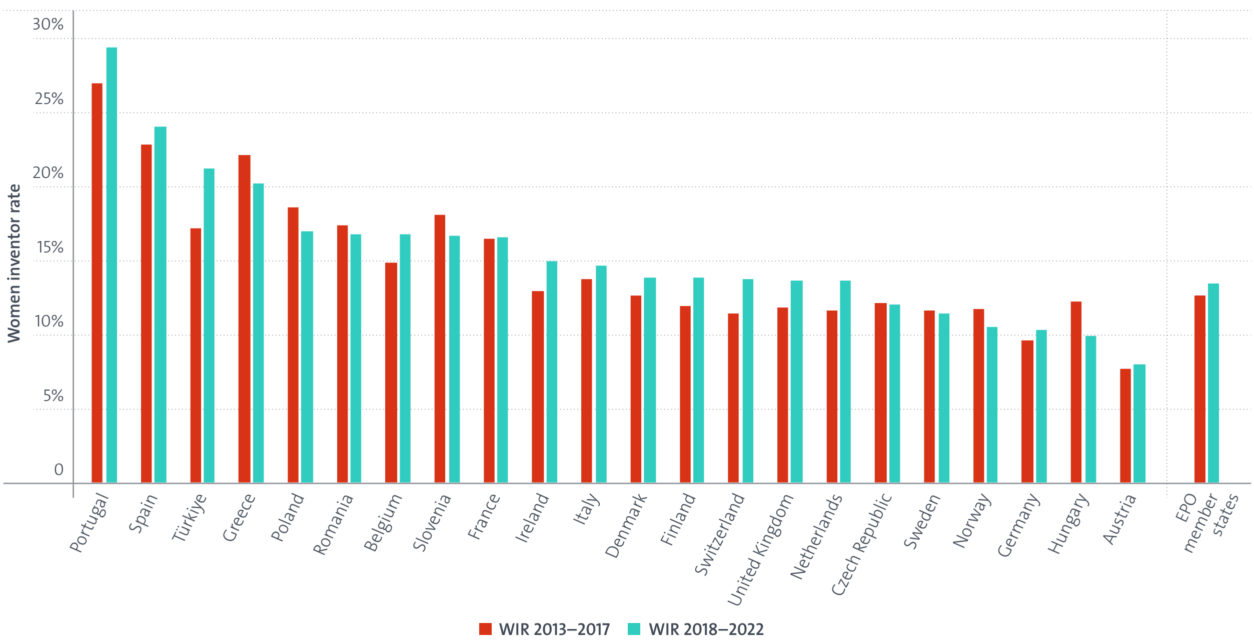
Portugal and Türkiye also showed the largest absolute increases in WIR among the larger jurisdictions, with gains of 2.4 and 4 percentage points, respectively, between the two periods. At the other end of the distribution, Austria had the lowest WIR in 2018–2022 at 8%, despite a small improvement over time. Hungary (-2.3 percentage points), Greece (-1.9 percentage points) and Poland (-1.6 percentage points) recorded the largest absolute decreases in WIR between 2013–2017 and 2018–2022.

Country-level differences in WIR are closely linked to the composition of patenting across technology fields and applicant types. Among the 35 technology fields, pharmaceuticals (34.9%), biotechnology (34.2%) and food chemistry (32.3%) show the highest WIR in 2018–2022, while machine tools (5.7%), basic communication processes (5.5%) and mechanical elements (4.9%) exhibit the lowest values. Across applicant types, universities and public research organisations (PROs) display a WIR of 24.4% in 2018–2022, clearly above business companies (11.6%) and individual inventors (12.5%), which are themselves quite close to each other.

This pattern is largely driven by the strong specialisation of academic institutions in high-WIR technological fields, and may also reflect a relatively higher openness of universities and PROs to women's participation, whether for historical or cultural reasons or due to regulatory frameworks. However, differences in technology specialisation and applicant-type structure do not fully account for the variation in WIR across EPO member states, suggesting that additional country-specific cultural and institutional factors also play a role.

Figure E2

WIR by EPO member state across the periods 2013–2017 and 2018–2022 (priority year)



Note: The Figure includes all EPO member states with at least 1 000 unique inventors in the period 2018–2022.

Source: EPO - PATSTAT

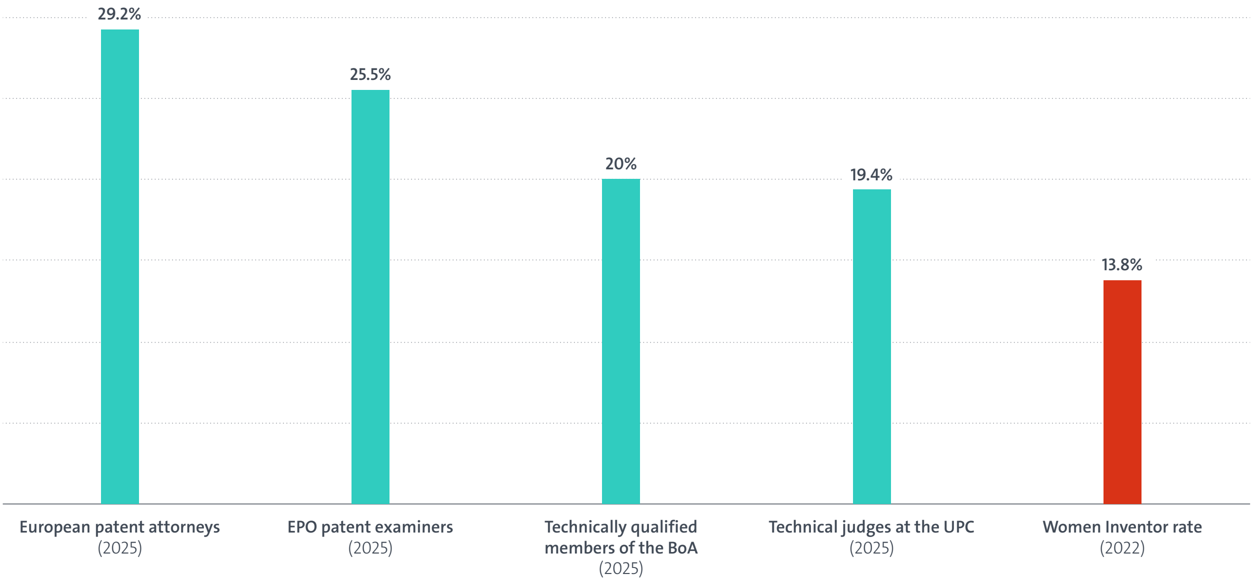
KF3 The gender gap in patent professions is markedly smaller than among European inventors.

Patent professionals form a backbone of the European innovation ecosystem. With regards to the European patent system, this includes professionals in the private sector such as patent attorneys, patent examiners, members of the EPO Boards of Appeal and patent judges who advise on IP and business matters, examine and adjudicate patent applications, facilitate technology commercialisation and resolve disputes. Most of these roles require a technical qualification followed by specialised legal training. Overall, the share of women in patent professions is significantly higher than the WIR in EPO member states, suggesting that women with technical backgrounds show a stronger propensity to pursue careers in a patent profession than to work as inventors in the business sector.

The percentage of female patent examiners at the EPO has increased over time, reaching 25.5% in 2025, with women accounting for over 30% of new hires. Among more than 14 000 European patent attorneys in 2025, 29.2% were women, up from 28.0% in 2015. For late-career, high-requirement positions such as technical judges at the Unified Patent Court (UPC) or technically qualified members of the Boards of Appeal (BoA), the female share is closer to 20%.

Figure E3

Share of women in different patent professions in Europe



Sources: EPO - PATSTAT

B. Women tech founders and patenting

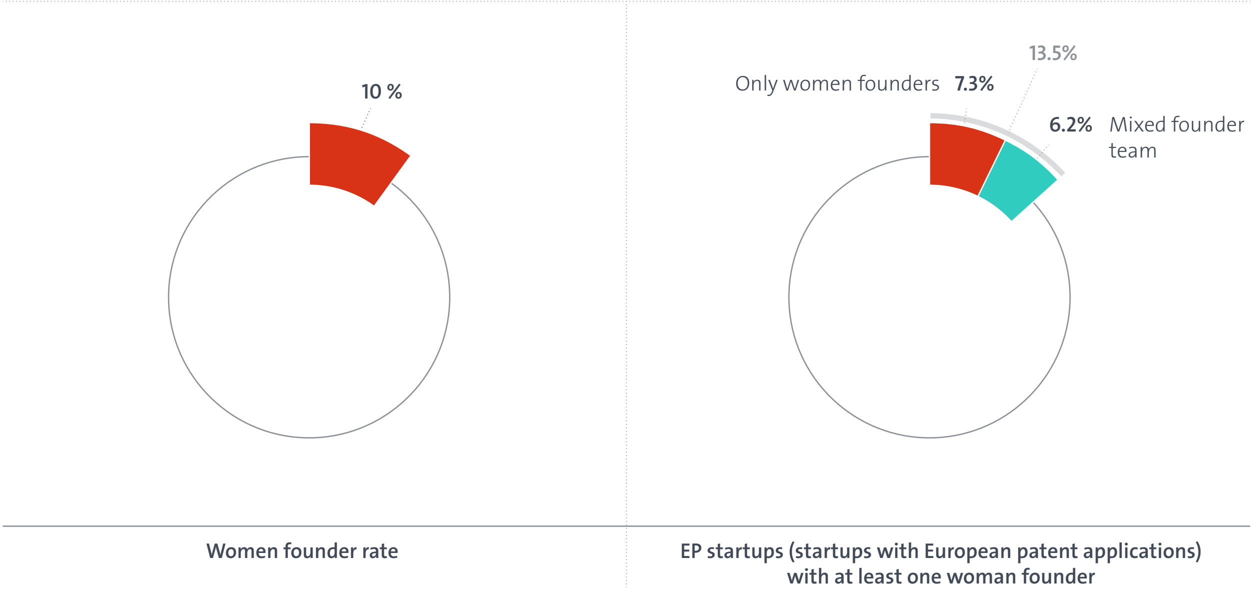
Technology startups are engines of European innovation, driving the development and commercialisation of cutting-edge technologies. Patents play a crucial role in this ecosystem, enabling startups to protect their inventions, attract investment, signal technological credibility to markets and partners and establish competitive advantages as they scale. Against this backdrop, data from Dealroom are utilised to assess the participation of women as founders in over 10 000 such European technology ventures that engage with the European patent system and are featured in EPO's Deep Tech Finder.

KF4 Women represent less than 10% of founders of tech startups with patents in Europe

The share of women among founders of European technology ventures, i.e. startups with European patent applications, is approximately 10%, comparable to the WIR for patent applications from small businesses and individual inventors among EPO member states. These women founders created 13.5% of startups with European patents, with 7.3% founded by all-female teams and 6.2% by mixed-gender teams.

Figure E4

Women's participation as founders in EP startups, 2025



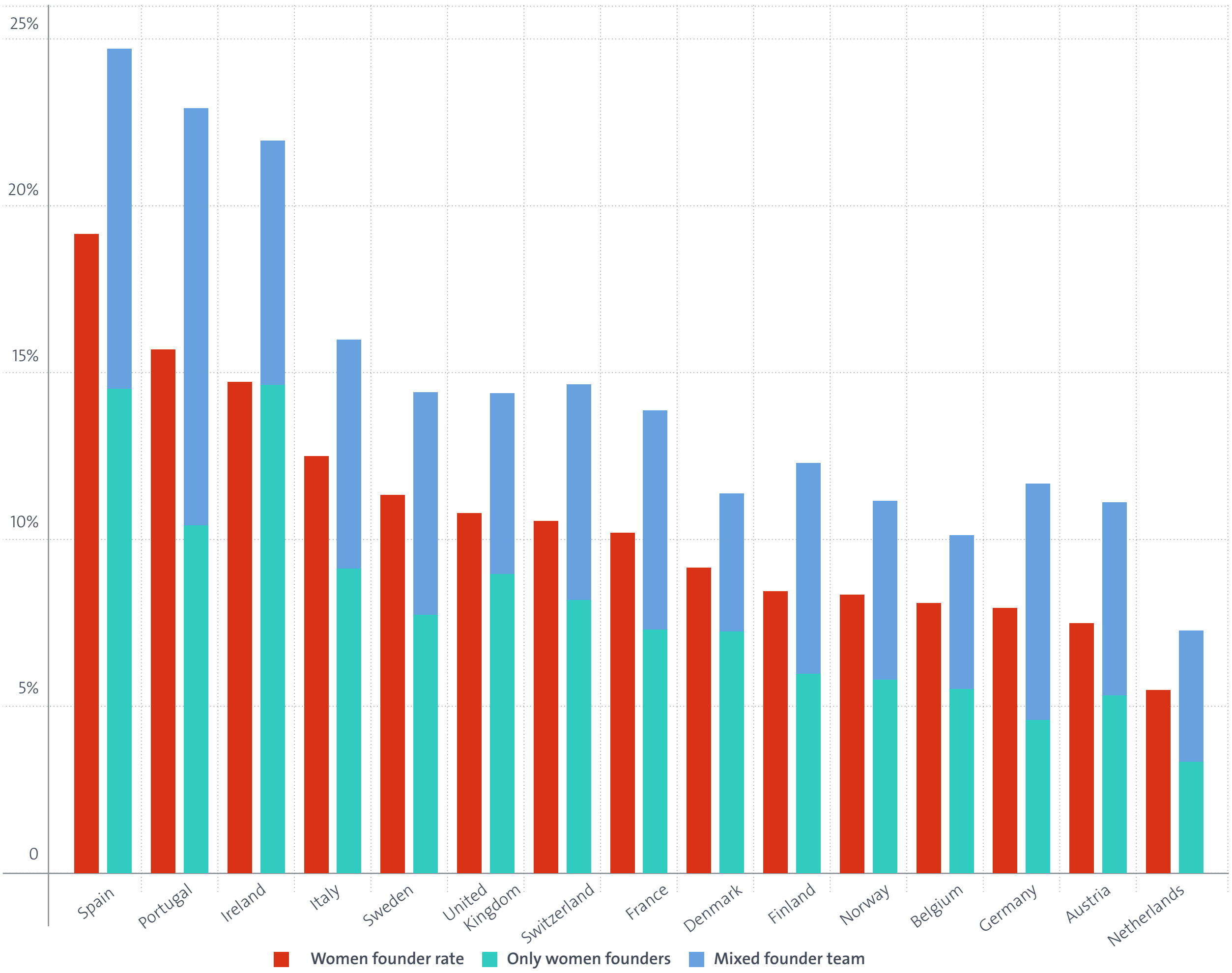
Sources: EPO - Dealroom; Crunchbase; own calculation

Significant variation exists both across countries and sectors. Spain (19.2%) and Portugal (15.7%) show the highest women founder rates, aligned with their elevated WIR, followed by Ireland (14.8%), while, Germany (8.0%), Austria (7.5%) and the Netherlands (5.5%) record the lowest. By sector, women founders are most active in Chemicals (15.6%), Agrifood (14.8%) and Health Tech (14.0%), but markedly under-represented in Transportation (5.9%), Robotics (5.5%) and Consumer Electronics (4.4%).

As with the WIR, industry specialisation patterns alone do not fully explain cross-country differences, suggesting that country-specific institutional and regulatory factors also shape women's participation in technology entrepreneurship.

Figure E5

Women's participation as founders in EP ventures (startups with European patent applications) by country of company, 2025



Sources: EPO - Dealroom; Crunchbase; own calculation

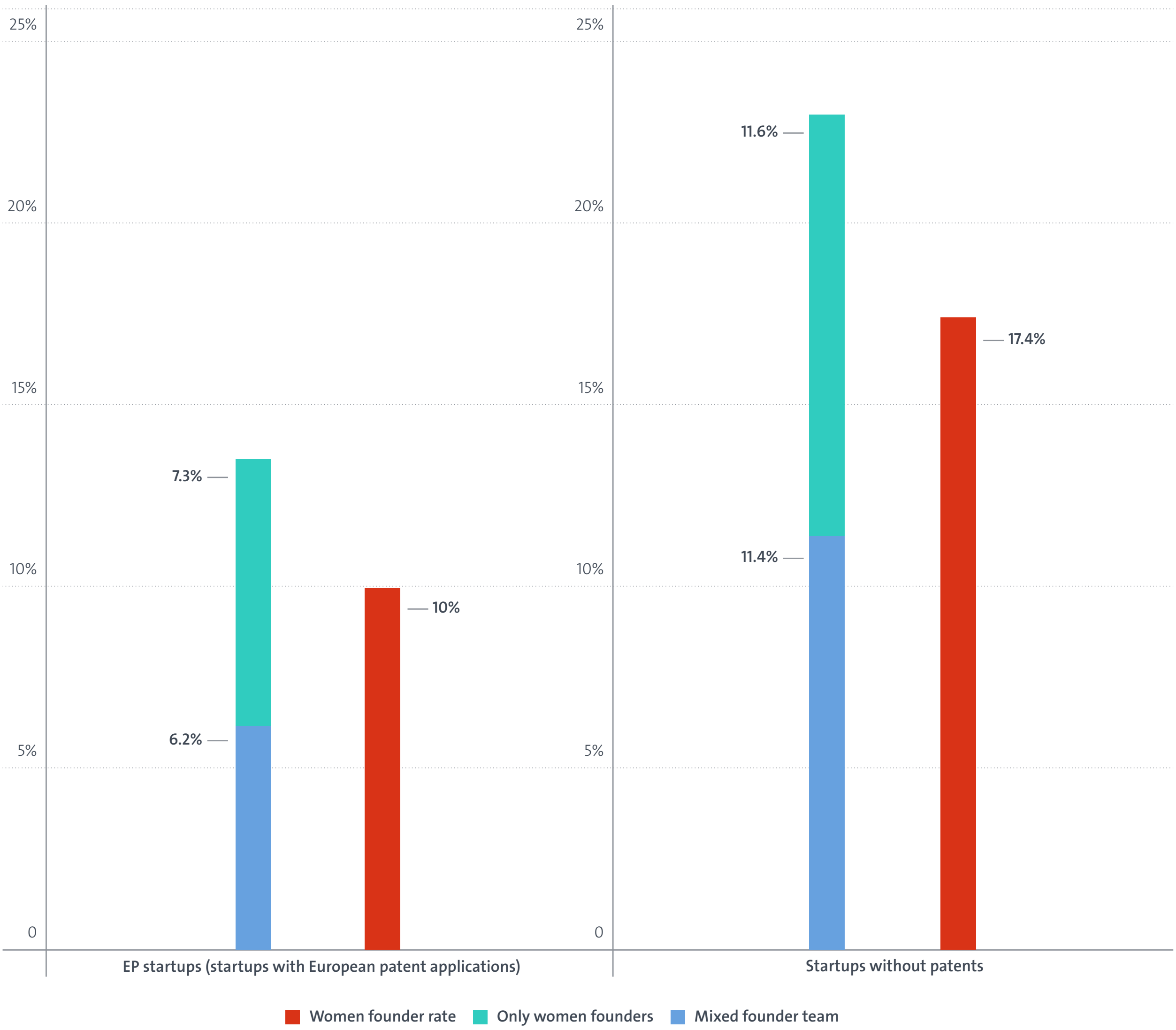
KF5 Patenting startups show a substantially wider gender gap than non-patenting startups

The gender gap is markedly wider among founders of patenting startups than among non-patenting startups with similar industry distributions. Women accounted for 17.4% of founders in non-patenting startups, compared to just 10% in patenting ventures – a gap of over 7 percentage points.

Similarly, the share of founding teams with at least one woman was 9.5 percentage points higher among non-patenting startups than among those relying on patent protection, a difference that remains significant even after controlling for factors such as country, age and growth stage of the company.

Figure E6

Comparison of women's participation as founders in EP startups and non-patenting European startups, 2025



Sources: EPO - Dealroom; Crunchbase; own calculation

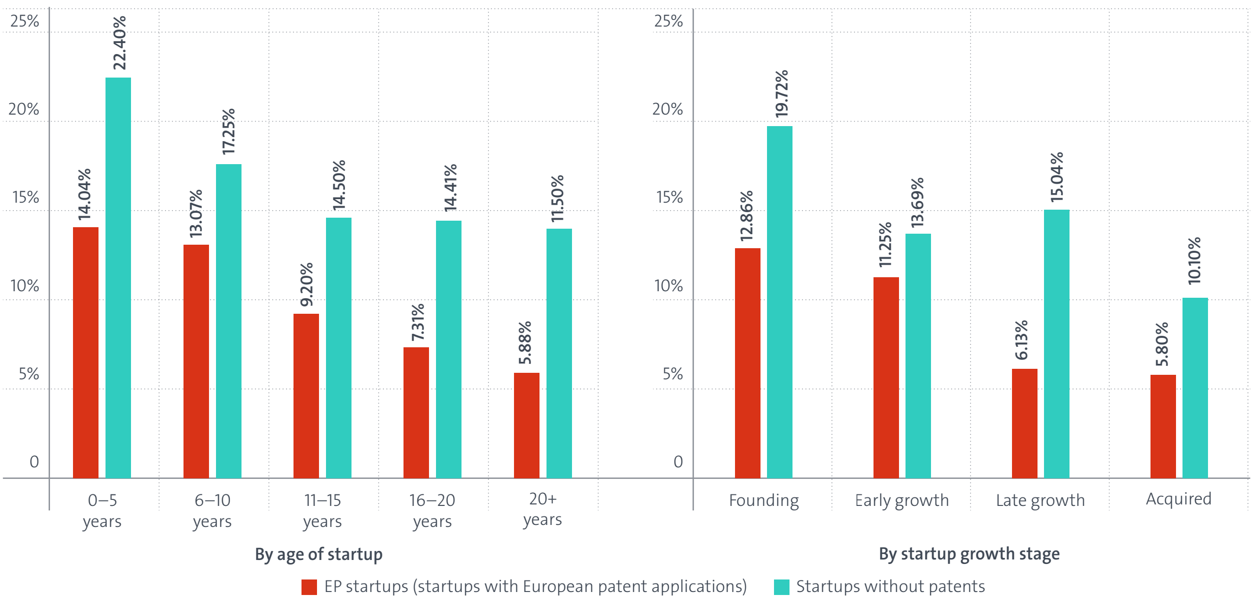
KF6 The gender gap is narrower in new technology startups, but remains high at late growth stages.

The participation of women founders in European patenting startups is higher among younger cohorts: ventures founded fewer than five years ago show a 14% share of women founders, compared with 5.9% among startups older than 20 years. However, the difference to non-patenting startups persists across all company age groups.

At the same time, analysis by growth stage suggests that companies co-founded by women face greater difficulties in scaling: while women-founded patenting startups account for between 11.3% and 12.9% of ventures receiving early funding, their share drops to around 6% among those reaching later growth stages or successful exit. This pattern is consistent with other studies showing that, as companies mature, women and gender-diverse founders become rarer and more severely underfunded. Comparing patenting with non-patenting startups suggests that this problem may be more pronounced for tech ventures, since the largest gap in the share of startups with women founders occurs among late-stage companies, where the difference to non-patenting ventures reaches 8.9 percentage points.

Figure E7

Share of EP startups with at least one woman founder by age and growth stage of the company, 2025



Sources: EPO - Dealroom; Crunchbase; own calculation

C. Women STEM graduates and patenting

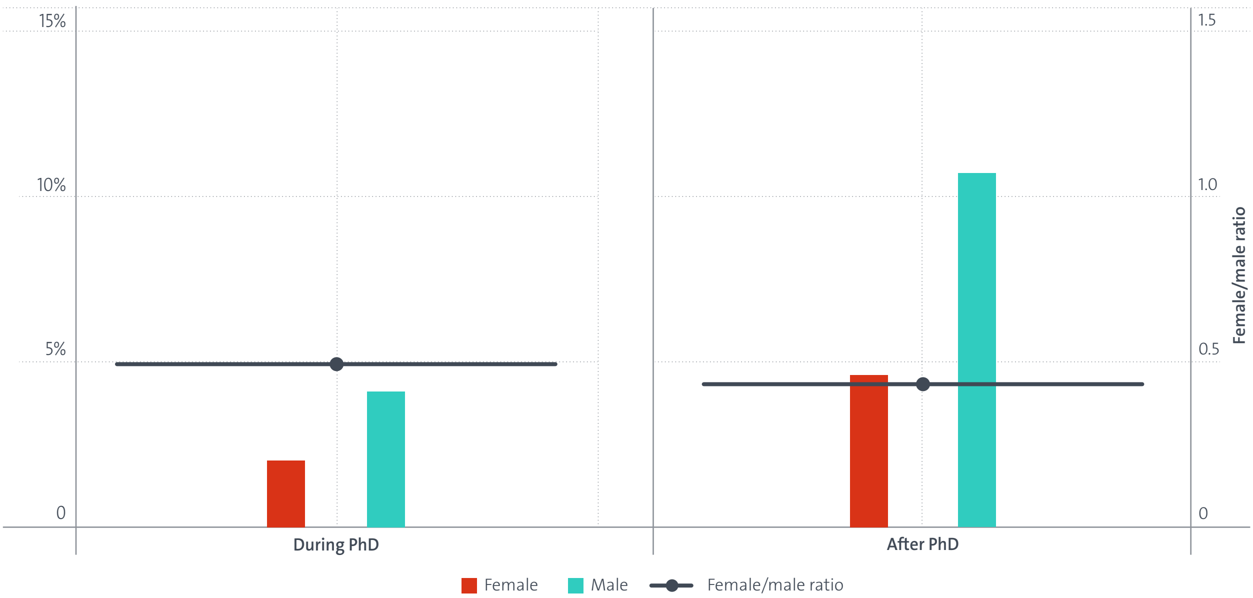
STEM education is not a strict requirement for becoming an inventor, but it is often an important pathway into careers in technology and innovation. Women remain under-represented among undergraduates and doctoral graduates in science and engineering – accounting for around 30% and 37%, respectively, in the EU – although their participation varies across specific STEM disciplines. This raises the question of whether additional attrition occurs between STEM doctoral training and subsequent patenting activity. DOC-TRACK, an international research project funded by the European Patent Office (EPO), links scientific publications with the patenting activity of STEM doctoral graduates from 2000 to 2020 across seven European countries (Austria, France, Germany, Italy, the Netherlands, Spain and the United Kingdom). This dataset makes it possible to analyse how women and men transition from doctoral research into inventive activity, providing crucial insights for understanding gender gaps in innovation.

KF7 Women PhD graduates in STEM are less likely to become inventors than their male counterparts, compounding the lower propensity of women to engage in STEM studies.

The share of women PhD graduates in STEM fields listed as inventors on at least one patent (filed during or after graduation) is roughly half that of men. Women are systematically under-represented among patent-active PhD graduates relative to their share in the doctoral population across all STEM disciplines. The ratio of shares of women inventors to men inventors slightly declines from 0.49 to 0.43 when comparing pre- and post-graduation patent filings at the EPO. Overall, these findings establish that the lower representation of women among patent inventors is already visible at the graduation stage, even among women who did engage in STEM curricula, and increases even further over the course of their careers.

Figure E8

Share of graduates with at least one patent filed pre- and post- graduation; 2000–2020



Sources: EPO - DOC-TRACK; PATSTAT

Note: The red and green bars represent, respectively, the shares of female and male graduates with at least one patent filed during (left graph) and after (right graph) their PhD. Their values are reported on the left-hand vertical axis. The black line represents the ratio between the shares of female and male graduates (female/male ratio), as measured on the right-hand vertical axis. If the two shares are equal, the ratio takes the value one; if the share of female graduates is larger than that of male graduates, the female/male ratio takes values larger than one, and vice versa.

KF8 The inventive potential of women's research is comparable to that of men, suggesting other reasons for the gender gap in patenting.

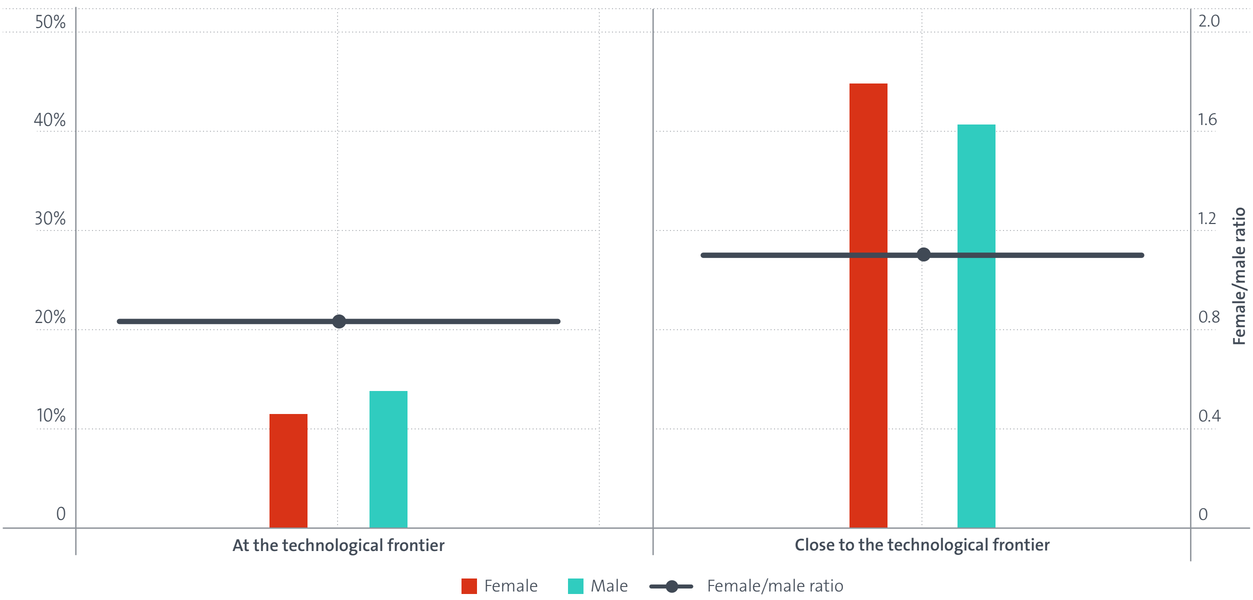
Evidence shows that gender gaps in patenting among STEM PhD graduates cannot be explained by differences in their inventive potential. Using indicators that measure the proximity of PhD graduates' publications to the technological frontier as a proxy for its inventive potential, the analysis reveals a leaking pipeline from doctoral research to patenting that filters out more women than men.

In contrast to patenting, there is no gender imbalance for publications close to the technological frontier, where the ratio of women's to men's shares is around 1.1, and only a moderate imbalance for publications at the technological frontier, where this ratio is about 0.83.

This pattern suggests that lower female participation in patenting is unlikely to be driven by a lack of frontier-relevant research results, and may instead be associated with institutional, cultural, and economic factors shaping women's careers.

Figure E9

Share of graduates with at least one publication at or close to the technological frontier, 2000–2020



Sources: EPO - DOC-TRACK; PATSTAT

Note: The red and green bars represent, respectively, the shares of female and male graduates with at least one publication at the technological frontier (left graph) and close to the technological frontier (right graph) during their PhD. Their values are reported on the left-hand vertical axis. The black line represents the ratio between the shares of female and male graduates (female/male ratio), as measured on the right-hand vertical axis. If the two shares are equal, the ratio takes the value one.

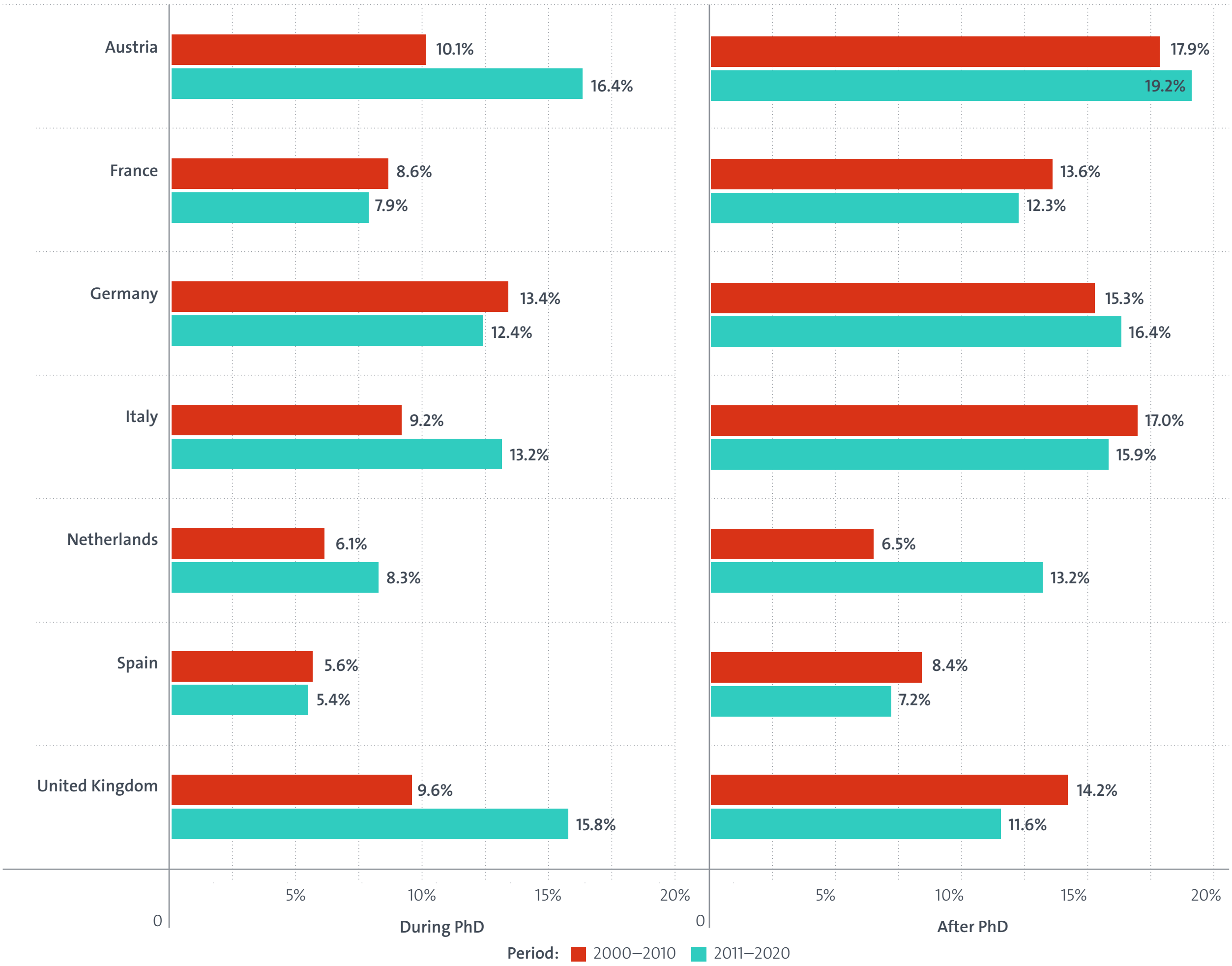
KF9 Systematic under-representation of women in patenting persists among STEM PhD graduates across all countries, with limited and uneven progress toward parity.

Another way to assess the gender gap in patenting across countries is to compare the share of women among patenting STEM PhD graduates with their share among all STEM PhD graduates. As STEM disciplines differ markedly in patenting intensity and gender composition, regression techniques are used to monitor for these effects.

The analysis shows that women are systematically under-represented among patenting PhD graduates relative to their share in the PhD population in every country, time period and career stage examined. Moreover, comparing PhD-period with post-PhD outcomes confirms that the gap widens over career progression. Progress toward parity has been limited and uneven over the past two decades, with some countries, such as Austria and the Netherlands, experiencing deterioration and others, such as France and Spain, showing improvement. For other countries, developments over time were mixed.

Figure E10

Regression-adjusted under-representation of women, i.e. gender gap, in patenting relative to their presence in doctoral programs by country, across two time periods (2000–2010 and 2011–2020) and two career stages (during PhD and after PhD graduation) (in %)



Note: These plots illustrate the gender gap distribution across two dimensions for each of the seven countries: It shows the magnitude of female under-representation in patenting relative to their presence among doctoral STEM program graduates (measured in percentage points): it represents the difference between the share of women among all PhD graduates, averaged across fields, and the predicted share of female inventors among all PhD graduates who hold patents.

Sources: EPO - DOC-TRACK; PATSTAT

1. Introduction

1.1. The gap of women in patenting

Improving women's participation in science, technology, engineering and mathematics (STEM) is a priority for gender equality and for the performance of Europe's research and innovation ecosystem. Yet, across advanced economies, women remain less likely to work in STEM-intensive occupations and also less likely to contribute to patented inventions. In Europe, patent applications that include at least one woman inventor still account for less than one-third of filings, with comparable patterns reported in other developed economies. This gap persists despite long-term progress in education and labour market participation: women represent a substantial share of STEM graduates and of the broader community of scientists and engineers, but their representation declines at successive stages of STEM careers. In policy terms, closing this gap is no longer framed only as an equality objective: it is increasingly treated as a condition for Europe's research and innovation performance. At EU level, gender equality and inclusiveness are explicit priorities of the European Research Area, including the ERA Policy Agenda action on promoting gender equality and fostering inclusiveness. In addition, since 2022, the EU's funding plan for Research and Development, Horizon Europe, has made a Gender Equality Plan an eligibility requirement for many public bodies, research organisations and higher-education establishments, embedding institutional change into the framework conditions for funding.

The lack of representation of women in science and innovation is often framed by the "leaky pipeline" metaphor: women's participation declines from education into early-career roles, further still from mid-career into senior scientific and technical positions, and from there continues to narrow in the roles most closely associated with patenting, technology leadership and entrepreneurship. There are multiple interrelated causes, including early educational choices shaped by stereotypes and role models, workplace cultures and biases in recruitment and progression, unequal access to professional networks and the uneven distribution of caregiving responsibilities.

These drivers can play out differently in academia and in industry: academia may offer greater autonomy and perceived flexibility, but also constrained resources, short-term contracts and slower progression; whereas industry can provide stronger R&D capacity and resources for patenting, but with accompanying challenges related to work-life balance, established norms and advancement pathways.

The implications are both economic and societal. Patents are an important channel through which research results are translated into technologies, investment and industrial competitiveness. Under-representation in patenting and in innovation-driven entrepreneurship indicates that Europe risks not only leaving talent underused, but also shaping innovation in a way that reflects a narrower range of experiences and problem definitions.

1.2. Why this report?

In 2022, the European Patent Office (EPO) published a study titled *Women's participation in inventive activity*, providing a patent-based assessment of women inventorship in Europe and introducing key indicators such as the women inventor rate (EPO, 2022). The analysis highlighted substantial variation across technologies and applicant types, differences across countries, the importance of collaboration patterns and the role of international mobility. Most patent-based assessments – including in the 2022 study – provide a largely static view: they measure outcomes observed in patent data, but cannot fully explain how women and men arrive at (or exit from) patenting over the course of their careers.

This evidence gap matters because policy demand has shifted from describing disparities to identifying where, when and why they emerge along career pathways. The European Commission has launched work on its first EU Action Plan for Women in Research, Innovation and Start-ups, explicitly aimed at mobilising talent and improving Europe's competitiveness. This report contributes to this effort by adding a career-path perspective and pinpointing the transition points where interventions are likely to have the highest impact. It combines updated patent-based indicators for the full set of EPO member states with new linked evidence that connects stages of STEM careers – doctoral training, publishing activity, patenting and entrepreneurial participation – over time.

The analysis is enabled by **DOC-TRACK**, an academic research project supported by the EPO's Academic Research Programme, which links national doctoral graduate registers to scientific publications and patent data. This approach makes it possible to examine where the pipeline narrows most sharply, and how patterns differ by gender across early and mid-career transitions.

The report also broadens the lens beyond patenting alone by examining innovation-driven entrepreneurship using the **EPO Deep Tech Finder**. This provides a complementary view of women's participation among founders of tech startups that have filed European patent applications, an important pathway through which patented technologies are brought to market. This broader policy agenda extends beyond research careers into innovation and scaling. Under the New European Innovation Agenda and related European Innovation Council initiatives, the EU has introduced measures intended to strengthen the participation and visibility of women innovators and founders, including work on gender and diversity indicators and support programmes for women-led companies. This makes it particularly relevant to examine whether under-representation in patenting is mirrored in innovation-driven entrepreneurship.

Finally, the report is designed to support action. Throughout its various sections, it includes short profiles based on interviews with successful women inventors and awardees from the **European Inventor Award** and the **Young Inventors Prize**, alongside thematic boxes highlighting policy measures and initiatives from key policy organisations.

The timing of the report also reflects a broader strategic focus within the **EPO Observatory on Patents and Technology**. The Observatory's mission is to provide robust evidence and analysis on patents in innovation and to support informed decision-making by policymakers, researchers, industry and the wider innovation community. Following a wide consultation that informed the Observatory's Biannual Work Plan for 2026–2027, advancing women's participation in innovation and STEM was identified as a priority theme where better evidence can support more effective action. This aligns with the EU's wider push for institutional change through Gender Equality Plans and stronger monitoring of progress across the ERA.

The study is delivered within that framework, bringing together data, analysis and practical insights to help focus attention on the stages of STEM careers where interventions can make the greatest difference. All this work is developed as part of an Observatory co-operation project in which 22 countries participate through their national patent offices, contributing to shared evidence and helping ensure that the analysis is relevant across diverse national contexts.

Published in the week of International Women's Day 2026, the report aims to inform policymakers, research and innovation organisations, universities and public research organisations, companies, the intellectual property community, and stakeholders in innovation finance. Its purpose is to provide a stronger evidence base for targeted measures, by identifying not only how large gaps are, but when and where they emerge along the career ladder.

1.3. Structure

The report is structured into five main parts. Section 2 frames the issue and reviews what research and policy responses suggest about where obstacles arise. Section 3 updates the descriptive patent evidence and includes a focused look at the patent profession (attorneys and judges). Section 4 examines women's participation among founders of tech startups linked to European patenting, while Section 5 uses linked longitudinal data to track career transitions and locate where gaps widen most, before concluding with implications from recent policy developments. Annexes detail the methods and give broader results of women representation in patenting by country and institution.

2. The progress of women in STEM

2.1. The "leaky pipeline"

The "leaky pipeline" is a widely used metaphor in the literature on gender equality in science and engineering. It describes a simple but persistent pattern: women's representation is highest at earlier stages of education and training, and declines progressively at successive career transitions, so that women remain under-represented in senior technical roles and leadership positions. The metaphor is used to highlight that under-representation is not the result of a single barrier, but rather of cumulative losses at multiple points – for example when moving from study to advanced training, from training to early-career positions, and from early career to senior roles.

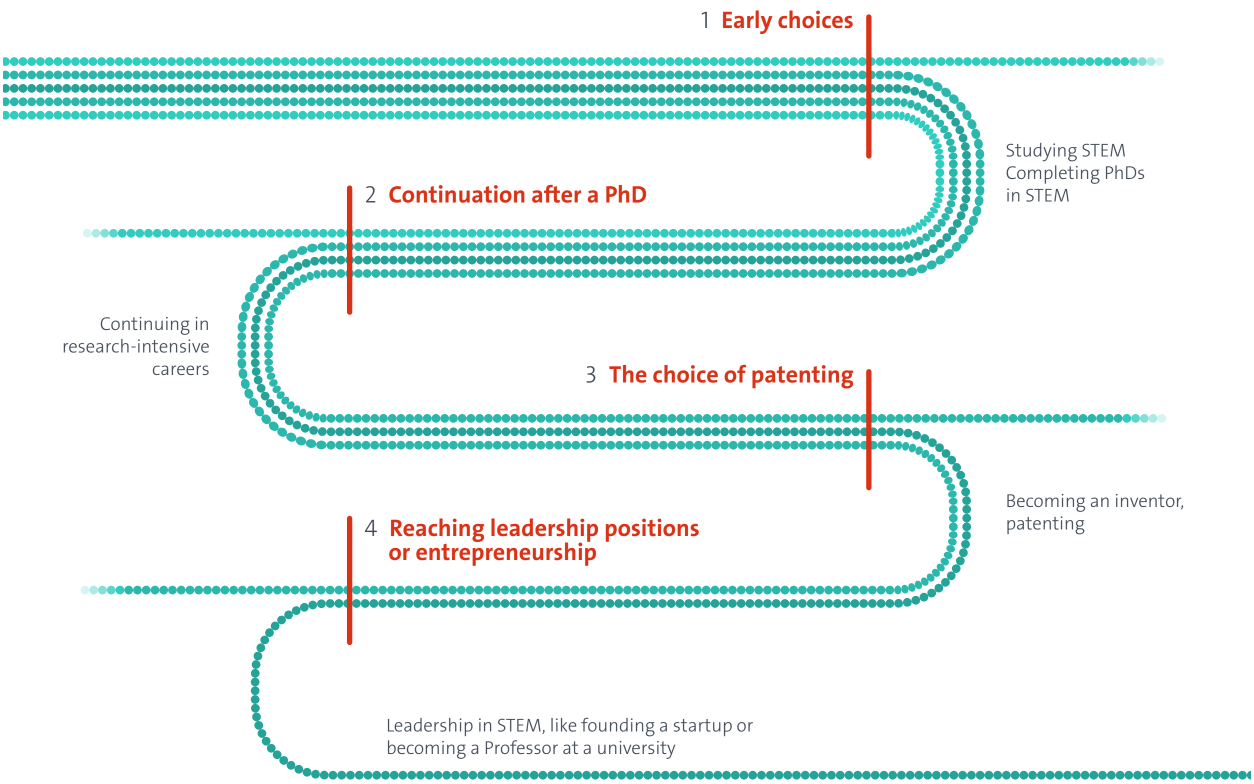
In its original form, the pipeline is often applied to academic careers. In this report, we adapt it to innovation and patenting by treating patenting as a distinct transition point between "being active in STEM" and "being visible in measurable inventive output".

This matters because patenting is not evenly distributed across STEM careers: it is more likely in certain organisational settings, research profiles and project types, and it often reflects access to established disclosure, IP support and collaboration pathways. The adapted pipeline therefore helps connect three domains that are frequently analysed separately – education, careers, and inventive activity – and makes it easier to discuss where gaps widen and what kinds of measures correspond to each stage.

Figure 1 provides a stylised representation of this adapted pipeline. It starts with participation in STEM study, moves through advanced STEM training and participation in applied science "at the technological frontier", and then adds two outcomes that are central to innovation systems: patenting and leadership (e.g. leading R&D teams, heading laboratories, becoming a professor, or founding a tech company). In Europe, women remain a clear minority among inventors named on European patent applications (less than 14% in 2022).

Figure 1

The leaky pipeline of women in STEM and innovation



Source: EPO

This framing, however, comes with important caveats. First, careers in STEM and innovation are rarely linear. People enter through different routes, move between academia and industry, and may contribute to innovation without going through every step suggested by a single pipeline diagram. Second, parts of the traditional "leaky pipeline" narrative have been questioned, particularly for the transition from bachelor's degree to PhD in some contexts. Evidence from the United States suggests that the pipeline explained historical gender differences but no longer describes current gender differences in the transition in STEM in the same way; in some fields, under-representation at later stages reflects earlier differences in field choice more than higher female "attrition" after graduation (Miller and Wai, 2015). Third, the metaphor can have negative connotations if it implies that leaving academia or a tenure-track route is a failure. In practice, many move into other high-impact roles where STEM skills are valuable, and these transitions can reflect preferences and opportunities rather than a "loss" (Miller, 2015).

We nevertheless retain the pipeline metaphor in this report, explicitly to show the dynamic aspect of STEM careers. Used carefully, it helps show how modest differences at several transition points can accumulate into large imbalances in senior roles, without claiming that any single "leak" explains the whole pattern. It also provides a clear structure for bringing together different evidence bases, education and career patterns on the one hand, and patenting outcomes on the other, into a single, consistent narrative. Most importantly for this study, adapting the pipeline to include patenting makes one analytical point easier to see: participation in invention is not an automatic consequence of being trained or employed in STEM. It is a transition shaped by access to applied projects, disclosure and IP support, recognition, and team roles – factors that patent data can help observe and compare across countries, technologies and types of organisations.

2.2. The different steps of the pipeline

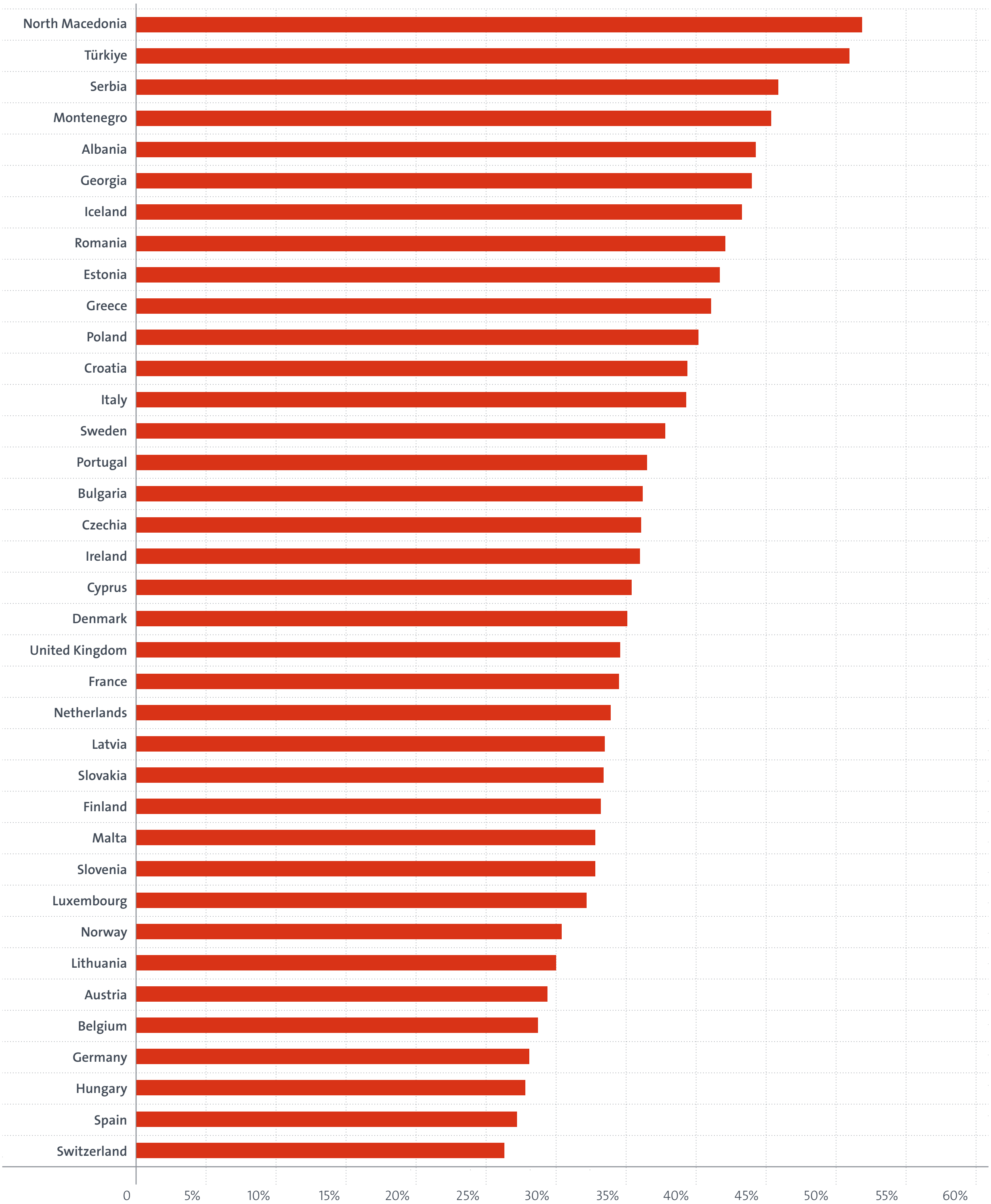
Early stages: choosing STEM in education

Even though barriers can appear at every stage of the "leaky pipeline", the earliest transition – choosing a STEM degree or specialisation in tertiary education – often sets the trajectory. That choice is strongly shaped by earlier experiences that influence identity, confidence and a sense of belonging in STEM. Across most European countries, women account for roughly 30% of STEM tertiary graduates, while shares are markedly higher in Türkiye and in parts of the Western Balkans, where they come close to parity.

At doctoral level, women represent around 37% of STEM PhD graduates in the European Union. This Figure is partly driven by the mix of STEM disciplines and by how likely graduates are to continue into doctoral training: fields with higher female participation (such as areas of the life sciences) also tend to produce more PhDs per tertiary graduate than fields like engineering. A substantial gender gap persists across the education-to-research pathway, and it varies considerably between technical fields (EIGE, 2025).

Figure 2

The share of women among STEM graduates (in %)



Note: All data are from 2023 except those from Türkiye, which are from 2022.

Source: EIGE, 2025; World Bank Group, 2026

Across educational stages, women report lower self-confidence in STEM than men despite comparable or superior performance (Whitcomb et al., 2020). As these are self-rated measures, observed differences should not be read as reflecting lower knowledge, ability or ambition; rather, they may capture confidence gaps shaped by internalised gender stereotypes and by cumulative educational and workplace experiences. This confidence gap can weaken STEM identification and reduce the perceived fit of a long, high-commitment pathway such as doctoral training. Reduced belonging in science and lower self-efficacy are reported from school through graduate training more often by women than men pursuing these studies (Clark et al., 2021; O'Connell and McKinnon, 2021; Wilson and van Antwerp, 2021). Importantly, these perceptions emerge alongside structural and cultural barriers, such as biased expectations, unequal access to mentoring and networks, and uneven recognition, that can create additional hurdles even for highly capable and ambitious women, making the PhD track feel less attainable or less attractive.

Continuation after PhD: women may exit STEM careers during early- and mid-career stages

In early career, the decision to continue in research is often shaped by whether researchers can consolidate stable professional motivation and working conditions. Impostor experiences and stereotype-related pressures can be linked to burnout and higher exit likelihood for women researchers (Whitcomb et al., 2020; Van Veelen et al., 2019; Cadaret et al., 2017; Shin, 2025). At the same time, limited access to mentoring and professional networks can constrain opportunities and support at points where informal channels strongly influence progression (Tal et al., 2024; Schoen et al., 2018; Botella et al., 2019; van den Brink and Benschop, 2012; Bell and Yates, 2015). Workplace isolation in male-dominated settings can further increase disengagement and exit risk (Rodriguez et al., 2022).

In mid-career, women who leave often report dissatisfaction with working conditions (especially work–life balance) alongside pay and promotion dissatisfaction, job insecurity and precariousness, long working hours, travel-heavy roles, and cultures of constant availability (Hunt, 2010; Bataille et al., 2017; VHTO, 2022). While these appear gender-neutral, research highlights that they are experienced in gendered ways due to bias in evaluation and resource allocation, because unpaid domestic labour and caring responsibilities remain unequally distributed, and due to gender-unbalanced leadership (Moss-Racusin et al., 2012; European Commission, 2021; Bol et al., 2022; Foss and Olsen, 2024; Isaksson et al., 2004; Holmes and O'Connell, 2007). "Up-or-out" career structures also penalise non-linear trajectories and make re-entry after breaks difficult, contributing to the motherhood penalty or "maternal wall" (Mavriplis and Heller, 2010; Joecks et al., 2014).

Specific challenges to patenting: inventive output remains especially unequal

Women's contributions to patenting are rising, but remain far from balanced, and this matters because incomes are strongly related to patent contributions and because missing women inventors can narrow technological progress and inclusivity (Bell et al., 2019; Nielsen et al., 2017; Koning et al., 2021; Jaravel and Einiö, 2021). For example, evidence from US biomedical patents suggests women's patents are more likely to address women-specific health problems (Koning et al., 2021).

Two main stylised patterns stand out from our EPO report from 2022 looking at the patenting gender gap: First, the situation varies across technologies and applicant types: women's shares tend to be higher in more science-based fields (closer to life sciences) and where universities and public labs play a larger role. Second, women's presence in patenting increases with teamwork, yet women remain under-represented among team leaders – an important detail because leadership within teams often shapes visibility, credit and downstream career returns in later patents.

There are several mechanisms that can help explain why patenting, in particular, remains unequal:

- **Organisational positioning and industry links:** women in universities may have fewer links to industry and may be more confined to traditional academic career models (Ding et al., 2006).

- **Credit and recognition for inventions (the so-called "Matilda effect"):** women's work can be undervalued or misattributed (Rossiter, 1993; Jansson and Tyrefors, 2022; Wu, 2020). In the patenting context, this aligns with evidence that women credited as authors in scientific publications are less likely than male co-authors to be credited as inventors on corresponding patents (Lissoni et al., 2013; 2020). In other words, even when women contribute to the underlying knowledge, women inventors might not be featured as inventors in the patent applications as fairly as their men colleagues.

— **Returns to inventive work and maintaining rights:** evidence from business R&D indicates women can earn less despite contributing to high-quality inventions (Hoisl and Mariani, 2017). Some studies also suggest women inventors are less likely to obtain and maintain patent rights, and their patents may have fewer claims and citations on average (Jensen et al., 2018; Reshef et al., 2021).

Leadership positions: fewer women reach senior roles

Women's under-representation in senior roles limits access to sponsorship, influential networks and high-visibility opportunities – resources that are consistently linked to advancement and that women often identify as pivotal to their progression (Tal et al., 2024; Schoen et al., 2018; Botella et al., 2019). Informal, often male-dominated networks can mediate recognition and opportunity, while persistent workplace isolation and care duties can further reduce access to these advancement channels (van den Brink and Benschop, 2012; Bell and Yates, 2015; Rodriguez et al., 2022).

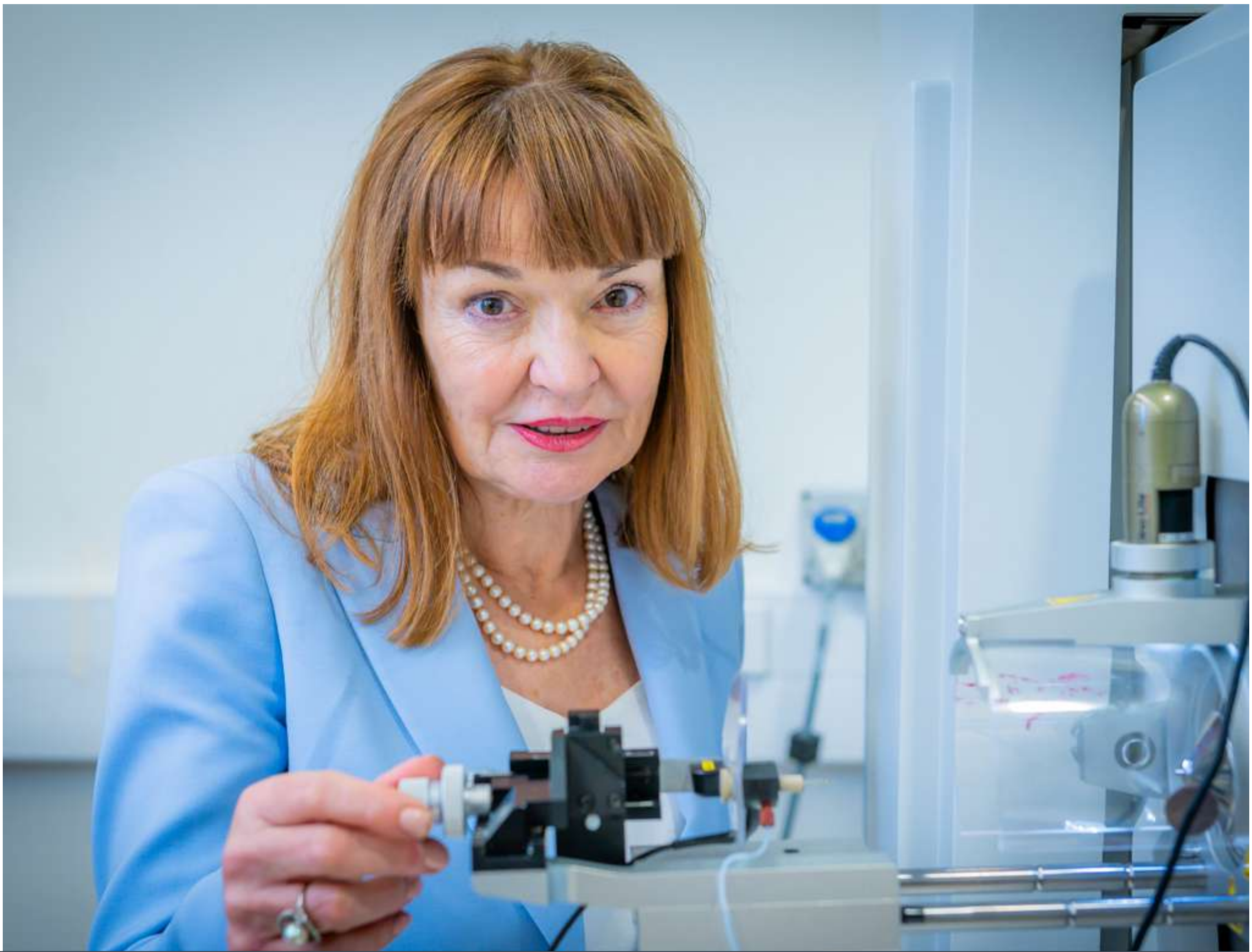
Leadership pipelines are also shaped by bias in hiring, promotion, tenure and funding decisions (Moss-Racusin et al., 2012; European Commission, 2021; Bol et al., 2022; Foss and Olsen, 2024), alongside career systems that reward uninterrupted trajectories and penalise breaks, contributing to the maternal wall (Mavriplis and Heller, 2010; Joecks et al., 2014). The result is that even women who remain in STEM through mid-career may face compounding disadvantages in accumulating the prestige, resources and recognition typically required to move into leadership positions and top inventor roles.

2.3. A question of fairness and competitivity

Gender gaps along the STEM and innovation pipeline not only raise fairness concerns: they also weaken the quality and competitiveness of Europe's knowledge base. Evidence on research teams shows that "science teams made up of men and women produce papers that are more novel and highly cited" (Yang et al., 2022, PNAS). Firm-level research for Europe similarly finds that "gender diversity is strongly related to firms' performance," and that workforce diversity is "relevant to all phases of the innovation process" (Capozza and Divella, 2024).

In patenting, barriers can mean foregone high-value inventions: using stock-market reactions to patent grants, one study reports that "female-authored patents are associated with significantly higher economic values" (Gu, 2025). This is tightly aligned with the need to retain and attract R&D talent for Europe's competitiveness. The Draghi report says it best: "Competitiveness today is less about relative labour costs and more about knowledge and skills embodied in the labour force," and "skills shortages are acting as a barrier to innovation and technology adoption" (Draghi, 2024).

The World Bank underlines that "the gender gap in STEM is an inefficient allocation of labour and talent, and a missed opportunity for economies" (Hammond et al., 2020). It also stresses that "gender gaps in STEM can have broader negative consequences by influencing the products that STEM brings to economies and society," including the risk that seemingly "gender-neutral" technologies reproduce bias when they are built only by men inventors (Hammond et al., 2020). Strengthening women's participation at every stage, from STEM education and research careers to patenting and commercialisation, is therefore not only a question of equal opportunity: it is a precondition for making Europe's innovation system more effective, more competitive and more socially robust.



Inventor Profile: **Dame Carol Vivien Robinson**

Biography

Dame Carol Vivien Robinson is a British chemist and pioneer of native mass spectrometry, a breakthrough technique that allows proteins to be studied in their natural state. Professor of Chemistry at the University of Oxford (the first woman to attain the position) and founding director of the Kavli Institute for Nanoscience Discovery, Robinson's work has transformed structural biology, advanced drug discovery and personalised medicine. She is also a co-founder of the pharmaceutical company OMass Therapeutics, which works to translate fundamental research into innovative approaches for targeting complex membrane proteins. Robinson is a recipient of numerous prestigious awards and nineteen honorary titles, and in 2024, was awarded the European Patent Office's European Inventor Award in the "Lifetime Achievement" category for her enduring impact on biochemistry, medical technology and scientific leadership.

UN Sustainable Development Goals
SDG 3, SDG 10

Technical field
Medical technology

Organisation
Oxford University Innovation

Q&A **Dame Carol Vivien Robinson**

Looking back, how have the non-linear career choices you made shaped the scientist and leader you have become?
"My non-linear path of leaving school at 16 and working as a lab technician for seven years grounded me in practical mass spectrometry and removed any fear I may have had about tinkering with instrumentation. I believe it also deepened my empathy for diverse career routes. Then becoming the first woman full professor at both the great institutions of Oxford and Cambridge was initially intimidating and I felt great imposter syndrome for some time, and maybe that has never quite left me, even today."

> *"My advice would be to own your career story and celebrate it. [...] I believe talking about unconventional paths makes them more accepted. I aim to build communities where non-traditional journeys are celebrated."*

What drove you to pursue native mass spectrometry at a time when many were sceptical of it as a technique?
"I pursued native mass spectrometry because I believed in it. I saw spectra where the stoichiometry and interactions of complexes matched what was established by other traditional approaches. I started to believe! The rest of the field was focused on proteomics – an incredibly powerful technique – but to me that fact that protein interactions could be maintained in a mass spectrometer represented an exciting glimpse of what could be possible."

To find out more about the science of mass spectrometry, see here:
epo.org/en/news-events/european-inventor-award/meet-the-finalists/carol-vivien-robinson

From your perspective, why does the "leaky pipeline" persist in science, and how effectively do current academic structures support scientists who take career breaks? What still needs to change?
"I believe we have improved the leaky pipeline, particularly for motherhood and mid-career scientists, partly due to options for remote working and the connectivity of the internet. Paid career breaks are supported by a number of funding institutions today, but the fact remains that funding cycles still have heavy expectations for constant productivity. What I believe is needed are reforms to parental leave, protected grant application timelines and ideally on-site childcare."

What advice would you offer to women in STEM today, particularly those whose careers may not follow a traditional or uninterrupted path?
"My advice would be to own your career story and celebrate it. For too long I tried to hide mine, but now I'm much more open, because I believe talking about unconventional paths makes them more accepted. I aim to build communities where non-traditional journeys are celebrated. I owe a huge debt to mentors who believed in me before I did, giving me a chance and encouraging me to move forward before I felt ready. I want to take that forward to the next generation of scientists, helping them find their own paths with confidence and support."

Want to hear more about Dame Robinson's inspiring story? A podcast episode based on this Q&A will be available here:
epo.org/en/news-events/podcast

Career	
1972	— Leaves school and begins work as a laboratory technician at Pfizer in Kent, U.K., while pursuing higher education qualifications in Chemistry at Canterbury College of Technology
1976 – 1979	— Remains at Pfizer, graduating from the Royal Society of Chemistry at Medway College of Technology.
1979 – 1980	— Completes a Master of Science degree at the University of Wales.
1980 – 1982	— Earns a PhD at the University of Cambridge, focusing on structural studies of bioactive organic compounds.
1982 – 1983	— Undertakes an MRC Training Fellowship at the University of Bristol Medical School.
1983 – 1991	— Takes a career break to raise three children.
1991	— Completes a Postgraduate Diploma in Information Technology at the University of Keele.
1991 – 1995	— Returns to academia as a Postdoctoral Research Fellow at the University of Oxford.
1995 – 2001	— Appointed Royal Society University Research Fellow at the University of Oxford. — Titular Professor at the University of Oxford.
2001 – 2009	— Appointed Professor of Mass Spectrometry in the Department of Chemistry at the University of Cambridge.
2004	— Elected Fellow of the Royal Society, UK. — Receives the Rosalind Franklin Award by the Royal Society, UK.
2006 – 2016	— Holds a Royal Society Research Professorship.
2009-Present	— Appointed Dr Lee's Professor of Physical and Theoretical Chemistry at the University of Oxford. — Elected Fellow of the Academy of Medical Sciences.
2010	— Awarded the Davy Medal from The Royal Society UK.
2013	— Appointed Dame Commander of the Order of the British Empire.
2015	— Receives the L'Oréal-UNESCO Women in Science Award.
2016	— Co-founds OMass Therapeutics, applying mass spectrometry innovations to drug discovery.
2018 – 2020	— Serves as President of the Royal Society of Chemistry.
2019	— Receives the Royal Medal from the Royal Society, UK.
2021	— Founder Director of the Kavli Institute for Nanoscience Discovery at the University of Oxford.
2022	— Receives the Louis-Jeantet Prize for Medicine. — Awarded the Benjamin Franklin Medal in Chemistry from The Franklin Institute, USA.
2024	— Receives the European Inventor Award for Lifetime Achievement. — Inducted to the National Academy of Inventors.

3. Contribution of women to patenting

3.1. Women's participation in inventive activity: Evidence from EPO data

This section provides an update of the statistical evidence on women's patenting activity at the EPO in the 39 contracting states to the European Patent Convention (EPC). Besides extending the time coverage of the main indicators up to 2022 (most notably the "women inventor rate", WIR) it shows some additional analyses per type of patent applicant, technology field, and more in-depth cross-country comparisons.

Two key features of the first EPO report on women inventors (EPO, 2022) were the use of disambiguated inventor data for the production of statistics not just at the patent level, but also at the inventor level, and the use of inventors' names, jointly with ethno-linguistic information, for gender attribution. This update makes use of the same type of data, so we refer readers to the annexes to the 2022 report for a detailed description of both methodologies, for both disambiguation and gender attribution. The same applies to all methodologies for classifying patents by technology and applicant type. As regards the classification by applicant type, we have adopted a slightly different methodology that distinguishes between universities and public research organisations, large business enterprises with patent portfolios in the top 5% of the distribution, and the remaining applicant types, mostly including startups, small and medium-sized enterprises and individual inventors. Annex 1 to this update contains information on the gender attribution rate (percentage of inventors whose name can non-ambiguously associate to a gender) per EPO member state and selected non-EPC countries, as well as on the total number of patents and inventors considered.

One important reason for using disambiguated inventor data resides in the consequent possibility of computing – along with patent-based statistics on the presence of women among the inventors of given patents – an inventor-based indicator such as the women inventor rate (WIR) which measures the percentage of women inventors among all inventors in patent applications within a given time period and/or country, technological field or group of applicants.

3.1.1 Women's inventorship in EPO member states, 2013–2022

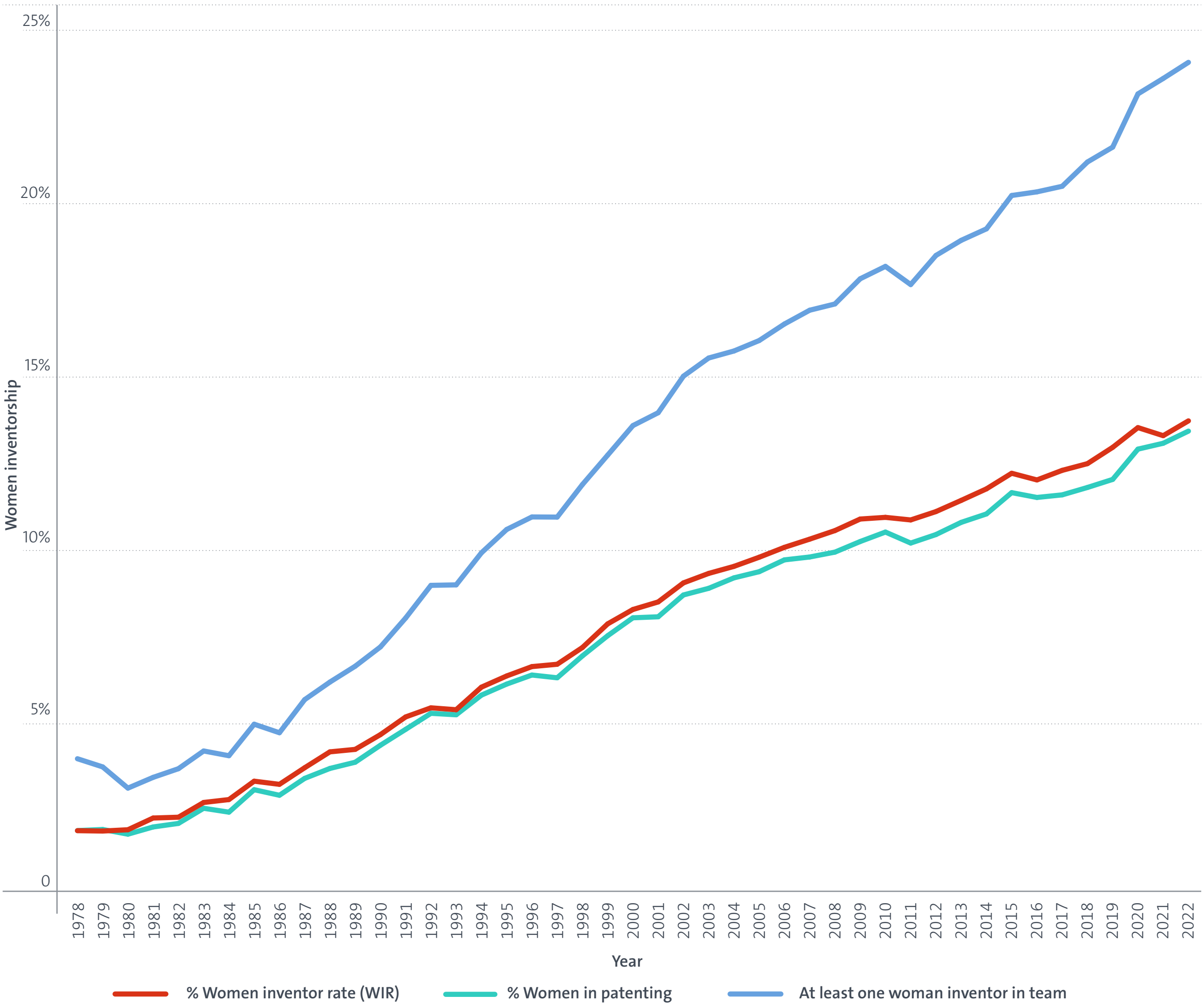
While WIR is our main metric of interest, the patenting activity of women has been frequently assessed by other reports using indicators that do not require any disambiguation of inventors, namely the number of patent applications listing at least one woman among their inventors[1] and the women's share of patents, based on the fractional attribution of each patent application to its inventors and the aggregation of these fractions by gender. Figure 3 presents all three indicators, not by priority year (as in most tables and figures of this update) but by application year to avoid problems with right truncation due to delays in publication of patent applications.[2] All trends identified in the 2022 EPO report are confirmed, suggesting that – whichever metric is used – women's patenting activity appears to be increasing, but linearly rather than exponentially, which makes closing the gender gap a rather distant perspective. The WIR rose from around 2% in the late 1970s to around 13% in 2019, and further to 13.8% in 2022, indicating that the gender gap remains substantial over the entire period. It is notable that WIR is always slightly higher than the women's share of patents and lower than the share of patents with at least a woman inventor, which increased from less than 4% around 1980 to 21.6% in 2019 and 24.1% in 2022. As explained in this update, these differences are largely due to women patenting mainly as members of inventor teams rather than as individual inventors and, although to a lesser extent, to women having lower productivity than men, as measured by the number of patents filed per year. The increasing gap between WIR and the share of patents held by women indicates that women's participation in patenting via team activities is progressing much more quickly than that via individual patenting.

1 The share of EP applications with at least one woman inventor is regularly reported by the EPO in its annual Patent Index: https://www.epo.org/en/about-us/statistics/patent-index-2024/statistics-and-indicators/applicants/women-inventors

2 For this update the PATSTAT version April 2025 was used.

Figure 3

Women's participation in patenting in EPO member states, various measures, 1978–2022



Note: "Year" refers to the application incoming year at the EPO.

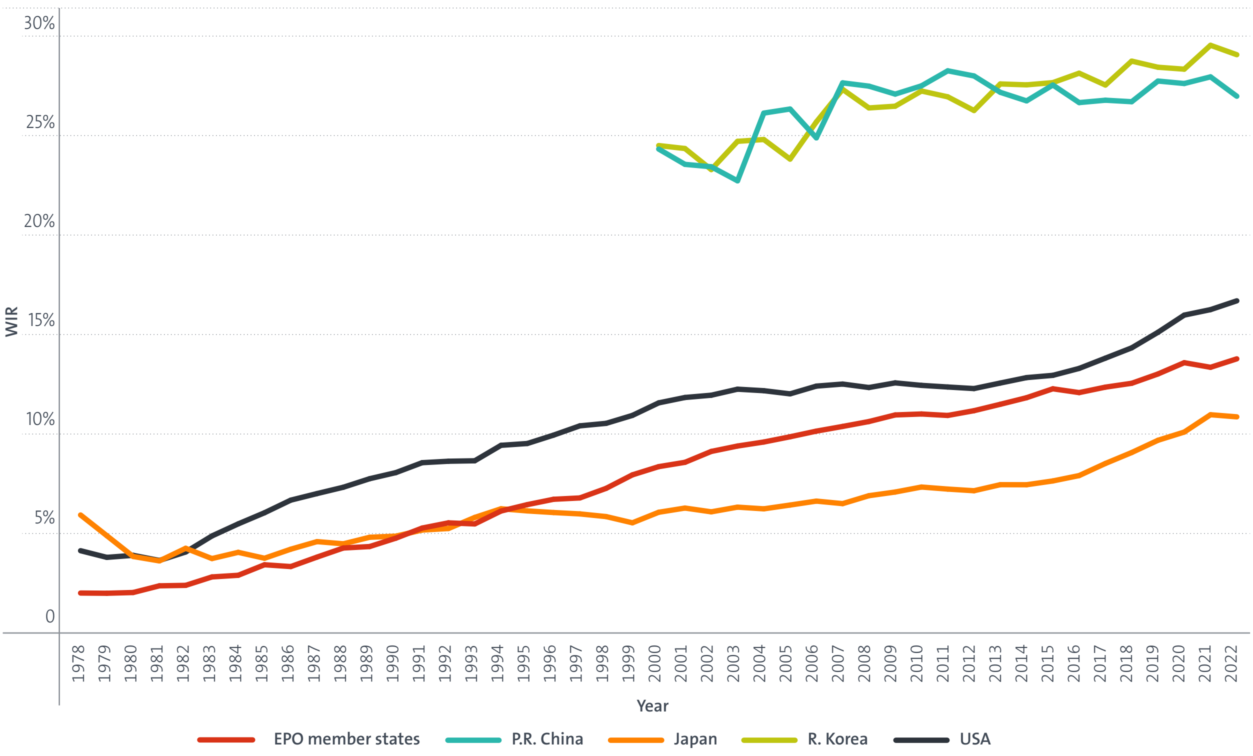
Source: EPO - PATSTAT

Figure 4 presents – also by application year – the value of WIR for the ensemble of the EPO member states and for selected non-EPO countries with large patent portfolios, namely the United States, Japan, China and South Korea. The WIR for US inventors, at 16.7% in 2022, remains higher than the combined rate of all EPO member states. Japanese inventors, by contrast, display a lower WIR of 10.9%. Interestingly, the WIR gap between Europe and Japan has narrowed in recent years, whereas the gap between European and US inventors has begun to widen again after reaching near parity in 2015.

The values reported for China (27%) and South Korea (29%) in 2022, and in particular their relatively high levels compared with other countries, should be interpreted with caution, as gender attribution for these two countries lacks precision (owing to a high number of false positives) and may result in an overestimation of the WIR (see Annex A.1.3 in EPO, 2022).

Figure 4

WIR in EPO member states compared with top non-EPC countries, 1978–2022



Note: "Year" refers to the application incoming year at the EPO.

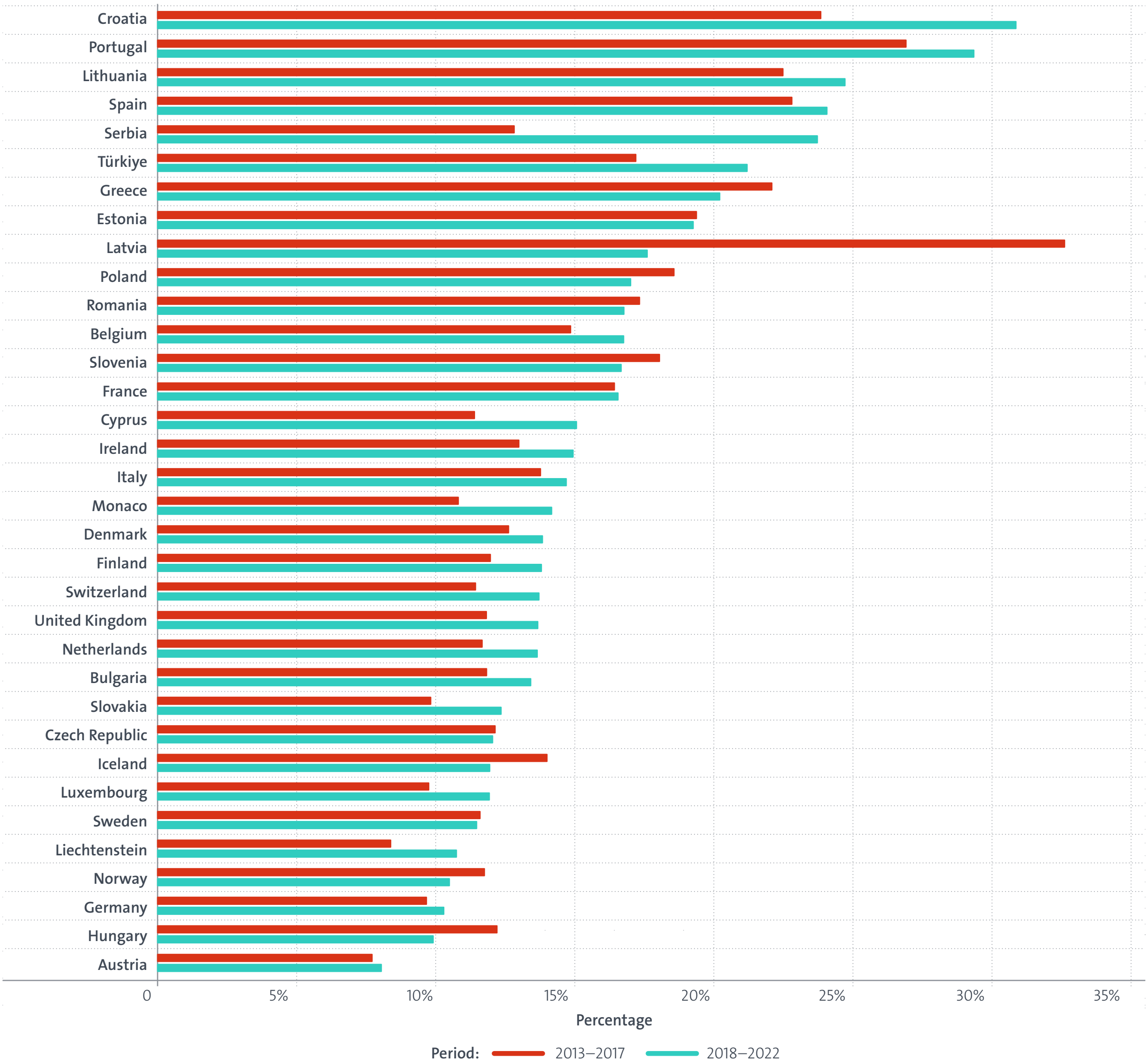
Source: EPO - PATSTAT

Figure 5 presents WIR values for two time periods, 2013–2017 and 2018–2022, by EPO member state, provides a good indication of more recent developments. With a few exceptions, it appears that WIR keeps increasing – albeit moderately – in most countries, and the country ranking has remained rather stable. Latvia, Serbia, Lichtenstein, Iceland and Monaco are the main exceptions, most likely due to their relatively low number of inventors, which increases the volatility of the indicator (Figure 5 excludes Albania, North Macedonia, Montenegro and San Marino for this same reason).

Two other exceptions, with a significant number of inventors, are Türkiye, whose WIR increases more markedly than in most other countries, and Hungary.

Figure 5

WIR (in %) by EPO member state, 2013–2022 (priority year)

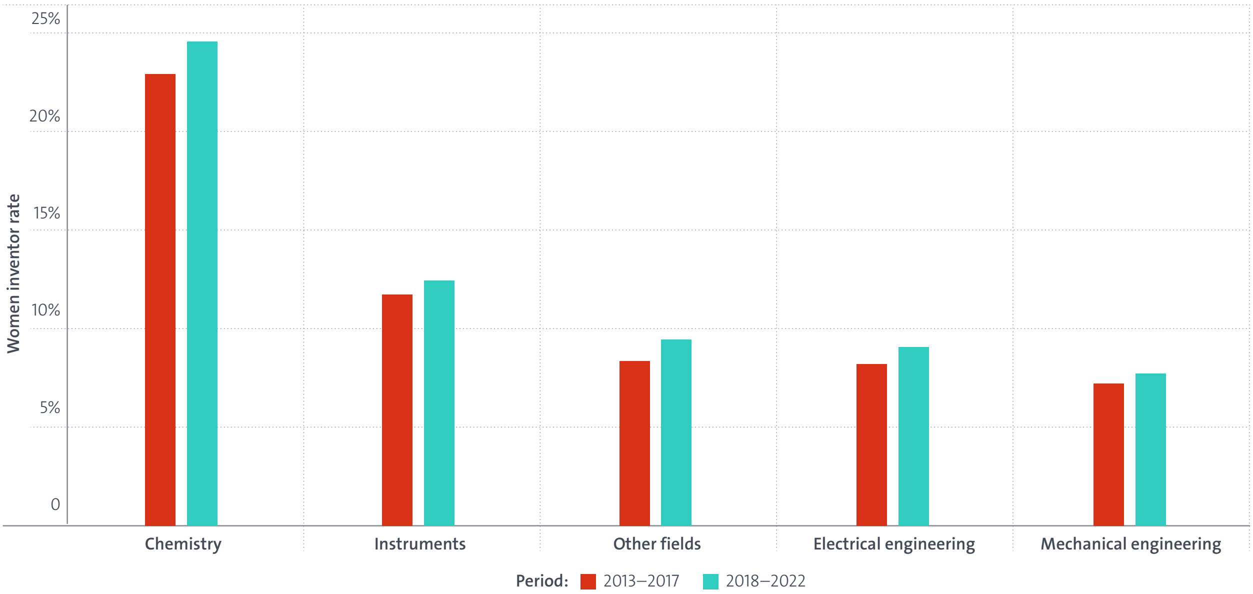


Source: EPO - PATSTAT

Note: The Figure includes all EPO member countries except Albania, North Macedonia, Montenegro and San Marino, whose number of patents is too small to provide a meaningful WIR estimate.

Figure 6

WIR (in %) across technological sectors, 2013–2022



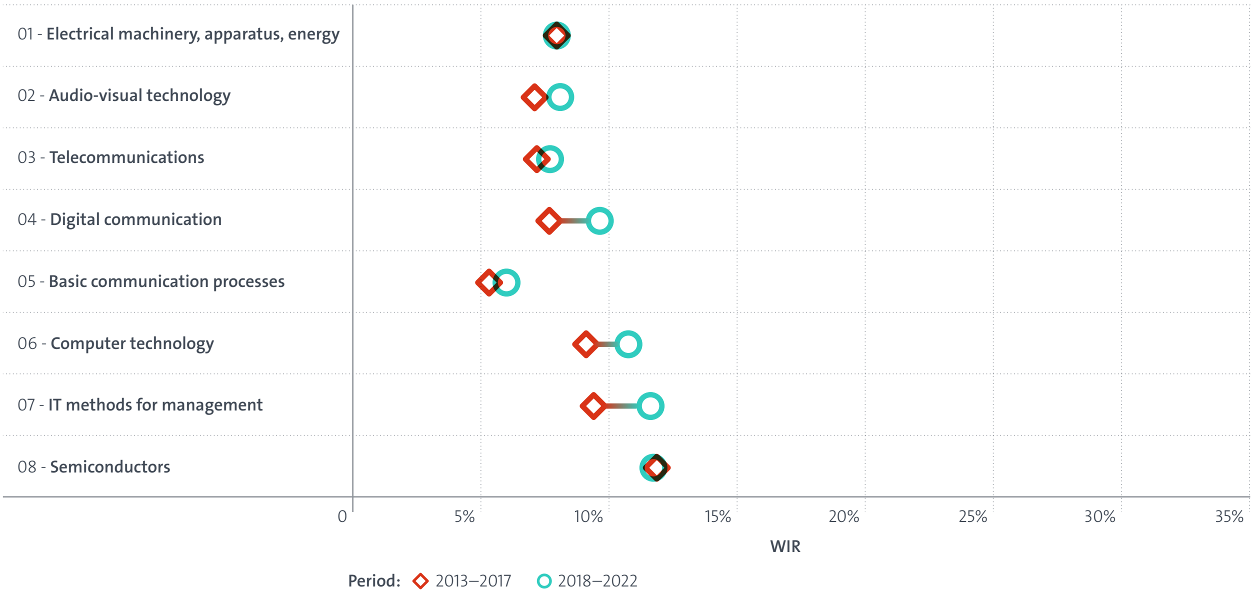
Source: EPO - PATSTAT

Figure 6 examines WIR across broad technological sectors and shows that its value has increased in all of these sectors. Chemistry remains by far the sector with the highest WIR, with 24.6% in 2018–2022 with no sign that other sectors are catching up. Mechanical engineering remains the field with the lowest WIR in the 2018–2022 period, with only 7.7%. Figures 7 to 11 below provide details for finer classification across 35 technology fields. Figure 9 in particular shows how results for Chemistry are driven mostly by Biotechnology (34.1% in 2018–2022), Pharmaceuticals (34.9%) and a handful of specialty fields including Organic fine chemistry (30%) and Food chemistry (32.3%). The same holds true – with respect to Instruments – for results for Analysis of biological materials (27.5%). The remaining fields exhibit the same variance, with all fields therein exhibiting rather low WIR values.

Three sectors of Electrical Engineering (Digital communication, Computer technology and IT methods for management) as well as two in Instruments (Analysis of biological materials and Control) and two in Chemistry (Pharmaceuticals and, especially, Food chemistry) mark significant increases in WIR. A noticeable increase is also visible in Textile and paper machines (Mechanical Engineering) and in Other consumer goods (Other Technologies). This confirms that the general increase in WIR is not driven entirely by one specific technology sector or field.

Figure 7

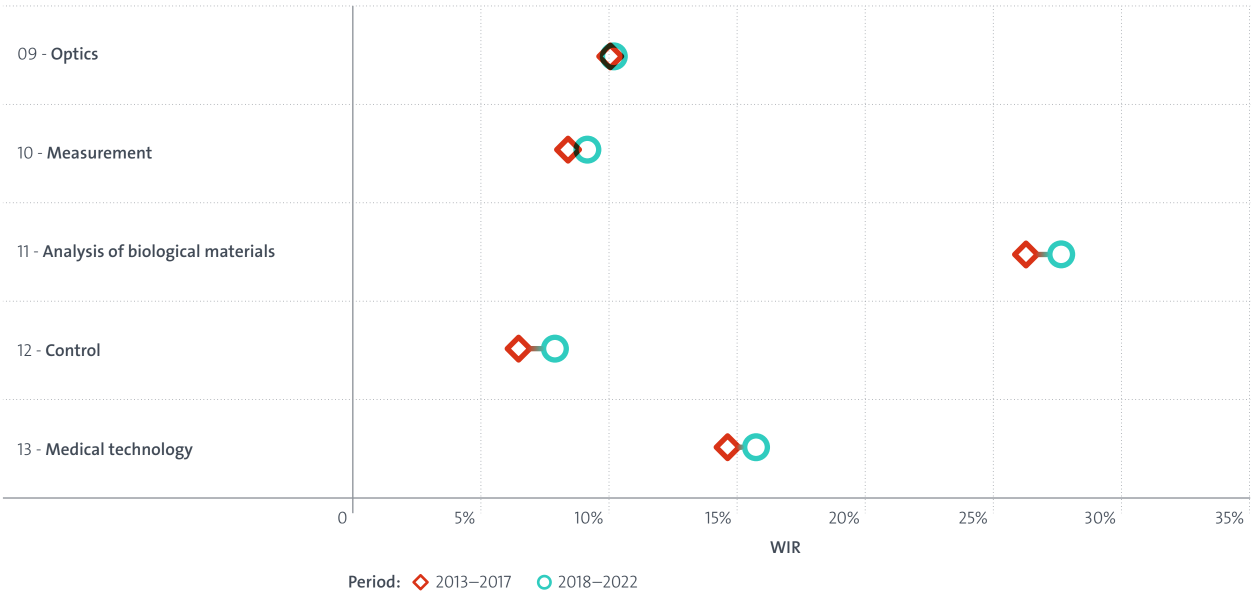
WIR across technological sectors, 2013–2022 (Electrical Engineering)



Source: EPO - PATSTAT

Figure 8

WIR across technological sectors, 2013–2022 (Instruments)



Source: EPO - PATSTAT

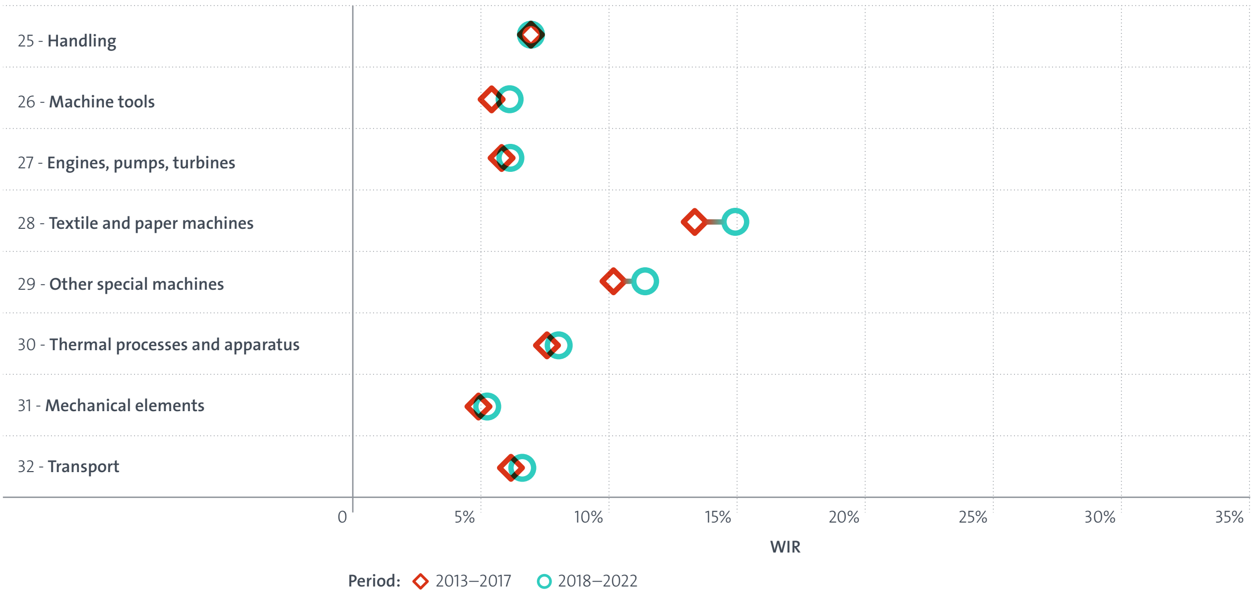
Figure 9

WIR across technological sectors, 2013–2022 (Chemistry)

Source: EPO - PATSTAT

Figure 10

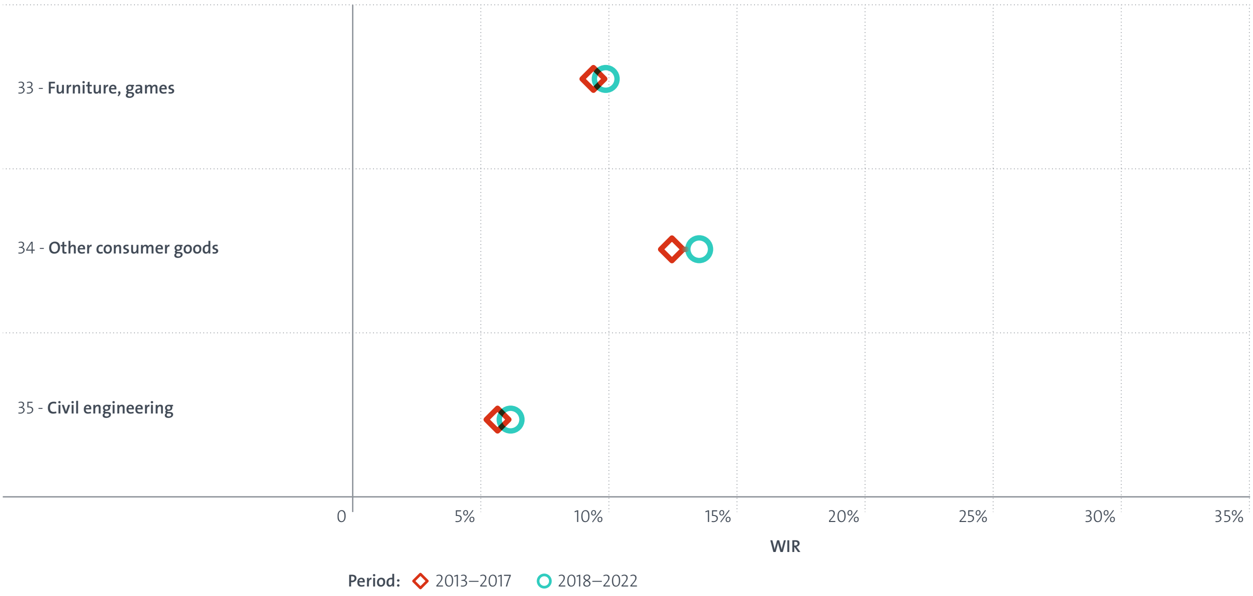
WIR across technological sectors, 2013–2022 (Mechanical Engineering)



Source: EPO - PATSTAT

Figure 11

WIR across technological sectors, 2013–2022 (Other Technologies)



Source: EPO - PATSTAT

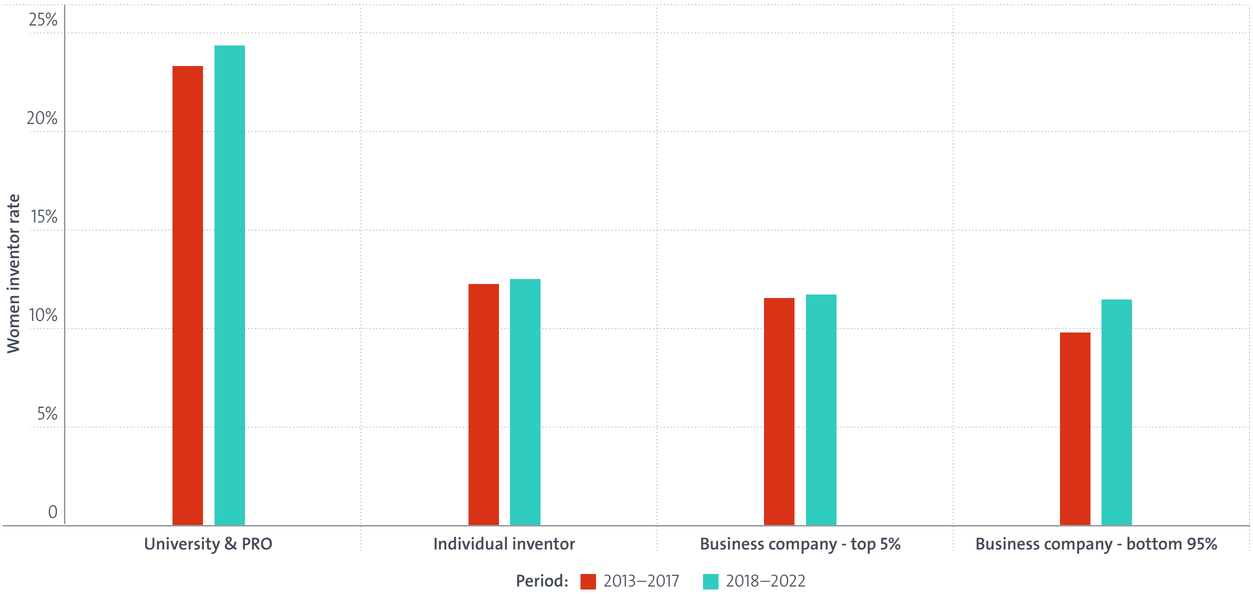
Figure 12 presents the WIR for different types of patent applicants, namely Individual inventors, Business companies, and Universities and public research organisations (PROs, including hospitals, non-profit organisations and governmental agencies). Business companies are further split between those in the top 5% of the size distribution and the remaining 95% of companies where size is defined by the number of patent applications filed at EPO and listing at least one inventor in an EPO member country, with priority years 2013–2022.[3] The value of WIR for Universities and PROs, with 24.4% in 2018–2022, is much higher than those of the other categories, which, by contrast, are rather similar (12.5% for Individual inventors; 11.4% and 11.7% for small and large Business companies, respectively).

This is explained first and foremost by the very high and specific specialisation of academic inventors, who are relatively more active in the highest WIR technology fields, namely Biotechnology and Pharmaceuticals (Lissoni, 2012; EPO, 2024; EPO, 2025). Second, most universities in EPO member countries are public and/or more receptive to gender parity policies put in place by their governments, which may more generally increase their WIR value, regardless of the technology. Notice, however, that Business companies in the top 5% filed 62.5% of the patent applications in the reference period, which means it is primarily their specialisation and inventor recruitment patterns that most strongly affect the observed country-level WIR values. Last, we also note that WIR increases over time for all types of applicants, with the highest absolute increase for Business companies falling in the bottom 5% of the size distribution, from 9.8% to 11.4%, which confirms the generality of the trend.

3 For details on the classification of applicant types, see Annex 1.

Figure 12

WIR (in %) by applicant type



Source: EPO - PATSTAT

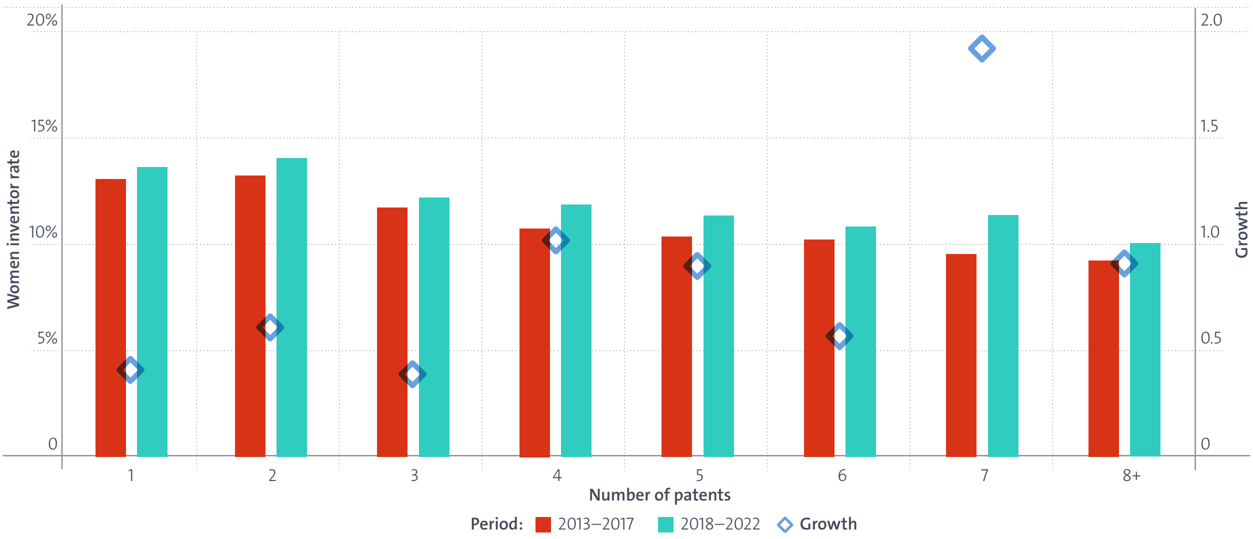
Note: The applicant type classifiers and the applicants' unique identifiers used for calculating the number of patent applications for each applicant vary based on the EEE-PPAT enhancements to PATSTAT (https://www.ecoom.be/en/data-collections/patstat-enhancements). The top 5% of Business companies are those falling in the top 5% of the size distribution, with size defined as the number of EPO patent applications filed as first applicants and with at least one inventor's address in an EPO member country, for the priority years 2013–2022.

When it comes to productivity (number of patent applications contributed by an inventor over a given time period), women appear to lag behind men but are slowly catching up. Figure 13 presents the WIR values for different groups of inventors based on their productivity, as measured in two-time intervals, 2013–2017 and 2018–2022. The groups run from inventors with just one patent in the period to inventors with eight or more patents. The WIR is higher in the lower productivity groups but increases in all groups, especially in those with four, five, seven, or eight or more patent applications in each period.

The gender analysis of productivity based on WIR by productivity groups has two limitations. First, it does not consider the possible composition effects, namely the possibility that the average productivity of inventors varies by field, and it is lower in those in which women patent the most. Second, it does not consider that women are on average less experienced inventors than men, since their number has been increasing over time, and therefore it is the lower, i.e. the older cohort of inventors we consider. To the extent that more experienced inventors still in activity may be laboratory directors or team leaders, we may expect them to sign more patents than their more junior collaborators. These, in turn, may include a disproportionate number of women, who mostly patent in teams.

Figure 13

WIR (in %) across productivity groups of inventors, 2013–2022



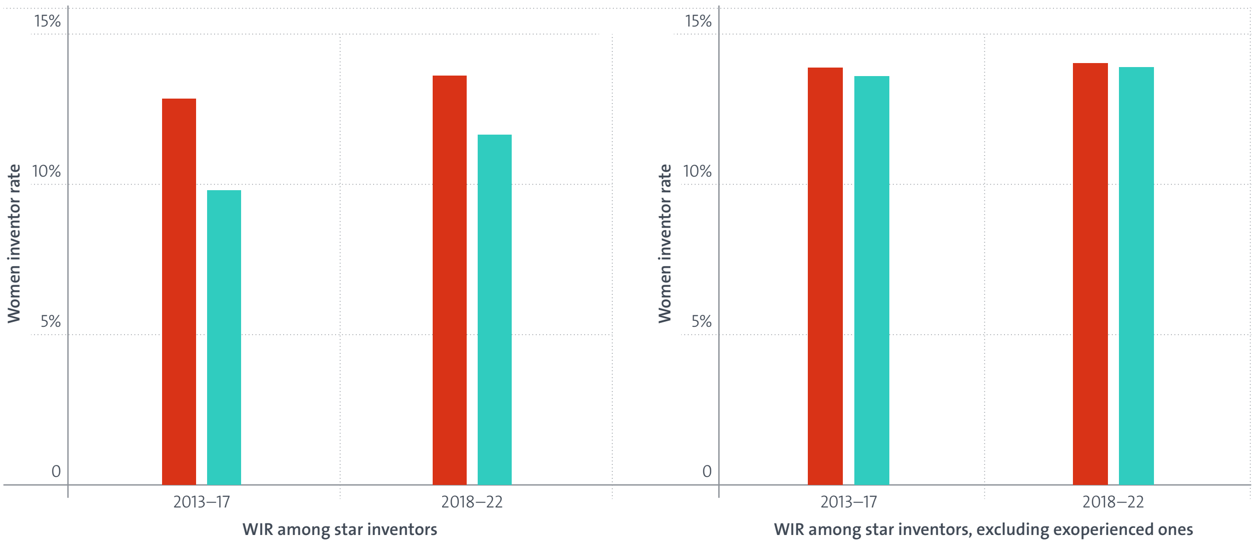
Source: EPO - PATSTAT

Figure 14 provides evidence that is less affected by the experience effects. The left-hand graph compares the WIR values for "star inventors" (the inventors in the top 5% of the patent-per-person distribution of each technological field) to that of all others, for the two periods 2013–2017 and 2018–2022. The right-hand graph reports the same statistics after excluding from the sample all experienced inventors, namely those whose first-ever filed patent has a priority year preceding the beginning of each period.

In the left-hand graph, WIR is higher for non-star inventors than for the stars, but the gap decreases in the second period. In the right-hand graph, the gender gap for star inventors disappears almost entirely, which suggests that it is mostly due to composition effects in terms of experience and may close entirely among future generations of star inventors. Note that, having selected the star inventors from all technological fields, the values in the figures are not due to composition effects.

Figure 14

WIR (in %) for star inventors, including/excluding experienced inventors, 2013–2022



Source: EPO - PATSTAT

Note: Star inventors are identified as the most productive inventors in terms of patents produced (top 5%) for each time period, considering only EPO-based inventors.

3.1.2 Inventor gender gap analysis

The WIR country ranking in Figure 5 above does not take into account the sectoral composition effects described in the tables and Figures 6 to 12. In what follows, we develop a simple gender gap indicator, which is intended to measure the cross-country WIR differences that do not result directly from differences in the technology specialisations of countries, but are possibly due to cultural or institutional factors, such as the differences in women's access to STEM higher education or the industrial R&D labour market.

We proceed in three steps. First, we calculate the average WIR value for each technology field, regardless of the country (that is, for our entire sample), which we indicate with WIR_t, where t stands for technology. Second, we produce an "expected" value of WIR for each country c, which consists of the weighted average of WIR_t, as follows:

$$\mathrm{WIR}_c^{exp} = \sum_t \mathrm{WIR}_t \, s_{(t,c)} \qquad (1)$$

where $s_{(t,c)}$ technology t's share of inventors in country c.

Third, we calculate a "WIR gap" for country c as the difference between the observed WIR value (WIR_c, as reported in the previous section) and the expected one, as follows:

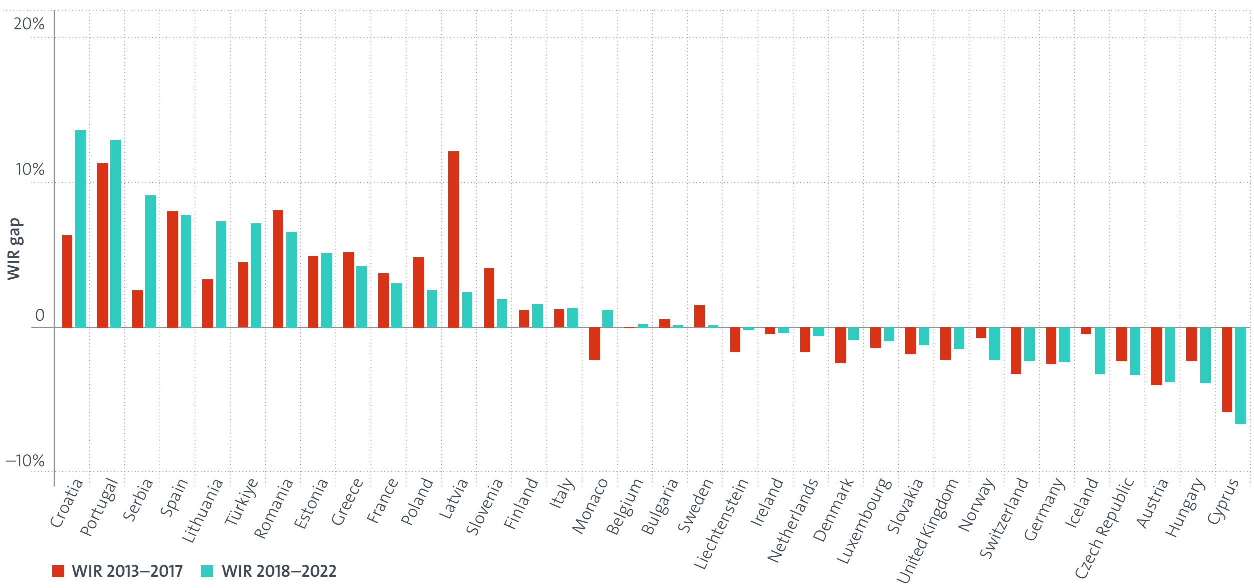
$$\mathrm{WIR}_c^{gap} = \mathrm{WIR}_c - \mathrm{WIR}_c^{exp} \qquad (2)$$

The WIR^{gap} may be either null, negative or positive. A value of WIR^{gap} equal to zero indicates that – for the purpose of cross-country comparisons – the observed WIR is entirely explained by the country specialisation (that is, the WIR in each technological field is equal the international average WIR_t). When negative (positive), the WIR^{gap} indicates that the observed WIR is lower (or higher) than what we expected had its value been entirely determined by the specialisation of the country. This must be the case due to differences, at least in a few technologies, between the country WIR and its international average. Note, however, that the size of the WIR^{gap} still depends on the country's specialisation, because this amplifies the WIR differences at the technological level.

Figure 15 replicates the ranking in Figure 5, this time based on their WIR^{gap}. Table A1.3 in Annex 2 reports both the WIR and the WIR^{gap} for all countries and both periods of interest.

Figure 15

Gender WIR gap (in %) by EPO member state (technology sector composition effects), 2013–2022 (priority year)



Source: EPO - PATSTAT

Note: This table reports the WIR^{gap} indicator. A value close to zero indicates that the observed WIR (as per Figure 5) is entirely explained by the country specialisation. A negative (or positive) value indicates that the observed WIR is lower (or higher) than we could expect from the country specialisation.

While intuitive, the WIR^{gap} indicator does not explain why a country may fall short of its expected WIR based on its technology specialisation. This may have to do with other composition effects besides specialisation, such as the weight of universities and PROs on the total patenting activity of a country. Albeit highly correlated with the country's technology specialisation (which is mostly determined by that of its business sector and its large number of patents), this may also have to do with the overall strength of business R&D in the country. In countries with a weaker business R&D, especially in the absence of large companies, the weight of academic research and patenting may be higher. To investigate this, we re-calculate the indicator of the expected WIR in each country, this time based not just on the average WIR of technology sector, but on the average WIR of the combination of sector and type of applicant, namely:

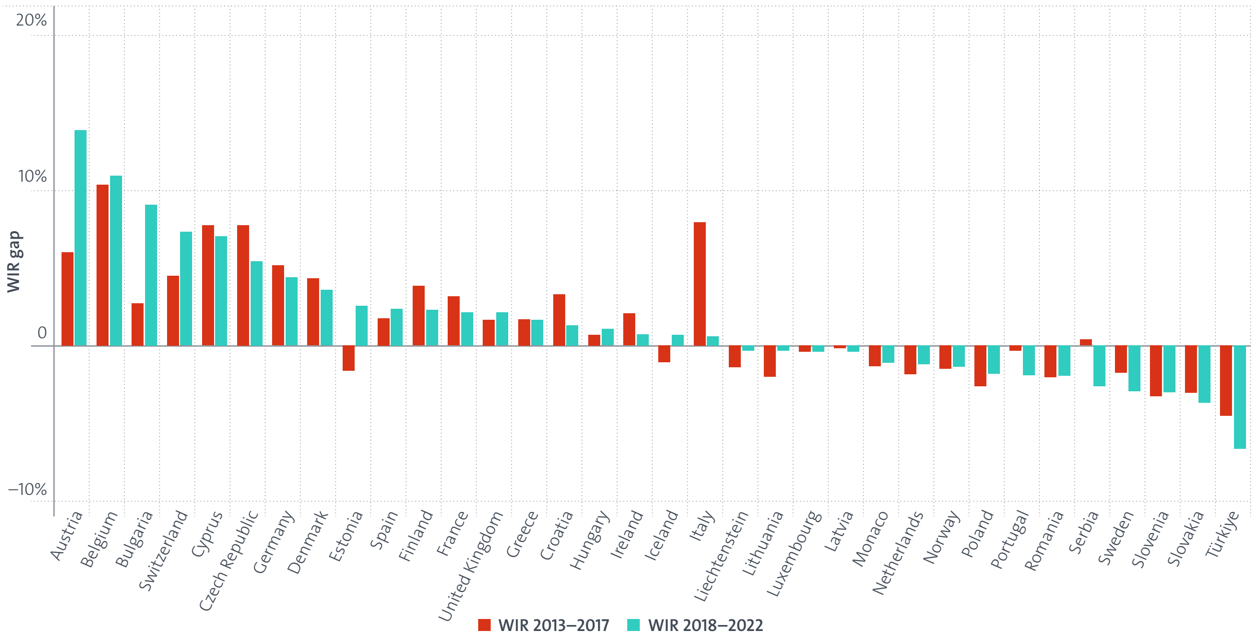
$$WIR_c^{(exp\text{-}a)} = \sum_{t,a} WIR_{t,a}\, s_{t,a,c}$$

where $s_{t,a,c}$ is the share of inventors from country c that patent in technology t with applicant type a.

Figure 16 replicates Figure 15, but with the WIR gap calculated on the basis of $WIR_c^{(exp\text{-}a)}$, that is, taking into account both the composition effects due to each country's specialisation and those due to the relative weight of different applicants' type. We notice only minor changes in the country ranking. In particular, no country's WIR gap changes sign, except for those very close to zero or a few countries with a very small number of patents, which makes the indicator not fully reliable.

Figure 16

Gender WIR gap (in %) by EPO member state (technology sector and applicant type composition effects), 2013–2022 (priority year)



Source: EPO - PATSTAT

Note: The table reports the WIR^{gap} indicators which consider both the country technology specialisation and the weight of different types of applicants on patenting activity.
A value close to zero indicates that the observed WIR (as per Figure 2 in the previous section) is entirely explained by the country or regional specialisation.
A negative (or positive) value indicates that the observed WIR is lower (or higher) than we could expect from the country specialisation.

In general, the persistence of WIR gaps different from zero after considering multiple sources of composition effects suggest the existence of country-specific barriers to women to inventive activities that are unrelated to specialisation or the public-private balance in R&D activities. Further investigation of these issues should be a research priority.

3.1.3 Regional analysis of the inventor gender gap

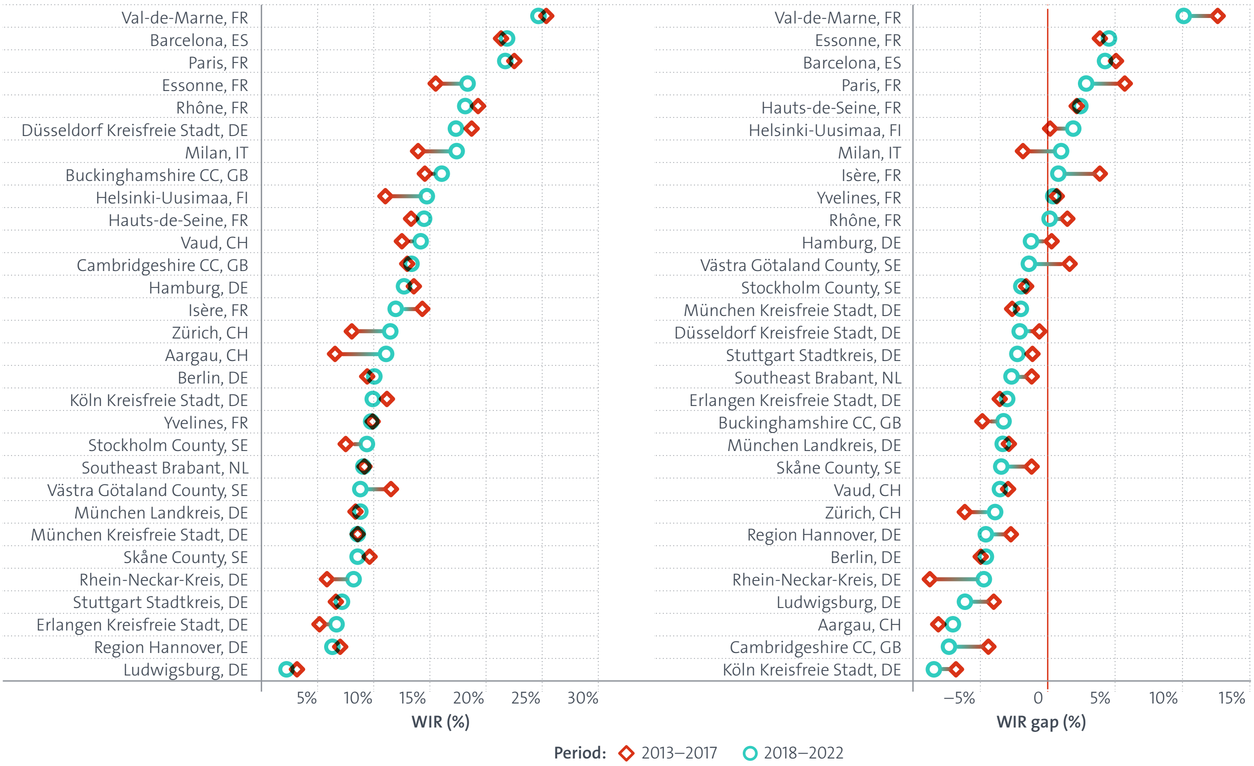
In what follows we show the WIR and the WIR gap for the top-30 largest patent clusters (NUTS3 areas), measured as the largest source of European patent applications in the period 2013–2022, as well as for the top 30 fastest growing patent clusters where growth is measured by the percentage increase in the number of European patent applications filed in the 2013–2022 period relative to 2003–2012.

Figure 17 examines WIR and the WIR gap (as defined in the previous section) in the top geographical clusters of innovation in the EPO member states, namely the NUTS3 regions with the highest number of patent applications filed from 2013 to 2022. Most of such clusters are located in France and Germany, but we also find three each in Switzerland (Vaude, Zurich and Aargau) and Sweden (Stockholm, Västra Götaland County and Skåne County), two in the United Kingdom (Buckinghamshire and Cambridgeshire), and one each in Spain (Barcelona), Italy (Milan), Finland (Helsinki) and the Netherlands (Southeast Brabant). The clusters are ranked from top to bottom according to the value of WIR in the 2018–2022 period, next to which we also report the value for 2013–2017.

In the left-hand graph, we note that – with the exception of Düsseldorf and, to a lesser extent, Hamburg – all German clusters show WIR values far below the French values. Note, however, that the top French clusters have WIR values far above the national average, while the bottom German ones stand far below it. Swedish clusters also report rather low WIR values, all of which are in line with the national average. Barcelona's WIR value is close to (and possibly determines) that of Spain, and the same holds true for the British ones. In contrast, the values for Milan and Helsinki stand above the respective national values. With no more than a few exceptions, e.g. Isere (FR) and Västra Götaland County (SE), for most regions the WIR value for 2018–2022 is close to or greater than that for the previous period.

Figure 17

WIR and WIR gap (in %) in the top 30 European regions, 2013–2022



Source: EPO - PATSTAT

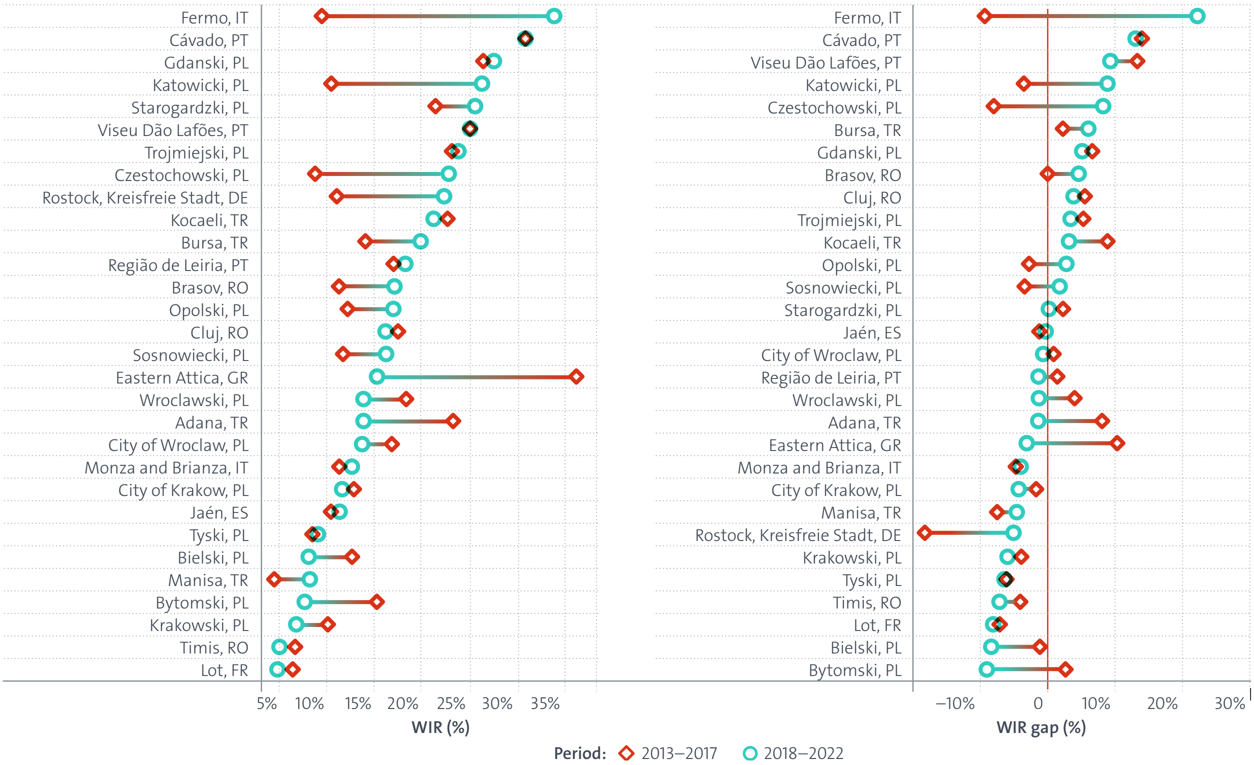
Note: The top 30 most innovation clusters are defined as the NUTS3 regions with the 30 highest shares of EPO patent applications, for the priority years 2013–2022. Patent applications are fractionally assigned to regions on the basis of the number and addresses of their inventors. No attention has been paid to the applicants' addresses, which may be in a different NUTS3 region than the inventors'. On NUTS3 regions, see: https://ec.europa.eu/eurostat/web/nuts.

The right-hand graph in Figure 17 reports the WIR gap, calculated using the same methodology that considers technology specialisation as in the previous section (see also Figure 15), but also takes regions into account. We note that the WIR gap is either zero or positive for most regions, and especially those with higher WIR values. This suggests that the regions that record high participation of women in inventive activities do so either thanks to their technology specialisation (zero WIR gap) and/or to a higher-than-average participation in one or more technological fields. A few clusters exhibit a negative WIR gap, which is indicative of a lower-than-average participation in one or more technological fields, and this is especially the case of the Swiss clusters and some German ones. Cambridgeshire in the UK is a special case, with a very high WIR – most likely due to a strong specialisation in biotechnology and pharmaceuticals – but a negative WIR gap, which is indicative of relatively low participation of women in those same technology fields.

Figure 18 is analogous to Figure 17, but for the 30 fastest growing clusters. None of these are among the top 30, and most of them are located outside the countries hosting them (we find only one French cluster – Lot – and one German cluster – Kreisfreie Stadt Rostock – and no British or Dutch cluster). Almost half are in Poland, four in Türkiye, three in Portugal as well as in Romania, and the remainder in Greece, Spain and Italy. Only a few clusters exhibit a negative or null WIR gap, which suggests that most of the observed WIR values are not due entirely to the clusters' technology specialisation, but also to a higher-than-average participation of women to inventive activity in the sectors of specialisation. No country pattern emerges, in the sense that regions belonging to the same country do not exhibit similar WIR or WIR^{gap} values.

Figure 18

WIR and WIR gap (in %) in the 30 fastest growing clusters, 2013–2022



Source: EPO - PATSTAT

Note: Growth is defined as the percentage increase in the cluster patents in the period 2013–2022 relevant to 2003–2012. The 30 fastest growing clusters are the NUTS3 regions with the highest growth rate. Patent applications are fractionally assigned to regions on the basis of the number and addresses of their inventors. No attention has been paid to the applicants' addresses, which may be in a different NUTS3 region than the inventors'. On NUTS3 regions, see: https://ec.europa.eu/eurostat/web/nuts..

3.1.4 Conclusions on women's participation in inventive activity in Europe

The role of women in patenting has continued to expand. However, this growth has been broadly linear rather than exponential. While women's inventor rates have risen steadily, the pace of change remains insufficient to close the gender gap in patenting in the foreseeable future. In particular, progress in patenting continues to lag behind women's participation in upstream STEM education and research, reinforcing concerns that improvements, while real, are not fast enough to translate into parity.

One factor that may help explain the low participation of women in patenting is that women graduates in STEM disciplines progressively withdraw from patent-related activities as they pursue research careers (see Section 5). In addition, the proportion of women in senior academic positions or in leadership roles in R&D projects is substantially lower than their proportion among students, a gap that widens as one moves up the professional ladder (Alper, 1993; Delgado and Murray, 2021). Although many descriptive analyses in this area rely on data that combine different cohorts and life stages in men's and women's research careers, available longitudinal analyses also show lower representation of women in positions of responsibility in research and innovation. However, more recent evidence indicates that a gradual shift in this trend is occurring in some sectors and institutions. The gender gap in research funding has narrowed substantially in recent years (Cruz-Castro et al., 2022).

The EPO (2022) report on women's participation in inventive activity identified two further central stylised facts. First, the gender gap in patenting varies markedly across technologies and applicant types: women are more strongly represented in science-based fields – particularly those close to the life sciences – and in patenting carried out by universities and public research organisations, where their presence is systematically higher than in corporate patenting. Second, women's participation in patenting is closely associated with teamwork: women are more frequently found in collaborative inventor teams, although they remain under-represented in senior or leadership positions within those teams.

The evidence assembled in this update confirms both stylised facts. Across countries and over time, women continue to be disproportionately active in science-intensive technologies and in public-sector research environments, and their participation in patenting remains closely linked to the growing importance of collaborative invention. These patterns appear remarkably persistent, suggesting that the structural features highlighted in the original report continue to shape women's inventive activity.

However, lower involvement of women in business-driven projects, or in sectors other than chemistry, may result in important human needs being overlooked, thereby slowing progress and societal well-being. According to Feng et al. (2021), "innovators tend to create products that are more likely to be adopted by people similar to them along observable dimensions" (p. 1). Gender plays a prominent role among these observable dimensions, and disparities in gender can affect the diversity of technological solutions and generate structural biases in the orientation of research, as shown by Nielsen et al. (2017) in their analysis of academic publications.

Koning et al. (2021) find that biomedical patents invented by women are more likely to propose solutions to problems specifically related to women's health, whereas those invented by men tend to focus on male-related problems. Taken together, these findings suggest that the scarcity of women inventors may negatively affect the scope and inclusiveness of technological development.

Moreover, this section sheds further light on cross-country differences. Although countries' technological specialisations and the weight of universities and PROs explain an important share of the observed variation, they do not account for it fully. Significant differences remain even after controlling for these factors, indicating that additional country-specific elements may be at play, such as institutional settings, labour-market structures, organisational practices or cultural norms.

Finally, a regional perspective shows that, in some countries, women's participation in patenting varies widely. Leading innovation clusters often diverge strongly from national averages, with high participation values reflecting both favourable specialisation and, in some cases, higher-than-average female participation. In fast-growing clusters, rising women's participation cannot be explained by technological specialisation alone.

These patterns underline the importance of local innovation dynamics and suggest that regional factors play an independent role in shaping gender outcomes in patenting. Understanding these residual differences at both the country and the regional level is essential. Investigating these specific drivers of women's participation in inventive activities should therefore be a priority for future research and for the design of more effective, targeted policy interventions.

Despite the overall slow pace of convergence, several encouraging developments emerge from this update. Some specific technology fields have seen notable gains in women's participation in the more recent period, including Food chemistry, Pharmaceuticals, but also Digital communication, IT methods for management and Computer technology, all of which recorded some of the largest recent increases in WIR. Small corporate applicants also show the strongest WIR growth among applicant types. Moreover, among young star inventors, the gender gap nearly disappears once experienced cohorts are excluded, indicating that early-career women increasingly reach similar performance levels as their male counterparts. Finally, Europe's most innovative regions tend to exhibit lower WIR gaps than their national averages, suggesting that leading and fast-growing innovation clusters provide comparatively more inclusive environments for women's inventive activity.

3.2. Women as patent professionals

Patent professionals form the backbone of innovation ecosystems. In Europe[4], four professions play a crucial role in this process: professionals in the private sector such as patent attorneys, patent examiners, members of the Boards of Appeal and patent judges. They support and advise inventors and applicants in business- and IP-related matters, serve as stewards of the patent system, facilitate technology commercialisation and help resolving disputes over IP rights. Most of them need a technical qualification before they can further train for their individual job and fulfil a specific purpose in the patent ecosystem.

Their roles are foundational to innovation ecosystems because they determine which inventions receive protection (influencing R&D investment allocation), enable technology transfer through licensing or partnerships, provide dispute resolution that protects investor confidence and venture capital funding decisions, and, through case law, establish the legal frameworks that signal whether countries will protect intellectual property – as weakened patent systems directly deter investment and limiting access to newest technologies (see EPO 2017, Patents, trade and foreign direct investment in the European Union).

The analysis in the previous section showed that the share of women inventors from European countries filing European patent applications has steadily increased over the past decades. Nevertheless, at only 13.8%, it remains far from gender parity. The purpose of this section is to examine the contribution of women within the patent profession, highlighting their role in the broader innovation ecosystem and how this role has evolved in recent years.

4 The qualifications and responsibilities differ between different states and regions. This text tries to give an overview of the situation in Europe, without going into the details for each state.

3.2.1 Gender gaps in different patent professions

Patent attorneys act as trusted, strategic legal advisors for inventors. They are STEM professionals, which have further qualified to advise and represent their clients in patent matters. They draft, file, and prosecute patent applications, ensuring that the disclosed invention meets all applicable legal requirements. Patent attorneys also conduct prior art searches to assess novelty and advise on the scope of protection. Their expertise in both law and technology helps inventors to navigate the patent grant procedure and advise on the application strategy for a patent portfolio. In contentious matters, patent attorneys represent parties in opposition, nullity, invalidation and patent infringement cases before the various authorities e.g. patent offices and courts.

More than 14 500 “European patent attorneys” (officially “professional representatives before the EPO”) support their clients in dealing with patent matters before the EPO. Of these, over 4 000, or 29.2%, of professionals with disclosed gender, were women.[5] This marks a modest increase in the overall female share compared to 2015, while Figure 19 below shows that gender representation varies considerably across European countries. Germany exhibits the lowest female share among major markets at 20.7%, despite hosting 5 384 patent attorneys in 2025 – Europe’s second-largest professional population. France, by contrast, stands at a significantly higher female share of 40.1% across 1 416 practitioners, ranking among the large jurisdictions with comparatively strong female representation. In several smaller jurisdictions the female share is even higher: Bulgaria leads at 68.3%, followed by Romania at 63.6% and Slovakia at 60.0%. Like WIR and other patent-profession statistics, patent attorney gender gaps partly reflect structural imbalances in STEM education and professional participation across technology domains, and likely mirror the sectoral composition of each jurisdiction’s patent filings.

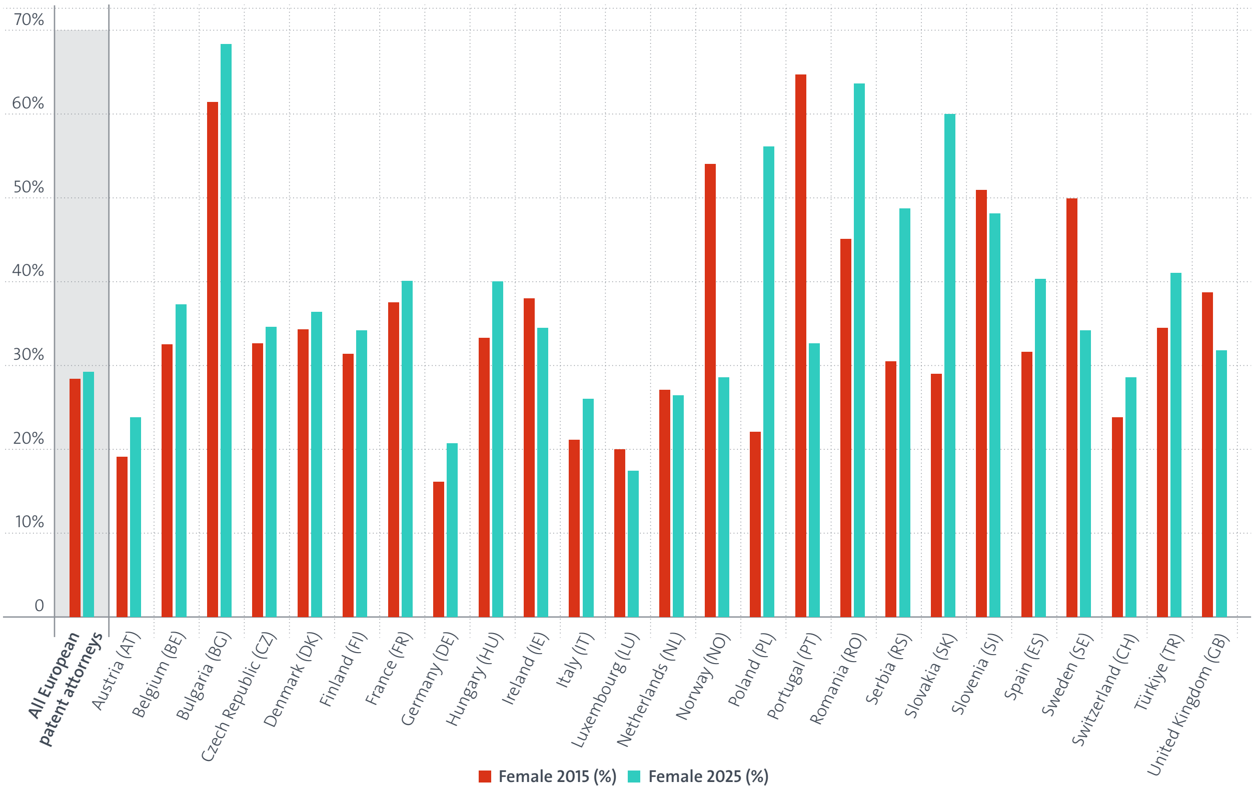
Like WIR and other patent-profession statistics, patent attorney gender gaps partly reflect structural imbalances in STEM education and professional participation across technology domains, and likely mirror the sectoral composition of each jurisdiction’s patent filings.

Examining decade-long trends from 2015 to 2025 reveals divergent trajectories across regions, reflecting both recruitment patterns and workforce turnover dynamics. Changes in female representation result from dual mechanisms: new entrants to the patent attorney profession (potentially reflecting stronger female participation in technical fields) and exits through retirement or career transitions (potentially skewing toward male-dominated cohorts). Several jurisdictions demonstrated consistent progress. Switzerland and Belgium recorded a strong improvement, both gaining 4.8 percentage points (Switzerland: from 23.8% to 28.6%; Belgium: from 32.5% to 37.3%). Germany, despite maintaining the lowest female share among major markets, showed notable improvement of 4.6 percentage points (16.1% to 20.7%), suggesting accelerated female recruitment in recent years. Conversely, some established markets experienced reversals or volatility: Sweden declined by 15.7 percentage points (49.9% to 34.2%), Norway fell 25.4 points (54.0% to 28.6%), and the United Kingdom dropped 6.9 points (38.7% to 31.8%).

5 For 793 European patent attorney gender was not disclosed.

Figure 19

Share of women European patent attorneys by member state in 2025



Note: Only EPO member states with at least 25 registered attorneys in 2025 are considered.
Patent attorneys with undisclosed gender information have been excluded.

Source: EPO

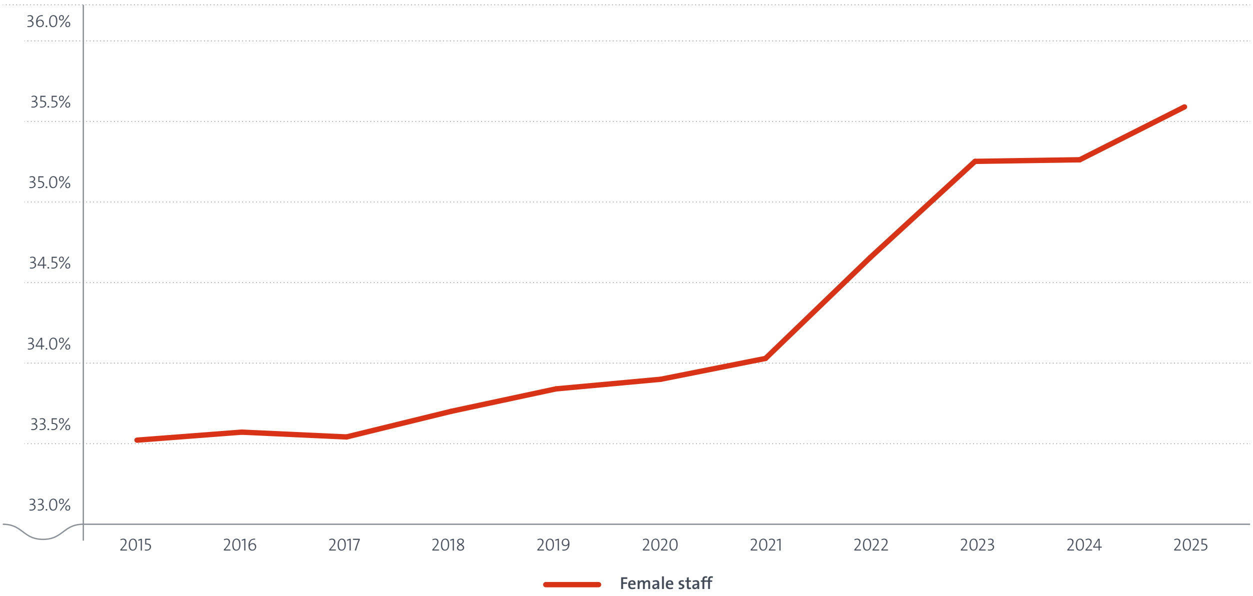
Patent examiners, employed by patent offices, review applications to determine whether an invention qualifies for protection. As STEM professionals highly specialised in their field, they conduct thorough prior art searches, looking though vast datasets of patent literature and other forms of publications. Taking into account the prior art found, they then assess whether the application fulfils the legal requirements for being granted a patent, including the assessment of novelty, inventive step and industrial applicability. Their detailed search and examination ensure that patents are granted only for applications that meet the legal prerequisites, thereby safeguarding the integrity of the patent system and promoting fair competition. The European Patent Office is the largest patent office in Europe, with around 6 000 employees, of which almost 4 000 are highly specialised examiners.

Since 2019, the EPO has made gender balance a priority. This investment has paid off, and the percentage of women staff at the EPO has steadily increased, from 33.7% in 2018 to 35.6% in 2025 (Figure 20).[6]

6 All figures in this subsection refer to the situation as at 31 December of the respective year.

Figure 20

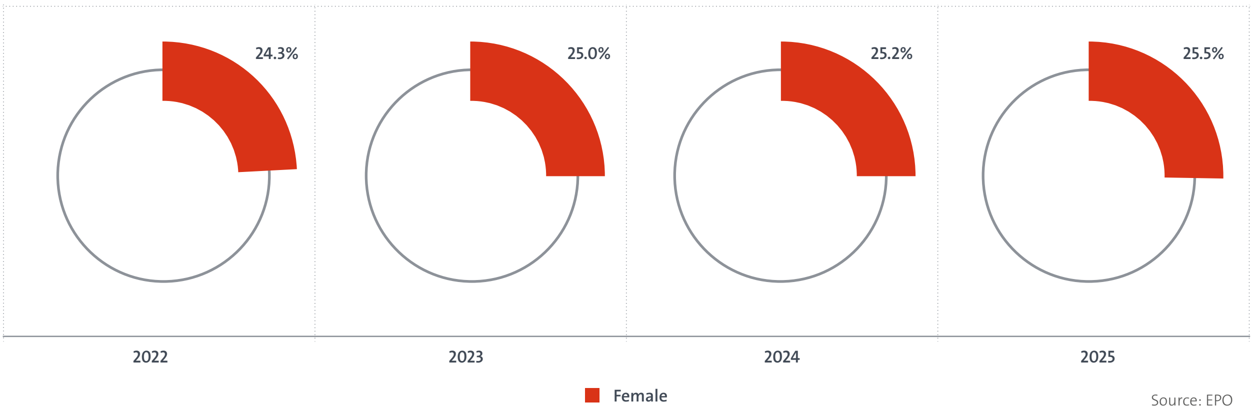
Trend in share of female staff at the EPO (in %), 2015–2025



Source: EPO

Figure 21

Share of female patent examiners at the European Patent Office, 2022–2025



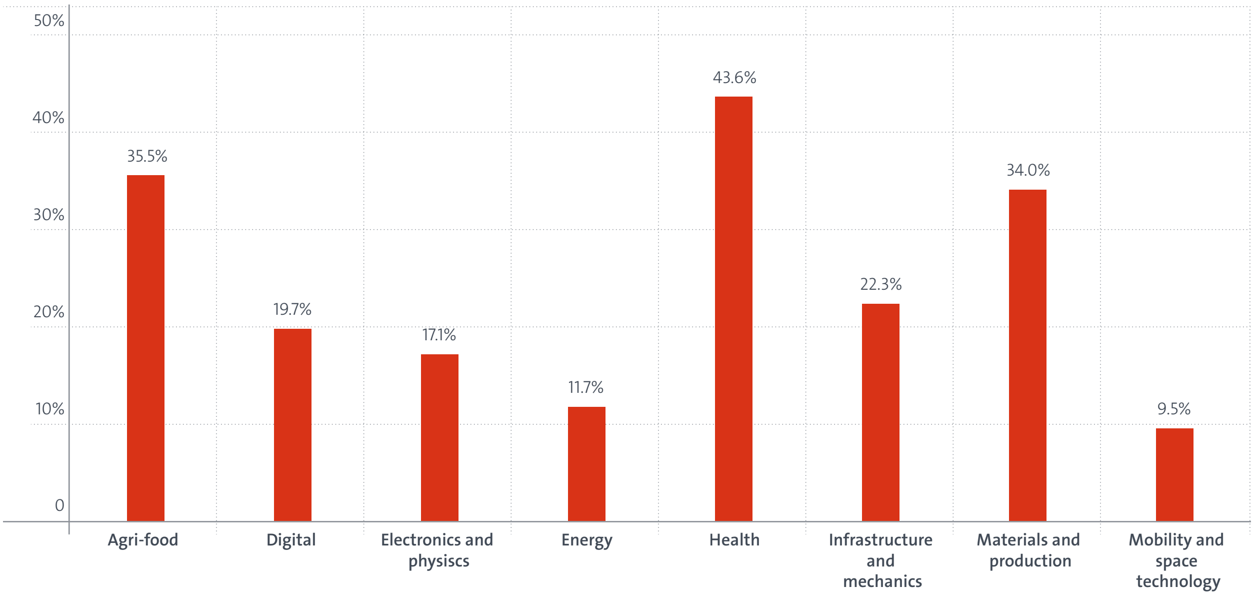
Source: EPO

Among patent examiners, who represent 64.4% of EPO staff in 2025, the percentage of women has also risen over the years, reaching 25.5% in 2025 – a more than one percentage point increase compared to 2022. This was driven by a significantly higher woman rate among new examiner hires (over 30% in 2025). Similar to the distribution of women inventor rates across technology fields, the percentage of female examiners differs significantly across EPO technology communities, ranging from only 9.5% women in the "Mobility and Space Technology" sector in 2025 to 43.6% in the Health sector, as shown in Figure 22.

In general, the share of women examiners is higher than the WIR observed for EPO member states across similar technology groups, suggesting a preference for careers in the patent field than to work as inventors in the business sector. Interestingly, it is very close to the WIR for patent applications in the research category.

Figure 22

Share of female examiners at the EPO by technology community in 2025



Source: EPO

The Boards of Appeal (BoA) are the first and final judicial instance in the procedures before the EPO. They are independent of the EPO in their decisions and are bound only by the law. They provide an independent review of decisions taken by the Receiving Section, Examining Divisions, Opposition Divisions and the Legal Division of the EPO. Depending on the case, they are composed of legally and/or technically qualified members of the BoA. Legally qualified members of the EPO BoA must hold a fully completed university degree in law, often with a specialisation in intellectual property, and have many years of professional experience as a judge, lawyer or legal adviser in patent law. Legal qualifications are traditionally held by a significant proportion of women. In contrast, technically qualified members are required to have a scientific or engineering degree, extensive experience in patent law, and must demonstrate both technical and legal analytical skills, with knowledge of the EPC and BoA case law.

A position on the BoA demands long professional experience and cross-disciplinary expertise, which results in a lower proportion of women among technically qualified members compared to patent examiners at the EPO.

In 2025, the BoA comprised 160 members, including 134 technically qualified members and 26 legally qualified members. The number of women acting as members of the Boards of Appeal amounted to 38, representing 23.8% of the total. The distribution was uneven, however, as women accounted for 46.2% of legally qualified members but 19.4% of technically qualified members.

Patent judges come into play when conflicts arise, such as infringement claims or challenges to the validity of a patent. Their decisions can uphold or revoke patents, or maintain them in amended form, and determine whether a competitor who infringed a patent has to pay damages. Depending on the jurisdiction, they also rule on a diversity of adjacent topics, such as supplementary protection certificates (SPCs) or licenses, and might grant provisional and protective measures as well as preliminary and final injunctions. By enforcing legal standards, judges provide legal certainty and play an important part for the commercial success of an invention.

To resolve disputes, courts have to apply the applicable patent law and assess technical evidence; therefore, many judicial systems foresee both technically qualified and legally qualified judges working on patent cases together. For example, legally qualified judges at the Unified Patent Court (UPC), require the same qualification as a judge in a contracting member state (Article 15(2) UPCA), i.e. a university law degree – a degree which, traditionally, is held by a significant number of women.

On the other hand, technically qualified judges at the UPC must have a university degree and proven expertise in a field of technology, as well as proven knowledge of civil law and procedure relevant in patent litigation (Article 15 (3) UPCA). As one of the most important patent courts in Europe, the UPC decides on disputes relating to certain classical European bundle patents (EPs) and European patents with unitary effect (UPs) for 18 EU member states.[7]

Women judges at the UPC are represented with 28.2%. However, like the EPO BoA, the percentage of female judges differs strongly between legally qualified and technically qualified judges: 35.8% of all UPC judges are legally qualified, of which 43% are women. Of the 64.5% technical judges at the UPC, 20% are female.

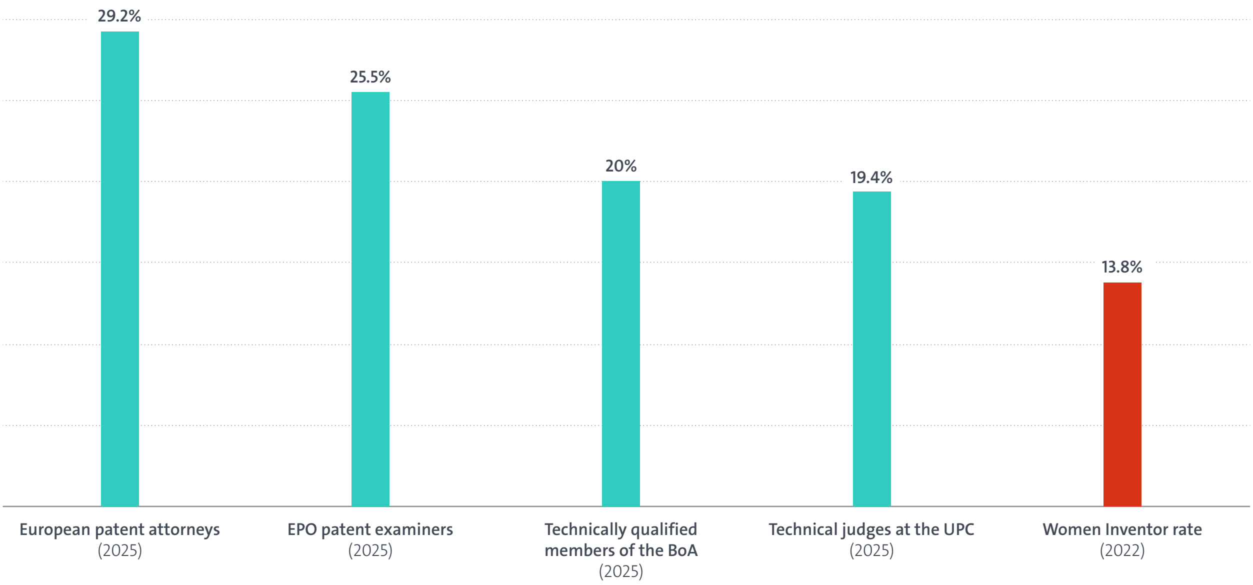
As the percentage of women amongst STEM graduates is usually lower than amongst lawyers, fewer women qualify for these positions. In addition, since candidates have to have a certain amount of experience in the technical field, as well as knowledge of the relevant legal aspects, a position of technically qualified judge is usually only achievable later in the career, where the percentage of qualified women is usually also lower.

3.2.2 Impact of under-representation of women in the patent sector

Women in patent-related professions can act as an influential support for other female researchers and engineers. They bring diverse perspectives to the protection and commercialisation of innovations, ensuring that the unique contributions of female scientists and engineers are recognised and safeguarded. In addition, they serve as mentors who can guide others through complex legal and business landscapes, empowering more women to thrive in tech careers.

Figure 23

Share of women across different patent professions in Europe



Source: EPO

7 See https://www.epo.org/en/applying/european/unitary for more information about the Unitary Patent and the UPC.

Overall, it is clearly visible in Figure 23 that the analysed patent professions which require a STEM qualification are held significantly less often by women then by men (25.5% of EPO patent examiners, 21.4% of technically qualified members of the BoA and 28% of European patent attorneys, while women make up 20% of the technically qualified judges at the UPC in 2025) – although significantly higher than the WIR for EPO member states. This disparity partly reflects lower female graduation rates in certain STEM fields, but is further compounded by late-career entry requirements: patent professions demand substantial post-qualification training, taken on later in professional trajectories when female career mobility is lower. Also, amongst the patent professions, the ones usually held very late in one's career (patent judges and members of BoA) show an even lower percentage of female professionals.

The under-representation of female patent professionals may also influence women participation as innovators or tech entrepreneurs. Women in STEM who are looking to protect their inventions via a patent have a lower probability of working with female patent professionals when applying for or enforcing patents. Prejudices, cultural biases, miscommunications and other challenges women meet in the workplace can therefore also significantly impact a woman's ability to apply for or enforce a patent, or receive guidance on how to strategically use patents for economic benefit. It may also lead to a lack of female role models, making it less likely for other women to decide for a career in this field. Moreover, a recent USPTO experiment shows that providing additional patent-examination assistance to applicants increases the likelihood of securing patent rights, with women applicants – particularly first-time women inventors – benefiting the most (Pairolero et al., 2022)

Against this background, it becomes clear that support for women in technology and innovation should also include encouraging more women in patent professions. The EPO is aware of this challenge and has made diversity a priority already since 2019. The Strategic Plan 2023 underlined the importance of women in the work force and introduced a specific mentoring programme to support women in leadership roles. With the Strategic Plan 2028, this journey was continued, introducing a KPI target of 40% of staff to be women by 2028. To support the role of women in the patent profession, the EPO pursues the Candidate Support Programme with a specific pillar to close the gender gap in EQE-successful candidates.

The Institute of Professional Representatives before the European Patent Office (epi) is similarly working to improve diversity, equity and inclusion across its members and processes. In September 2021, the epi Board established a Diversity & Inclusion (D&I) Working Group to promote the values of diversity and inclusion within the epi community. In 2022, the epi Council adopted a D&I policy (https://patentepi.org/en/diversity-and-inclusion/di-policy.html), which highlights our profession's and its members' commitment to those values. Following four years of work by the Working Group including articles in epi Information (see issues 1/22, 3/23, 1/24, 3/25), presentations at epi and EPO events, advocating for inclusivity in the EQE, preparing a series of case studies and engagement with the epi and beyond, the epi Council voted in May 2025 to establish a permanent Diversity, Equity and Inclusion Committee which started its work in November 2025.

Inventor Profile: **Cordelia Schmid**

Biography

Cordelia Schmid is a leading computer scientist specialising in computer vision and machine learning. She is a Research Director at Inria, a member of the Willow project team (ENS-PSL, CNRS, INRIA), and has held a joint appointment with Google Research since 2018. Her work on image and video understanding and visual learning has made foundational contributions to modern artificial intelligence. She is a recipient of numerous international honours, including an ERC Advanced Grant, the Royal Society Milner Prize, the IEEE PAMI Distinguished Researcher Award, the Körber European Science Prize, and in 2024, the European Patent Office's European Inventor Award in the "Research" category.

UN Sustainable Development Goals
SDG 8, SDG 9

Technical field
Audio-visual technology

Organisation
Inria

Q&A **Cordelia Schmid**

What first sparked your interest in STEM, and what led you to pursue mathematics and computer science?
"I'd say it began in high school. I always liked maths classes, and it was clear to me that I wanted to do something mathematically or technology oriented – either mathematics, applied maths, or computer science. There was really no doubt for me nor for my teachers that this was my direction. I was fortunate nobody put obstacles in my way."

How did you decide between mathematics and computer science, and did you already have a clear career path in mind?
"Maths always seemed more logical to me – you learn the rules and then you can apply them. At first, I wanted to pursue pure or applied mathematics, but I was told that computer science had better job opportunities at the time, so I ended up choosing that. It was a compromise – about half the courses in computer science were maths, so it was a good mix."

"At the time, there was certainly less encouragement for women to do a PhD [...] so it was a difficult decision, but without it, I wouldn't be where I am today."

What motivated you to pursue a PhD, and what challenges did you face at that stage?
"I started a PhD because I liked research. During my studies I realised that I was more attracted to that than to an engineering job. I was also actually encouraged to do a PhD – several professors suggested I join their teams. The challenge was more cultural and family related, as at that time, there was certainly less encouragement for women to do a PhD. It wasn't a clear-cut barrier, but it made the decision harder, especially given the long and uncertain path afterward toward a professorship. So it was a difficult decision, but without it, I wouldn't be where I am today."

Have you ever considered leaving research or STEM altogether?
"I wouldn't say I considered leaving STEM altogether, but I did hesitate before committing to a PhD. After finishing my studies, I worked in industry for about nine months and realised very quickly that I didn't like it. In that sense, it was a useful experience, because it helped me understand what I didn't want to do. That realisation actually pushed me to commit fully to doing a PhD and staying in research."

Computer science remains a male-dominated field. Have you seen it evolve at all over the course of your career?
"I feel that progress has been slower than we would hope. At the time, there was certainly less encouragement for women to do a PhD ... so it was a difficult decision, but without it, I wouldn't be where I am today. It wasn't my personal experience to feel discouraged, but I've seen it happen around me. Even with encouragement, societal expectations can be very strong, and without support or motivation, many girls may simply choose not to continue in STEM."

How do you approach mentorship and supervision, particularly with female researchers?
"I've had a few successful female PhDs join my work, though the numbers in computer science are low. I currently work closely with one senior female researcher and one female PhD student, and I try to support them and we discuss challenges related to the gender gap. When they face difficulties or feel uncomfortable, I encourage them to persevere and continue their careers. So while I mentor all researchers equally, I think its important to recognise that supporting women can require extra guidance."

At which points in the STEM pipeline do you most often see women leave, and what factors contribute to their departure?
"I think the first point is often right after high school – of course if girls don't choose STEM then, it's unlikely they'll return later. Another potential drop-off is at the PhD stage, though I haven't observed that as strongly recently, and it seems fairly balanced between men and women. The other significant factor is when women have children – societal expectations often lead women to reduce working hours or go part-time, which can make advancing in research careers much harder."

From your perspective, what are the most effective ways to support women's long-term progression in STEM and what advice would you give to women entering or advancing in STEM careers today?
"I think awards and recognition aimed at women can really help – they give visibility, open networking opportunities, and help push your career forward. Events and mentoring programs are useful too. But honestly, in fields like computer science, the challenge starts much earlier – so few girls even start that path, and that is something more cultural or structural that society hasn't fully fixed. And so my advice to women in STEM would be to always think about what really interests you, follow your own path, and don't get sidetracked. Focus on what excites you and surround yourself with people and programs that can support you along the way."

Career	
1992	— Earns Master's degree in Computer Science at University of Karlsruhe, Germany.
1996	— Completes PhD in Computer Science at Institut National Polytechnique de Grenoble.
1996–1997	— Postdoctoral researcher in the Robotics Research Group at the University of Oxford.
1997	— Joins Inria Grenoble Rhône-Alpes Centre as a researcher.
2001	— Achieves Habilitation (advanced academic qualification).
2003–2018	— Leads the LEAR project, later renamed the Thoth team.
2013	— Receives ERC Advanced Grant for "Active Large-scale LEarninG for visual RecOgnition (ALLEGRO)".
2016	— Awarded Inria & French Academy of Sciences Grand Prix. — Promoted to Senior Research Director.
2017	— Elected member of the German National Academy of Sciences, Leopoldina.
2018–present	— Holds joint appointment with Google Research.
2020	— Contributes to the Willow project team. — Receives Royal Society Milner Prize.
2021	— Awarded IEEE PAMI Distinguished Researcher Award.
2023	— Receives Körber European Science Prize.
2024	— Awarded the European Inventor Award "Research" by the European Patent Office.
2025	— Honored with ACM Athena Lecturer Award and Archimedes Science Award.

4. Women founders and startups in Europe

Technology startups are among the most dynamic drivers of European innovation. They play a central role in developing and commercialising cutting-edge technologies, often operating at the frontier of scientific and engineering advances. In this context, patents are a critical strategic asset. For young technology-driven firms, patent protection not only secures exclusive rights over key inventions, but also strengthens their ability to attract investment, signal technological credibility to markets and partners and build sustainable competitive advantages as they scale (see EPO, 2023 and Farre-Mensa et al., 2020).

This section examines the participation of women as founders in technology startups that engage with the European patent system. The analysis relies on data from Dealroom and the EPO's Deep Tech Finder (DTF), an openaccess tool that integrates business information with patent intelligence to identify tech ventures across Europe. The DTF provides a comprehensive repository of startups, PROs and universities that have filed European patent applications, making it an appropriate data source for assessing women's participation within the patent-intensive segment of the European startup landscape.

To construct the sample, a multistage identification strategy was applied. A company is classified as part of the DTF population if it (i) maintains an active Dealroom profile with information on growth stage, employee count and founding year; (ii) is headquartered in one of the 39 EPO member states; (iii) is in the Seed, Early growth or Late growth stage; (iv) employs no more than 1 000 people; (v) was founded within the past 30 years; and (vi) has published at least one European patent application within the past 21 years. This methodology ensures that the analysis focuses on technology-driven startups at relevant stages of development and with demonstrable engagement in patenting.

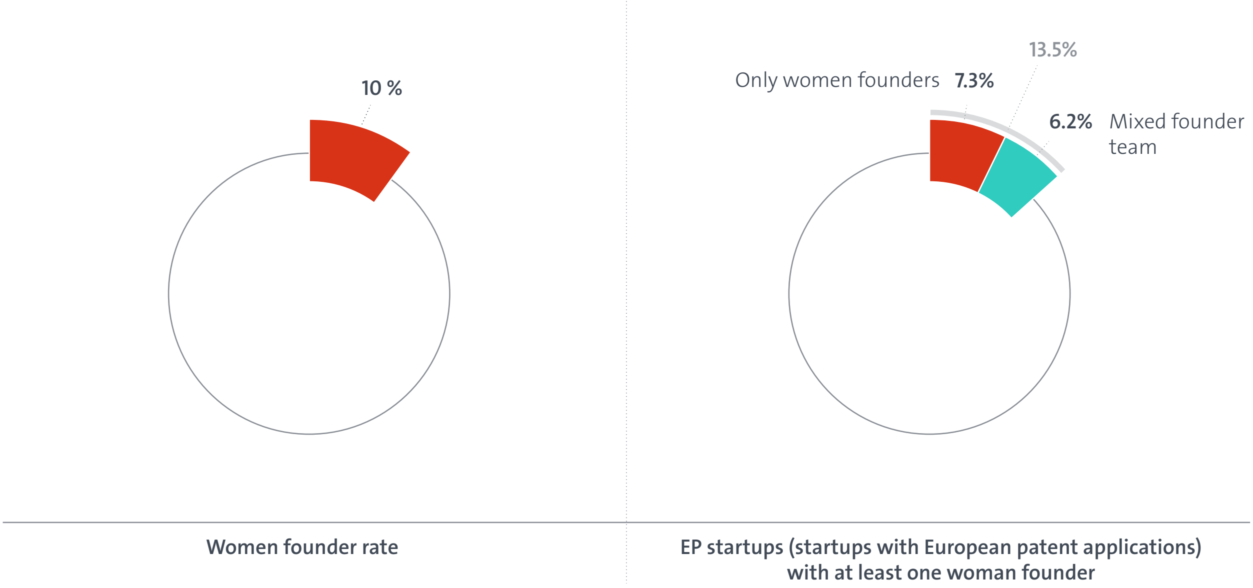
To understand whether gender disparities are specific to tech entrepreneurship or reflect broader patterns within the startup ecosystem, a comparison group of non-patenting startups with similar characteristics was also constructed. This section compares "EP Startups", those with at least one patent application at the EPO, and "other startups" (startups without patent applications at any patent office). This enables an assessment of whether women are systematically less represented in patenting ventures than in comparable non-patenting startups. tech entrepreneurship or reflect broader patterns within the startup ecosystem, a comparison group of non-patenting startups with similar characteristics was also constructed. This enables an assessment of whether women are systematically less represented in patenting ventures than in comparable non-patenting.

4.1. Gender gap in patenting startups

The gender gap in founders of startups with European patent applications is both clear and substantial. Women represent only around 10% of all founders of companies in the Deep Tech Finder, meaning that for every woman founder there are roughly nine men. This Figure is closely aligned with the results in Section 3, since founders of technology startups are often inventors themselves: the WIR for patent applications filed by businesses with smaller patent portfolios and among individual inventors is 11.4% and 12.5%, respectively, for applications filed between 2018 and 2022.

Figure 24

Women's participation in European startups with at least one European patent application (EP Startups), 2025



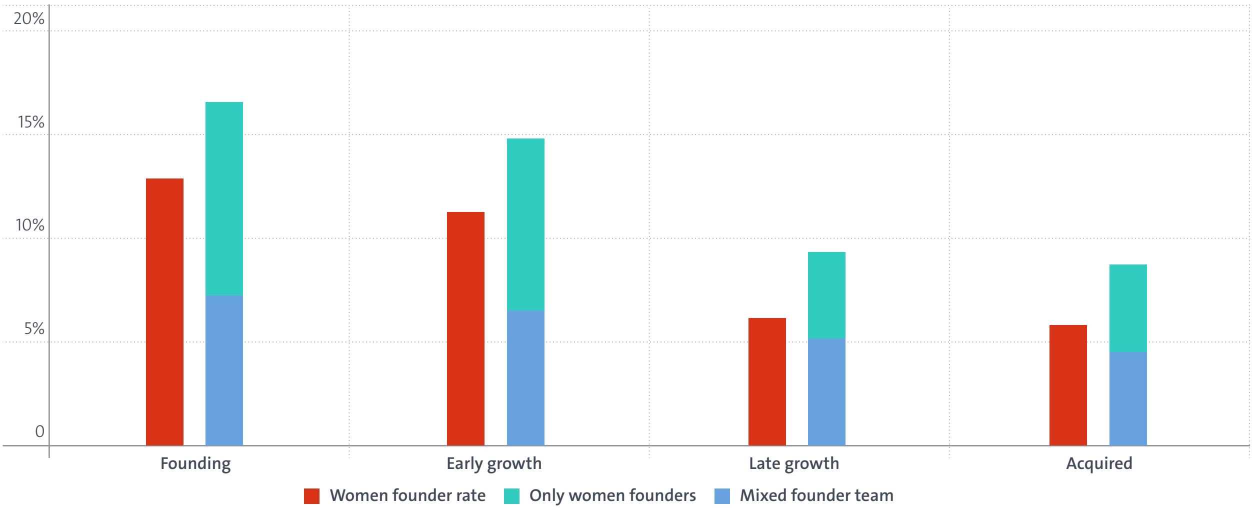
Sources: EPO - Dealroom; Crunchbase; own calculations

At company level, only 6.2% of startups have mixed-gender founding teams that include both women and men, while women-only founding teams represent 7.3% of the entire population of startups with European patents. Taken together, the women participation index (WPI) – defined here as the share of startups with at least one woman among the founders – stands at 13.5%, with a slightly larger share of these companies having women-only founding teams than mixed-gender teams.

These findings are consistent with results from related studies. For example, an EIT analysis of 7 165 startups across 37 countries which also used Dealroom data but applied different startup and deep tech definitions reports that 17.4% of companies, disregarding their patenting activity, had at least one woman in the founding team over the period 2010–2022 tech definitions reports that 17.4% of companies.

Figure 25

Women's participation in EP startups (in %) by growth stage, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

If the growth stage of companies is considered, women's representation as founders is highest at the Founding stage (12.9%) and lowest among acquired startups (5.8%), following a clearly decreasing trend over the company growth cycle (with women founder shares of 11.3% in Early growth and 6.1% in Late growth stages). At the Founding stage, both mixed-gender founding teams (7.2%) and women-only founding teams (9.32%) reach their highest shares. As companies progress to Early growth, the presence of women declines, with mixed-gender teams accounting for 6.5% of startups and women-only teams for 8.3%. In the Late growth stage, the share of mixed-gender teams falls further to 5.2%, while women-only teams decline to 4.2%. Among acquired companies, which have the lowest WPI at 8.7%, mixed-gender teams represent 4.5% and women-only teams 4.2%, together accounting for all companies with at least one woman founder.

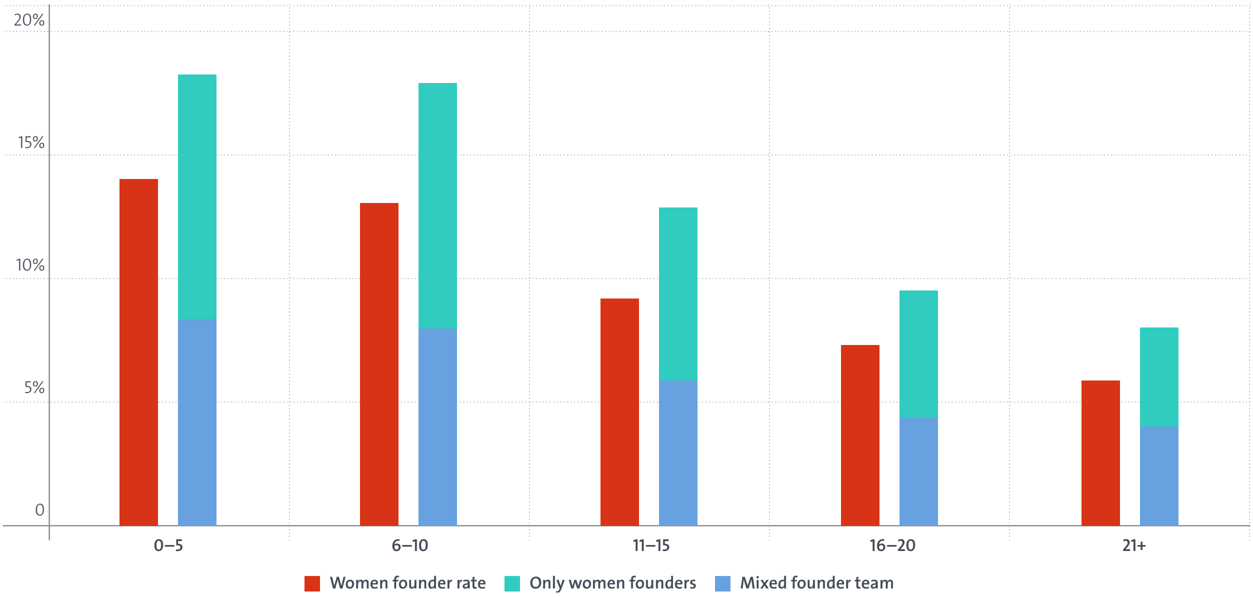
Taken together, these figures indicate a "leaky pipeline" in technology tech entrepreneurship. As companies move from Founding to later stages and eventual acquisition, women's presence among founders declines and all-male founding teams become increasingly dominant. Mixed-gender teams remain rare at all stages, though they have a slightly higher share than women-only teams in Late growth and acquired companies. In practice, women-led and gender-diverse founding teams are underrepresented among late-stage outcomes, which is consistent with evidence from the State of European Tech 2025 report (Atomico, 2025), which shows that, as companies mature, women and gender-diverse founders become both less common and more severely underfunded.

The concentration of capital in all-male founding teams is particularly pronounced in the largest funding rounds: of the ten largest investments in 2025, only one involved a mixed-gender founding team, and no women-only teams appear among the fifty largest rounds. These data suggest that the "leaky pipeline" operates by way of two reinforcing mechanisms: the progressive under-representation of women in later-stage outcomes, and a systematic bias in the allocation of scale-up capital away from mixed-gender and women-founded companies.

However, as shown in Figure 26, differences in the age structure of startups also contribute to the pattern, since women are more prevalent among younger companies. Indeed, women's representation as founders declines with startup maturity. The youngest companies (0–5 years) have a women founder rate above 14%, whereas this share falls to 5.9% among companies older than 21 years. The youngest firms also show the highest WPI (18.3%), indicating that women's participation in deeptech founding has increased in recent years compared with earlier cohorts. By contrast, older companies (21–30 years) were founded in periods characterised by lower women's participation in the innovation ecosystem, and

Figure 26

Women's participation in EP startups (in %) by company age, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

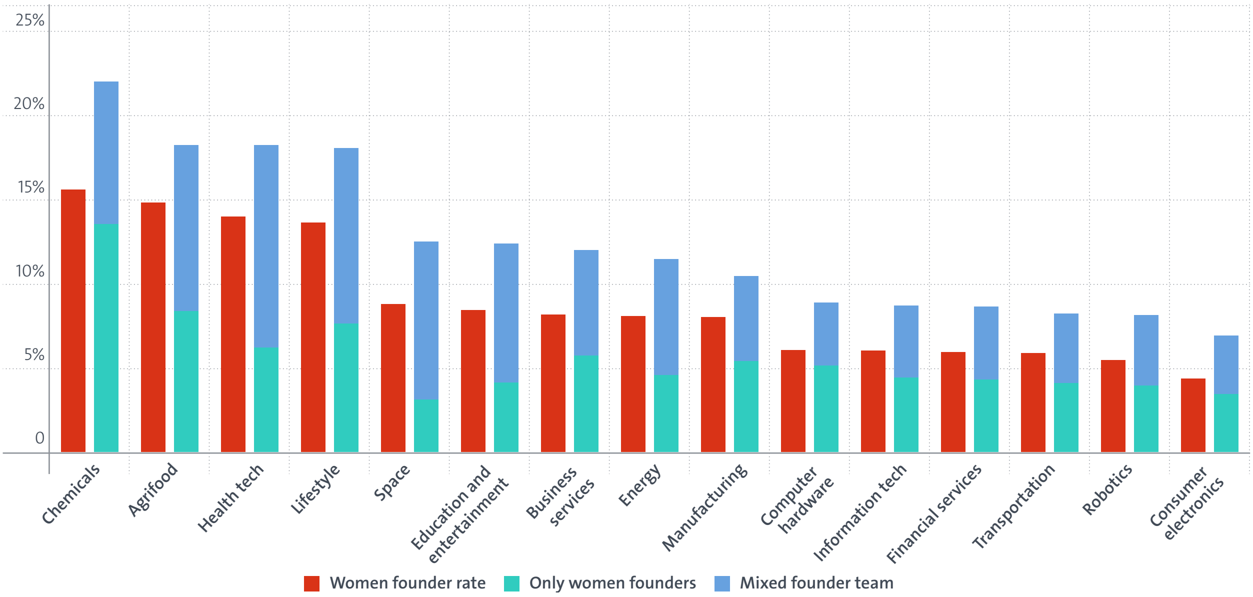
the 21+ age group shows the lowest WPI (8%), in line with historical patterns in which women's involvement in innovation activities was substantially lower.

Women's representation in technology startups varies strongly by industry (see Figure 27). Women founders are most represented in Chemicals (15.6%), Agrifood (14.8%) and Health Tech (14.0%), but their participation drops in Information Tech (6.0%), Manufacturing (8.0%) and Business Services (8.2%), with Consumer Electronics lowest at 4.4%. This hardware oriented underrepresentation is consistent with Section 3, where Biotechnology and Pharmaceuticals exceed 30.0% women inventors in 2018–2022, while many Engineering fields remain at only 5.0–7.0% women inventors.

Gender diversity in founding teams shows similar sectoral contrasts. Chemicals has the highest WPI, with 22.0% of startups having at least one woman founder (8.5% women only and 13.6% mixed-gender teams), while Consumer Electronics has a WPI of about 7.0%. In Chemicals, mixed-gender teams are about 1.6 times as frequent as women only teams, whereas in Space (and similarly in Education and Entertainment or Lifestyle) women only teams outnumber mixed teams by roughly three to one. These differences suggest that norms and networks around founding team formation vary substantially between industries.

Figure 27

Women's participation in EP startups (in %) by industry, 2025



Note: Only countries with at least 48 startups with European patent applications have been considered.

Sources: EPO - Dealroom; Crunchbase; own calculations

Geographical variation is also pronounced. Women founders are most represented in Spain (19.2%), Portugal (15.7%), Ireland (14.8%) and Italy (12.5%), while Germany (8.0%), Austria (7.5%) and the Netherlands (5.5%) sit at the lower end. Most countries fall in the 7.0–10.0% range, indicating widespread underrepresentation, but Southern European countries generally show higher women founder shares than Northern innovation hubs, partly reflecting sector composition.

WPI follows a similar gradient: Spain leads at 24.7%, followed by Portugal (22.9%) and Ireland (21.9%), while Italy, Sweden, Switzerland and France cluster around 13.9–15.9%.

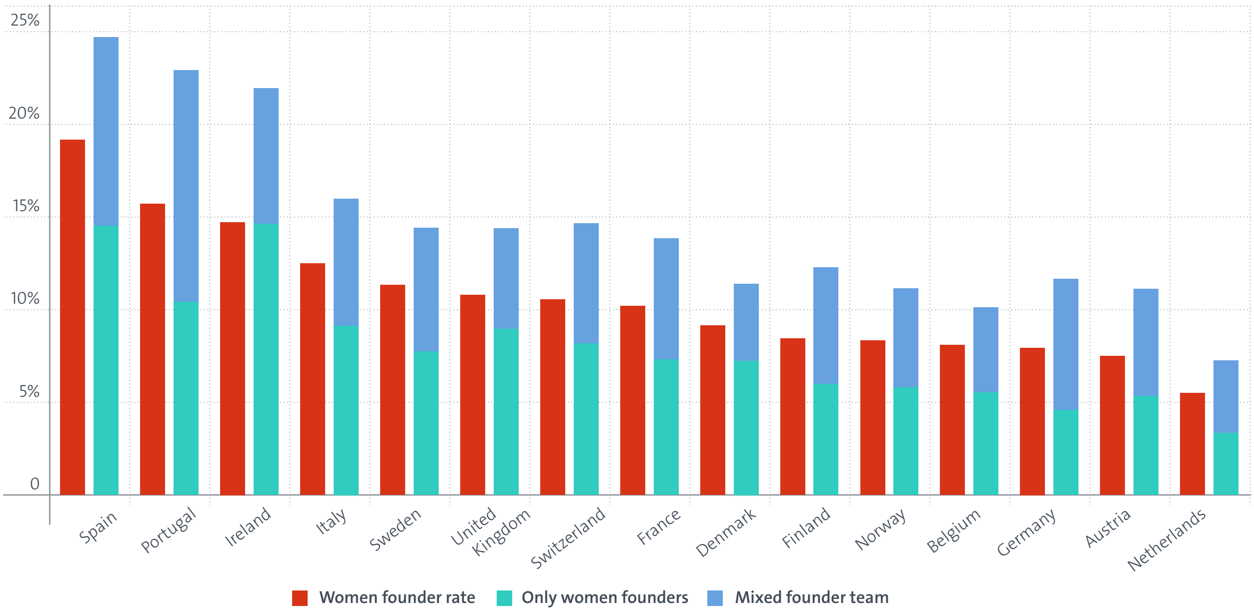
Northern European countries, including Denmark (11.3%), Finland (12.3%), Norway (11.2%), Belgium (10.1%), Germany (11.7%), Austria (11.1%) and the Netherlands (8.8%) record lower WPI values than Southern European countries, reinforcing the pattern seen for women founder shares.

Team composition indicators by country also mirror these patterns. Women-only founding teams range from 3.3% in the Netherlands to 14.6% in Ireland, with Spain close behind at 14.5%. Mixed-gender teams range from 3.9% (Netherlands) to 12.5% (Portugal), with the Netherlands, Denmark (4.1%) and Belgium (4.6%) at the bottom.

To assess how far these country differences reflect structural factors, two related scenarios are computed using an "Observed minus Expected" framework like the one described in Section 3.1.2 above. In the first scenario, the outcome is the share of founders who are women in each country.

Figure 28

Women's participation in EP startups (in %) by country, 2025



Note: To ensure statistically meaningful comparisons, only countries with at least 48 companies are reported in this section.

Sources: EPO - Dealroom; Crunchbase; own calculations

Figure 29:

Regression-adjusted gender gap in EP startups (in %) by country, 2025

Sources: EPO - Dealroom; Crunchbase; own calculations

The observed value is the actual fraction of women among founders, while the expected value is the fraction that would prevail if each country had the same industry, age and growth-stage mix as the full sample. Figure 29 shows the gap between the observed and expected values for the respective countries.

Spain, Portugal, Ireland and Italy all "punch above their weight" once differences in industry, age and growth-stage composition are controlled for: their adjusted gaps are clearly positive, indicating higher women founder shares than expected. France and Switzerland have gaps close to zero, suggesting no material difference between observed and expected women founder shares. At the lower end, Austria, Belgium, Denmark and especially the Netherlands exhibit significantly negative gaps, implying that their already low raw women founder shares cannot be explained solely by a specialisation in maledominated sectors, but are likely to reflect additional countryspecific factors.

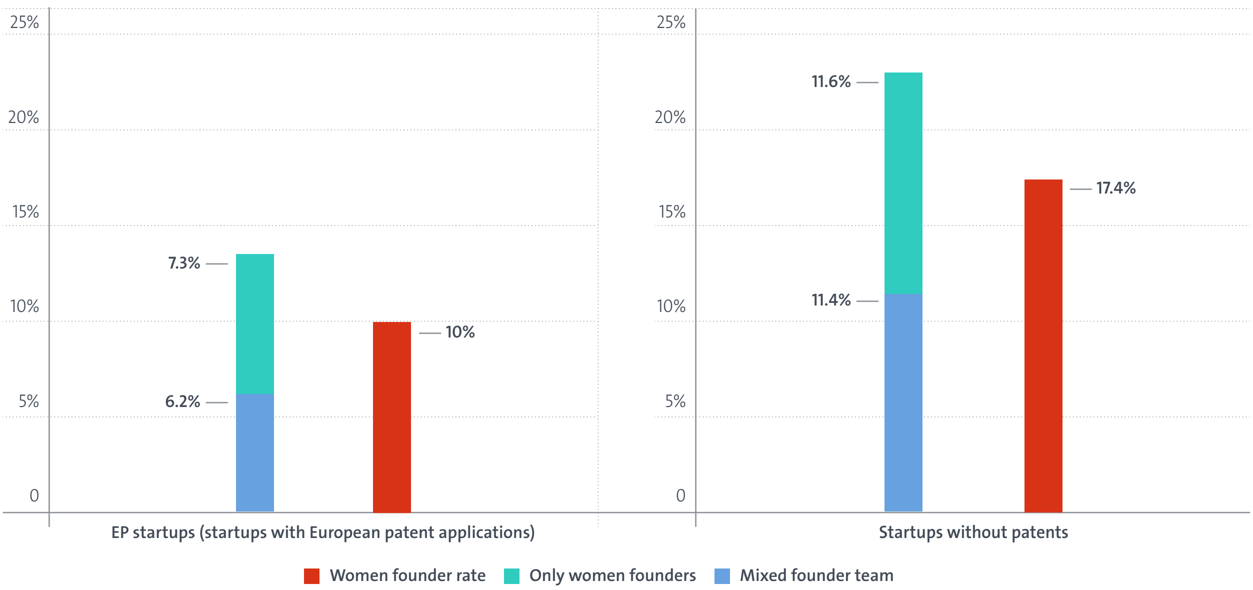
4.2. Gender gap between patenting and non-patenting startups

In this section, the gender gap between women and men founders is assessed by comparing the Deep Tech Finder population with a constructed comparison group of non-patenting startups from Dealroom that satisfy the same startup criteria. Because patenting is rare and concentrated in specific industries, a stratified sampling approach was used that controls for companies' industry sectors; the resulting comparison sample comprises 6 176 non-patenting European startups for which founders were identified and assigned a gender (see Annex 2).[8]

Figure 30 shows that the gap is substantially larger among patenting companies than in the non-patenting sample. Women represent about 10.0% of founders in patenting companies, compared with 17.4% in non-patenting startups. The same pattern emerges at the startup level: among patenting firms, mixed-gender founding teams account for 6.2% of startups and women-only teams for 7.3%, whereas among non-patenting firms the shares are 11.4% and 11.6%, respectively.

Figure 30

Comparison of women's participation as founders between EP startups and non-patenting European startups, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

8 The detailed sampling strategy for the non-patenting comparison group, as well as an alternative matching design based on nearestneighbour matching, are described in Annex 2; both approaches yield similar results.

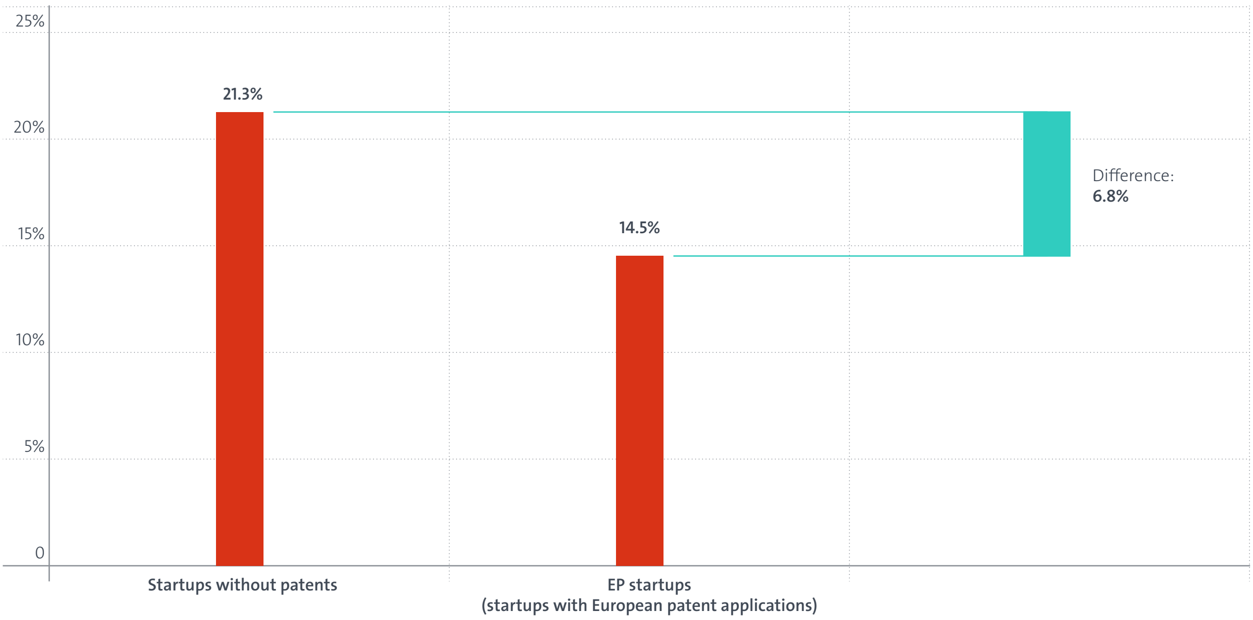
Overall, the share of companies with at least one woman founder is 23.0% for non-patenting startups – 9.5 percentage points higher than for patenting startups. These findings are consistent with earlier evidence that patents are relatively rare among business owners and marked by strong gender disparities. For example, in the United States, menowned businesses are about twice as likely as womenowned businesses to hold patent rights (Williams-Baron et al., 2018).

Given the variation by industry, country, age and growth stage as shown further below, a logistic regression analysis was conducted to assess whether the difference in women's participation remains statistically significant when these factors are controlled for. This method isolates the correlation between gender composition and patenting status, ensuring that observed differences are not simply driven by other characteristics (e.g. if women-led startups were concentrated in sectors that patent less frequently). The model calculates the probability of observing at least one woman in the founding team based on multiple characteristics simultaneously, enabling a comparison between companies that are otherwise similar in age, industry, stage and location.

The results in Figure 31 show that non-patenting companies have a predicted probability of 21.3% of having at least one woman founder, compared with 14.5% for patenting companies – a statistically significant difference of 6.8 percentage points. Since patent ownership is often a marker for tech ventures that leverage cutting-edge technologies and face high capital needs and risks, this result suggests that tech startups are systematically less likely to be founded by women, even after accounting for sector and growth-stage effects. However, we also cannot exclude that the lower likelihood of observing women founders among patenting companies may be due to lower awareness of the benefits of patenting among women entrepreneurs.

Figure 31

Average predicted probabilities of a woman being part of the founder team between EP startups and non-patenting European startups (in %), 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

As shown in the previous section, the distribution of women founders varies substantially across industries, with systematic differences between patenting and non-patenting startups. Non-patenting companies almost always show higher women founder rates (share of all founders who are women) than startups with European patents. The largest gaps in women founder rates (Figure 32) appear in Space and Chemicals, where women founder shares in non-patenting firms are roughly 20–24 percentage points higher.

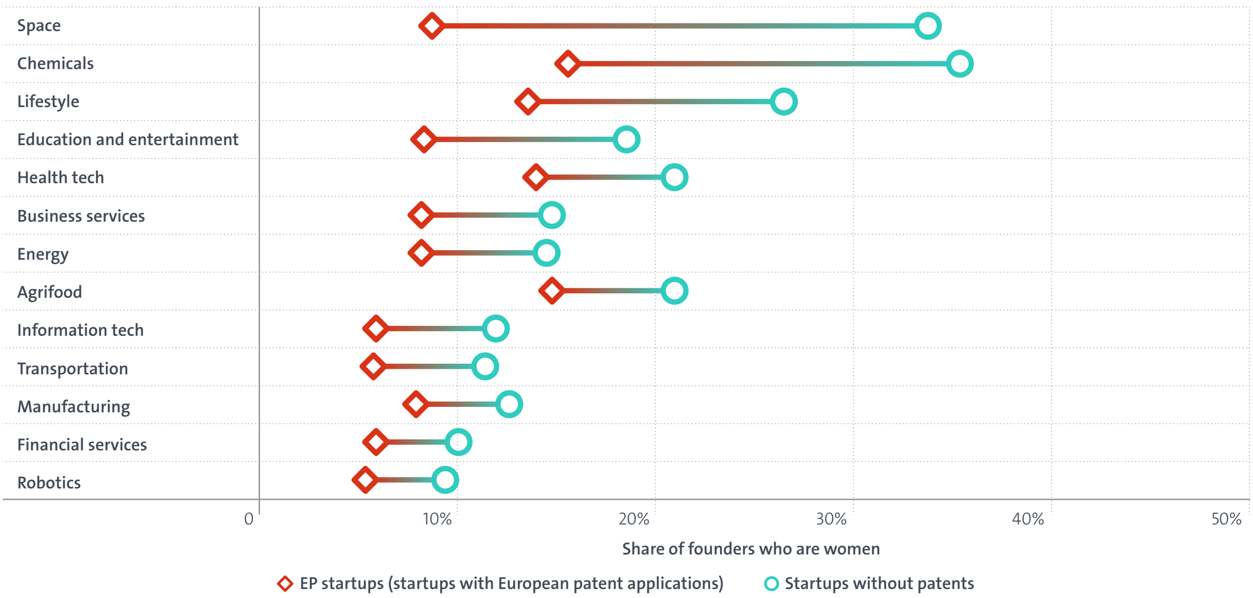
In Lifestyle, Education and Entertainment, Health Tech and Business Services, the difference is smaller but still sizeable, at around 5–10 percentage points, and even Robotics, Financial Services and Manufacturing show consistently higher women founder shares in non-patenting than in patenting startups.

In most industries, higher women founder rates in non-patenting startups go hand in hand with higher WPI, meaning women are present in more companies and also hold a larger share of founder roles (Figure 33). However, the relationship between these two indicators is not uniform across sectors. In Chemicals, the WPI gap between patenting and non-patenting startups is relatively small despite a large difference in women founder rates, implying that women appear in a similar proportion of Chemical startups in both groups but occupy fewer founder positions per team in patenting firms.

By contrast, in sectors such as Health Tech, Agrifood and Lifestyle, both the WPI and the women founder rate are visibly higher in non-patenting companies, indicating not only that women are present in a larger share of firms, but also that founding teams in those firms tend to be more gender-balanced and include multiple women rather than a single woman founder.

Figure 32

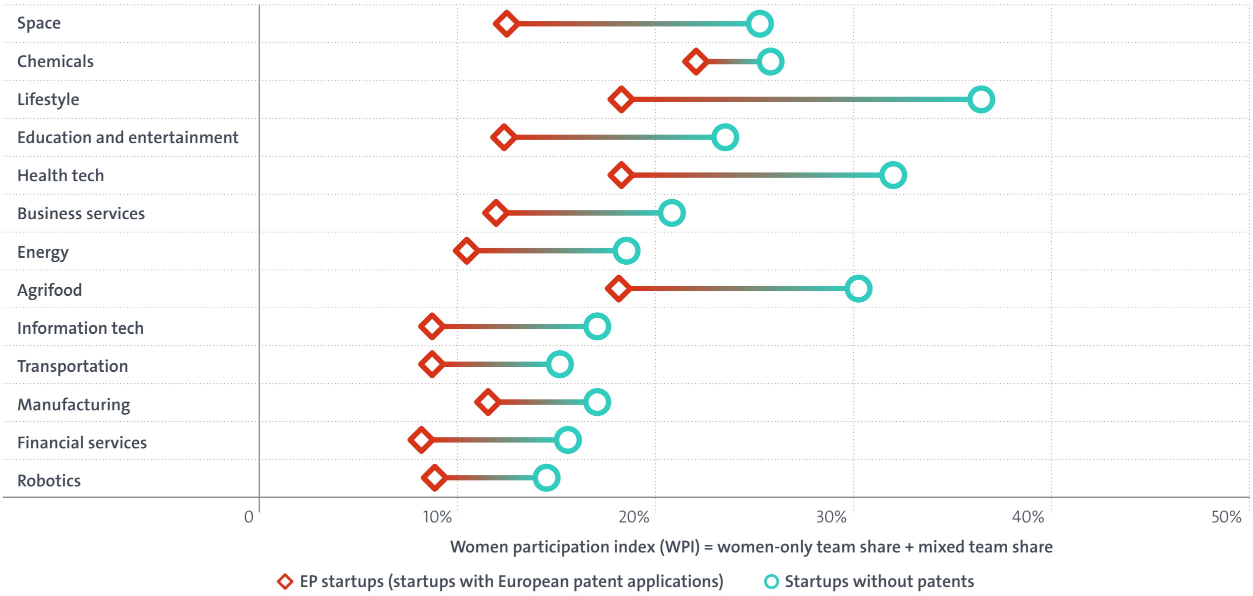
Comparison of women founder rates between EP startups and non-patenting European startups (in %) by industry, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

Figure 33

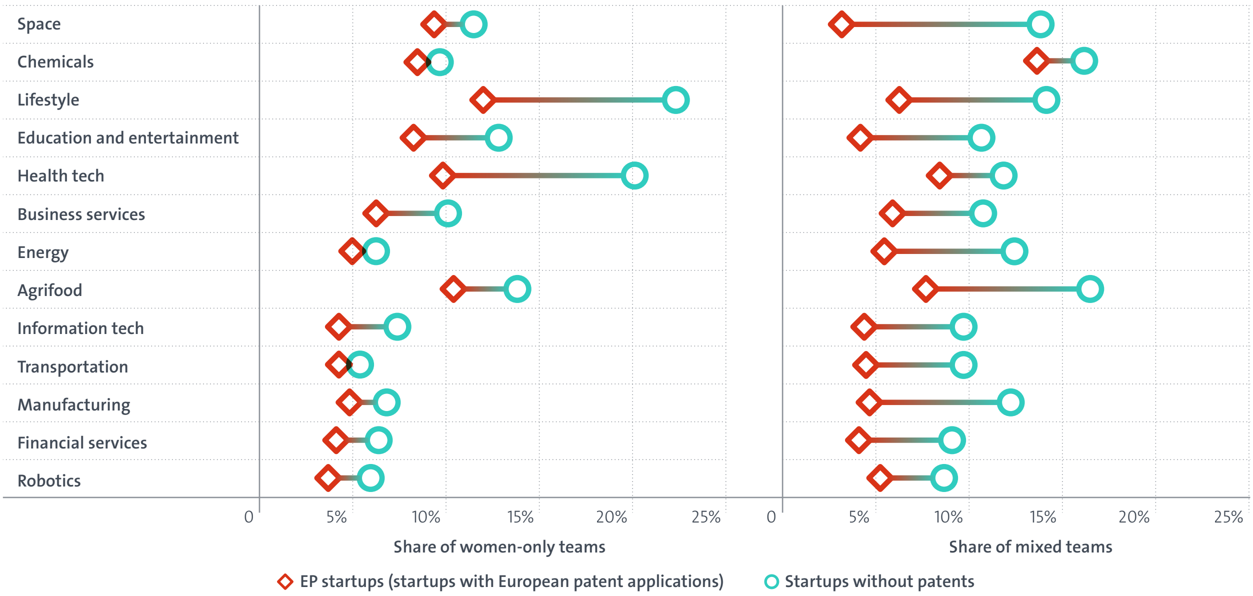
Distribution of shares of companies with at least one women founder between EP startups and non-patenting European startups (in %) by industry, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

Figure 34

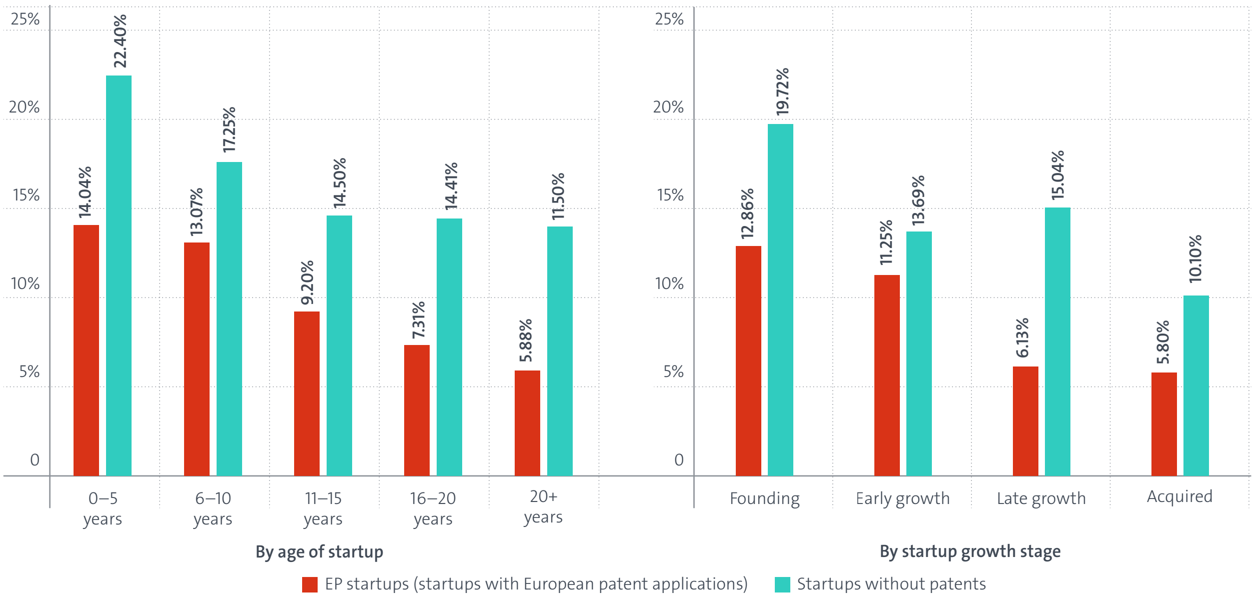
Distribution of shares of companies with at least one women founder between EP startups and non-patenting European startups (in %) by industry and team composition, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

Figure 35

Share of EP startups with at least one woman founder (in %) by age and growth stage, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

Team-composition data by industry in Figure 34 reinforce these insights. Women-only founding teams are much more common in service and application-oriented sectors such as Lifestyle, Health Tech and Agrifood, and in all three cases they are clearly more frequent in non-patenting than in patenting startups. In contrast, highly technical sectors such as Robotics, Transportation, Information Tech and Space show very low women-only shares in both groups, although non-patenting firms still tend to have slightly higher levels.

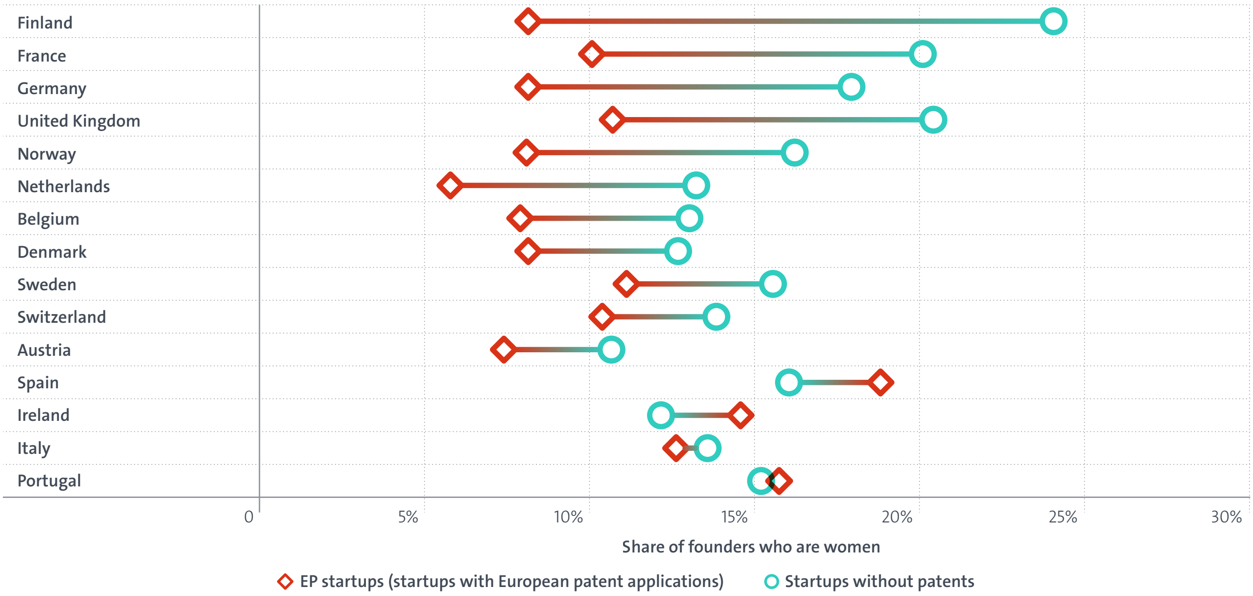
Mixed-gender teams show the clearest divergence: in Space, Agrifood and Lifestyle, mixed-team shares are around 14–16% in non-patenting firms but only about 6–7% in patenting firms and in Space only around 3%, indicating that when women participate in these industries they are far more likely to cofound with men in non-patenting than in patent-intensive startups.

Figure 35 shows that, by startup age, women founder rates decrease with firm maturity in both groups, but remain consistently higher in startups without European patents. Among 0 to 5-year-old companies, women account for 14.0% of founders in patenting tech startups versus 22.4% in non-patenting firms; this gap persists at 6–10 years (13.7% vs 17.3%), 11–15 years (9.3% vs 14.5%), 16–20 years (7.3% vs 14.4%) and 21+ years (5.9% vs 11.5%). These patterns indicate both a higher overall presence of women in non-patenting startups and an increasing gap for older startups. One plausible explanation for the relatively large gap in the youngest cohort is that some technology startups delay filing European patent applications, so a portion of today's early-stage, women-(co)-founded technology startups that will patent in the future are still classified in the non-patenting group.

By growth stage, women founder rates are consistently higher in startups without patents than in those with European patents. The gap varies across the life cycle: it is sizable at the Founding stage (19.7% vs 12.9%, i.e. 6.8 percentage points) and smallest in Early-growth (13.7% vs 11.3%, i.e. 2.4 percentage points) but widens sharply in Late-growth (15.0% vs 6.1%, i.e. 8.9 percentage points) and remains large among Acquired firms (10.1% vs 5.8%, amounting to 4.3 percentage points). The temporary convergence in Early-growth suggests that patenting and non-patenting startups have more similar gender profiles during the first expansion phase, while the renewed divergence in Late-growth and Acquired stages indicates that women-founded patenting startups are less likely to progress to or be recognised in these mature outcomes.

Figure 36

Comparison of women founder rates between EP startups and non-patenting European startups (in %) by country, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

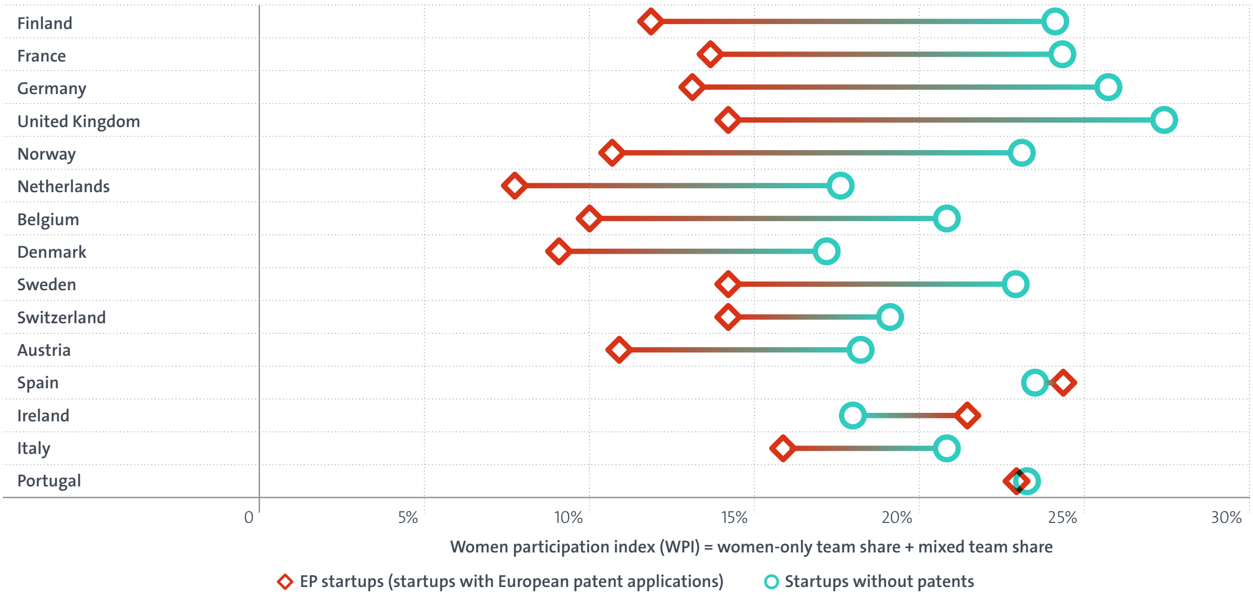
The representation of women founders among patenting and non-patenting startups also shows substantial variation across European countries, with differences partially reflecting the industrial composition of each country's startup ecosystem.

When examining the women founder rate (Figure 36), Finland and France emerge as clear leaders among non-patenting companies, with rates reaching approximately 18% and 20%, respectively, compared with only about 9–11% for their patenting counterparts. Germany, the United Kingdom and Norway follow, showing non-patenting rates near 15–18% versus roughly 9–12% in the patenting group. This pattern of higher women's representation in non-patenting firms extends to the Netherlands, Belgium, Denmark, Sweden and Switzerland, where non-patenting rates generally range from 11% to 15% while patenting rates sit between 7% and 12%. A different trend appears in Ireland and Spain, where the share of women founders in the patenting community exceeds that in non-patenting companies. In Italy and Portugal, the two groups show near parity.

The women participation index (WPI) – the share of companies with at least one woman founder – amplifies these geographic disparities. The United Kingdom leads the non-patenting community with approximately 27% of startups having women founders, compared with about 14% in the patenting group – a gap of roughly 13 percentage points. Similar gaps of around 10–12 percentage points appear in Finland, France, Germany, Norway, Belgium and the Netherlands. By contrast, Southern European countries show much smaller differences: in Italy the gap is about 5 percentage points, while in Portugal and Spain the WPI is almost identical for patenting and non-patenting firms. In Ireland, the WPI is actually higher for patenting startups (around 21%) than for non-patenting ones (around 18%). These cross-national patterns reveal that while the gender gap in patenting is a Europe-wide phenomenon, its magnitude varies significantly, with Southern European ecosystems often showing more convergence between the two groups.

Figure 37

Distribution of shares of companies with at least one women founder between EP startups and non-patenting European startups (in %) by country and team composition, 2025



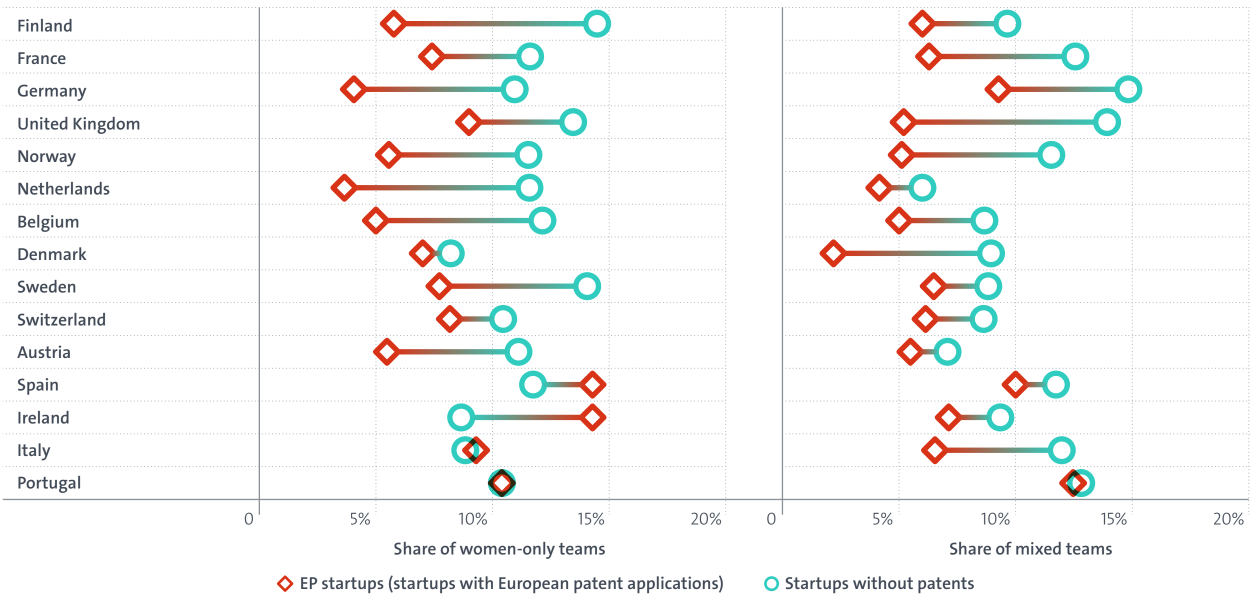
Sources: EPO - Dealroom; Crunchbase; own calculations

Team composition in Figure 37 further clarifies these differences. Women-only founding teams are generally more common in non-patenting than in patenting startups across Northern and Western Europe, with especially large gaps in Finland and in countries such as the Netherlands, Belgium, Germany, Sweden and Norway. By contrast, Italy and Portugal show parity between the two groups, and in Spain and Ireland women-only teams are actually more frequent in patenting startups, indicating that, in some ecosystems, women-led teams are at least as likely to operate in patent-intensive segments.

Mixed-gender teams mostly follow the same pattern: they are more prevalent in non-patenting startups, with the largest differences in the United Kingdom, Finland and France. Yet Spain and Portugal again show similar mixed-team shares in both groups, and Ireland records higher mixed-team participation in patenting than in non-patenting firms. Overall, non-patenting companies tend to exhibit higher women's participation, but the size and even the direction of the "patenting gap" varies considerably across countries.

Figure 38

Distribution of shares of companies with at least one women founder between EP startups and non-patenting European startups (in %) by country and team composition, 2025



Sources: EPO - Dealroom; Crunchbase; own calculations

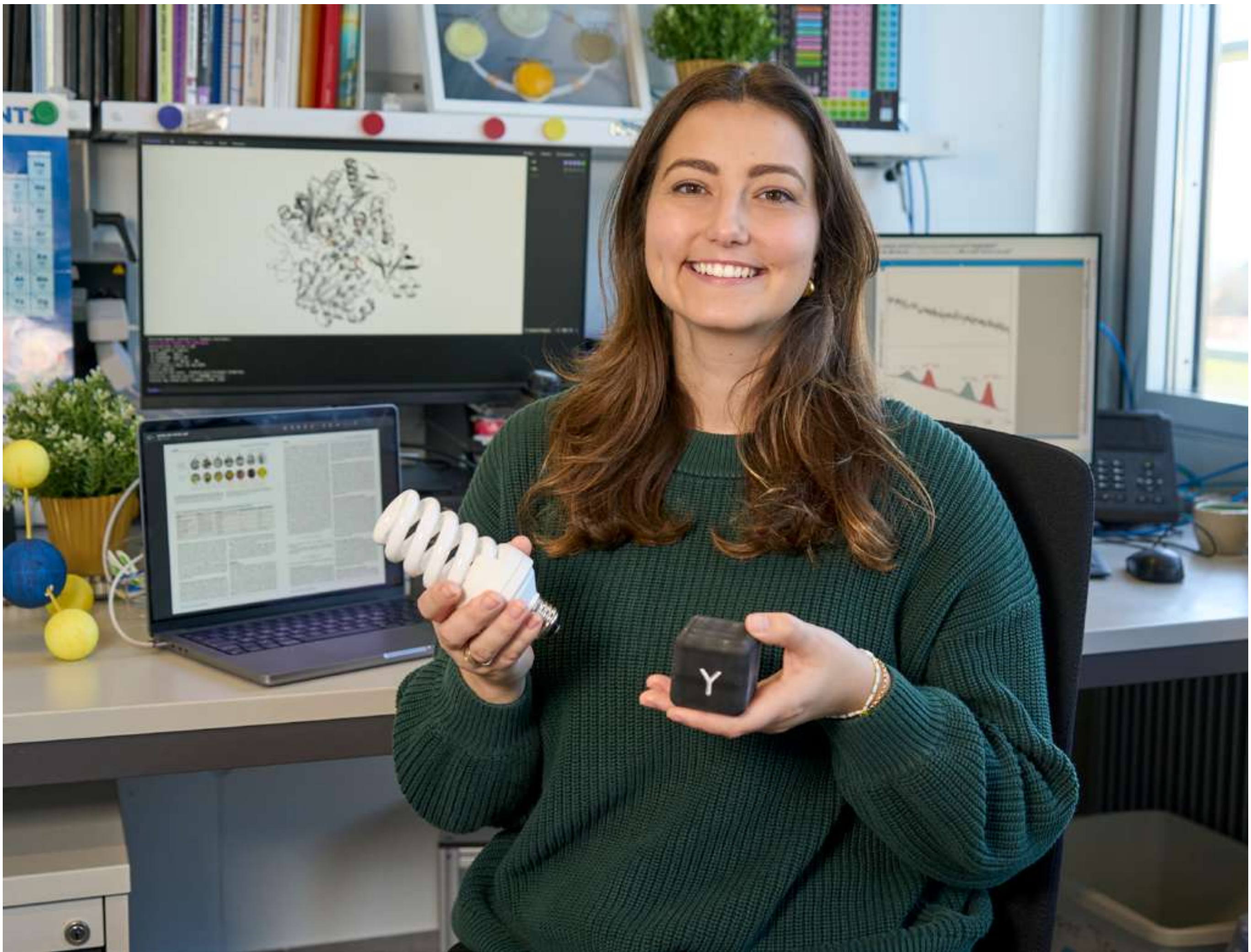
4.3. Conclusions on women in European tech startups

The findings presented in this section highlight substantial gender gaps in Europe's technology entrepreneurship landscape, with the patent system serving as a critical lens for understanding these disparities. Women represent less than 10% of founders in patenting technology startups – significantly below their share in comparable non-patenting companies (17.4%). This "patenting gap" is structural: even after controlling for industry, age and growth stage, tech startups are systematically less likely to have women founders than their non-patenting counterparts.

Across countries and sectors, women's participation varies widely. Southern European ecosystems such as Spain, Portugal and Italy show higher women founder rates and smaller gaps between patenting and non-patenting firms than many Northern European innovation hubs. Sectoral analysis reveals a dual barrier: in most industries, women are less likely to be present at all in patenting startups, and in highly technical fields like Chemicals, even when present, they tend to occupy a smaller share of founder roles within teams.

Team composition data further clarify these dynamics. While women-only founding teams are concentrated in service-oriented sectors such as Lifestyle and Health Tech – often with little difference between patenting and non-patenting firms – mixed-gender teams are far more common in the non-patenting segment, suggesting that co-founding with men outside the patent-intensive space remains a primary pathway for women's entrepreneurship. Encouragingly, the gender gap narrows among the youngest startups, pointing to gradual improvement, yet it widens significantly as companies scale, with women-founded ventures remaining underrepresented in later growth stages and among acquired firms.

Together, these insights illustrate that the intersection of gender, entrepreneurship and patenting remains a critical challenge for Europe's innovation performance. The evidence points not only to pipeline issues but also to specific hurdles in scaling and IP-intensive growth. Understanding these patterns is an essential step toward designing policies that support women-led tech ventures throughout their life cycle, ensuring that Europe fully harnesses the innovative potential of its diverse talent base.



Inventor Profile: **Marie Perrin**

Biography

Marie Perrin is the CEO of REEcover, a startup project contributing to the circular economy by turning electronic waste into a valuable resource. Her lifelong interest in science led her to focus on rare earth elements (REEs), a family of elements that are crucial for modern technology, and to develop a more efficient method for recycling them. In 2025 she received European Patent Office's Young Inventors Prize in the "World Builder" category for her breakthrough, which enables rare earth recovery to be faster, cleaner, and more sustainable compared with traditional extraction methods.

UN Sustainable Development Goals
SDG 12, SDG 15

Technical field
Environmental technology

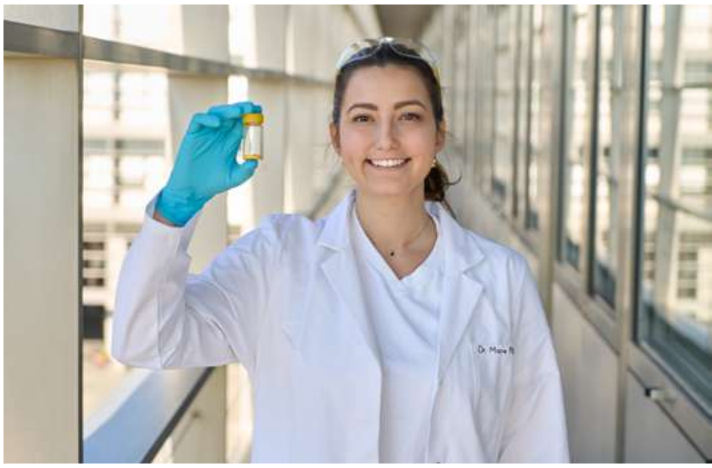
Company
REEcover

Q&A **Marie Perrin**

What first sparked your interest in STEM?
"I was interested in science from a very early age. I grew up in a family of scientists – my mom was a chemistry teacher and my dad was an engineer – so they shared their passion for STEM. In high school, I became interested in engineering, building robots and learning how to code, which was very male dominated. Then during prep classes, I discovered my passion for chemistry. I admired the beauty of understanding the world at a molecular level and having a real impact. That stayed with me through my Bachelor's, Master's, and PhD. I think my career path has really been driven by curiosity, getting out of my comfort zone, and learning new things."

Alongside your parents, have any other mentors supported your journey, and what role do you think mentorship plays in advancing STEM?
"Yes, I think mentorship is absolutely critical. When you're young and haven't proven yourself yet, you need people who believe in you and give you a chance, especially as a woman. I was very lucky to have both male and female mentors, and I was part of a female mentoring group through the Swiss Chemical Society and had a female professor who helped me pursue my goals. When I moved into entrepreneurship, I did initially feel lost because I didn't see many other female founders, but as I grew my network, I found inspiring women. So today I try to give back by mentoring younger students."

"Change won't happen on its own; I think it requires collective action, institutional awareness, and questioning the systems we take for granted."



What drew you to materials and environmental technology in particular?
"Well, I'm part of a generation that is extremely sensitive to environmental issues. I remember being nine years old when the documentary *'An Inconvenient Truth'* with Al Gore was released. I grew up with this sense that the planet is in danger and that we need solutions, and so throughout my journey, I've been motivated by using science to solve real-world problems. During my Bachelor's and Master's, I worked on plastic production. For my PhD, I joined a group working on an experimental project in bio-inspired chemistry, which I found absolutely fascinating. It was a far-reaching idea, but it ended up unlocking entirely new research directions that we're now building on today."

What was your experience of the patenting process as a first-time inventor? What kind of support helped you navigate it?
"I was completely new to patenting, so it was intimidating at first. I was extremely lucky to have the support of my PhD supervisor. Thankfully, my supervisor already had dozens of patents and supported the decision. University support was also key – I had strong backing from ETH's tech transfer office. So my experience was positive, but it depended entirely on that support."

What advice would you give to someone interested in patenting their work early in their career? And to women PhD candidates specifically?
"First of all, get informed about patenting and what it means. There are many resources available through the EPO, universities, and at the national level, including free consulting and patent searches. I'd encourage them to be proactive and bring it up with their supervisor early. One of my first discussions was about whether I was aiming for academia or industry, because that affects whether publishing or patenting is a priority. For women especially, it's important not to wait until everything feels perfect – be bold and put yourself out there."

What have been the most challenging aspect in your career so far?
"There's a very big gap between academia and entrepreneurship. When I moved into entrepreneurship, I felt lost, especially because I didn't see many female founders in my network. So, finding the right communities was essential. I joined Talent Kick in Switzerland, which was fundamental for my development and gave me that first push. I also benefited from strong university support through the ETH Pioneer Fellowship, which allows a gradual transition with access to labs and a salary. That structure made the move into entrepreneurship much smoother than it otherwise would have been."

Where do you hope your career will take you over the next ten years?
"The past year has been incredible, especially with the EPO prize, and I'm very grateful for the opportunities it opened up. Over the coming years, my main goal is to make the startup work and turn critical raw material circularity into a reality. I love that this role brings together my interests in science, policy, and communication. You can have the best technology in the world, but without the right legislation, it may never be implemented. Long term, whether I stay in entrepreneurship or move into science policy, my goal is to work where scientific expertise can have the greatest impact."

Have you observed the leaky pipeline first-hand? What's most important for encouraging more young women to pursue science and turn their work into inventions or businesses?
"Yes, I've seen it first-hand. I started in a specialised engineering track at 15, and it was already very male dominated.

Career	
2016	— Begins studying Bachelor's degree in Chemistry at Paris-Saclay University.
2018	— Awarded a grant for research internship at ETH Zurich.
2019	— Completes Master's degree thesis research at The Massachusetts Institute of Technology. — Begins a PhD at ETH Zurich focused on rare-earth chemistry.
2021	— Publishes first peer-reviewed scientific paper on molecular complexes for nitrogen fixation. — Begins leadership roles at the Swiss Chemical Society.
2023	— Co-founds REEcover and steps into the role of CEO while completing a PhD. — Begins formal training in entrepreneurship and innovation.
2024	— Files first patent at ETH Zurich for rare-earth element separation technology. — Publishes breakthrough research in Nature Communications. — Wins major awards for chemistry and technology. — Completes PhD at ETH Zurich.
2025	— Awarded the Young Inventor Prize "World Builder" by the European Patent Office. — Named Inventor of the Year in France. — Becomes an ETH Pioneer Fellow. — Continues research as a postdoctoral scientist while scaling REEcover.

Though, that experience created strong bonds between the few women there, and I think that sense of sorority is extremely important. I've also seen a cultural bias suggesting women have to compete with each other, which is absolutely the wrong mindset – supporting one another is critical. I know the leaky pipeline becomes most visible at senior academic and leadership levels, and so I think representation and exposure matter enormously. Change won't happen on its own; I think it requires collective action, institutional awareness, and questioning the systems we take for granted."

5. Patenting and publishing activities of STEM graduates in Europe – contribution from the DOC-TRACK project

Section 3 provided systematic evidence on women's participation in patenting across all 39 contracting states to the European Patent Convention (EPC). This evidence, however, only concerns inventors and their patents and does not extend to potential inventors, especially individuals with sufficient knowledge in science, technology, engineering or mathematics (STEM) to come up with new ideas susceptible to patent protection. This makes it difficult to appreciate the extent to which women's inventive potential – conditional on the STEM knowledge they acquire through education and/or experience – is fully realised. *Are STEM-educated men more likely than equally educated women to end up filing a patent application and possibly become inventors? If yes, to what extent is the difference explained by their specific type of knowledge (more or less applied, more or less close to patentable subject matters, etc.) or, instead, by some form of gender bias in accessing invention-related jobs (e.g. R&D positions in industry) or opportunities (support for patenting in university or public research, for instance)?*

This section explores these issues by focusing on a highly relevant subset of potential inventors, namely the 2000–2020 STEM doctoral graduates of seven European countries (Austria, France, Germany, Italy, the Netherlands, Spain and the United Kingdom) based on the DOC-TRACK database, a new and original data source produced with the EPO's financial support.[9] The DOC-TRACK database contains information on both the scientific publications and patents produced by STEM graduates during and after their doctoral studies in these countries. In addition, it classifies the publications by their citation distance to what we call, following Ahmadpoor and Jones (2017), the *technological frontier*, namely the worldwide set of scientific publications directly cited by one or more patents (filed by any inventor at either the EPO or the USPTO).

9 More information at https://doc-track.eu/. The DOC-TRACK database also includes doctoral graduates in medical sciences, which we do not cover here due to heterogeneity in the type of degrees across countries, which create problems with international comparisons.

In this way, we can compare not only the shares of female and male graduates who become inventors, but also the key gender differences in terms of scientific production and its invention potential. Based on this, we can evaluate the extent of the "leakage" in the pipeline from science to technology that should channel STEM knowledge held by women to R&D labs and their inventions. An overview of existing literature on the gender bias in patenting and publishing in these seven countries is presented in Annex 5.

Holding a doctoral degree is far from being a prerequisite for becoming an inventor. The PatVal survey of European inventors[10], based on patent applications filed at the EPO between 1993 and 1997, found that the share of inventors with a doctorate was 26%, with great variation across both technological fields (from 59% in Chemicals and Pharmaceuticals to around 9% in Mechanical Engineering) and countries (from 35% in Germany to 3% in Italy). In all countries and fields, these percentages are inferior to those of inventors with just a master's or an undergraduate degree.[11] While this evidence indicates that the representativeness of doctoral graduates as potential inventors varies across technological fields of patents and countries, the choice of putting them at the centre of an enquiry on gender bias in patenting comes with two advantages. The first one concerns data availability: information on doctoral graduates can be largely obtained from electronic theses and dissertations (ETD) repositories maintained by the national library or other dedicated agencies in a number of countries. ETDs come with metadata on the dissertations' authors, which we can use to identify who – among them – becomes an inventor.

10 For the PatVal survey, see Giuri et al. (2007). The survey covers over 9 000 inventors in six European countries, namely: France, Germany, Italy, the Netherlands, Spain and the UK.

11 The RIETI-Georgia Tech Inventor Survey, based on triadic patents with priority years from 1995 to 2001, found that the equivalent shares for the United States and Japan were 65% and 15%, respectively. Evidence for Sweden, based on matching EPO inventors and population register data, shows that the share of inventors with a PhD has increased over time – from 14% for patents filed in 1985 to 29% in 2007 – but remains far from that of inventors with any type of tertiary education (stable at 90%). Similar data for Finland, over the period 1988 to 1996, indicate a share of 13.6%. For the RIETI-Georgia Tech Inventor Survey, which covers around 5 500 inventors, see Walsh and Nagaoka (2009). For population-based studies on Sweden and Finland, respectively, see Jung and Ejermo (2014) and Toivanen and Vaananen (2016).

Assembling a similar dataset for master's degree holders is at present an impossible task, especially for many countries at a time. Second, while most doctoral holders never file a patent, a large majority of them publish one or more scientific articles during their PhD or afterwards. By tracking these publications, whose contents are indicative of the individual's inventive potential, we can observe whether women and men with similar potential have the same probability to file a patent or not. By using a metaphor largely used in gender studies, we can test whether the pipeline leading from doctoral studies to inventive activities leaks more for women than for men.

5.1. The DOC-TRACK database

The DOC-TRACK database results from the combination of multiple bibliographic sources (full details in Annex 4). These include the national ETD repositories for seven countries, namely: Austria, France, Germany, Italy, the Netherlands, Spain and the United Kingdom. These repositories are managed by public agencies or universities' consortia and cover almost all doctoral programs in our period of interest, 2000–2020. Of these, we retain only the STEM dissertations, which we further classify univocally in one out of four large disciplines, namely:

i). *Engineering* (comprising General Engineering, Chemical Engineering, and Energy);

ii). *Life Sciences* (comprising Agricultural and Biological Sciences, Biochemistry, Genetics and Molecular Biology, Immunology and Microbiology, Neuroscience, Pharmacology, Toxicology and Pharmaceutics);

iii). *Mathematics and Computer Science*

iv). *Physical Sciences* (comprising General Physics and Astronomy, Material Sciences, Environmental Science, Earth and Planetary Sciences, and also Chemistry as a neighbouring discipline).

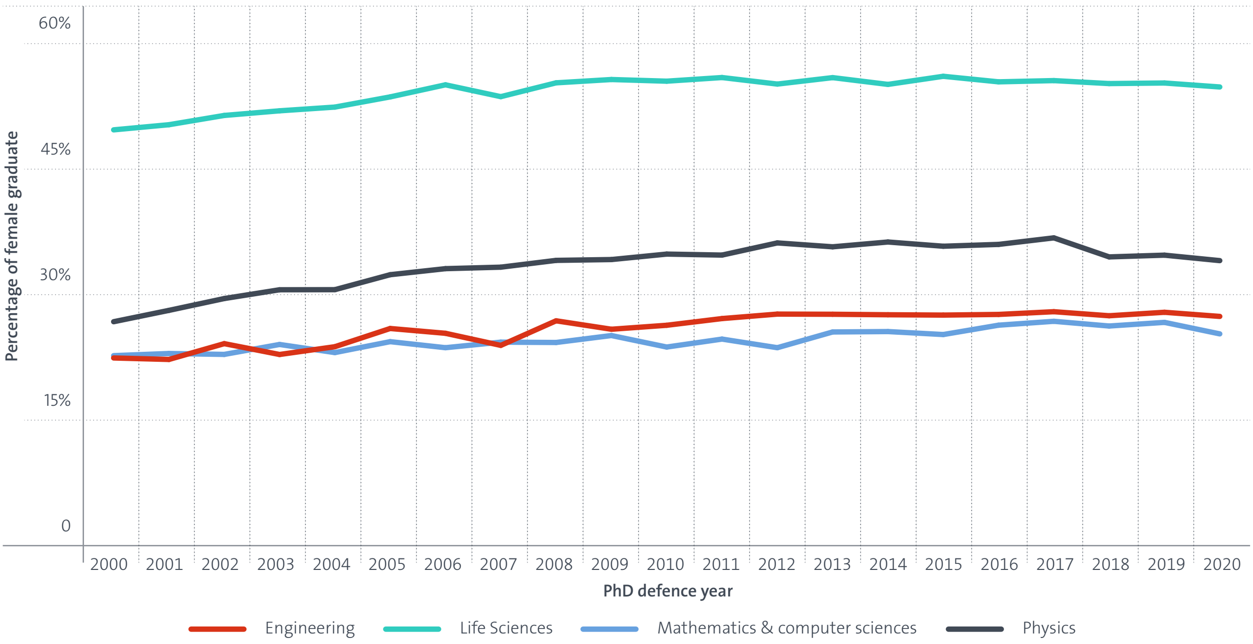
All ETD repositories provide information on the doctoral graduates' surnames and – with some exceptions – given (first) names, but are silent on any other biographical detail, including gender. DOC-TRACK attributes gender based on names, when available, which leads to mixed results according to the quality of the name information and the share of gender-neutral names typical of each linguistic group. In particular, we could attribute gender to only 34.7% of the graduates from Dutch universities and to 85.2% of those in the British ones (for all other countries, the percentage is always 97% or more). All the analyses in the remainder of the report exclude dissertations for which gender could not be attributed.

Figure 39 provides an overview of the gender distribution of graduates across disciplines and countries, and over time (where values in the horizontal axis correspond to graduation years or "cohorts"), based on the contents of the DOC-TRACK database.

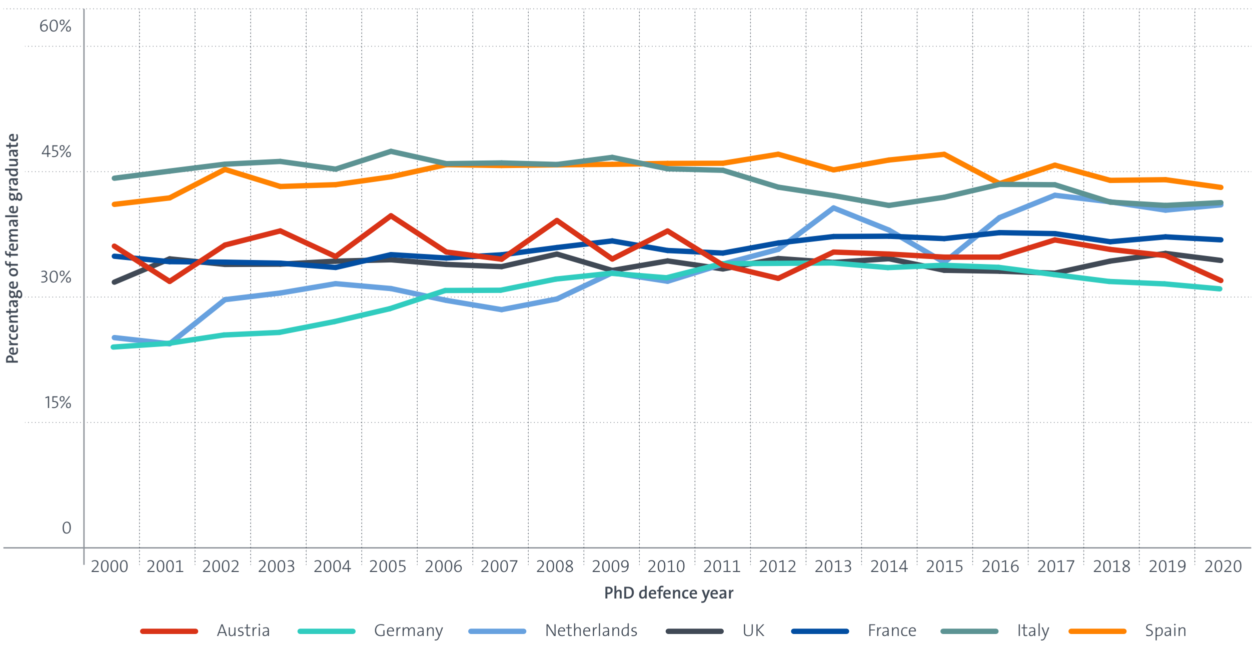
Figure 39:

Share of female doctoral graduates, by graduation year

a) By STEM discipline



b) By country



Source: DOC-TRACK

Discipline-wise, for the ensemble of the seven countries, the share of female graduates appears to have been increasing since the year 2000. With the exception of the last few years in the series, the most persistent trend concerns the *Physical Sciences*, whose share of female graduates increases from less than 30% in 2000 to almost 40% in 2017. *Engineering* as well as *Mathematics and Computer Science* also follow an increasing trend, but less pronounced. In fact, their shares of female graduates start below that of the *Physical Sciences* (around 20% in 2000) and never catch up. The *Life Sciences* stand apart from all other disciplines, with an almost equal gender distribution of graduates in 2000 and a prevalence of women (almost 60%) in 2020. However, since around 2005, the trend has been substantially flat.

Trends by country are much less clear as they depend on both the disciplinary composition of the different graduation cohorts and country-specific factors (such as gender differences in the attractiveness of research careers and differences in the inflow of foreign students, whose gender composition may differ from that of native students).

At the beginning of the period, both the Netherlands (for which, however, we have few observations) and Germany stand below all other countries, with little more than 20% of female graduates. But their ensuing trends are very different, with the Netherlands' share increasing quickly and steadily up to around 40% in 2020, while Germany exhibits a mild increase up to around 35% in 2012, and a trend reversal in the following years. In the UK, the women's share is substantially stable at over 30%, and the same applies to Austria, albeit with more year-to-year variations, most likely due to the small sample size. Italy and Spain exhibit the highest share, but with different trends: at first over 45% then dropping below 45% for Italy, and almost the opposite for Spain.

The DOC-TRACK database augments this basic information on the gender distribution of graduates with additional information on the graduates' scientific and inventive activities. In particular, based on a name-match between graduates and authors of scientific publications as well as inventors listed on EPO patent applications, the DOC-TRACK database includes, for each graduate:

— the number of scientific publications per year, as found in Elsevier Scopus (a commercial database) and OpenAlex (a free-access bibliographic database), with complete publication coverage up to 2021;

— the number of patent applications filed at EPO, as found in the December 2024 edition of the PATSTAT database, with complete EPO patent filing coverage up to 2022.

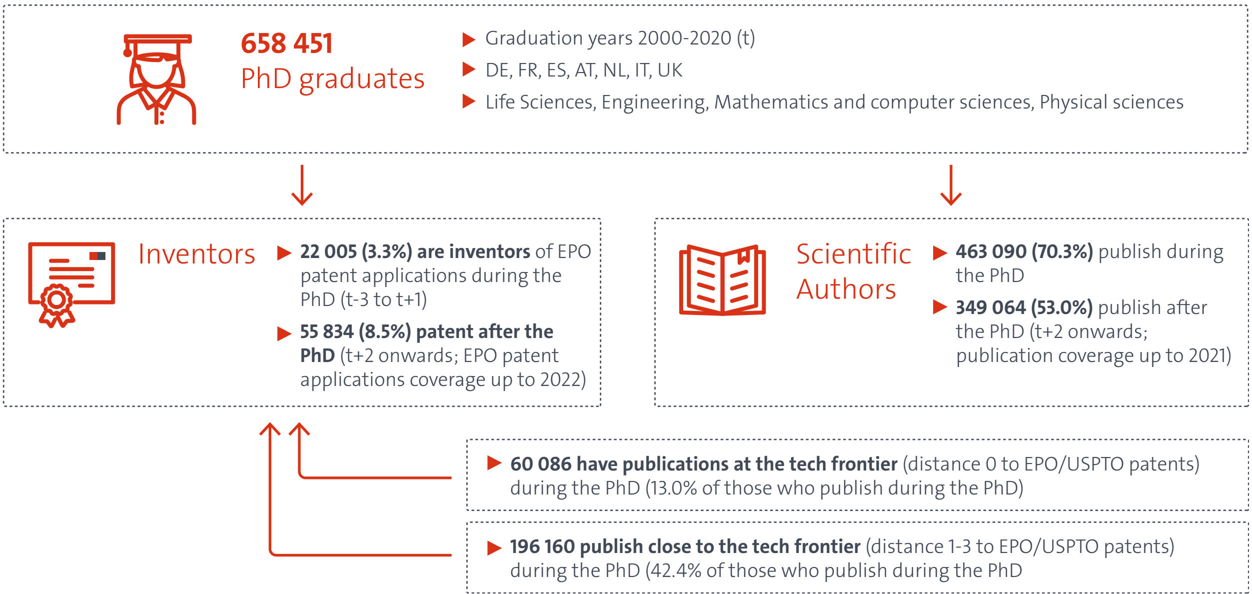
For both publications and patents, the DOC-TRACK database distinguishes between those produced during and after the PhD. In this report we use data from DOC-TRACK on patents produced during the doctoral studies (indicative of the graduate's interest in inventive activities) and on patents produced afterwards (which are instead indicative of the graduates' professional outcome and subsequent career in inventive activities), as well as data on publications produced during the doctoral studies and their relevance for technological change, as measured by patented inventions. The latter is based on the concept of "technological frontier", which is defined, following Ahmadpoor and Jones (2017), as all pairs of patent applications and scientific publications linked by a citation from the former to the latter. All publications at the frontier are clearly relevant inputs for the patented inventions. In addition, DOC-TRACK identifies all the scientific publications cited by one publication at the frontier as standing at a distance 1 from the frontier itself. By extension, DOC-TRACK follows all citation chains between publications eventually leading to the frontier and classifies the related publications as *connected* to the technological frontier, at a distance measured by the number of citations. Figure A4.2 in Annex 4 provides a few illustrative examples.

Figure 40 summarises the information on the contents of the DOC-TRACK database that are most relevant for this report, as well as on the sample sizes. Note that patenting is a rare event, with only 3.3% of all doctoral graduates filing one or more patents during their studies and 8.5% afterwards. Instead, 70.3% of the graduates publish at least once during their studies, and 53% keep doing so afterwards.

This does not mean, however, that the research conducted by doctoral students is irrelevant for inventions: 13% of those who publish during their PhD have at least one publication at the technological frontier that is directly cited by a patent, and 42.4% have at least one publication at a short distance (1 to 3 citation steps).

Figure 40

DOC-TRACK Women in STEM database



Source: EPO

5.2. STEM doctoral graduates and patenting

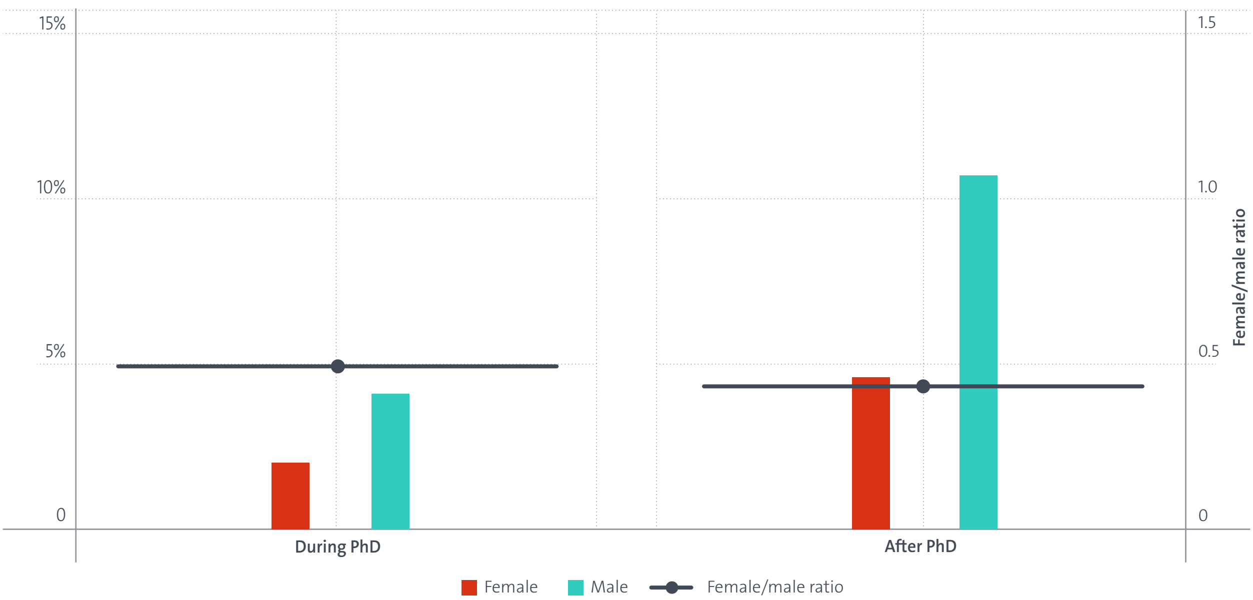
In this section, we examine the gender gap in patenting by comparing patenting rates, that is, by measuring the share of women inventors among all women graduates relative to the analogous share for men. This approach addresses a straightforward question: *Do women and men with STEM PhDs differ in their observed likelihood of patenting across countries, disciplines and career stages?*[12]

Figure 41 reports the baseline information concerning the gender distribution of doctoral graduates with at least one patent filed either before or after graduating, both over the entire period of interest and by year of graduation (graduation cohort). The red and green bars represent the shares for women and men, respectively, whose values can be read on the left-hand vertical axis. The black line, whose value is reported on the right-hand vertical axis, measures the ratio between the two.

We note that, both before and after graduating, the share of women graduates with patents is around half that of men, the ratio of shares always standing at around 0.5. This is indicative of a strong gender imbalance, with two male graduates filing a patent for every female graduate who does so. From the right-hand graph, we also note that – at least for men – the share of graduates who end up filing at least one patent is non-negligible, standing at 10%. This value is all the more impressive when keeping in mind that our patent data suffer from right-hand truncation, being complete only up to 2022, just two years after the most recent graduation cohort in our sample (see the right-hand graph in Figure 42, where we show time trends).

Figure 41

Share of graduates with at least one patent filed, pre- and post-graduation; 2000–2020



Sources: EPO - DOC-TRACK; PATSTAT

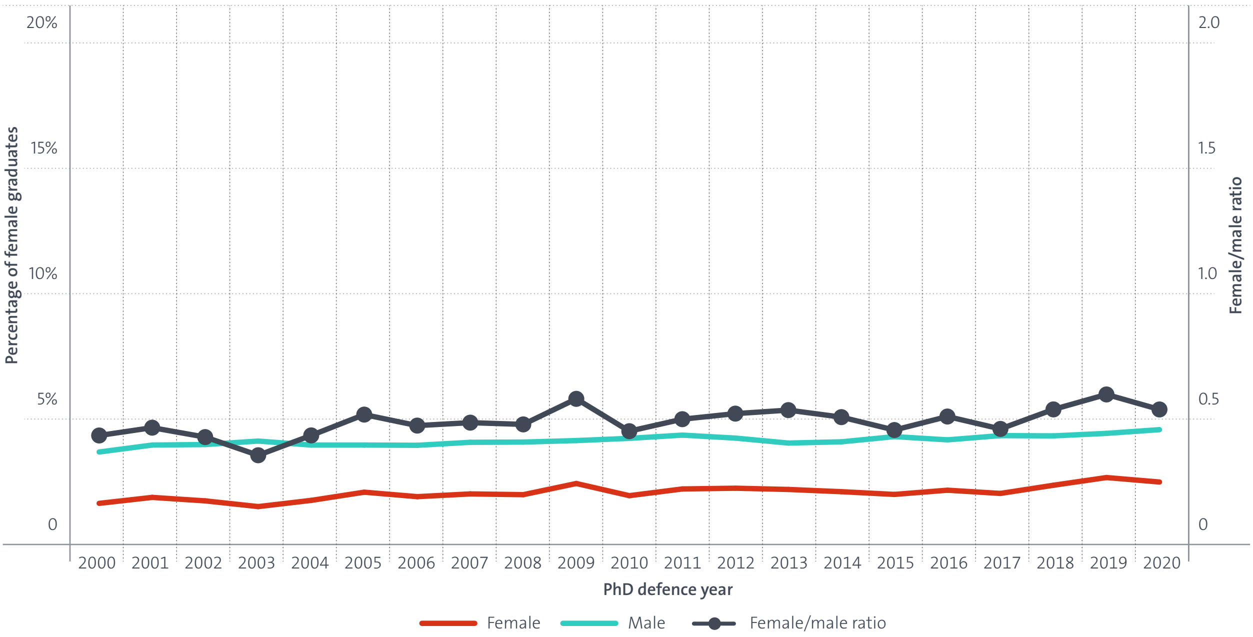
Note: The red and green bars represent the shares of female and male graduates, respectively, with at least one patent filed during (graph at left) and after (graph at right) their PhD. Their values are reported on the left-hand vertical axis. The black line represents the ratio between the shares of female and male graduates (female/male ratio), as measured on the right-hand vertical axis. If the two shares are equal, the ratio takes the value one; if the share of female graduates is larger than that of male graduates, the female/male ratio takes values larger than one, and vice versa.

12 Section 5.5 provides a complementary approach by asking a related but distinct question: Are women under- or over-represented among patenting PhD graduates relative to their share among all PhD graduates?

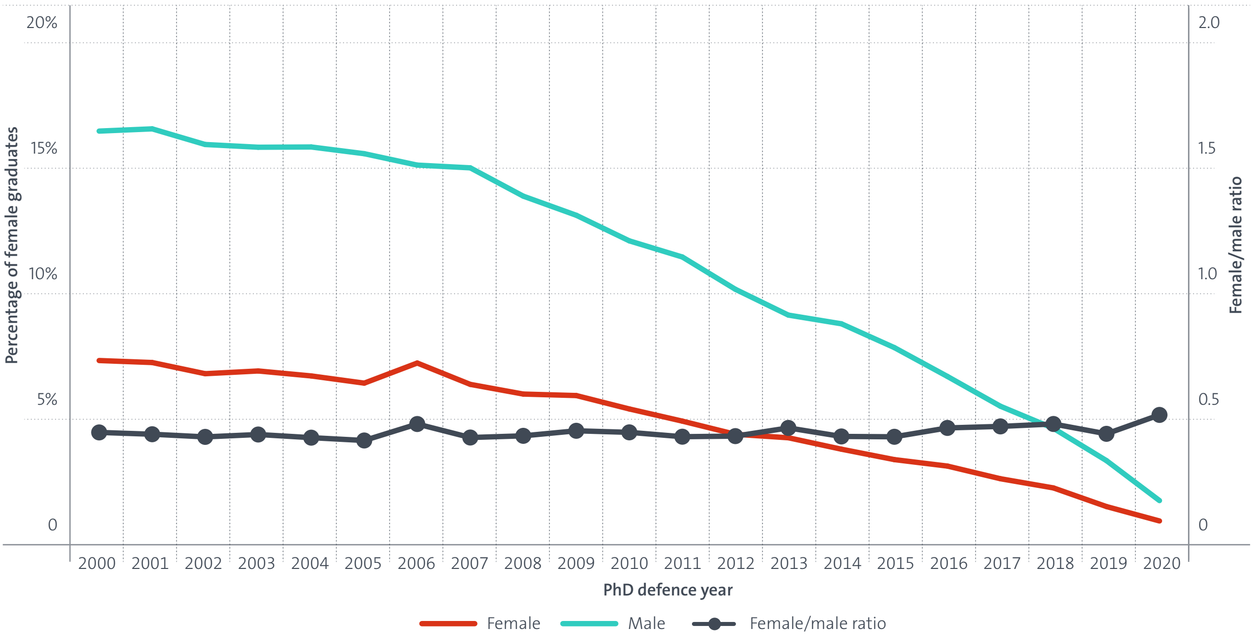
Figure 42

Evolution of share of graduates with at least one patent filed, pre- and post- graduation; 2000–2020

a) During PhD



b) After PhD



Source: EPO - PATSTAT, DOC-TRACK

Note: The red and green lines represent the shares of female and male graduates, respectively, with at least one patent filed during (graph a) and after (graph b) their PhD. Their values are reported on the left-hand vertical axis. The black line represents the ratio between the shares of female and male graduates (female/male ratio), as measured on the right-hand vertical axis. If the two shares are equal, the ratio takes the value one; if the share of female graduates is larger than that of male graduates, the female/male ratio takes values larger than one, and vice versa.

Figure 43 breaks down the baseline evidence by country. In all countries, men have a higher share of graduates with at least one patent than women, both before and after graduation (the black lines indicating the ratio of shares never reach the value one). The ratio of shares is particularly low in Austria and Germany (way less than 0.50, especially post-graduation) and much less so in Spain (around 0.75), with the other countries in between.

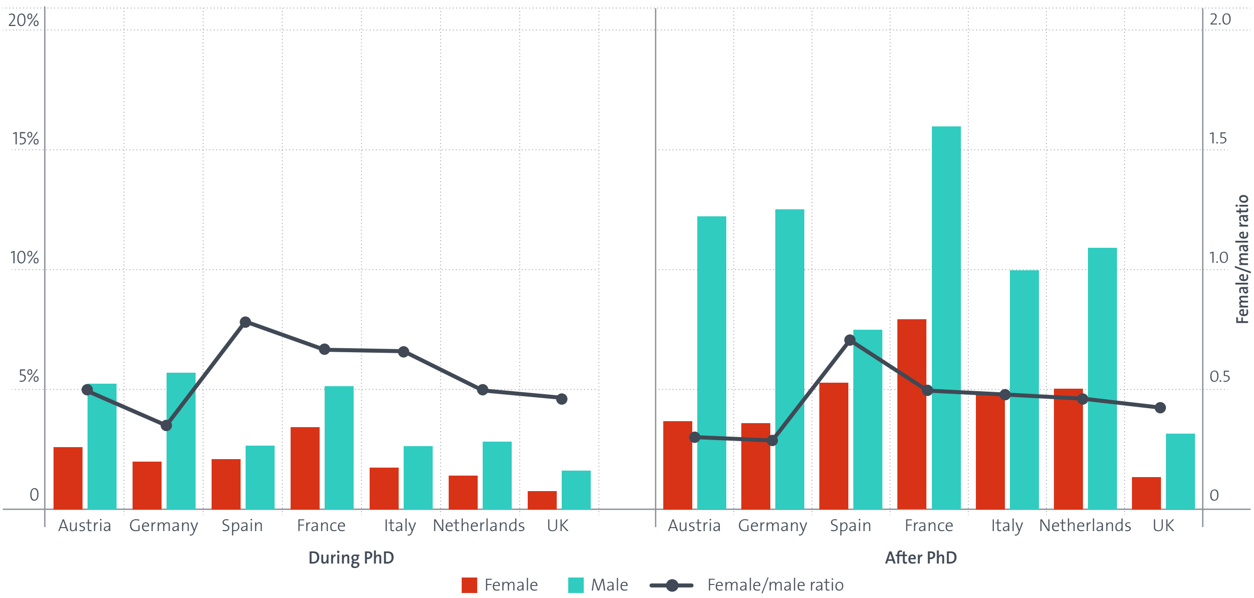
A comparison of the left- and right-hand graphs suggest that the gender gap – as expressed by the ratio of shares – worsens after the graduation: while both women and men are much more likely to file a patent after graduating, rather than before, this increase is more remarkable for men than for women in all countries (especially in the case of Austria and Germany). As for general values, we note that the probability of filing a patent during the PhD is relatively high, and similar for Austria, Germany and France, with the Netherlands and Italy catching up in the post-graduation period, and low for the UK.[13] Once again, this holds true especially for men, and is more nuanced for women.

Figure 44 breaks down the baseline evidence by discipline. Engineering graduates, especially male graduates, are those with the highest share of inventors during the PhD, with the Physical Sciences graduates catching up afterwards. The ratio of shares moves down in the post-graduation period for all disciplines, more or less maintaining the same cross-disciplinary differences. This is in contrast with the cross-country evidence, according to which the decrease was stronger for some countries and weaker for others. This suggests that differences in the disciplinary distribution of graduates do not explain the observed cross-country differences entirely.

Doctoral graduates who patent after graduating may do so while working for different types of patent applicants, namely small or large business companies, as well as universities and public research organisations. In addition, many patents filed when working for the latter may be applied for not by their employers, but by business companies funding or co-funding the research. This is similar to what happens before the graduation: while being employed – as doctoral students – by their universities, the future graduates may work on business-sponsored projects, with the resulting patents being applied for by the sponsors. Figure 45 breaks down the baseline evidence by patent applicant and discipline, by patent applicant and country.

Figure 43

Share of graduates with at least one patent filed, pre- and post-graduation, by country; 2000–2020



Sources: EPO - PATSTAT, DOC-TRACK

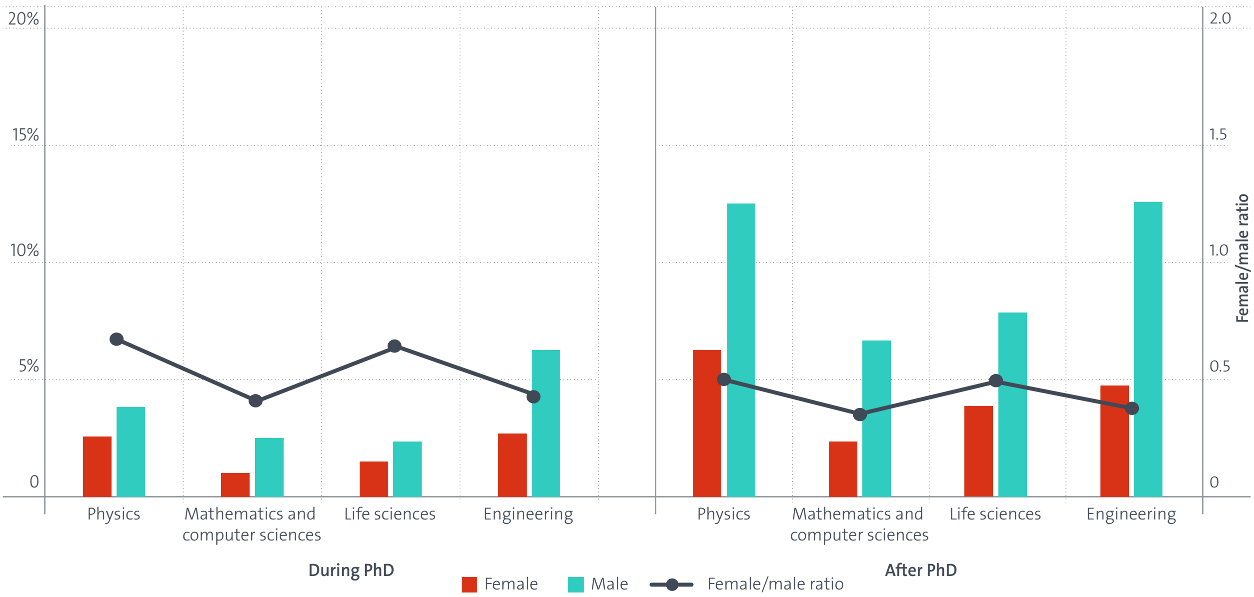
Note: For the interpretation of bars and lines, see note to Figure 41.

13 The low patenting propensity may reflect a broader trend of low per-head patenting in the UK (e.g. CIIP, 2024; EPO, 2024).

The main applicant types we consider are business companies (small and large, with the small ones also including startups and individual inventors), and research entities (universities plus public research organisations), based on EPO internal data (see Annex 4 for the definition of the different categories in the patent applicant classification).[14]

Figure 44

Share of graduates with at least one patent filed, pre- and post-graduation, by discipline; 2000–2020

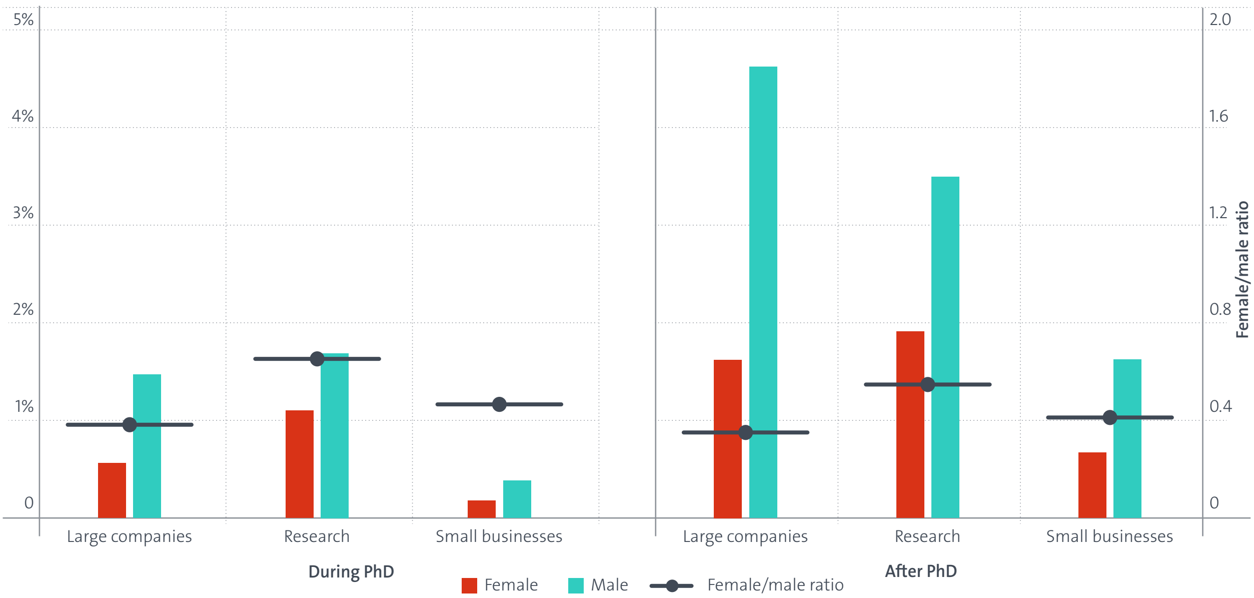


Note: For the interpretation of bars and lines, see note to Figure 41.

Sources: EPO - PATSTAT, DOC-TRACK

Figure 45

Share of graduates with at least one patent filed pre- or post-graduation, by applicant type; 2000–2020



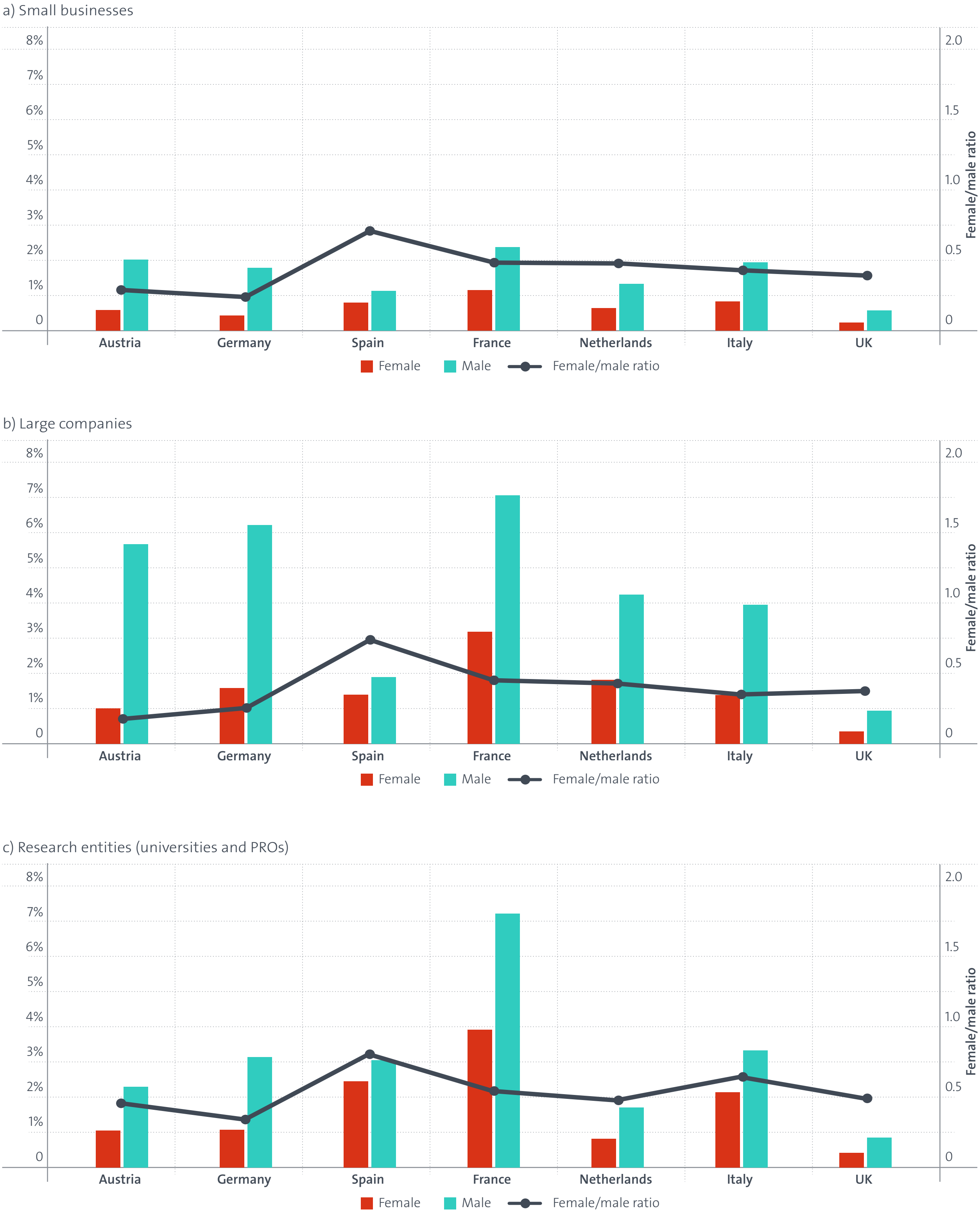
Note: For the interpretation of bars and lines, see note to Figure 41.

Sources: EPO - PATSTAT, DOC-TRACK

14 The share of all graduates with patents filed by small businesses corresponds largely to startups, both during the PhD (0.01% individuals, 0.22% startups, 0.09% other small businesses) and after the PhD (0.06% individuals, 0.93% startups, 0.31% other small businesses).

Figure 46

Share of graduates with at least one post-graduation patent, by applicant type and country; 2000–2020



Note: For the interpretation of bars and lines, see note to Figure 41.

Source: EPO - DOC-TRACK; PATSTAT

By comparing the left- and right-hand graphs in the figure, we note that, irrespective of gender, the patents signed by doctoral graduates are more likely to come from large companies and research entities, with a slight preponderance of the latter for the applications filed during the PhD and of the former for those filed afterwards. As for gender imbalances, we note that – regardless of the applicant type – the share of female graduates with patents is lower than the share of males. More interestingly, the ratio of the two shares is especially low when applicants are large companies, for which the ratio also declines the most when moving from pre- to post-graduation patents. In other words, much of the increasing gender bias that we observe when moving from before to after graduation is due to large companies.

Figure 46 focuses on post-graduation patents, with a breakdown by type of applicant and country. We note that, whatever the combination of applicant and country, the share of female graduates with patents is lower than the share of males.

We also note that, when it comes to the ratio of shares, the country ranking is similar to that in the right-hand graph of Figure 43, with Austria and Germany presenting the lowest value and Spain the highest, irrespective of the applicant type. Finally, we note that in all countries the ratio is higher for patents filed by research entities, with minimal differences between those filed by small and large companies.

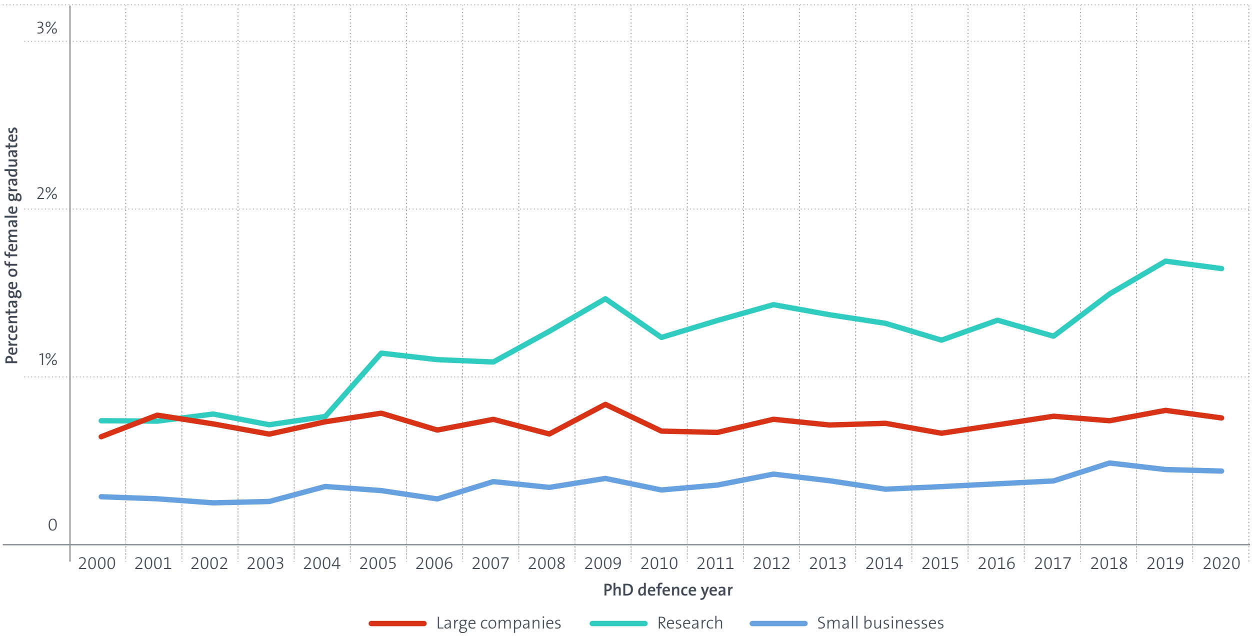
As regards time trends, Figure 47 indicates that, for both men and women, the overall increase in the share of graduates with patents filed during the PhD is almost entirely due to the patenting activities of research entities. This is in line with the extensive literature on the rise of academic patenting in all European countries (Lissoni, 2012; EPO, 2024; EPO, 2025). By comparing the two graphs in the figure, we get further confirmation of large companies being the main source of the gender imbalance in the pre-graduation patenting rates over the entire time period. Note, however, the increase in university patenting also contributes, albeit less, to increasing the gap between male and female graduates.

Figure 48 provides the same type of evidence, but for patents filed after graduation. Data for more recent years are less informative due to right truncation issues (therefore, no trend can be reliably inferred from the graphs). Data up to around 2014 are informative enough and once again point to large companies as the main – although not exclusive – source of gender imbalance: while the share of female graduates patenting for large companies and research entities is very similar, in the case of male graduates, that for large companies is considerably higher. Patents by research entities, however, also come disproportionately from men relative to women, suggesting that combining academic careers with inventive activities is far more common for men than for women, also in accordance with the existing literature.

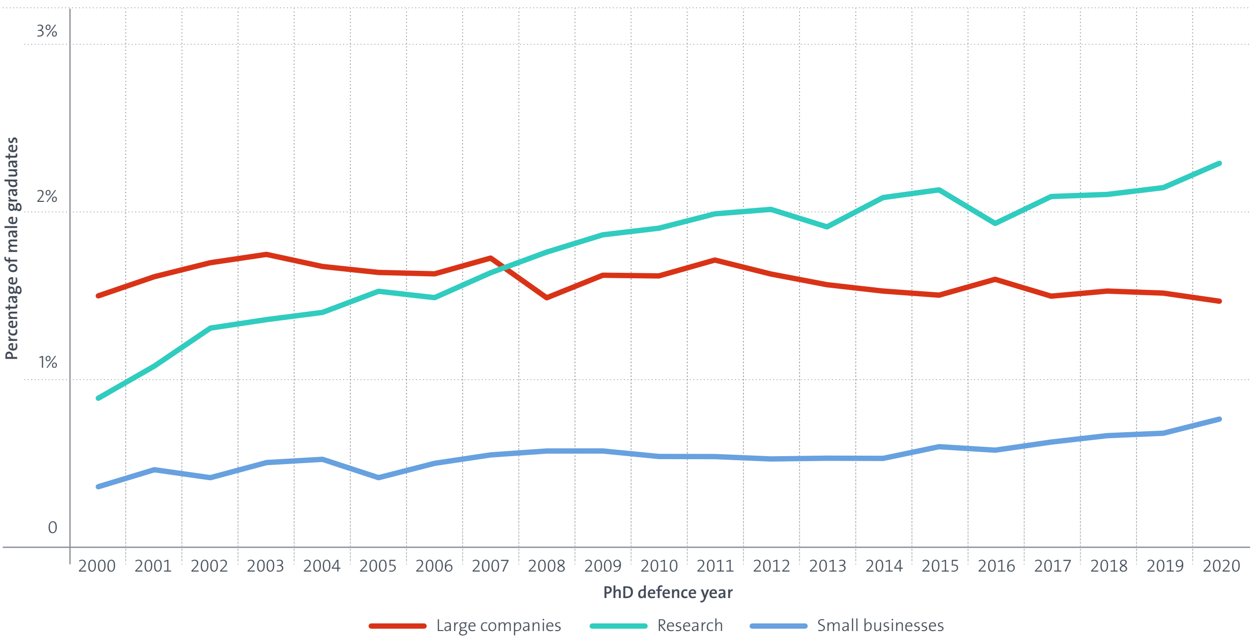
Figure 47

Share of graduates with at least one patent before graduation, by type of applicant and year; graduation years 2000–2020

a) Female PhD graduates



b) Male PhD graduates



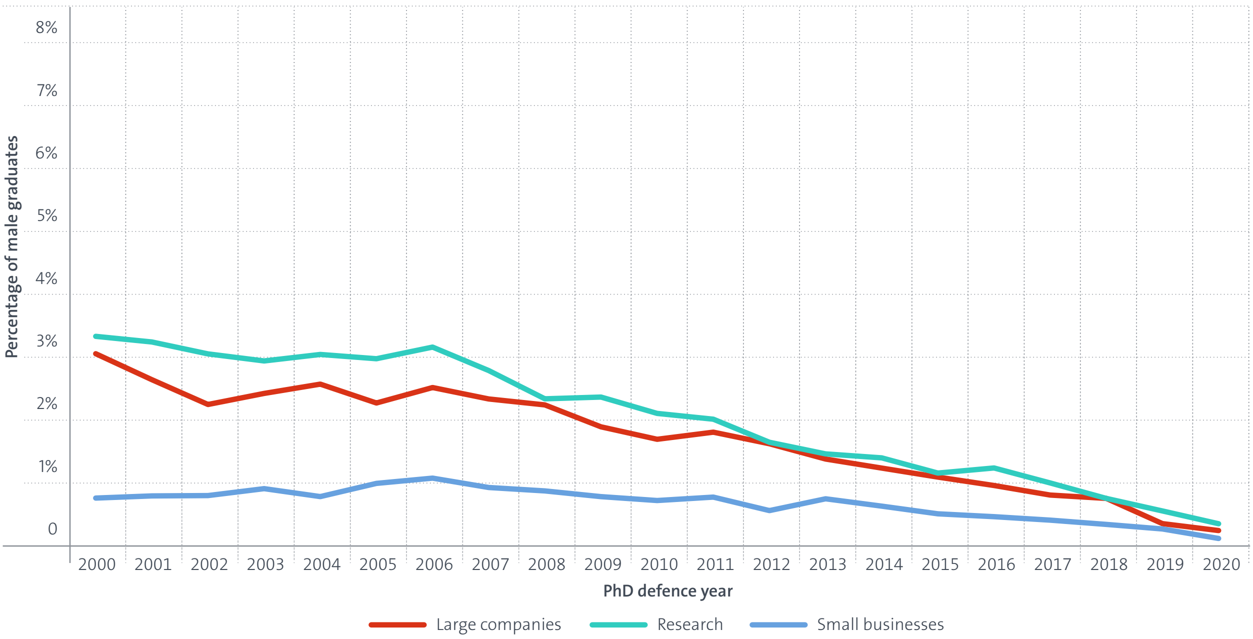
Sources: EPO - PATSTAT, DOC-TRACK

Note: The graph at the top shows the shares of female graduate-inventors over all female graduates, by graduation cohort and type of applicants of patents filed during their PhD, listing them among the inventors, where the latter is defined as "having at least one patent with an applicant of a given category". The categories considered are large companies, research, small businesses (including startups, individual applicants and other small and medium-sized enterprises). Only patents of graduates with categories of applicants identified are considered. The graph at the bottom shows the same results for male graduates.

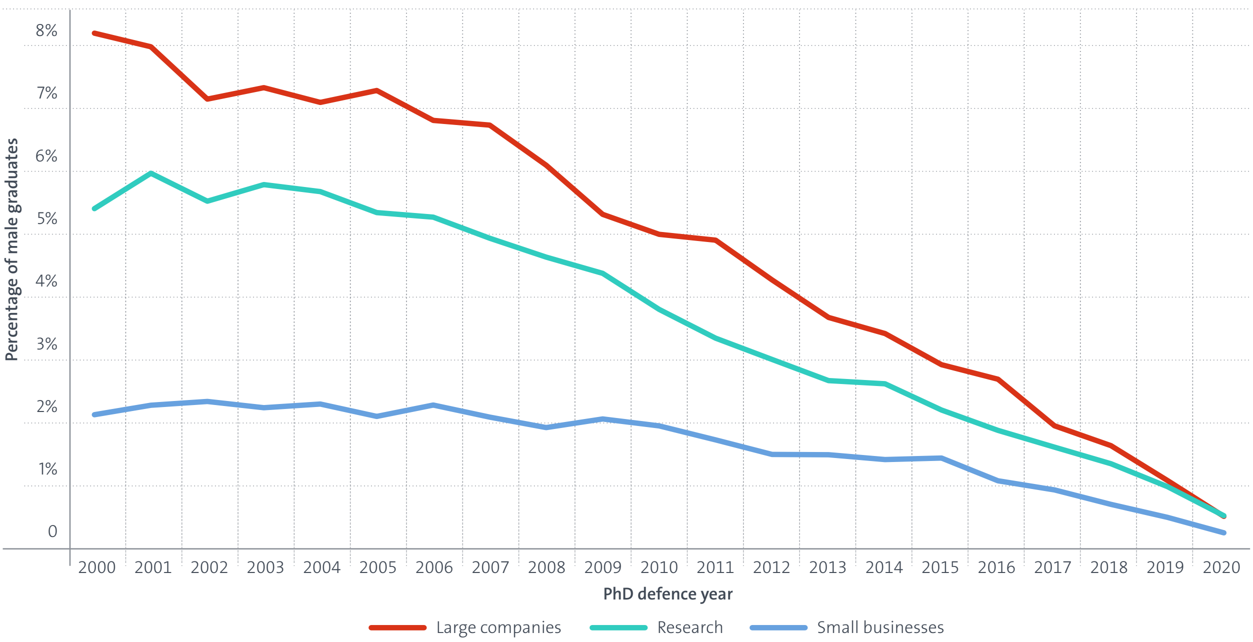
Figure 48

Share of graduates with at least one patent after graduation, by type of applicant and year; graduation years 2000–2020

a) Female PhD graduates



b) Male PhD graduates



Sources: EPO - PATSTAT, DOC-TRACK

Note: The graph at the top shows the shares of female graduate-inventors over all female graduates, by graduation cohort and type of applicants of patents filed during their PhD, listing them among the inventors, where the latter is defined as "having at least one patent with an applicant of a given category". The categories considered are large companies, research, small businesses (including startups, individual applicants and other small and medium-sized enterprises). Only patents of graduates with categories of applicants identified are considered. The graph at the bottom shows the same results for male graduates.

5.3. STEM doctoral graduates and publishing

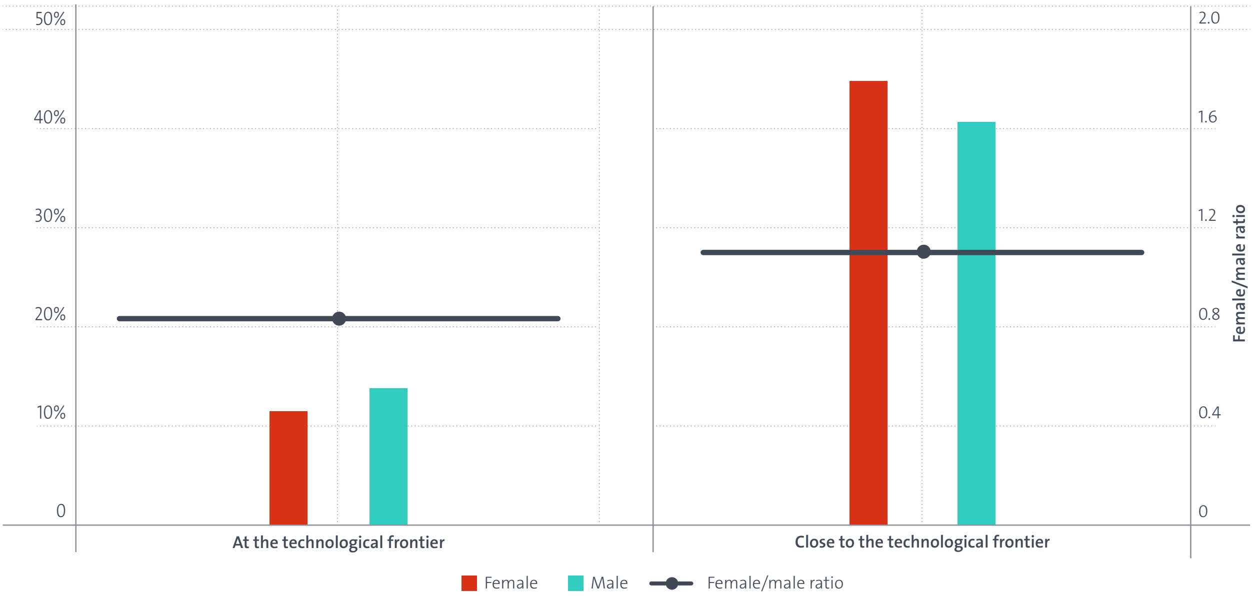
In this section, we analyse the articles published by female and male graduates *during their PhD*, which serve as key input for subsequent inventive activities. Specifically, we consider articles at the technological frontier and close to the technological frontier. Our aim is to answer the question: *How close is the scientific knowledge produced by PhD graduates to the technological frontier, and is there a difference in the technological potential of female and male graduates' academic research?*

While patenting during a doctorate is a rare event, publishing is very common, with no less than 70% of the graduates in our sample producing at least one scientific article. Many of these articles are either cited directly by a patent (i.e. they stand at the technological frontier) or are cited indirectly, via a short citation chain passing through other publications (i.e. they stand close to the technological frontier at distances 1, 2 or 3).[15]

Figure 49 shows that around 10% of graduates have at least one publication at the frontier, i.e. directly cited by a patent, and 40% have at least one publication close to the frontier, i.e. at distances of 1, 2 or 3 from a patent citation. The share of female graduates with at least one publication at the frontier is slightly smaller than that for males (left-hand graph), but becomes slightly higher when considering the publications close to the frontier instead (right-hand graph).

Figure 49

Share of graduates with at least one publication at or close to the technological frontier, 2000–2020



Sources: EPO - PATSTAT, DOC-TRACK

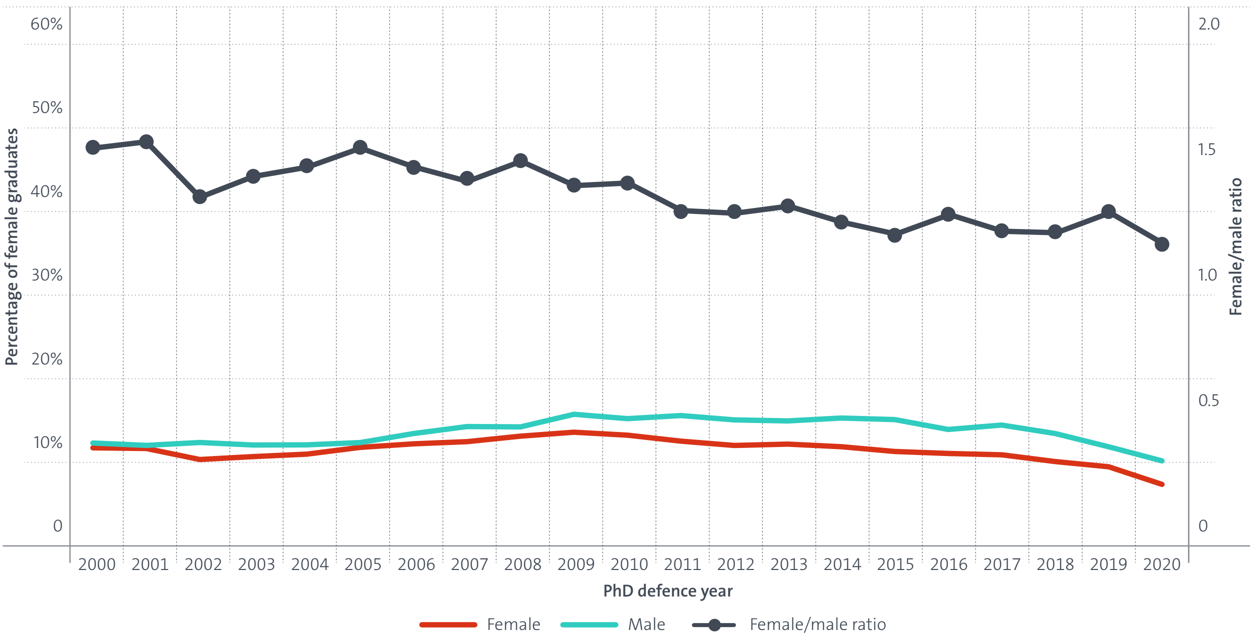
Note: The red and green bars represent the shares of female and male graduates, respectively with at least one publication at the technological frontier (graph at left) and close to the technological frontier (graph at right) during their PhD. Their values are reported on the left-hand vertical axis. The black line represents the ratio between the shares of female and male graduates (female/male ratio), as measured on the right-hand vertical axis. If the two shares are equal, the ratio takes the value one; if the share of female graduates is larger than that of male graduates, the female/male ratio takes values larger than one, and vice versa.

15 See Annex 4 for more information.

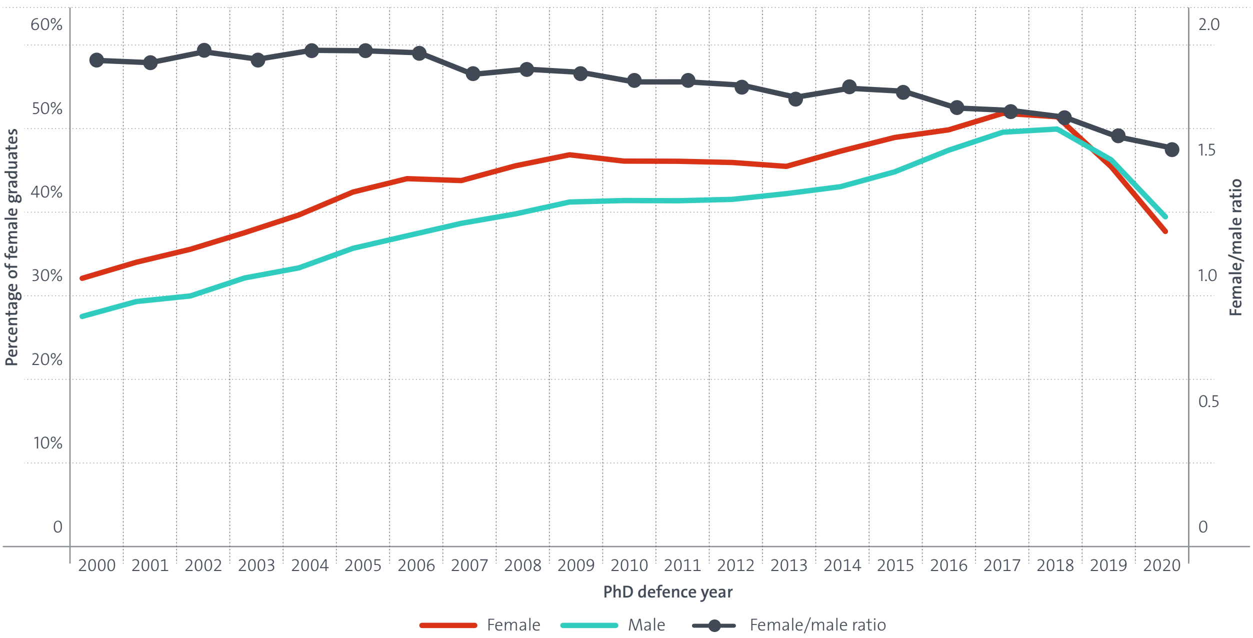
Figure 50

Share of graduates with at least one publication at or close to the technological frontier, by graduation year; 2000–2020

a) At the technological frontier



b) Close to the technological frontier



Sources: EPO - PATSTAT, DOC-TRACK

Note: The red and green lines represent the shares of female and male graduates, respectively with at least one publication at the technological frontier (graph a) and close to the technological frontier (graph b) during their PhD. Their values are reported on the left-hand vertical axis. The black line represents the ratio between the shares of female and male graduates (female/male ratio), as measured on the right-hand vertical axis. If the two shares are equal, the ratio takes the value one; if the share of female graduates is larger than that of male graduates, the female/male ratio takes values larger than one, and vice versa.

Figure 50 shows that the percentage of female and male graduates with at least one publication at the frontier is rather constant across graduation cohorts, with a slightly decreasing female/male ratio for more recent cohorts. On the contrary, the percentage of female and male graduates with at least one publication close to the frontier has been increasing since 2000, with a slight decrease in the female/male ratio. This evidence shows the absence of a gender imbalance, especially when considering publications close to the technological frontier, in contrast to what we observed for patenting, and a much more moderate imbalance for publications at the frontier.

This implies that the technological potential of female graduates' research is not inferior to that of men, but that the former – nevertheless – patent much less than the latter. To put it differently, it is unlikely that female graduates do not become inventors because of the lack of relevant research results.

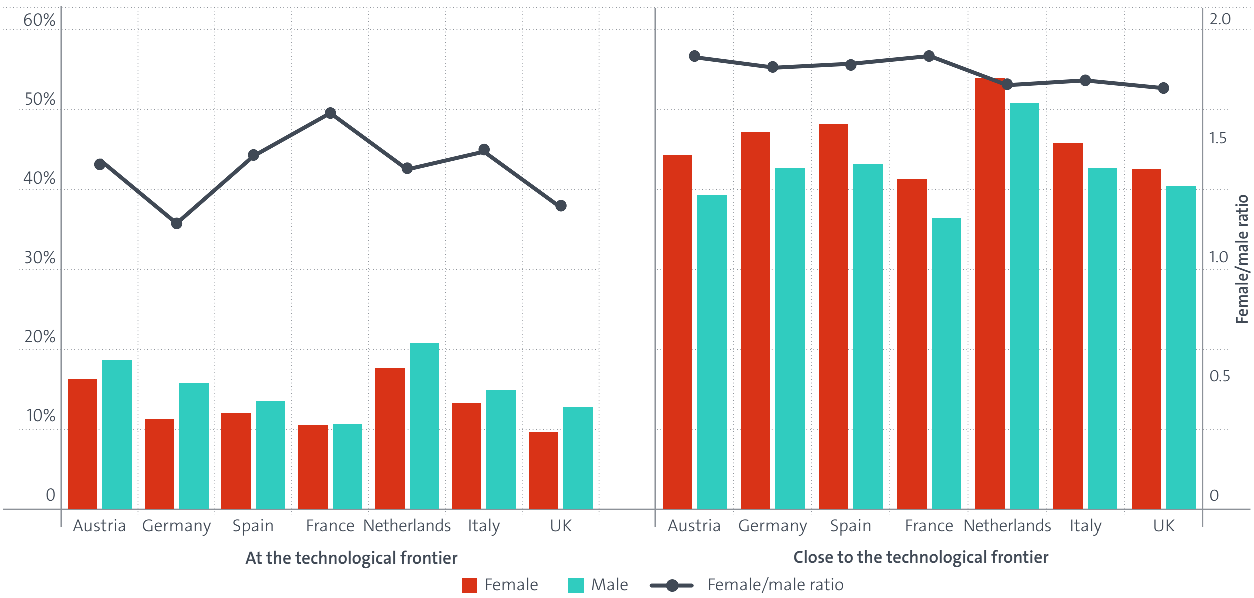
Figures 51 and 52 indicate that this evidence holds true for all the countries and disciplines in our sample (with only the limited exception of *Mathematics and Computer Science* when considering publications at the technological frontier), which implies that the difference in the gender shares in patenting and publishing does not depend on composition effects due to the distribution of gender across countries or disciplines.

These results also hold true regardless of whether the authors of scientific publications connected to the technological frontier are also inventors (that is, they file a patent during or after their PhD).

Figure 53 shows that the percentage of graduates with publications at the frontier during the PhD is higher among inventors than among non-inventors, whereas it is nearly equivalent among graduates with publications close to the frontier. More importantly, we observe a gender gap only for the least numerous case (non-inventors with at least one publication at the technological frontier), which suggests – once again – that the origin of the gap in patenting observed in the previous section does not originate in the type of research conducted during the PhD.

Figure 51

Share of graduates with at least one publication at or close to the technological frontier, by country; 2000–2020

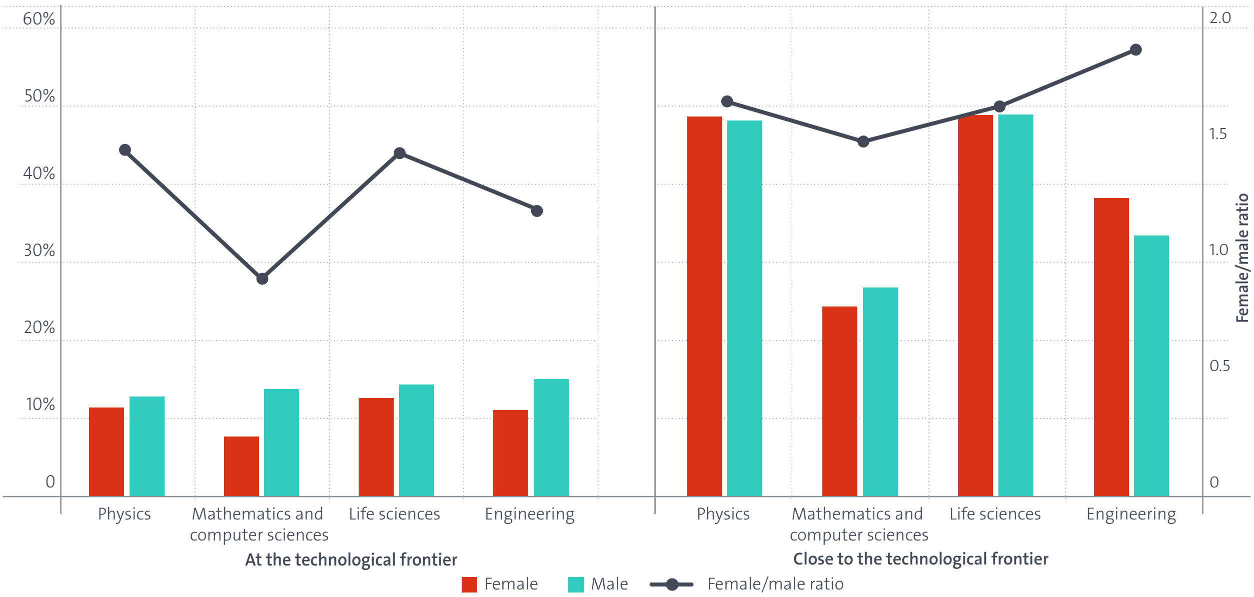


Note: For the interpretation of bars and lines, see note to Figure 49.

Sources: EPO - PATSTAT, DOC-TRACK

Figure 52

Share of graduates with at least one publication at or close to the technological frontier, by discipline; 2000–2020

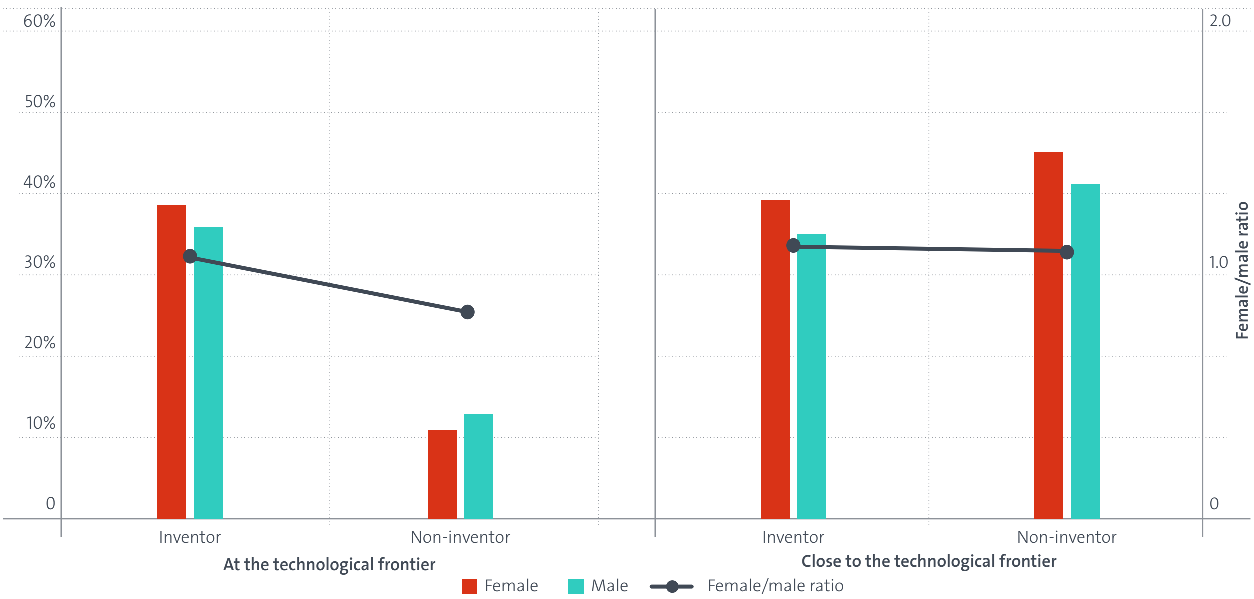


Note: For the interpretation of bars and lines, see note to Figure 49.

Sources: EPO - PATSTAT, DOC-TRACK

Figure 53

Share of graduates with at least one publication at or close to the technological frontier, inventors versus non-inventors; 2000–2020



Note: For the interpretation of bars and lines, see note to Figure 49. Inventors are graduates with at least one patent filed during the PhD.

Sources: EPO - PATSTAT, DOC-TRACK

5.4. The "leaky pipeline" from academia

Much of the literature on gender in science commonly uses the "leaky pipeline" metaphor to describe the progressive under-representation of women when moving from STEM undergraduate to graduate studies and from there to the research profession, either at a university or (especially) in industry, particularly in the most senior positions (Carpentier et al., 2024). The evidence produced by the EPO in its 2022 report already showed that this phenomenon is especially striking when it comes to patenting, where the under-representation of women is higher than in R&D professions as a whole.

Figure 54 summarises the results from Sections 5.2 and 5.3 above, and provides further details on the "leakage" for doctoral graduates from science to technology, both by country and discipline, by analysing publications and patents produced exclusively during their doctoral studies.

Each of the two graphs in the Figure presents three colour-coded ratios of shares: a green line for the ratio of shares of female over male graduates with at least one publication *close* to the technological frontier (1 to 3 citation steps), an orange line for the ratio of female over male graduates with at least one publication *at* the frontier (directly cited by a patent), and a red line for the share of female over male graduates with at least one *patent*. All publications and patents refer to the PhD period.

We notice immediately that, in all countries and disciplines (with only the limited exception of *Mathematics and Computer Science*), the ratio of shares is equal to one or higher when considering the publications close to the frontier, moves down to less than one when considering the publications at the frontier, and drops to around 0.5 for patents. Note that the drop from the green to the orange line may be due to both the contents of the publications (slightly more remote from the frontier for women than for men), but also to the fact that, as discussed above, male graduates are more likely to patent than women and have their patents directly citing their research. The pipeline leading from a thesis (science) relevant to inventions (technology) is indeed leaky, with women dropping out at much higher rates than men.

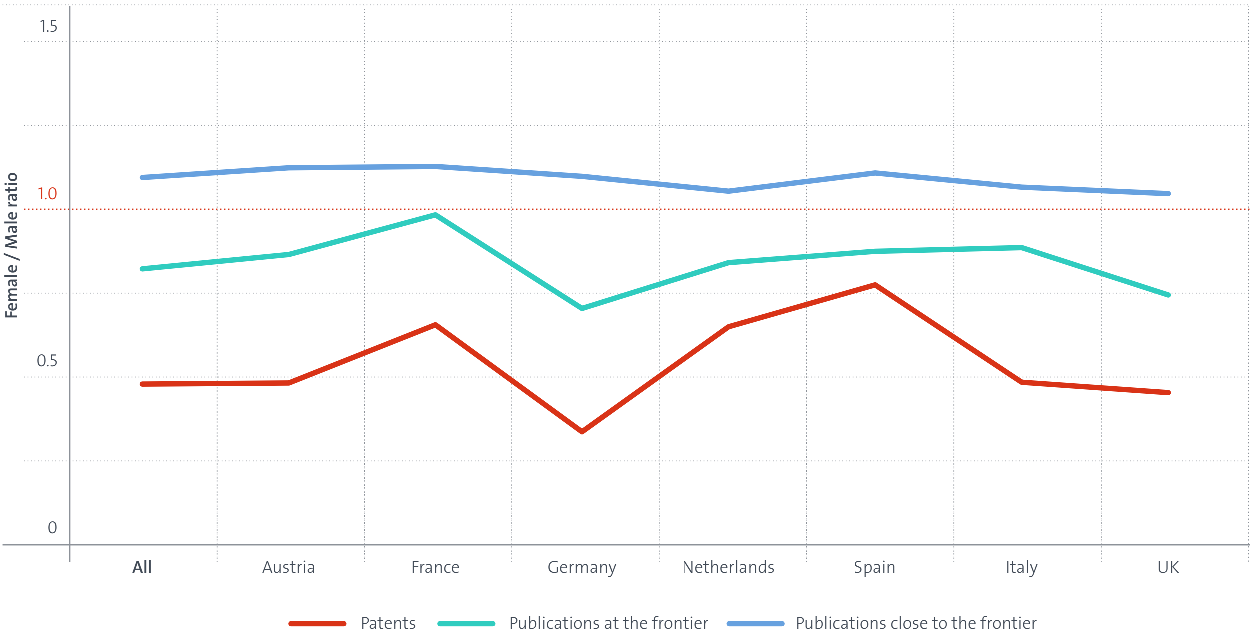
A closer look at countries suggests that much of the leakage is due to country-specific factors. When observing the ratio of female/male graduates with publications close to the frontier (green line), we see no major cross-country difference. These emerge when moving to the ratio of graduates with publications at the frontier (orange line) and even more so to the ratio of graduates with patents (red line).

Here, the hierarchy observed in Section 3, with Germany exhibiting the lowest ratio, and Spain the highest, is finally established. Similarly, some discipline-specific effects – having more to do with the sociology of the associated professions than the nature of knowledge produced by men and women – may be at play. In particular, the largest drop from the green line to the orange line, and then to the red line, is for *Engineering*.

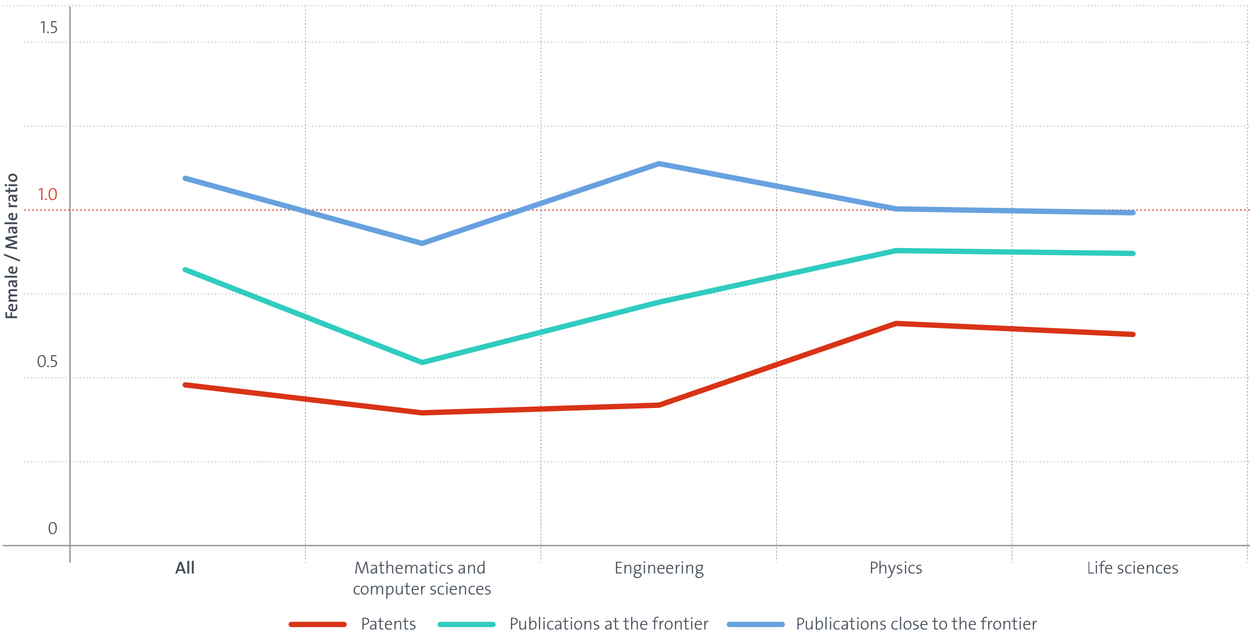
Figure 54

Ratios of female/male share of graduates with at least one publication at or close to the technological frontier, or with patents during the PhD, by country and discipline; 2000–2020

a) By country



b) By discipline



Sources: EPO - PATSTAT, DOC-TRACK

Note: Each line reports a ratio of shares of female and male graduates with patents, publications at the technological frontier (direct citations from patents), and publications close to the frontier (citation distance 1 to 3), respectively, during the PhD. If the two shares are equal, the ratio takes the value one; if the share of female graduates is larger than that of male graduates, the female/male ratio takes values larger than one, and vice versa.

5.5. Gender gap in patenting by STEM graduates – a complementary view

In Section 5.2 above, we examined the gender gap in patenting by STEM PhD graduates by comparing patenting rates, that is, by measuring the share of women inventors among all women doctoral graduates relative to the analogous share for men. This approach addresses a straightforward question: *Do women and men with STEM PhDs differ in their observed likelihood of patenting across countries, disciplines and career stages*? In this section, we take a complementary approach by asking a related but distinct question: *Are women under- or over-represented among patenting PhD graduates relative to their share among all PhD graduates*?

To formalise this distinction, we define:

w^P= the number of women with patents (among PhD graduates)

w^G= the number of women PhD graduates

m^P= the number of men inventors (among PhD graduates)

m^G= the number of men PhD graduates

In Section 3, we investigated the ratio between $s_w = \frac{w^P}{w^G}$ (the patenting propensity among women, i.e. the fraction of women PhD graduates who become inventors) and $s_m = \frac{m^P}{m^G}$ (the analogous propensity for men).

Under this framework, no gender gap exists when

$s_w = s_m$, or equivalently, when $\frac{s_w}{s_m}=1$.

Values of this ratio below 1 indicate a gender gap, with lower values signalling larger disparities.

Here, we focus instead on a different quantity:

$$Y= \frac{w^P}{w^P+m^P}$$

which represents the share of women among all PhD graduate inventors. We can similarly define

$$X= \frac{w^G}{w^G+m^G}$$

which is the share of women among all PhD graduates.

Comparing X and Y provides an alternative measure of the gender gap in patenting. The absence of a gender gap corresponds to the situation where $Y=X$, that is, when the share of women among PhD inventors equals the share of women among all PhD graduates. When $Y<X$, women are under-represented among patent holders relative to their presence in the PhD population, and the difference $(X\text{-}Y)$ quantifies the extent of this under-representation in percentage points.

5.5.1 Observed under-representation of women among inventors

Figure A3.1 presents the observed values of X (share of women among all PhD graduates) and Y (share of women among patent holders) for each of the seven countries in our sample, across two time periods (2000–2010 and 2011–2020) and two career stages (during PhD and after PhD graduation).

The most striking feature of Figure 55 is that all observations lie below the 45-degree line where $X=Y$. This indicates that women are systematically under-represented among patent holders relative to their share in the PhD population in every country, time period and career stage examined. The labels adjacent to each data point show the gap in percentage points, that is, the extent to which women's share among patent holders falls short of their share among PhD graduates.

While under-representation is universal, its magnitude varies considerably across countries. During the 2000–2010 period, the gaps during PhD ranged from 3.5 percentage points (Netherlands) to 17.3 percentage points (Germany), with Spain (6.5 percentage points) and France (7.8 percentage points) showing relatively smaller gaps, while Italy (14.3 percentage points), the United Kingdom (15.1 percentage points) and Austria (12.2 percentage points) displayed larger disparities. In the 2011–2020 period, Spain continues to exhibit the smallest gap during PhD (5.8 percentage points), while Germany (17.4 percentage points), Italy (16.6 percentage points) and Austria (15.6 percentage points) show the largest. This cross-country variation persists, and in some cases widens substantially when examining post-PhD patenting.

Comparing the left panels (during PhD) with the right panels (after PhD) reveals that, in most countries, the gender gap increases as researchers transition from doctoral studies to post-graduation careers. For instance, in the 2011–2020 period, Germany's gap increases from 17.4 percentage points during PhD to 20.4 percentage points after PhD. Austria shows a dramatic widening from 15.6 percentage points during PhD to 21.5 percentage points after PhD. The Netherlands exhibits a notable increase from 11.8 percentage points to 16.7 percentage points.

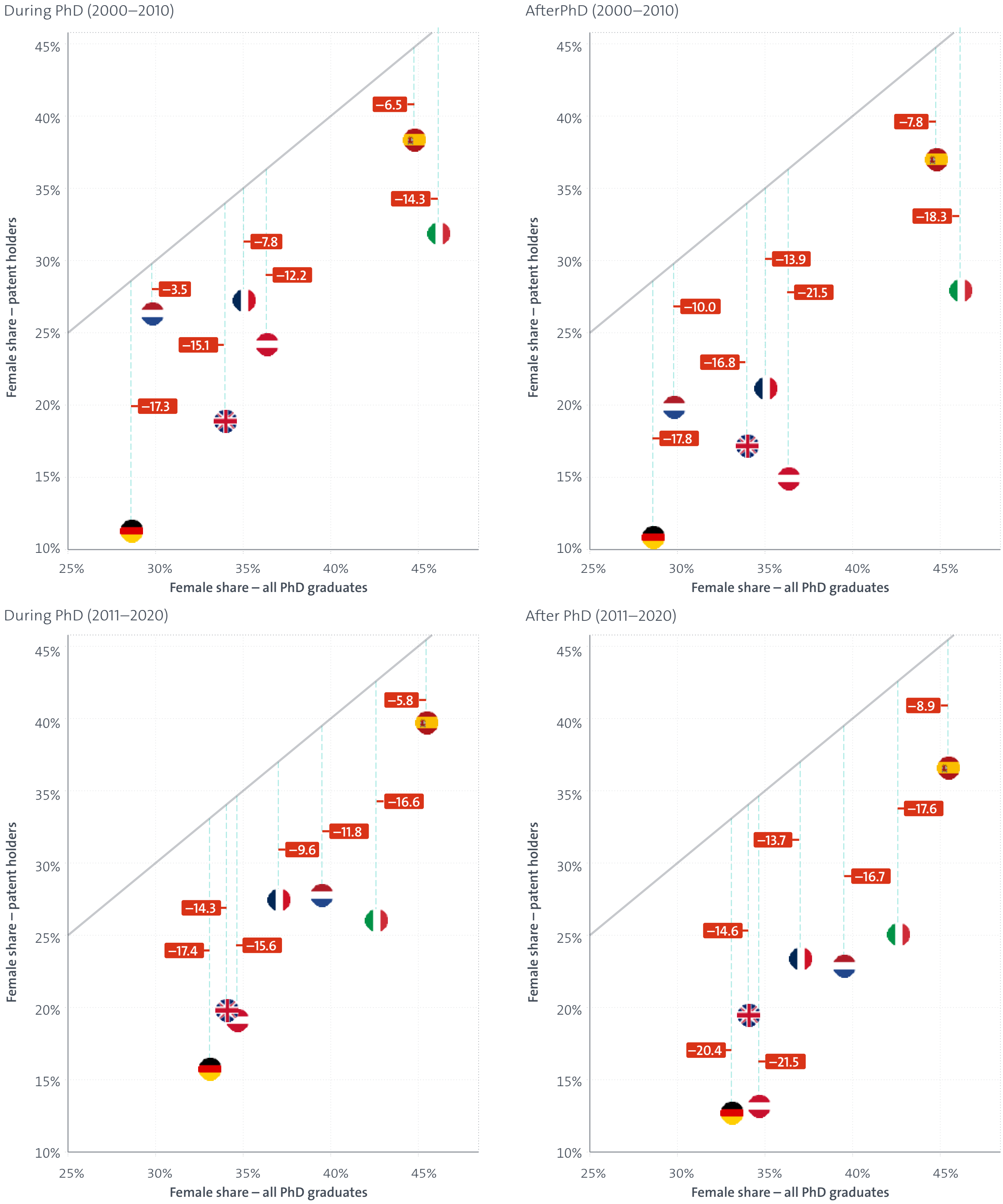
Comparing the upper panels (2000–2010) with the lower panels (2011–2020) reveals a mixed picture regarding temporal trends. Spain shows modest improvement in the during-PhD gap, narrowing from 6.5 to 5.8 percentage points. However, the Netherlands experienced a substantial deterioration, with its during-PhD gap increasing from 3.5 to 11.8 percentage points. Austria's post-PhD gap remained essentially unchanged at 21.5 percentage points in both periods. These patterns suggest that progress toward gender parity in patenting has been uneven and, in many contexts, disappointingly slow or even reversed.

Spain consistently ranks as the country with the smallest gender gap across all panels. However, the relative positioning of other countries shifts notably between during-PhD and after-PhD stages.

The Netherlands, for example, shows the smallest during-PhD gap in 2000–2010 (3.5 percentage points) but moves to a mid-range position for after-PhD gap (10.0 percentage points). Austria displays a moderate gap during PhD but consistently shows one of the largest after-PhD gaps (21.5 percentage points in both periods). These shifts suggest that the factors driving gender gaps in patenting may operate differently at different career stages.

Figure 55

Under-representation of women among patent-holders – Share of females among patent-holders vs. share of females among PhD graduates



Sources: EPO - PATSTAT, DOC-TRACK

Note: These plots illustrate the gender distribution across two dimensions for each country: the share of women among all PhD graduates (x-axis) and the share of female inventors among all PhD graduates who hold patents (y-axis). The dashed 45° line represents gender parity between these two groups; the distance of a data point from this line indicates the magnitude of female under-representation in patenting relative to their presence in doctoral programs (measured in percentage points).

5.5.2 Estimated under-representation of women among inventors

A potential limitation of the descriptive results in Figure 55 is that the observed under-representation in any given country may partly reflect composition effects. Because different fields have different patenting rates and different gender compositions, two countries with identical overall shares of women among PhD graduates (X) could exhibit different values of simply due to differences in how women are distributed across disciplines.[16]

Similarly, temporal changes in the distribution of women across fields, or shifts in the overall propensity to patent across different disciplines, could generate changes in that are unrelated to changes in gender-specific barriers to patenting. To obtain a more accurate picture of the "true" gender gap – one that is not confounded by compositional differences – we employ a regression-based approach which is described in Annex 6.

Figure 56 presents the regression-adjusted results showing the predicted share of women among patent holders against the share of women among all PhD graduates for each country, after controlling for field composition effects.

The most important finding is that women remain systematically under-represented among patent holders even after removing field composition effects. All observations continue to lie below the 45-degree line, confirming that the gender gap in patenting cannot be attributed solely to women's concentration in lower-patenting fields.

Rather, within-field factors, potentially including differential access to industry positions, unequal support for patenting activities or other gender-specific barriers, contribute substantially to the observed disparities.

Comparing Figure 55 (observed values) with Figure 56 (regression-adjusted values) reveals that the importance of field composition differs markedly across countries. For Germany in 2011–2020, controlling for composition reduces the during-PhD gap substantially from 17.4 to 12.4 percentage points, a reduction of 5.0 percentage points attributable to compositional factors. Similarly, Italy's during-PhD gap decreases from 16.6 to 13.2 percentage points after adjustment (3.4 percentage points explained by composition), and the Netherlands shows a reduction from 11.8 to 8.3 percentage points (3.5 percentage points). In contrast, Spain's gap remains essentially unchanged (5.8 to 5.4 percentage points), suggesting that compositional factors play a minimal role in that country. Notably, for the United Kingdom and Austria, the adjusted gaps are actually larger than the observed gaps (UK: 14.3 to 15.8 pp; Austria: 15.6 to 16.4 percentage points during PhD), indicating that women's field distribution in these countries partially masks an even larger underlying gap.

The regression adjustment produces meaningful changes in country rankings. In the observed data for 2011–2020 during PhD, the ranking from smallest to largest gap was: Spain (5.8 percentage points), France (9.6 percentage points), Netherlands (11.8 pp), UK (14.3 percentage points), Austria (15.6 percentage points), Italy (16.6 percentage points) and Germany (17.4 pp). After adjustment, this becomes: Spain (5.4 pp), France (7.9 percentage points), Netherlands (8.3 percentage points), Germany (12.4 pp), Italy (13.2 percentage points), UK (15.8 percentage points) and Austria (16.4 percentage points). Most notably, Germany moves from having the largest observed gap to a mid-range position, while the UK and Austria emerge as having the largest composition-adjusted gaps. This suggests that Germany's large observed gap partly reflects women's concentration in lower-patenting fields, while the UK and Austria face more severe within-field barriers to women's patenting.

16 Consider a hypothetical example: two countries, both with (30% women among all PhD graduates). In Country A, women might be concentrated in life sciences (a field with lower patenting rates), while in Country B, women might be more evenly distributed across engineering and life sciences. Even if the gender gap in patenting propensity (i.e., the ratio) were identical in both countries, Country B would mechanically exhibit a higher because more of its female PhD graduates are in high-patenting fields.

The regression-adjusted results confirm that the gender gap widens after PhD graduation in most countries, consistent with the "leaky pipeline" pattern. In the 2011–2020 period, the Netherlands shows the most dramatic amplification, with the adjusted gap increasing from 8.3 percentage points during PhD to 13.2 percentage points after PhD, an increase of 4.9 percentage points. France similarly shows substantial widening from 7.9 to 12.3 percentage points (4.4 percentage points increase). Germany increases from 12.4 to 16.4 percentage points, Austria from 16.4 to 19.2 pp and Italy from 13.2 to 15.9 percentage points. The only exception is the United Kingdom, where the adjusted gap actually narrows from 15.8 percentage points during PhD to 11.6 percentage points after PhD. These findings reinforce the conclusion from Section 4 that women face increasing barriers to patenting as their careers progress, and that these barriers operate independently of field composition.

Examining changes over time in the regression-adjusted gaps reveals heterogeneous patterns. For during-PhD gaps, some countries show improvement: Germany narrowed from 13.4 to 12.4 percentage points, France from 8.6 to 7.9 percentage points and Spain from 5.6 to 5.4 percentage points. However, several countries experienced substantial deterioration: the UK's gap increased dramatically from 9.6 to 15.8 percentage points, Austria from 10.1 to 16.4 percentage points, Italy from 9.2 to 13.2 percentage points and the Netherlands from 6.1 to 8.3 percentage points. For after-PhD gaps, the patterns are more mixed: Spain, France, Italy and the UK all show improvements, while Austria, Germany and the Netherlands show deterioration. Austria consistently maintains the largest post-PhD gap, increasing from 17.9 to 19.2 percentage points between the two periods.

5.5.3 Comparing observed and adjusted results

The comparison between Figure 55 and Figure 56 yields several important insights.

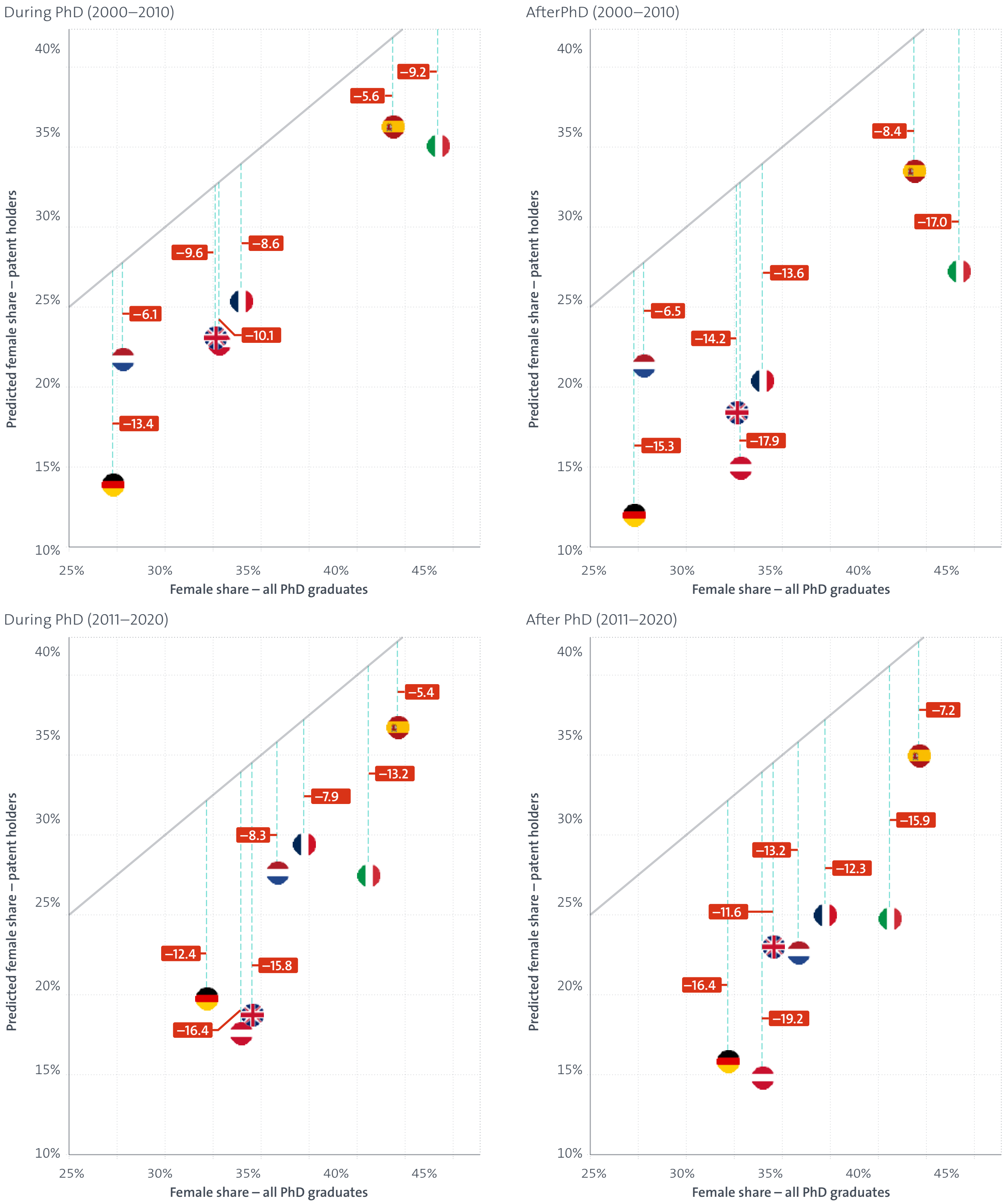
Field composition explains a substantial portion of the observed gap in some countries but not others. In Germany (2011–2020), composition accounts for nearly 5 percentage points of the during-PhD gap and 4 percentage points of the after-PhD gap, roughly one-quarter to one-third of the observed disparity. Italy and the Netherlands show similar patterns. In contrast, composition explains very little in Spain (0.4 percentage points during PhD, 1.7 percentage points after PhD). Most strikingly, in the UK and Austria, controlling for composition actually increases the estimated gap, suggesting that women in these countries are disproportionately represented in higher-patenting fields, which partially masks an even larger underlying gender disparity.

Regardless of whether we examine observed or adjusted values, during-PhD or post-PhD patenting, or the 2000–2010 or 2011–2020 period, the fundamental finding remains the same: women are substantially under-represented among patent holders relative to their presence in PhD programs. The smallest adjusted gap in any country-period-stage combination is 5.4 percentage points (Spain, during PhD, 2011–2020), while the largest is 19.2 percentage points (Austria, after PhD, 2011–2020). This consistency across specifications and time periods strengthens confidence that the gender gap in patenting reflects genuine barriers faced by women researchers.

The key conclusion of this analysis is that women are systematically under-represented among patent holders in all seven countries examined, across both time periods and both career stages. This under-representation cannot be fully explained by women's concentration in lower-patenting fields: substantial gaps persist even after controlling for composition. Moreover, the gap tends to widen after PhD graduation, and progress toward parity has been limited and uneven over the past two decades, with some countries actually experiencing deterioration.

Figure 56

Regression-adjusted under-representation of women among patent-holders – Predicted share of females among patent-holders vs. share of females among PhD graduates



Source: DOC-TRACK; PATSTAT

Note: These plots illustrate the gender distribution across two dimensions for each country: the share of women among all PhD graduates (x-axis), averaged across fields, and the predicted share of female inventors among all PhD graduates who hold patents (y-axis). The dashed 45° line represents gender parity between these two groups; the distance of a data point from this line indicates the magnitude of female under-representation in patenting relative to their presence in doctoral programs (measured in percentage points).

5.6. Concluding remarks

This section provided complementary evidence to the main and most commonly used indicators on women's participation in inventive activity. It does so by focusing on a specific, but highly relevant population of potential inventors, namely doctoral graduates in STEM disciplines from selected European countries.

The focus on potential inventors allows for a better understanding of gender imbalances in patenting, as it allows for comparison to gender imbalances in the inventive potential of doctoral and post-doctoral research, as measured by publications and their citation distance from patents (not only by the doctoral graduates themselves, but by any inventor with access to the scientific literature). Quite strikingly, we have shown that – in many countries or disciplines – no such imbalance exists or, where it exists, is much more limited than the imbalance concerning patenting. This, in turn, suggests that institutional, cultural, or economic factors affecting women's research careers play an important role, especially when it comes to corporate research in large companies and a few specific countries. The pipeline leading from the doctoral research to patenting leaks out more women than men, but not because the former's potential is inferior.

A growing body of evidence indicates that female and male scientists exhibit comparable research performance. For instance, Huang et al. (2020) show that active female and male researchers achieve largely indistinguishable annual productivity and receive similar citation impact for equivalent bodies of work. This finding reinforces the conclusion that women's lower representation among inventors cannot be explained by a lack of scientifically or technologically relevant research results, as we highlight in this report. Rather, observed differences in cumulative productivity are primarily driven by gender-specific career dynamics, including higher dropout rates and shorter publishing careers among women.

The gender gap in the production of research at the technological frontier may also reflect structural inequalities within the academic profession that affect how women's research is incorporated into technological development. Gender inequality in academic science can make women's work less likely to be recognised, prioritised or drawn upon when inventors develop new technologies (Bikard et al., 2025). From a supply-side perspective, women's lower average status and seniority in academic science may reduce the visibility and perceived relevance of their research for inventors (e.g. Lerchenmueller et al., 2019; Murray and Graham, 2007). Women are less likely than men to commercially exploit their own research, for instance through patenting activities (Ding et al., 2006; Koning et al., 2021). Moreover, from a demand-side perspective, gendered status beliefs and evaluation biases further contribute to this gap. Experimental and observational studies show that women's scientific contributions tend to receive less attention and are evaluated less favourably than comparable contributions by men (Correll and Benard, 2006; Tak et al., 2019). As a result, inventions may draw disproportionately less on research produced by women, even when its scientific quality and technological relevance are comparable. Overall, these mechanisms may help explain why female graduates, despite generating research of similar technological potential, are substantially less likely than their male counterparts to become inventors or get their works cited directly by patents.

Several studies have also found that women's contributions are less visible in patents than in scientific publications. Ding et al. (2006) show that female researchers in academic settings patent approximately 40% less than their male colleagues, despite exhibiting similar levels of scientific productivity. The results of Lissoni et al. (2013, 2020), comparing scientific publications and patents relating to the same inventions ("patent-paper pairs"), indicate that women are more likely to appear among the authors of scientific articles than among the inventors listed on patents. According to Hoisl and Mariani (2017), women obtain lower economic returns from their inventions than men, despite contributing equally to the development of high-quality inventions. The analysis by Beneito et al. (2022) reveals that patents invented predominantly by women (with more than 70% of women among the inventors) face greater barriers in accessing financing and in finding partners for innovation collaboration.

Annex 7 provides details on the patenting and publishing activities of doctoral graduates in the 20 largest institutions in each discipline across all seven European countries in the sample, amongst the largest 100 for all STEM disciplines. Size is measured by the total number of degrees granted in the discipline from 2016 to 2020. Most institutions belong to the countries with the largest number of graduates in our sample (namely France, Germany and the UK), but in some disciplines we also find – among the top institutions – several universities from Italy and Spain. For Austria, we find the University of Vienna (U. Wien) in the *Life Sciences* and the Technical University of Vienna (TU Wien) in *Mathematics* and *Computer Science*. For the Netherlands, we find Wageningen University and the University of Groningen in the *Life Sciences* discipline.

Inventor Profile: **Pilar Granado**

Biography

Pilar María Granado García is a biotechnologist and co-founder and Chief Technology Officer of Oscillum, a startup developing smart labels that indicate food freshness in real time. A graduate of Miguel Hernández University (Elche, Spain), she leads R&D and product development, translating laboratory work into market-ready solutions that improve food safety and reduce waste. Under her technical leadership, Oscillum has expanded its solution set and gained international recognition, including winning the European Patent Office's Young Inventors Prize in the "Popular Prize" category in 2025.

UN Sustainable Development Goals
SDG 2, SDG 3, SDG 12, SDG 13

Technical field
Food chemistry

Company
Oscillum

Q&A **Pilar Granado**

What first sparked your interest in science?
"What I remember from when I was little is that I always liked the idea of working in a lab coat, and I imagined myself as an adult working in a lab. That curiosity was encouraged by movies, TV series, and magazines like *'Muy Interesante Junior'*, which had experiments and questions about everyday things. Science is very beautiful, and it was what I enjoyed most at school, and my teachers, many of them women, nurtured that excitement. When choosing a degree, I was drawn to biology and then biotechnology, because it allows you to give real usefulness to theory. "

"In the startup world [...] there are many more men, particularly in executive roles. But I don't want to overemphasise that. An executive can be like an orchestra conductor, but the real engine of the company can be another team with many women."

What motivated you to create Oscillum, and how did you find the process?
"In science degrees, you're often pushed toward doing a PhD or competing for very few positions, with little funding and few opportunities. It didn't feel like a secure future. At UMH, where we studied, there was a company-creation program – a kind of small incubator – that encouraged us to develop ideas and gave us resources. That felt like a way out, a new path. We started exploring ideas within the program and realised that, even if it would be very difficult, it was possible. That's how the idea of creating the company came about."

Did you participate in other startup support programs, and what kind of support mattered most?
"What helped us most was the initial support. In science, you need labs, equipment, licenses – and we had no money, not even to pay rent. That first push is essential, and it's what scares people the most. Once you get started, it's easier to access funding or commercialisation programs, but the beginning is the hardest. There's a lot of uncertainty, especially in science, where projects take years. We started with a very basic idea, faced rejection, and even changed our original concept. Without those early programs, it would have been impossible to take the leap."

Why did you decide to start a company instead of joining an existing one as a researcher?
"What we saw was that private companies have limits. They have their own R&D lines, focus areas, and needs, and they're not going to give money to just any idea you have. We felt we'd be quite stuck and wouldn't be able to research freely. We loved meeting up – the three of us from biotechnology – and brainstorming ideas based on what we learned in class, thinking about how to give that knowledge an application. We had a long list of ideas, some crazy, some more realistic. We felt we had many ideas we wanted to explore, and creating our own company gave us that freedom."

What was the gender balance like in your degree, and how did that change when you moved into entrepreneurship?
"In my biotechnology degree, it was quite balanced – around 60/40, and in many science degrees there are often more women.

Pilar Granado with Oscillum co-founders Pablo Sosa and Luis Chimeno

But that changed when we moved into entrepreneurship. In the startup world, and especially when meeting investors or clients, there are many more men, particularly in executive roles. But I don't want to overemphasise that. An executive can be like an orchestra conductor, but the real engine of the company can be another team, with many women. In entrepreneurship, the bigger shift for me was moving from a structured academic environment to being completely adrift and having to learn everything from scratch – more so than moving into a male-dominated space"

Data often show that there are fewer women within technical leadership positions. What influenced your decision to take on your role as Oscillum's Chief Technology Officer?
"All our roles were very natural. There are three of us, and we each took responsibility for one area: finance, marketing, and research. I had taken a biosensors course, which was closest to what we were developing, and my colleagues felt I was the most careful and methodical in the lab. So that fit me. Nobody felt forced into a role."

Do you see the same opportunities from women in entrepreneurship and deep tech in Spain?
"In my experience, I haven't received bad looks or bad comments, and I haven't felt undervalued for being a woman or for being young. I've felt insecurity, but I think that comes more from broader social messages than from face-to-face interactions. We may be in a very healthy ecosystem. In fact, we've often received positive feedback from investors, who valued our energy and the balance in our team. They highlighted functional diversity, not gender, and said they liked how we complemented each other. Around us, I haven't heard bad experiences either."

On your IP protection, why did you decide to file a patent, and how did you approach the process?
"For us, it happened because in the entrepreneurship program where we started, one of the prizes was the possibility to file a patent. If we hadn't had that opportunity, there's no way we would have even thought about it. We had guidance, funding, and an advisor who explained the process and helped us decide whether it made sense. In our case, he recommended patenting."

How do you see Oscillum in the next five to ten years, and what is your IP strategy?
"We plan to keep patenting and protecting our technologies, always with good advice based on the product and region. Patents are an important factor and give investors confidence. In ten years, we aim to be a large company investing in R&D and creating solutions to real societal problems. We want products that matter. We hope to have a strong, much larger team – hundreds of people – working with clients to gather ideas and proposals and develop new solutions for real, unsolved problems."

Career	
2014	— Begins studying Bachelor's degree in Biotechnology at Miguel Hernández University.
2017	— Completes first internship at the Institute of Molecular and Cellular Biology of Miguel Hernández University, developing fluorescent nanoparticles for biotechnological applications based on conjugated polymers.
2018	— Completes second internship at the Institute of Molecular and Cellular Biology, synthesising multifunctional nanoformulations for drug delivery and cell labelling. — Graduates with a Bachelor's degree in Biotechnology.
2019	— Officially launches Oscillum with EUR 6.000 of self-funded capital.
2021	— Participates in EIT entrepreneurship projects, including the IESE Business Angels EIT Food Investment Forum.
2022	— Files first patent application for Oscillum technology.
2023	— Secures €1.5 million from the Spanish CDTI "Seal of Excellence" grants. — Named in Forbes 30 Under 30 alongside Oscillum co-founders. — Receives funding from the Valencian Innovation Agency. — Files second patent application for Oscillum.
2024	— Special guest at the Congress of Women and Technology of the Valencian Community.
2025	— Awarded the Young Inventors Prize "People's Choice" by the European Patent Office.

6. Policy responses and concluding remarks

Closing the gender gap in STEM participation and inventive activity requires more than general, "gender-neutral" innovation policy. Evidence across Europe points to persistent structural frictions, spanning education choices, working conditions, access to networks and finance and unequal care responsibilities that cumulatively reduce women's likelihood of reaching roles where IP is produced, protected and commercialised. Policymakers at different levels has therefore already developed targeted measures that act at multiple points along the pipeline: early skills formation, institutional incentives in research-performing organisations, capability-building for technology transfer and entrepreneurship, and visibility and recognition that broadens who is perceived as an inventor and innovation leader.

In Europe, the policy landscape has matured from early awareness-raising and monitoring to a more "mainstreamed" approach that embeds gender equality requirements directly into research funding rules, innovation ecosystem programmes and digital skills policy. The sections below summarise key EU-level initiatives and how they connect to women's participation in STEM and patenting.

6.1. Women in STEM initiatives on a large scale

Action on women in science in the wider European context has roots in the late 1990s and early 2000s. The European Commission's 1999 communication on Women and Science and the establishment of the Helsinki Group on Women and Science helped structure early co-ordination and exchange of national approaches, while the *She Figures* series (first published in 2003) made gender gaps in research careers and decision-making systematically visible through comparable indicators. More recently, the European Commission's Gender Equality Strategy 2020–2025 has reinforced gender mainstreaming across policy areas, providing a common political frame for initiatives in education, labour markets, research and innovation.

A major shift under Horizon Europe has been to hard-wire gender equality into programme design and participation conditions. For certain categories of applicants, having a Gender Equality Plan (GEP) became an eligibility requirement for calls with deadlines in 2022 and beyond.

In parallel, integrating the gender dimension into research and innovation content is treated as a default expectation and assessed under the excellence criterion (unless a topic explicitly states otherwise). Together, these provisions push institutional change (through GEPs) and research quality (through gender analysis in R&I content), rather than treating gender equality as an optional add-on (European Commission, 2026).

Complementing framework measures, EU innovation instruments increasingly provide targeted support for women entrepreneurs and innovators, particularly in deep tech and commercialisation from research organisations. For example, the European Innovation Council runs the EIC Women Leadership Programme (in partnership with the European Institute of Innovation and Technology), a skills-enhancement and networking programme aimed at women researchers and entrepreneurs. In addition, Women TechEU supports women-led tech startups under the European Innovation Ecosystems strand of Horizon Europe, combining targeted funding with coaching and mentoring for early-stage founders. At the level of recognition and signalling, the European Prize for Women Innovators (powered by EIC and EIT) provides high-visibility acknowledgement and support of women entrepreneurs behind breakthrough innovations.

Comparable approaches have also emerged outside Europe. In the United States, Equalize Startups (established in 2020) has built a structured, mentor-led programme for academic women inventors seeking to translate research into start-ups. The initiative also places strong emphasis on tracking outcomes: through regular impact reporting it documents scale and progress over time, and it reports that it has mentored more than 90 academic women entrepreneurs, supporting participants to launch companies and secure funding—an indication of a substantial uplift in commercialisation outcomes following participation. As European programmes increasingly focus on deep tech, technology transfer and scale-up finance, initiatives such as this are increasingly referenced internationally as practical models for reducing structural frictions and accelerating women's pathways from research to market.

Some of the institutions driving this change in Europe have contributed to this study with an explanation of some of their key programmes:

Strengthening Gender Equality in the European Research Area

In 2026, the European Commission plans to propose two key initiatives to advance its commitment to gender equality in research and innovation: **the Action Plan on Women in Research, Innovation and Startups** and the **European Research Area (ERA) Act**.

These initiatives are aligned with broader EU commitments such as the **Roadmap for Women's Rights**[17] (March 2025), the **2026–2030 Gender Equality Strategy**[18] or the Union of Skills. They also build on longstanding efforts to address persistent gender disparities in the ERA, ensuring that every individual can have equal opportunities to lead and contribute to scientific progress. For instance, the EU has already allocated over €79 million to support more than 350 organisations in implementing Gender Equality Plans (GEPs) through dedicated funding, demonstrating.[19]

The **Action Plan on Women in Research, Innovation and Startups** will build on the achievements and efforts so far and propose further actions to address the gender and skills gaps in research and innovation and the underrepresentation of women in participating and driving innovation ecosystems. It will aim to further support structural change to ensure a safe and inclusive research environment, empower researchers and innovators to advance gender equality in career choices, career progression and long-term development, and close gender gaps in STEM careers and the innovation ecosystem. It will thus respond to the need to harness the full potential of the EU's diverse talent pool as an essential driver for the EU's sustainable competitiveness.

The **ERA Act** – a legislative proposal under preparation – will respond to longstanding challenges in the EU's research and innovation ecosystem, including fragmented regulatory frameworks, uneven R&D investment, and barriers to knowledge sharing. It will also reinforce the upholding of fundamental values within the ERA, including gender equality and equal opportunities, and seek to improve framework conditions for researchers and their careers.

Strengthening gender equality in the talent pool:

The "Union of Skills" initiative of the European Commission provides a unified vision for education, training, and skills, bringing together concrete action, governance, and investment. It aims to ensure that everyone in Europe is empowered to build strong foundational skills and engage in lifelong upskilling and reskilling.

Under the Union of Skills,[20] the European Commission has launched a STEM Education Strategic Plan,[21] an initiative aimed at reclaiming Europe's competitive edge in science, technology, engineering, and mathematics.

The Plan aims to enhance the quality of STEM education and strengthen the entire talent pipeline in these sectors. This is achieved by anchoring STEM as a strategic priority in EU education and training policies; making STEM education more attractive, including by strengthening collaborations between education, research organisations, and businesses, by aligning skills supply and demand, reinforcing industry and sector-specific approaches; and by attracting more girls and women to STEM fields, countering the negative trend that sees them underrepresented in these sectors.

The STEM Education Strategic Plan is currently under implementation. Several funding calls under programmes such as Erasmus+, Horizon Europe, and Digital Europe, opened between the end of 2025 and the beginning of 2026.

17 The EU Roadmap for Women's Rights: a renewed push for gender equality, European Commission, 2025
18 Gender Equality Strategy 2026–2030
19 Promoting gender equality and institutional changes through Eu-funded research - Publications Office of the EU, 2026.
20 Union of skills - European Commission
21 STEM Education Strategic Plan (legal document) - European Education Area

EIT Supernovas

The European Institute of Innovation and Technology (EIT) is an autonomous body of the European Union that fosters innovation and entrepreneurship across Europe by supporting Knowledge and Innovation Communities in key sectors.

EIT Supernovas is a flagship cross-sector initiative that aims to increase women's presence across Europe's innovation, entrepreneurship and investment ecosystem jointly implemented by **EIT Food, EIT Manufacturing and EIT Urban Mobility.**

A defining feature of Supernovas is its dual focus on entrepreneurs and investors. In addition to supporting women-led startups through the internationalization programme Rocket Up, Supernovas explicitly targets the underrepresentation of women in venture capital and angel investing, recognising investor diversity as a structural driver of fairer funding outcomes. This approach aligns with EU policy objectives to improve access to finance while strengthening Europe's innovation capacity.

Building the Pipeline of Women Investors

EIT Supernovas counts with a portfolio of **dedicated programmes for women investors,** designed to strengthen skills, visibility and career growth:

— **Women2Invest** supports women with STEAM backgrounds in entering the venture capital ecosystem by providing comprehensive investment training and connecting this talent with VC funds actively recruiting.

— **VC Academy** provides targeted training, coaching and peer learning for women pursuing or advancing careers in venture capital, addressing barriers to progression into decision-making roles.

— **Business Angels Academy** equips women with the competences, networks and confidence to engage in early-stage angel investment, through training, access to dealflow and community.

Together, these programmes function as **pipeline interventions:** they increase the number of women active in investment roles while fostering stronger connections between women investors and women-led ventures emerging from the EIT ecosystem. Supernovas complements these actions with investor networking and visibility tools, reinforcing ecosystem-level change rather than isolated capacity building.

Figure 57

Rocket Up 2024 Demo day at Slush - Helsinki

Evidence-Informed Design: Understanding Gender Bias

Supernovas' rationale is grounded in research evidence, including collaboration with the **Esade Center for Social Impact and Equinox Partners**. The joint study *Levelling the Playing Field: Key Levers to Mitigate Gender Bias in European Venture Capital* confirms that gender bias in VC remains largely structural, influencing deal sourcing, evaluation criteria and risk perceptions. Importantly, the research demonstrates that investment teams with higher gender diversity are more likely to invest in women-led startups, highlighting investor composition as a policy-relevant leverage point.

These insights have been operationalized through the **Gender Bias Mitigation Tool**, which supports VC firms in assessing bias across investment processes and identifying concrete actions adapted to different levels of organizational maturity.

From Insight to Systemic Action

By embedding research, training and community across multiple EIT Knowledge and Innovation Communities, Supernovas ensures that evidence is translated into **scalable, cross-sectoral action.** The programme's emphasis on women investors strengthens feedback loops: greater diversity among investors contributes to more inclusive funding practices, which in turn improves the visibility and growth prospects of women-led innovation.

Policy Relevance

EIT Supernovas illustrates how EU-funded initiatives can move beyond diagnosis towards **structural change in venture capital and entrepreneurship ecosystems**. The programme links investor diversity, skills development and access to finance, positioning gender equality as an enabler of Europe's long-term innovation competitiveness.

The European Institute for Gender Equality

The European Institute for Gender Equality (EIGE), an EU agency based in Vilnius, serves as the EU's central knowledge hub on gender equality. It provides high-quality research, data, and practical gender mainstreaming tools to help EU institutions and Member States advance gender equality and eliminate gender-based discrimination.

Gender Equality Index

EIGE's Gender Equality Index is a key benchmark for assessing progress in gender equality across the EU. Since its launch in 2013, it has shaped policy debates and decisions by showing where improvement is most needed. The 2025 edition introduces a revised structure and a new baseline in response to rapidly changing context and policy priorities.

The Index measures six key dimensions of everyday life: work, money, knowledge, time, power and health. Outside the core, it also includes two cross-cutting domains: violence and intersecting inequalities. Built on 27 indicators, the Index aligns with major EU gender equality policies and targets.

The knowledge domain falls within the lowest-scoring areas. Educational attainment and participation in higher education and IVET score 78.7 (out of 100), while a low 41.8 for gender segregation in education holds the domain back. Although girls and boys perform similarly in science and mathematics in secondary school, girls' interest in STEM declines with age. This shift is shaped by deep-rooted social norms and gender stereotypes around career choices, often reinforced through educational content and school environment.

As a result, women remain under-represented in STEM fields at tertiary level and make up a minority in STEM jobs. There, women often hold lower-level positions and earn less what contributes to a sizeable gender pay gap in the sector.

EIGE estimates that reducing gender disparities in STEM education could help narrow the EU's skills shortage, boost women's employment and contribute an additional €610– €820 billion to the EU's GDP by 2050.

CARE survey

Gender inequalities in care have received unprecedented policy attention in recent years. Policymakers increasingly recognise that women's disproportionate share of unpaid care work limits their ability to enter, remain and progress in the labour market, ultimately weakening EU's economic potential. EIGE's CARE survey offers important evidence on how time pressures linked to caregiving limit women's economic opportunities and career advancement.

Figure 58

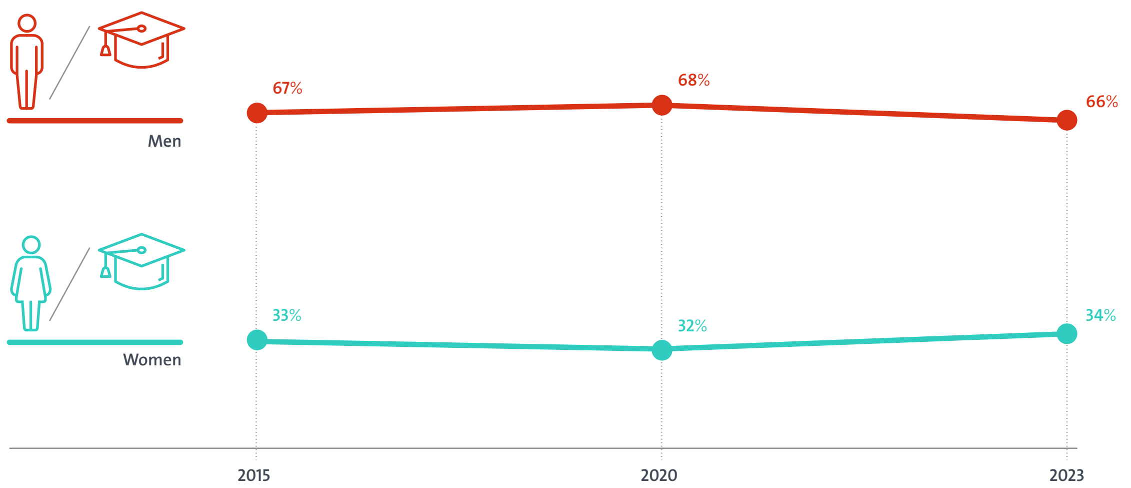
Intersecting inequalities

Source: EIGE

Figure 59

Who graduates in STEM?

Gender differences at the tertiary levek



Source: EIGE

Women in STEM face particular challenges in achieving work-life balance. They leave STEM careers at higher rates than men, often due to difficulties in reconciling demanding work environments with care duties. Many must adopt deliberate strategies, such as setting boundaries, using flexible work options, prioritising tasks and relying on strong support networks.

The CARE survey shows that insufficient care services heighten work-life conflict and can lead to substantial employment related costs for women, such as reduced work hours, absenteeism, slower career progression or even leaving a job. Overcoming these disparities calls for a broader cultural shift in gender norms and workplace practices, alongside stronger public policies supporting work-life balance and shared care.

Gender mainstreaming in research and innovation

EIGE is mandated to work on gender mainstreaming by providing practical tools, data, and guidance to EU institutions and Member States. Its work helps integrate gender perspective across all policies, from budgeting to public reforms, notably though resources such as the Gender Mainstreaming Platform and Gender Statistics Database.

Gender inequalities remain pronounced in research and innovation (R&I), from gender bias in research assessment, recruitment and promotion to experiences of gender-based violence. To address these challenges and help research organisations meet Horizon Europe requirements on gender equality, EIGE developed the Gender Equality in Academia and Research (GEAR) tool. The GEAR tool offers step-by-step guidance on how to design, implement and sustain an effective gender equality plan. Such plans are essential for transforming organisational culture, processes and structures that perpetuate gender imbalances.

The Gender Mainstreaming Platform also hosts a wide range of practical tools, such as gender budgeting or gender impact assessment, which are essential instruments for more equitable policymaking, institutional practice and everyday life.

EIGE's Gender Statistics Database offers comprehensive and comparable data on women and men across numerous policy areas, including indicators on Women in STEM. By combining employment statistics with EIGE's unique decision-making data in Education, science and research, it enables users to explore women's representation in STEM and their influence on STEM-related policies.

6.2. The role of IP offices

IP offices are a particularly relevant actor in efforts to strengthen women's participation in inventorship and IP use because they operate at the exact junction where research results and technical problem-solving can be translated into protectable, commercialisable outputs. They can intervene at moments that often determine whether an idea becomes an IP asset – through guidance on patentability, prior-art searches, filing strategy and routes to commercialisation. This is especially important in light of the study's findings, which point to a persistent "patenting potential gap": women researchers are publishing in fields that are highly relevant for patenting, yet their patenting rate remains around half that of men researchers.

National IP offices in Europe are engaging on multiple fronts to support women in innovation and intellectual property. At national level, Figure 60 maps a set of concrete examples contributed by participating countries in this report. One broad strand is direct, office-led programming that targets women inventors and entrepreneurs through practical services and visibility: mentoring and peer networks (e.g. buddy/mentoring schemes), communication formats that amplify role models (podcast series and dedicated web portals), prizes and award categories recognising women inventors (or organisations advancing women in innovation) and events and training such as themed conferences, entrepreneurship events, webinars and panels timed around key moments. A second strand is the growing emphasis on evidence and measurement, where offices publish or support analytical studies and gender-disaggregated statistics tools to identify barriers and track progress (often feeding into broader policy discussions). Together, these approaches combine hands-on support with sustained awareness-raising and better data to inform action.

At the same time, the initiatives show that IP offices often act as connectors rather than working alone: many activities are delivered through government-wide strategies (national digital or STEM plans, for example), partnerships with foundations, universities and private-sector programmes (such as "returner" schemes for women researchers to come back to STEM careers after a break) and participation in international or multi-office initiatives such as campaigns around World IP Day and joint International Women's Day messaging. This mix matters for scale: office-run programmes can provide tailored IP-facing support (e.g. coaching, searches and competitions), while collaborations plug IP into wider talent pipelines, from girls' STEM education through to women re-entering technical careers, helping reach different groups at different stages. These targeted actions that connect IP services to broader ecosystem initiatives can be useful to address the patent gap highlighted in the study.

The Austrian Patent Office provides a good example of how this portfolio of measures can be built as a coherent sequence, starting from evidence and translating it into follow-up measures. After the EPO's 2022 analysis of women's participation in inventive activity, the Austrian office developed a national follow-up grounded in qualitative insight, running a stakeholder survey and publishing an analytical study that identifies barriers and proposes recommendations. Building on that evidence base, the Austrian office moved into implementation through a mix of direct support and sustained visibility: Buddy for Her pairs women IP experts with aspiring women inventors and creators and includes free patent searches for promising projects, while a dedicated communications track (including podcast episodes) supports role-model visibility and practical awareness of IP strategy. Their activities also include a structural incentive lever: the "Matilda" special prize category within the national patent award framework recognises organisations that advance women in innovation, linking recognition to institutional practices and organisational measures.

Figure 60

Examples of activities and programmes from national patent offices on supporting women in STEM in Europe

United Kingdom

■ STUDY/STATISTICS
Gender profiles in patenting, Other studies looking at the IP outcomes of female-led companies;

■ EVENT
Participation at Women into Leadership conference series

■ PRIVATE/NGO COLLABORATION
STEM Returners programme, Code First Girls partnership, IP Inclusive participation

■ INTERNAL STAFF NETWORK
Women's Inclusive Network

■ GOVERNMENT COOPERATION
Women researchers / talent pipeline collaboration, IP & gender evidence collaboration (IPGAP)

Belgium

■ GOVERNMENT COOPERATION
Women in Digital Strategy, BeDigitalTogether

Germany

■ NETWORK
Alliance for Women in STEM Professions, MINT-Vernetzt;

■ STUDY/STATISTICS
Female inventor rate statistics (2018, 2023)

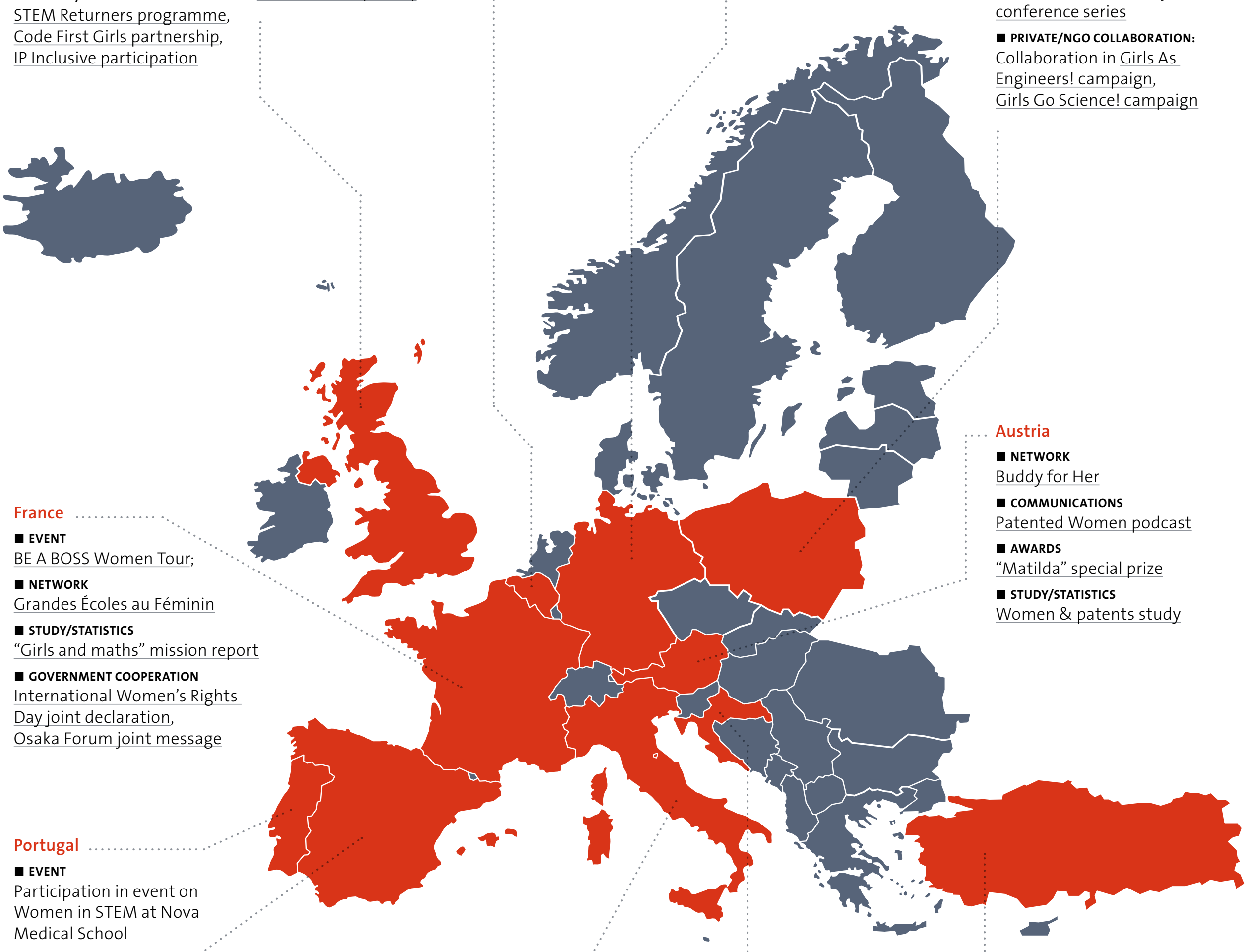
■ COMMUNICATIONS
Ingenious Women

Poland,

■ STUDY/STATISTICS
Participation in WIPO's report Gender gap in industrial designs of Central European and Baltic States

■ EVENT
"She Inspires" women's designs showcase (CEBS), Women's innovation & creativity conference series

■ PRIVATE/NGO COLLABORATION:
Collaboration in Girls As Engineers! campaign, Girls Go Science! campaign



Austria

■ NETWORK
Buddy for Her

■ COMMUNICATIONS
Patented Women podcast

■ AWARDS
"Matilda" special prize

■ STUDY/STATISTICS
Women & patents study

France

■ EVENT
BE A BOSS Women Tour;

■ NETWORK
Grandes Écoles au Féminin

■ STUDY/STATISTICS
"Girls and maths" mission report

■ GOVERNMENT COOPERATION
International Women's Rights Day joint declaration, Osaka Forum joint message

Portugal

■ EVENT
Participation in event on Women in STEM at Nova Medical School

Spain

■ EVENT
Registering the Change: 50 Years of Women's Innovation in Spain, Talent recruitment (women in STEM);

■ TRAINING/WORKSHOP
Regional webinar on Women and IP

■ AWARDS
Best Invention awards (women-specific categories)

■ COMMUNICATIONS
Women inventors web portal

■ STUDY/STATISTICS
Gender-disaggregated IP statistics tools

Italy

■ AWARDS
Intellectual Property Award (women's entrepreneurship section)

■ GOVERNMENT COOPERATION
Women's Enterprise Committee

■ PRIVATE/NGO COLLABORATION
Knowledge Share platform (women's entrepreneurship section)

Croatia

■ COMMUNICATIONS
International Women's Day joint message

■ TARGETED SUPPORT
World IP Day support for women

Türkiye

■ COMMUNICATIONS
World IP Day video competition promotion

■ EVENT
KIWIE participation support, ISIF invention fair (TEKNOFEST), Women & IP panel

■ AWARDS
Patentle Türkiye – university inventions competition

Source: EPO

Another instance is the work of the UK Intellectual Property Office, whose role can be presented as part of wider policy efforts aimed at mainstreaming gender equality in science and technology. The Women in Tech Taskforce was launched on 16 December 2025 by the Department for Science, Innovation and Technology (DSIT) to bring together actors from across the tech ecosystem to advise on practical ways to improve diversity, specifically by identifying barriers to education, training and career progression, and developing solutions that government and industry can implement together. This aligns closely with a gender-mainstreaming approach in which equality objectives are integrated into the design and delivery of mainstream policies and programmes rather than treated as a standalone initiative. In this context, IP-related action can sit naturally inside the pipeline: strengthening evidence on women's participation in innovation, providing targeted capability-building on how to protect and commercialise ideas, and partnering with skills, entrepreneurship and "returner" programmes so that women encounter IP support at the moments it is most useful, not only at the point of filing.

The support from France shows how IP expertise can be scaled by embedding it inside existing networks that support women's education-to-entrepreneurship pathways. *Grandes Écoles au Féminin* federates a large graduate community and runs GEF Startup, a programme supporting environmentally impactful startups, including the "GEF Startup weekend" competition. Since 2022, INPI has participated in the GEF Startup weekend by providing free, hands-on IP consultations to women entrepreneurs throughout the competition. This "meet innovators where they are" delivery model is similar in spirit to initiatives reported by the State Intellectual Property Office of the Republic of Croatia around World IP Day 2023: selected professional search and analysis services were offered free of charge to women, enabling novelty checks and early assessment of protection options alongside themed social media contests to reinforce visibility and engagement. Together, these examples illustrate a common pattern: national IP offices combine their own services and incentives with embedded partnerships and campaigns to reach women at multiple stages – from early ideation and novelty checks to startup acceleration and recognition.

At the European level, the European Patent Office is also active in this agenda, both by strengthening the evidence base and by showcasing women's success stories at scale. The EPO Observatory is placing diversity high on the agenda by developing studies like this one and by expanding accessible, comparable data on women in innovation through the annual release of women inventorship data in the Patent Index, helping keep trends visible and comparable across countries and technologies.

The EPO also supports awareness and inspiration through high-profile recognition and engagement activities: its inventor awards and prizes – the European Inventor Award and the Young Inventors Prize – highlight outstanding profiles. Many laureates and finalists of these awards then participate in the European Inventor Network, which supports activities in schools and universities to bring science and invention closer to younger generations. This can include participation in initiatives that help make STEM careers and innovation more tangible for girls, such as Girls' Day. Internally, institutional action also matters: the EPO has measures to support inclusive recruitment and working practices, and it has taken steps to promote inclusive language in its institutional communications and administrative frameworks, reinforcing the same objective of broadening participation in the innovation and IP ecosystem.

6.3. Concluding remarks

This report set out to move beyond a static description of gender gaps in patenting and to locate where they emerge along the pathway from STEM education to invention, patenting and technology entrepreneurship. The evidence confirms that progress is real but slow: women's participation in EPO patenting has risen over the long run, yet the women inventor rate remains around 13.8% in 2022—far from parity—and women are still much more likely to appear in collaborative teams than as individual inventors.

At the same time, women's representation is higher in specific technology areas (notably in parts of chemistry and life science-related fields) and among universities and public research organisations, indicating that institutional context and technology mix shape outcomes—though they do not fully explain persistent national differences. A central contribution of this study is to show that the "leaky pipeline" cannot be reduced to a simple argument of lower scientific or technological potential. The analysis of doctoral STEM graduates, a highly relevant population of potential inventors, finds that women's research outputs are as close to the technological frontier as men's, but that women remain substantially less likely to transition into patenting. This contrast strengthens an important interpretation: the pipeline leaks not because women's research is less linked to patentable innovation, but because social, institutional and economic factors shape access to inventorship pathways, recognition and credit within teams, and access to resources and networks. These mechanisms merit closer examination, including how working conditions, care responsibilities and social dynamics interact with patenting outcomes, and how gender intersects with other dimensions.

The report also broadens the lens to the wider patent ecosystem. While women remain under-represented among inventors, the gender gap is markedly smaller in several patent professions, with women representing around a quarter of EPO patent examiners and close to a third of European patent attorneys in 2025. This matters: it points to a substantial pool of technically trained women who engage with innovation through legal-technical careers and who help shape access to protection, strategy and enforcement, an enabling layer that can be leveraged more deliberately, alongside other influential decision-making and leadership roles across organisations that affect portfolio strategy and the design of innovation policy.

Looking forward, one of the clearest signals comes from deep-tech entrepreneurship. Among European ventures that have filed European patent applications, women represent roughly 10% of founders—similar to the inventor rate seen among smaller business applicants—while the gap is substantially wider than in comparable non-patenting startups. The pipeline also tightens as firms scale: women's participation is higher among younger cohorts, yet falls sharply at later growth stages and exits, consistent with barriers in access to scale capital and late-stage outcomes. This is consequential for Europe's competitiveness agenda because it suggests that the "patenting step" within deep tech can act as an additional selection point in precisely the technology domains shaping the next wave of industrial transformation. It also highlights the value of tracking for future analysis not only whether women are present in founding teams, but their role in leadership, their stake in ownership, and how inventorship and patent ownership evolve across the innovation lifecycle (including technology maturity and funding rounds), distinguishing more clearly between spin-offs and other startups.

With regards to current advances in policy, Europe is increasingly embedding gender equality into mainstream research and innovation frameworks through instruments of institutional change (such as Gender Equality Plans) and expectations to integrate gender considerations into research and innovation content, in line with broader strategic priorities in the European Research Area and EU innovation and deep-tech agendas. However, the evidence in this report points to the need to connect the dots between interventions across stages so that improvements in education and research careers translate into participation in patenting, technology leadership and scalable entrepreneurship. That implies a sharper focus on the moments where the pipeline narrows most: disclosure and patenting support inside organisations, recognition and credit within teams, targeted capability-building and mentoring, and access to networks and finance—especially for women-led deep-tech ventures—supported by clearer prioritisation, assignment of responsibilities across actors, and measurable indicators for monitoring progress.

Finally, the study highlights why mapping and learning from practice matters. National IP offices and ecosystem partnerships sit at a strategic point where technical knowledge becomes an asset to be commercialised, and the initiatives collected for this study illustrate a growing portfolio of practical support, measurement tools and collaborations. The challenge now is to align evidence, incentives, governance and delivery—across the public and private innovation ecosystem—so that women can participate fully in the technologies that will lead tomorrow, with the skills, support and institutional conditions required to turn ideas into protected innovations and growth.

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Annex

A.1 Women inventor rate

For this update to the 2022 EPO report on women's participation in inventive activity, we considered all patent applications included in the April 2025 edition of PATSTAT and filed at the EPO, from 1978 to 2022 (by priority year), for a total of 4 393 031 observations (unique appln_ids). We then applied the same disambiguation and gender attribution algorithms described in the 2022 report[22] and assigned each inventor and his/her patents to a country of residence, based on his/her address(es) as reported on the patent application. We then select the patents – for in-depth analysis – coming from European Patent Convention (EPC) contracting countries, namely all patents with at least one inventor's address in any such country.

Table A1.1 reports, for both EPO member and non-member countries, the number of inventors resulting from the disambiguation algorithm and the share of such inventors for which our gender attribution algorithm provided an unambiguous response. Table A1.2 provides the same information, but for original inventor identifiers in PatStat (person_id, non disambiguated).

Table A1.1

Gender attribution rate by inventor country of residence (disambiguated inventors)

	Successful gender attribution (%)	Number of inventors (in thousands)
All countries	**91.7**	**6 091**
All EPO countries	**98.1**	**2 188**
Selected EPO countries:		
Germany	98.4	722
Austria	98.7	54
France	98.3	342
Spain	98.6	67
Sweden	97.7	92
Italy	98.3	154
Switzerland	97.9	107
Netherlands	96.1	118
UK	97.9	275
Selected non-EPC countries:		
US	95.4	1 495
China	59.3	245
Japan	93.4	1 502
R. Korea	68.9	293
India	87.5	65

Notes: EPO member states are: Albania, Austria, Belgium, Bulgaria, Switzerland, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, United Kingdom, Greece, Croatia, Hungary, Ireland, Iceland, Italy, Liechtenstein, Lithuania, Luxembourg, Latvia, Monaco, Montenegro, North Macedonia, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Sweden, Slovenia, Slovakia, San Marino and Türkiye.

Source: PATSTAT

22 See Annex 1 in: https://link.epo.org/web/womens_participation_in_inventive_activity_2022_en.pdf

Table A1.2

Gender attribution rate by inventor country of residence (for PATSTAT's person_id)

	Successful gender attribution (% of person_id's)	Number of person_id's (in thousands)
All countries	**93.5**	**7 837**
All EPO countries	**98.4**	**3 066**
Selected EPO countries:		
Germany	98.7	1 016
Austria	98.9	70
France	98.4	479
Spain	98.9	92
Sweden	98.1	121
Italy	98.6	224
Switzerland	98.3	148
Netherlands	96.7	176
UK	98.3	381
Selected non-EPC countries:		
US	95.8	2 338
China	59.4	214
Japan	93.3	1 465
R. Korea	71.7	259
India	87.8	72

Notes: EPO member states are: Albania, Austria, Belgium, Bulgaria, Switzerland, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, United Kingdom, Greece, Croatia, Hungary, Ireland, Iceland, Italy, Liechtenstein, Lithuania, Luxembourg, Latvia, Monaco, Montenegro, North Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Sweden, Slovenia, Slovakia, San Marino, and Türkiye.

Source: PATSTAT

For what concerns the technological classification of patents in five broad classes, we followed the IPC and Technology Concordance Table produced by the IPC Union's Committee of Experts for WIPO in 2008.[23]

Concerning types of patent applicants, we distinguish between Individual inventors, Companies, and Universities/Public research organisations (including hospitals, non-profit organisations and governmental agencies) based on the PATSTAT Standardised Names (PSN) produced by K.U. LEUVEN.[24]

When a patent is filed by more than one applicant type, we assign it entirely to one single applicant type, namely: to University/PRO if a university or public organisation is among the applicants (based on the assumption that the idea comes from it), or to Individual inventor if no university is involved (but an individual inventor is). We furthermore split business companies between those falling within the top 5% of the size distribution, and all the remaining businesses, where size is defined by the number of patent applications filed at EPO, and listing at least one inventor in an EPO member country, with priority years 2013–2022.

23 See: https://www.wipo.int/meetings/en/doc_details.jsp?doc_id=117672, Annexe 1.

24 See; https://link.epo.org/web/searching-for-patents/business/patstat/data-catalog-patsat-global-spring-en.pdf and especially table TLS206.

Table A1.3

WIR and WIR^{gap} in EPO countries

Country	Number of inventors 2013–2017	WIR 2013–2017	WIR gap 2013–17	Number of inventors 2018–2022	WIR 2018–2022	WIR gap 2018–2022
AL	7	0.0	-6.2	9	0.0	-7.5
AT	11 555	7.7	-4.0	17 032	8.0	-3.8
BE	10 688	14.8	0.0	15 589	16.8	0.3
BG	279	11.8	0.6	410	13.4	0.2
CH	20 874	11.4	-3.2	34 148	13.7	-2.3
CY	79	11.4	-5.8	166	15.1	-6.7
CZ	2 629	12.1	-2.3	3 263	12.0	-3.3
DE	133 728	9.7	-2.5	201 425	10.3	-2.4
DK	8 662	12.6	-2.5	13 789	13.8	-0.9
EE	351	19.4	5.0	592	19.3	5.2
ES	16 265	22.8	8.1	21 646	24.1	7.8
FI	9 194	12.0	1.2	12 856	13.8	1.6
FR	64 365	16.4	3.8	88 227	16.6	3.1
GB	44 421	11.8	-2.2	60 532	13.7	-1.5
GR	806	22.1	5.2	1 524	20.2	4.3
HR	281	23.8	6.5	337	30.9	13.7
HU	1 803	12.2	-2.3	2 685	9.9	-3.9
IE	3 688	13.0	-0.4	5 670	14.9	-0.3
IS	200	14.0	-0.5	268	11.9	-3.2
IT	29 230	13.8	1.2	42 102	14.7	1.4
LI	179	8.4	-1.7	242	10.7	-0.2
LT	298	22.5	3.4	785	24.7	7.4
LU	595	9.7	-1.4	981	11.9	-0.9
LV	414	32.6	12.3	267	17.6	2.5
MC	74	10.8	-2.3	120	14.2	1.2
MK	10	0.0	-10.0	24	45.8	23.7
NL	22 566	11.7	-1.7	31 797	13.6	-0.6
NO	3 932	11.7	-0.7	4 890	10.5	-2.3
PL	5 715	18.6	4.9	7 932	17.0	2.6
PT	1 992	26.9	11.4	3 997	29.3	13.0
RO	808	17.3	8.1	1 002	16.8	6.7
RS	156	12.8	2.6	215	23.7	9.2
SE	16 269	11.6	1.6	28 030	11.5	0.1
SI	1 125	18.0	4.1	1 776	16.7	2.0
SK	499	9.8	-1.8	745	12.3	-1.2
SM	17	5.9	-3.7	41	2.4	-6.6
TR	4 618	17.2	4.6	6 662	21.2	7.2
MT	-	-	-			

Source: EPO - PATSTAT

A.2 Founder identification and gender data collection

The approach used to founder identification and gender assignment involved a systematic process designed to maximise data completeness and accuracy. An initial exploratory analysis of the DTF dataset revealed that gender information was missing for 72.25% of the over 10 000 identified companies, necessitating supplementary data collection. Furthermore, founder names were incomplete in the initial dataset for a subset of companies.

Step 1: Dealroom and Crunchbase API data integration

Startup and founder information were downloaded directly from Dealroom and Crunchbase through their respective APIs. Dealroom's API provides access to the most extensive startup database in Europe without limitation, including detailed founder profiles. Crunchbase, on the other hand, offers complementary founder information and biographical data. This dual source data extraction strategy provided information on company characteristics and founders identities where available.

Step 2: Deep search for missing founder information

For records where founder names were absent or incomplete following the Dealroom API extraction, a targeted internet search was conducted using a large language model (Perplexity LLM) to retrieve missing founder information. This supplementary search strategy helped bridge data gaps stemming from incomplete Dealroom records and enabled more comprehensive founder identification across the DTF companies' data.

Step 3: Gender attribution using WIPO World Gender Name Dictionary

After compiling founder names, we used the World Intellectual Property Organization's World Gender Name Dictionary (WGND) to infer gender for founders with missing gender information. Because name–gender associations vary by country, we applied the WGND using founder country information where available (e.g. "Andrea" is more commonly female in the United States but male in Italy). (Source: https://www.wipo.int/en/web/economics/w/blogs/using-the-world-gender-name-dictionary)

Step 4: Manual verification of unresolved gender records

For individuals whose gender could not be definitively assigned through the WGND, typically because of name ambiguity or limited naming convention data for certain geographic regions, manual internet-based verification was conducted. This final step involved search of founder information through professional profiles and company websites to establish gender classification with reasonable confidence.

This multi-stage approach enabled progressive enrichment of the founder and gender dataset. Out of the 10 489 companies, it was possible to obtain information for approximately 8 000 of them. The combination of automated dictionary matching, LLM-assisted information retrieval and manual verification procedures enabled a substantial increase in the coverage of gender-attributed founder records, moving from the initial 27.75% of complete data to 76.48%. Thanks to Dealroom, it was possible to obtain 52.59% of the data, Perplexity Deep Search provided information for 17.62% of the companies and Crunchbase for another 6.27%.

After the process to complete the data, an exploratory analysis was conducted to determine whether the remaining missing gender information was systematically related to company characteristics such as growth stage or company age. The analysis revealed no structural difference in the distribution of companies with complete founder information and companies with missing founder information across growth stage (Seed, Early-Growth or Late-Growth stage) or company founding year. This finding indicated that the missing data were not concentrated in any particular company development phase, suggesting that data gaps resulted from random retrieval failures rather than systematic bias related to company maturity.

Geographic distribution of data completeness

Data completeness showed considerable variation across European countries represented in the sample. The United Kingdom demonstrated the highest number of companies (2 022) with a gender information completion rate of 74.04%, indicating relatively robust founder data availability. France and Germany, the second and third largest samples by country count (with 1 886 and 1 575 companies, respectively), showed completion rates of 74.92% and 67.11%.

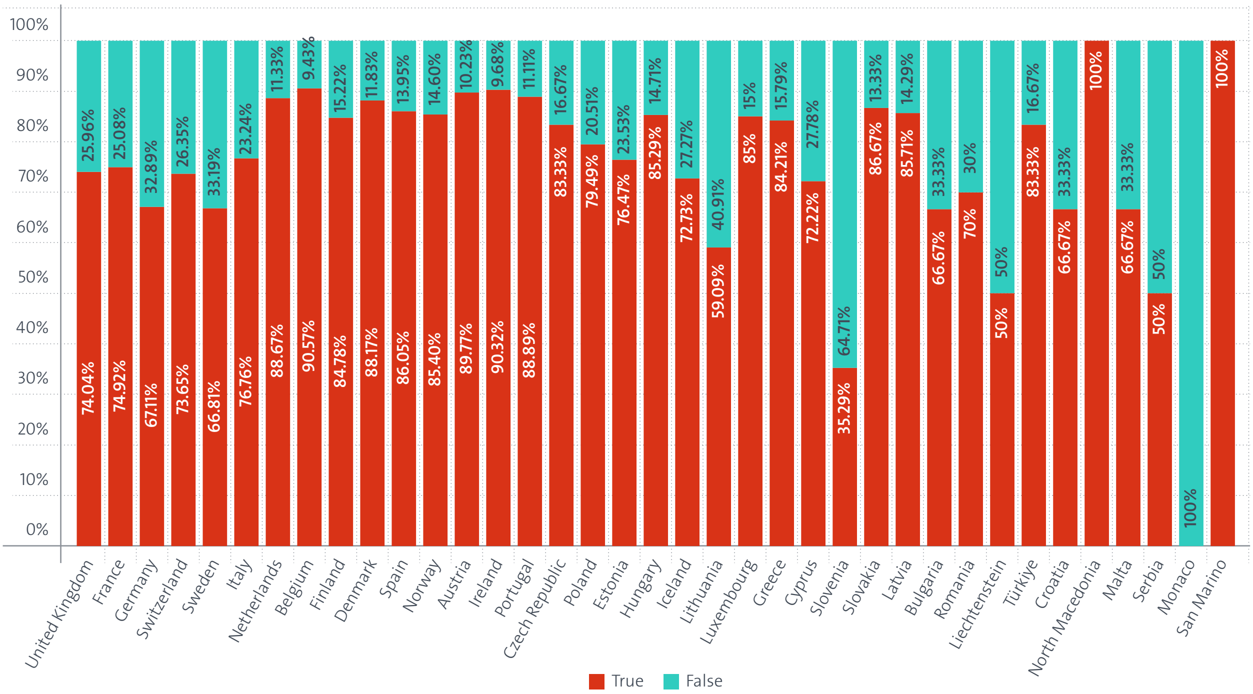
Among countries with moderate sample sizes (350–600 companies), Sweden (624 companies, 76.76%), Belgium (406 companies, 88.67%) and the Netherlands (371 companies, 90.57%) demonstrated above-average data completeness. Several smaller national sample sizes, including Croatia, Serbia and Monaco, achieved 100% completion rate, though these gains reflected lower absolute numbers of companies where founder information retrieval was exhaustively completed.

Conversely, certain countries with substantial representation exhibited lower completion rates. For example, Slovenia (17 companies) showed a completion rate of 35.29% indicating potential challenges in accessing founder information for companies in this region.

These geographic variations in data completeness likely reflect differences in the online documentation and public visibility of founder information across European countries, and variation in business registration transparency requirements. According to Transparency International research, nine EU member states have failed to establish a public beneficial ownership register, while six countries (Cyprus, Czech Republic, Finland, Greece, Romania and Spain) maintain registers that are not publicly available. Additionally, countries such as Belgium, Croatia, Portugal and Sweden impose geographic access restrictions limiting access to nationals and residents, preventing foreign researchers from retrieving founder information. (Source: https://transparency.eu/eu-must-act-beneficial-ownership-registers/)

Figure A2.1

Data completeness by country



Sources: EPO - Dealroom; Crunchbase; own calculations

Table A2.1

Distribution of startups with founder and gender information by country

Country	# Companies	Country	# Companies
United Kingdom	2 022	Iceland	22
France	1 886	Lithuania	22
Germany	1 575	Greece	20
Switzerland	835	Luxembourg	19
Italy	708	Cyprus	18
Sweden	624	Slovenia	17
Belgium	406	Slovakia	15
Netherlands	371	Latvia	14
Finland	368	Bulgaria	12
Denmark	338	Romania	10
Spain	301	Türkiye	8
Norway	274	Croatia	6
Austria	264	Liechtenstein	3
Ireland	93	Malta	3
Portugal	54	Serbia	3
Poland	42	Monaco	2
Estonia	39	North Macedonia	2
Czech Republic	34	San Marino	1
Hungary	34		

Sources: EPO - Dealroom; Crunchbase; own calculations

A.3 Comparison group of non-patenting startups and regression analysis

Comparison group

The target population consisted of all startups in the database, which resulted in a finite population of 8 000 companies. Given the rarity of patenting events among startups and the potential for sparse cell counts when stratifying by gender composition, a stratified sampling approach was adopted to ensure adequate representation of patent-holding firms.

Stratification was implemented along these primary dimensions: patent status (company with European patent records and company without patent records) and industry sectors.

Company age and funding stage were not used as stratification variables, rather instead incorporated as control variables in subsequent regression models.

Sample size calculation followed standard procedure for stratified sampling with finite population correction. The base sample size was computed using Cochran's formula for proportions:

$$n_0 = \frac{Z^2 p(1-p)}{e^2}$$

Where Z = 1.96 (95% confidence level), p=0.5 (maximum variability assumption) and e = 0.05 (5% of margin error). The finite population correction was then applied:

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

Given the extreme rarity of patenting among startups, a disproportionate stratified sampling strategy was employed rather than a proportional allocation. This approach follows the principle of Neyman optimal allocation, which minimises overall sampling variance by allocating larger samples to strata with greater variability or where the outcome of interest is rare. For strata with population sizes smaller than the calculated required sample, complete enumerations were conducted.

To generate population-representative estimates from disproportionately stratified sample, design weights were computed for each observation. For companies in stratum, the weight is:

$$w_i = \frac{N_h}{n_h}$$

Where N_h represents the total number of companies in stratum in the population database.

After the sampling for the comparison group, the same steps to retrieve founder information were applied as for the DTF group. The procedure led to these results: 40.9% of the information came from Dealroom, 33.51% of the information was obtained through deep search (leading to a 74.41% availability of founder information). There was no CrunchBase founder information available for this sample. The final sample is composed of 6 176 companies for which it was possible to find founder information.

Logistic regression

Logistic regression was employed to model the relationship between patenting status and the presence of women on founding teams because the dependent variable is binary: a team has at least one woman or is male-only. Logistic regression ensures all predictions remain valid probabilities through its logistic transformation.

The logistic regression models the logarithmic odd (logit) of the outcome as a linear combination of predictor variables:

$$\ln = \left(\frac{P(\text{HasWoman}=1)}{1 - P(\text{HasWoman}=1)} \right)$$
$$= \beta 0 + \beta_1(\text{EP}) + \beta_2(\text{Country}) + \beta_3(\text{Growth Stage}) + \beta_4(\text{Age})$$

Where P(HasWoman = 1) represents the probability that a firm has at least one woman founder.

The results obtained indicate substantial gender disparities associated with patenting status. Patenting companies demonstrate an odds ratio (OR) of 0.623 with p-value < 0.001, indicating 37.7% lower odds of having at least one woman on the founding team relative to non-patenting companies. When translated to the probability scale, patenting companies exhibit 6.75 percentage points lower probability of having women on the team, with a marginal effect of -0.0675 (95% CI: [-0.0678, -0.0673]).

In substantive terms, this pattern suggests that, among European startups, those engaged in patenting activity are significantly less likely to include female founders. Holding constant industry sector, company age, growth stage and geographic region, the average predicted probability of having at least one woman on the founding team is 21.27% for non-patenting companies compared to 14.52% for patenting companies. This disparity underscores a pronounced gender gap in technology commercialisation and intellectual property development, with patent-intensive ventures remaining predominantly male-dominated even after accounting for structural differences across industries and regions.

Second comparison group

To establish a rigorous comparison between patent-filing companies and non-patent-filing companies, it was decided to create a second comparison group with a structured matching procedure. This approach ensured that observed differences between the two groups are mainly due to patenting behaviour rather than systematic differences in company characteristics such as geographic location, industry sector or founding timeline.

The core methodology employed exact matching on country and industry combined with nearest-neighbour matching on launch year. This two-step approach works as follows:

First, patenting companies were grouped together based on their country and industry combination. For each such group, a pool of non-patenting companies from the same country and industry was identified as potential controls.

Second, within each country-industry group, every patenting company was matched to the non-patenting company with the closest founding year.

This ensures that companies of similar maturity were compared, reducing confounding effects arising from company age. To maintain matching quality, an optional year-distance threshold of 5 years was applied: if no non-patenting company within the same country-industry group had a founding year within 5 years of the patenting company's founding year, that patenting company was left unmatched. This threshold balances the desire for clean matches with the practical constraints of available data.

The data acquisition process for founders in the comparison group companies follows the same methodology employed for the patenting group dataset. The data collection process achieved a completion rate of 73.6%, with the following distribution of sources: 0.24% from the Crunchbase platform, 37.8% from Dealroom and 35.55% through Deep Search. The retrieval process led to 6 107 companies with founders' information available out of 8 298 of the initial sample.

Analysing the second comparison group confirms the results obtained. This analysis reveals that the three main metrics – share of women founders, share of only-women teams, and share of mixed teams – are once again higher in the group of non-patenting companies.

— The share of women among patenting startups is 4.42 percentages points lower than the non-patenting startups.

— The share of teams with only women is 1.68 percentage points lower than the non-patenting startups.

— The share of mixed teams is 5.17 percentage points lower than the non-patenting startups.

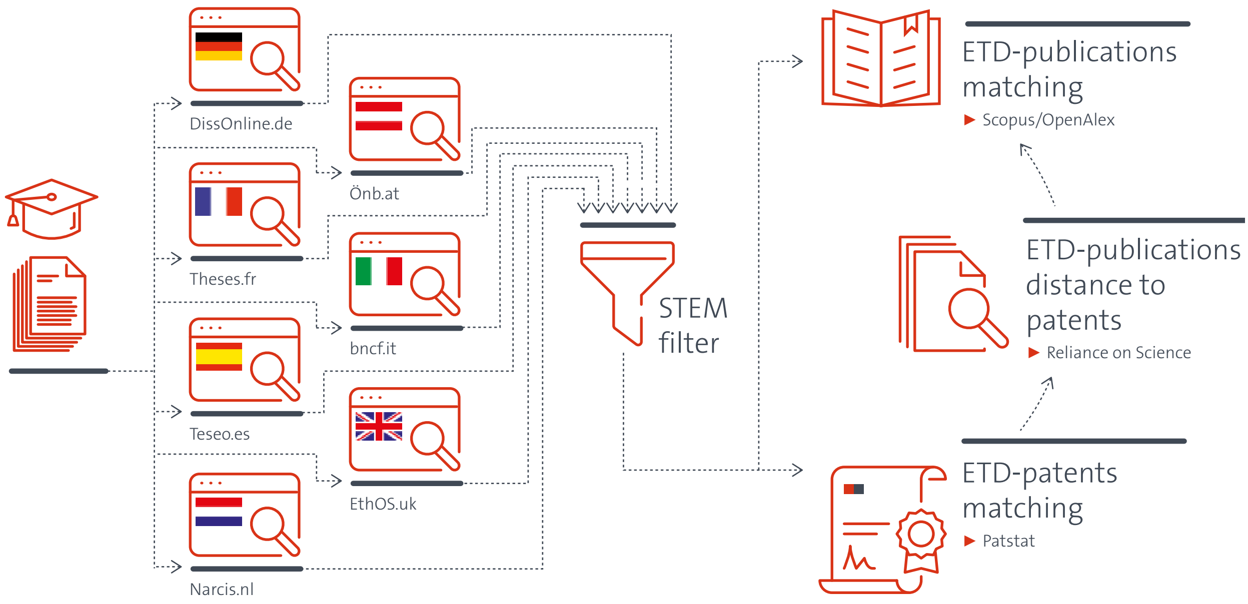
The results obtained were once again validated through a conditional logit regression. The use of conditional logit rather than standard logit is due to the sampling method performed for the second comparison group. Conditional logit is a variant of logistic regression that accounts for the matched structure of the data. Unlike standard logit, which assumes that all observations are independent, conditional logit controls for the matching criteria used in sample selection, thereby addressing potential bias from the non-random sampling design.

A.4 DOC-TRACK data sources and methodology

The DOC-TRACK database includes information on PhD graduates from seven European countries, their publications and patents (Figure A4.1).

Figure A4.1

DOC-TRACK project overview – data sources and activities



Source: DOC-TRACK

It results from the combination of multiple bibliographic sources, namely:

i). The national Electronic Theses and Dissertations (ETD) repositories of France (Theses.fr), Germany (DNB catalogue and DissOnline), Spain (TESEO), the Netherlands (Narcis), Austria (ONB catalogue), the UK (EThOS) and Italy (BCNF OPAC and OAI-PMH) from which we extract information on the STEM doctorate recipients and their theses, from 2000 to 2020;

ii). The OpenAlex publication and citation database (release 2024-09-27);

iii). The Scopus publication database, published by Elsevier, for the years between 1996 and 2021;

iv). The PATSTAT database, release Autumn 2024;

v). The Reliance on Science (RoS) database, as of 2024, which contains information on patent citations to scientific literature, for both USPTO and EPO patent documents (Marx and Fuegi, 2020a, 2020b).

ETD repositories are collections of doctoral dissertations either managed by public agencies or universities' consortia, often as a consequence of legal obligations – the details of which vary widely across countries – to make the dissertations traceable and available for consultation. Since the dissertations are catalogued according to different national classification systems, we identified the STEM theses based on different criteria for each ETD repository (Table A4.1).

Table A4.1

ETD sources and DOC-TRACK coverage

Country	Sources	Organisation	Coverage	Number of theses, of which STEM
France	*theses.fr*	Agence Bibliographique de l'Enseignement Supérieur (ABES)	All universities, 2000–2020	257 739 theses ▼ 137 825 STEM theses (53%)
Germany	DNB catalogue; DissOnline	Deutsche Nationalbibliothek (DNB)	All universities, 2000–2020	544 237 theses ▼ 205 655 STEM theses (38%)
Spain	TESEO	Spanish Ministry of Science, Innovation and Universities	All universities, 2000–2020	204 506 theses ▼ 82 276 STEM theses (40%)
Netherlands	Narcis	Dutch National Center of Expertise and Repository for Research Data (DANS)	All universities, 2000–2020	81 571 theses ▼ 38 113 STEM theses (47%)
Austria	ONB catalogue	Österreichische Nationalbibliothek (ONB)	All universities, 2000–2020	49 808 theses ▼ 24 172 STEM theses (49%)
UK	EThOS (Electronic Theses Online Service)	British Library (BL)	All universities, 2000–2020	347 838 theses ▼ 138 536 STEM theses (40%)
Italy	BCNF OPAC, plus OAI-PMH repositories of individual universities	Biblioteca Centrale Nazionale di Firenze (BNCF)	All universities, 2000–2020	159 899 theses ▼ 85 775 STEM theses (54%)

We then classified the STEM ones into four large disciplines, namely:

— *Engineering* (comprising General Engineering, Chemical Engineering, and Energy);

— *Life Sciences* (comprising Agricultural and Biological Sciences, Biochemistry, Genetics and Molecular Biology, Immunology and Microbiology, Neuroscience, Pharmacology, Toxicology and Pharmaceutics);

— *Mathematics and Computer Science*

— *Physical Sciences* (comprising General Physics and Astronomy, Material Sciences, Environmental Science, Earth and Planetary Sciences, and also Chemistry as a neighbouring discipline).[25]

All ETD repositories provide information on the doctoral graduates' surnames and given (first) names, but are silent on any other biographical detail, including gender. Therefore, we inferred it from first names, based on two databases, one included in the Global Name Recognition by IBM, and the other produced by WIPO for the purpose of gender-classifying inventors (Lax-Martinez et al., 2016, 2021; Miguelez et al., 2019; Di Iasio et al., 2022). For Italy, we also resolved inconclusive cases – where possible – with a manually curated list of names and the Ethnea gender predictor.[26]

It is important to bear in mind that the success of this name-based strategy varies across countries. For the Netherlands, it proved especially difficult to implement, since the Dutch repository most often reports only the graduates' initials.

Where possible, we scraped the full name from the dissertations' first pages, but still, we were unable to assign gender to 65.7% of the graduates (compared to 3.9% for the full dataset excluding the Netherlands). For the UK, the percentage of observations with missing gender is also higher than average (14.8%) due to the very high share of non-European names, especially Asian names, which are often impossible to genderise once transliterated into the Roman alphabet (as is the case for 50% of Chinese names in our data). In contrast, for all other countries, gender was successfully assigned to almost all graduates (97% in France, 97.6% in Austria, 97.7% in Germany, 98.7% in Spain and 100% in Italy). All the analyses in the remainder of the report exclude dissertations for which gender could not be attributed.

The DOC-TRACK database augments this basic information on the gender distribution of graduates with additional information on the graduates' scientific and inventive activities. In particular, based on a name-match between graduates and authors of scientific publications as well as inventors listed on EPO patent applications, the DOC-TRACK database includes, for the following for each graduate.

— the number of scientific publications, per year, as found in Elsevier Scopus (a commercial bibliographic database) with coverage up to 2021, and, among them, those available in OpenAlex (a more extensive, alternative, albeit less structured open-access database);

— the number of patent applications filed at EPO as found in the December 2024 edition of the PATSTAT database, which includes the patent documents published up to the end of July 2024.

25 This classification follows the "All Science Journal Classifications" (ASJC) system used by Scopus to categorise scientific journals. Specifically, we refer to the three Scopus Subject Areas in the Science, Technology, Engineering, Mathematics and Medicine (STEMM) disciplines, except that we have divided the Physical Sciences into three subcategories. See: https://service.elsevier.com/app/answers/detail/a_id/14882/supporthub/scopus/~/what-are-the-most-frequent-subject-area-categories-and-classifications-used-in/. The complete DOC-TRACK database also includes a fifth discipline, Medicine (comprising Medical Science, Nursing, Veterinary, Dentistry and Health Professions) which we have excluded from this report. The main reason for this choice is that, in some countries, most notably Germany, medical dissertations at the master's level are archived along with doctoral dissertations with no means of distinguishing between them. This generates some confusion between medical doctors with and without a PhD as well as some difficulties for undertaking cross-country comparisons.

26 http://abel.lis.illinois.edu/cgi-bin/ethnea/search.py.

Patent applicants are classified into three groups, based on EPO internal databases[27]: 1) Small companies, including individuals, SMEs and startups, which are identified by matching names of patent applicants to company names in Dealroom, ORBIS and Crunchbase; 2) Large companies, which are also identified by matching patent applicants to company names in those platforms, but are classified as large because they do not belong to the group of Small businesses.[28]

We distinguish between patents produced during doctoral studies and afterwards, especially in the aftermath of the graduation, which are instead indicative of the graduates' professional outcome (has the graduate become an inventor? where? at a university or in industry?) but focus on publications produced during doctoral studies.

Unfortunately, all ETD repositories report graduation years (which we can indicate with t), but not the start date of the graduates' doctoral studies. For this reason, we assumed that doctoral studies last four years and we calculated their start at *t-3* retroactively and their end at *t+1*, allowing for a one-year lag after graduation. The lag is needed because some research related to the PhD may be published or submitted as a patent application after graduation. We then classify all publications and patents dated from *t-3* to *t+1* as produced during the doctoral studies, and those produced from *t+2* on as produced afterwards.[29]

One interesting further piece of information concerning scientific publications is their relevance for inventions. Some research conducted during the PhD may not lead to any patentable result, but produce a key input for a subsequent inventive activity – or for further research eventually resulting in a patent – whether conducted by the doctoral graduates themselves or other researchers who the graduate may or may not know or collaborate with. We are therefore interested in classifying all publications in terms of distance to the technological frontier, as defined by Ahmadpoor and Jones (2017). This consists of all pairs of patent applications and scientific publications, where the former cite the latter in either the invention description or the search report. It is safe to assume that the contents of the cited publications are immediately relevant for the patented invention (albeit we cannot say how and why). It is also safe to assume that other publications not cited directly by the patents but by publications at the frontier are also relevant, albeit indirectly. By extension, we can move further away from the frontier and identify all the scientific publications whose citation chain ultimately leads to a patent and define them as *connected* to the technological frontier, that is, ultimately relevant for some inventive activity (in contrast with the unconnected ones, which appear not to be conducive to any invention). We can also classify such connected publications according to the length of their citation chain. In particular, we distinguish between those at the frontier, those close to the frontier, at a distance (chain's length) comprised between 1 and 3 (roughly the median distance, conditional on connection), and all others. Figure A4.2 provides a few illustrative examples. Note that the older a publication, the more likely it is that it is connected and close to the technological frontier, as the probability of getting cited (by other publications and/or patents) increases with time. For this reason, when calculating the distance of the publications from the frontier, we use a fixed time window of 5 years.

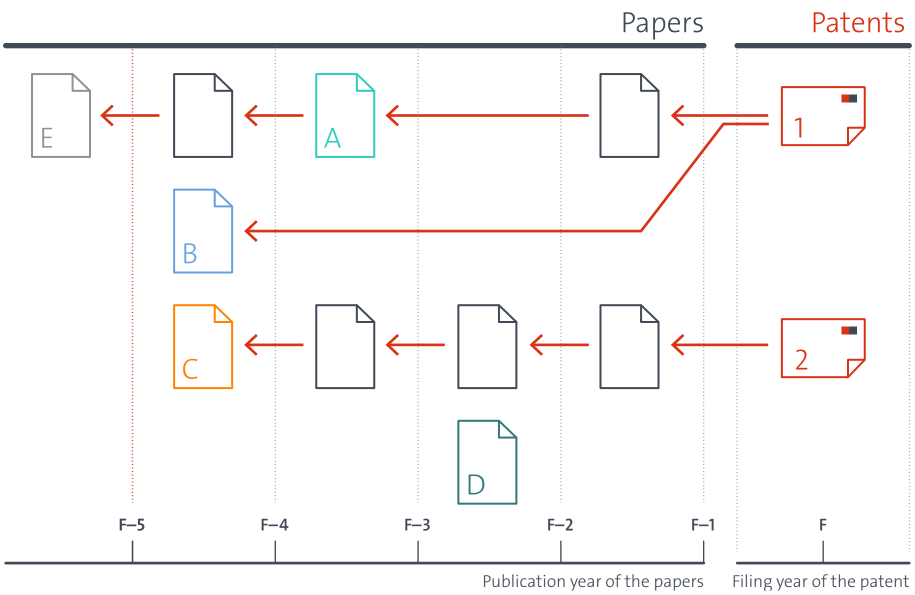
27 It should be noted that about 30% of applicant names are not matched, so the classification is not exhaustive.

28 This differs from the first part of the report, where types of applicants are based on the EEE-PPAT classification (https://www.ecoom.be/en/data-collections/patstat-enhancements), and Small and Large companies are distinguished based on the size of their patent portfolios, in the years comprised between 2000 and 2020. Specifically, Large companies are defined as those falling in the top 5% of the portfolio size distribution, with all other firms defined as Small companies.

29 Note that we extend the duration of doctoral studies to (t-3, t+3) in a robustness test (see Figure A4).

Figure A4.2

Calculation of the DOC-TRACK distance-to-patent metric



Paper A
is **indirectly** connected to patent 1 (citation level=1).

Paper B
is **directly** connected to patent 1.

Paper C
is **indirectly** connected to patent 2 (citation level=3).

Paper D
is **not connected** to patent documents.

Paper E
is **indirectly** connected to patent 1 (citation level =3), but outside 5-year time window.

Note: Own elaboration metric, based on the methodology of Ahmadpoor and Jones (2017).

A.5 Overview of existing literature on publishing and patenting activity in Spain, Germany, United Kingdom, France, the Netherlands, Italy and Austria

Spain

Using USPTO data for the period 1976–2019, Medina and Álvarez (2022) – in line with previous studies based on EPO data – find that the recent increase in inventions by women in Spain is mainly driven by their participation in internationally oriented mixed teams and by their sectoral concentration, predominantly in chemistry-related fields.

Martinez and Miguelez (2025) show that patent families with women inventors account for approximately 30–35% of all patent families invented in Spain, and display four main characteristics. First, they are more often linked to universities and public research centres (60%) than to firms (30%) or individuals (15%). Second, they are more frequent in chemistry-related sectors, such as pharmaceuticals and biotechnology. Third, they tend to be generated by larger teams, especially in more recent years. Fourth, they display a stronger international orientation, suggesting that they are likely associated with higher-value inventions. Overall, the analysis highlights that women's contribution to patents in Spain is increasingly significant in strategic, high-complexity sectors such as pharmaceuticals and biotechnology, but it remains concentrated in the academic sphere and continues to be substantially lower in the business sector, which remains an unresolved challenge.

The overall conclusion is that women inventors work more frequently in the public sector, but, as Cañibano and Corona (2023) point out, there are no detailed statistics on gender differences in R&D career trajectories outside the public sector, which makes it difficult to assess the contribution of women inventors to innovation in the private sector. Innovation surveys indicate that women account for around 30% of innovation personnel in Spanish firms.

Germany

Frietsch et al (2009) analyse fractional shares of female inventors in EPO applications from the 1991–2005 period, assigning gender according to first names. They find that, with 2.4 to 4.9 percent, Germany, along with Switzerland (for early years) and Austria had lower shares of patents attributed to female inventors than the other 11 countries in the sample, whereas Spain and France have the highest female inventor shares. The authors show that female inventor shares increase with the relative importance of pharmaceuticals and chemicals in the respective countries, whereas fewer female inventors are observed in countries – such as Germany – where more patents relate to transport and machinery. However, Germany is found to have below-average female inventor shares across all technology fields.

While Frietsch et al. (2009) do not provide any in-depth empirical analysis of potential factors underlying the observed differences, they show that national shares of female contributions to science tend to vary with GDP shares devoted to pre-school education.

Using data from the EU Labour Force Survey (EU-LFS), Hook and Paek (2020) report that among the DOC-TRACK countries, Germany had the lowest labor force participation rate among women holding a tertiary degree with children 0-4 years old (74 percent compared to 80 percent in Italy and the UK, 82 percent in Austria, 85 percent in France, 87 percent in Spain and 91 percent in the Netherlands). Both the lack of public childcare infrastructure and traditional social norms (in Western Germany) are seen as responsible for the low rate in Germany (Borck, 2014; Boehlmann et al., 2025). To the extent that patenting activities of female graduates reflect anticipated rewards, the differences across DOC-TRACK countries may be associated with the differences we observe in the female/male ratio among inventors. Specifically, it might be conjectured that female doctoral students in Germany are less inclined to file patents than their peers in other DOC-TRACK countries because, for them, patents have lower signalling value in the labour market.

United Kingdom

While the absolute number of female inventors in the UK remains relatively low, there has been a steady increase in the proportion of women among inventors over time. According to UKIPO (2016), the share of female inventors rose by more than 15% between 2006 and 2015, increasing from 7.2% in 2006 to 9.3% in 2015. Although this upward trend is encouraging, the UK level in 2015 remained below the global average share of female inventors, which stood at approximately 12.7% in 2017 (UKIPO, 2019). This pattern is consistent with the broader evidence presented in this report, which shows that the UK tends to exhibit lower female representation across innovation indicators, while nevertheless displaying positive dynamics over time, particularly in the earlier and later periods of observation.

Disaggregating patenting activity by technology field further reveals that female inventorship in the UK is highly uneven across technological domains. During the 2000–2015 period, technology areas such as biotechnology (25.5%), pharmaceuticals (24.4%) and organic fine chemistry (23.4%) recorded the highest shares of female inventors among the 35 WIPO technology fields (UKIPO, 2016). In contrast, traditionally male-dominated engineering fields such as machine tools (3.3%), thermal processes and apparatus (3.3%) and mechanical elements (2.9%) exhibited the lowest female inventor shares. These patterns closely mirror those identified in Figures 50 and 51, where the UK is observed to rank among the countries with the lowest female inventor ratios in several mechanical and engineering-intensive fields.

In parallel, the overall proportion of patents involving at least one female inventor more than doubled, rising from around 6% in the early 2000s to over 12% by 2015 (UKIPO, 2016). This increase has been driven largely by growth in mixed-gender inventor teams, rather than by a rise in female-only inventorship. Overall, these trends help explain why the UK emerges as an exception in the cross-country analysis: despite persistently low absolute levels, female patenting propensity has increased relative to that of men, contributing to a narrowing adjusted gender gap from the PhD stage to the post-PhD phase.

France

No specific research on gender bias in patenting exists for France. Instead, research on gender inequality in science highlights persistent structural disparities despite comparatively favourable institutional features (Hermann and Cyrot-Lackmann, 2002). Although women now constitute a large share of PhD graduates, they remain significantly less likely to obtain permanent academic positions (Bisantis, 2025). Large-scale administrative evidence indicates that this gap emerges primarily during the transition from PhD to first permanent job and is driven mainly by differences in application

behaviour rather than lower success rates conditional on applying (Bisantis, 2025). Geographic mobility constraints play a key role: women apply to fewer positions, over shorter distances, and are more negatively affected by spatially dispersed job markets (Bisantis, 2025). Complementary work documents substantial gender gaps in research output and cumulative academic trajectories, resulting in thousands of “missing women” from French academia over recent decades (Bisantis, Bramoullé and Ziparo, 2025). Evidence from promotion processes within major public research organisations suggests that, conditional on productivity, men and women have similar promotion rates, but that family characteristics, mentoring and research responsibilities affect career advancement differently by gender (Mairesse, Pezzoni and Visentin, 2020). Overall, the French literature converges on the view that gender inequality in science arises less from overt evaluative bias than from structural constraints, differential productivity trajectories, and mobility- and family-related frictions that cumulatively disadvantage women.

Netherlands

To the best of our knowledge, no specific study has been produced on gender bias in inventive activities of Dutch firms or other organisations. However, JUVE Patent (2019) finds a pronounced gender imbalance in Dutch patent firms, with women remaining extremely under-represented, particularly at partner and senior levels. It attributes this pattern partly to the male-dominated technical education pipeline feeding into patent practice, but also to retention and promotion barriers within firms. The authors argue that, without active diversity strategies, gender inequality in the Dutch patent profession is likely to persist.

Some research instead has been produced on gender bias in Dutch science, which shows a combination of long-standing structural inequalities (Wouters, 2001; Van den Brink and Benschop, 2012). Historical analyses document that women were systematically excluded from senior academic positions in the Netherlands well into the twentieth century, creating enduring pipeline effects (Wouters, 2001). Contemporary studies highlight persistent under-representation of women at higher ranks, particularly among full professors (Van den Brink and Benschop, 2012). Other evidence concerns access to public funding via competitive grants and suggests that female applicants receive lower evaluations due to possible bias in peer review (van der Lee and Ellemers, 2015a). However, reanalyses and formal critiques argue that these gender differences are small, sensitive to model specification, and may partly reflect disciplinary composition rather than direct discrimination (van der Lee and Ellemers, 2015b). Other studies of Dutch academia emphasise informal recruitment practices, network effects and cultural norms as key mechanisms sustaining inequality (Van den Brink and Benschop, 2012).

Italy

Using data on a sample of 2 538 academic patents by Italian inventors in the period 1996–2007, Giuri et al. (2020) show that there has been a growing involvement in patenting activity by Italian women academic scientists over the 10-year period of the study. In particular, there has been considerable growth in the share of university-owned patents, with at least one female academic inventor on a patent team. Regression results further highlight the positive impact of university IPR ownership on women's participation in patenting. In addition, they show that the presence of a university TTO as a dedicated unit in support of commercialisation and the participation of universities in science and technology parks are factors positively associated with a stronger presence of women inventors in academic patents.

Austria

Frietsch et al. (2009) categorise Austria within a cluster of "conservative" innovation systems, characterised by a female propensity to patent that remains notably lower than European counterparts like Spain or the Baltic states. This gap is largely attributed to the country's industrial specialisation. As Lax-Martinez et al. (2016) observe, female inventor participation is heavily concentrated in the chemistry and life sciences sectors, yet these are overshadowed by Austria's dominant mechanical and electrical engineering industries – sectors where female participation remains at a critical low.

Recent policy evaluations by Regent (2025) emphasise the necessity of transformative instruments such as the INNOVATORINNEN program to address these systemic inequalities and ensure that the Austrian innovation system fully leverages its human capital.

A.6 Regression-based approach to calculate under-representation of women inventors among STEM PhD graduates

We define:

w^P= the number of women with patents (among PhD graduates)

w^G= the number of women PhD graduates

m^P= the number of men inventors (among PhD graduates)

m^G= the number of men PhD graduates

And:

$$Y=\frac{w^P}{w^P+m^P}$$

which represents the share of women among all PhD graduate inventors. We can similarly define

$$X=\frac{w^G}{w^G+m^G}$$

which is the share of women among all PhD graduates.

To address these compositional concerns, we estimated the following linear regression model:

$$Y_{cft}=\beta 0+\beta_1\times X_{cft}+\gamma_{ct}+\delta_f+\varepsilon_{cft}$$

where:

- Y_{cft} is the share of women among all graduates who patented within the specified period (during PhD or after PhD), in country *c*, field *f*, and graduation year *t*
- X_{cft} is the share of women among all PhD graduates (regardless of patenting) in country *c*, field *f*, and graduation year *t*
- γ_{ct} are country × year fixed effects (capturing country-specific trends over time)
- δ_f are field (discipline) fixed effects

This specification allows us to isolate the relationship between women's representation among patent holders and their representation in the PhD population, conditional on field composition and country-specific temporal trends.

Based on these estimates, we computed what the expected gender gap would be for each country *after removing compositional effects*. After estimating the model, we proceeded as follows:

Step 1: We generated the predicted share of women among patent holders for each country-year-field combination using the actual female graduate share for each country-year:

$$\hat{Y}_{cft}=\hat{\beta}0+\hat{\beta}_1\times X_{cft}+\hat{\gamma}_{ct}+\hat{\delta}_f$$

Step 2: We averaged the predicted share of women among patent holders across all disciplines to obtain country-year predictions:

$$\hat{Y}_{ct}=\frac{1}{F}\sum_f \hat{Y}_{ct}$$

where F denotes the total number of fields. Thus, $\hat{Y}_{ct}$ is the predicted share of female patenting for a given country and graduation year, *using the actual gender composition for that country-year* and averaging over all disciplines. This isolates country-year effects while controlling for field compositional differences.

Step 3: To simplify presentation, we computed the average predicted share for two subperiods (2000–2010 and 2011–2020) by averaging the yearly predictions within each subperiod.

$$\hat{Y}_{c,1}=\frac{1}{11}\sum_{t=2000}^{2010}\hat{Y}_{ct}$$

$$\hat{Y}_{c,2}=\frac{1}{10}\sum_{t=2011}^{2020}\hat{Y}_{ct}$$

Finally, we compared these predicted values with each country's own average share of female PhD graduates (regardless of patenting status) for that sub-period. This provides a country-specific baseline for comparison:

$$X_{c,p} = \frac{1}{F \times T} \sum_{f} \sum_{t} X_{cft}$$

where F is the number of fields and T is the number of years in the subperiod (i.e. 11 for the subperiod 2000–2010 and 10 for the subperiod 2011–2020) for country c. More precisely, this is the average of X_{cft} across all country-field-year observations in the regression sample for country c in that period. It represents the average female graduate share for that specific country, averaged across disciplines and years within the subperiod. If the predicted female patenting share is lower than the country's PhD share, that implies that women are under-represented in patenting relative to their presence in that country's PhD programs. Conversely, if the predicted share exceeds the country's PhD share, women are over-represented.

A.7 Patenting and publishing activities of doctoral graduates from European degree-granting institutions

In this section, we provide details on the patenting and publishing activities of doctoral graduates in the 20 largest institutions in each discipline across all countries in our sample, amongst the largest 100 for all fields, with size measured by the total number of degrees granted in the discipline from 2016 to 2020. Most institutions belong to the countries with the largest number of graduates in our sample (namely France, Germany and the UK), but in some disciplines we also find – among the top institutions – several universities in Italy and Spain. For Austria, we find the University of Vienna (U. Wien) in the *Life Sciences* and the Technical University of Vienna (TU Wien) in *Mathematics and Computer Science*. For the Netherlands, we find Wageningen University and the University of Groningen in the *Life Sciences*.

For each discipline and set of institutions, we report four indicators:

i). the share of graduates patenting during the PhD, by gender and subperiod (2000–2010 vs 2011–2020)

ii). the share of graduates patenting after the PhD, by gender, over the entire period 2000–2020 (in consideration of right truncation issues, which would make a two-period comparison meaningless)

iii). the share of graduates publishing during the PhD, with at least one publication connected to the technological frontier, by gender and subperiod

iv). the share of graduates publishing during the PhD, with at least one publication at the technological frontier, by gender and subperiod

i). The data presented in the various graphs do not lend themselves to specific comments, also because we do not have information on the various institutions and the factors behind their different ranking according to the various indicators. In fact, the graphs are meant more for consultation than for analytical purposes. Still, a few common patterns emerge, namely the following.

ii). None of the patterns observed by discipline appears to be driven by one or a few outliers with extreme values.

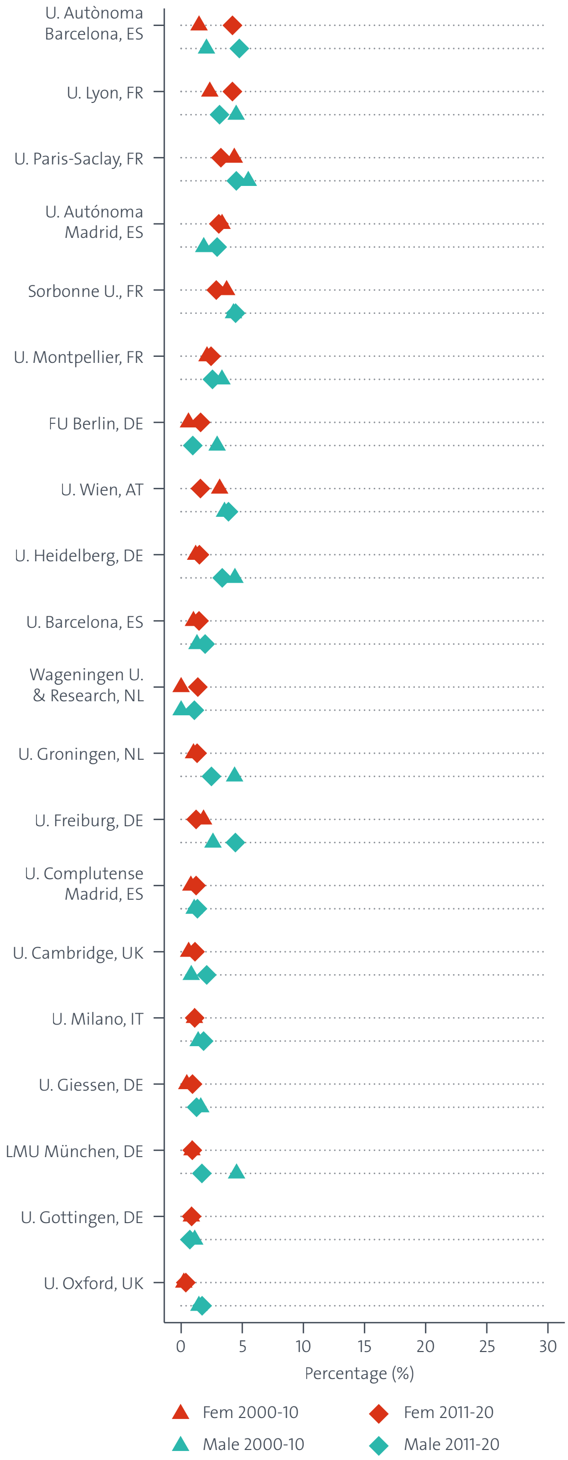
iii). Among the top institutions, the British ones appear consistently at the bottom of rankings for all indicators (with rankings based on the share of female graduates either patenting or publishing at or close to the technological frontier), but with limited biases.

iv). German universities exhibit the highest gender gaps with respect to patenting, especially after the PhD, but not publishing, which is indicative of a strong "leaking pipeline" effect.

Life sciences

Figure A6.1

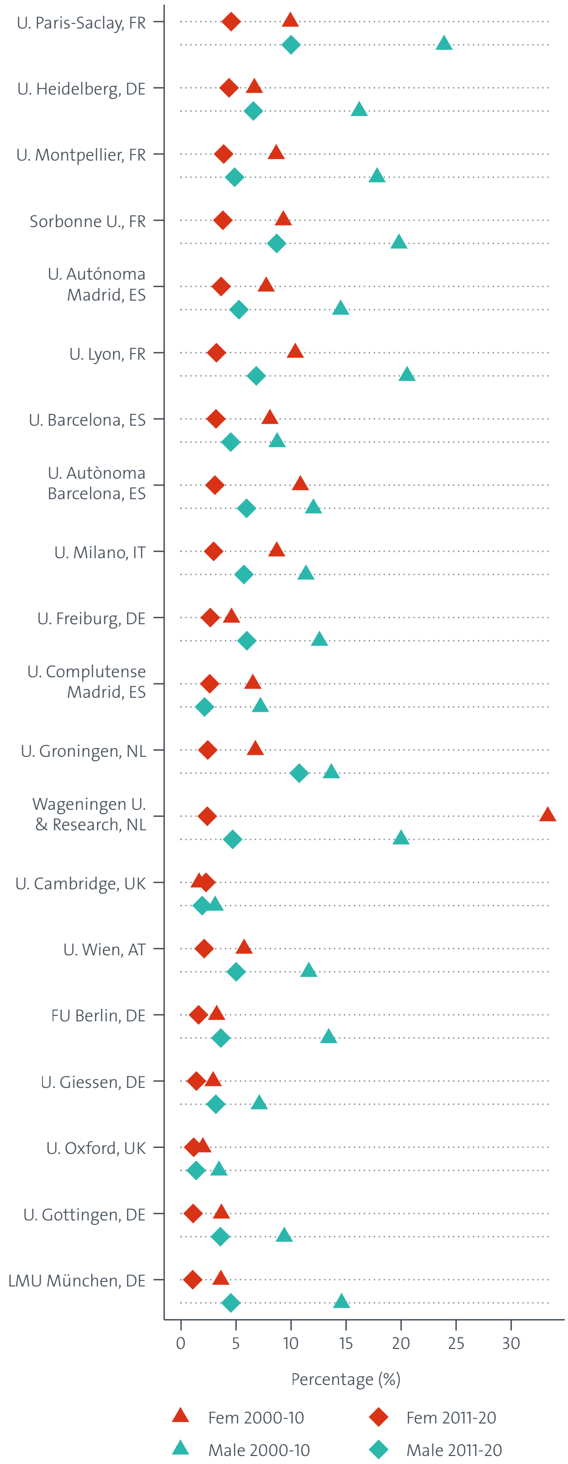
Top 20 institutions in Life Sciences – Percentage of graduates patenting during PhD, graduation years 2000–2010 and 2011–2020



Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.2

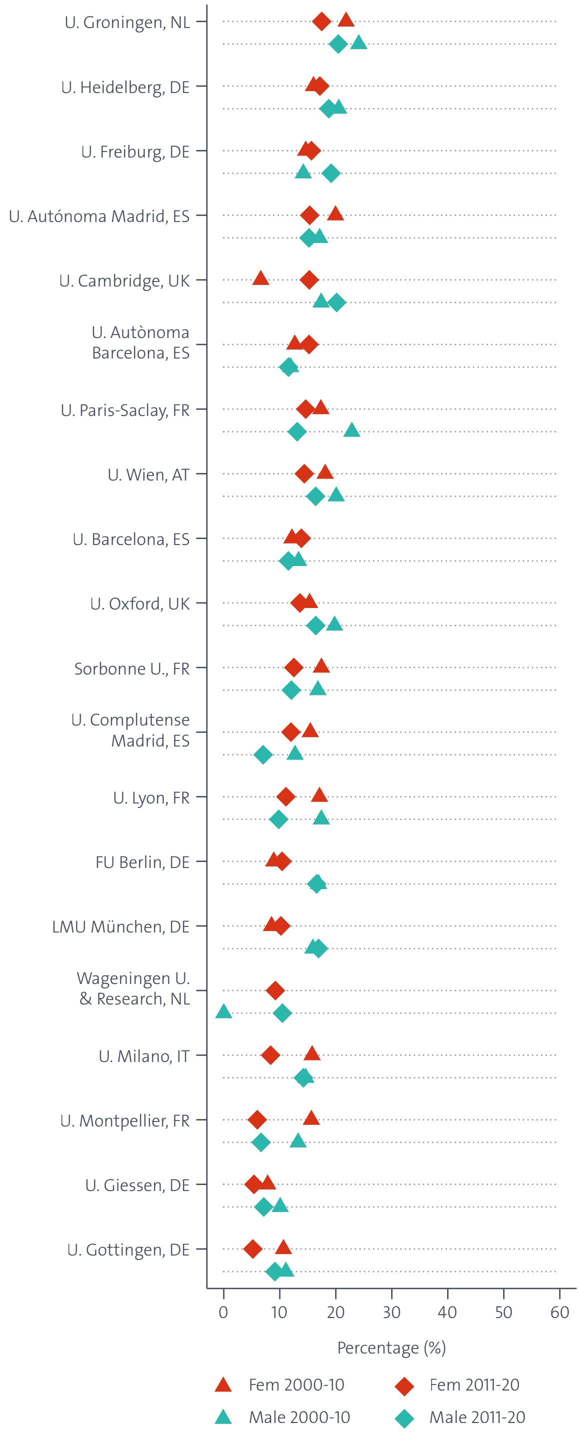
Top 20 institutions in Life Sciences – Percentage of graduates patenting after PhD graduation years 2000–2020



Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.3

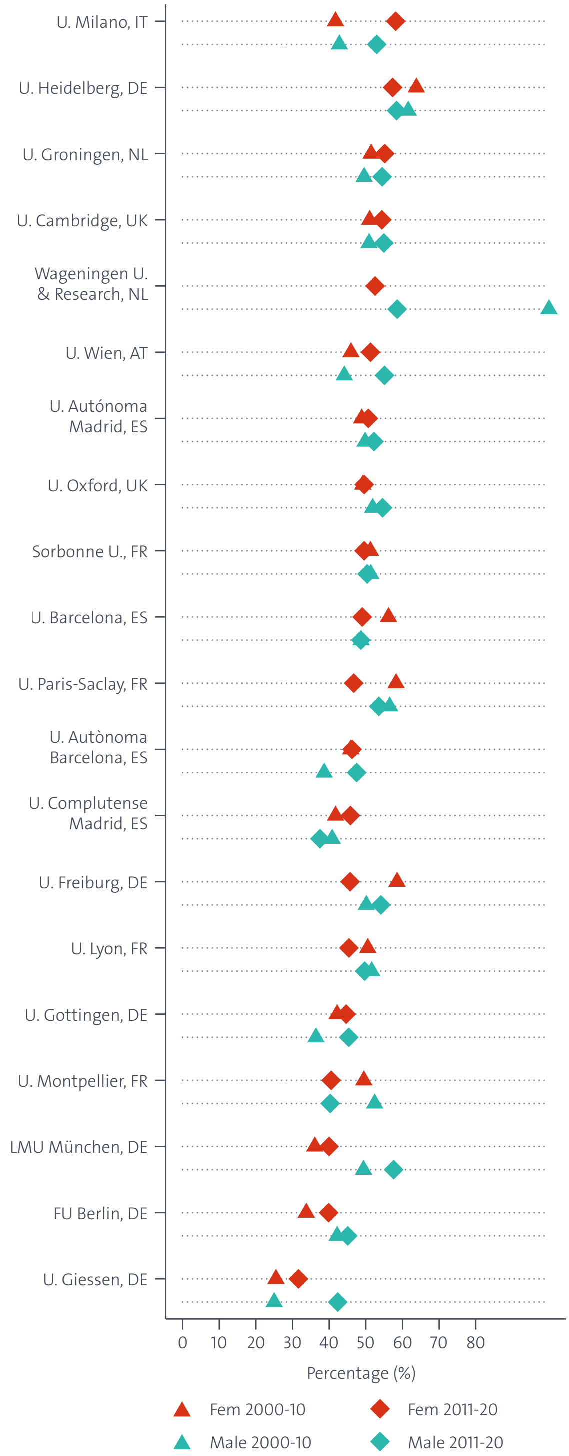
Top 20 institutions in Life Sciences – Share of graduates with publications connected to patents during PhD, graduation years 2000–2010 and 2011–2020



Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.4

Top 20 institutions in Life Sciences – Share of graduates with publications close to the technological frontier during PhD, graduation years 2000–2010 and 2011–2020

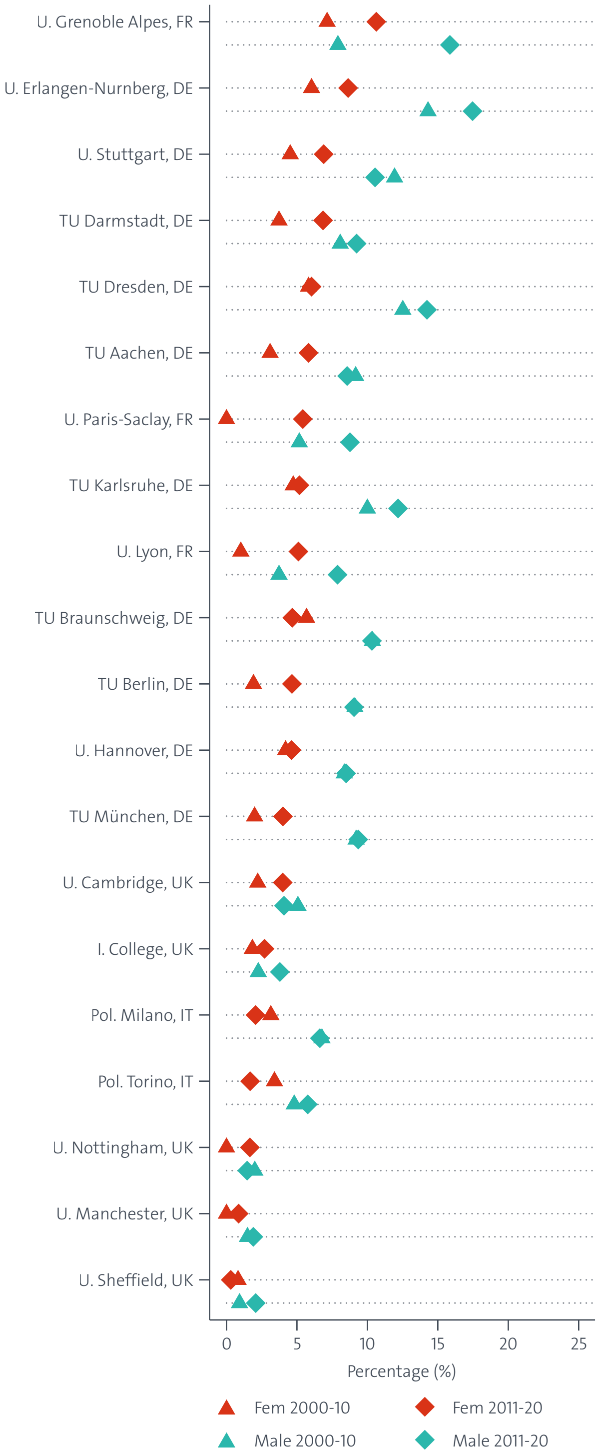


Sources: EPO - PATSTAT, DOC-TRACK

Engineering

Figure A6.5

Top 20 institutions in Engineering – Percentage of graduates patenting during PhD, graduation years 2000–2010 and 2011–2020



Sources: EPO - PATSTAT, DOC-TRACK

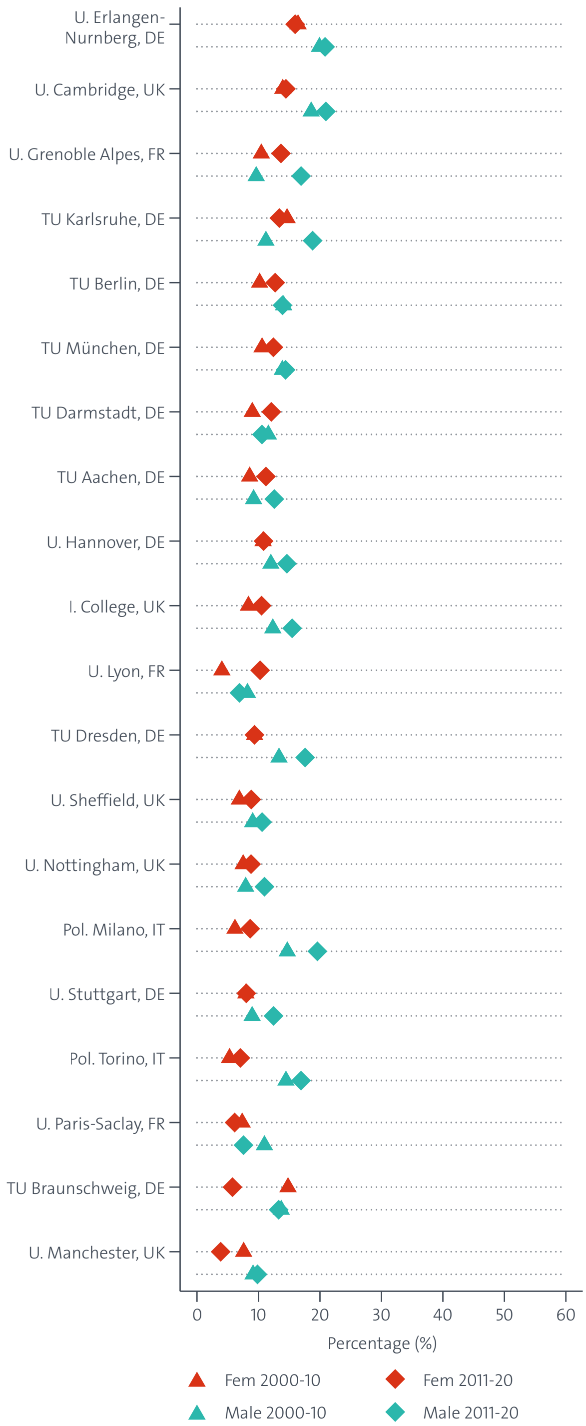
Figure A6.6

Top 20 institutions in Engineering – Percentage of graduates patenting after PhD, graduation years 2000–2020

Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.7

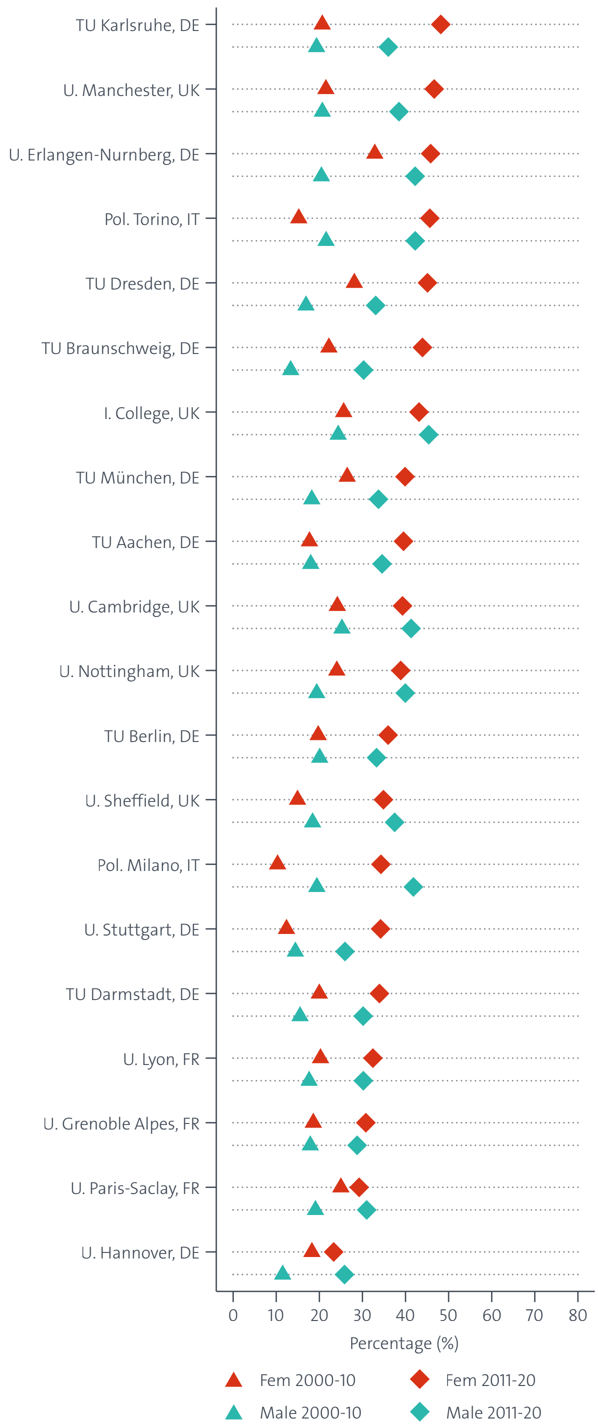
Top 20 institutions in Engineering – Share of graduates with publications connected to patents during PhD, graduation years 2000–2010 and 2011–2020



Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.8

Top 20 institutions in Engineering – Share of graduates with publications close to the technological frontier during PhD, graduation years 2000–2010 and 2011–2020

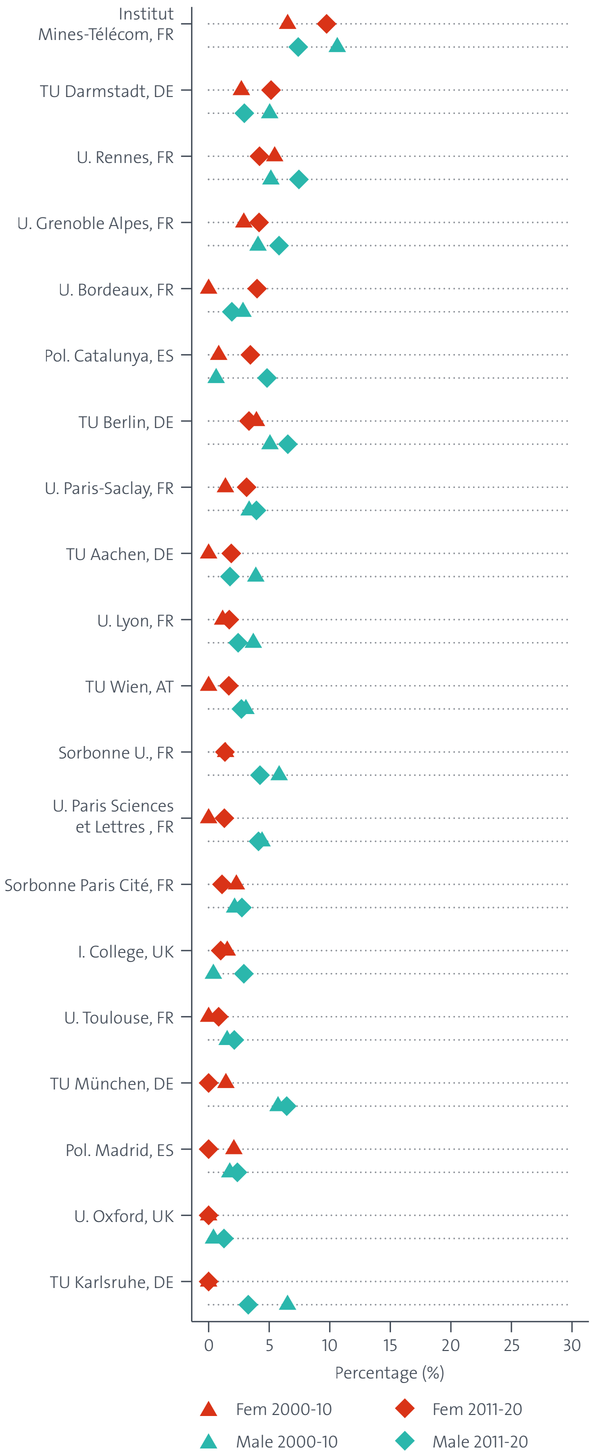


Sources: EPO - PATSTAT, DOC-TRACK

Mathematics and Computer Science

Figure A6.9

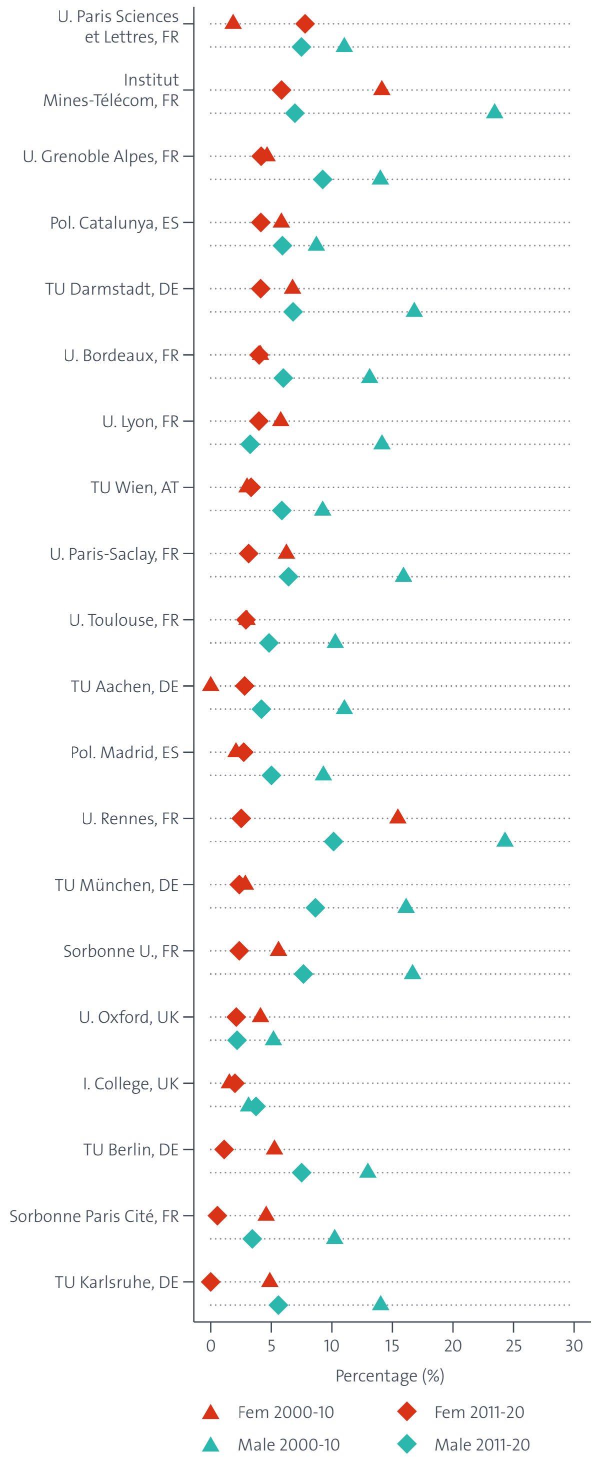
Top 20 institutions in Mathematics and Computer Science – Percentage of graduates patenting during PhD, graduation years 2000–2010 and 2011–2020



Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.10

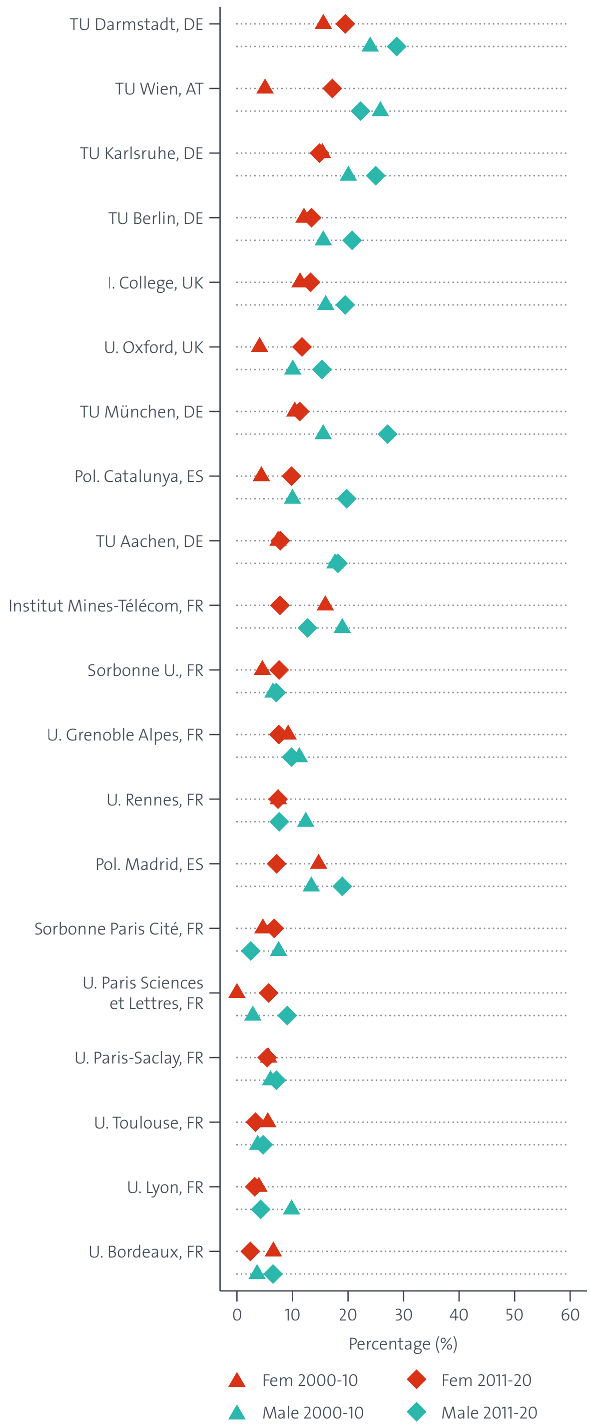
Top 20 institutions in Mathematics and Computer Science – Percentage of graduates patenting after PhD, graduation years 2000–2020



Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.11

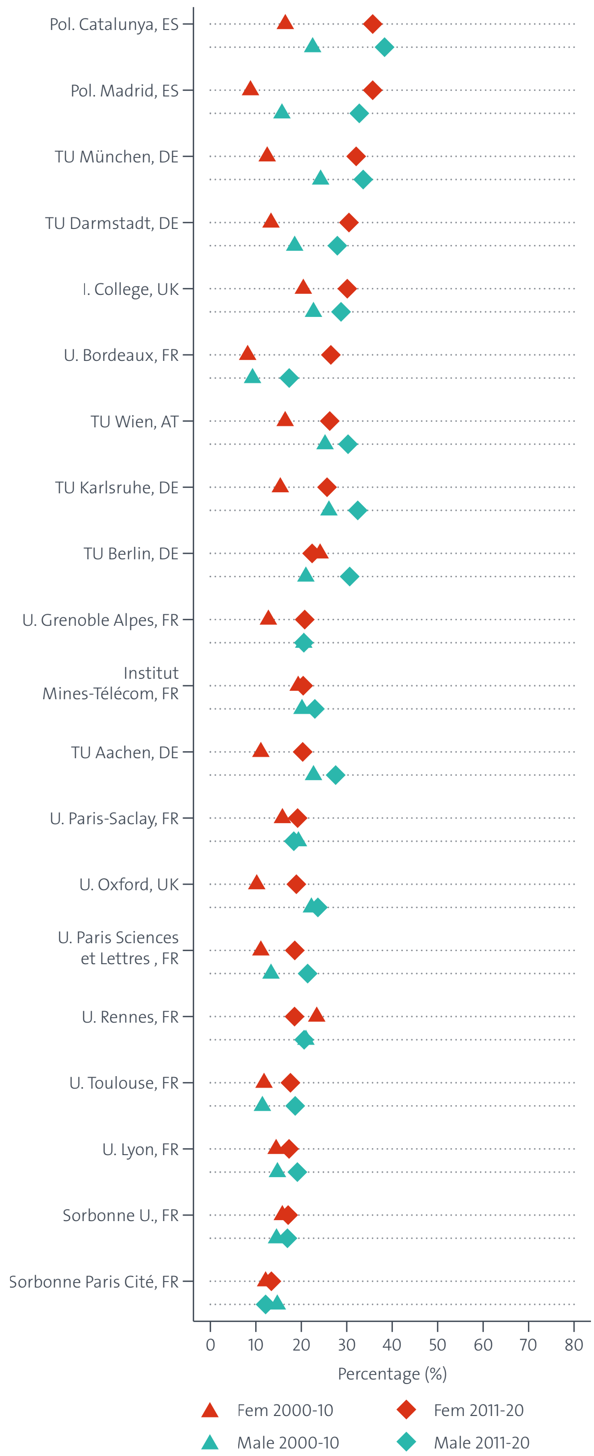
Top 20 institutions in Mathematics and Computer Science – Share of graduates with publications connected to patents during PhD, graduation years 2000–2010 and 2011–2020



Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.12

Top 20 institutions in Mathematics and Computer Science – Share of graduates with publications close to the technological frontier during PhD, graduation years 2000–2010 and 2011–2020

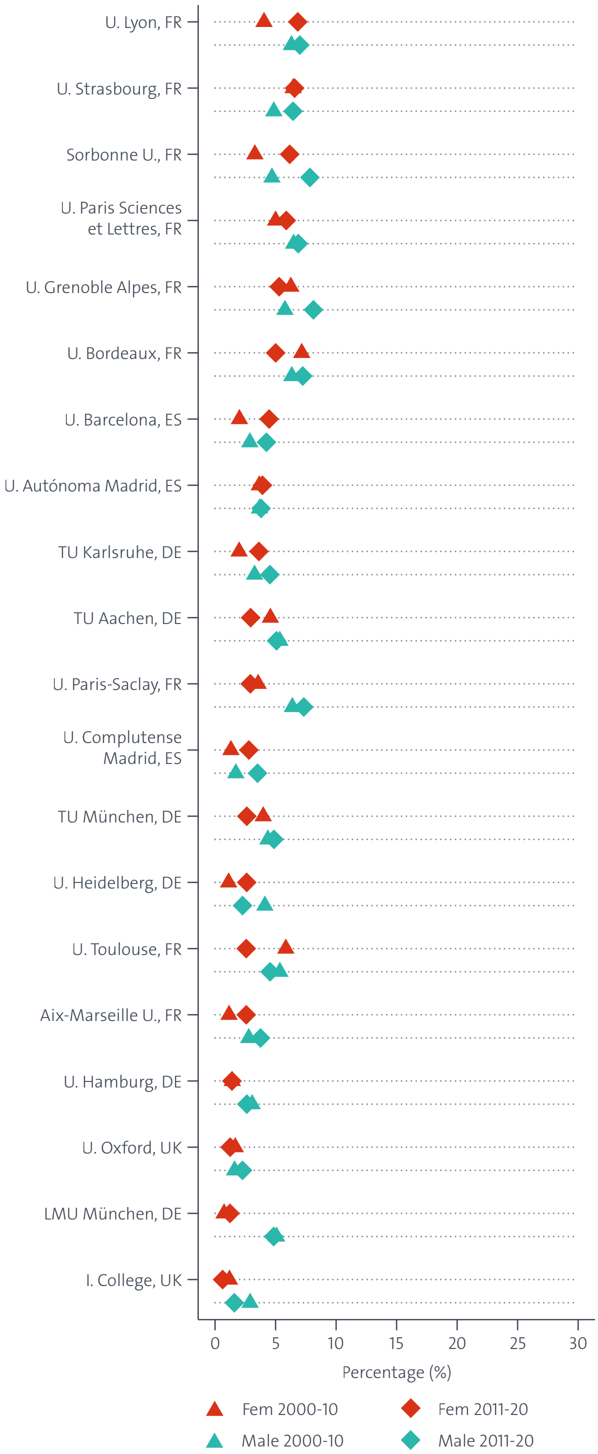


Sources: EPO - PATSTAT, DOC-TRACK

Physical Sciences

Figure A6.13

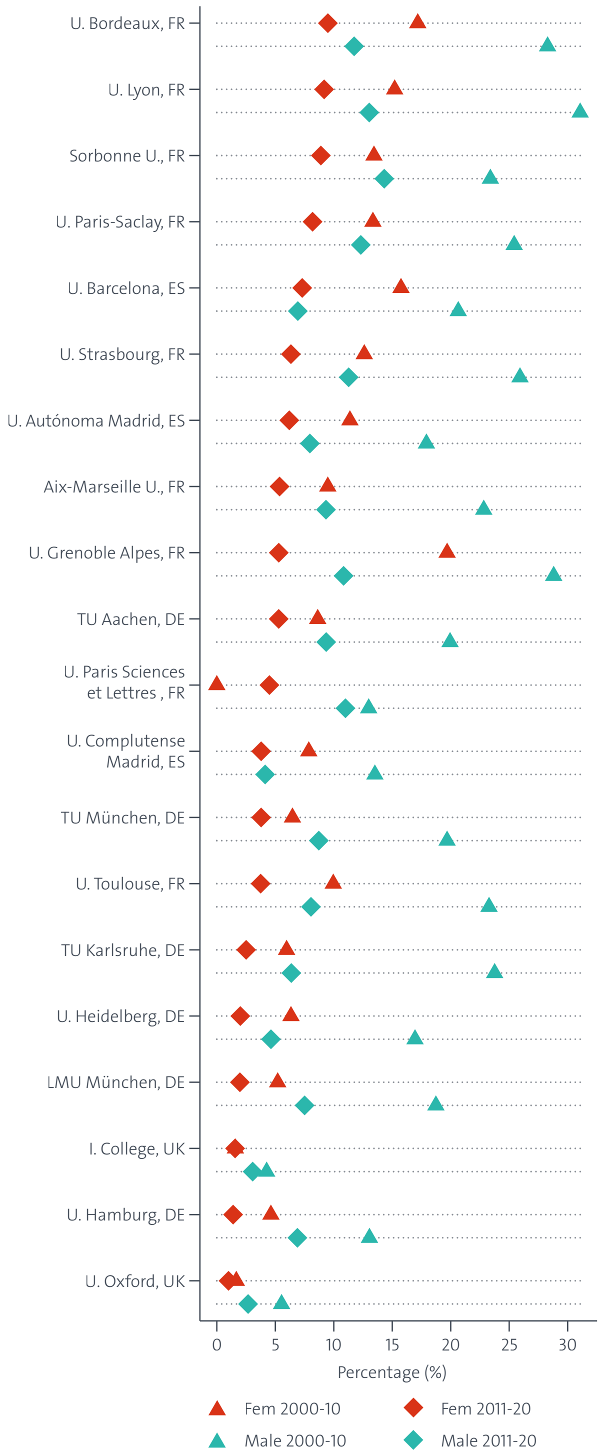
Top institutions in Physical Sciences – Percentage of graduates patenting during PhD, graduation years 2000–2010 and 2011–2020



Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.14:

Top institutions in Physical Sciences – Percentage of graduates patenting after PhD, graduation years 2000–2020



Sources: EPO - PATSTAT, DOC-TRACK

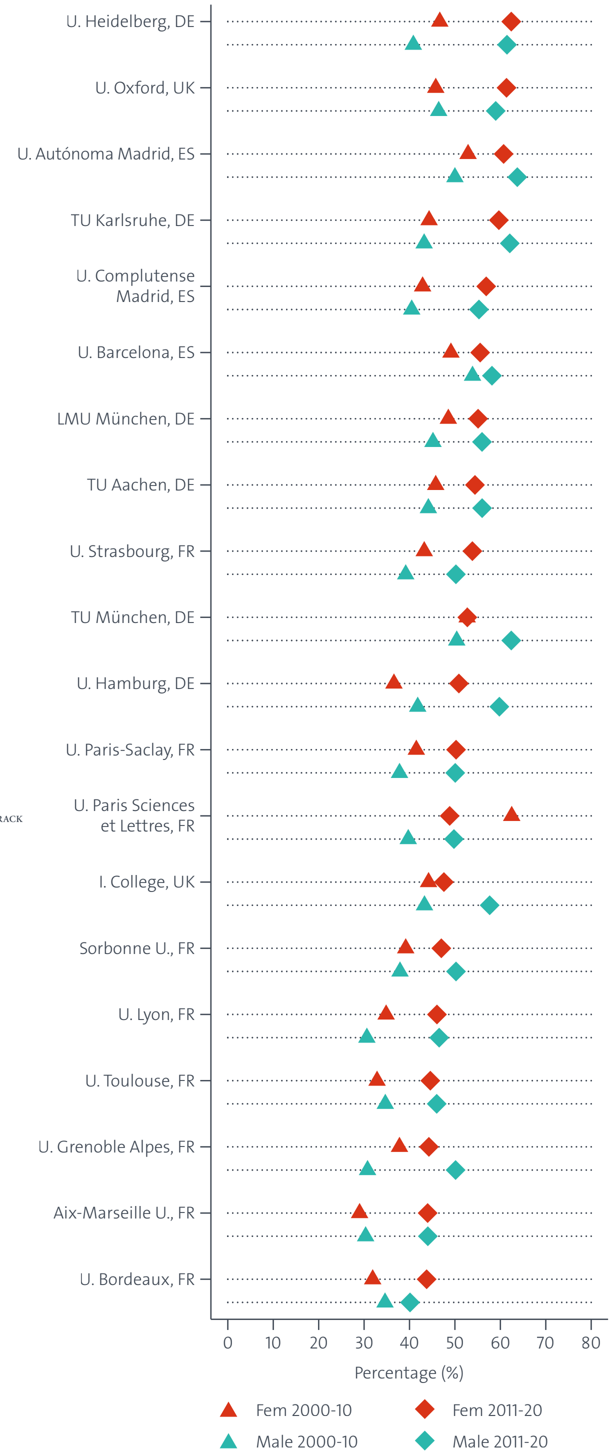
Figure A6.15

Top institutions in Physical Sciences – Share of graduates with publications connected to patents during PhD, graduation years 2000–2010 and 2011–2020

Sources: EPO - PATSTAT, DOC-TRACK

Figure A6.16

Top institutions in Physical Sciences – Share of graduates with publications close to the technological frontier during PhD, graduation years 2000–2010 and 2011–2020



Source: EPO - PATSTAT

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