

TACKLING THE GENDER AND RACIAL PATENTING GAP TO DRIVE INNOVATION

Lessons from Women's Experiences

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INTRODUCTION

Innovation is a hallmark of American culture, fostering societal growth and development while also stimulating the economy (Council on Competitiveness 2020). In the innovation process, women and people of color are woefully underrepresented as inventors (Milli et al. 2016). Yet greater diversity of perspective and lived experience among inventors will improve the chances that we discover solutions to some of the world's biggest challenges, such as pandemic outbreaks, food insecurity, and climate change. A diverse workforce also has the potential to drive innovation: organizations that encourage it can become more creative, efficient, and inclusive (Mayer, Warr, and Zhao 2018). Increasing efforts to diversify the science, technology, engineering, and mathematics (STEM) fields, particularly by improving access for White women and women of color to enter STEM careers and thrive, is key to unlocking the true potential of the United States' innovation-based economy (Fechner and Shapanka 2018; National Women's Business Council 2017). Creating more equitable opportunities will require inclusive and proactive policies to address the barriers that women and people of color face at every stage of innovation and patenting.

While the share of patents with at least one woman inventor grew from 20.7 percent to 21.9 percent between 2016 and 2019, this improvement is smaller than that of other benchmarks of women's education and employment as scientists and engineers (Toole et al. 2020). Women continue to face challenges that prevent them from patenting and innovating at rates on par with men. There is little data on the share of patents held by women of color. However, given the challenges people of color

face in innovation and patenting—and the multiple, overlapping race-gender barriers women of color face in the workplace and society—it is safe to assume that women of color apply for patents at even lower rates than White women (Collins et al. 2020; Crenshaw 1989; Fechner and Shapanka 2018).

Multiple obstacles prevent women from inventing and patenting their inventions. Women are often deterred from patenting their inventions because the patenting process is complex, expensive, and time-consuming (National Women's Business Council 2012). Without education about and exposure to innovation and patenting, many women inventors do not have basic knowledge about the patenting process. Working through patent drafts, developing relationships with intellectual property attorneys, and responding to feedback from the U.S. Patent and Trademark Office are all necessary steps for success, but can be intimidating for a new inventor. Given the lack of formal education on the process, engaging with a mentor and expanding one's network are key steps in gaining valuable feedback, advice, and support for years to come. Yet, women have a harder time accessing the mentors and networks they need to succeed (Giang 2015; Williams 2011).

Women face various systemic obstacles throughout the innovation and patenting process, with women of color experiencing additional challenges stemming from systemic racial inequity. Women of color find themselves trailblazing their own paths as they face the intersecting impact of challenges associated with both their gender and race. The gender gap in patenting can only be partially explained by the smaller number of women entering patent-intensive sectors (Fry, Kennedy, and Funk 2021; Sugimoto et al. 2015). Rather, women face structural barriers that reinforce, and are reinforced by, typical feminine stereotypes, such as women taking fewer risks, not speaking up for their projects, and thinking about commercializing their inventions less often than men (Burk 2018). Women may also be afraid to ask questions for fear of seeming less intelligent and they may lack confidence in men-dominated spaces. Yet, organizations with greater gender and racial diversity have higher research and development (R&D) intensity, file for more patents, and report greater innovative efficiency (Cheng and Groysberg 2020; Mayer, Warr, and Zhao 2018). Thus, while diversifying the innovation sector will yield greater productivity, the share of women in patent-intensive positions is still far behind parity with men.

This brief contributes to existing research on the lack of diversity in patenting, highlighting the challenges women generally and women of color in particular face as inventors and innovators, and how those challenges affect their ability to successfully patent their ideas. Relying on findings from 21 semi-structured interviews, this study explores each stage of the patenting and innovation process, from developing an idea to applying for a patent to receiving a patent. Interviews were conducted with a diverse sample of participants, representing different gender and racial/ethnic identities, career stages, and industry sectors. Respondents included five men and 16 women, 11 of whom were women of color. All interviewees successfully obtained at least one patent. Many have multiple patents.¹ Appendix A provides more information on the research methodology.

This brief describes the challenges and facilitators to success that women inventors face at each stage of the process. It first discusses the systemic barriers to innovation and patenting faced by women, women's lack of formal education on the patenting process, informal education on patenting and the importance of mentors, and gatekeepers to patenting. Then the brief details how barriers to the patenting process, and the supports women need to overcome them, differ by industry and sector. It concludes with policy and program recommendations that, if implemented, will help promote diversity in the innovation and patenting process.

¹ Ten interviewees had one to five issued patents, two interviewees had six to ten issued patents, and nine had over 15 issued patents. While ten participants have filed solo patents, 11 have only filed patents as part of a team setting.

SYSTEMIC BARRIERS TO INNOVATION AND PATENTING: GENDER AND RACE MATTER

All women, and particularly women of color, face systemic obstacles in the innovation and patenting process. Of the 21 innovators interviewed, twenty said that women and men have different experiences of the innovation and patenting process. Many of the men interviewed struggled to pinpoint the specific barriers faced by White women and women of color. However, all the women interviewed felt there were numerous systemic barriers that make it difficult, if not impossible, for women to patent their innovations.

Women's Underrepresentation in STEM and Other Patent-Intensive Fields

Most of the women inventors, and almost all the men inventors, interviewed attribute the lack of diversity in patenting, at least in part, to the lack of White women and women of color in STEM. In fact, most of the men interviewed thought the lack of gender equity on patents was primarily due to a "pipeline" issue—i.e., the lack of women entering STEM and patent-intensive fields. Educational attainment trends show that while women continue to earn degrees in STEM fields at increasing rates, their presence in engineering and technology fields is significantly lower than in health-related STEM fields (Fry, Kennedy, and Funk 2021).

All the men and 12 women interviewed reported that they were first exposed to STEM and innovation before or during high school. Four women reported they were not exposed to STEM and innovation until college. Yet, most of the women interviewed spoke about the barriers faced by young women when entering STEM fields:

"I would say from a young age, it was pretty limited exposure [to STEM]... It wasn't necessarily a thing that I was encouraged to do. I remember when I was trying out for my math team in middle school, the coach specifically told me 'Oh, there are never any girls on the team.'"

—Asian woman, entrepreneurship²

"Growing up I never had...exposure to STEM. I had science classes in school but really it wasn't in my immediate environment... No one in my family really was in any STEM fields... I didn't know you could be, you know, a scientist."

—Latina woman, corporate

Much more than "pipeline" issues are at play here; women in STEM are less likely to patent than their male colleagues (Burk 2018). Many experts attribute this innovation gap to stereotypes about women, structural barriers, and bias throughout the STEM fields (Burk 2015). Even as more women continue to graduate with STEM degrees from undergraduate and graduate programs, the structural barriers they continue to face in the workforce places them at risk for being overlooked, not taken seriously, or pushed off the innovation career path.

All women interviewed said that STEM fields remain heavily men-dominated. In fact, all the women said that White men dominate the fields they work in, occupy most of the corporate leadership positions, or attract the most media attention for their inventions and startups.

² In this briefing paper, interviewees are identified by their gender, race, and the general industry in which they patent. IWPR segmented each interviewee's work experience into three categories: academia, corporate, and entrepreneurship. For interviewees with patenting experience in more than one category, both categories are noted.

Many women said that it is important to see women who look like them succeeding in STEM fields. However, these role models are still few and far between:

"You don't see people who look like us in leadership positions who are inventors. Most of the inventors are White men who are engineers. So, when you don't see people who look like you that are doing certain things, you just can't picture yourself doing it."

—Latina woman, entrepreneurship

"I think probably just a lot of how it's portrayed...the idea of a 'tech bro' startup... You have to be a cis[gendered] White guy to really get the funding and make it big... I didn't think someone like me could lead a company or start a company. I just didn't have role models."

—Asian woman, entrepreneurship

Work-Life Balance

Seven women and one man interviewed spoke about the importance of work-life balance issues for women. Women face numerous constraints—such as additional caregiving, household task responsibilities, and other family obligations—that hinder or limit career advancement and opportunities to innovate and patent. Colleagues and corporate leaders may question women's commitment to their careers once they have children. Women inventors often face a "motherhood penalty," the perceived notion that if a woman has a child, she is less dedicated to her career and, therefore, will be less likely to be considered for promotions or leadership opportunities. This hurts women's career advancement and pushes many out of the workforce altogether (Warfield 2018). These biases and women's additional caregiving responsibilities create barriers to women's professional advancement (Delgado, Mariani, and Murray 2019). These barriers also limit the time women are able to devote to innovation and patenting:

"I just feel like as a female or a minority, sometimes you have other additional responsibilities...a lot of women leave the workforce for kids. Even now in the pandemic, women are taking on the burden of all the additional tasks... They have a lot of responsibility caring for family."

—Asian woman, entrepreneurship

"You have to be in a slightly privileged position to be able to [patent] because it costs money and it also costs time. So, that means you have to take money away from something else or time away from something else to be able to do it and...you can only have that risk-taking mindset if you have some form of stability."

—Asian woman, entrepreneurship

To overcome these barriers, corporations must be dedicated to cultivating women inventors. The COVID-19 pandemic has increased caregiving burdens, forcing many working women to leave their careers (Mason, Flynn, and Sun 2020). In men-dominated, innovation-heavy fields, the existing gender and racial gaps will only widen without additional supports for all women.

The Difficulty of Being the "Only" One in the Room

Many women said they do not feel welcome in innovation spaces, which they attributed to being the "only" one in the room: the only woman, the only woman of color, etc. Women professionals who are the "only" are more likely to have negative experiences, including having their abilities challenged,

being the target of unprofessional remarks, and feeling like they are the stand-in for all women (McKinsey & Company and Lean In 2018). Seven women talked about being the "only" in the room:

"Most of the time, we were the only all-female group [pitching to investors]... The people who are judging [our pitches], they are older White guys... It's very intimidating...and that's definitely one experience we've noticed a lot. We were the only all-female minority group there."

—Asian woman, entrepreneurship

"I've had some experiences too, like people questioning the scientific basis of what I'm doing or asking me for more things than they will ask other men."

—Latina woman, entrepreneurship

"I get invited to events with other technical co-founders. I get there. Everyone is a man. I am the only female and then I get the same exact questions, which are like, 'Wow, your product is so cool. Who did the actual chemistry? Who did this? Who did that?' and I'm like, 'I did.'"

—Asian woman, entrepreneurship

Stereotypes, Discrimination, and Bias

Stereotypes about women inventors stall their professional progress. Women are perceived as being less interested in commercializing their inventions, less willing to take risks, and less competent in their field, reinforcing existing biases against women in men-dominated fields (Burk 2018; Carli et al. 2016). In Carli et al.'s 2016 study, stereotypically "male" traits were more closely associated with those of a scientist than stereotypically "female" traits. Study participants reported that successful scientists are more competitive and willing to take risks, suggesting men are perceived as more likely to succeed in STEM careers.

Every woman interviewee shared multiple stories of the ways stereotypes, biases, and discrimination impacted them, their careers, and their innovation and patenting journey. One man said that women in his field (health) were encouraged to go into practice rather than research because it would be a better fit for women who wanted to have families. Several women interviewed spoke about their own experiences of this bias in the workplace:

"I have definitely felt bias. And in this particular company, it comes three ways, right. There's gender, there's age, and then there's the marketplace I'm in. And when you put those together, it's made this just an incredibly difficult journey even for somebody who's done, you know, what I've done."

—White woman, entrepreneurship

"I feel like if I weren't as involved, I wouldn't get to where I am. Whereas I feel, for a male colleague, they can just say, 'Okay, I have this,' and then they will get everything done without them having to oversee every step of the way to ensure that they get to the finish line."

—Latina woman, corporate

One inventor, who co-founded a startup with her two men colleagues, said that she had experienced multiple incidents of sexual harassment:

"Once an investor asked me—and my two cofounders are both guys—if we were in a three-way relationship, which is very inappropriate. It was at a table for a due diligence session... Clearly, if I was a guy, that question never would have been asked. They would have never asked if this was a three-way relationship."

—Asian woman, entrepreneurship

Women of color in STEM often experience additional race-gender biases. With few visible role models or mentors in their field, it is challenging for women of color to overcome discrimination (TrustRadius 2020). Women of color often experience "imposter syndrome," which is a lack of confidence in oneself or feeling like a fraud. Many trailblaze their own path without guidance from other women inventors of color (Collins et al. 2020). Eight women (six of whom were women of color) said that they had felt imposter syndrome:

"I think there are for women...mental and psychological barriers to entering STEM. I definitely think that impacted me a lot growing up and I think it still impacts me to this day since often when I talk about what I'm most insecure about, it's my technical know-how and my technical knowledge. I always wish I knew more. I always feel like I don't know enough."

—Asian woman, entrepreneurship

"I think [the feeling of imposter syndrome] played a lot into me not speaking up... I think that played a huge role because I did not want my advisor at any point to think that he made a mistake by selecting me as a student in his lab and I wanted to make sure that I represented myself as a woman and as a minority in a positive light."

—Black woman, academia/entrepreneurship

Despite feeling imposter syndrome, all eight women said they wished they trusted themselves and their own work earlier on. At the same time, most women said that women are often held to higher standards. As a result, women feel that their ideas and products had to be polished before they could approach supervisors, university technology transfer offices,³ or patent attorneys. This phenomenon means that women inventors are often in a double bind where they want to trust themselves but are held to higher standards than their male counterparts.

³ For inventors in academia, technology transfer offices are responsible for assisting with the patenting process and other aspects of the commercialization of research for innovations that take place within the college or university. Offices are common at large research universities and provide resources to faculty throughout the innovation process. Technology transfer offices often take the burden off the specific inventor, by taking care of the most time-consuming and expensive parts of the patenting process. However, the tradeoff for inventors is that all intellectual property is owned by the institution.

LACK OF FORMAL EDUCATION ON THE PATENTING PROCESS

Given the complexity of the patenting system, a lack of formal education about patenting prior to undergraduate or graduate studies means that many inventors do not have the requisite background or knowledge of the patenting process. This lack of basic knowledge will keep many men and women from even contemplating patenting in the first place. This can especially disadvantage women, people of color, and those from low-income communities, as they are less likely to be exposed to or encouraged into STEM fields or have the resources to explore innovation and entrepreneurship at a young age (Bell et al. 2019).

All interviewees, both men and women, said they did not receive formal education on the patent process. While none of the inventors were taught about the patenting process as part of their high school, undergraduate, or graduate classes, this lack of education affects women differently from men. Women face additional barriers in accessing mentors and other networks that are important sources of information on patenting. This initial barrier to patenting is often insurmountable for women, preventing them from patenting their innovations or ideas.

Understanding What Is Patentable

Five women inventors said that when they began in the innovation field, they did not understand what constitutes (and does not constitute) an invention:

"I knew nothing about the patent space; I knew nothing about what to do with your ideas. I didn't even know that academics patented their ideas."

—White woman, academia

"I think before even getting started in the process, understanding how to identify that you invented something, I think that's the main [barrier]... Scientists, engineers, people in STEM, they're inventing new things almost on a daily basis. But most of us don't know how to identify that we did."

—Latina woman, corporate

Where to Find Information and Resources

The lack of formal education also means many women do not know where to find resources about patenting:

"The barrier was not really knowing how to write a patent...and once you are told by your [academic] advisor to write a patent, where do you go for resources to figure out how to draft an invention disclosure when that's not something that you're taught before?"

—Black woman, academia/entrepreneurship

"I really didn't have anyone to go to and be like, 'Can you explain [this] to me?' So I had to learn a lot on my own."

—Latina woman, corporate

Understanding the Basics of the Patenting Process

Five women said they were confused about the patent review process, and particularly what it meant to receive a rejection from the United States Patent and Trademark Office (USPTO). Many said they were confused about when a rejection is truly a rejection and when it is an opportunity to refine and resubmit the idea:

"I think the lack of knowledge is the biggest [barrier]. And the tiny little things, like when I submit it the first time, I'm probably going to get a rejection, but that rejection is going to help me submit it stronger the second time."

—Black woman, academia

"My team and I interpreted [negative feedback from the USPTO] as a very bad thing—like oh, this means they didn't accept it and now they're asking us to change all of these things. When I took the [accelerator program] I learned that's exactly what's supposed to happen."

—White woman, entrepreneurship

When asked what advice or information is most important for women who are beginning the patenting process, one White man and prolific inventor discussed the importance of understanding "first to file":

"In our country, where there's 370 million people, the idea of you being the only person to have this idea, this invention is like, it's foolhardy. I guarantee you no matter what you've done, if you look hard enough, you'll find three to five other people have done the same thing. That's why 'first to file' is so important."

—White man, corporate

This confusion and the lack of understanding follows women throughout their careers. Women are left in the dark, as the current systems leave them without the necessary information or resources to progress and succeed. One Asian woman, who is intricately involved with patenting as the chief technical officer and co-founder of a business, said:

"As someone who writes [patents], I still sometimes am deeply confused about what I'm doing and I think the fact that all the knowledge is in the hands of these very expensive patent lawyers isn't good for access."

—Asian woman, entrepreneurship

INFORMAL EDUCATION AND MENTORING

Given the lack of formal education, mentors who are willing to guide new inventors through the patenting process provide essential information (National Women's Business Council 2012). Academic advisors, supervisors, and colleagues often assist new inventors in understanding the patenting process. These relationships are crucial because many students and early-career professionals know little about patenting until someone teaches them.

All the interviewees said that they relied on the informal education—from mentors, accelerator programs, or on their own—to learn about the patenting process. Those who had been successful with the patenting process attributed much of this success to their informal support networks and mentors. Nearly all interviewees said that mentors provided them with important and trusted information about the patenting process. Yet, there were stark differences between men's and women's experiences with mentors.

Men Inventors Have Easier Access to Networks and Mentors

All the men inventors discussed the importance of their personal networks and connections to mentors who helped guide them through the patenting process. None of the men said that they had trouble finding mentors and support networks. In fact, the opposite was true. One White man inventor talked about the importance of his friendship with a patent attorney, who helped him file his patents and explained the entire patenting process. An Asian man inventor discussed the essential guidance and financial assistance he received from his networks of mentors, who assisted him with both patenting and launching his business.

In contrast, only two women interviewees reported having easy access to support networks and mentors. One Asian woman interviewee "got significant help" from her father, who was also a patented inventor, and relied on her father's network of mentors and supports. The second woman was married to a patent inventor, and she said her husband was an important resource when navigating the patent application process.

Women Work Harder to Build Networks and Find Mentors

Most of the women (14 of the 16) said they had to work hard to find resources, mentors, and networks to help them succeed:

"I feel like I had a lot of support throughout the years, but I had to find that and I had to look for all the opportunities. It wasn't, like, things just magically just came to me... I really had to go out of my way to learn and then get opportunities for myself."

—Latina woman, corporate

"I think really it is being outsiders versus insiders. If we think about who's inside the patenting system, right? So, you've got the prolific inventors and the attorneys, and if they've been around in the space for a long time, they may or may not want to have some new person come into their turf. If that new person looks different, they can feel very threatened."

—White woman, corporate

Women interviewees also often spoke about not being invited into the spaces where innovation often occurs or where decisions are made. Exposure to the patenting process often depends on the discretion of the advisor or supervisor, and advisors and supervisors are more likely to mentor someone of their race and gender:

"Honestly, I feel that we're not being invited into that space. And, you know, it's a White male-dominated [space]...and it's been kept like that for a long time... If my advisor didn't tell me, 'We're going to file a patent,' I'd have no idea. I never heard of that. I'd never be invited. There's so many of us, especially women and minorities, people of color, we don't have that... That part is being kept from us."

—Latina woman, corporate

GATEKEEPERS TO PATENTING: THE QUALITY OF NETWORKS AND ADVOCATES MATTER

The quality and reach of professional networks and contacts is important to patenting success. More than mentorship, sponsorship—having someone “in the room” advocating on one’s behalf—helps new inventors get named on patents. Not all individuals who contributed to a patentable innovation will be in the room when the decision is made about who will be named on the patent. Those in leadership positions are likely to determine who gets included on the patent and who is left off. Because fewer women hold leadership positions, they are much less likely to be in the room when these decisions are being made. The gatekeepers to patenting are vital in ensuring that women, and women of color in particular, get the credit they deserve for their work.

Supervisors and Advisors

Women in both academia and corporations said that academic advisors and supervisors play an important role in ensuring that women, particularly women of color, get credit on patents:

“I’m very fortunate that my mentor gave me 50/50 ownership over that patent. I had nothing to do with that discussion... He negotiated a pretty good payout for it... I think there’s always a power dynamic between the trainee and their mentor. Obviously, in that situation, I had very little power. I was fortunate that my mentor was willing to utilize his power on my behalf but yeah, would I be at even more of a disadvantage if my racial background or my economic background or anything about me was more minority than mine? I don’t know, maybe.”

—White woman, academia

“You might be in a research group meeting where you provide the idea, and you get left out. And it happened to me, and then some colleague of mine actually brought it up, saying, no, this was actually her idea, so I’m going to add her to the list [of patent authors].”

—Asian woman, academia/corporate

The lack of sponsorship was often discussed as a major barrier to getting named on a patent, particularly for the women of color:

“[Those] with the PhDs [in my company] tend to be White and male. So, then they end [up] being named inventors on the patents, because they’re pulled into the meetings that are thinking about the patent. I think it’s mostly just the people that are in higher positions tend to get to be in on the brainstorming.”

—Asian woman, entrepreneurship

“My first interest in getting a patent [came because]...I found that my advisor actually patented [our invention]. With a guy that I’ve never heard of. And so, I was like, what is this patent thing, and how could he do it without me?”

—Black woman, academia

Patent Attorneys

Patent attorneys play a crucial role in the patent application process. While each one of the interviewees talked about the importance of patent attorneys, the women inventors were more likely to talk about challenges they faced in dealing with patent attorneys. These challenges were

not echoed by the men inventors. Seven women talked about the disconnect between the legalese needed for the patent and the technical specifications of their inventions. The back and forth to address inaccurate changes made by the attorneys added time and, in some cases, money to the patenting process:

"The hardest thing for me was communicating with the lawyers. They were super smart and super good at what they do but they're not experts in anyone's field; they're experts in their own field of patent law... They would take my ideas and try to word them in a way that made sense legally but that ended up not being correct at all so...[it] took months of trying to make sure that the idea was communicated clearly."

—White woman, academia

Hiring a quality patent attorney often takes time and money. All the women who patented outside of academia and corporations noted the importance of investing in quality patent attorneys.⁴ One woman described a lesson she learned when trying to save money by using a lawyer friend:

"[The patent] isn't as comprehensive as we need and our angel investors are also kind of looking at us being like, you can't save money on lawyers. That's the one thing as a startup...you can't save money on. You need to find a good law firm as soon as possible, one that will take you on as a startup, one that will view you as a priority, will be able to give you discounts, but also not charge you too much."

—Asian woman, entrepreneurship

The women inventors also spoke about how gender and racial bias affected their experiences with patent attorneys:

"Patent lawyers are more likely to pursue drafting the patent applications of White men than some of these other demographics."

—White woman, entrepreneurship

"There was a time where we were sitting with lawyers...and then there was a point where they were explaining something to us and we were trying to explain something back to them. It was really frustrating because we understand what they were saying. They didn't understand what we were saying, but they keep repeating the same basic information to us as if we didn't understand it."

—Asian woman, entrepreneurship

One Latina inventor insisted on working only with women patent attorneys:

"I'm very intentional about the hires that I do... I wanted to work with women. I find them better [to work with] than men in general."

—Latina woman, entrepreneurship

⁴ Inventors who patent within universities or corporations do not incur the cost of filing the patent or hiring a patent attorney because they have access to in-house counsel or other legal counsel through their university's technology transfer office. Inventors outside of universities and corporations must cover these costs themselves.

Technology Transfer Offices

In academia, inventors who want to patent must work with their university's technology transfer office. Technology transfer offices guide academics through the patenting process, bring their own teams of patent attorneys, and ensure that patent fees are paid. Three inventors, two men and one woman, said that their university's technology transfer office made the patenting process run smoothly. However, several women spoke about the barriers and biases they faced when working with technology transfer offices:

"Often, what happened was [the technology transfer office] would file patents of people that had previously patented something or shown commercialization success with their patents. So, if you're new, and you don't have a history of patenting something with them or showing that your patent can be commercialized, you were less likely to be picked for the process."

—Asian woman, academia/corporate

This bias often privileges established academics, who are more likely to be White men, and disadvantages newer academics, who do not yet have extensive patenting track records.

PATENTING CHALLENGES, AND THE SUPPORTS NEEDED TO OVERCOME THEM, DIFFER BY SECTOR

Women face distinct and unique challenges depending on where they are working when they patent. Likewise, the supports needed to overcome these challenges differ from one sector to the next.

Academia

The women interviewees cited several barriers to patenting that are unique to academia. First, faculty who are interested in maintaining the sole intellectual property (IP) rights to their patents must either use their own resources to patent outside of their academic institution or they must buy their patent back from the university after it is filed and approved. This can be a major barrier for White women and women of color as they often lack the networks and resources needed to patent on their own or to purchase their patent from a university.

Three women academics said that patenting is often not given the same prestige as publishing an academic paper, especially while on the tenure track, which disincentivizes women from patenting:

"One of the issues, and this particularly affects the women, is your department tenure process... Some departments appreciate patents. Some departments do not, and don't count them. So, if you're in one that doesn't count them, you can't spend [the time] getting your patent as well as your paper [published], because then you'll not get your tenure."

—White woman, academia

"[In academia] we're sort of fighting between publications and patents...and one's valued more than the other. So, why would you go through the whole process of fighting with the tech transfer office and trying to get the resources and all of that if it's not going to turn into something else?"

—Asian woman, academia/corporate

Corporate

Women interviewees who patent in corporations felt they had the added barrier of needing to learn about and navigate the corporate culture and structures of their workplace. Understanding how a company functions and the networks one must navigate to get their innovation patented is an essential part of patenting within corporations:

"I think female technologists...have a lot of tendencies to think, 'Well, I'm just going to do good work and my line manager will make sure that whatever needs to happen happens'—not realizing that there's this whole other system, whole other set of relationships and conversations that have to take place, that the individual has to take the initiative to start the conversation and to stick with it."

—White woman, corporate

One woman and one man inventor, both of whom patented extensively within their corporations, said that companies should make sure their patenting processes are fair, equitable, and accessible to all employees:

"We had a [Black] employee...who wrote an internal email to the president of our division saying that patents were political and that if you didn't put your boss on the invention

record of the patent, they wouldn't put your invention record forward. This was, of course, shocking to the people on the patent committee. So, we did an investigation and we found that was kind of true."

—White man, corporate

Startup/Entrepreneurship

All the inventors who filed patents outside a company or an academic institution said that patenting is expensive. The high costs associated with patenting disadvantage women. These costs include application fees, patent attorneys, and legal battles to protect intellectual property:

"Licensing the technology from [my] university was when I was finally able to see how much it actually cost to file a patent because...we had to get our own lawyers to negotiate with the university to get our technology out of the university and so that was really when I saw the tens of thousands of dollars involved in getting a patent."

—Black woman, academia/entrepreneurship

"We've also come to learn that sole inventorship and licensing your invention to a company has become much less popular... Now companies recognize that they are powerful enough to just use your IP without owning or renting your IP and they know that we...would not have the money to sue a company if they wanted to steal our IP."

—White woman, entrepreneurship

Four women inventors and co-founders said that it was difficult to get external funding for their entrepreneurial endeavors. Three other women inventors said they decided not to launch a company because they were not able to get funding. Three women and one man inventor specifically mentioned the negative impact of the patent restrictions on Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) funding: entrepreneurs are only allowed to use SBIR/STTR grant funds on patent costs when they receive a Phase II grant award. Thus, without the backing of an academic institution or a large corporation, the expenses of filing patents, engaging in research, and financing patent attorneys are cost-prohibitive (Quinn 2015).

Funding for startups typically comes from angel investors or other venture capital (VC) opportunities. However, angel investors and VCs are more likely to invest in startups founded by men. Research shows that investors often take women less seriously and view their inventions less favorably than their male counterparts (Burk 2015; Fechner and Shapanka 2018). This leaves women-led companies with fewer options and less financial support than their male peers, regardless of the potential of their business or invention.

At the same time, the long-term economic impact of the gender and racial wage gap already leaves women with less access to capital and fewer personal resources to rely on (Hess et al. 2015). Given the additional wage gap that Black, Indigenous, and Latina women face, this barrier is even greater for women from these groups. People of color accumulate significantly less wealth over their lifetimes, with the typical White family having eight times the wealth of the average Black family and five times the wealth of the average Latinx family (Bhutta et al. 2020). Women inventors have significantly less personal wealth capital to rely upon, meaning that they are at an even greater disadvantage. Without efforts to promote gender equity among venture capital firms and other funders, women-led startups will continue to find it difficult to succeed.

CONCLUSION AND RECOMMENDATIONS

Many inventors experience benefits, such as increased prestige, bonuses, and career advancement opportunities, from applying for and receiving a patent. However, White women and women of color face numerous and varied challenges when innovating and patenting. All the men and five women interviewed felt they had gained personally or financially because of their patent(s). For almost all the remaining women inventors, however, the challenges they experienced throughout the process outweighed the benefits. Depending on the field and whether they work for a university or corporation, the likelihood of promotion or a raise may or may not be linked to patenting. Yet, while some inventors did not receive any career or major financial benefits from patenting, they still viewed having a patent as a personal accomplishment brought about by their hard work and passion.

This brief focused on the challenges that women faced when patenting their innovations. However, each of the women interviewed successfully patented at least one innovation, with most going on to successfully hold multiple patents. This brief examines the challenges that White women and women of color experience during the patenting process, and what supports would be most helpful to ensure gender and racial equity in patenting. More research is needed to fully understand and identify the best pathways to support women from diverse backgrounds in their journey to patent their innovations.

While progress has been made, including the recent passage of the Inventor Diversity for Economic Advancement Act (IDEA Act), additional policies and programs are needed to ensure equity in patenting. To close the gender patent gap, efforts to support White women and women of color must be taken by a wide range of individuals and organizations involved in patenting, such as accelerator programs, academic institutions, companies, and policymakers.

Recommended actions include:

- **Promoting early exposure to STEM for girls and young women from diverse backgrounds:** Funders—such as philanthropic organizations, corporations, academic institutions, and governmental programs, among others—should support initiatives that introduce girls and young women from diverse backgrounds to patenting and innovation early in their lives. Funders should also provide grants and scholarships to support girls and young women and increase their access to quality educational opportunities in STEM fields.
- **Developing formal curricula on the patenting process:** Formal education on the innovation and patenting process should start at an early age. Curricula on patenting and innovation should be incorporated into K-12 schools. Additionally, much like teaching students how to write an academic paper, colleges and universities should also prioritize teaching undergraduate and graduate students how to draft invention disclosures and patent applications. Learning about the patenting process should be an integral part of higher education, especially in STEM fields.
- **Tackling systemic racial and gender bias and discrimination:** Every woman interviewed had experienced gender bias, racial bias, or combinations thereof during their innovation and patenting process. Companies, academic institutions, and funders and venture capital firms should prioritize addressing issues of bias, discrimination, and sexual harassment. This would include, but is not limited to: a thorough audit of university or corporate data on the share of White women and women of color in patenting; analysis of the barriers White women and women of color face within that environment; proactive accountability measures to close the patenting gaps between White women, women of color, and men; new or expanded zero-tolerance anti-discrimination policies; and consistent and systematic anti-bias training that covers topics such as microaggression.

- **Investing in child care and work-life balance supports:** Providing paid sick and family medical leave, developing employer-sponsored care subsidy programs, and increasing workplace flexibility would help alleviate the work-life balance issues that make patenting more difficult for women.
- **Increasing support and funding for accelerator programs for women:** Most of the women interviewed said they had received important education and resources from accelerator and other programs for inventors. Funding should be increased for accelerator programs and other outreach and educational initiatives that specifically target and provide support for women, and particularly for women of color.
- **Increasing access to quality patent attorneys:** Programs that connect women from diverse backgrounds to quality pro-bono legal support should be increased and expanded. These programs should also work to prioritize connecting women inventors to patent attorneys who understand technical fields and to women patent attorneys.
- **Increasing flexibility in governmental grant funding:** Several individuals noted that grant funding from the federal government often will not allow innovators to spend those funds on patenting costs. Government agencies should increase the flexibility of their grant programs so that diverse innovators have the resources necessary to file for patents.
- **Increasing funding for women, particularly for women of color, for innovation and patenting:** Foundations, universities, corporations, and the government, among others, should establish and expand funds that give grants or invest in women and women of color inventors, specifically earmarked to help them patent their innovations.

Promoting gender and racial diversity in innovation requires broad action across the entire patenting process. This will not only bring a rich range of new perspectives and insights to further drive discovery; it will also unlock the full potential of the United States' innovation economy to tackle the pressing challenges of today and tomorrow.

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APPENDIX A: METHODOLOGY

To identify interviewees with patenting experience, IWPR contacted over 30 individuals with connections to inventors, all of whom had attended previous IWPR workshops on diversity in patenting. These connections provided IWPR with 97 potential inventors to interview. To ensure a diverse sample, IWPR compiled demographic data on each inventor, including gender, race/ethnicity, geographical location, and industry. Inventors were then selected for interviews based on those demographic characteristics.

To determine which inventors to consider for the study, IWPR analyzed each inventor's demographics, industry and work setting, and geography. By selecting interviewees across the country, within different fields and from different backgrounds, the respondents could provide information about different types of innovation experiences. IWPR contacted about two-thirds of the inventors via email, and upon their agreement to participate, the researchers scheduled a time and conducted the interviews via videoconference.

IWPR conducted interviews with 21 inventors: 16 women and 5 men. Of those 16 women, 11 were women of color (six Asian or Pacific Islander, two Black, and two Hispanic women) and of the five men, one was Asian American. The interviewees came from 14 different industries and 13 different states. IWPR considered the interviewees' age and stage of career, with participants ranging from still completing their undergraduate degree, to having decades worth of innovation and patenting experience. Two interviewees were 18 to 25 years old, five interviewees were 25 to 34, four were 35 to 44, three were 45 to 54, five were 55 to 64, and one was older than 64. Of the 21 interviewees, twenty held at least a bachelor's degree and 16 had graduate or professional degrees.

The interviews sought to understand the inventors' experience throughout all stages of the patenting process, focusing on challenges, successes, and main takeaways from idea to patented invention. Six of the 21 questions in the interview protocol specifically asked about how gender and race affected the interviewees experiences. However, interviewees responses highlighted gender and racial differences, even in the questions that did not specifically ask gender or race. Interviews lasted from 45 minutes to over an hour. Respondents also submitted a short demographic survey to provide additional background information. The interviews were then transcribed and coded for common themes, with major themes and meaningful quotes selected for inclusion in the briefing paper.

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