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Gender and Innovation through an Intersectional Lens: Re-imagining Academic Entrepreneurship in the United States

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Abstract

How to study inequality in innovation? Often, the focus has been gender gaps in patenting. Yet much is missing from our understanding of gendered inequality in innovation with this focus. This review discusses how gender and innovation are intertwined in durable academic inequalities and have implications for who is served by innovation. It summarizes research on gender and race gaps in academic entrepreneurship (including patenting), reasons for those longstanding inequities, and concludes with discussing why innovation gaps matter, including the need to think critically about academic commercialization. And while literature exists on gender gaps in academic entrepreneurship and race gaps in patenting, intersectional analyses of innovation are missing. Black feminist theorists (Collins, 1990) have taught us that gender and race are overlapping and inseparable systems of oppression. We cannot accurately understand inequality in innovation without intersectionality, so this is a serious gap in current research. Intersectional research on gender and innovation is needed across epistemic approaches and methods. From understanding discrimination in academic entrepreneurship to bringing together critical analyses of racial capitalism (e.g., McMillan Cottom, 2020; Wooten, 2015) and academic capitalism (e.g., K. Moore et al., 2011; Slaughter & Rhoades, 2004), there is much work to do.

**Keywords:** innovation, patenting, gender, race, academic entrepreneurship, higher education, intersectionality
Gender and Innovation through an Intersectional Lens: 
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Policymakers are in search of solutions to the problem of inequality in innovation. In a bipartisan vote during May of 2021, the US Senate passed the “Inventor Diversity for Economic Advancement Act” or IDEA Act, which called for the US Patent and Trademark Office (USPTO) to track the demographic distribution of inventors (by gender, race, class) in patent data. As she introduced the bill on the Senate floor, Senator Mazie Hirono (D-HI) said closing the patent gap for women and minorities could “turbocharge the U.S. economy.” While the IDEA Act would not directly address the lack of diverse representation in the patent system, Hirono explained, “It’s a critical first step. We need to have the data on which to make decisions” (Invent Together, 2021a).

Understanding innovation gaps has urgent economic and social justice imperatives. In the United States, innovation is central to job growth, wealth generation, and higher living standards, but failing to maximize the potential of diverse ideas stalls social prosperity (Cook, 2020; Fechner & Shapanka, 2018). Additionally, researchers involved in patenting see increases in their personal wealth, research funding, and status, and yet women and BIPOC faculty continue to be shut out of these opportunities (Lawton-Smith et al., 2017). Perhaps most importantly, improving representation in innovation would shift the very nature of knowledge production, leading to the development of inventions aimed at improving the lives of people who have been traditionally marginalized or harmed by inventions.

How might sociologists contribute understanding to this problem of gendered and racialized inequalities in innovation, or ideas that make money? Social scientists certainly have the tools to analyze gender, race, and class in the patenting data that will presumably soon
become available from USPTO. This review considers what we know about lack of inventor diversity already, and also looks beyond patenting gaps to discussion of how innovation is gendered and racialized, and how sociological perspectives might permit new ways of thinking about innovation. We conclude with a re-imagining of innovation, one grounded in a critical intersectional lens, to suggest possibilities for an equitable and emancipatory way forward.

**Defining Innovation**

Innovation is “the commercialization of invention” (Cook, 2020). The innovation system in the US includes many kinds of activities in which scientists and engineers could participate including: starting up firms, inventing and patenting their applicable ideas, transferring technology from academic labs to industrial firms, working as part of a collaborative team on scientific or technical products, serving on investment or venture capital boards, advising or making policy related to innovation, etc. For the purposes of our short review, we will focus on scientists and engineers located in academic settings, and make a case for looking at gendered innovation with an intersectional lens in higher education. Converting ideas into commercial products is the bread and butter of industrial science, but innovation has a particular meaning in higher education.

Innovation in higher education contexts is usually associated with academic entrepreneurship, or the commercialization of research by faculty members into products sold through firms (Nelson, 2020). That is, with the generation of new ideas and intellectual property that will lead to useful products sooner than later.¹ In other words, “innovation” is not

¹ Note that ‘useful products’ assumes commercial markets under capitalism, see Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004 on academic capitalism.
about teaching, community engaged scholarship, or even about publishing peer-reviewed research, in its most common usage. As Cook’s (2020) definition specifies, commercialization is a key part of innovation. In higher education, innovation most often refers to patentable scientific processes or technical products invented by STEM faculty rather than copyrights on artistic products. Innovation is concentrated in particular disciplines on campuses. As Owen-Smith and Powell (2001: 102) note: “Across the academic universe, engineering and biomedical research are the two main drivers of patenting.”

The protection of a scientific invention through a patent is often the first step towards innovation, and since the 1980 Bayh-Dole Act, there has been a dramatic increase in university patenting activity. Universities in the US have rapidly developed ties to commerce through licensing agreements, joint research ventures, and university-based startups (Link et al., 2007). Units within universities now facilitate commercialization including technology transfer offices, industry-university research centers, and incubators. Universities welcome technology transfer in the hopes that it will generate prestige, significant revenue, and ties with external stakeholders in industry and government (Colyvas et al., 2002; Markman et al., 2005). While basic research in the form of academic publishing remains important for future innovation, there are increasing demands especially on faculty in biomedical and engineering fields to increase profitable intellectual property via patents (Sanberg et al., 2014).

Gendered innovation is a concept that acknowledges most recognized inventors—including academic entrepreneurs—are men (Schiebinger, 2008). The innovation system in the United States often excludes women scientists of all races, and Black, Latinx and Indigenous scientists of all genders. We follow sociologist Patricia Hill Collins (1990) and other Black
feminist theorists (Crenshaw, 1989; hooks, 1984), in understanding that gendered inequalities are inseparable from racialized inequalities. An intersectional lens allows a more accurate view of gendered innovation by acknowledging the interlocking systems of racial and gender oppression. In 1888, the first registered Black woman inventor in the US, Ellen Eglin, revolutionized the domestic labor of laundry when she sold her patent for a clothes wringer. At that time, few women inventors received proper credit for their inventions, especially for innovations aimed to improve the lives of women. Despite the American Wringer Company profiting greatly from Eglin’s invention, she earned just $18 when she sold her patent to a patent agent (McNeil, 2017). But racial bias further compounded the gendered barriers to Eglin’s success. When asked why she didn’t instead build a business around her invention, Eglin noted that, “If it was known that a negro woman patented the invention, white ladies would not buy the wringer. I was afraid to be known because of my color in having it introduced to the market, that is the only reason” (Smith, 1891). Domestic work was one of the few occupations considered to be “appropriate labor” for Black women in the US (Wooten & Branch 2012), but that conceptualization of appropriateness did not extend to Black women as inventors of domestic labor-saving technologies. While women and (free) African Americans have technically had legal access to the U.S. patent system since the Patent Act of 1790, the positionality of Black women and women of color inventors in the United States often forced them into bad deals - or to forego innovation entirely (Cook, 2020).

This short review on gendered and racialized inequalities in innovation focuses on the context of higher education in the United States. We begin with research on who has held patents in the US, especially among academic faculty. We outline the gender gaps in
innovation; as a preview, one recent study of gender gaps in the life sciences found that while women hold about half of the PhDs in the US, women are represented on only 25% of life science patents. This same study by Koning et al. (2021) shows that teams of women inventors are 35% more likely to innovate in areas of women’s health than teams of men. When men inventors are favored in innovation systems, there are consequences for who benefits from innovation and who does not. Studies of gender gaps covered here are important, yet we note research on racial disparities within the context of academic entrepreneurship has not been as well developed.

Our review reflects the literature, where studies typically focus on gender or race, rarely their intersection. Yet, as the example of Ellen Eglin demonstrates, the experiences of women of color in the innovation ecosystem will be distinct from both those of white women and men of color. And while at least one study suggests that innovation is also classed, with the propensity to patent correlated with multigenerational income and wealth disparities (Bell et al., 2016), not enough research has connected social class to gender to allow us to include discussion here. We draw on organizational sociology to suggest why gender and racial gaps persist, examining the consequences of the organizational systems of innovation (Dahlin, 2014). We conclude with a call for new research toward intersectional understanding of inequalities in innovation.

Gaps in the Innovation Economy

Participation gaps in the US innovation economy are well-documented, with gender and racial disparities existing at each stage of the innovation process. For example, despite women
making up 51% of the US population in 2019, they were only listed as inventors on 13% of patents (Invent Together, 2021b). The percentage of Black, Latinx, and Indigenous college graduates who hold patents is approximately half that of white college graduates (Fechner & Shapanka, 2018). White and Asian men overwhelmingly patent the most, applying for and holding patents at significantly higher rates than Black and Latinx men and women of all races (Cook, 2020; Lawton-Smith et al., 2017; Milli et al., 2016). Many of these gaps result from a disparity in patent applications, rather than awards, with women inventors, for example, filing only one-third as many patent applications as men from 2000-2016 (Milli et al., 2016). These gender and racial gaps in commercial outcomes exist in both industrial and academic sectors, but research has found larger patenting gaps in academia than industry (Lawton-Smith et al., 2017; Rosser, 2009; Smith-Doerr, 2004; Whittington & Smith-Doerr, 2005, 2008; cf., Sugimoto et al. 2015).

A wealth of social science research assesses the determinants and implications of faculty involvement in commercialization, with a smaller literature examining gendered and racialized experiences in innovation (for a review, see Nelson, 2020). For faculty, engaging in academic entrepreneurship may begin with the patenting and then licensing of research for commercial development, but also includes activities like prototype sales, or faculty members serving as advisors, board members, or founders of private companies. Patenting performance can be linked to assessments of publishing activity, taken as an indicator of a scientist’s research capabilities and career potential (Sanberg et al., 2014). Research generally demonstrates that women faculty members in STEM disciplines file proportionately fewer patents and invention disclosures than men, launch fewer startup companies, and garner less venture capital and
angel funding (Lawton-Smith et al., 2017; Murray & Graham, 2007; Rosser, 2009; Thursby & Thursby, 2005). While women faculty’s entrepreneurship might be increasing (Ding, 2006; Sugimoto et al., 2015), women remain much less likely than men to be involved with startup companies or to hold leadership positions in organizations licensing university-generated intellectual property (Ding et al., 2013).

While research points to a distinct race gap in patenting generally in the United States (Cook, 2020; Fechner & Shapanka, 2018), research is lacking altogether on the role of race within the context of academic entrepreneurship (Nelson, 2020). Insights on the racialized organization of higher education (Ray, 2019; Wooten & Couloute, 2017) could be drawn on to analyze the racialization of academic entrepreneurship. Black, Latinx, and Indigenous inventors, particularly women, are both underrepresented numerically and barred from full participation in innovation through racial-ethnic bias and discrimination (Alegria, 2020; Rincón, 2017; Turner et al., 2011). Asian scientists and engineers are in fact numerically overrepresented in STEM fields, and in many ways their racial status aligns with the cultural ideal of a technical worker (Alfrey & Twine, 2017). But Asian faculty also encounter discriminatory workplace practices and stereotypes; for example, Asian immigrants working on H1B visas must navigate racialized immigration policies that limit their careers (Banerjee, 2019; Rudrappa, 2009). Despite the lack of literature on racial inequalities in academic innovation systems, we infer from research on academia and tech work how BIPOC faculty might experience discrimination and isolation as academic entrepreneurs. The small number of Black, Latinx, and Native faculty in STEM, particularly women, often leads to studies comparing the experiences men and women faculty without examining race, or comparing white faculty to all faculty of color. These studies are an
important first step, but result in uncritically centering white and Asian men as the norm in innovation without questioning the status quo.

Some studies of academic entrepreneurship look beyond simplistic counts or rates of patenting to understand more fully the contributions of women and BIPOC inventors. Impact can be conceptualized as patent quality, originality, and reach, as well as the various ways in which scientists might be involved in the commercialization process (Colyvas et al., 2012; Feldman et al., 2016; Owen-Smith & Powell, 2001; Whittington & Smith-Doerr, 2005). For example, de Melo-Martín (2013) argues that there is no evidence that women do less important or innovative work than men, with the quality of women’s academic outputs and citations being similar to those of men. For example, while fewer women academics engage in patenting than men, women patent work that is more applicable to a wide variety of technological fields, evidenced by women receiving a higher or equal number of citations on their patents than men across generational cohorts, an indicator of patent quality and commercial impact (Whittington & Smith-Doerr, 2005). Similarly, while women academics disclose fewer inventions than men, their inventions are just as likely to secure licenses to firms as men, suggesting that the quality and impact of women’s patents is at least equal to their male counterparts (Colyvas et al., 2002). Other research indicates that women follow similar trajectories as men into patenting, but they just move more slowly into commercialization (Whittington & Smith-Doerr, 2005).

The challenge in understanding gender and racial patenting disparities has been described as a “measurement issue,” with a major question about whether quantity or quality is being considered (Lawton-Smith et al., 2017). Women faculty often engage in less intensive
participation such as consultancy, whereas men are more likely to form their own startup companies (Klofsten & Jones-Evans, 2000; Polkowska, 2013). To assess how gender shapes academic collaborations with industry, Bozeman and Gaughan (2011) created the “industrial involvement index,” a weighted scale that aggregates various types of interactions, ranging from modest engagement (such as providing research papers on request) to intensive engagement (collaborating on patent development). Despite including a range of activities in their index, they conclude that men tend to be more involved with industry than women faculty. As such, understanding the underlying causes of these patent disparities remains urgent, and requires examination of the organizational systems of innovation (Dahlin, 2014), and how they are gendered and racialized.

**Why Do Gaps Exist? An Organizational Perspective**

To address how and why innovation gaps persist, we draw on organizational sociology to outline the barriers facing women and BIPOC inventors across the various stages and organizational levels of innovation – from education and training to the practice of invention and commercialization (Cook, 2020; Cook & Kongcharoen, 2010). We discuss how an organizational perspective differs from supply-side or human capital approaches that attribute gender gaps to individual differences in preferences, skills, and education. Education does play a role in the low patenting rates of women, with a “filtering process” leading to a small proportion of women and BIPOC inventors (Whittington & Smith-Doerr 2005: 366). We suggest that the gendered and racialized organization of academic institutions (Acker, 1990, 2006; Ray,
2019; Wooten & Couloute, 2017) shape patenting opportunities to create distinct barriers for women and BIPOC faculty.

The role of education is often emphasized in explanations of innovation gaps, with much research pointing to the stubborn gender segregation of academic fields (e.g. Charles & Bradley, 2002; 2009). While the share of women and BIPOC students earning both bachelor’s and doctorate degrees in science and engineering (the fields most closely associated with innovation) has increased since 1970, these increases vary across field of study (NSF, 2017). Women tend to receive the highest share of doctoral degrees in the life sciences and psychology fields, and the smallest shares in mechanical and electrical engineering (Cook, 2020; Fechner & Shapanka, 2018; NSF, 2017). Amongst STEM doctorates earned by African Americans, the highest share has traditionally been in the life sciences, with the lowest share of degrees in the physical sciences (NSF, 2017).

The “leaky pipeline” metaphor is a dominant supply side perspective suggesting that innovation gaps are due to women’s low representation among STEM degree holders, and that gaps increase as the level of commercial activity intensifies (Tinkler et al., 2015). This approach suggests that gender differences in seemingly voluntary career choices emerge along the pipeline of careers in ways that reproduce gender segregation (Bol et al., 2018). Strong evidence suggests that women’s career preferences or choices are in fact constrained by a culture that associates men and masculinity with science, math, and engineering (Correll, 2004; Cech, 2014; Cech et al., 2011). Gendered and racialized status beliefs shape perceptions of the

2 Correll (2004) importantly notes that neither supply- nor demand-side processes alone can “fully account for gender segregation in paid labor” (94). Both perspectives are needed.
ideal scientist, with notions of mathematical and technical competence centering around white and Asian masculinity (Moss-Racusin et al., 2012; Ridgeway, 2011). Individual preferences have also shaped by macro-level, institutional shifts in higher education and the economy, such as diversified college curricula and the rising demand of service sector jobs (Charles & Bradley, 2009).

As innovation often begins during education and training in a technical field, understanding the mechanisms preventing the full participation of women and people of color in STEM education is an important first step. However, the educational and career processes of becoming an academic scientist are complex and include various “potholes” for white women and women of color (Alegria & Branch, 2015; Branch, 2016; Smith-Doerr 2010; Xie & Shauman 2003). The leaky pipeline calls for increasing the labor pool as a solution to diversity gaps in innovation, rather than critically examining institutional inequities shaping the retention of women and BIPOC academics (Branch & Alegria, 2018; Kulis et al., 2002). Simply adding women and BIPOC faculty to the pipeline will not alone fix the diversity problem in innovation, as these groups continually lack institutional support for patenting (Cook & Kongcharoen, 2010; Etzkowitz et al., 2000; Long, 2001; Rosser, 2009; Whittington & Smith-Doerr, 2008). And because we are examining the involvement of academic entrepreneurship among PhDs who have already become faculty, in many ways the pipeline is not an issue. Instead, we must consider the systems of innovation in which faculty are engaging or are excluded from.

Innovation opportunities are shaped by the gendered and racialized organization of academic institutions (Acker, 1990, 2006; Ray, 2019; Wooten & Couloute, 2017). A wealth of research illustrates how the structure and culture of academia and specifically STEM create a
“chilly climate” excluding women and BIPOC students and faculty (Britton, 2017; Charles & Bradley, 2009; Hall & Sandler, 1982). In engineering, for example, various organizational factors contribute to gendered and racialized career barriers, including cultural norms like initiation rituals (Seron et al., 2016), heightened visibility associated with tokenism (Muhs et al., 2012; Ong, 2005; Settles et al., 2018), and exclusion from social networks (Fox, 2008; Mickey, 2019).

The hierarchical, bureaucratic structure of universities limits women’s patent productivity (Smith-Doerr, 2004; Whittington et al., 2009). Despite academic research labs engaging in collaboration, academic success is attained at the individual level (Misra et al., 2017). A culture of internal competition compels academic scientists and engineers to compete for resources like lab space, equipment, and grant funding that diminishes the experiences of historically underrepresented groups including women and people of color. Flexible, team-oriented firms in industry that rely on collaborative networks may better accommodate women scientists and promote their productivity than academia (Smith-Doerr, 2004).

Additionally, academic systems of evaluation rely on gendered and racialized metrics of success (Bailyn, 2003; M.R. Moore, 2017), with women faculty of color being less likely than white women or men of any racial group to be awarded tenure (Lisnic et al., 2019). In the university context, academic publishing remains valued over patenting (de Melo-Martín, 2013; Lawton-Smith et al., 2017). As such, women might focus their research time and efforts on academic publishing rather than patenting efforts (Fox & Xiao, 2013). This prioritization might be particularly true for academic mothers who, balancing parenthood and career responsibilities, logistically do not have time or resources to dedicate to forms of productivity that are not required (Whittington, 2011). And because women faculty in STEM are more junior
on average, they have less freedom to venture from the traditional expectations of productivity (Stephan & El-Ganainy, 2007). Typically, senior faculty are positioned to launch entrepreneurial activity, and (white) men continue to be overrepresented among full professors. As noted by Lawton-Smith and colleagues (2017): "In many countries, the association between seniority and commercialization activity means that the actual number of women who might commercialize their research is small” (79).

Gendered and racialized inequalities seep into the organization of innovation itself, creating pervasive barriers. Contemporary barriers are rooted in the racist and sexist foundations of early patent laws, as well as the historical legacy of slavery and patriarchy in the United States, structures that directly excluded Black citizens and women from innovation. The Patent Office, for example, refused to grant patents to enslaved African Americans under the original Patent Act of 1790 (Baker, 1902). And laws in many US states allocated marital property rights to husbands, thereby preventing married women from owning patents in their names (Gage, 1883; Pursell, 1981). Similarly, commercialization relies on financial capital and wealth to introduce invention to society, but women and Black citizens have historically had diminished access to financial capital in the United States (Cook, 2007; Fechner & Shapanka, 2018). While legal access to the patent system has opened, historical-legal policies continue to shape who earns US patents (Cook, 2020). For example, contemporary legal restrictions place limits on international collaboration on “critical technologies,” especially between US and Chinese researchers. The high-profile arrest and 2021 trial of a Harvard chemist because of his failure to disclose ties to China in financing his research lab showed faculty the strength of these restrictions (U.S. Department of Justice, 2020). These legal barriers today look different than
the explicit refusal to grant patents to enslaved African Americans, but nonetheless allow for mechanisms that may curtail innovation opportunities and lead to discrimination against international faculty, especially Asian scientists.

Today, women and BIPOC scientists and engineers engaged in academic entrepreneurship confront less direct but still powerful mechanisms of exclusion. Gendered and racialized perceptions of technical incompetence in the spheres of research and development (R&D) and venture capital require women and BIPOC researchers to exert extra effort to prove themselves and “sell” their invention (Stephan & El-Ganainy, 2007; Tinkler et al., 2015). Black entrepreneurs describe encountering “perception problems” more than their white and Asian counterparts, which they attribute to the small number of Black-owned IT and venture firms in the US (Cook, 2020).³ Black entrepreneurs must constantly battle subtle and overt discrimination, including challenges to their credentials, assumptions that they are not in charge of their startups, and regular suggestions that they hire white business partners to put investors at ease (Anand & McBride, 2020; Cook, 2020). Similarly, women more so than men need certain indicators of “potential,” such as connections to key players and technical background, to achieve legitimacy in venture capital evaluations and earn capital investments (Tinkler et al., 2015).

Additionally, academic entrepreneurship often relies on networks, which provide faculty with key forms of social capital including collaborative ties, information about funding opportunities, and access to resources. Research shows a positive relationship between

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³Cook (2020) notes that Black employees and senior managers at venture capitalist firms are “largely nonexistent” (17).
individual network centrality and creativity (Ferriani et al., 2009; Ibarra, 1993), but women and BIPOC faculty hold less central or strategic positions in innovation collaboration networks than white men (Gaughan et al., 2018; Mickey, 2019; Whittington, 2018). Women are also less likely to be in the same innovation networks as their white male counterparts (Etzkowitz et al., 2000; Long & Fox, 1995; Meng, 2016; Rosser, 2009). Black entrepreneurs note that social, professional, and financial networks are crucial for inventive activities, but they are often missing strategic social ties (Cook & Kongcharoen, 2010). Women and people of color were historically barred entry to professional scientific societies until the mid-twentieth century, depriving them of key connections to social capital for innovation (Oldenziel, 1999). This initial exclusion continues to create barriers to commercialization access today. Despite women entrepreneurs having the necessary skills and experience to innovate and lead ventures, women are consistently left out of key networks facilitating commercialization of research (Meng, 2016; Stephan & El-Ganainy, 2007; Whittington, 2018). Women faculty have fewer informal friendships with colleagues who actively patent and have industry contacts than their male colleagues, resulting in fewer invitations to serve on scientific advisory boards (Ding et al., 2013; Murray & Graham, 2007). These network differences limit the participation of women and BIPOC inventors in the commercial marketplace.

Organizational interventions might address these network barriers. For example, women affiliated with interdisciplinary university research centers are more likely to have commercial activity resembling their male colleagues compared to women colleagues in traditional academic departments (Bozeman & Gaughan, 2011; Corley & Gaughan, 2005; Link et al., 2007). However, university research centers may create a new form of institutional
stratification among faculty. Center affiliation advantages both men and women, but men enjoy slightly greater advantages than women in industry involvement (Gaughan & Corley, 2010). Taken together, various organizational features of academia and industry work to shuffle women and BIPOC faculty out of the innovation ecosystem. These patterns have career implications for individual scientists, with patenting providing “new coinage” in academia (Whittington, 2011, p. 419).

Why Innovation Gaps Matter

The underrepresentation of women, people of color, and low-income individuals in the innovation system has both economic and social justice implications. Much has been written about the economic costs of the gender and racial patenting gaps in the US, with innovation being critical in job growth, wealth generation, and higher living standards (Cook, 2020). The central idea is that greater diversity in inventing would “unlock a wealth of innovation and economic growth that is now untapped” (Fechner & Shapanka, 2018, p. 728). The US economy would benefit from closing the patenting gaps, experiencing substantial economic growth through new business and job creation, and innovation. One study finds that including more women and BIPOC scientists of all genders in the innovative process would increase the GDP up to 4.4 percent per capita (Cook & Yang, 2017). Given the rapid growth and increased importance of the global innovation economy, the connection between patents and startup companies also has broad economic implications. Patents are crucial to the development and

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4 From 1960 to 2013, the number of US workers in innovation jobs grew three percent annually, compared to two percent growth of the broader workforce (Cook, 2020). In 2017, the NSF estimated that the innovation economy comprised 7 million to 25 million workers (NSF, 2020).
success of startup companies, encouraging capital investment, and startup businesses generate ten percent of all new jobs in the US per year (Fechner & Shapanka, 2018). Innovation economy jobs are among the highest paying in the US and have lower unemployment rates than the general labor market (NSF 2020).5

The commercialization of academic knowledge is considered economically desirable for individual researchers, institutions, and the public (de Melo-Martín, 2013; Polkowska, 2013; Rosser, 2009). Those academics who are involved in patenting experience increases in research funding, access to better equipment, personal financial gains, and institutional status associated with producing high-impact research (Lawton-Smith et al., 2017). Creating space for individuals from marginalized and underrepresented communities to become academic entrepreneurs is important, but critical scholars note that this is a neoliberal project centered on an individualistic narrative of success rather than wider change toward liberation (Noble, 2016).

Feminist Science & Technology Studies (STS) scholars also highlight how products of innovation are not neutral, but simultaneously gendered and racialized. Feminist STS reveals how scientific “objectivity” and authority are infused with masculinity where traditionally science works for “the good of only some races, classes, and one gender” (Rosser, 2009, p. 70; see also, Haraway 1988; Harding 1986; Keller 1985). Black feminist thought brings an intersectional lens to understand how gender and race are co-constituted through the historical, social, political, and economic processes of innovation (Collins, 1990; Gray, 2012; Cook (2020) importantly points out that within the innovation economy, salaries and unemployment rates vary greatly by gender and race.

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hooks, 1984; McMillan Cottom, 2020; Noble, 2018). Together, these two perspectives allow us to understand how research priorities are set, and who benefits (or not) from particular lines of research.

The racial and gender biases embedded in new science and technologies often render them exclusionary, harmful, and/or dangerous to historically oppressed groups, including the most marginalized women, Black, Latinx, Indigenous, LGBTQI+, poor, and disabled (Benjamin, 2019; Couldry & Mejias, 2019; Daniels, 2015; Eubanks, 2018; Noble, 2018; Zuboff, 2019). Because innovative ideas often arise in areas with which inventors have personal experience, the predominance of men in patenting has meant that innovations useful for women and people of color have gone undeveloped. Despite being a leading cause of death for women in the United States, breast cancer remained mostly a hidden disease until the 20th century, neglected by predominantly male surgeons (Osuch et al., 2012). In response to women activists, Dr. Bernadine Healy, the first woman director of the National Institutes of Health, launched the NIH Women’s Health Initiative in 1991 to study the causes, prevention, and cures of diseases that affect women (NIH, 2017). Once understanding women’s health became a funding priority, and the inclusion of women subjects in clinical trials demanded, knowledge about breast cancer increased dramatically, including relevant patents for diagnosis and treatment. More recently, NASA had to scrap its first planned spacewalk with an entirely female team of astronauts in 2019 because they did not have enough spacesuits small enough to properly fit women’s bodies. As women increasingly hold some of the highest offices at NASA, they are leading design efforts to create spacesuits to fit about 100 body shapes and sizes (Botkin-Kowacki, 2020).
Racial disparities within innovation ecosystems have material consequences imbued within technology products, “ranging from embarrassing to potentially fatal” (Alegria, 2020: 9). Biases embedded within technology result in algorithmic oppression (Benjamin, 2019; Noble, 2018), with some now notorious examples. We’ve seen Google search results for “Black girls” leading primarily to pornography sites (Noble, 2018), software in self-driving cars being systematically worse at detecting pedestrians with darker skin (Wilson et al., 2019), and the NFL determining eligibility for payouts in its settlement of brain injury claims for retired football players with a scoring algorithm that assumes Black men start with lower cognitive skills than white men (Science, 2021). These algorithmic biases can result in emotional, financial, and physical harm, and illustrate how technologies are far from neutral and equitable – but in fact mirror the biases of those individuals involved in innovation design and decision-making processes (Benjamin, 2019; Gray, 2012; Noble, 2018).

Concluding Thoughts

The processes of racialized and gendered inequalities discussed here in academic entrepreneurship may very well apply to other parts of academic science like publishing, and even to other professions like law and medicine. Empirical studies of inequalities intersecting with gender are still in development in these adjoining fields as well (Misra et al., 2020), and while it is beyond the scope of this short review, we also see the benefits of intersectional analysis applied to other work settings. The reason why intersectional analysis is so pressing in

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6 A wealth of previous research has focused on “the productivity puzzle,” identifying gendered differences in academic publishing (e.g. Cole & Zuckerman, 1984; Fox & Mohapatra, 2007; Long, 1992).
studying innovation, however, is because of the material effects on the lives of women and especially women of color. We must attend to white male privilege being built into the products that are being marketed or withheld including medicines (Roberts, 2012), and AI powered data systems that shape opportunities from dating (Curington et al., 2021) to work (Joyce et al., 2021) to healthcare access (Cruz, 2021).

Understanding the gender, race, and class gaps in patenting is an important first step towards diversity and inclusion in innovation. Diverse representation in academic entrepreneurship shifts the very nature of knowledge production. The positionality of researchers shapes their research topics and questions, and the theories and methods they develop and use (Collins, 1990; Haraway, 1988; Harding, 1986; Hartsock, 1987). The lived experiences of women and BIPOC inventors may lead them to see opportunities to invent for people like themselves (Koning et al., 2021). Women, for example, have invented more technologies related to reproduction, children, and the home, including the dishwasher, disposable diapers, and the pull-down baby changing stations found in public restrooms (Cockburn, 1985; Schwartz Cowan, 1983; Wajcman, 2004). Schiebinger (2014) defines “gendered innovations” as those that integrate sex and gender analysis into all phases of basic and applied research, harnessing the power of gender to stimulate new technologies and knowledge. As Fiona Murray (2021) writes, “Diverse inventors ‘see’ the world differently,” leading them to explore solutions differently, overcoming previous blind spots (p. 1261). As we reduce barriers to innovation, including more diverse inventors, new problem domains and scientific priorities will be pursued, so that innovation can benefit everyone.
Yet misgivings remain about whether the inclusion of women and BIPOC faculty in innovation is the best step forward, considering the tensions between academic feminisms and corporatization (de Melo-Martín, 2013; Newson, 2018). Academic scholarship on emerging technologies creates troublesome alliances between the academy and industry, with seemingly neutral research actually lending credibility to corporations and reproducing their profits and wealth gaps (Vinsel, 2021). Technologies are a dominant tool of capital, resting on the racialized logic of what Tressie McMillan Cottom (2020) calls “predatory inclusion” which simultaneously includes BIPOC workers while reconfiguring labor relations to exploit and expropriate their labor. In this sense, inclusion in innovation reinforces intersectional inequalities of extraction, exploitation, and coercion.

Parallels can be drawn between the exploitation of communities of color by the platform or “gig” economy and the racist practices of universities. Feminist scholars point to the long history of academic institutions extracting from and exploiting communities of color in the name of discovery and innovation (Briggs, 2003; Fisher, 2020; Reverby, 2009; Schiebinger, 2017). Women faculty of color, including in the fields of public health, anthropology, and sociology, have redefined academic knowledge to remove the “artificial separation” between analysis and activism, theory and practice (Ross, 2017, p. 287). Bringing non-academics into the knowledge production process, women of color engage in praxis to put social justice into action based on intersectionality theory. This approach, writes reproductive justice scholar Loretta Ross, “embrace[s] the holistic challenges to domination offered by radical Black women outside and within the academy across many domains and the futurity of possibilities” (2017, p. 287).
The futurity of possibilities will break wide open when models of academic entrepreneurship move to center intersectional praxis. Feminist sociologist Firuzeh Shokooh Valle challenges us to “imagine a feminist technopolitical praxis that mobilizes close emotional relationships to construct collective communities of affect, solidarity, and care between activists, the communities they serve, and the technologies they use” (2018, p. 340).

Innovation, Shokooh Valle argues, can simultaneously challenge and operate within gendered and racialized logics of neoliberal capitalism, with entrepreneurship anchored in feminist principles and values. Linking critical analyses of racial capitalism (Cottom, 2020; Wooten, 2015) and academic capitalism (K. Moore et al., 2011; Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004) could provide a framework for deepening sociological analyses of power and oppression in the innovation ecosystem. Reimagining the future of innovation in a critical intersectional lens, contextualized in the Black feminist tradition (Noble, 2016), allows for theorizing a liberatory, reciprocal, and perhaps even empowering, alternative.
References


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