SANTA CLARA UNIVERSITY
SCHOOL OF LAW

SUCCESS ACT Testimony
Submission Pursuant to 84 FR 17809
June 30, 2019
Professor Colleen Chien[1]

It's my honor to submit this testimony to the USPTO based on my experience as a researcher that has been working for the past several years to use patent data to advance innovators that patent and not just patented innovation, and prior to that, as a public servant. As detailed below, this testimony recommends that:

1) Due to the absence of other sources of reliable demographic data on participation in inventing, the USPTO should collect data from patent applicants, but keep this information segregated from the examination function and initially disseminate it in bulk-reported form or for research related purposes resulting in bulk-reporting. During an initial collection period, the Office should ask applicants and stakeholders about their concerns to their data being sharing more generally, and develop policy informed by these responses.
2) In addition to collecting data about patent applicants, the PTO should more systematically collect and distribute data about assignees that support the tracking of startups, small businesses, independent inventors, minority- and veteran-owned businesses; it should also more systematically support the tracking not only of patent application, but the full participation, through grant, maintenance, and patent transaction - of underrepresented applicants and assignees - in the patent system.
3) The PTO should support investigations of the possibility of implicit, structural, or other forms of bias on participation in the patent system - for example by carrying out or supporting experimentation to uncover the root causes of the 7-21% lower grant rate to

[1] Professor of Law and Faculty Scholar, Markkula Ethics Center, Santa Clara University. 2013-215 White House Senior Advisor, Intellectual Property and Innovation. This written testimony supplements oral testimony delivered at the June 3, 2019 SUCCESS hearings held in San Jose, CA. The comments draw from several research projects. One is a multi-year project on *Patents to Advance Innovators (and not just Innovation)* (hereinafter "*Innovators*") which is underway (draft paper available upon request) that involves tracking innovators through patents, publications, and social media profiles. The second project is on *Rigorous Policy Pilots: Experimentation in the Administration of Law*, __Iowa Law Rev. __ (2019) available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3312696, which describes the use of policy pilots and rigorous evaluation by the USPTO and other government agencies to develop, deploy, test, and continuously improve policy interventions. This version contains a few cleaned up typos from the initially submitted version.

female applications, as well as considering the barriers to participation inadvertently created by the degree prerequisites of patent prosecutors[2] - and take appropriate action.

4) The USPTO should use its convening power to work with companies to uncover the practices that lead to greater rates of participation in inventing.

Although the patent system is typically thought of as a way to advance innovation, the SUCCESS Act embodies another, long-standing but often overlooked function of the patent system - to advance innovators. As detailed in related writings,[3] from the start, the US patent system has included distinct features meant to encourage participation and inclusion – at least certain kinds[4] – in inventing and distinct features meant to encourage participation and inclusion in inventing. The first patent system featured relatively low fees,[5] the ability to accept applications by mail,[6] and a merits- rather than patronage- based system for awarding patents to support low-income, rural, and worthy inventors.

Decades later, a commitment to inclusive inventing also led Congress, in 1982, to introduce fee discounts for small, non-profit, and individual inventors.[7] In 2011, as part of the America Invents Act, Congress created a new tier of fees for the smallest "micro-entity" inventors,[8] and specified the creation of regional offices of the USPTO in Detroit, Dallas, Denver, and San Jose to offer services across the country, not just in Alexandria, Virginia and support for pro se applicants.

Despite these efforts, inventing remains largely exclusive. As the USPTO's report[9] documents, women comprise about 12% of inventors, a share that is less than half of the share of women among STEM degree holders and in the STEM workforce. Based on analyzing patent records, Raj Chetty and his colleagues have concluded that, "if women, minorities, and children from

---

[2] This point is the subject of a separate comment submitted to this RFC by Professors Eric Goldman, Laura Norris, and Jason Shultz, and Santa Clara Law 2L Jess Miers, and myself.

[3] Chien, *Innovators*, supra note 1.

[4] During the first century of the patent system, slaves, non-white foreigners, and married women faced structural barriers to patenting as described *Id*. See also Olatunde Johnson, *Overreach and Innovation in Equality Regulation*, 66 *Duke* L.J. 1771, 1777 (2016) (describing "inclusion" as implicating barriers not just based on identity but poverty and geography).

[5] Peter Drahos, The Global Governance Of Knowledge: Patent Offices and Their Clients, 99-109 (2010) (describing U.S. fees as set below U.K. fees at the outset, in 1790, and lower than most European countries, for the first half of the 19th century).

[6] B. Zorina Khan & Kenneth L. Sokoloff, *Patent Institutions, Industrial Organization and Early Technological Change: Britain and the United States, 1790-1850, in* Technological Revolutions in Europe: Historical Perspectives (Maxine Berg & Kristine Bruland eds., Edward Elgar 1998).

[7] Act of Aug. 27, 1982, Pub. L. No. 97-247, § 1, 96 Stat. 317. For additional history about the introduction of reduced fees, see Jeff A. Ronspies, Comment, *Does David Need a New Sling? Small Entities Face a Costly Barrier to Patent Protection*, 4 J. Marshall Rev. Intell. Prop. L. 184 (2004).

[8] *Id.* §10(b)-(g), 125 Stat. at 316-18 (2011) (codified at 35 U.S.C. § 123) (establishing micro-entity fees and defining a "micro entity" as an inventor with fewer than four patents and whose income did not exceed three times the median household income for the preceding calendar year)

[9] *Progress and Potential: A Profile of Women Inventors on U.S. Patents*, USPTO (Feb. 2019), https://www.uspto.gov/learning-and-resources/ip-policy/economic-research/progress-potential

low-income families were to invent at the same rate as white men from high-income families, there would be four times as many inventors in America as there are today."[10]

The USPTO Should More Systematically Collect and Report Demographic Data on Patent Applicants

One of the two enumerated duties of the PTO is to "be responsible for disseminating to the public information with respect to patents and trademarks."[11] Over the last decade, the USPTO, and in particular, the Office of Chief Economist, have made huge strides in unlocking the potential of the patent and trademark datasets to generate actionable insights about the US intellectual property system. Patent records have numerous advantages over alternate sources of innovator data, including publication data, surveys, and social data (for example on LinkedIn). For example, unlike surveys, patent records cover all, not just a sample, of those with the particular trait of having filed for a patent and include penalties for misrepresenting legal facts. Because patent records are part of the public record, few privacy or proprietary barriers stand in the way.

However, while the USPTO, through PatentsView, bulk downloads, and related efforts, has done much to make valuable innovator data available, numerous barriers persist:

1. It is difficult in many cases to reliably infer the gender or race of a patent applicant based on name data, and impossible to determine veteran-status. In my own work I have attempted used numerous using name-based classifiers, with mixed results. Attempting to predict race and ethnicity identification based on last names is fraught with respect to identifying African-American and Black applicants (as detailed below), as is distinguishing between certain types of Asian inventors. Name-based classifiers also cannot reliably identify mixed races or the ethnicity of individuals that have taken a partner's last name in a bi-racial partnership. Predicted gender, though easier to assign than race, also has its limitations: as the USPTO has also acknowledged, among Asian and other foregin inventors in particular the ability to predict gender based on anglicized names is often low.[12] In addition, existing classifiers are binary in their identification.

2. The difficulty of distinguishing between African American and white names presents a significant challenge to tracking the participation of African-American and Black

[10] Alex Bell et al., *The Who Becomes an Inventor in America? The Importance of Exposure to Innovation*, 43 (December 2017) available at http://www.equality-of-opportunity.org/assets/documents/inventors_paper.pdf.
[11] 35 U.S.C. § 2(a)(2) (2012). The "Dissemination Clause," was added via the November 29, 1999 amendment to the Patent Act of 1952. Patent and Trademark Office Efficiency Act, Pub. L. No. 106-113, § 2(a)(2), 113 Stat. 1536 (1999).
[12] One way that classification could be improved is by allowing names to be reported on the ADS in the inventor's native language. In my own work, I've been able to overcome some challenges by having native readers read names written in their mother tongue.

inventors. Further efforts should be made, for example through accessing Census or other administrative datasets, to support the creation or uptake of African American inventor databases like those created by Dr. Lisa Cook,[13] to support identification of this population. The ability to track distinct groups is crucial because of significant differences in how, for example, Asian, Hispanic, and Black inventors - all "minorities" - use the patent system.

To overcome these challenges, this testimony recommends that the USPTO collect demographic data on patent applicants, but initially only disseminate it in bulk-reported form or for research related purposes resulting in bulk-reporting. To some degree the USPTO and WIPO already do this, by making gender datasets available to researchers.[14] To calibrate appropriate levels of access to the data, particularly in light of the potential of implicit bias described below, real or perceived, during an initial collection and reporting period (of, for example, 1-2 years), the Office should not make demographic information at the individual level any more readily available than it currently does. It should use this time to carry out consultations with applicants and stakeholders regarding concerns with use and dissemination of the data. This way the USPTO can develop its policy in an iterative and flexible way that balances applicant privacy and fairness as well as the need to develop data-driven inclusion policies.

In addition, although there is great interest in supporting startups, smaller innovators, rural innovators, and other underrepresented groups, data that could enable such tracking is ambiguous, poorly reported, and not consistently available. Specifically, the small and micro-entity categories are noisy, including the smallest inventors to the largest universities.
The entity data that is available is neither easily available nor captured or reported in a way that supports tracing over time. PTO assignee data in its current form is difficult to join to databases of business characteristics from which some of the variables of interest could be coded.

Thus, this testimony commends to the USPTO creation and disclosure of assignee metadata from which trends and patterns in participation in the patent system (in all of its aspects, from application to patenting to transacting) by startups, small-businesses, minority- or veteran-owned business so as to enable a fuller understanding of the role that patents play in their development and trajectory. Steps to do so could include creating a separate flag that indicates on what basis the entity qualifies for small or micro-entity payments, e,g, due to having fewer than 500 employees or on the basis of being a nonprofit. Gathering (e.g. by asking applicants / assignees or joining to datasets available to the USPTO for example through partnerships with the Small Business Association or IRS) and then releasing entity characteristics data (e.g. re: startup, veteran-owned, or minority-owned business status) to researchers would also support greater evaluation and data-informed policy making.

[13] Described, e.g. in Lisa Cook and Chaleampong Kongcharoen. *The Idea Gap in Pink and Black*. NBER Working Paper No. 16331 (2010)
[14] Namely the WIPO WGND Dictionary and the US Gender dataset.

The USPTO Should Support Investigations of Possible Bias In the Patent System

Another step the USPTO could take to advance the goals of the SUCCESS Act is to support inquiry into the implicit, structural, and other forms of bias related to participation in the patent system.

To take one example, the reasons for the under-representation of women in patenting are complex.[15] While many of the factors possibly contributing to the gap are outside the patent system, some are squarely within it. Structural barriers to the full participation of women inventors date back to the earliest inventions. For example, Hannah Wilkinson Slater is credited by many as the first woman to hold a patent, on a method for producing cotton-sewing thread.[16] Her invention post-dated the first grant to a man, by Samuel Hopkins, over potash, an ingredient in fertilizer, by three years.[17] But she was not given independent credit for the invention - the Patent Office issued the patent to Mrs. Samuel Slater.[18] The rights of married women to patent independently of their husbands was only confirmed about a century after that.[19]

Female inventors have a lower success rate on applications to the US Patent Office than male inventors, a striking study by Jensen and his colleagues has documented.[20] All-women inventor teams were 21% less likely to have their patents awarded than all-male teams, a difference that shrank to 7% when controlling for technology.[21] The patents awarded to women were worse (had fewer independent claims and had more words added, making them narrower) than the ones awarded to men and were less likely to be maintained.[22]

Patenting is not the only innovation context in which applications from women do worse. Among job applications that differed only with respect to the gender of the applicant, causal

[15] As to the gender gap in STEM in general, studies have found the differences in math and science aptitude to be "small or nonexistent," making it unlikely that differences in technical ability are the primary explanation.(Corinne A. Moss-Racusin et al., *Science Faculty's Subtle Gender Biases Favor Male Students*, 109(41) Proc. of the Nat'l. Acad. of Sci. 16474-16479 (2012).) However, research by Goet and Steary suggests that the advantages of girls and women in reading over math contribute to women selecting *into* non-STEM (rather than being excluded *out of* STEM) careers. Gijsbert Stoet and David Geary, *The Gender-Equality Paradox in Science, Technology, Engineering, and Mathematics Education.* 29 Psychological Science 4 (2018). Summarized in Olga Khazan, The More Gender Equality, the Fewer Women in STEM, The Atlantic (Feb. 18, 2018), available at https://www.theatlantic.com/science/archive/2018/02/the-more-gender-equality-the-fewer-women-in-stem/553592/

[16] As recounted in USPTO, *Progress, supra* note 9 at 3

[17] https://www.uspto.gov/about-us/news-updates/first-us-patent-issued-today-1790

[18] USPTO, *Progress, supra* note 9 at 3.

[19] *Fetter v. Newhall*, 171 F. 841, 843 (C.C.S.D.N.Y. 1883) (confirming that minors, married women, and individuals suffering from a legal disability could apply for and own patents under the Patent Act)

[20] Kyle Jensen et al., *Gender Differences In Obtaining and Maintaining Patent Rights*, 36(4) Nat. Biotechnology 307-309 (2018).

[21] Id. at 307. Though reported only in the appendix, not main article, these differences were robust and in fact grew when the models included only US inventors (Table S13) and excluded pending applications (Table S14).

[22] *Id.*

work has found that science professors (both male and female) favor male students.[23] In the context of grant funding, a crucial milestone for many fields of academia, studies across countries and disciplines show that male researchers receive more research funding than their female peers.[24] At the National Institutes of Health (NIH), a governmental agency like the USPTO, for example, awards to first-time principal investigators are 25% lower to women than to men with statistically indistinguishable publication records.[25] A quasi-experimental study of gender gaps in funding provided by the Canadian Institutes of Health Research found that ender gaps in grant funding stem from women being evaluated less favorably as principal investigators, not from differences in the quality of proposals led by men and women.[26]

What contributes to gender disparities in patenting? It is important to acknowledge that applicant and Patent Office decisions each contribute in varying degrees to who gets a patent and which patents remain in force. For example, applicants alone select the inventions on which to seek patents, as well as decide whether or not a patent, once granted, should be kept in force. The PTO, for its part, examines applications and sets the fees and the cost of patenting. The high cost of patenting has previously been cited as an obstacle to female patenting,[27] and has motivated the creation of deep discounts for small and micro-entities.

The vast majority of the gap between employment and patenting appears to be attributable to a lack of application, as even if the 12% female inventor rate were increased to reflect grant parity using the estimates of Jensen et al., it would only increase by 1-3%,[28] leaving more than a double digit gap between female technical employment (28%) and patent application (up to 15%).[29] But as to the perhaps most important outcome, whether or not a patent application was granted, conditional upon application, both examiner and applicant behavior matters: the examiner determines whether or not and how to reject an application, and the applicant decides how to respond, and whether to continue pursuing the patent. This makes it hard to tell whether or not examiners are reviewing applications differently, resulting in an "evaluation" effect, and whether or not differences in the effort or persistence applied to pursuing a patent application or, "prosecution effort" effects are contributing to the observed difference.

---

[23] Moss-Racusin, *supra* note 15 at 16476.
[24] Holly Witteman et al. *Are Gender Gaps Due To Evaluations Of The Applicant Or The Science? A Natural Experiment At A National Funding Agency* 393 The Lancet 19171, P531 (2019).
[25] See, e.g. Uzzi, Brian, Diego FM Oliveira, Yifang Ma, and Teresa Woodruff. 2019. "Comparison of National Institutes of Health Grant Amounts to First-Time Male and Female Principal Investigators." JAMA. 321(9): 898–900 (finding that first-time women principal investigators received $41,000 less in funding than men on average, despite statistically indistinguishable records, based on number of articles and citations across a range of fields).
[26] Witteman, supra note 24.
[27] Jessica Milli et al., *Equity in Innovation: Women Inventors and Patents*, IN□T. □OR WOMEN'□ POL'Y RE□. (Nov. 29, 2016), https://iwpr.org/publications/equity-in-innovation-women-inventors-and-patents/
[28] 7%-21% of 12%.
[29] 28%-15%

How important are "evaluation" as opposed to "prosecution effort" effects to the lower success rate of female applications? Two data points seem to suggest different answers to this question. First, when the examiner allows an application without consultation with the applicant through a so-called "first action allowance," a pure "evaluation effect" on grant rates can be observed. It appears that differences in first action allowance rates are relatively small[30] suggesting that if an evaluation effect is contributing to a disparity in grant rates, that it is quite modest, at least at the first action stage.[31] Cutting against this finding, however, is the finding that the gender disparity in grant rates appear to be much greater among inventors with familiar names like Jane and Lily, which were associated with an 8% gender gap, rather than unfamiliar names like Kunnath, which were associated with a 2.8% gender gap. As Jensen et al explains, because the gender of the inventor is presumably known to the applicant as well as inventor, implicit bias in evaluation, based on names, could be operating. Because foreign applicants tend to have forenames that are less readily associated with a particular gender, the operation of such a mechanism could have the unintended consequence of particularly disadvantaging US women inventors.

An Experimental Approach to Testing Bias in Inventing

To test for implicit bias, in evaluation or alternatively, in prosecution effort, a well-designed mechanism pilot or set of pilots would be worth carrying out. One relatively straightforward and inexpensive way to do so at the Patent Office would be through a mechanism test. Borrowing from "resume studies" that send identical resumes with different names to evaluators, a gender pilot could test the impact of a person's name on patent examination by sending identical patent application to examiners, half of which had the female version of a name and half which had the male version of the name.[32] Carrying out a study in which the only difference between the treatment and control is the applicant's name has the benefit of reducing the impact of unobserved variables.

Rather than subjecting the application to a full examination, to keep costs low, the USPTO might be able to exploit pre-existing processes for assessing the readiness of patents. Each examiner could be given one version of the application and asked to rate it for its compliance with one or more statutory categories of patentability. The application and rating scheme should be designed carefully so as to elicit a spread of ratings - not just a single binary decision. Natural experiments, for example associated with the omission of first names (or inclusion of initials only) – on the assumption that gender is being inferred from first names – on some patent

[30] Jensen et al, *supra* note 20, at Online Appendix, S14

[31] In a similar vein, an applicant's decision to withdraw from prosecution before the patent has begun substantive examination, or "early abandonment" reflects only the applicant's, not the examiner's behavior, and could be used to isolate the impact of a persistence effect on differences in grants.

[32] To observe an effect size of 20% would require as few as 93 observations per control and treated group, and an effect size of 7% would require more like 771 observations per group.

applications[33] could also be studied though interference through other means, for example, direct contact with the inventors or patent attorney would need to be screened out. However, uncovering the true gender identity of the applicant would require successful attempts to locate and confirm gender with the inventor, which could introduce considerable selection bias. Another kind of natural experiment could be carried out by looking at the impact of implicit bias training on gender differences. Regardless of the specific rigorous testing approach, if bias is detected, the agency could justify taking steps ranging from targeted implicit bias training to blinding,[34] and then use this mechanism to test for the effectiveness of the training.

The private sector might be interested in carrying out its own tests, for example, by initially blinding a subset of applications with female inventors (chosen at random) and observing any change in the difference of outcomes. However, there is currently a non-zero risk and cost associated with doing so. The Application Datasheet (ADS) rule[35] and the inventor's oath or declaration rule[36] require the legal name of the inventor to be supplied. If the inventor's legal name includes a first name, supplying less than that, for example a first initial or just a blank, would not comply with the rule. Consultations with the USPTO[37] have confirmed if an applicant wanted to initially provide a "blinded" (e.g. first initial or omitted) name followed by a full first name, then a petition to correct the name of the inventor under 37 CFR 1.48(f) would be required, introducing the need for attorney's fees and a USPTO fee pursuant to 37 CFR 1.17(i), as well as uncertainty because the petition would have to be formally granted.

The USPTO could dramatically reduce this risk however, in any number of ways - by creating a non-petition based pathway to correcting inventorship name, encoding the presumptive grant of a name-correcting petition and waiving its fees, or providing other procedural support. As such the USPTO has several options for affirmatively acting - either through its own pilot or supporting the private sector in its pursuit of such pilot or both - to support the investigation of the 7-21% gender gap in inventing.

<u>The USPTO Should use its Convening Power to Encourage Participation in Inventing</u>
The description above outlines how the USPTO can work with the private sector in a novel, collaborative approach to increasing inclusion in innovation that could be emulated by other agencies dedicated to improving inclusion in innovation. It could also be applied upstream to decisions made before the decision to apply for the patent, with the USPTO working to convene and encourage cross-company sharing of best practices for encouraging inclusive inventing such

[33] My analysis suggests that out of 3.5M unique inventor names in the PatentsView database, 537K are missing first names, and 760k have only 1-2 letter names, suggesting a path forward for exploring this strategy.
[34] Doing so en masse, its important to acknowledge, could represent a significant change to how the Office carries out examination. That's because, currently, Examiners often use full inventor and assignee names to do searches for prior art and relevant other invention, in the context of normal prosecution and interferences.
[35] 37 CFR 1.76.
[36] 37 CFR 1.63.
[37] Email with USPTO official dated May 29, 2019 on file with the author.

as, for example, spotlighting prominent female inventors to bring greater visibility, ensuring a diversity of decision-makers related to ideation and invention disclosures, setting diversity targets for counsel, and promoting incentives to innovate in ways that resonate with women.

By calling for the sharing of information, and then the sharing of the results of rigorous pilots in their application across companies, the USPTO - itself one of the US government's preeminent innovation agencies - could play a transformative role in harnessing its own innovation in policymaking to advance an inclusive innovation economy.