



# Briefing Paper

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## The Gender Patenting Gap

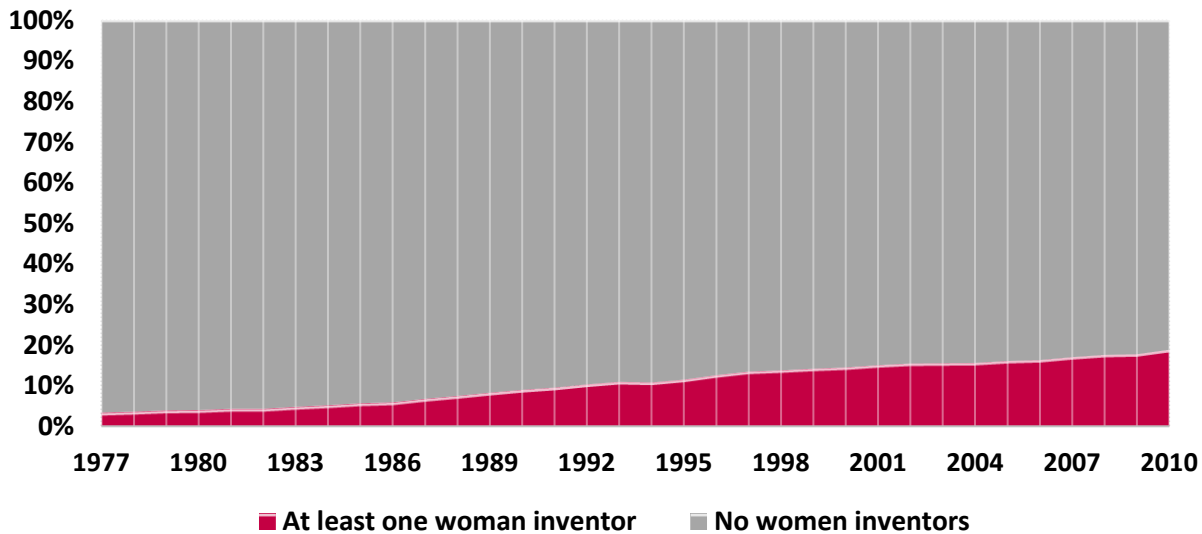
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The Institute for Women’s Policy Research reviewed and analyzed published data and literature on women and patenting, finding that women hold an extremely small share of patents, and that at the current rate of progress, gender equity is more than 75 years away. This briefing paper presents a snapshot of the data and related recommendations.

### Women’s Small Share of Patents

Although women have more than quintupled their representation among patent holders since 1977, only 18.8 percent of all patents had at least one woman inventor in 2010, compared with 3.4 percent in 1977 (Figure 1).<sup>1</sup>

**Figure 1. Share of Patents with Any Women Inventors, 1977-2010**



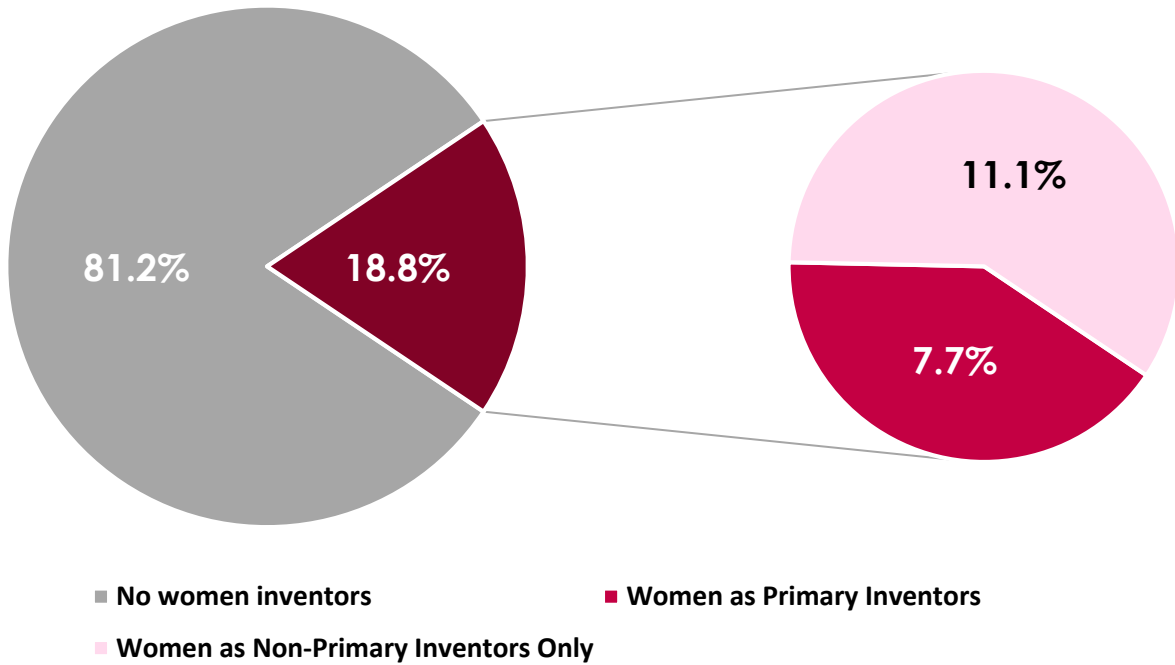
Source: IWPR analysis of Delixus, Inc. and National Women’s Business Council (2012) and United States Patent and Trademark Office (USPTO) (2016a).

<sup>1</sup> Unfortunately, due to data limitations, recent information on the representation of women of color among patent holders is unavailable.

## Women Underrepresented as Primary Inventors

Only 7.7 percent of all patents listed a woman as the *primary* inventor (Figure 2).

**Figure 2. Share of Women as Primary and Non-Primary Inventors on Patents, 2010**

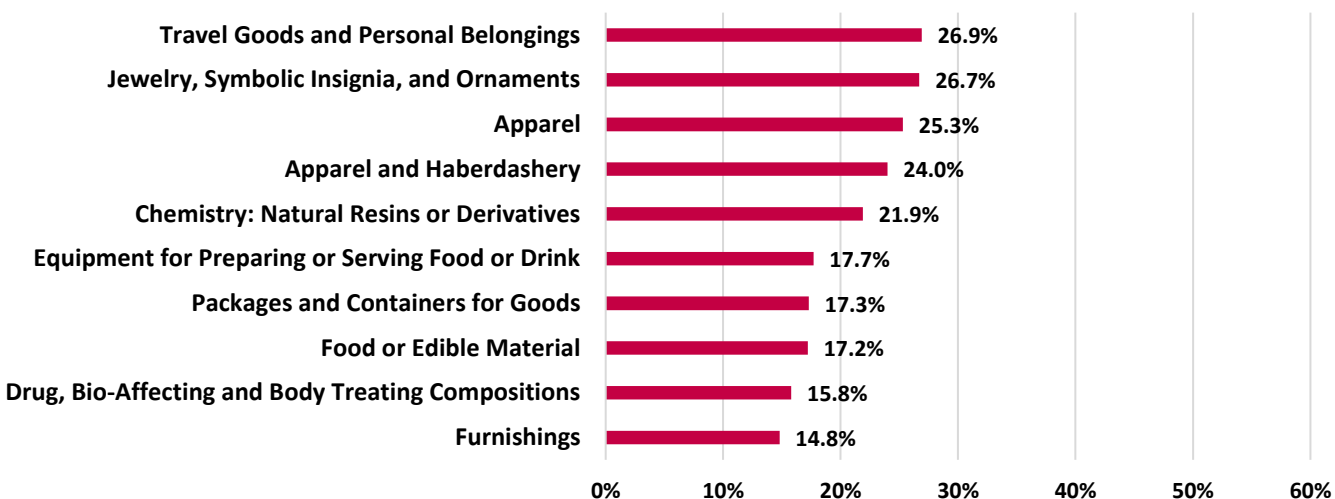


Source: IWPR analysis of Delixus, Inc. and National Women's Business Council (2012) and USPTO (2016a).

## Female Silos of Science

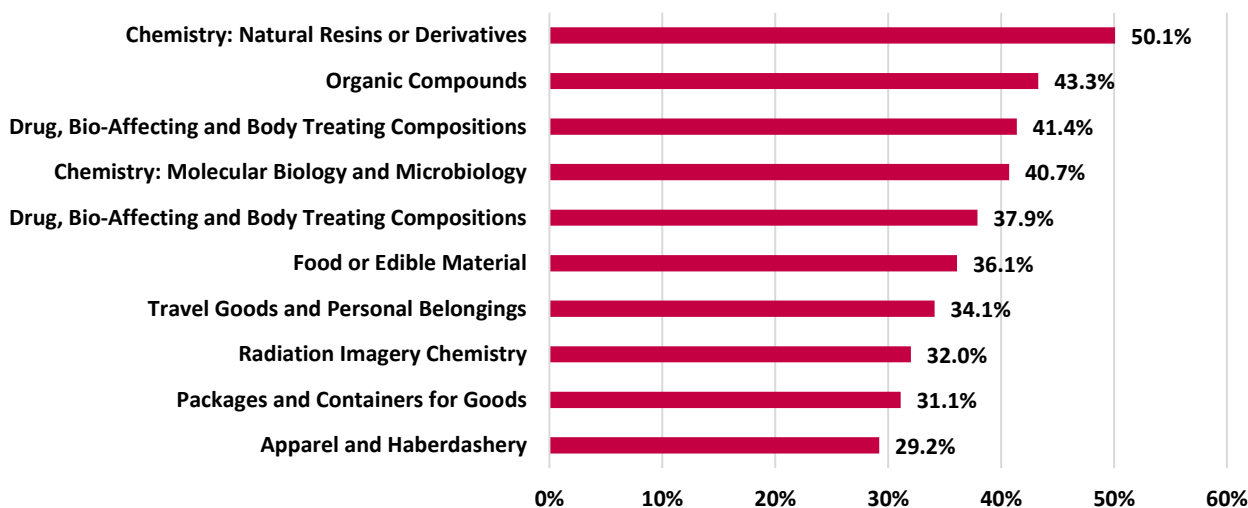
Women are rarely the “Primary Inventor” on a patent and among those who are, most are concentrated in patent technologies associated with traditional female roles, such as jewelry and apparel. Patents that have any women inventors, however, span a greater variety of patent classes (Figures 3a and 3b).

**Figure 3a. Top 10 Patent Classes by Share with a Woman as the Primary Inventor, 2010**



Note: Data represent total patent grants of U.S. origin only and do not include patent grants of foreign origin.  
Source: Delixus, Inc. and National Women’s Business Council (2012).

**Figure 3b. Top 10 Patent Classes by Share with any Women Inventors, 2010**

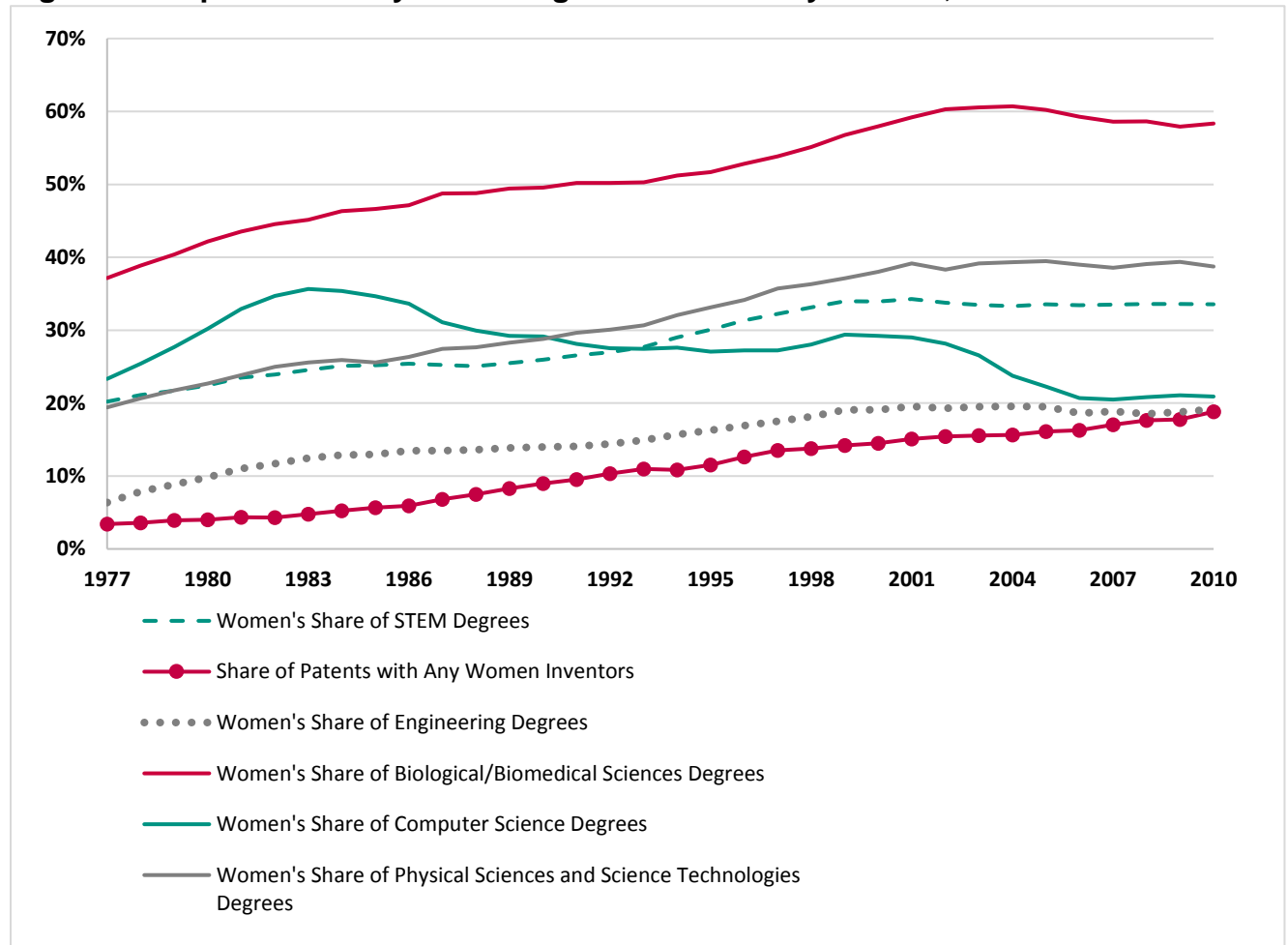


Note: Data represent total patent grants of U.S. origin only and do not include patent grants of foreign origin.  
Source: Delixus, Inc. and National Women’s Business Council (2012).

## The Pipeline is Part of the Problem

Women’s low representation in Science, Technology, Engineering, and Math (STEM) fields plays a role in their low patenting rates, and Black, Hispanic, and Native American women are especially underrepresented among STEM degree holders (Hess, Gault, and Yi 2013). While increases in women’s patenting are associated with increases in the share of STEM degrees awarded to women, women continue to be grossly underrepresented in some patent-intensive STEM fields, such as engineering and computer science (Figure 4). The ongoing scarcity of women in these specific fields may play a larger role in the patenting gap than women’s representation in STEM overall (Hunt et al. 2012). In 2010, only 19.1 percent of engineering degrees, 20.9 percent of computer science, and 38.7 percent of degrees in the physical sciences were awarded to women, whereas 58.3 percent of degrees in the biological sciences were held by women.

**Figure 4. Proportion of Key STEM Degrees Received by Women, 1977-2010**

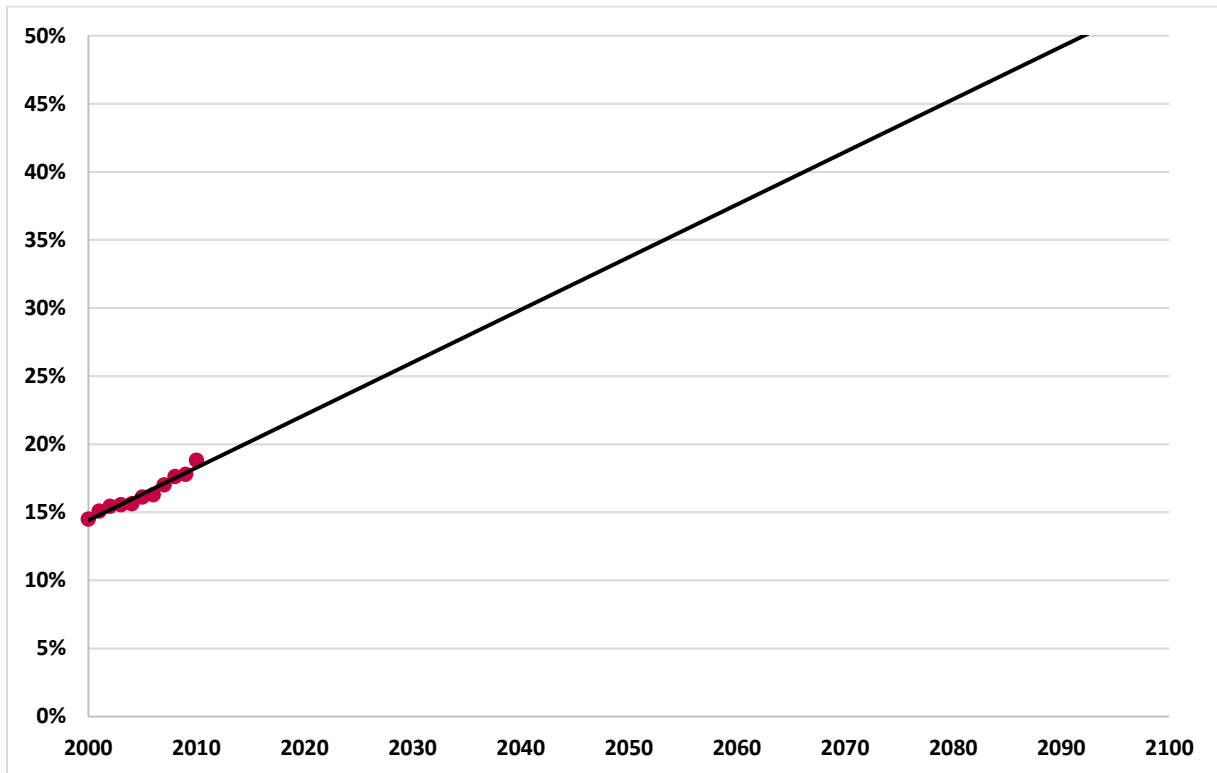


Source: IWPR analysis of Delixus, Inc. National Women’s Business Council (2012); USPTO (2016a); and Snyder, Brey, and Dillow (2016).

## How Far Do Women Have to Go to Reach Parity?

At the current rate of progress in recent years (since 2000), women are not expected to reach parity in patenting until 2092 (Figure 5).

**Figure 5. Share of Patents with any Women Inventors, 2000-2010, with Projection to Parity in 2092**

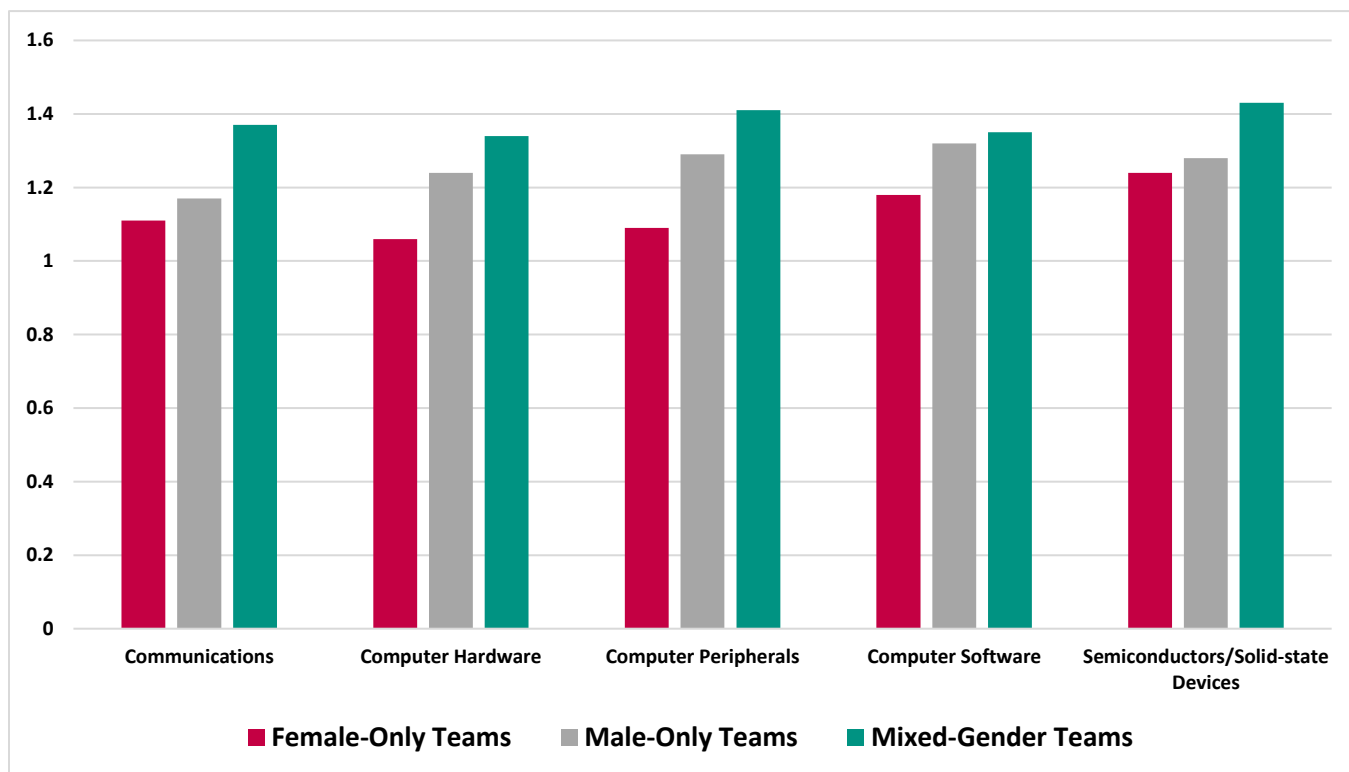


Source: IWPR analysis and projection based on Delixus, Inc. and National Women's Business Council (2012) and USPTO (2016a).

## Gender Diverse Teams Succeed

A study published by the National Center for Women and Information Technology found that IT patents with mixed-sex teams are cited more often than those with single-sex teams in later patent applications (Figure 6), suggesting that greater diversity may lead to the development of patents that are more useful and successful (Ashcraft and Breitzman 2012).<sup>2</sup>

**Figure 6. Citation Index: U.S.-Invented IT Patents, 1980-2010**



Note: The citation index developed by Ashcraft and Breitzman (2012) first normalizes individual patent citation counts by technology class and year granted in order to account for the fact that some technologies have higher average citation counts than others and that older patents have had a longer period of time over which to accrue citations. These normalized citation counts were then compared with expected citation counts based on an individual patent's technology class and age to calculate the citation index.

Source: Ashcraft and Breitzman (2012).

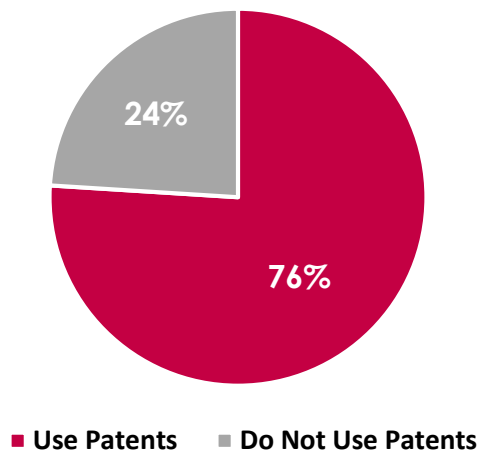
<sup>2</sup> Mixed sex teams in the study were also substantially larger than single sex teams, which could point to an alternate explanation for the teams' higher citation count. The study authors suggest that further research would be needed to assess the relative importance of diversity and/or team size (and other factors potentially associated with team size, such as invention complexity).

## Securing Support

Women entrepreneurs' access to venture capital funding is likely to be affected by their low rates of patenting. While 36.3 percent of all businesses in the United States are women-owned (National Women's Business Council n.d.), only three percent of venture capital funding went to businesses with a woman CEO between 2011 and 2013 (Brush, Greene, Balachandra, and Davis 2014). Men are four times more likely to have received outsider equity to finance their businesses than women—in 2010, outsider equity made up 12.8 percent of men-owned businesses' total financial capital compared with only 3.0 percent in women-owned businesses (Robb 2013).

Start-up managers report that 76 percent of venture capital investors consider patents in funding determinations (Figure 7). Patent applications signal quality for new projects and aid venture capital investors in their decision making process (Haeussler, Harhoff, and Muller 2009).

**Figure 7. Percent of Venture Capital Investors that Use Patents in Funding Determinations, 2008**



Source: Graham, Merges, Samuelson, and Sichelman (2009).

## Research-Based Recommendations for Increasing Women's Patenting

- Develop systems and data tools to better track women's progress in patenting.

The U.S. Patent and Trademark Office (USPTO) does not collect demographic information on inventors as a part of the patent application, so researchers typically use name-matching software to try to identify the gender or race/ethnicity of the inventors. The National Survey of College Graduates, which gathered data on patenting among college graduates in the past, has not provided data on the topic since 2003.

- Employers can offer women assistance with patenting costs.

Fees associated with filing a patent can pose a substantial barrier for women and underrepresented communities of color, since they earn less, on average, than white men (Hegewisch and DuMonthier 2016). In addition, women entrepreneurs are less likely than comparable men to have access to start-up capital (U.S. Census Bureau 2016) or to receive venture capital funding (Brush, Greene, Balachandra, and Davis 2014) that can contribute to costs of obtaining new patents.

According to one leading patent attorney, patenting expenses can include: the costs of legal help with a patent search; legal fees associated with filing any provisional application and a non-provisional application; USPTO filing fees; and the costs of professional drawings. The attorney fees just for filing a non-provisional application can range from \$5,000 to \$16,000, not including any of the other associated costs (Quinn 2015).

- Support efforts to improve gender diversity in STEM.

Hunt et al (2012) found that gender segregation within STEM fields accounts for 31 percent of the commercial patenting gap, so initiatives that encourage inclusion of women and girls into STEM, at all levels of the pipeline, can contribute to closing the gender patenting gap.

- Encourage women's cultivation of industry contacts and higher-power networks.

Meng (2016), using data from a national study of academic scientists in the United States, finds that having industry contacts is the most influential factor in patenting involvement for women. Interview studies with life scientists find that women have smaller and lower-level professional networks than men (Ding, Murray, and Stuart 2006; Murray and Graham 2007). Employers, supervisors, and mentors can take affirmative steps to open high-powered networks to women, and to value time spent developing such contacts in evaluating women's performance.

## References

- Ashcraft, Catherine and Anthony Breitzman. 2012. *Who Invents IT? Women's Participation in Information Technology Patenting, 2012 Update*. National Center for Women & Information Technology.  
<[https://www.ncwit.org/sites/default/files/resources/2012whoinventsit\\_web\\_1.pdf](https://www.ncwit.org/sites/default/files/resources/2012whoinventsit_web_1.pdf)> (accessed March 7, 2016).
- Brush, Candida G., Patricia G. Greene, Lakshmi Balachandra, and Amy E. Davis. 2014. *Women Entrepreneurs 2014: Bridging the Gender Gap in Venture Capital* (Diana Report).  
<<http://www.babson.edu/academics/centers/blank-center/global-research/diana/documents/diana-project-executive-summary-2014.pdf>> (accessed July 11, 2016).
- Delixus, Inc. and National Women's Business Council. 2012. *Intellectual Property and Women Entrepreneurs*.  
<<http://nwbc.gov/sites/default/files/IP%20&%20Women%20Entrepreneurs.pdf>>.



- Ding, Waverly W., Fiona Murray, and Toby E. Stuart. 2006. "Gender Differences in Patenting in the Academic Life Sciences." *Science*, New Series, 313 (5787): 665–67.
- Graham, Stuart J. H., Robert P. Merges, Pam Samuelson, and Ted Sichelman. 2009. "High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey." *Berkeley Technology Law Journal* 24 (4) <<http://scholarship.law.berkeley.edu/facpubs/2124> >
- Häussler, Carolin, Dietmar Harhoff, and Elisabeth Mueller. 2012. *To Be Financed or Not... - The Role of Patents for Venture Capital-Financing*. SSRN Scholarly Paper, ID 1393725. Rochester, NY: Social Science Research Network. <<http://papers.ssrn.com/abstract=1393725>> (accessed July 11, 2016).
- Hess, Cynthia, Barbara Gault, and Youngmin Yi. 2013. *Accelerating Change for Women Faculty of Color in STEM: Policy, Action, and Collaboration* (#C409). Institute for Women's Policy Research. <<http://www.iwpr.org/publications/pubs/accelerating-change-for-women-faculty-of-color-in-stem-policy-action-and-collaboration>>
- Hegewisch, Ariane and Asha DuMonthier. 2016. *The Gender Wage Gap: 2015; Earnings Differences by Race and Ethnicity* (#C437). Institute for Women's Policy Research. <<http://iwpr.org/publications/pubs/the-gender-wage-gap-2015-earnings-differences-by-race-and-ethnicity>> (accessed May 16, 2016).
- Hunt, Jennifer, Jean-Philippe Garant, Hannah Herman, and David J. Munroe. 2012. *Why Don't Women Patent?* National Bureau of Economic Research. <<http://www.nber.org/papers/w17888.pdf>>.
- Meng, Yu. 2016. "Collaboration Patterns and Patenting: Exploring Gender Distinctions." *Research Policy* 45 (1): 56–67. doi:10.1016/j.respol.2015.07.004.
- Murray, Fiona and Leigh Graham. 2007. "Buying Science and Selling Science: Gender Differences in the Market for Commercial Science." *Industrial and Corporate Change* 16 (4): 657–89. doi:10.1093/icc/dtm021.
- National Women's Business Council. n.d. "Women-Owned Businesses (WOBs): NWBC Analysis of 2012 Survey of Business Owners." <[https://www.nwbc.gov/sites/default/files/FS\\_Women-Owned\\_Businesses.pdf](https://www.nwbc.gov/sites/default/files/FS_Women-Owned_Businesses.pdf)> (last accessed July 18, 2016).
- Quinn, Gene. 2015. "The Cost of Obtaining a Patent in the US." *IPWatchdog.com | Patents & Patent Law*. April 4. <<http://www.ipwatchdog.com/2015/04/04/the-cost-of-obtaining-a-patent-in-the-us/id=56485/>> (accessed July 11, 2016).
- Robb, Alicia. 2013. "Access to Capital among Young Firms, Minority-owned Firms, Women-owned Firms, and High-tech Firms." *Small Business Administration: Office of Advocacy*. <[https://www.sba.gov/sites/default/files/files/rs403tot\(2\).pdf](https://www.sba.gov/sites/default/files/files/rs403tot(2).pdf)> (last accessed July 18, 2016).
- Snyder, Thomas D., Cristobal de Brey, and Sally A. Dillow. 2016. *Digest of Education Statistics, 2014* (NCES 2016006). National Center for Education Statistics. <<https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2016006>> (accessed May 24, 2016).
- U.S. Census Bureau. 2016. "2012 Survey of Business Owners: Table SB1200CSCB16: Statistics for All U.S. Firms by Total Amount of Capital Used to Start or Acquire the Business by Industry, Gender, Ethnicity, Race, and Veteran Status for the U.S.: 2012." *American FactFinder*. <[http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=SBO\\_2012\\_00CSCB16&prodType=table](http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=SBO_2012_00CSCB16&prodType=table)> (accessed July 11, 2016).

- U.S. Patent and Trademark Office. 2016a. "U.S. Patent Statistics Chart: Calendar Years 1963-2015." <[http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us\\_stat.htm](http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm)> (accessed July 11, 2016).
- . 2016b. "USPTO Fee Schedule." Text. April 9. <<http://www.uspto.gov/learning-and-resources/fees-and-payment/uspto-fee-schedule>> (accessed May 16, 2016).
- Winters, John. 2014. "Foreign and Native-Born STEM Graduates and Innovation Intensity in the United States." *IZA Discussion Papers Research Network*, October. <<http://ftp.iza.org/dp8575.pdf>>.

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