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Closing Innovation and Intellectual Property Diversity Gaps A Global Literature Review

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Closing Innovation and Intellectual Property Diversity Gaps: a global literature review

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Abstract

Innovation is a driver of competitive advantage and economic growth, with patent rights playing a critical supporting role. However, differential access to patent rights and relatively less participation in innovation can affect women and people from other historically underrepresented groups, thereby hindering progress and limiting the potential economic benefits generated by innovation. This paper reviews the global literature on these “diversity gaps”, identifies their key drivers, and documents international policies and initiatives that show promise in addressing them. Building upon Shapanka and Fechner (2018), it expands the geographic scope and reinforces the scientific basis of their analysis. The paper also provides recommendations for a wide range of stakeholders and offers insights for fostering more inclusive and equitable innovation ecosystems.

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1 Introduction

Innovation is widely recognized as a crucial contributor to competitive advantage and economic growth across jurisdictions, at the national as well as organizational level (Rosenberg, 2006; World Intellectual Property Organization, 2015). In the European Union (EU), industries that rely intensively on patent rights are responsible for more than 75 per cent of intra-EU trade. Companies with a high number of patents generate almost 40 per cent of jobs in the EU Member States, pay higher salaries and account for nearly 50 per cent of total economic activity (GDP) in the EU (EPO and EUIPO, 2022).

Patents help to drive investments in innovation, enabling inventors to commercialize their ideas in the marketplace, reap the benefits of their ingenuity, attract financing, and work with partners to scale their efforts and impact (Conti et al., 2013; De Rassenfosse, 2012; De Rassenfosse et al., 2016; Hoenig and Henkel, 2015; Webster and Jensen, 2011). Studies recognize the value of patents for individuals, as inventors are paid higher wages and are offered better job and promotion opportunities (Kline et al., 2019; Toivanen and Väänänen, 2012). For instance, Akcigit and Goldschlag (2023) find that American inventors tend to earn higher wages than the general population, with 88 per cent of “super star” inventors (those with the most impactful patents) sitting in the top 10 per cent of the earnings distribution – and with nearly 20 per cent of them in the top one per cent of American earners.

Patents also bring benefits to businesses, in particular for small and medium-sized companies. By reducing asymmetries of information between capital seekers such as startups and venture capitalists, patents facilitate access to capital and can increase commercialization opportunities. Patents help investors to calibrate their expectations regarding the quality of new ventures, and they reach faster funding decisions when companies have at least one patent application (Haeussler et al., 2014). Venture capitalists are not the only funders taking into account the presence of patents in their funding decision-making. Commercial and investment banks, angel investors, and friends and family also consider intellectual property rights when looking to invest in a business (Graham et al., 2009). One study in the United States finds that startups with patents are associated with 55 per cent more job creation and 80 per cent higher sales growth, on average, after five years (Farre-Mensa et al., 2020).

Patents contribute to countries’ economic growth (Hasan and Tucci, 2010). The patent system helps to incentivize private-sector investment in research and development. Innovations generated from patent-supported R&D not only improve productivity; they also indirectly stimulate the creation of new businesses which, in turn, promotes job creation (Kirchhoff, 1993; Wennekers and Thurik, 1999).

Unequal participation in patenting has been recorded, for individuals from diverse demographic groups in Finland and in the United States, and worldwide based on gender (Aghion et al., 2017; Bell et al., 2019; World Intellectual Property Organization, 2023). This fact is slowing down the pace of innovation: it diminishes opportunities for individual inventors and also deprives society of their ideas and talents.

Hsieh et al. (2019) consider the misallocation of talent due to gender and racial discrimination in the United States to have decreased productivity by 20 to 40 per cent during the past 50 years. Peterson and Mann (2020) calculate the cost of systemic racism to be as much as \$16 trillion of United States GDP and over 6 million jobs over the last 20 years. And Bell et al. (2019) estimate that if women, minorities, and people raised in lower-income families were to invent at the same rate as white men from high-income families, the total number of inventors in the United States economy would quadruple. There are currently no similar estimates for other countries, and it is possible that the magnitude of the effects vary according to context.

In addition to GDP benefits, leveraging the perspectives and talents of individuals from diverse backgrounds makes it more likely that more diverse offerings addressing the needs of all individuals will reach the market. Most innovations are based on inventors' personal experiences, and inventors from diverse backgrounds are more likely to explore a broader set of ideas while innovating. Recent research shows, for instance, that female-led or all-female inventor teams are significantly more likely to invent treatments and other products that address diseases and health challenges specific to women (Jensen et al., 2018). Similarly, Einiö et al. (2019) find that exposing entrepreneurs to peers from lower-income groups during higher education increases their propensity to create novel essential products. Mindful of the potential economic and other benefits of closing diversity gaps in patenting and innovation, economists and social scientists increasingly recognize that a better understanding of the elements behind these gaps can make it possible to design better policies for dismantling them, and for promoting innovation more broadly.

National and international organizations are expressing concern about the impact of these diversity gaps. They are engaged in measuring the gaps and have proposed projects and policies to mitigate them. For instance, the World Intellectual Property Organization (WIPO) has been investigating the gender gap in patenting since 2016. At the request of its Member States, WIPO has been exploring initiatives to address this gender patent gap and other intellectual property gaps. WIPO is not alone in this endeavor, as many other national and regional intellectual property offices have followed a similar path. Non-governmental organizations have been critical in advancing this work, such as Invent Together, a United-States-based coalition that has long promoted public policies and private efforts to broaden participation in inventing and especially

better access to the United States patent system for inventors from historically under-represented groups.¹

Effectively addressing patent diversity gaps requires understanding their roots. Researchers need access to reliable data to carry out the necessary measurement and analysis. Collaboration among different entities is important to facilitate data collection and the exchange of evidence and insights, and can provide the basis for concerted action to progressively eliminate the gaps. To this end, Invent Together and WIPO co-hosted a series of regional meetings in 2022 and 2023 to focus political attention on patent diversity gaps, especially the gender gap. In each region, the partners arranged three sessions: a high-level political discussion on the actions that intellectual property offices are taking to address the gaps; a conversation among intellectual property office chief economists and scholars on best practices for measuring the gaps; and a private discussion among representatives of companies and technology transfer offices regarding initiatives, emerging best practices, and challenges faced in eliminating the gaps.²

Following the expression of concern about intellectual property diversity gaps by scholars and myriad private and public organizations, this paper contributes to the discussion by reviewing the existing innovation literature about the different gaps and documenting international policies attempting to address them. The analysis focused on patents relative to other types of intellectual property rights. We build on the work of Shapanka and Fechner (2018) and Fechner et al. (2022), extending the scope of their analysis along several dimensions. Both papers highlight the significant disparities in patenting rates among people from certain demographic groups (women, people of color, and lower-income individuals) within the United States, emphasizing the economic benefits of increasing participation from people from historically underrepresented groups in invention and patenting. The authors propose specific policy recommendations aimed at promoting equity, inclusion, and diversity in the United States' innovation ecosystem.

Our paper expands the geographic focus of the 2018 and 2022 analyses by reviewing literature about the patent diversity gaps beyond the United States and by providing examples of relevant initiatives and programs from other geographic regions. It then strengthens the scientific foundation of the analyses by presenting evidence from a larger body of peer-reviewed academic publications. Finally, this paper provides recommendations for companies, educational institutions, government bodies, and other stakeholders across the globe, in contrast to the 2018 piece, which suggested programs for companies and educational institutions, and the 2022 article, which focused

¹The reader will find more information about Invent Together at <https://inventtogether.org/>.

²The reader can find the sessions' recording and learn more about the seminar series at the following web page: https://www.wipo.int/about-ip/en/ip_innovation_economics/gender_innovation_gap/.

on policy recommendations for the United States Government.

Following this introduction, section 2 reviews literature about the size of the gender gap in patenting, identifies its drivers across contexts, and discusses the limited evidence about other diversity gaps. Section 3 documents relevant initiatives; emerging best practices; and programs that universities, companies and governments may leverage to close the gaps. Section 4 provides conclusions.

2 Patent diversity gaps

Women, like people from certain ethnic groups and social classes, among other demographics, are historically underrepresented in the population of inventors and patent owners. Existing literature has in fact focused relatively more on the gender dimension of patent and innovation diversity gaps. But, as discussed briefly below, other diversity gaps are equally pernicious. Likewise, most of the work focused on patent diversity to date has centered on the gender gap, but the reality is that there is much work to be done to ensure that all inventors from all underrepresented groups have access to the patent system and its benefits.

The United States Patent and Trademark Office (USPTO), United Kingdom Intellectual Property Office (UKIPO), and WIPO have been instrumental in raising awareness about as well as quantifying patent diversity gaps over the last decade. In 2016, WIPO published its first assessment of the gender gap in international patenting, based on analysis of Patent Cooperation Treaty (PCT) applications. At the same time, it released the first edition of its global gender name dictionary, a tool that helps researchers determine the most likely gender of inventors based on their names (Martinez et al., 2021, 2016; Raffo, 2021). Also in 2016, UKIPO published an assessment of the gender gap in patenting in the United Kingdom (United Kingdom Intellectual Property Office, 2016).³

In 2017, the Canadian Intellectual Property Office analyzed its own gender patent gap by looking at PCT applications filed in Canada (Canadian Intellectual Property Office, 2017). In the United States, the USPTO launched a comprehensive research program that pushes the policy agenda towards prioritizing greater inclusion in innovation and access by all inventors to patent rights (Migueluez et al., 2019; Saksena et al., 2022; Toole et al., 2020). Since 2022, the Australian Patent Office, European Patent Office, and European Union Intellectual Property Office have extended the research landscape by publishing assessments of their own gender gaps in patenting

³WIPO and UKIPO collaborated and shared methodologies when preparing their respective reports.

and designs (European Patent Office, 2022; European Union Intellectual Property Office, 2023; Huang et al., 2022).⁴

All these studies support an alarming consensus that a broad systemic gender gap in innovation and intellectual property rights ownership exists across jurisdictions. The reports create a strong baseline for assessing patent diversity gaps and their evolution over time, and they inform relevant policy efforts. Practically speaking, initiatives to improve patent diversity are more prevalent for the gender gap compared to other gaps, for reasons we touch on below. This section documents the importance of, and progress in, data collection about the gender patent gap; reviews research about the extent and causes of the gender patent gap; and discusses the scarce findings regarding other types of patent diversity gaps.

2.1 Data collection

Collecting data is foundational for good policymaking. Data are essential for identifying baselines, tracking progress over time, and assessing the impact of old and new policies. Data are also crucial for identifying the drivers of patent and other intellectual property diversity gaps, which in turn makes it possible to design more efficient and impactful policies.

In general, intellectual property application forms do not collect demographic information on creators and applicants. There are various reasons for this. One is that this information is typically considered irrelevant to the process of assessing whether an invention meets patentability criteria. Since primary data are lacking, researchers rely on three fundamental approaches to measure the gender gap in innovation and intellectual property ownership: survey data, data about employees and civil servants, and predictive algorithms. A fourth and more recent approach involves the direct collection of demographic information on intellectual property applications.

Survey data represents the traditional approach whereby respondents report their gender as they answer a broader series of questions about their innovation activities. Recent legislation in the United States, the SUCCESS Act, endorsed this approach. However, survey data are necessarily limited in scope since only a small sample of the population can be realistically surveyed. Also, it is resource-intensive and potentially biased depending on the survey design.

A more systematic and reliable alternative consists of collecting demographic information about company employees and civil servants directly from the human resources

⁴This list is not exhaustive; several other countries have also published similar reports.

department of their organizations, or from national statistical offices of their countries. These individual records can then be linked to patent inventors using either national identifiers (such as social security numbers, when they feature on patent applications, as is the case in Chile and in the Republic of Korea) or names and addresses usually available in both data sources (patent documents and demographic information from government statistics). This approach, adopted by Bell et al. (2019) and Carayol and Carpentier (2022), among others, is perceived as valuable for large-scale empirical research. However, it is restricted to those governments and organizations that collect relevant data in the first place, and most importantly to those that will grant access to it for research purposes.

Regulations governing access to personal data can complicate efforts to obtain the data needed to analyze diversity gaps. While they are undeniably valuable in protecting citizens' privacy and rights, such regulations are likely to slow the progress of research about diversity gaps until the demographic data can be collected directly on intellectual property applications. Because such regulations provide grounds for rejecting a request for access to data, they generate uncertainty as to the availability of data for research purposes. This may ultimately reduce the attractiveness of an approach to research that relies on data from governments and other organizations.⁵ A further limitation is the absence of international data on citizens' and employees' demographics. This makes it difficult to assess whether findings based on those countries where data are available can be generalized to other countries. Since the empirical assessment of diversity gaps is the first step towards securing commitments from governments and other stakeholders to close patent diversity gaps, and since this goal is defined at the United Nations level (i.e., SDGs 5 and 9), it is important that the chosen research approach offers the widest possible geographical coverage.

Finally, researchers have used algorithms to assess the most likely gender of individuals based on their first names and locations, relying on tools like WIPO's World Gender Name Dictionary (Martinez et al., 2021, 2016; Raffo, 2021). Based on analysis published by the World Intellectual Property Organization (2023), this approach allows researchers from any country to assign individual inventors the gender that is

⁵For instance, the General Data Protection Regulation (GDPR) is a privacy and security law introduced in the European Union in 2016. It sets guidelines for the collection and processing of individuals' personal information, stipulating that personal data must be collected and processed for specific, explicit, and legitimate purposes. Organizations must clearly define the purposes for which they are collecting data and ensure that data is not used for incompatible purposes. The GDPR regulates how organizations may collect, store, and delete personal data. It applies to organizations anywhere in the world, provided they target or collect data in relation to people in the European Union. In cases of infringement, the Data Protection Authority may impose a reprimand, a temporary or definitive ban on data processing, and a fine of up to 20 million euros or 4 per cent of the business's total annual worldwide turnover. Such consequences may reduce incentives for organizations and institutions to share information about employees and civil servants with researchers, in order to prevent data breaches and avoid penalties. The reader can find more about GDPR here: <https://gdpr.eu/what-is-gdpr/>.

statistically most likely, so they can track the gender patent gap relatively easily and at a minimal cost. Unfortunately, at the time of writing, there is no comparable dictionary to assess patent gaps for other demographics at a global scale, except for ethnicity.

None of the strategies described above can be considered a best practice. Rather, they offer options to better understand the patent diversity gaps landscape.

The encouraging news is that disaggregated data about intellectual property diversity gaps, especially in relation to patents, are becoming more and more available. This is possible thanks to improved access to government data (Fechner et al., 2022), as well as to the collection of demographic information directly on patent applications. Countries collecting such information from applicants include Argentina, Chile, Colombia, Cuba, Israel, Peru and the Dominican Republic; all have recently included a gender checkbox in their patent applications. In addition, after WIPO published its latest gender patent gap report in 2023, the WIPO Committee on Standards XML4IP Task Force proposed a revision to WIPO Standard ST.96,⁶ to provide a gender category for natural persons.⁷ This approach is not possible in many countries due to data privacy regulations, as discussed briefly above. In principle, because gender is not relevant to the process of evaluating applications for intellectual property rights, there is no basis for intellectual property offices to collect such personal information.

Similar to the work carried out in the WIPO Standards Committee, lawmakers in the United States have considered enacting legislation that would direct the USPTO to collect inventors' demographic data on a voluntary basis and make this information available to the public on an aggregate, anonymized basis (United States Congress, 2021). An example is the 2021 Inventor Diversity for Economic Advancement (IDEA) Act. This bill would have applied to data about gender, along with data regarding race, military or veteran status, and any other demographic data deemed appropriate by the USPTO Director. Although such primary data do not allow for the measurement of diversity gaps historically – for the simple reason that the data would start being collected upon enactment of the legislation – it could permit the examination of diversity gaps beyond gender and could be most valuable for future research.

⁶WIPO Standard ST.96 is a set of XML schemas to capture industrial property and copyright orphan work data. The latest version is published on the WIPO website at: <https://www.wipo.int/standards/en/st96/v7-1/>

⁷The proposal was introduced in August 2023 and is still in discussion by the Task Force as of March 2024. The proposal defines four gender categories as follows: “Male”, “Female”, “Other” and “Unidentified” and is available at: <https://www.wipo.int/standards/en/st96/v7-1/annex-iv/index.html>.

2.2 What do we know about the gender patent gap?

A growing body of research provides insights into women's participation in patenting and the reasons behind their systematic and persistent underrepresentation. Barriers to equal participation in patenting include women's lower exposure to innovation; more limited access to innovation-related education, family and career decisions; relatively limited access to capital; and certain cultural and institutional factors.

2.2.1 The extent of the gender gap in patenting

Women are severely underrepresented among inventors who seek patents. In 2020, women made up only 16 per cent of inventors listed in international patent applications filed through the Patent Cooperation Treaty (PCT). The situation is slightly better in Latin America and the Caribbean as well as in Asia; however, even those regions are only halfway to gender parity. Africa and Oceania have an even longer way to go before reaching parity. The per centage of female inventors is highest in industries such as biotechnology, food chemistry and pharmaceuticals, and lowest in electrical and mechanical engineering (Huyer, 2015; World Intellectual Property Organization, 2023). These differences align with the differing proportions of female graduates across scientific fields. Also, women inventor rates are higher in the academic sector compared to corporate and public sector contexts (Sugimoto et al., 2015; World Intellectual Property Organization, 2023).

All studies that quantify women's patenting activities at the national and international levels indicate that women's participation has been rising over time (Ding et al., 2006; Jung and Ejeremo, 2014; Martinez et al., 2016; Miguelez et al., 2019; United Kingdom Intellectual Property Office, 2019). This holds true even in countries where women's publishing rates are stagnant (Frietsch et al., 2009). But this good news is tempered by the evidence-based reality that progress towards eliminating the gender patent gap is very slow.

2.2.2 Exposure to innovation

Becoming an inventor relies to a significant extent on exposure to role models, mentoring and social interactions. This is different from other professions; for example, a child may dream of becoming a doctor or a lawyer without knowing one personally.

In the United States, Bell et al. (2019) find that girls are less likely to become inventors than boys. They estimate that children exposed to inventors are nine times more

likely to become inventors themselves. They also estimate that if girls were exposed to *female* inventors at the rate that boys are exposed to *male* inventors, the gender gap in patenting could shrink by half. Hoisl et al. (2022) further explore how inventorship is transmitted from parents to children in Denmark. They find that when inventor parents have a second-born son instead of a daughter, they are less likely to encourage their first-born daughter to become an inventor herself. This suggests that role models are necessary but not sufficient.

Mentoring is also a crucial vector for the transmission of inventorship. Fewer women than men obtain PhDs in STEM subjects, and the gap widens when we look at women PhDs who also invent. Delgado and Murray (2023) find that, overall, PhD students whose supervisor is a prolific inventor are more likely to become inventors than students who are supervised by non-prolific inventors or non-inventors. However, since female students are less often supervised by prolific inventors, they remain underrepresented among inventors. In addition, differently from previous findings, the authors report that the gender of supervisors doesn't play a role in the transmission of inventorship (Bell et al., 2019).

More broadly, social interactions play an important role in invention. One study looked at the impact of the sudden interruption of social interactions in bars, the result of new legal restrictions on alcohol consumption in certain parts of the United States. The authors reported a subsequent 13-35 per cent decrease in the number of patents per year in affected counties (Andrews, 2019). Moreover, innovation activities are increasingly concentrated in a few large clusters located in a small number of countries (Audretsch and Feldman, 1996; Crescenzi et al., 2019). Gender differences in social interactions whereby women tend to network more in private settings, combined with women's greater geographical constraints, may place them at a disadvantage compared to men when it comes to inventing (Berger et al., 2015; Delgado et al., 2019).

2.2.3 Access to STEM, invention and patent education

Invention today relies substantially on highly skilled workers who build on previous scientific and technological advances. Certain skills and knowledge have become essential for invention. These include training in the relevant disciplines, as well as understanding about the process of invention itself and the complex administrative procedures involved in obtaining a patent.

Studies have found that girls are less likely to choose math-related fields in school, and less likely to pursue science, technology, engineering, and mathematics (STEM) studies in college. However, this appears to be changing. The most recent statistics

from advanced economies no longer support this claim, finding that women earn more bachelor's and master's degrees in STEM than men. Unfortunately, the trend stops there. Women earn fewer PhD degrees and obtain even fewer tenured research positions than men, a phenomenon usually referred to as the "leaky pipeline" (Huyer, 2015). The leaky pipeline phenomenon partly explains the underrepresentation of women among inventors.

Women may also be underrepresented because they lack formal education about the patenting process. Semi-structured interviews with diverse American inventors, carried-out by Shaw and Mariano (2021), revealed that many women do not know what constitutes an invention and/or is patentable, do not know where to find resources about patenting, do not understand the meaning of USPTO patent rejections, and are confused about the patenting process overall.

Women's relatively lower exposure to inventors, as discussed in the previous subsection, could deprive them of knowledge about the invention process, including the criteria for determining whether something is inventive for patenting purposes. And, while there is no systematic evidence to support this claim, some suggest that women also identify less as inventors as compared to men. A 2011 survey finds that although American women between the ages of 16 and 25 years old possess many of the characteristics needed to become inventors – such as creativity, an interest in science and math, an altruistic desire to invent, and a preference for working in groups or with mentors – they often do not see themselves as inventive (Perry, 2011).

In the academic sector, opening technology transfer offices helps prospective female inventors to find the resources and support they need to patent. One study finds that women inventors at Italian academic institutions that have a technology transfer office, are part of science-industry parks, and have clear patenting policies in place patented to a greater extent than women inventors at institutions without such facilities and policies (Giuri et al., 2020).

Finally, research has demonstrated that patent applications filed by women inventors are less likely to be granted than those filed by men, a result that holds true even when taking into account the application's novelty (Jensen et al., 2018; Madan et al., 2021). Women being less knowledgeable about the meaning of an initial rejection from the patent office, and therefore reacting differently to their male counterparts by abandoning the process, explains at least some of this difference (Aneja et al., 2024). Pairolo et al. (2022) show that providing women with additional assistance during this process increases their chances of obtaining a patent by 11 percentage points relative to the grant rate for male inventors who also received assistance.

2.2.4 Family and career decisions

In a society where women continue to take on a greater share of household and care duties, marital and parental status affects their ability to devote time and energy to inventing and patenting.

Whittington (2011) shows that mothers working in academia are less likely to engage in first-time patenting than childless women or mothers working in industry. During the baby boom in the United States (the mid-1950s), lower patenting productivity among mothers working in academia, compared to childless women and men (with or without children) also in academia, persisted for a full 15 years following marriage. Women's productivity recovered only after the 20th wedding anniversary (Kim and Moser, 2021).

The mechanisms behind these patterns may be traced back to societal expectations and gender roles that encourage women to prioritize household responsibilities over career development. For instance, in dual-earner households, long working hours tend to drive women out of work but do not affect men's workforce participation (Cha, 2010).

The women's sector of employment (public or private) and the features of the organization that employs them can amplify this phenomenon. In the private sector, women employed in firms with hierarchical organizational structures are less likely than men to participate in patenting activities. In contrast, women employed in flatter and more flexible firms, which are more prevalent in the biotechnology or life sciences industries, are more likely to patent than women in more hierarchical firms (Eaton, 1999; Jung and Ejeremo, 2014; Whittington and Smith-Doerr, 2008).

Under such conditions, and until gender equality becomes a reality in all spheres of society, we should expect that the trade-offs that women have to make as they pursue their careers will prevent them from contributing equally to invention and patenting. More research is needed to assess the extent to which the availability and cost of childcare, or the cost of family housing in highly innovative cities, influences the gender gap in innovation and patenting.

2.2.5 Differential access to capital

Women do not have the same access to venture capital (VC) as men. Having a patent significantly affects an entrepreneur's chances of attracting funding. However, the cost of obtaining patent protection can seem prohibitively expensive when, at the start of a venture, resources are scarce. This reality contributes to the gender gap in patenting.

Women founders in the United States receive less than 3 per cent of all venture capital funding (Hinchliffe, 2021). In Europe, all-women-founded startups raised on average just 1.8 per cent of investment in 2021; the percentage ranged from 0 to 14 per cent depending on the country (European Women in VC, 2022). We are not aware of statistics for other regions of the world.

This funding gap means that women have comparatively fewer resources to dedicate to research, develop and protect their ideas, and to bring them to market. As noted above, patents are an important lever for attracting further venture capital funding. Women's lack of initial funding therefore creates a paradox in which they don't have the resources to cover the cost of patent rights – and the absence of patent rights substantially decreases their chances of obtaining further venture capital funding down the road (Milli et al., 2016).

2.2.6 Cultural and institutional factors

The cultural and institutional contexts in which women grow up and live appear to affect their propensity to innovate. When women enter the patent system, they may find themselves unwelcome and subject to institutional, structural or organizational biases. In the 19th century, in the United States, women were formally excluded from the patent system; during this period, the patriarchy only allowed men, who were often women inventors' fathers or husbands, to own patents. Khan (1996) shows that removing formal barriers enabled women to take ownership of their inventions and patent rights. Cultural factors also affect women's access to the patent system. Research indicates that the spoken language of a country, and in particular its grammatical gender marking, affects that country's patenting rates (Berman et al., 2022).

More subtly, a series of feminist studies has uncovered underlying gender bias in intellectual property laws and regulations, for instance in the definition of the "person having ordinary skills in the art", which is a standard applied when assessing patentability (Burk, 2011; Lai, 2020, 2021; Yanisky-Ravid, 2011). The non-obviousness of an invention is assessed against the knowledge of a person having ordinary skills in the art, and in light of common general knowledge. Given that certain feminine knowledge is maintained in the private sphere, often in oral form, it may not be part of the common general knowledge. This line of research argues that inventions are only assessed relative to the masculine, publicly known body of knowledge about science and invention.

The requirement to formally apply for patent protection, as opposed to copyrights and trademarks for which registration is not compulsory, has been found to contribute to perpetuating unequal access to intellectual property rights (Marcowitz-Bitton and Mor-

ris, 2020). For instance, Marcowitz-Bitton and Morris argue that registering intellectual property rights involves complex and costly procedures and entails examination, during which bias comes into play. Such conditions work to the disadvantage of women and inventors from other underrepresented groups, who tend to have fewer resources and are usually the target of (negative) prejudice.

2.3 Additional patent diversity gaps

Building an inclusive innovation ecosystem requires addressing all types of intellectual property diversity gaps. The analysis in this section focuses on patents. While the gender gap has received the most attention to date, the situation is evolving. This is true from the point of view of policymakers, for whom race and other demographic characteristics are gaining in importance in policy design, and of researchers, for whom recent developments in inference techniques (to determine ethnicity, for example) and the opening up of access to large government databases are paving the way for more research about the experiences of inventors from diverse groups.

Policy priorities to address patent gaps depend on the context. In the United States, along with the focus on the gender and race gaps, there is a focus on ensuring access to patents by disabled people and veterans, although research has not comprehensively examined these demographic gaps (Fechner et al., 2022; Shapanka and Fechner, 2018). In Australia and India, among other countries, the relationship between the patent system and indigenous knowledge is of interest to policymakers (Graham and McJohn, 2005; Gupta, 2006).

Of all demographics, gender is the one for which data and inference techniques are the most widely available to researchers (Martinez et al., 2021). Previously, innovation researchers had to perform intensive data collection to investigate gender patent gaps. Today, they have greater access to government census data and are developing sophisticated approaches, such as supervised learning techniques, to gather information about inventors from various underrepresented groups (Aghion et al., 2017; Bell et al., 2019; Cook, 2014; Cook and Kongcharoen, 2010; Niggli, 2023).

2.3.1 Race

Cook and Kongcharoen (2010) and Cook (2014) have pioneered research on the race gap in patenting. Their work features intensive data collection of names of African-Americans and examination of the inventors named on patents filed in the United States during the 1980s. Their studies find that African-Americans appeared as inventors on

4.5 patents per million African-American people, compared to 278 patents per million people for the non-African-American population.

A recent study from Akcigit and Goldschlag (2023) extends this line of research, accounting for races additional to African-Americans and looking at patenting trends during a more recent period (2000-2016). They find that African-American, Black, American Indian, Alaska Native, and Hispanic inventors are underrepresented in patenting, when compared to their corresponding share of the United States population – unlike Asian inventors. In the 2010s, they determine that African-American people accounted for 1.2 per cent of inventors, while making up to 12.6 per cent of the population, a ratio of 0.1. In contrast, they determine that Asians have an inventor share 2.6 to 4.6 times higher when compared to their proportion of the United States population (Akcigit and Goldschlag, 2023).

While research into the race patent gap remains limited to the United States, research into the ethnic origins of inventors has been carried out in other countries (Nathan, 2015; Niggli, 2023). (Kerr, 2008) documents the rising contribution of foreign-born inventors living in the United States, in particular Chinese and Indian scientists, to United States patenting since the 1990s. A subsequent study finds that inventors from ethnic minorities in the United Kingdom are geographically concentrated, and it identifies a positive correlation between inventors' ethnic diversity and patenting rates (Nathan, 2015). Niggli (2023) implements supervised learning techniques to assign ethnicity to inventors named on patents, worldwide. His research reveals that inventors' ethnic composition has become more diverse over time, mostly due to a relative increase in inventors of Asian origin.

Among researchers, there is a global consensus that ethnic diversity increases patenting rates in highly innovative countries (Bahar et al., 2020; Hunt and Gauthier-Loiselle, 2010; Kerr, 2010; Nathan, 2015), although the evidence is less straightforward for lower-ranked countries in international innovation rankings such as Italy or Croatia (Bratti and Conti, 2018; Stojčić et al., 2016). For three Eastern European countries, Wachowska and Homa (2020) find that the participation of foreigners in patenting increases the social and economic value of innovations. At the organizational level, the evidence on the relationship between ethnic diversity and patenting rates is less conclusive (see Wachowska and Homa (2020) for a detailed review of the relevant literature).

2.3.2 Income

Research on the income gap has examined in particular how parental income relates to the chances that individuals will become inventors. Focusing on the United States, Bell et al. (2019) find that children born to families in the top 1 per cent of the income distribution are 10 times more likely to become inventors as those from below-median-income families. Aghion et al. (2017) considered the same research question in Finland, a country where income inequality is less pronounced and education is free. They found a similar correlation between parental income and individuals' chances to become inventors. However, controlling for parental education and individuals' IQ greatly diminishes the extent of this effect. The authors estimate that if all individuals had a father in the top income decile, individuals' probability of becoming an inventor would increase by about a third. Although the importance of parental income for access to innovation and patenting varies according to the geographic region, in part due to the educational systems in each place, it seems likely that fostering the inclusion of individuals from different parental income groups in innovation will benefit these individuals, their income group, and their country's technological progress and economic growth (Einiö et al., 2019).

3 Initiatives promoting greater engagement by women in innovation ecosystems

National agencies and organizations have launched a number of promising initiatives to bolster women's participation in innovation and sometimes in patenting, while acknowledging that there is no single solution. When combined, and especially if evaluated for impact, these initiatives can provide a blueprint for academia, industry, and policymakers.

Building on analysis from Shapanka and Fechner (2018), this section identifies promising initiatives in the following areas: STEM education, institutional structures, support for women entrepreneurs (encompassing mentorship and networking, since global programs supporting women entrepreneurs often integrate these two components together), access to finance, and data collection and sharing.

Our research has identified a growing number of policies and initiatives around the world that are aimed at encouraging women's participation in patenting. Many of them do so by addressing upstream issues like lower participation of women in STEM fields, less access to capital for women entrepreneurs, and work-life constraints. The

following initiatives present a glimpse into the types of policies and programs that are being tried. The list is by no means exhaustive. More than 200 of these are presented in the Appendix of this paper, and an even more complete list is available in WIPO's online library.⁸

Unfortunately, at present, we find little evidence of quantitative evaluations of the initiatives described in this paper. For some programs, their nature is such that it will become possible to understand their impact only after another decade or two have passed, at which point a full evaluation should be carried out. For most programs, we would encourage quantitative and qualitative evaluations wherever possible.

3.1 Boosting women's access to STEM education

A critical first step towards creating a more diverse community of inventors is to ensure equal access for people from historically underrepresented groups to quality education, particularly in STEM fields. According to one study in the United States, many students lack access to STEM and invention education due to federal education standards and other systemic constraints. These barriers, such as “[s]chool finance mechanisms, K–12 accountability standards, and college entrance requirements, reinforce a siloed, linear approach to teaching and learning” and make the implementation of robust STEM and invention education difficult (Skukauskaite et al., 2019).

To address such challenges, various initiatives and legal frameworks have been put in place. STEM and invention education programs often feature partnerships between schools and companies, higher education institutions, and other entities. Instruction may occur in makerspaces, industry locations, clinical settings, and libraries. Though important, the reach of these targeted programs is far smaller than the public school system.

The United States Congress has taken action to broaden access to STEM education. The Every Student Succeeds Act of 2015 requires schools to use certain federal funds to “implement programs and activities that support access to a well-rounded education”, including “programming and activities to improve instruction and student engagement in science, technology, engineering, and mathematics, including computer science” (Fechner et al., 2022; United States Congress, 2015). Moreover, the Chips and Science Act, which was signed into law in August 2022 by President Biden, authorizes the National Science Foundation (NSF) to administer grants to support various

⁸The most complete lists of policies and initiatives are published at the following links respectively: <https://www.wipo.int/web/economics/search-results?tag=Type+of+resource%3A+Policy&tag=Theme%3A+Gender>, and <https://www.wipo.int/web/economics/search-results?tag=Type+of+resource%3A+Initiative&tag=Theme%3A+Gender>.

informal STEM opportunities at the Pre-K-12 levels, as well as institutions of higher education (United States Congress, 2022a). From December 2022 through September 2024, Congress appropriated \$125 million (out of \$1.95 billion authorized in the Chips and Science Act) for the NSF for STEM education programs (United States Congress, 2022a,b).

Encouraging more diversity in the most patent-intensive STEM fields (mechanical engineering and electrical engineering) in colleges and graduate schools is another important step in closing those patent gaps that are attributable to differential access to education. The L'Oréal-UNESCO For Women in Science Young Talents and the International Rising Talents programs are a promising endeavor in this sphere. Since 1998, L'Oréal and UNESCO have sponsored women scientists at doctoral and post-doctoral levels in STEM-based fields (e.g. life sciences and engineering) to pursue research. The programs are available in all regions of the world, supporting women as they pursue their research in institutions at home or abroad (United Nations Educational, Scientific and Cultural Organization, 2023). These programs assist a total of about 250 young women every year.

Other programs target early investment in the STEM pipeline. One example is Qualcomm's Thinkabit Lab, which provides free, daylong STEM programs for primary and secondary school students, to expose children to careers in science and engineering ("careers they may not know exist") (Qualcomm, 2023). In a similar vein, initiatives such as Girls Who Code (United States), Girl Develop It (United States), Girls Code it Better (Italy), and Girls as Engineers (Poland) are instrumental in acquainting children from all backgrounds with STEM opportunities.

Another important dimension to consider is the delivery of innovation and intellectual property management concepts through education programs. For instance, South Korea's school system integrates invention education into standard curricula, fostering an innovative mindset from a young age (Kwon et al., 2016).

The Inventor's Patent Academy (TIPA) is another notable initiative, launched in the United States and available worldwide, that democratizes knowledge about patenting and intellectual property. Offered as a free online course, TIPA is designed to help inventors understand intellectual property and the United States patenting process. The program also explores certain challenges that inventors from historically underrepresented groups – such as women, people of color, individuals with lower incomes, and people with disabilities – may face during their invention and patenting journey, and it provides ideas and tools to overcome them. TIPA was created by Invent Together and its partner Qualcomm. The course has been endorsed by US-based universities, professional associations, and the USPTO (Invent Together, 2023).

Initiatives that foster the participation of women and girls in STEM-related fields, and that enable more inclusive access to intellectual property systems, are by no means limited to high-income countries. In Rwanda, for instance, private sector associations such as the Rwandan Association for Women in Science and Engineering, provide workshops for girls to hone their research and learning skills so they can thrive in STEM educational subjects. Initiatives led by business and civil society actors may be complemented by government policies that are supportive of inclusivity in science and innovation. In Rwanda, the government has a Science, Technology and Innovation (STI) policy that sets quotas for engaging more women in STEM-related research projects, funding schemes, enterprises, and education and employment opportunities.

In Latin America, programs in Mexico, Colombia, and Brazil, are widening STEM learning and professional pathways to enable greater participation of women and girls in STEM fields. In Brazil, the Digital Girls Program, managed by the Brazilian Computer Society, incentivizes girls in high school and in the final years of elementary school to pursue careers in computer science and STEM fields by connecting them with field experts and practitioners through workshops and lectures. Government-driven initiatives, such as Colombia's +Women +Science +Equity Program, build bridges for young women to scientific careers by providing them with access to connection, empowerment and leadership support within the National Science, Technology and Innovation System (SNCTI). In Mexico, the program "Niñas STEM Pueden" empowers women and girls to pursue careers in STEM subjects regardless of gender-related barriers in Mexican society that may otherwise hold them back.

Turning to Asia and Oceania, the Australian government runs two flagship programs that address gender inequalities in STEM fields. Through the Women in STEM Ambassador initiative, business leaders, educators and policymakers work together to mobilize resources and create tools that help women and girls to undertake STEM-related research and career development projects. Superstars of STEM is another initiative in Australia aimed at closing the gender gap in innovation. This program equips female STEM experts with advanced communication skills and opportunities to showcase their achievements in the media, on stage and in schools. In Cambodia, the STEM Sisters program builds communities where women and girls can discover career pathways in STEM fields through being connected with professionals.

3.2 Making institutions work for women entrepreneurs

Challenges to universal participation in innovation, like access to intellectual property rights, are rooted in complex institutional structures. There has been a lack of networking opportunities for prospective inventors from historically underrepresented groups.

Also, societal perceptions and expectations can affect these individuals' aspirations and opportunities, as can disparities between the norms and practices of academia and the private sector. These factors can hinder equitable participation in innovation and curb certain inventors' access to intellectual property tools. The good news is that targeted programs can address these institutional structures across industry, academia, and national intellectual property offices.

Many countries have recognized the important role that SMEs play in the economy. The World Economic Forum (WEF) highlights that over 30 per cent of micro, small and medium-sized enterprises (MSMEs) are owned by women, underscoring the importance of gender parity in enabling societies to benefit from the full contribution of these companies. WEF projections suggest that empowering women in the global economy could result in an additional 28 trillion dollars of annual GDP growth by 2025. Countries around the globe are investing in programs designed specifically to support and encourage entrepreneurship, particularly by individuals from historically underrepresented groups. Such initiatives can enable entrepreneurs to establish businesses, develop and commercialize their innovations, and access intellectual property rights.

The leadership of private companies may encounter fewer obstacles than those in academia when seeking to encourage inventors from diverse groups to patent, owing to relatively greater freedom in granting private incentives. However, there are significant challenges even in the private sector when it comes to increasing participation in patenting among women and inventors from historically underrepresented groups.

To address this imbalance, companies can implement strategies such as improving the invention disclosure process, or making it easier for all inventors to navigate the patent process. For instance, Qualcomm took steps to modify internal procedures and simplify the invention disclosure process, thereby making it more inclusive. The company also offered more guidance to all employees on how to complete the necessary forms and get credit for their contributions. By streamlining and raising awareness about these processes, companies can effectively support people from underrepresented groups in securing recognition for their contributions. This opens the door to receiving financial and other rewards that accompany invention in the private sector.

There are several ways that companies can facilitate inclusion in invention disclosure and the management process. For instance, a program at 3M Company focused on information exchange and mentoring programs. These programs do not explicitly target inventors from specific demographic groups; rather, each department's human resources manager helps individuals assess which mentorship program could be the best fit for them. WIPO has developed another approach to enabling women in the private sector to more fully participate in their organization's inventive activities. The "WIPO Training, Mentoring and Matchmaking Program on Intellectual Property

for Women Entrepreneurs from Indigenous Peoples and Local Communities” targets a very specific subset of underrepresented inventors for capacity building. Through a competitive application process, WIPO recruits a pool of 20 participants every year from seven selected geographic regions.

Graduate and internship programs that seek to increase participation by people from underrepresented groups in influential organizations within innovation ecosystems, such as intellectual property practices at law firms, can also contribute to closing gaps in access to intellectual property tools. Inventors may in this way be emboldened to seek and use patents when working with patent advisors who resemble them.

Ensuring that professional goals are compatible with private family duties is likewise important for fostering a more inclusive innovation environment, and companies are taking action to ensure they align with that approach. For example, Google and Cisco are among the few big-tech companies in the United States that now offer on-campus child care. Several of the Max Planck Institutes offer such benefits in Germany.

At the national level, setting up broad gender equality initiatives within governmental bodies and institutions can foster inclusivity and diversity in various fields, including science and innovation. For instance, Spain established the Women, Science, and Innovation Observatory group, an interministerial body dedicated to promoting gender equality within the realm of science. Similarly, Brazil’s National Institute of Industrial Property (INPI) has demonstrated commitment to increasing diversity in innovation by forming its Strategic Committee on Gender, Diversity, and Inclusion (CEGDI), aimed at addressing equality in access to the intellectual property system.

In other parts of the world, national intellectual property offices are also taking steps to ensure their staff are sufficiently diverse. For example, India has launched an initiative to re-train unemployed female engineers to become patent examiners by leveraging their already advanced technical skills. Known as WOS-C, this program is part of a larger initiative to “support women’s re-entry in the science and technology (S&T) workforce after a career break.” Notably, WOS-C enables participants to work from home, to allow a more harmonious balance between work and domestic life for women who might otherwise be forced to choose exclusively the latter (Department of Science and Technology, Government of India, 2023).

National legislators can also take action to ensure that the requirements for becoming a patent practitioner are inclusive and do not inadvertently exclude qualified candidates from diverse backgrounds. A recent example of positive reform comes from the USPTO. In 2021, the USPTO made changes to the criteria for qualifying as a patent practitioner, prompted by the realization that certain requirements may have been biased against women. This was due to a disproportionate number of women studying

subjects that were technical enough for the patent bar examination and to practice patent law, but that had not been recognized as eligible fields of study (IPWatchdog, 2021; United States Patent and Trademark Office, Department of Commerce, 2021). As far as we know, no such internal review of eligibility criteria has been conducted by any other intellectual property office.

In the academic sector, opening technology transfer offices (TTOs) has been demonstrated to foster patenting, including by women. The functioning of various TTOs, and how differences affect women and other under-served populations, is an ongoing subject of research. As noted in the previous section, Giuri et al. (2020) find that Italian universities that open a technology transfer office, publish clear patent policies, and are part of science-industry parks benefit from greater participation by women in patenting. Such practices, therefore, could be a promising avenue for the academic sector to further analyze.

Government agencies and intellectual property offices have a significant impact in supporting women entrepreneurs throughout their entrepreneurial journey, given the importance of the intellectual property system and its benefits for all businesses, including those founded and led by women. Government agencies are increasingly launching outreach efforts to help women-led businesses, creating networking opportunities and mentorship programs that are tailored to women entrepreneurs' needs. Mentoring programs can provide invaluable access to role models, who offer guidance on professional and personal development, while also facilitating access to networks and resources essential for success in the business world. For example, programs like Mexico's Mujeres Innovadoras initiative and Rwanda's Women in Business Initiative offer enterprising women a range of support services. These include skill-building workshops, mentorship opportunities and technical assistance aimed at boosting their innovative capabilities and ensuring they know what to do to effectively protect and otherwise manage their intellectual property assets.

Dedicated programs and centers can further bolster women's entrepreneurship. Entities like the Technology Innovation and Entrepreneurship Center (TIEC) under the Information Technology Industry Development Agency (ITIDA) in Egypt extend support to early-stage women entrepreneurs operating in the ICT sector. Such initiatives aim to empower women by providing resources and assistance in high-technology product development and commercialization.

Similarly, the establishment of the Business Center for Women Entrepreneurs by the Saudi Ministry of Commerce aims to enhance women's participation in the economy, thereby contributing to achievement of the sustainable development goals. With the removal of the country's guardian consent requirement, women are now able to initiate and manage businesses on equal footing with men. They have unhindered

access to business registration, trademark procedures and other activities relevant for entrepreneurship. Additionally, the Saudi government focus on facilitating funding for women-owned enterprises, given their substantial and growing presence in the entrepreneurial landscape, gives rise to more equitable opportunities and combats gender discrimination in financial services.

In general, the issue of participation of women in the innovation ecosystem and in intellectual property systems is not merely a matter of representation. It has the potential to catalyze a broader cultural shift within the most innovative sectors and fields of technology. Increasing the visibility of women in innovation can serve as a powerful impetus for others to enter the relevant sectors, creating a multiplier effect that further enhances diversity while contributing valuable ideas to society. This phenomenon is underpinned by the profound influence of role models in shaping career aspirations and attitudes.

The presence of successful women inventors and intellectual property professionals in educational initiatives and at public events serves a dual purpose. It challenges prevailing stereotypes about the demographic makeup of these fields and provides tangible evidence of achievable success for aspiring girls and women. When students see women achieving at high levels in innovation and patenting, this can leave a profound positive impression and expand their view of what is possible in their own lives.

3.3 Financial support for women entrepreneurs, innovators and scientists

Women's access to financing and venture capital is relatively limited across the globe (see subsection 2.2). The relationship between intellectual property rights and access to capital can create a paradox for female entrepreneurs and innovators. Securing intellectual property rights often leads to greater access to capital, as intellectual property assets can increase the valuation and perceived credibility of a venture (Milli et al., 2016). However, obtaining and maintaining intellectual property rights typically requires significant financial investment and may be out of reach for those without access to the necessary capital.

Initiatives supporting entrepreneurs from historically underrepresented groups in accessing finance include loans, monetary grants through awards, and reduced fees for intellectual property rights registration. For example, the Cyprus Women's Cooperative Bank Limited aims to bolster women's entrepreneurship by providing specialized programs and by facilitating access to funding. They offer small loans of up to 100,000 euros to SMEs, along with free advice and access to a professional network. They also

offer flexible repayment plans, grace periods of up to two years, relatively low interest rates and the possibility of accessing funds within 48 hours (EIGE Europa, 2014b).

Some government and international organizations have focused on increasing women entrepreneurs' access to finance, know-how and non-financial business development services. This knowledge is invaluable for such entrepreneurs, who face disproportionate difficulty in accessing the financial sector. One program run by the European Bank for Reconstruction and Development (EBRD), "Finance and advice for women in business", operated between December 2013 and December 2017 with a total budget of 38 million euros. The program delivered financial and technical assistance to women-led businesses and also made numerous loans available to women-led businesses in Turkey (EIGE Europa, 2017). In the United States, the Department of Energy's "Phase 0 Assistance Program" provides inventors with assistance in applying for grants and other government support, to encourage inventors who are women or from under-served groups to seek funding for their innovative enterprises (Innovation Partnership, 2023).

Furthermore, the Women Entrepreneurs' Loan Program in Croatia provides advantageous loans to women entrepreneurs for a variety of investment purposes, targeting companies that are majority-owned and/or led by women. The program makes funding available and also provides a range of intellectual property services so the companies can secure patents, copyrights and licenses to use others' intellectual property rights. The loan conditions offered by this program are more favorable than those available in the market, making it a valuable resource for women entrepreneurs (EIGE Europa, 2014a).

Nigeria is also home to programs offering valuable financial and technical assistance to entrepreneurs from under-served groups. The Investment in Digital and Creative Enterprises Program (i-DICE) aims to nurture and advance Nigeria's digital and creative industries. With a budget of approximately 618 million dollars sourced from various entities including the African Development Bank, Agence Française de Développement, the Islamic Development Bank, the Bank of Industry and private investors, i-DICE provides funding and technical assistance to entrepreneurs and startups within these sectors. Its overarching objective is to foster economic growth and employment opportunities by equipping digital and creative ventures with the necessary resources for expansion and job creation. The program allocates a dedicated budget of 1.14 million dollars to support women-led startups in technology and creative fields. The program's interventions are structured around three main components: enhancing enterprise and skills development, expanding access to finance through the Digital and Creative Enterprises (DICE) Funds, and establishing an enabling regulatory framework and policies.

Another avenue for helping women entrepreneurs to secure funding involves facilitating access to venture capital (VC), increasing participation by women in VC firms, and extending the reach of women-led VC firms. For instance, European Women in VC is a community of over 1000 senior female venture capital investors from across Europe and beyond that aims to change the status quo and facilitate access for women to VC investors. The group has committed to establish a 3-billion-euro “Fund of Funds” for women-led VC firms, granting loans to fund General Partner contribution, setting up relationship-building events for women-led VC firms and limited partners, and encouraging financial tax incentives for investment in women-led funds (European Women in VC, 2023). The idea is that if women-led VC funds continue to rise, so too will VC funding for female entrepreneurs and innovators.

Programs that recognize and award women and innovators from other historically underrepresented groups can be instrumental in enabling them to increase visibility, build a brand, secure financing and enhance credibility. A prime example of such a program is the Women Innovators Prize awards, which celebrates talented women inventors across the European Union and associated countries. Administered jointly by the European Innovation Council, SMEs Executive Agency, and the European Institute for Innovation & Technology, the awards distribute three prizes: 100,000 euros for the winner and 70,000 euros and 50,000 euros for the two runners-up (European Commission, 2023). These awards not only provide financial assistance but also promote the broader recognition of innovation and entrepreneurial excellence among women. They give hope to aspiring entrepreneurs who may otherwise feel discouraged by the lack of female entrepreneur role models.

In some countries, the government offers fee reductions for intellectual property rights registration together with targeted loans to finance efforts to secure intellectual property rights. Taking India as an example, the country’s Office of the Controller General of Patents, Designs, and Trade Marks offers an 80 per cent fee reduction to start-ups and women entrepreneurs. Meanwhile, the USPTO offers a 60 per cent and 80 per cent fee reduction to small and micro entities, respectively, many of which are women-led (Kanellia and Jorgenson, 2023).

Similarly, the Intellectual Property Office of the Philippines has launched the Juana Patent and Juana Design Protection Incentive Programs aimed at encouraging women inventors and designers to participate in the intellectual property system, by waiving certain fees associated with intellectual property applications. The initiatives remove fees for up to 50 patent grants, 150 utility models, and 150 industrial design applications, thus removing financial obstacles for women-led MSMEs and startups. These fee waivers cover the application, publication and substantive examination processes. They can result in substantial cost savings.

In conclusion, while addressing the funding gap for women entrepreneurs remains a global challenge, initiatives such as fee reductions, targeted loans and other specialized funding programs show promise in facilitating access to capital and intellectual property rights for women-led ventures. Fostering collaboration between governments, financial institutions and non-profit organizations can be expected to contribute to a more supportive ecosystem for women in entrepreneurship.

3.4 Data collection, sharing and analysis

Most, if not all, of the programs and initiatives cited previously have been implemented without a comprehensive – or sometimes any – evaluation. A proper program evaluation includes a systematic, methodical approach that applies rigorous and empirical methods to assess the design, implementation and outcomes of a program. Program evaluations are crucial because they provide evidence-based assessments that can inform policy and decision-making. Without them, there is a risk of continuing ineffective programs, with a lack of accountability or measurable positive outcomes. A well-conducted evaluation can help to identify best practices, inform improvements for future iterations of existing programs, and ensure that the intended beneficiaries are receiving the maximum possible benefit. It can also help stakeholders to justify the continued or even increased investments in successful initiatives and to make informed decisions about reallocating resources from programs that are found to be less effective.

As the number of programs seeking to close the patent diversity gaps grows, it is becoming increasingly important to assess their effectiveness, in order to allow for efficient decisions in designing, funding and otherwise prioritizing them. One necessary condition for program evaluations is to improve not only the collection of demographic data but also the availability of such data sets among researchers. This constitutes an opportunity for national and international actors to facilitate data collection and access.

The United States has recently made efforts to improve its data collection and sharing. The SUCCESS Act of 2018 requires the USPTO, in consultation with the Small Business Administration (SBA), to identify publicly available data on patents held by inventors from historically underrepresented groups, namely women, minorities and veterans (United States Congress, 2018). Invent Together played a role in advocating for the enactment of this legislation, which provided a basis for significantly increasing data collection and analysis by USPTO and contributed to a better understanding of patent gaps in the United States. The text of the SUCCESS Act emphasizes the benefits of increasing the number of patents applied for and obtained by people from underrepresented groups, and it includes recommendations on how to promote participation in the US patent system by inventors from these groups.

Further efforts to improve patent diversity, also endorsed and advocated by Invent Together, have featured in the United States Congress. The IDEA Act was proposed bipartisan legislation that would have directed the USPTO to collect (on a voluntary basis) demographic information from inventors listed on patent applications, including gender, race, military status, and other information. This information would have been kept confidential but could have been used for data analysis and for the preparation of an annual report by the USPTO, in order to foster diversity and inclusion in the patenting process (Stallion, 2021).

Europe is catching up with the United States in data collection on participation by inventors from diverse groups, in European patent systems. In 2022, the European Patent Office (EPO) published a study entitled “Women’s participation in inventive activity”, the first significant quantitative study on gender and patenting. It found that only 13.2 per cent of inventors named on patents in Europe are women (European Patent Office, 2022).

At the international level, WIPO has created platforms for exchanges among intellectual property scholars and chief economists at national and regional intellectual property offices. One such initiative, as noted above, centers around the diffusion of WIPO’s World Gender Name Dictionary, a tool that is supplemented by built-in commands in STATA and Python, assisting researchers in assessing the likely gender of inventors (Martinez et al., 2021, 2016; Raffo, 2021). Additionally, WIPO maintains a dedicated GitHub page to support collaboration and ongoing refinement of this tool (World Intellectual Property Organization, 2021). WIPO’s commitment to managing databases that include information on international patent applications (PCT) as well as on designs, trademarks and copyrights helps scholars to track innovation diversity trends and deepen understanding of the disparities in innovation, beyond just patents.

Going forward, open-source data and research facilitated through collaboration among intellectual property offices, scholars and industry players will be key to ensuring that significant strides can be made in bridging the patent gaps and other intellectual property diversity gaps.

4 Summary and conclusions

Closing intellectual property diversity gaps is expected to deliver numerous substantial benefits at the individual, organization and national economic levels – but there is a long way to go before we can achieve these outcomes. This paper, like most research, has focused on the patent gap between men and women. Further research on the extent

and reasons behind other types of patent diversity gaps is needed. Also, existing literature largely focuses on the United States; future research into the gender and other intellectual property diversity gaps should consider other countries as well.

Closing the gender patent gap has emerged as a shared concern for the global intellectual property community. It is now firmly on the political agenda. It is important that this momentum be leveraged to benefit not only inventors from just this one historically underrepresented group. Our hope is that researchers and policymakers will make concerted efforts to enhance innovators' engagement in patent system and in innovation ecosystems more broadly. We also consider it important to work to improve access by diverse inventors to the full range of intellectual property rights.

Central to this endeavor is the need for more robust data collection. As a first step, researchers could focus on under-researched patenting gaps, such as gaps between different income and race groups, as well as the lower rate of participation in patent systems by members of indigenous communities. Priority should be placed on utilizing primary source data, keeping in mind that the work in this domain is rapidly evolving and is marked by a need for substantial collaboration between data holders and researchers as well as among researchers from different organizations.

In the preceding sections, we have mentioned many promising initiatives from private companies, academia, national intellectual property offices and supranational agencies. These policies and programs could help to bridge the patent diversity gaps. The challenge we face, however, is understanding the impact of those initiatives, given they have not been thoroughly evaluated. Program evaluations of each policy are needed to understand not only their impact, but also their potential effectiveness across different countries and contexts.

Innovative collaborations will be critical to tackling patent diversity gaps. The collaboration since 2021 between WIPO and Invent Together, for example, illustrates the difference that can be made when the public and private sectors join forces to raise awareness about gaps and to identify promising initiatives to close them. Concerted action by policymakers, companies, industry groups, academics and nongovernmental organizations will enable the intellectual property community to achieve true progress.

In conclusion, while progress in quantifying and tackling patent diversity gaps has been made, closing those gaps completely is a task that is both complex and urgent. There is still a long road to travel. With shared commitment, evidence-based strategies and innovative partnerships, we expect significant strides in closing the patent diversity gaps, across regions, in the coming years.

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Appendix: Global initiatives promoting women's engagement in innovation ecosystems

Continent	Country	Name	Author(s)	Type	URL	Year
Africa	Egypt	Heya Raeda Program	Technology Innovation and Entrepreneurship Center	Policy	https://tiec.gov.eg/English/Programs/She-program/Pages/default.aspx	2022
Africa	Egypt	National Intellectual Property Strategy	National Council for Women in Egypt	Policy	https://www.sis.gov.eg/UP/Culture/Strategic%20Book%20(E).pdf	2022
Africa	Egypt	National Strategy for Empowering Egyptian Women 2030	National Council for Women	Policy	http://ncw.gov.eg/Images/PdfRelease/Fact%20sheet%20NCW%20E%20A%2003-1202124201933473.pdf	2020
Africa	Egypt	The Women Techsters Initiative Fellowship Class of 2023	FinTech Egypt	Policy	https://fintech-egypt.com/news/news_details.php?id=165	2023
Africa	Egypt	Who is she	Who is she	Initiative	https://whoisshe.wmf.org.eg/about-us/	2022
Africa	Egypt	Women Entrepreneurship Program	Technology Innovation and Entrepreneurship Center (TIEC) of the Information Technology Industry Development Agency (ITIDA)	Policy	https://mccit.gov.eg/en/Innovation/Get_Inspired/Women_Entrepreneurship_Program	2022
Africa	Nigeria	Copyright Act 2022	National Assembly of the Federal Republic of Nigeria	Policy	https://www.wipo.int/about-wipo/en/offices/nigeria/news/2023/news_0011.html	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Africa	Nigeria	High-Level Advisory Council on Support for Women and Girls	State House of Nigeria	Policy	https://statehouse.gov.ng/news/president-buhari-says-women-girls-remain-integral-to-development-launches-high-level-advisory-council-on-support/	2023
Africa	Nigeria	Investment in Digital and Creative Enterprises (I-DICE) Programme	African Development Bank	Policy	https://projectsportal.afdb.org/dataportal/VProject/show/P-NG-K00--009	2022
Africa	Nigeria	National Gender Policy	Ministry of Women Affairs	Policy	https://radionigeria.gov.ng/2022/12/09/fg-unveils-revised-national-gender-policy/	2022
Africa	Nigeria	Nigeria Integrated National Financing Framework: Financing strategy	Integrated National Financing Frameworks	Policy	https://inff.org/resource/nigeria-integrated-national-financing-framework	2022
Africa	Nigeria	Women's Economic Empowerment Policy	Federal Executive Concil	Policy	https://nairametrics.com/2023/05/20/fg-launches-national-womens-economic-empowerment-policy/	2023
Africa	Rwanda	National Research and Innovation Fund (NRIF)	National Council for Science and Technology	Policy	https://www.ncst.gov.rw/fileadmin/user_upload/NCST/Publications/Policies/NRIF_Policy_framework_FINAL_June_8_2021.pdf	2021
Africa	Rwanda	Rwandan Association for Women in Science and Engineering	RAWISE	Policy	https://web.archive.org/web/20230528060645/https://www.rawise.org.rw/	2023

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Continent	Country	Name	Author(s)	Type	URL	Year
Africa	Rwanda	Science, Technology and Innovation Policy	National Council for Science and Technology	Policy	https://www.mineduc.gov.rw/index.php?eID=dumpFile&t=f&f=17135&token=c64ea84e90450da788598d96cc37bcd124d001e7	2020
Africa	Rwanda	Special Cluster for Women, Young Entrepreneurs and People with Disabilities	Private Sector Federation (PSE)	Policy	https://www.africa-press.net/rwanda/economy/psfs-jeanne-francoise-mubiligi-on-how-to-beat-female-youth-stereotypes-in-business	2022
Africa	Rwanda	Women In Business Initiative	Norrsken East Africa; Swedish International Development Cooperation Agency (Sida)	Policy	https://www.ktpress.rw/2023/03/women-in-business-initiative-turning-business-ideas-into-reality/	2023
Americas	Argentina	UN Women in Argentina and Argentina's foreign policy commitment to gender equality	Ministerio de Relaciones Exteriores, Comercio Internacional y Culto	Policy	https://cancilleria.gob.ar/en/news/newsletter/un-women-argentina-and-argentinas-foreign-policy-commitment-gender-equality	2023
Americas	Belize	Summer Coding Camp for Girls	Directorate General for Foreign Trade (DGFT); Belize Coalition of Service Providers (BCSP); Belize Association of ICT Professionals (BAICTP)	Policy	https://www.pressoffice.gov.bz/summer-coding-camp-for-girls-to-be-launched-in-belize-city-and-belmopan/	2019
Americas	Belize	The National Women's Commission	The National Women's Commission	Policy	https://www.nwcbelize.org/	2023
Americas	Belize	Women's Financial Inclusion Workshop	Ministry of Foreign Affairs	Initiative	https://www.belizebank.com/portfolio/womens-financial-inclusion-workshop/	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	Bolivia	Bolivia - Gender Equality through Art	European Union National Institutes for Culture	Initiative	https://www.eunicglobal.eu/projects/promotion-of-gender-equality-in-bolivia	2019
Americas	Brazil	Meninas Digitais	Sociedade Brasileira de Computação (SBC)	Initiative	https://meninas.sbc.org.br/	2018
Americas	Brazil	Strategic Committee on Gender, Diversity and Inclusion (CEGDI)	Brazilian National Institute of Industrial Property (INPI)	Policy	https://www.gov.br/inpi/en/content-center/news/new-committee-will-address-gender-diversity-and-inclusion-in-the-field-of-intellectual-property	
Americas	Canada	Business Women in International Trade	Canada, Global Affairs	Policy	https://www.tradecommissioner.gc.ca/tcs-sdc/businesswomen-femmesdaffaires/index.aspx?lang=eng	2019
Americas	Canada	Canadian Association of Women Executives & Entrepreneurs	Canadian Association of Women Executives & Entrepreneurs	Policy	https://cawee.net/	2023
Americas	Canada	Canadian Women's Chamber of Commerce	Canadian Women's Chamber of Commerce	Policy	https://canwcc.ca/	2023
Americas	Canada	Canadian Women's Foundation	Canadian Women's Foundation	Policy	https://canadianwomen.org/	2023
Americas	Canada	Catalyst Canada Advisory Board	Catalyst Canada Advisory Board	Policy	https://www.catalyst.org/catalyst-canada-advisory-board/	2023
Americas	Canada	Department for Women and Gender Equality – Women's Program	Government of Canada	Initiative	https://www.canada.ca/en/women-gender-equality/news/2019/03/department-for-women-and-gender-equality--womens-program.html	2023

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	Canada	Funding programs for women and gender equality	Government of Canada	Policy	https://women-gender-equality.canada.ca/en/funding/funding-programs.html#wp	2023
Americas	Canada	Society for Canadian Women in Science and Technology (SCWIST)	SCWIST	Initiative	https://scwist.ca/	2023
Americas	Canada	Startup Canada	Startup Canada	Initiative	https://www.startupcan.ca/	2023
Americas	Canada	The Forum	The Forum	Policy	https://www.theforum.ca	2023
Americas	Canada	Venture Capital Catalyst Initiative	Government of Canada	Policy	https://ised-isde.canada.ca/site/sme-research-statistics/en/venture-capital-catalyst-initiative	2023
Americas	Canada	WES Ecosystem Fund	Government of Canada	Initiative	https://ised-isde.canada.ca/site/wes-ecosystem-fund/en	2023
Americas	Canada	Woman Entrepreneur Get financing, advice and free resources	Government of Canada	Initiative	https://www.bdc.ca/en/i-am/woman-entrepreneur	2023
Americas	Canada	Women Entrepreneurship Knowledge Hub (WEKH)	Government of Canada	Initiative	https://wekh.ca/	2023
Americas	Canada	Women Entrepreneurship Loan Fund	Government of Canada	Initiative	https://ised-isde.canada.ca/site/women-entrepreneurship-strategy/en/women-entrepreneurship-loan-fund	2023
Americas	Canada	Women Entrepreneurship Strategy	Government of Canada	Policy	https://ised-isde.canada.ca/site/women-entrepreneurship-strategy/en	2023
Americas	Canada	Women in Trade	Government of Canada	Initiative	https://www.edc.ca/women-in-trade	2019

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	Canada	Women's Enterprise Organizations of Canada	Women's Enterprise Organizations of Canada	Initiative	https://weoc.ca/	2023
Americas	Chile	Análisis de Mujeres Inventoras: Año 2022	Instituto Nacional de Propiedad Industrial (INAPI) - Chile	Policy	https://www.inapi.cl/docs/default-source/2023/centro-de-documentacion/estudios/reporte-de-genero-sobre-solicitudes-de-patentes-en-chile/analisis_de_las_mujeres_inventoras_ano_2023_inapi.pdf?sfvrsn=7a187460_2	2022
Americas	Chile	Análisis de las Mujeres Emprendedoras: Años 2019–2020	Instituto Nacional de Propiedad Industrial (INAPI) - Chile	Policy	https://www.inapi.cl/docs/default-source/default-document-library/reporte_de_geenero_marcas_.pdf?sfvrsn=85a918d9_2	2020
Americas	Chile	Asociación Nacional de Mujeres Rurales e Indígenas	ANAMURI	Initiative	https://www.anamuri.cl	2023
Americas	Chile	Red Latinoamericana de Propiedad Intelectual y Género	Instituto Nacional de Propiedad Industrial (INAPI) - Chile	Initiative	https://www.inapi.cl/sala-de-prensa/detalle-noticia/directora-nacional-de-inapi-funda-la-red-latinoamericana-de-pi-y-genero-junto-con-colombia-costa-rica-y-peru	2021
Americas	Chile	SAGA (STEM And Gender Advancement) Project in Chile	United Nations Education, Science and Culture Organization (UNESCO)	Initiative	https://www.unesco.org/en/articles/chile-implements-saga-project-reduce-gender-gap-science	2019
Americas	Colombia	Decreto 1860 de 2021	Agencia Nacional de Contratación Pública	Policy	https://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=127758&dt=S	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	Colombia	Fondo Mujer Emprende	Agencia Presidencial de Cooperación Internacional	Initiative	https://www.apccolombia.gov.co/proyectos/fondo-mujer-emprende	2022
Americas	Colombia	IEEE Colombia Women in Engineering	IEEE	Policy	https://site.ieee.org/colombia-wie/about-ieee/	2023
Americas	Colombia	Inicia Con TIC	Ministerio de Tecnologías de la Información y las Comunicaciones (MINTIC)	Policy	https://iniciacontic.gov.co/776/w3-channel.html	2021
Americas	Colombia	Leading for Peace Project in Colombia: Virtual Training for Participation Strategy	Plan International Canada	Initiative	https://plancanada.ca/stories/impact-reports/leading-for-peace-in-Colombia	2022
Americas	Colombia	Ley 2056 de 2020	Gestor Normativo de Función Pública	Policy	https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=142858	2020
Americas	Colombia	Programa +Mujer +Ciencia +Equidad	Ministerio de Ciencia Tecnología e Innovación	Initiative	https://mujercienciaequidad.minciencias.gov.co/	2023
Americas	Colombia	SheCodes Foundation Program for Colombian Women	SheCodes Foundation	Initiative	https://www.shecodesfoundation.org/	2023
Americas	Colombia	Women in Tech Colombia Ambassadors	Women in Tech Network, Anna	Initiative	https://www.womentech.net/en-us	2023
Americas	Costa Rica	Implementation of actions in the guidelines to close financial gaps between women and men in Costa Rica and its pilot program	CAF	Initiative	https://www.caf.com/en/currently/news/2022/04/costa-rica-launches-women-s-financial-inclusion-project/	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	Costa Rica	Ley de Promoción de la Igualdad Social de la Mujer	Sistema Costarricense de Información Jurídica	Policy	http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?param1=NRTC&nValor1=1&nValor2=10806&strTipM=TC	1990
Americas	Cuba	Gender in STEM Research Initiative (GIST)	IDRC - International Development Research Centre	Policy	https://idrc-crdi.ca/en/project/advancing-gender-inclusion-natural-sciences-technology-engineering-and-mathematics-haiti	2023
Americas	Cuba	Programa Nacional para el Adelanto de las Mujeres	Ministerio de Justicia	Policy	https://oig.cepal.org/sites/default/files/2021_dp198_cub.pdf	2021
Americas	Dominican Republic	Academy for Women Entrepreneurs	Embajada de los Estados Unidos en Republica Dominicana; Pretty Busy Club; Fundación Innovati	Initiative	https://www.awedominicana.com	2023
Americas	Dominican Republic	Plan Nacional de Igualdad y Equidad de Género (PLANEG III)	Ministerio de la Mujer	Policy	https://siteal.iiep.unesco.org/bdnp/3072/plan-nacional-igualdad-equidad-genero-planeg-iii	2018
Americas	Ecuador	Calendario de Mujeres Ecuatorianas en Ciencias	Red Ecuatoriana de Mujeres en Ciencia (REMCI); Microbios	Initiative	https://www.edicionmedica.ec/secciones/profesionales/presentan-la-segunda-edicion-del-calendario-de-mujeres-ecuatorianas-en-ciencias-100029	2022
Americas	Ecuador	Gender Analysis and Action Plan	United Nations Development Programme (UNDP)	Policy	https://info.undp.org/docs/pdc/Documents/EQU/Gender_Action_Plan_4thNC_Ecuador_Final_30april_2020_final.pdf	2020

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	El Salvador	MercaMujer	Instituto Salvadoreño para el Desarrollo de la Mujer	Initiative	http://isdemu.gob.sv/2022/09/06/lanzan-mercamujer-para-impulsar-emprenimientos-de-salvadorenas/	2022
Americas	El Salvador	Sistema de Estadísticas y Monitoreo para la Igualdad-SEMI	Instituto Salvadoreño para el Desarrollo de la Mujer	Initiative	http://isdemu.gob.sv/proyectos2/	2023
Americas	Haiti	Women in Tech Haiti Ambassadors	Women in Tech Network	Initiative	https://www.womentech.net/en-us	2023
Americas	Honduras	Connected Women Initiative	GSMA Latin America	Initiative	https://www.gsma.com/latinamerica/connected-women-honduras/	2017
Americas	Honduras	Plan de Implementación de la Política Nacional de Género en la Agenda Nacional 2030 de Honduras	EUROsociAL+	Initiative	https://eurosocial.eu/fichas_descargables/plan-de-implementacion-de-la-politica-nacional-de-genero-en-la-agenda-nacional-2030-de-honduras/	2022
Americas	Honduras	Política Nacional de la Mujer. II Plan de Igualdad y Equidad de Género de Honduras 2010–2022	Instituto Nacional de la Mujer	Policy	https://siteal.iiep.unesco.org/bdnp/801/politica-nacional-mujer-ii-plan-igualdad-equidad-genero-honduras-2010--2022	2010
Americas	Honduras, El Salvador, Guatemala	MujerProspera (WomanProsper) Challenge	United States Agency for International Development (USAID)	Initiative	https://www.usaid.gov/mujer-prospera-challenge	2023
Americas	Jamaica	Second cohort selected for Academy for Women Entrepreneurs Jamaica	Women Entrepreneurs Jamaica	Initiative	https://www.jamaicaobserver.com/news/second-cohort-selected-for-academy-for-women-entrepreneurs-jamaica/	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	Latin America and the Caribbean countries	Latin America and the Caribbean Gender Innovation Lab	World Bank	Initiative	https://www.worldbank.org/en/programs/latin-america-and-the-caribbean-gender-innovation-lab	2023
Americas	Latin America and the Caribbean countries	The Regional Alliance for the Digitalization of Women in Latin America and the Caribbean	Board of the Regional Conference on Women in Latin America and the Caribbean, the Ministry of Women and Gender Equity of Chile	Initiative	https://www.cepal.org/en/notes/regional-alliance-digitalization-women-latin-america-and-caribbean-highlighted-event-within	2021
Americas	Mexico	Becas para madres CONACYT	Consejo Nacional de Humanidades, Ciencias y Tecnologías (CONAHCYT)	Initiative	https://mextudia.com/becas/conacyt/	2023
Americas	Mexico	Código X	Instituto Mexicano de la Juventud	Initiative	http://www.gob.mx/imjuve/articulos/codigo-x-iniciativa-tecnologica-por-las-ninas-y-mujeres-jovenes?idiom=es	2017
Americas	Mexico	Ley General para la Igualdad entre Mujeres y Hombres	Cámara de Diputados LXV Legislatura	Policy	https://www.diputados.gob.mx/LeyesBiblio/ref/lgimh.htm	2006
Americas	Mexico	NIÑASTEM PUEDEN	Secretaría de Educación Pública; Organización de Cooperación y Desarrollo Económico (OECD)	Initiative	http://ninastem.aprende.sep.gob.mx/en/demo/home_	2023

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	Mexico	Red de Mujeres Innovadoras y Propiedad Industrial	Instituto Mexicano de la Propiedad Industrial (IMPI)	Initiative	https://mujeresinnovadoras.impi.gob.mx/Paginas/Conocenos.aspx	2023
Americas	Mexico	Victoria147	Victoria147	Policy	https://victoria147.org/quienes-somos/	2023
Americas	Mexico	Women in Tech Mexico Ambassadors	Women in Tech Network	Initiative	https://www.womentech.net/en-us	2023
Americas	Paraguay	IEEE Paraguay Women in Engineering	IEEE	Policy	https://r9.ieee.org/paraguay-wie/	2023
Americas	Paraguay	PYLAB 2030 Workshop	FIIAPP	Initiative	https://www.fiiapp.org/en/noticias/public-innovation-accelerator-of-the-2030-agenda-in-paraguay/	2022
Americas	Paraguay	Women Entrepreneurs of Paraguay (WEP) Program	U.S. Embassy in Paraguay; Alliance for Commercialization and Innovation Research (ACIR); KOGA	Initiative	https://www.paraempresarias.com	2021
Americas	Peru	Programa de Asistencia a Inventores (PAI-Perú)	Instituto Nacional de Defensa de la Competencia y de la Protección de la Propiedad Intelectual (INDECOPI)	Initiative	https://www.patenta.pe/pai-peru	2021
Americas	United States of America	Council for Inclusive Innovation	United States Patent and Trademark Office (USPTO)	Policy	https://www.uspto.gov/initiatives/equity/ci2/about	2023
Americas	United States of America	Federal And State Technology (FAST) Partnership Program	Small Business Innovation Research (SBIR) Program	Initiative	https://www.sbir.gov/about-fast	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	United States of America	H. R. 7055: A Bill - To support empowerment, economic security, and educational opportunities for adolescent girls around the world, and for other purposes.	Senate of the United States	Policy	https://www.congress.gov/115/bills/hr7055/BILLS-115hr7055ih.pdf	2018
Americas	United States of America	IP Patch	United States Patent and Trademark Office (USPTO); Girl Scout Council of the Nation's Capital (GSCNC); Intellectual Property Owners (IPO) Education Foundation	Policy	https://www.uspto.gov/kids/patchFAQ.html	2023
Americas	United States of America	Increasing the Role of Women in Innovation and Entrepreneurship, Encouraging Women in Developing Countries to Use the Intellectual Property System	Governments of Mexico, Canada and the United States of America	Policy	https://dacatalogue.wipo.int/projects/DA_1_10_12_23_25_31_40_01	2023
Americas	United States of America	Inventor Diversity Advocacy Group Launches 'Patent Academy' in Latest Effort to Reach Underrepresented Inventors	Steve Brachmann	Policy	https://ipwatchdog.com/2022/07/14/inventor-diversity-advocacy-group-launches-patent-academy-in-latest-effort-to-reach-underrepresented-inventors/id=150223/	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	United States of America	Law School Clinic Certification Program	USPTO, USPTO	Initiative	https://www.uspto.gov/learning-and-resources/ip-policy/public-information-about-practitioners/law-school-clinic-1	2023
Americas	United States of America	Legal Experience and Advance Program (LEAP)	USPTO	Initiative	https://www.uspto.gov/patents/ptab/leap#:~:text=The%20purpose%20of%20LEAP%20is,be%20requested%20on%20that%20basis	2023
Americas	United States of America	NIST Steering Group for Equity in Career Advancement (SGECA)	NIST	Policy	https://www.nist.gov/diversity-equity-and-inclusivity/steering-group-equity-career-advancement	2019
Americas	United States of America	National Strategy on Gender Equity and Equality	The White House	Policy	https://www.whitehouse.gov/briefing-room/statements-releases/2021/10/22/fact-sheet-national-strategy-on-gender-equity-and-equality/	2021
Americas	United States of America	Patent Pro Bono Program	USPTO	Initiative	https://www.uspto.gov/patents/basics/using-legal-services/pro-bono/patent-pro-bono-program	2023
Americas	United States of America	Patent Trial and Appeal Board Pro Bono Program	USPTO	Initiative	https://www.uspto.gov/patents/patent-trial-and-appeal-board/patent-trial-and-appeal-board-pro-bono-program-independent	2023
Americas	United States of America	Progress and Potential 2020 update on U.S. women inventor-patentees	U.S. Patent and Trademark Office • Office of the Chief Economist	Initiative	https://www.uspto.gov/sites/default/files/documents/OCE-DH-Progress-Potential-2020.pdf	2020

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	United States of America	S. 2578: A Bill - To increase the participation of historically underrepresented demographic groups in science, technology, engineering, and mathematics education and industry.	Senate of the United States	Policy	https://www.congress.gov/116/bills/s2578/BILLS-116s2578is.pdf	2019
Americas	United States of America	S. 632: A Bill - To amend chapter 11 of title 35, United States Code, to require the voluntary collection of demographic information for patent inventors, and for other purposes.	Senate of the United States	Policy	https://www.govinfo.gov/content/pkg/BILLS-117s632is/pdf/BILLS-117s632is.pdf	2021
Americas	United States of America	Success (SUCCESS) Act	U.S. Patent and Trademark Office (USPTO)	Policy	https://www.uspto.gov/ip-policy/legislative-resources/successact?MURL=successact	2018
Americas	United States of America	The Inventor's Patent Academy	Invent Together	Initiative	https://learn.inventtogether.org/about/	2023
Americas	United States of America	Women in Technology Scholarship - North America	Palantir	Initiative	https://www.palantir.com/careers/students/scholarship/wit-north-america/	2023

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Continent	Country	Name	Author(s)	Type	URL	Year
Americas	United States of America	Women's Business Centers	U.S. Small Business Administration	Initiative	https://www.sba.gov/local-assistance/resource-partners/womens-business-centers	2023
Americas	United States of America	Women-Owned Small Business Federal Contract program	U.S. Small Business Administration	Initiative	https://www.sba.gov/federal-contracting/contracting-assistance-programs/women-owned-small-business-federal-contract-program	2023
Americas	United States of America	Women's Economic Security	US Department of State	Initiative	https://www.state.gov/womens-economic-empowerment-3	2023
Americas	Uruguay	Girls in Tech Uruguay	Girls in Tech	Policy	https://uruguay.girlsintech.org/	2023
Americas	Venezuela	Technovation Girls Venezuela	Impact Hub Caracas	Policy	https://caracas.impacthub.net/en/technovation-girls/ , https://caracas.impacthub.net/en/technovation-girls/	2020
Asia	Cambodi	STEM Sisters Cambodia	Ministry of Education youth and sport	Policy	https://stemcambodia.ngo/stem-sisters-cambodia/	2023
Asia	China	China to help stimulate innovation vitality of female sci-tech talents	The People's Republic of China	Initiative	https://english.www.gov.cn/statecouncil/ministries/202107/19/content_WS60f55e9cc6d0df57f98dd3c9.html	2021

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Continent	Country	Name	Author(s)	Type	URL	Year
Asia	China	Percentage of the female IP practitioners in China's IP service industry.	Government of China	Initiative	https://www.cnipa.gov.cn/module/download/downloadfile.jsp?classid=0&showname=2022%E5%B9%B4%E5%85%A8%E5%9B%BD%E7%9F%A5%E8%AF%86%E4%BA%A7%E6%9D%83%E6%9C%8D%E5%8A%A1%E4%B8%9A%E7%BB%9F%E8%AE%A1%E8%B0%83%E6%9F%A5%E6%8A%A5%E5%91%8A.pdf&filename=3ff02512772840b3a28675570e179233.pdf	
Asia	China	She (IP) Matters	IP Key China	Initiative	https://ipkey.eu/en/china/news/she-ip-matters	
Asia	India	Annual Report IP India	Office of the controller general of patents, designs, trademarks and GI INDIA	Policy	https://ipindia.gov.in/writereaddata/Portal/Images/pdf/IP_India_English_29.08.21_Final_.pdf	2019
Asia	India	Intellectual Property Facilitation Centre	Government of India	Policy	http://www.ipcphdcci.in/	2023
Asia	India	The Office of the Controller General of Patents, Designs, and Trade Marks (CGPDTM)	The Office of the Controller General of Patents, Designs, and Trade Marks (CGPDTM)	Policy	https://pib.gov.in/pib.gov.in/Pressreleashere.aspx?PRID=1741227	2021
Asia	India	Women Scientist Scheme-A (WOS-A)	Department of Science and Technology	Initiative	https://online-wosa.gov.in/aboutUs.html	2021
Asia	India	Women Scientist Scheme-B (WOS-B)	Department of Science and Technology	Initiative	https://www.indiascienceandtechnology.gov.in/programme-schemes/women-schemes/women-scientist-scheme-b-wos-b	2021

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Continent	Country	Name	Author(s)	Type	URL	Year
Asia	India	Women Scientist Scheme-C (WOS-C)	Department of Science and Technology	Initiative	https://www.indiascienceandtechnology.gov.in/programme-schemes/women-schemes/women-scientist-scheme-c-wos-c	2023
Asia	Indonesia	Accelerating 24 Women-Led Startups Deliver Tech Solutions to Solve SDG Challenges	United Nations; Indonesia	Initiative	https://indonesia.un.org/en/143871-accelerating-24-women-led-startups-deliver-tech-solutions-solve-sdg-challenges	2021
Asia	Indonesia	Women's Empowerment Principles Awards Puts the Spotlight on Indonesian Businesses in Advancing Gender Equality	UN Women	Initiative	https://asiapacific.unwomen.org/en/news-and-events/stories/2020/11/womens-empowerment-principles-awards-puts-the-spotlight-on-indonesian-businesses	2020
Asia	Iraq	Women Entrepreneurs Shaping Innovation in Iraq	Response Innovation Lab	Initiative	https://www.responseinnovationlab.com/year-in-review-lab-highlights/women-entrepreneurs-shaping-innovation-in-iraq-1	2021
Asia	Israel	External Scholarships — Advancing Women in Science and Gender Equality	Weizmann Institute of Science	Initiative	https://www.weizmann.ac.il/women-in-science/resources/awards-scholarships/external-scholarships	2023
Asia	Israel	Israel Innovation Authority Grants:	Israel Innovation Authority	Initiative	https://innovationisrael.org.il/en/reportchapter/israel-innovation-authority-grants	2022
Asia	Japan	Women Entrepreneurship in the EU and Japan	Alice Van Langendonck	Policy	https://www.eu-japan.eu/sites/default/files/publications/docs/2022--12-Women-Entrepreneurship.pdf	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Asia	Japan	Women in IP Law in Japan	Japan Patent Attorney Association	Policy	https://www.jpaa.or.jp/en/activity/women-in-ip-law-in-japan2022/	2022
Asia	Lebanon	A hub for female web entrepreneurs in Lebanon — Research and Innovation	WeHubs project	Initiative	https://ec.europa.eu/research-and-innovation/en/projects/success-stories/all/hub-female-web-entrepreneurs-lebanon	2019
Asia	Malaysia	Academy For Women Entrepreneurs (AWE) Malaysia Program 2022/2023	US Embassy Kuala Lumpur's Academy For Women Entrepreneurs	Initiative	http://www.wena.my/awe-2022/	2023
Asia	Pakistan	Women IP Helpline	IPO Pakistan	Policy	https://www.ipo.gov.pk/women_ip_helpline	2020
Asia	Philippines	Juana Patent and Juana Design Programs	Intellectual Property Office of the Philippines (IPOP HL)	Initiative	https://www.ipophil.gov.ph/news/ipophil-launches-new-juana-patent-and-juana-design-programs-to-empower-msmes-women-inventors-designers/	2022
Asia	Philippines	Science, Technology, Research and Innovation for Development (STRIDE)	United States Agency; for International Development (USAID) Philippines	Initiative	https://gendercenter.rti.org/node/1601	
Asia	Philippines	WinIP e-Magazine	IPOP HL	Initiative	https://www.ipophil.gov.ph/winip-e-magazine/	2023
Asia	Saudi Arabia	Business Centers for Women	Saudi Ministry of Commerce, Knowledge Management	Initiative	https://mc.gov.sa:443/en/About/Initiativesandprojects/women/Pages/Branches.aspx	2023
Asia	Saudi Arabia	Entrepreneurial bootcamp empowers Saudi women	King Abdullah University of Science and Technology (KAUST)	Initiative	https://www.kaust.edu.sa/news/entrepreneurial-bootcamp-empowers-saudi-women	2022

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Continent	Country	Name	Author(s)	Type	URL	Year
Asia	Turkey	BOOST: Women Innovators — Turkey - BOOST	Koç University Entrepreneurship Center	Initiative	https://boostimpact.org/challenges/boost-women-innovators-turkey/	2023
Asia	Yemen	The Yemeni Women's Entrepreneurship Program (YWEP) — Amideast	YWEP	Initiative	https://www.amideast.org/yemen/develop-a-skill/entrepreneurship/the-yemeni-women%E2%80%99s-entrepreneurship-program-ywep	2023
Europe	Austria	FEMtech	Federal Ministry of Republic of Austria	Policy	https://www.femtech.at/	
Europe	Austria	RTI Strategy 2030 Strategy for Research, Technology and Innovation of the Austrian Federal Government	Federal Government of Republic of Austria	Policy	https://era.gv.at/public/documents/4489/RTI_Strategy_2030--1--1.pdf	
Europe	Croatia	Cheap loans for Croatia's women entrepreneurs	Croatian Bank for Reconstruction and Development	Policy	https://old.eige.europa.eu/gender-mainstreaming/good-practices/croatia/cheap-loans-croatias-women-entrepreneurs?lang=sk	
Europe	Czech Republic	Support for the integration of researchers into MU research teams after career breaks (Podpora začlenění vědeckých pracovníků po přerušení kariéry do výzkumných týmů MU)	Univerzita, Masarykova	Policy	https://gamu.muni.cz/pro-vedce/career-restart	
Europe	France	BE A BOSS	Be a boss	Initiative	https://www.be-a-boss.com/en/	2023

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Continent	Country	Name	Author(s)	Type	URL	Year
Europe	Germany	Gleichstellungsbeauftragte - Women Professors' Program (Professorinnenprogramm) (Universität Paderborn)	Paderborn University	Initiative	https://www.uni-paderborn.de/en/equality/equal-opportunities-officer/awards/women-professors-program-professorinnenprogramm#:~:text=The%20Federal%20and%20State%20Program%20for%20Women%20Professors,the%20proportion%20of%20female%20professors%20at%20German%20universities.	2023
Europe	Germany	Scientifica - Portal für Frauen in Wissenschaft und Technik Baden-Württemberg	Baden-Württemberg Ministry of Science	Policy	https://www.bildungsserver.de/onlineresource.html?onlineresourcen_id=49207	2023
Europe	Germany	Spokesperson budget – DFG (DE)	European Institute for Gender Equality	Policy	https://eige.europa.eu/gender-mainstreaming/toolkits/gear/spokesperson-budget-dfg-de?language_content_entity=en	2023
Europe	Germany	Women in EU Research	Federal Ministry of Education and Research (BMBF).	Initiative	https://www.horizont2020.de/beratung-fif.htm	2023
Europe	Italy	Girls Code it Better - Italy — Digital Skills & Jobs Platform	Officina Futuro Fondazione W-Group Foundation	Initiative	https://digital-skills-jobs.europa.eu/en/inspiration/good-practices/girls-code-it-better-italy	2014
Europe	NA	4iP Council	4iP Council	Initiative	https://www.4ipcouncil.com/	
Europe	NA	Girls' Day at the EPO — Epo.org	EPO	Initiative	https://www.epo.org/en/news-events/news/girls-day-epo	2023

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Continent	Country	Name	Author(s)	Type	URL	Year
Europe	NA	INNOVATION AWARDS – Global Innovation Summit 2022	Portuguese Chairmanship, the Eureka Secretariat and Cascais City Hall,	Initiative	https://www.gis2022.org/global-inovation-summit-2022/eureka-innovation-awards-about/	2022
Europe	NA	Women4IT - Empowering young women with digital skills	EEA Grants	Policy	https://women4it.eu/	2017
Europe	Netherlands	GEAR TOOL Netherlands	European Institute for Gender Equality	Initiative	https://eige.europa.eu/gender-mainstreaming/toolkits/gear/legislative-policy-backgrounds/netherlands?language_content_entity=en	2023
Europe	Netherlands	Home — Talent naar de Top	Talent naar de Top	Initiative	https://www.talentnaardetop.nl/en	2023
Europe	Slovakia	Slovak Women in TECH EN - Aj Ty v IT	Slovak Women in Tech	Policy	https://ajtyvit.sk/slovak-women-in-tech-en/?lang=en/	2023
Europe	Slovenia	Woman Engineer of the Year	Mediade d.o.o.	Initiative	https://www.inzenirka-leta.si/	
Europe	Spain	Observatory of Women, Science and Innovation (OMCI)	Ministry of Science and Innovation	Policy	https://www.ciencia.gob.es/Secc-Servicios/Igualdad/OMCI.html;jsessionid=B058615587B819CF1C7030D26D0950CE.1	2023
Europe	United Kingdom	Athena Swan Charter — Advance HE	Athena Swan Charter	Initiative	https://www.advance-he.ac.uk/equality-charters/athena-swan-charter	2023
Europe	United Kingdom	Code First Girls - Learn to code for FREE	Code First Girls	Initiative	https://codefirstgirls.com/	2022
Europe	United Kingdom	Delivering Women Centered Equity, Diversity & Inclusion Solutions	WISE	Initiative	https://www.wisecampaign.org.uk/	2023

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Continent	Country	Name	Author(s)	Type	URL	Year
Europe	United Kingdom	Gender Profiles in UK Patenting An analysis of female inventorship	UK Intellectual Property Office	Policy	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/514320/Gender-profiles-in-UK-patenting-An-analysis-of-female-inventorship.pdf	2016
Europe	United Kingdom	Gender profiles in worldwide patenting An analysis of female inventorship (2019 edition)	IPO UK	Initiative	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/846363/Gender-profiles-in-worldwide-patenting-2019.pdf	2019
Europe	United Kingdom	Government Science & Engineering Profession	Government Science & Engineering	Initiative	https://www.gov.uk/government/organisations/civil-service-government-science-engineering	2023
Europe	United Kingdom	IPO gender pay gap 2021	Government UK	Policy	https://www.gov.uk/government/publications/ipo-gender-pay-gap-2021/ipo-gender-pay-gap-2021	2022
Europe	United Kingdom	Investing in Women Code IIWC	British Business Bank	Policy	https://www.british-business-bank.co.uk/about-us/our-values-and-culture/investing-in-women-code/	2023
Europe	United Kingdom	STEM Returners programme	STEM Returners	Initiative	https://www.stemreturners.com/	2023
Europe	United Kingdom	UK-Israel Women Leading Innovation	British Embassy Israel	Initiative	https://www.ukisraelhub.com/uk-israel-women-leading-innovation/	2020

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Continent	Country	Name	Author(s)	Type	URL	Year
Europe	United Kingdom	WE Invent means patent costs are no barrier for Imperial's women entrepreneurs — Imperial News — Imperial College London	Ian Mundell	Initiative	https://www.imperial.ac.uk/news/243556/we-invent-means-patent-costs-barrier/	2023
Europe	United Kingdom	Women in IP	Women in IP	Policy	https://ipinclusive.org.uk/community/women-in-ip/	2023
Europe	United Kingdom	Women in IT Awards	Women in IT Awards	Initiative	https://womeninitawards.com/london/	2023
Europe	United Kingdom	Women in Innovation - Innovate UK KTN	Women in Innovation	Initiative	https://iuk.ktn-uk.org/programme/women-in-innovation/	2023
Europe	United Kingdom	Women in Innovation Awards 2022/23 - Innovate UK KTN	Women in Innovation Awards	Initiative	https://iuk.ktn-uk.org/opportunities/women-in-innovation-awards-2022--23/	2023
Oceania	Australia	Australia — Chiefs in Intellectual Property “Women in IP”	Australian Government	Initiative	https://www.iporganisers.com.au/australia-chiefs-in-intellectual-property-women-in-ip/	2022
Oceania	Australia	Australia's Women in STEM Ambassador	Australian Government	Initiative	https://womeninstem.org.au/	2023
Oceania	Australia	Breaking the bias for women and girls through our programs	Australian Government	Initiative	https://www.industry.gov.au/news/breaking-bias-women-and-girls-through-our-programs	2022
Oceania	Australia	Business Toolkit for Indigenous Women	Australian Government	Initiative	https://www.dss.gov.au/sites/default/files/documents/08_2020/abtiw2311102.pdf	

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Continent	Country	Name	Author(s)	Type	URL	Year
Oceania	Australia	Cyber Security Skills Partnership Innovation Fund (CSSPIF)	Australian Government	Initiative	https://business.gov.au/grants-and-programs/cyber-security-skills-partnership-innovation-fund	2023
Oceania	Australia	Empowering Women Innovation Leaders in Australia and Southeast Asia	Australian Government	Policy	https://asialinkbusiness.com.au/uploads/documents/ALB0102_WomenLeadershipAsia_Report2020_v18_(003).pdf	2021
Oceania	Australia	Innovative new program connecting Indigenous Australian and Papua New Guinean entrepreneurs	Australian Government	Initiative	https://png.embassy.gov.au/pmsb/1061.html	2023
Oceania	Australia	L'oreal-Unesco for women in science Australia & New Zealand fellowships	Australia	Policy	https://www.forwomeninscience.com.au/	2023
Oceania	Australia	STEM Equity Monitor	Australian Government	Initiative	https://www.industry.gov.au/publications/stem-equity-monitor	2023
Oceania	Australia	Superstars of STEM	Australian Government	Initiative	https://scienceandtechnologyaustralia.org.au/what-we-do/superstars-of-stem/	2023
Oceania	Australia	The Academy for Enterprising Girls	Australian Government	Initiative	https://enterprisinggirls.com.au/	2022
Oceania	Australia	The Boosting Female Founders (BFF)	Australian Government	Initiative	https://business.gov.au/grants-and-programs/boosting-female-founders	2023

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Continent	Country	Name	Author(s)	Type	URL	Year
Oceania	Australia	The Boosting the Next Generation of Women in STEM awards	Australian Government	Initiative	https://business.gov.au/grants-and-programs/boosting-the-next-generation-of-women-in-stem	2023
Oceania	Australia	The Future Female Entrepreneurs Program (FFEP)	Australian Government	Initiative	https://futurefemaleentrepreneursprogram.com.au/	
Oceania	Australia	The Girls in STEM Toolkit (The GiST)	Australian Government	Initiative	https://www.thegist.edu.au/	2023
Oceania	Australia	The Women in STEM and Entrepreneurship	Australian Government	Initiative	https://business.gov.au/grants-and-programs/women-in-stem-and-entrepreneurship	2023
Oceania	Australia	Women in Innovation	Government of South Australia	Initiative	https://www.womenininnovation.com.au/	2023
Oceania	Australia	Women in Technology (WiT)	WiT	Initiative	https://wit.org.au/about/about-wit/	2023
Oceania	New Zealand	Manatū Wāhine Ministry for Women	Government of New Zealand	Policy	https://women.govt.nz/about-us	2023
Oceania	New Zealand	The Gender Action Plan 2021–2025	New Zealand Government	Policy	https://www.mfat.govt.nz/assets/Peace-Rights-and-Security/International-security/Gender-Action-Plan-2021--2025.pdf	
World	NA	Women in Tech conference	Radulovski, Anna	Initiative	https://www.womentech.net/en-us	2023

61

Note: To provide feedback on this table, or receive an update, please write an email to aikaterini.kanellia@wipo.int.

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