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The Need to Increase Gender Diversity in Innovation and Patenting

Testimony Submitted to the Senate Judiciary Subcommittee on Intellectual Property

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April 3, 2019

Thank you Chairman Tillis, Ranking Member Coons, and Members of the Intellectual Property Subcommittee for holding this important hearing on the diversity gap in innovation and patenting. My name is Barbara Gault, and I am Executive Vice President at the Institute for Women's Policy Research (IWPR). I appreciate your invitation to testify on IWPR's work on women and innovation.

IWPR conducts and communicates research to inspire public dialog, shape policy, and improve the lives and opportunities of women of diverse backgrounds, circumstances, and experiences. IWPR has an interdisciplinary staff of scholars in fields such as economics, sociology, and psychology. As a nonpartisan organization IWPR ensures the independence of its research through rigorous internal and peer review. IWPR has developed a portfolio of research on diversity in innovation, highlighting the extent to which women and people of color are underrepresented, exploring obstacles to participation, and profiling programs that encourage diverse participation in the innovation ecosystem. IWPR's publications in this area include [*Equity in Innovation: Women Inventors and Patents*](#); [*Innovation and Intellectual Property Among Women Entrepreneurs*](#); and [*Closing the Gender Gap in Patenting, Innovation, and Commercialization: Programs Promoting Equity and Inclusion*](#) (attached).

IWPR's work, along with scholarship by academic researchers, the US Patent and Trade Office, and others, suggests that we must accelerate progress to ensure that women and other underrepresented groups have opportunities to develop and reap the benefits of intellectual property. Research evidence is beginning to shed light on the reasons for slow progress toward gender and racial/ethnic equity in patenting, to illuminate programs and professional settings that encourage women's patenting, and to suggest policy strategies for hastening equity in innovation. Ensuring a larger and more diverse ecosystem of innovators is essential to addressing the critical social, economic, and health challenges of our time.

Women's Low Representation as Patent Holders

IWPR's research finds that women patent inventions at much lower rates than men, which means that potential innovations to improve technology, productivity, health, and well-being, are being left on the table. Equity in inventing would bring new and different perspectives to the table and increase the volume of ideas contributing to economic, social, and scientific progress in the United States.

A 2016 IWPR report found that fewer than 20 percent of all U.S. patents listed one or more women as inventors. And while the U.S. has made significant progress toward gender diversity in patenting—more than quintupling the share of patents with at least one woman inventor listed from just 3.4 percent in 1977 to 18.8 percent in 2010. At this rate of progress, however, economists estimate that men and women will not reach parity in patenting for 70-100 years (Milli et al. 2016, Bell et al., 2018). Part of the disparity in patent holdings is due to women's relatively low rates of submitting patent applications—in 2010, men were nearly five times as likely as women to apply for a patent (Delixus, Inc. and National Women's Business Council 2012). Women also tend to apply for patents in technology classes with lower allowance rates (Carley, Hegde, and Marco 2014).

A report recently released by the U.S. Patent and Trademark Office (USPTO) finds that the share of patents listing one or more women as inventors increased to 21 percent in 2016. The report also examines the share of unique inventors that are women and finds that in 2016 only 12 percent of patent inventors were women. When using this measure of women's participation in patenting, progress has been sluggish. In the four decades between 1976 and 2016, the women inventor rate increased from less than five percent to just 12 percent (Toole et al. 2019). This participation rate stands in stark contrast to women's share of the overall population (50.8 percent) and women's share of the workforce (47.4 percent; Institute for Women's Policy Research 2019). The USPTO also finds that women's representation as inventors varies substantially across settings, with women most likely to hold patents in university and hospital settings (where about 20 percent of inventors are women) and least likely to hold patents in business settings (where 12 percent of inventors are women).

Considerably less is known about the participation of women of color in the innovation ecosystem due to data limitations. IWPR's research shows that White and Asian men with college degrees are far more likely to apply for and receive patents than women and people of color. In 2003, 2.7 percent of White men and 5.1 percent of Asian men with college degrees had applied for a patent within the past five years while only 0.3 percent of White women, 0.3 percent of Hispanic women, and 0.5 percent of Black women had applied (Milli et al. 2016). Bell et al. (2018) find that among children attending a New York City public school between grades 3 and 8 between 1989 and 2009, White children went on to have an inventor rate of 1.6 in 1,000, far greater than the rate for Black (0.5) and Hispanic (0.2) children.

Reasons for Women's Under-representation

A major factor in women's low representation among patent holders is their underrepresentation in patent-intensive science, technology, engineering, and mathematics (STEM) fields, such as engineering and computer science, where women earned only 20 percent of undergraduate degrees awarded in 2015 (Milli et al. 2016). Even in STEM fields where women are well-represented, however, women's patenting rates are much lower than expected. For example, in 2015 women made up about 48 percent of the biological and life science workforce, but were only 25 percent of inventors on biotechnology patents and 23 percent of inventors on pharmaceutical patents (Toole et al. 2019).

Researchers point to a range of additional challenges that may affect women's low rates of patent-holding, including the need for policies and programs to help female scientists maintain work-life balance, institutional support for women's patenting activity, and access to networks that would help women and girls learn about inventing and patenting. Navigating the patenting process requires familiarity with the steps involved and access to affordable legal support which can be enhanced through strong networks. Research suggests that women academic scientists are less likely to have strong connections to colleagues and mentors who can help them pursue a patent. Based on semi-structured interviews with 56 life science faculty members at a large university, Murray and Graham (2007) find that while women often have supportive senior male colleagues, those colleagues rarely consider women as collaborative partners, inviting them to join teams less often than their male counterparts, which closes off avenues to commercial science that are open to their male colleagues. Bell et al. (2018) estimate that if girls were exposed to female inventors in their childhood at similar rates that boys are to male inventors, it would cut gender disparities in patenting by half. The time and money required to navigate the patenting process can also pose unique challenges for women inventors, since women are typically paid less and bear a higher share of family caregiving responsibilities than men (Quinn 2015; Hess et al. 2015; Delixus, Inc. and National Women's Business Council 2012).

Implications of Women's Under-Representation as Patent Holders

Intellectual property rights, including patents, can play an important role in business success, which means that women's low-representation among patent-holders may inhibit their opportunities as entrepreneurs. Many lenders consider patent ownership, or at least having a patent application filed, an important factor in making their funding decisions. Graham et al. (2009) found that patents factored significantly into the investment decision of friends and family (31 percent), commercial banks (21 percent), angel investors (57 percent), and investment banks (50 percent). Similarly, Häussler, Harhoff, and Mueller (2012) find that patent holders are more likely to receive private equity financing from venture capitalists and typically receive funding more quickly than entrepreneurs who do not hold patents.

IWPR research shows that intellectual property rights are associated with higher firm revenues—women-owned businesses that had a patent pending had average revenues more than 16 times higher than those firms without intellectual property rights, for example (Williams-Baron, Milli, and Gault 2018). Highly-cited patents have also been linked to greater market value among established businesses. Hall, Jaffe, and Trajtenberg (2005).

Research suggests that women’s underrepresentation among IP holders may put them at a disadvantage in attracting investors as business owners. IWPR’s research shows that women have made progress in increasing their representation among business owners, increasing their share from 16.8 percent of all employer firms in 1997 to 20.8 percent in 2015, yet many women business owners lack access to start-up capital, including venture capital, which can be crucial to the success of their business ventures. And while women-owned businesses engage in research and development activities and produce innovative products at rates nearing or surpassing those of men-owned firms, they are much less likely to hold intellectual property rights—just 0.7 percent of women-owned businesses had a granted patent in 2015, compared with 1.5 percent of men-owned businesses—suggesting that their innovative power could be better marshalled to benefit their businesses and promote economic and social progress more broadly (Williams-Baron, Milli, and Gault 2018).

Progress toward greater diversity in innovation would benefit society. A diversity of viewpoints is essential to identifying and developing solutions to the pressing problems confronting individual and global communities. Yet, the inventors creating technologies that help to advance society are significantly less diverse than the societies those technologies benefit. When significant portions of the population are not represented in the innovative process, social and economic progress suffers. The exclusion of women, people of color, and members of other disadvantaged groups from invention, patenting, and entrepreneurship leaves a vast reserve of untapped potential that could be harnessed to identify solutions to the pressing issues of the day.

Recommendations to Advance Gender Diversity in Patenting

IWPR’s work makes several research-based recommendations to help close the gender gap in patenting:

1) Programs for Diverse Inventors and Entrepreneurs

Communities, private employers, and the public sector can implement programs to encourage and increase women’s participation in intellectual property development and entrepreneurship in profitable industries. Programs that encourage business ownership can present data on industry segments most likely to provide strong business returns (such as in STEM fields) along with guidance on how to enter those fields.

IWPR’s report *Closing the Gender Gap in Patenting, Innovation, and Commercialization: Programs Promoting Equity and Inclusion* profiles seven such programs across the country

working to increase gender and racial/ethnic diversity in innovation and entrepreneurship, and identifies common program elements and promising practices. Programs featured in the report use a variety of approaches to promote relationships between women inventors and investors, provide education and coaching on the patent application process and other research and development activities, and guide women and people of color through the process of commercializing innovation, including conducting market analyses, developing prototypes, and preparing pitch presentations. Examples include Empowering Women in Technology Startups (EWITS®), which is an experiential learning program designed to provide women with an introduction to the process of forming a startup venture and developing a commercialization strategy, and STEM to Market (S2M), a two-part program that provides entrepreneurial training and support to women in STEM fields, and works with key decision-makers, investors, and funders to address systemic bias (Shaw and Hess 2018).

2) Public Support for Diversity in IP Development and Entrepreneurship

A number of promising programs and research efforts have received funding from government sources, including the National Science Foundation, the Small Business Administration, the U.S. Economic Development Administration, and the Department of Energy. Continuing to provide adequate funding for programs that show evidence of impact and investing in scaling-up the most effective programs could help level the playing field by providing women with access to education, mentors, and other resources to help them become active participants in the innovation ecosystem. In addition, exploring ways that existing government programs, such as the Small Business Administration's Women's Business Centers, could be expanded to include support services for women developing intellectual property may be another way to improve women's representation in patenting.

3) Increasing Women's Representation in STEM-Intensive Fields

Employers, grant makers, and educational institutions should also focus on increasing women's representation in patent-intensive STEM fields. Women's disparate participation in patenting has been linked to their underrepresentation in patent-intensive STEM fields such as engineering (Hunt et al. 2013). By pursuing strategies to increase women's participation in these fields, from early childhood exposure to science, to recruiting and retaining young women in patent-intensive college majors, women entrepreneurs will be more likely to pursue patents and to encourage and support other women's intellectual property development. The National Science Foundation has been integral in supporting research on women and girls in STEM and how to improve their representation. In order to ensure that we are investing in institutional changes that work, funding for such research should be sustained at sufficient levels. The for-profit sector can contribute to progress by improving hiring and promotion practices, workplace climate, and developing more programs to support diverse inventors.

4) Encouraging Investors to Finance Women Innovators and Entrepreneurs

Testing and implementing strategies to encourage investments in women-owned businesses and innovation is also critical. Women business owners' lower levels of funding can restrict the types of innovation firms can pursue, and IWPR's research shows that difficulty raising funds is one of the primary reasons that women-owned businesses close (Williams-Baron, Milli, and Gault 2018). Venture capitalists and other investors have a major role to play in enabling women-owned firms to develop intellectual property and other innovations, and in helping women-owned businesses thrive more broadly. Investors should pursue intentional strategies to minimize the influence of bias in their investment decisions. For example, following formal or informal guidelines or quotas for investing across gender or racial/ethnic lines could help investors ensure they make equitable investment decisions.

The STEM to Market (S2M) program, developed by the Association for Women in Science, is an example of a program that seeks to help investors be more inclusive. The program recognizes the importance of addressing bias among investors and funders and includes an Intentional Investing program as part of its curriculum. This program hosts leading members of the investment community and includes structured dialog about the benefits of creating inclusive portfolios and offers evidence-based tools for creating inclusive investment practices (Shaw and Hess 2018). While the S2M program is still relatively new, an evaluation of its outcomes once more cohorts have moved through the program could support scaling it up to reach a wider audience. Funds that target businesses owned by women and women of color can also help mitigate bias and increase access to capital. A number of corporations and a handful of venture funds around the country specifically target women entrepreneurs with promising product innovations.

5) Establishing Evidence on Effective Practices

Programs designed to promote innovation among women and girls should be independently evaluated to allow an evidence-based approach to replicating and scaling effective strategies. In addition, further research should be done to understand practices used in settings where women are better represented among patent-holders, compared to those with lower rates of representation. Universities, which have higher rates of patenting among women, compared with the business sector, often have Technology Transfer Offices (TTOs) which offer a broad range of supports, including contacts, advice, and education to female faculty who are developing intellectual property supports that may be less common in the private sector. Many universities do not consider patents in tenure decisions. Particularly in STEM fields, women feel more pressure to serve on committees and mentor students and, often choose to focus on academic publications with their limited time rather than pursuing patents (Murray and Graham 2007). Developing more uniform support structures, particularly within the private sector, to support women's patenting activity and considering patenting activity in advancement decisions could help advance women's inclusion in the innovation ecosystem.

We can also look to other countries to identify best practices. The World Intellectual Property Organization (WIPO) found that among U.S. inventors seeking international protections through the Patent Cooperation Treaty system (PCT) between 2011 and 2015, fewer than 30 percent had at least one woman inventor listed and just 14 percent of all inventors listed were women. Compared with other countries, the U.S. is falling behind. In both the Republic of Korea and China women are listed as inventors on at least 50 percent of all PCT applications and they make up 27 percent and 29 percent of all inventors respectively (Martinez, Raffo, and Saito 2016). Exploring the context within these countries that has contributed to the relatively high representation of women in patenting could illuminate policies and programs that the U.S. could implement to promote greater diversity.

6) Improving Data to Track Progress toward Diversity

Finally, we need to improve data availability on women entrepreneurs, especially to allow disaggregation by gender, race and ethnicity. Large surveys and public agencies dealing with entrepreneurship and innovation should collect data on the gender and race/ethnicity of survey and program participants and make data available in a form that can be disaggregated. Demographic information on patent applicants could also be collected by the USPTO on a voluntary basis and kept separate from the inventors' application. Such data would be invaluable to tracking progress toward greater inclusion of women and people of color.

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