

NATIONAL STRATEGY FOR INCLUSIVE INNOVATION

A Report by the
UNITED STATES PATENT AND TRADEMARK OFFICE,
U.S. DEPARTMENT OF COMMERCE



uspto

UNITED STATES
PATENT AND TRADEMARK OFFICE®

☞☞ *We have an incredible opportunity as a nation to unleash the next generation of American innovation, protect our national security, and preserve our global economic competitiveness. The time is now. ””*

Secretary of Commerce Gina Raimondo

☞☞ *We need to expand innovation inclusively, reaching people where they are with the resources to participate in our innovation ecosystem. It is the key to unleashing the potential of every American, to creating jobs, and to economic prosperity. ””*

USPTO Director Kathi Vidal

☞☞ *[T]he Federal Government must utilize the full talent and potential of the entire Nation by avoiding undue geographic concentration of research and STEM education funding, encouraging broader participation of populations underrepresented in STEM, and collaborating with nongovernment partners to ensure the leadership of the United States in technological innovation. ””*

CHIPS and Science Act of 2022, § 10301(4)

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About this Document

This National Strategy for Inclusive Innovation was developed by the United States Patent and Trademark Office (USPTO), with support from the Council for Inclusive Innovation (CI²). This Strategy is based on a vision for United States (U.S.) leadership in innovation that will lift communities, grow the economy, create quality jobs, and address global challenges. This vision will be achieved by increasing participation in science, technology, engineering, and mathematics (STEM) and innovation, starting with our youth, and will unleash every American's ability to fully take part in the innovation economy. Strategic objectives have been identified, along with exemplary programs and recommendations.

This Strategy focuses primarily on innovation in STEM fields and the role of the patent system in the constitutional aim of incentivizing innovation and bringing that innovation to impact.

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About the United States Patent and Trademark Office

The USPTO is the federal agency responsible for granting patents and registering trademarks in the U.S. The strength and vitality of the U.S. economy depends directly on effective mechanisms that protect new ideas and investments in innovation and creativity. The USPTO advises the President of the United States, the Secretary of Commerce, and U.S. government agencies on intellectual property (IP) policy, protection, and enforcement, and promotes stronger and more effective IP protection around the world. More information is available at www.uspto.gov/about-us.



About the Council for Inclusive Innovation

CI² was born out of the USPTO's SUCCESS Act report, transmitted to Congress in 2019, which found that women and minorities are under-represented as inventors and patentees named on U.S.-granted patents. The report encouraged the creation of a high-level council of industry, academic, professional, and government leaders tasked with helping develop a national strategy for increasing the participation of under-represented groups in innovation—as inventors, entrepreneurs, and innovation leaders. CI² is charged with strategizing new ways to expand American innovation, increasing the opportunities for all Americans to participate in innovation.



The USPTO plays a vital role in CI². The USPTO provides the primary support for CI², and Gina Raimondo, Secretary of Commerce, and Kathi Vidal, Under Secretary of Commerce for Intellectual Property and Director of the USPTO, serve as Chair and Vice Chair of CI², respectively. In addition to the USPTO, CI²'s members include federal government leaders from the Small Business Administration (SBA) and Co-Vice Chairs from the U.S. Copyright Office, the Economic Development Administration (EDA), the Minority Business Development Agency (MBDA), the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF), and the National Aeronautics and Space Administration (NASA).

The Co-Vice Chair agencies are advancing similar missions supported by the USPTO, including studying and addressing observed barriers in entrepreneurship, as well as observed barriers to innovation in the creative and artistic sectors, and highlighting the role IP plays in entrepreneurship and in the vibrancy of the creative and artistic sectors.

More information is available at www.uspto.gov/initiatives/equity/ci2/about.

Executive Summary

Overview

Innovation fuels the United States' economic engine. Since our nation's inception, the protection of intellectual property (IP), including patents, has been at the forefront of advancements in science and technology. However, an emerging body of research has revealed that participation in U.S. innovation is exceptionally unequal. For example, a recent report by the USPTO found that only 12.8% of all inventors named on U.S. patents are women. At the same time, a Harvard University study revealed that White Americans are three times more likely to become inventors than Black Americans, and that children born to parents in the top 1% of income earners are 10 times more likely to become inventors than those from families with below-median income.



The United States faces great challenges in addressing demographic, economic, and geographic under-representation in the innovation economy. Actively encouraging, endorsing, and implementing diversity and inclusion strategies promotes innovation and ultimately helps achieve long-term business success. It is vital that all sectors of the innovation ecosystem—corporations, associations, nonprofits, governments, and schools—take tangible steps to diversify and expand their ranks in order for every American to gain the skills and experience that will allow them

to fully utilize their inventive and entrepreneurial abilities. It is also imperative that in these efforts we define diversity broadly, to include those from rural regions; veterans and military families; retirees; homemakers; persons with disabilities; those who are under-resourced; and those who have educated themselves through non-traditional means, trade schools, community colleges, or work experiences. Without each individual's contribution, the United States will not innovate at its full potential.

To maintain its position atop the economic world stage, the United States must make sustained investments in its most important asset—the American people—by ensuring that every individual—irrespective, for example, of ethnicity, gender, disability, or location—has access to the resources and opportunities to innovate. Doing so will require contributions from all sectors of the United States, including government, industry, schools, and nonprofits. Working together, they can help reach under-served communities and provide resources and support to innovators today and in the future.

The USPTO is committed to playing a lead role in this effort. Throughout the course of the Biden-Harris Administration, the USPTO has been studying the state of the U.S. innovation ecosystem, including the barriers to full and widespread participation. The result of this study is this report, which includes a comprehensive review of the state of U.S. inclusiveness, highlights existing disparities, and explores opportunities to expand U.S. innovation in an equitable way.

This Strategy focuses primarily on innovation in STEM fields and the role of the patent system in the constitutional aim of incentivizing innovation and bringing that innovation to impact.

This Strategy is built upon four cornerstones, each addressing a critical inflection point in the lives of potential innovators:

- 1. INSPIRING new generations of innovators;**
- 2. EDUCATING and EMPOWERING innovators;**
- 3. ADVANCING inclusive innovation in our government agencies, industry, nonprofits, and academic institutions; and**
- 4. BRINGING innovation to market.**

CORNERSTONE 1: Inspiring New Generations of Innovators

Research demonstrates how critical it is that youth be attracted to innovation at an early age. Research also shows that hands-on, experiential, innovation-based programming creates a life-long interest in innovation for preK-12 students. But opportunities are not equally available to all youth. Students who struggle with traditional STEM classes may be discouraged from pursuing innovation opportunities. Schools that lack resources for traditional STEM curricula are less likely to find ways to support every student in STEM or to offer the enrichment provided by experiential innovation programming. Corporations and nonprofits have attempted to fill these gaps, but their laudable efforts have resulted in a patchwork of local programs.

Such additional support and programming—during the school day and through extracurricular efforts—require standardization so they can be scaled and deployed to millions of preK-12 students. At the same time, programming cannot become so generalized that it ignores individual or community-based needs and resources. One way around this tension is to provide several alternatives within a standard, and to let schools or educators choose among a smaller menu of programs.

We recommend appropriately standardizing and scaling youth innovation education; empowering parents, teachers, and communities to teach innovation; and providing youth with coaching, mentoring, and exposure to support long-term interest and capabilities in innovation.

CORNERSTONE 2: Educating and Empowering Innovators

In addition to ensuring that preK-12 students are exposed to and equipped to participate in the innovation ecosystem, we must continue to support them by providing life-long learning and support. Research shows that just a single course in entrepreneurship at a university or community college is associated with significant improvements in both entrepreneurship-related human capital and entrepreneurial outcomes. That support can come through higher education programming, including through trade schools or community colleges. It can also be obtained online or through other resources, including certificate programs.

We recommend fostering innovation and entrepreneurship learning and experiences in post-secondary education and providing support to post-secondary students through, for example, mentorship programs and additional exposure to innovation.

CORNERSTONE 3:

Advancing Inclusive Innovation in Our Government Agencies, Industry, Nonprofits, and Academic Institutions

Organizations—public and private—need to remove barriers that may preclude the innovation ecosystem from achieving demographic, economic, and geographic equity. They should build their workforce, practices, and ethos in such a way that provides each individual with the tools and support to optimize their contributions to innovation, while being free from prohibited discrimination. This can be achieved through establishing thoughtful and purposeful best practices, deploying those best practices across the organization, and measuring the impact of those practices on the organization compared to benchmarks.

Organizations can and should recruit broadly, and they should support employees from all walks of life. Just as not all employees fit into the same-sized shoes, recruiting and retention should be tailored to receive and support each qualified employee.

University faculty members with caregiving responsibilities, of whom a large majority are women, face special challenges in balancing work and family, particularly when on the tenure track. The balance of work for these faculty members also often favors publication instead of patenting in order to remain on track. Encouraging university boards to weigh patents and publications equally in tenure consideration could improve invention participation.

Further, organizations should infuse innovation education into training and celebrate innovation and invention broadly, rather than in siloed research teams. Doing so not only promotes innovation, but can lead to higher-quality jobs by making an organizational culture more egalitarian and by providing additional opportunities for skills and career development.

CORNERSTONE 4:

Bringing Innovation to Market

The goals in incentivizing more innovation are to bring innovation to market, and thereby to bolster economic prosperity, shore up national security, and solve world problems. Access to resources to obtain the IP protection necessary to attract investment and facilitate the long-term success of entrepreneurs, to engage in technology transfer and find commercialization support, and to attain funding are not equitably available. In addition, though the United States has a unique startup and innovation culture, additional policy changes and actions can scale what is working, reduce barriers, and more widely spread the resources and support that make U.S. startups thrive.

To address these challenges and embrace these opportunities, on February 8, 2024, the National Advisory Council on Innovation and Entrepreneurship (NACIE)¹ released the report titled “Competitiveness Through Entrepreneurship: A Strategy for Strengthening U.S. Innovation” (NACIE Report).² The NACIE Report sets forth 10 specific policy changes and actions that would help ensure America’s continued global entrepreneurial leadership in developing and commercializing innovation. In addition to supporting the implementation of NACIE’s recommendations, we must equitably facilitate IP protection for all innovators, entrepreneurs, and creators and leverage and expand commercialization, technology transfer (tech transfer), and financial support for all.

USPTO’s Recommendations

Taken together, the four cornerstones result in 11 recommendations to support inclusive innovation:

- 1. Standardize and scale youth innovation education (Cornerstone 1)**
- 2. Provide resources, training, and support to empower educators to teach innovation (Cornerstone 1)**
- 3. Provide youth coaching, mentoring, and career awareness to foster and support long-term interest and capabilities in innovation (Cornerstone 1)**
- 4. Expand research opportunities to a broad and diverse set of institutions in higher education (Cornerstone 2)**
- 5. Foster innovation and entrepreneurship learning and experiences in post-secondary education (Cornerstone 2)**
- 6. Provide post-secondary mentoring and internship opportunities to enable innovation (Cornerstone 2)**
- 7. Encourage and support an inclusive workforce across public and private organizations (Cornerstone 3)**
- 8. Cultivate innovation more broadly and equitably in organizations that innovate, including academic research institutions (Cornerstone 3)**
- 9. Equitably facilitate IP protection for all innovators and entrepreneurs (Cornerstone 4)**
- 10. Make entrepreneurship resources and support available to all (Cornerstone 4)**
- 11. Leverage and expand commercialization support and tech transfer for all (Cornerstone 4)**

Each recommendation focuses on different groups or sectors. Governments and nonprofits often take the lead for youth education and enrichment. Universities are largely responsible for post-secondary education and mentoring. Private industry and other organizations should establish equitable workplace policies, abide by them, and measure their progress. Government agencies, including the USPTO, provide critical training in IP protection and entrepreneurship.

Governments, academic institutions, private industry, and nonprofits will need to join together to bring about inclusive innovation—virtually every sector has its role. To help each sector better understand how it can help support the USPTO’s recommendations for inclusive innovation, a list of exemplary programs and resources is provided in the Appendix to this Strategy.

INTRODUCTION

Technological innovation is critical to national success and prosperity. With technological advancement becoming increasingly global, our nation will need to make strategic choices to maintain its economic position atop the world stage. Chief among these strategies is making sustained investments in our most important asset—the American people—by ensuring that every individual, irrespective of ethnicity, gender, disability, location, or any other distinguishing trait, has access to the resources and opportunities to contribute to our nation’s innovation economy. The USPTO is fully committed to playing a lead role in this effort.

The innovation ecosystem is out of reach to large portions of the American public, many of whom could contribute if given meaningful resources and the opportunity. The consequent harms to the U.S. economy are immense. As a member of the Federal Reserve Board of Governors and former USPTO Edison Fellow Lisa Cook concluded, “GDP [gross domestic product] per capita could rise by 0.6% to 4.4% if more women and African Americans were included in the initial stages of the innovation process.”³ One study by the National Bureau of Economic Research estimates that closing the gender gap in patents—fewer than 13% of inventors are women—could increase the U.S. GDP per capita by 2.7%.⁴ The NSF recognizes that to be representative of the U.S. population, by 2030 the number of women in science and engineering would need to nearly double from 2020, the number of Blacks in science and engineering would need to double, and the number of Hispanics or Latinos in science and engineering would need to triple.⁵

This Strategy provides a map for the federal government, academic institutions, private industry, and nonprofits to implement best practices that inspire and support a diverse population of problem-solvers who are prepared to tackle community and world problems. By harnessing the greatest strengths of the greatest number of contributors, the United States is poised to make the greatest contribution to global innovation.



BACKGROUND

Since its founding, the USPTO has been central to America’s leadership in innovation and entrepreneurship. As the agency that issues patents, the USPTO incentivizes and protects innovative ideas and investments in them. As the agency that registers federal trademarks, the USPTO protects the ability of businesses and individuals to develop and commercialize their innovations across the United States. The USPTO works through the courts to shape the law and provides technical advice to Congress on legislation. And as the

advisor to the President, through the Secretary of Commerce, on IP, the USPTO works on domestic and international policy and frameworks for ensuring a strong, fair, and transparent innovation ecosystem that supports inclusive innovation that drives jobs, economic prosperity, and global problem-solving.

The USPTO's enhanced engagement on the issue of inclusive innovation traces its roots to the SUCCESS Act of 2018.⁶ That Act charged the USPTO, in collaboration with the Small Business Administration (SBA), with determining how to encourage "the participation of women, minorities, and veterans in entrepreneurship opportunity."⁷ In 2019, the USPTO issued a report to Congress responding to the SUCCESS Act and demonstrating that women and minorities have all too often been marginalized in science, technology, and entrepreneurship.⁸

In response to these concerns, in September 2020, the USPTO hosted the inaugural meeting of the National Council for Expanding American Innovation (NCEAI). The purpose of this council was to help the USPTO "develop a national strategy to build a more demographically, geographically, and economically inclusive innovation ecosystem."⁹ To that end, in December 2020 the USPTO requested comments on developing such a strategy. More than 100 comments were received from industry, trade associations, bar associations, universities and other educational institutions, nonprofit agencies, and individuals.¹⁰ The NCEAI has since been rechartered as the Council for Inclusive Innovation (CI²), and this report is the culmination of the USPTO's efforts with CI² and sets the stage for future action.

The Biden-Harris Administration recognizes the importance of inclusive innovation. Shortly after the issuance of the request for comments and immediately upon taking office, President Biden issued Executive Order 13985 to "embed equity principles, policies, and approaches across the Federal Government."¹¹ The Executive Order stated: "By advancing equity across the Federal Government, we can create opportunities for the improvement of communities that have been historically underserved, which benefits everyone."¹² In 2021, the President issued Executive Order 14035, "Diversity, Equity, Inclusion, and Accessibility in the Federal Workforce," which stated: "A growing body of evidence demonstrates that diverse, equitable, inclusive, and accessible workplaces yield higher-performing organizations."¹³ More recently, President Biden issued Executive Order 14091 for "extending and strengthening equity-advancing requirements for agencies" and to promote investment in under-served communities.¹⁴ Pursuant to these orders, the U.S. Department of Commerce developed an Equity Action Plan.¹⁵ Of the five strategic goals the plan identified for the Department's equity agenda, the following three are most directly addressed by this Strategy:



- 1. "Mobilize our nation's diversity to fuel innovation and sustain our global competitiveness across geographic regions so that all communities have equal access to opportunities";**
- 2. "Expand growth opportunities for businesses and entrepreneurs, including in underserved communities"; and**
- 3. "Promote equitable economic development and career pathways to good jobs."¹⁶**

In 2022, Congress passed the Research and Development, Competition, and Innovation Act as part of the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act.¹⁷ Congress found that “the Federal Government must utilize the full talent and potential of the entire Nation by avoiding undue geographic concentration of research and STEM education funding, encouraging broader participation of populations underrepresented in STEM, and collaborating with nongovernment partners to ensure the leadership of the United States in technological innovation.”¹⁸ Also in 2022, Congress recognized the need for more USPTO outreach to under-served communities,¹⁹ as well as for greater assistance to first-time prospective patent applicants.²⁰

In addition to CI²'s work studying how to expand the reach of U.S. innovation, including to under-represented groups and communities, the USPTO, through Director Kathi Vidal, co-chairs the Economic Development Administration's NACIE. In February 2024, NACIE released a report and recommendations to Secretary of Commerce Gina Raimondo.²¹ The NACIE Report sets forth 10 recommendations to help ensure America's continued global entrepreneurial leadership in developing and commercializing innovation. NACIE's recommendations include a number of proposed actions that bear directly on the USPTO's focus on inclusive innovation, including:

- Adding entrepreneurship and IP courses and coursework to K-12 schools, community colleges, and technical schools²²
- Launching a “National Innovation Accelerator Network (NIAN),” which will, among other things, “[c]reate and manage the comprehensive online entrepreneurship resource hub and collaboration platforms and other awareness programs for entrepreneurship and innovation support proposed” by the USPTO²³
- Leveraging universities to play an active role in dispersing entrepreneurship in their communities²⁴
- Increasing the role of community colleges in helping deploy entrepreneurship education²⁵
- Supporting university technology transfer offices (TTOs) to increase the transfer of their patented technologies²⁶
- Supporting the USPTO's recently launched Diversity Information (DI) Platform, “which shares best practices and allows organizations to review USPTO demographic information and to compare their own data to industry benchmarks” and to support the further expansion of this platform²⁷

Additionally, the NACIE recommendations focus on numerous initiatives to promote and support innovation broadly and to ensure individuals have the funding to innovate as well as the financial resources, support, and IP not only to get their products to market, but to be successful long-term, including:

- “Establish[ing] a National Innovation Council, chaired by the Director of the Office of Science & Technology Policy and comprised of relevant Cabinet secretaries, Director of the National Science Foundation (NSF), Director of the USPTO, and U.S. Chief Technology Officer (CTO), to champion innovation and entrepreneurship across the country and coordinate relevant federal government activities”²⁸
- Restoring and expanding government investment in innovation and “substantially increasing federal” research and development (R&D) “investment in critical technologies”²⁹
- Providing IP “incentives for federally funded research and development” and “develop[ing] policies

and incentives for robust dissemination and commercialization of federally funded innovations”³⁰

- “Proactively work[ing] with innovators, entrepreneurs, and funders to ensure they have adequate intellectual property and cyber security education and resources to protect their ideas and businesses and are trained to be able to identify and prevent potential IP theft from foreign companies or states”³¹

The USPTO is committed to assisting NACIE in implementing NACIE’s recommendations, as part of the USPTO’s efforts to drive toward a more inclusive future for the United States. Consonant with Congress’s and NACIE’s priorities, as well as with the USPTO’s expertise as America’s Innovation Agency, this Strategy is principally focused on the technological and inventive community of innovators. The USPTO recognizes that innovation is also crucial to the creative and artistic communities, but the challenges facing those communities can be different from challenges in technological fields and are largely beyond the scope of this Strategy.

The Current State of **INCLUSIVE INNOVATION**

Certain groups are under-represented throughout the entire innovation process. There are troubling disparities in education, access to IP protection, and business development. Children of color, girls, those with disabilities, those living in poverty or in rural regions of our country, and those living in otherwise under-resourced and under-served communities have never been adequately inducted into the innovation ecosystem. When they do get inducted, they often do not stay or face obstacles in patenting their ideas and bringing them to market. U.S. competitiveness requires that the United States avail itself of all of its resources, including all of its people.

Limited access to quality STEM education at an early age and low levels of exposure to innovation at the community level are two of the biggest barriers causing inequities in who becomes an innovator. The landmark 2018 report from the Massachusetts Institute of Technology (MIT) Sloan School of Management, known colloquially as the “Lost Einsteins” study, determined:

1. children from high-income families are 10 times as likely to become innovators as those from below-median income families;
2. exposure to innovation in the family unit or community has a significant impact on a child’s propensity to become an innovator; and
3. if women, minorities, and children from low-income families invented at the same rate as White men from high-income families, there would be four times as many innovators in the United States as there are today.³²

Inequities in who becomes an innovator can also be attributed in part to the disparity in who obtains post-secondary STEM degrees. Blacks, Hispanics, Native Americans, and Alaska Natives are under-represented in STEM disciplinary studies relative to their overall populations.³³ Meanwhile, women, irrespective of ethnicity, are under-represented relative to men in engineering, computer science, mathematics, and statistics.³⁴ Only about a quarter of bachelor’s, master’s, and doctoral degrees in mathematics, computer science, and engineering are awarded to women.³⁵ Although the past decade has seen some improvement in the number of Hispanic and women students, progress has completely stalled for Black STEM students, and the situation has gotten worse for Native American and Alaska Native students.³⁶ Rural populations are



2024 National Inventors Hall of Fame inductee Lanny Smoot

Lanny Smoot is a special effects expert and Disney's most prolific inventor, with over 100 patents. He's developed technological advancements for Disney's theme parks as well as out-of-this-world inventions such as a retractable lightsaber.

"When I was coming up, I had never met an engineer. Certainly not a Black engineer. I grew up in Brooklyn, New York and my parents did not make a lot of money. But my dad started me off. He could fix everything, without specific training. In my earliest memory, my dad brought home a battery, a bell, some wire, and he got the bell to ring, and the light lit up, and he's wiring this on a tabletop. And I was like, what is this? My mind just, I, I have to do this!"

Learn more about Lanny's story at www.uspto.gov/learning-and-resources/journeys-innovation/audio-stories/if-magic.

—Lanny Smoot, Disney Research Fellow and Imagineer

also at a disadvantage because students from urban and suburban communities are more likely to attend college and obtain STEM degrees than their rural counterparts.³⁷ In addition, people with disabilities in STEM are underrepresented in postsecondary degrees and employment, they have higher unemployment rates, and they earn less.³⁸ While people with disabilities represent 9% of the total population aged 18-74, they make up only 3% of the STEM workforce.³⁹ The NSF is currently studying and funding how to make the STEM fields more accessible to people with disabilities.⁴⁰

However, the problems go beyond STEM access and education because the disparities in innovation are even more pronounced than the STEM figures would suggest. A growing body of literature is uncovering pervasive under-representation of minorities and women in patenting and innovation. For example, **African Americans, Hispanics, multiracial individuals, and Native Americans account for roughly 25% of the nation's U.S.-born population, yet they represented only 3.5% of respondents to a comprehensive survey of innovators.**⁴¹ Another study found that **Hispanic and African American men represent only 7% of workers in patent-intensive fields, and their female counterparts account for only 4%.**⁴² **Men born in the United States are also nine times more likely to contribute to an invention than women.**⁴³

Because patenting and protecting IP are often key to unlocking funding and building a successful business,⁴⁴ lower rates of IP protection mean that innovations from those who do not traditionally participate in the innovation ecosystem will not be as likely to make it to market. Overall, U.S. patent holders are 87% male and nearly 97% White, Asian American, or Pacific Islander.⁴⁵

The innovation and patenting picture is not any better when viewed specifically through the lens of gender. Women represent only 13% of named inventors.⁴⁶ Some of that is due to the fact that women in STEM are more active in health-related fields, including life sciences and psychology, than in more patent-

intensive fields such as engineering and computer science.⁴⁷ But female patenting rates are even lower than would be predicted by women's representation in STEM professions,⁴⁸ resulting in what has been called the "innovator-inventor gap."⁴⁹ **Between 2000 and 2016, male primary inventors submitted more than three times as many patent applications as female primary inventors.**⁵⁰ In addition, among all those who file for patents, women are more likely to drop out of the application process before receiving a patent. Such disparities disadvantage women. For example, male-focused innovation has been found to stunt research into women's health,⁵¹ affecting women across the world.

In addition to racial and gender disparities, there are extreme geographical gaps in invention. As illustrated in Figure 1, inventor locations are concentrated in existing technology corridors, including urban centers in California, the Pacific Northwest, Arizona, Texas, and the Northeast Corridor between Northern Virginia and Boston.

According to the Housing Assistance Council, **there are more than 2,000 rural and small-town census tracts in which racial and ethnic minorities make up the majority of the population.**⁵² Under-represented individuals are even more disadvantaged when they are raised in rural areas that are distant from innovation centers. For example, recent studies have found that **more than 90% of jobs in a broad cross-section of high-tech sectors are located in metropolitan areas,**⁵³ and that **50% of all patents originating in the United States are from just five coastal states.**⁵⁴ The remaining 10% of jobs in those high-tech sectors of the economy are spread out over vast rural geographies. Yet rural innovators' potential to innovate to solve rural problems has largely been overlooked.⁵⁵ Demonstrating this potential, a recent report from the Organisation for Economic Co-operation and Development concluded that R&D spending is more productive in rural areas than in metropolitan areas.⁵⁶

By volunteering with organizations such as the American Indian Science and Engineering Society, the Society of Advancement for Chicanos and Native Americans in Science, and AnitaB.org, Tara Astigarraga helps younger women and men from under-represented backgrounds see the possibilities of a career in STEM.



Tara Astigarraga is a Master Inventor at IBM, named on 81 patents. It was a path she could not have imagined as a first-generation college student. "When people talk about activities in STEM or how to build pipelines and get people involved, they typically talk about the Black and Hispanic communities and even women," said Tara. "But Native American communities hardly ever get brought up because when you round that data, we get rounded to zero and we don't even get included in those conversations. The Native American community is 1.2% of the U.S. population, but we represent 0.03% of the STEM workforce."

Learn more about Tara's story at www.uspto.gov/learning-and-resources/journeys-innovation/field-stories/conquering-impostor-syndrome.

—Tara Astigarraga, IBM Master Inventor and member of the Choctaw Nation of Oklahoma

Even when women and under-represented minorities become innovators, they must overcome additional barriers: disparities in U.S. business formation, financing, and ownership. If an innovator cannot start or sustain the business necessary to bring an idea to market, commercialization is unlikely to occur. Based on the Annual Business Survey (ABS) from the 2020 census, men had an ownership stake in 78% of U.S. businesses and a majority ownership share in 63% of businesses.⁵⁷ Women held an ownership stake in 37% of U.S. businesses but had a majority ownership share in only 22% of businesses (Figure 2).^{*} The data shows that women are under-represented as business owners relative to their proportion of the U.S. population.

Figure 1: Number of Inventors by County, 2012-2022

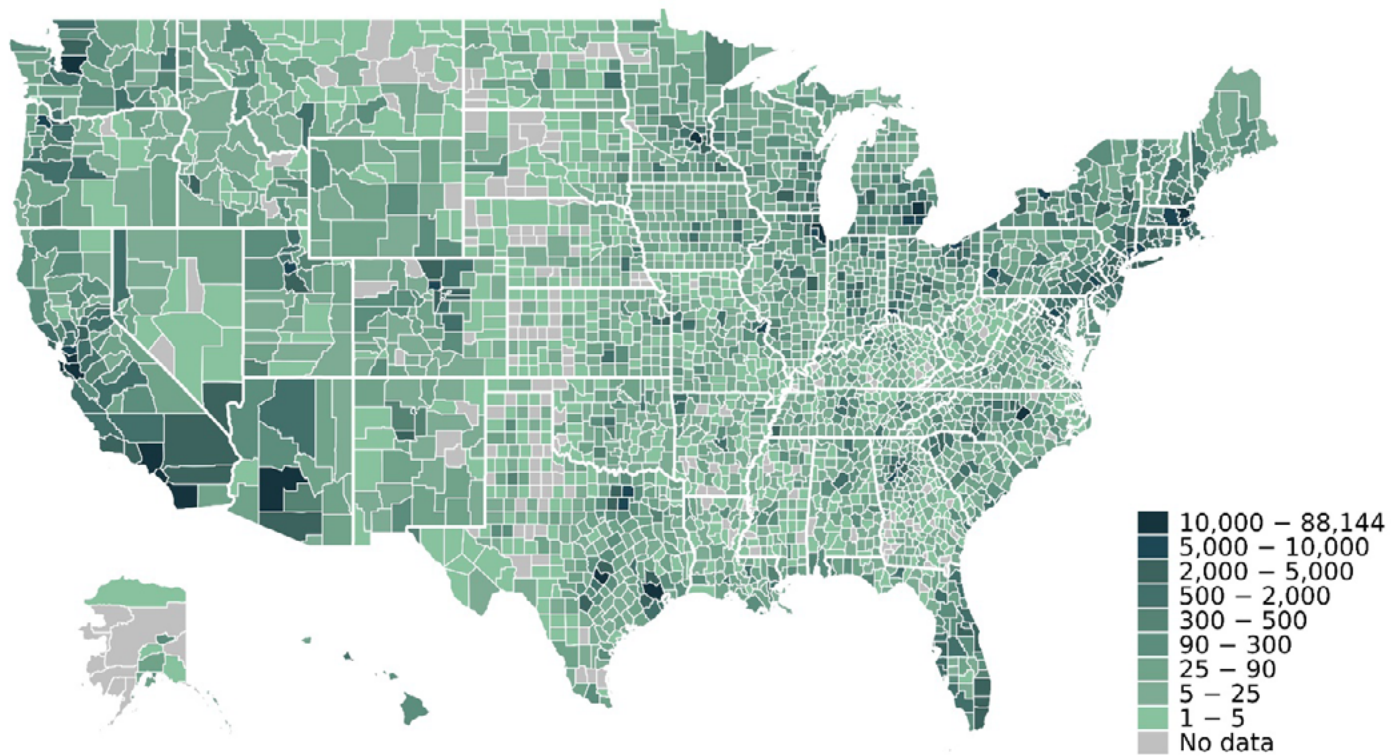


Figure 1 - Source: Authors' calculations using PatentsView.org data.

* Note that the percentages in Figures 2 and 3 are based on public ABS data that produces results that differ very slightly from calculations undertaken by the Census Bureau (see www.census.gov/newsroom/press-releases/2021/annual-business-survey.html).

Grouping the data by race instead of gender shows even greater disparities in business ownership. Nearly 86% of U.S. businesses were partially or wholly owned by White Americans in 2020 (Figure 3).

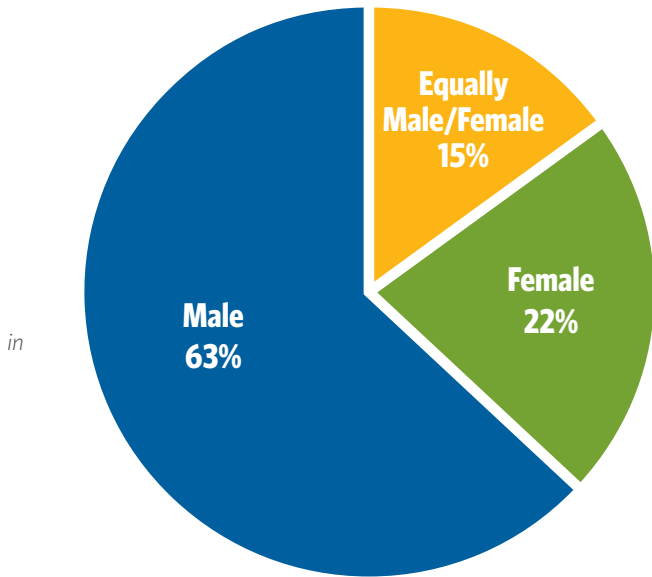


Figure 2: Percentage of businesses owned by gender

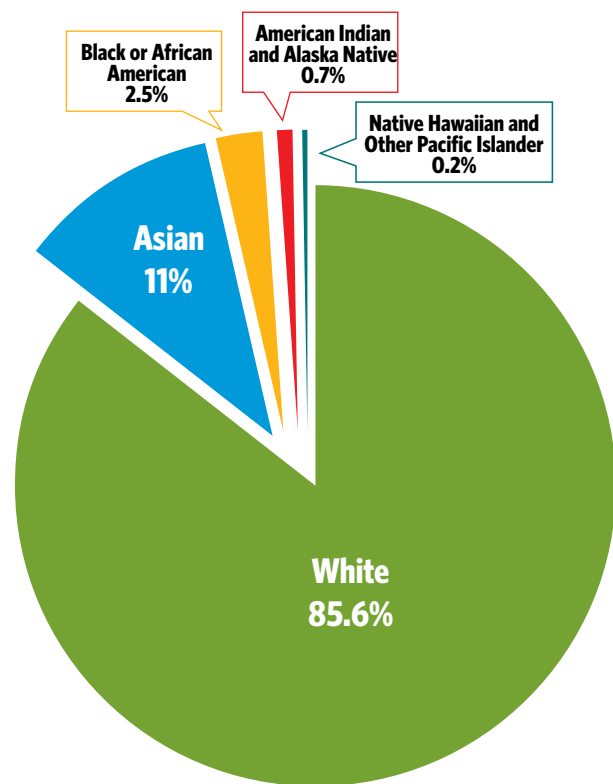
Figure 2 - Source: Annual Business Survey 2021 (<https://www.census.gov/data/developers/data-sets/abs.html>)

Note: Ownership classification by gender, race, ethnicity and veteran status is determined by 51 percent or more of ownership stock or equity the business by demographic group.

Figure 3: Percentage of businesses owned by race

Figure 3 - Source: Annual Business Survey 2021 (<https://www.census.gov/data/developers/data-sets/abs.html>)

Note: Ownership classification by gender, race, ethnicity and veteran status is determined by 51 percent or more of ownership stock or equity in the business by demographic group.



Small business formation is an especially important way for people with disabilities to achieve employment.⁵⁸ Indeed, the rate of self-employment for people with disabilities is about 50% higher than the rate for people without disabilities.⁵⁹ But innovators with disabilities face barriers to business formation, including the availability of financing.⁶⁰

Inventors who apply for and receive a patent may experience numerous personal benefits, including increased income and job promotions and new professional opportunities.⁶¹ Moreover, applying for and obtaining a patent helps companies gain access to financial capital, find licensees, stimulate additional innovation, and facilitate growth.⁶² Trademark and copyright protection can help support businesses commercializing patented inventions. But the women- and minority-owned businesses that exist each possess less protected IP than the businesses of their White male counterparts.⁶³

For example, although **women own less than 30% of businesses overall,[†] among businesses that hold a patent, only 18% are women-owned.⁶⁴ Black-owned businesses fare even worse. A mere 1% of Black-owned businesses own a patent.⁶⁵ Thus, women-owned businesses and Black-owned businesses are each one-third less likely to own a patent than businesses overall.** Hispanic-owned businesses fare only slightly better, being 25% less likely to own a patent than their businesses overall.⁶⁶

Trademark ownership fares a bit more equitably by gender. Specifically, 26% of women-owned businesses possess a trademark, 9% more than those who hold a patent.⁶⁷ However, trademark ownership is only marginally higher by race and ethnicity. For example, 1.4% and 4.6% of Black-owned and Hispanic-owned businesses respectively have a trademark.⁶⁸

Thus, disparities in income, wealth, education, exposure to innovation, and access to both information and capital are all obstacles to inclusive innovation.



[†] This percentage includes a one-half share of the 15% of businesses that are equally owned by men and women, as shown in Figure 2.



CORNERSTONES

This Strategy is built on four Cornerstones. Each Cornerstone is an inflection point in the process of becoming an innovator and is critical to maximizing American prosperity. The Strategy provides recommendations for how to support future and present innovators. The first Cornerstone addresses preK-12 educational disparities and the need to inspire youth of all backgrounds to become innovators. The second Cornerstone is directed at post-secondary educational disparities, both for students and faculty. The third Cornerstone promotes inclusiveness in government agencies, industry, nonprofits, and academic institutions. The fourth Cornerstone focuses on equity in the commercialization of new innovations to ensure that our work in expanding innovation achieves maximum impact—creates businesses and jobs, promotes economic prosperity, solves community and world problems, and shores up national security.

Each of these Cornerstones invokes different sectors and actors whose contributions are necessary for inclusive innovation. Governments and nonprofits are often the primary actors responsible for youth education and enrichment, especially in under-served communities. Universities are largely responsible for supporting their students and faculties. Private industry is in control of equitable access and inclusive innovation from within. The USPTO and other government agencies provide training in IP and entrepreneurship to the public. Industry and government often work together to help bring innovation to market. It thus takes an entire nation to foster inclusive innovation, and virtually every sector has its part. Exemplary programs and resources to help each sector identify actions for success are listed in the Appendix to this Strategy.

THE FIRST CORNERSTONE: INSPIRING NEW GENERATIONS OF INNOVATORS

Though there are many on-ramps to innovation, research indicates that early and sustained exposure to STEM is a driving factor in determining who becomes an inventor later in life.⁶⁹ Early exposure to innovation, invention, and STEM benefits students of all ages.⁷⁰ That said, there needs to be a shift in how STEM and innovation education are taught in order to inspire more children.⁷¹



Expanding access to STEM education that includes innovation and invention concepts (innovation education) that appeal to all children can greatly increase the involvement in the innovation economy from groups that have been historically sidelined in the United States. Recognizing these considerations, the federal government's 2018-2023 five-year STEM education strategic plan incorporated innovation by engaging learners where disciplines converge as a strategic pathway.⁷² But much remains to be done.

RECOMMENDATION 1 Standardize and scale youth innovation education

Under the Biden-Harris Administration, improving STEM education among preK-12 students has become a priority.⁷³ The Research and Development, Competition, and Innovation Act (part of the CHIPS and Science Act of 2022) charged the NSF and the National Academies with studying the efficacy of STEM programs for preK-12 students.⁷⁴ That study is to include a “review of the research literature” and to provide best practices.⁷⁵ The Department of Education already provides some evidence-based practice guides for supporting STEM education.⁷⁶

STEM and innovation, while closely related, are not the same. Advocates for innovation education characterize the framework as being complementary to existing STEM curricula. Successful innovation requires more than just mastering science, technology, engineering, and math. A recent research collaboration, convened by the Lemelson Foundation, outlined the parameters of an improved innovation education framework that would effectively develop the next generation of empathetic, resilient, driven problem-solvers who are capable of harnessing their ingenuity to meet societal needs.⁷⁷ Their collective research identified the need to teach collaboration, communication, and iterative problem identification and problem-solving.⁷⁸

Some of the key features of an impactful education framework include:

- Open-ended project-based work, on an individual basis and within teams
- Exploration of real-world problems and learning from real-world problem-solvers, including partnering with community institutions to identify and help solve local problems
- Integration across academic disciplines
- Embrace of failure and iteration as essential learning experiences
- Analytical reasoning and communication skills

This innovation education approach provides a learning environment that encourages students to take risks, experience failure, and be comfortable with ambiguity. Students gain confidence, resilience, and leadership skills that will prepare them to effectively address future challenges in the workforce, regardless of what path they pursue. There is growing consensus that to generate maximum student connection with the tenets of innovation education and innovation, especially for under-represented students, projects should address a community need and be collaborative in nature.⁷⁹ Once students realize they do not need to wait until they are adults to make an impact in their local communities, they begin to feel empowered and see themselves as problem-finders and problem-solvers. This empowerment helps them become more fully engaged learners. In practice, an effective innovation education program can include, for example, public-private partnerships with community organizations or local industry to connect classroom instruction to real-world applications.



For preK and elementary schools, simple approaches might include designing open-ended activities that foster a child's curiosity, implementing hands-on building activities, curating book lists that introduce STEM concepts and celebrate the innovations of inventors from all walks of life, and incorporating free lessons and activities from nonprofits and government agencies.⁸⁰ A number of classroom-ready modules and resources are already available. For example, some basic resources can be explored at inventioneducation.org, uspto.gov/kids, and ipoef.org/curriculum.

For middle school and high school students, a more intentional focus should be placed on teaching STEM and arts subjects not within their disciplinary silos, but by integrating material across fields.⁸¹ In addition, instructors should be enabled to highlight the evolving nature of scientific understanding and technological



development. Schools should seek out ways of illustrating the dynamic evolution of disciplines by hosting field trips to local universities, museums, and corporations that conduct novel R&D, and by suggesting that on those field trips, the children be exposed to diverse innovators. Lessons from free invention and entrepreneurship curricula should be curated to support objectives of STEM and innovation education.[‡] Team-oriented and experiential learning projects should be included in lesson plans, and the characteristics of

responsible leadership, empathy, and continuous improvement should be fostered, as they, too, are essential elements to the practice of innovation. Such programs are already a priority in the Republic of Korea (South Korea) and India.⁸²

The Design Tech High School (d.tech) provides an example of these concepts being put into practice. Housed on Oracle's campus, d.tech is a free public charter high school in California that was started through the Oracle Education Foundation. This learning environment promotes the tools for infusing problem-solving in every aspect of the student's curriculum; creating and using technology to augment confidence and accomplish goals; and creating a sense of belonging for all social identities in the school community of students, teachers, and families. In addition, Oracle employees serve as mentors to the students in such fields as business plan development and user-experience design.

Post-secondary institutions have also stepped up to provide STEM and innovation education for high school students. Local community colleges and universities should strive to offer dual-enrollment STEM programs for local high school students, with a special emphasis on outreach to students from under-represented groups and under-served communities. The Wisconsin Alumni Research Foundation, for example, supports a pre-college enrichment program designed for low-income and prospective first-generation college students⁸³ that has resulted in 94% enrollment in higher education.⁸⁴ Similarly, some corporations have explored dual-enrollment programs, such as IBM's six-year Pathways in Technology Early College High Schools (P-TECH) program, in which students graduate with their high school diploma as well as an associate degree in a technical field. Such dual-enrollment programs should be expanded and promoted, especially to students from under-represented backgrounds, and would ideally include project-based coursework that include elements of invention and IP education.

Numerous developmental resources are freely available, including on the websites for InventEd.org, the Intellectual Property Owners Education Foundation, the Michelson Institute for Intellectual Property, and Lemelson-MIT Invention Education. The USPTO also offers free resources. In addition, the USPTO hosts the National Inventors Hall of Fame (NIHF) museum at the USPTO headquarters in Alexandria, Virginia,⁸⁵ and through its partnership with NIHF, the agency offers educational materials and programming focused on hands-on invention and entrepreneurship curricula.⁸⁶

[‡] Many free resources are available at inventioneducation.org, ipoef.org, and invention competition convening organizations (e.g., the Henry Ford Foundation's National Invention Convention; Lemelson-MIT's InvenTeams® competitions).

The USPTO has also launched EquIP HQ,⁸⁷ a virtual hub for innovation education. This free online portal designed for K-12 educators and learners offers educational resources that expand student learning, creativity, and innovation through gaming. The portal features teacher- and student-tested lesson plans, interactive and fun activities, and videos of young inventors to inspire and unlock innovation within every student. EquIP HQ introduces students to the world of patents, trademarks, copyrights, and trade secrets at age-appropriate levels, allowing them to discover how IP plays a vital role in our everyday lives. This learning system serves an essential function in leveling access to education by bringing innovation training to those limited by their geographic region or economic circumstance.



**When I visited Camp Invention in Akron, Ohio, in August 2023, 10-year-old Grace excitedly showed me her invention. I asked her what she wanted to be when she grew up. Her response: “Well my goal was to be a singer, but, I don’t know, I might be considering engineering now.”
— USPTO Director Vidal**

It is important to build STEM and innovation education not only into base curricula, but also into after-school programming, clubs, and camps. During calendar year 2023, over 390,000 children across the United States were exposed to innovation and IP programs through the NIHF-USPTO partnership, including Camp Invention and Invention Project. Three-quarters of those students were from under-represented communities and received funding to attend these programs. The programs also provided professional development and IP exposure to 30,000 teachers and interns.

Educational materials are also available from open sources such as PBS’s Design Squad Global Clubs.⁸⁸ In addition, schools can promote and facilitate participation in other community programming such as the Scouts and YMCA educational programs, science and state fairs, vocational clubs that have technological elements, and library programs. Educators can also facilitate participation in “Shark Tank”-like pitch competitions and conventions such as the Henry Ford Foundation’s national invention convention, the Georgia Tech Center for Education’s K-12 InVenture Prize, the Lemelson-MIT’s InvenTeams[®] for high school students and JV InvenTeams for middle schoolers, and For Inspiration and Recognition of Science and Technology competitions.⁸⁹ Many large corporations are also active in implementing specialized innovation programs. For example, Qualcomm Inc. offers a Thinkabit Lab program that now reaches across the country.⁹⁰

The USPTO also supports community-level extracurricular innovation education by partnering with the Girl Scouts and the Intellectual Property Owners Education Foundation to offer an IP Patch for Girl Scouts.⁹¹ The USPTO has likewise coordinated with the Boy Scouts to offer an Inventing Merit Badge.⁹² The USPTO’s partnership with NIHF, discussed above, also offers after-school and summer programs for students throughout the country and provides scholarships to many students from under-represented communities.⁹³ Other opportunities, such as integrating innovation programming with the 21st Century Community Learning Centers supported by the U.S. Department of Education, are worth exploring.⁹⁴

The federal government has attempted to be a hub of information in the STEM education space. The NSF has established the Eddie Bernice Johnson INCLUDES⁹⁵ (Inclusion Across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science) National Network⁹⁶ to connect educational



Students in the Hopkinetics team participate in a robotics competition in December 2023 (Photo courtesy of Doug Scott)

Doug Scott, a teacher at Hopkinton High School in Massachusetts, uses hands-on experiences, including prototyping and building, to teach his students how to solve real-world problems. He finds this approach particularly effective at engaging under-represented students in STEM fields.

“I’m looking at my rosters now for next semester, and I’ll have, in a class of 24, let’s say, 22 boys and like two girls. That’s unfortunately common at the high school level. I just go right up to them, and I say, ‘I recognize what you do. You’re the only two girls in this room. All I ask is you give me at least a week. If you don’t like the class, leave,’ I said, ‘but don’t run to guidance today and switch out just because it’s all boys. Just give me one week.’ In my school district, the biggest under-represented group in STEM are the female students.”

Learn more about Doug’s story at www.uspto.gov/learning-and-resources/journeys-innovation/audio-stories/lets-do-real.

—Doug Scott, teacher at Hopkinton High School and past participant in the USPTO’s MTIP

institutions, individuals, alliances, pilot projects, federal agencies, and other entities to broaden participation in STEM careers.⁹⁷ The network includes a “Coordination Hub” meant precisely to improve coordination.⁹⁸ However, the NSF effort is presently devoted to STEM rather than innovation-specific programming. Although the INCLUDES Network helps connect entities knowledgeable about STEM education, it does not, and does not purport to, serve as a one-stop shop that pulls together programming information in a way that makes it easy for a teacher to introduce a lesson plan on innovation.

It is critical for the United States to discover the most effective programs available, and to scale them nationwide. Scaling these programs will require hard choices about which programs should be pushed forward to the millions of children who need them. At the same time, this standardization should not override the benefit of enabling outreach to local high-tech corporations or be so inflexible as to preclude solving community problems. As an active member in this space, the USPTO is ready to work together with the NSF and other agencies, including those charged in the CHIPS and Science Act, with moving forward the “widespread and sustained implementation” of STEM education improvements.⁹⁹

Public comments received by the USPTO recognize that the effort to scale programming is made more difficult by the lack of requirements for such programming.¹⁰⁰ Specific math and science curricula, for example, have been made mandatory in many states and school districts. The same needs to occur for innovation curricula. If innovation enrichment is always optional within a teacher’s curriculum, then the United States will continue to place undue reliance on the specific teachers and organizations with the motivation and resources to overachieve. And those overachievers are likely to be concentrated in schools with the greatest resources. As the University of California reported to the USPTO, a national curriculum on innovation and entrepreneurship would be welcomed.¹⁰¹ Though the USPTO will continue to work to scale its outreach to individual schools and school districts, a national curriculum—or statewide curricula—may be needed.

The USPTO welcomes the opportunity to assist in the creation of educational materials and resources that support the development of those curricula.

RECOMMENDATION 2

Provide resources, training, and support to empower educators to teach innovation

There are more than four million preK-12 educators in the United States,¹⁰² hundreds of thousands of whom need to be trained in innovation education.

Studies have shown that teachers who have been exposed to or have experience in STEM fields or innovation are more likely to be motivated toward and capable of teaching innovation education.¹⁰³ Accordingly, strategies should be focused on providing resources and training to inexperienced innovation education instructors, as well as motivating them to devote time and energy to implementing alternative instructional methods to support innovation education in the classroom.

Research in the field of education has identified at least three skill sets that instructors need to effectively teach innovation education to a diverse set of students, in addition to existing requirements for teaching technical fields:

- 1. knowledge and experience in guiding students through open-ended, problem-based inquiry¹⁰⁴**
- 2. ability to provide scaffolding instruction, in which teachers gradually remove guidance and support in order to empower students' greater independence¹⁰⁵**
- 3. ability to tie instruction to students' backgrounds and communities¹⁰⁶**

“Second career” teachers who have experience in the innovation community may sometimes be the most ready to jump into innovation curricula. But they are in



Olin Lagon meets with a student at Kamehameha Schools (Photo courtesy of Whitney/USPTO)

Olin Kealoha Lagon is a social entrepreneur who is harnessing innovation to address socioeconomic inequalities. He is transforming the energy sector with his use of machine learning technology to increase energy efficiency and reduce the strain on power grids. But his passion is addressing the challenges Native Hawaiians face in the 21st-century economy and encouraging K-12 students to pursue tech careers. At Kamehameha Schools in Honolulu, one student shared with him that “Every one of my neighbors’ dads works in construction. That’s not a job that will give you the best opportunities. Becoming a software engineer will give me the opportunity to break out of that cycle and change the culture.”

Learn more about Olin’s story at www.uspto.gov/learning-and-resources/journeys-innovation/field-stories/cultivating-community-driven-change-olin.

—Olin Kealoha Lagon, CEO of Shifted Energy

short supply and may require training in how to teach. Meanwhile, time and resources are lacking to train teachers (whether first career or second career) in innovation pedagogy. However, teachers and school administrators do not need to start from scratch. Beyond some of the available curricula that draw on best practices, which are described in the previous subsection of this Strategy on sparking interest, active hands-on training is available from numerous sources. In addition, post-secondary schools in the community can help high school teachers become certified in and compensated for teaching university STEM and innovation courses at the high school level.

Furthermore, expanding collaborative public-private partnerships could help finance teacher training in STEM and innovation education and connect teachers to real-world innovation environments. One example of such a partnership at the collegiate level is VentureWell, a nonprofit organization that is funded by a mix of academic and government sources. Its faculty grant awards support the development of courses and programs that lead to the formation of student innovation teams, thereby helping students gain entrepreneurial skills through experiential learning. Likewise, the Georgia Institute of Technology (Georgia Tech) runs an InVenture Prize program that includes teacher professional development and a proposed curriculum that culminates in a student invention competition. Georgia Tech succeeded in expanding the footprint of its program into rural counties by providing more regionally centered and in-person events.¹⁰⁷

The USPTO itself provides extensive training opportunities for preK-12 educators. The USPTO's flagship annual, five-day, professional development program for educators, the National Summer Teacher Institute (NSTI) on Innovation, STEM, and Intellectual Property, equips elementary, middle, and high school teachers with strategies and tools to integrate IP into their classroom instruction. The NSTI program is designed to help teachers inspire the next generation of inventors, innovators, and entrepreneurs by combining experiential training tools, practices, and project-based learning models. Even after just a week of such training, the percentage of participants who "have the strategies and tools to implement intellectual property and innovation education into classroom education" jumps from 10% to 100%.¹⁰⁸

To further scale the USPTO's train-the-trainer impact beyond the NSTI, the agency recently launched the Master Teacher of Invention and Intellectual Property Education Program (MTIP).¹⁰⁹ The MTIP is a first-of-its-kind, student-centered, train-the-trainer program that provides educators with the training and support to become teacher-leaders in innovation education and provide professional development to other K-12 educators across the United States. The program's mission is to foster a national network of teacher-leaders who will inspire, motivate, and empower educators to foster invention and IP education in all communities.



The USPTO has further scaled its education efforts by leveraging its geographic footprint with its recently announced Community Outreach program.¹¹⁰ With a nationwide workforce of more than 13,000, the USPTO is relying on employees' experience and knowledge to help under-served and under-resourced communities pursue innovation and entrepreneurship and learn how to protect their IP. USPTO employees, including patent examiners with technical backgrounds, will serve as IP Champions across the country to deliver awareness and educational programs on the IP system and the importance of IP and innovation in their own communities.

The USPTO also applauds Congress's authorization for the NSF to establish a National STEM Teacher Corps 10-year pilot program that will recruit diverse STEM educators who will work as a team to "develop and improve innovative teaching practices, including practices such as inquiry-based learning."¹¹¹ That program would expand on the impact of earlier similar efforts.¹¹²

Beyond these initiatives, we need to standardize and scale teacher education in innovation so every child across the United States has access to teachers who have the skills and materials to teach innovation.

RECOMMENDATION 3

Provide youth coaching, mentoring, and career awareness to foster and support long-term interest and capabilities in innovation

Youth are more likely to discover and sustain an interest in innovation if they can better understand the numerous pathways and careers open to them through an education rooted in innovation. Making a particular effort to showcase diverse workers and the stories behind their professional journeys helps inspire students throughout the preK-12 educational system. Beginning at the high school level, schools should also seek to provide career counseling services that accurately inform students about the wide range of career trajectories available to them in technical fields, as well as the skill sets required for them. Students not only need to be inspired, they also need to be prepared.

Private sector and government participants in the innovation economy can play an important role in educating youth about careers in innovation. They should proactively establish ties with schools and organizations in their communities. When they do so, they should encourage STEM professionals to provide invention or experiment demonstrations while showcasing innovators from under-represented groups as role models for diverse student populations.

Additionally, mentorships, internships, and apprenticeships play a crucial role in fostering the increased development of innovators in under-represented groups. Balancing classroom learning with real-world experiences creates cultural shifts, thus increasing access to experiential learning for Black, Native American, and Latino learners.¹¹³ These programs provide invaluable opportunities for individuals from marginalized backgrounds to gain hands-on experience, guidance, and support from professionals in their respective fields. Mentors are also critical for youth with disabilities.¹¹⁴ Diverse mentors instill confidence in students and foster self-efficacy;¹¹⁵ they serve as trusted advisors, offering insights, knowledge, and personalized guidance to help mentees navigate the challenges and opportunities of their chosen industry. By actively involving under-represented individuals in these programs, we not only empower them with the necessary skills but also help break down barriers and bridge the diversity gap in innovation. When these opportunities are paid, they become far more equitable for lower-income participants, who may lack the time or resources to take on unpaid internships.

The federal government has been active in trying to further such efforts. The USPTO, for example, has supported paid internships through Urban Alliance,¹¹⁶ focusing on training high school students in federal service, IP awareness, invention, and entrepreneurship. The USPTO also participated in the Enterprising Island-Wide Innovation Ecosystems program in Puerto Rico.¹¹⁷ That program was part of a multi-sector initiative that created partnerships among Puerto Rican K-12 schools, universities, the USPTO, and the private sector in Puerto Rico. This program aimed to provide a cultural shift to enhance an innovation and

entrepreneurship mindset in all elements of Puerto Rican society. The program included certification for K-12 educators to build their capacity to teach entrepreneurship and innovation in their classroom, and IP education and outreach efforts at the University of Puerto Rico. This collaboration successfully upskilled over 500 K-12 teachers and university faculty through IP professional development trainings throughout different regions on the island.

As a country, we need to make these opportunities a priority and ensure that they are freely and equitably available.

THE SECOND CORNERSTONE: EDUCATING AND EMPOWERING INNOVATORS

Once our youth have had the early training and exposure to innovation, we must continue to build on their learning and experiences and support them through post-secondary education and experiences. Given that many youths will not have had the recommended early experiences in innovation, it is especially important that we also provide post-secondary students with varying levels of innovation education and the support they need.

Historically, the opportunities for innovation for students have come from working on research projects in university laboratories. But research opportunities are largely out of reach for most schools and their students. Especially in the absence of research opportunities, schools should endeavor to provide resources and support so students themselves can try to innovate.

RECOMMENDATION 4

Expand research opportunities to a broad and diverse set of institutions in higher education

Half of all university research is funded by the federal government.¹¹⁸ Among four-year schools, fewer than 300 are designated as R2 or R1, representing “high” or “very high” research activity, with research funding to match. Among the schools left on the outside looking in are the hundreds of Historically Black Colleges and Universities (HBCUs); Tribally Controlled Colleges and Universities (TCCUs); and Minority Serving Institutions (MSIs), including Hispanic Serving Institutions (HSIs). For example, only 11 HBCUs are ranked as doctoral universities with R2 status, and while significant activity is underway for several to move up to R1 status, none of the approximately 100 HBCUs currently hold R1 status according to the Carnegie Classification of Institutions of Higher Education. The American Physical Society has recognized how such an imbalance in research funding negatively affects campuses with large numbers of under-represented students, such as HBCUs, TCCUs, and MSIs, by depriving these students of the opportunity to engage in research, and thereby to see innovation and inventions in action.¹¹⁹

It is not speculative to believe that HBCUs, TCCUs, and MSIs will be productive innovation incubators when given the opportunity. Some HBCUs, such as Morgan State, have demonstrated extraordinary success in innovation coming out of their labs, outperforming R1 institutions when measured on a per-research-dollar basis.¹²⁰ This should not be a surprise given that such schools have usually had to do more with fewer

resources than schools with mostly White student bodies.¹²¹ These funding disparities must be addressed to expand innovation opportunities for a vast number of students.

One way to address the funding disparity is for government agencies to further expand their collaborations with HBCUs, TCCUs, MSIs, and other schools, including those in rural communities that have not traditionally received equitable funding, and to provide support for research funding applications. For example, through the U.S. Department of Energy's RENEW program, researchers from Argonne National Laboratory and Brookhaven National Laboratory have partnered with the University of Puerto Rico-Río Piedras to prepare Hispanic students for the new energy workforce.¹²² The EDA, a Department of Commerce agency represented on CI², recently provided \$16.5 million in grants to 23 colleges and universities, including an HBCU, and MSIs, including HSIs and Native American-Serving Nontribal Institutions.¹²³ These grants are designed to leverage the schools' assets, promote innovation, and strengthen the regional economies around these schools.¹²⁴ In addition, the National Institutes of Health (NIH) has recently committed to better diversify some of its grants.¹²⁵

RECOMMENDATION 5

Foster innovation and entrepreneurship learning and experiences in post-secondary education

It is key that post-secondary education include both innovation and entrepreneurship learning and experiences. Entrepreneurship education not only supports bringing innovation to market (Cornerstone 4), it is also key to incentivizing and empowering students to innovate, as they can envision the end game.

Research shows that just a single course in entrepreneurship at a university or community college is associated with significant improvements in entrepreneurship-related human capital and entrepreneurial outcomes.¹²⁶ That support can also come through trade schools or through online or other resources, including certificate programs.

We must continue to provide innovation learning and experiences in higher education, while equipping students with transdisciplinary learning opportunities in fields such as communication, business, and design to ensure they have the knowledge and skills to translate their innovations into marketable products.¹²⁷

A number of four-year institutions have thoroughly integrated innovation and entrepreneurship instruction into degree programs. For example, Thomas Jefferson University's School of Design and Engineering has placed an intentional focus on supplementing traditional STEM knowledge with critical thinking, collaboration, and communication skills development.¹²⁸ The University of Colorado at Colorado Springs offers bachelor of innovation programs with focus areas in STEM fields, business, design, and the arts. Whether in STEM, business, design, or the arts, the bachelor of innovation requires a 24-hour core curriculum in innovation, entrepreneurship, business and IP law, and policy.¹²⁹

Educational institutions need not start from scratch. Open-source invention and entrepreneurship education resources, such as those offered by the Michelson Institute for Intellectual Property, Project Invent,¹³⁰ the University of Iowa's STEM Innovator, and some of the other curricular resources discussed in reference to Cornerstone 1, could be used to help impart basic knowledge of IP. In the entrepreneurship vein, edX is a leading online education platform founded as a nonprofit joint venture by Harvard University and MIT.¹³¹ This platform offers a range of free courses in entrepreneurship¹³² and related topics such as business plans¹³³

and IP. VentureWell's faculty grant awards support the development of courses and programs that lead to the formation of student innovation teams, thereby helping students gain entrepreneurial skills through experiential learning.

Universities and colleges could also consider making changes that intentionally broaden the institutional culture to foster collaboration among faculty and students. Universities should instill the importance of innovation in all departments that give rise to applied research, technology development, and IP, to include design and creative arts departments. For example, 300 institutions worldwide have started chapters of the National Academy of Inventors, which provide a grassroots infrastructure to promote a culture of innovation within the community.¹³⁴ Some cutting-edge programs, such as the University of Oregon's M.S. in sports product design and Rensselaer Polytechnic Institute's B.S. in design, innovation, and society, operate at the rare intersection of coursework that combines skills in science, innovation, business, engineering, and design to ensure that graduating students are prepared for innovating in society.¹³⁵

Innovation Is Being Woven into Iowa State University's Core Curriculum

Commercializing an idea requires unique skills that are often not part of the educational system. Therefore, a new curriculum is needed to help future innovators.

Iowa State University has created a Student Innovation Center to teach students how to turn ideas into inventions, patents, and new companies. The Center is helping to integrate entrepreneurship training into traditional curricula. It also provides students with mentors from Silicon Valley and companies such as Boeing. Additionally, the industrial engineering department is now teaching students about new product development and case studies on startups.

Students are provided with paid opportunities to build prototype products for industry clients. They learn how to make pitches to investors for seed funding. Through the university's Innovation Fellows in Training Program, students engage in the intricacies of applied innovation, such as participating in challenge competitions and sprint projects, attending workshops with industry experts and faculty, and networking with innovative companies and organizations.

The university understands that innovation is a core competency that must be part of the college curriculum and is essential to the future health of the university, the local community, the state, and the nation.

Institutions should consider defining a campus-wide applied research agenda that builds diverse teams of faculty and students from across the university to tackle the identified projects. Universities could also hire a rotating “entrepreneur in residence” from the private sector to assist faculty and students in navigating IP and commercialization processes. Usually on staff for one-year intervals, entrepreneurs in residence serve the university as experienced subject matter experts in startup and business development and serve as links to the surrounding corporate ecosystem.¹³⁶

Universities should use their technology transfer offices (TTOs) to help train students and not merely to monetize a university’s inventions. The University of Wisconsin, for example, has been a leader in this regard. The TTO that serves the University of Wisconsin’s regional campuses, WiSys, delivers programs such as pitch competitions and “hackathons” (during which students collectively brainstorm a solution to a concrete, real-world design problem) that allow students to gain first-hand experience in innovation. In addition, mentoring and training are included in all hosted competitions. Faculty research grants awarded by WiSys also include student training and involvement as criteria, and WiSys hires student interns as ambassadors for the university system. These students receive a stipend and training in IP and technology transfer processes. Similarly, the infusion of entrepreneurship and innovation hubs into many of its colleges led Brigham Young University’s TTO to achieve the highest small school ranking in terms of innovation impact in a 2020 report by the George W. Bush Institute.

However, it is critical that innovation support extends to campuses that have historically lacked it, including trade schools, community colleges, HBCUs, TCCUs, and MSIs. Trade schools can introduce students to innovation as well as training in the trades. Community colleges, meanwhile, enroll approximately 10 million students in the United States, representing nearly half of all undergraduate students.¹³⁷ Community colleges are widely dispersed and more accessible geographically, especially for students with disabilities.¹³⁸ The National Association for Community College Entrepreneurship (NACCE) has established a broad network of locally based entrepreneurship programs at community colleges nationwide. Through NACCE’s network, faculty and staff learn skills and increase access to information and resources for commercialization. Working with its member institutions, NACCE offers specialized areas of emphasis called centers of practice that promote greater participation in the innovation ecosystem, with specialized centers of practice targeting women, veterans, and historically under-served communities.¹³⁹

Recently, the USPTO began its Community College Pilot in collaboration with the League for Innovation in the Community College. The pilot is an initiative in which educational content on innovation and IP protection is provided by the USPTO to a consortium of community colleges.[§] The first such consortium comprises Austin Community College in Austin, Texas, including the 28 additional community colleges in its consortium. The educational content consists of “micro-learnings” that professors can integrate into existing courses. The USPTO hopes to partner with additional community college consortia, other federal agencies, and nonprofit organizations to scale the program further.

The USPTO has engaged in extensive outreach and partnering with HBCUs and MSIs to help bring IP literacy into more college classrooms. As discussed earlier regarding preK-12 education, the USPTO participated in the Enterprising Island-Wide Innovation Ecosystems project in Puerto Rico, a portion of which was devoted to IP education and outreach efforts across the campuses of the University of Puerto Rico.

§ A community college consortium is a group of community colleges that have partnered to allow cross-enrollment in order to expand educational opportunities for all the members of the consortium.



Dr. Marshall Jones, inventor of the industrial laser and National Inventors Hall of Fame Inductee (photo courtesy of NIHF)

Dr. Marshall Jones faced many challenges along his journey before he became a pioneering mechanical engineer at General Electric and a foremost authority in the field of laser material processing. As a young man, he developed a speech impediment and had to repeat the fourth grade to improve his reading and spelling skills. At Mohawk Valley Community College, he participated in the co-op program, which gave him the opportunity to gain hands-on experience working in the lab.

“The money wasn’t in the family to pay for me to go to college. My guidance counselor suggested that I consider going to a two year school, and if it wasn’t for that, I wouldn’t be here today,” said Marshall.

He then enrolled at the University of Michigan, where he was the only African American student in the engineering school. Marshall now holds more than 50 U.S. patents and 57 foreign patents.

Learn more about Marshall’s story at www.youtube.com/watch?v=Yw5inL_OXIY.

—Marshall Jones, Coolidge Fellow at General Electric Global Research

USPTO staff, as well as volunteers from the National Society of Black Engineers (NSBE), USPTO chapter, developed and deliver IP education on patents, trademarks, and copyright protection to engineering students at Howard University. This program’s primary goal was to decrease the attrition rate of first-year engineering students by integrating an innovation curriculum and IP awareness into a first-year engineering course. Students were provided access to and interacted with patent examiners, IP attorneys, inventors, and entrepreneurs and were required to conduct patent searches, draft mock patent claims, create brief summaries of inventions, and prepare innovation pitches.

The USPTO also recently collaborated with Texas Southern University (an HBCU) and the University of Houston on the NEXTGEN Energy X program to introduce women and under-represented minorities to careers in the energy industry and the innovation economy. The six-week program uses a lab-to-market conceptual framework and includes business model development and mentoring by energy executives and entrepreneurs. Students developed innovation and entrepreneurship competencies and became more marketable to employers, with 50% of program participants obtaining employment in STEM or energy jobs or going on to graduate school.

The USPTO is also committed to further expanding HBCU students’ participation in the USPTO National Patent Application Drafting Competition. This initiative is designed to introduce students to the intricacies of U.S. patent law, thereby enriching their skills in drafting, amending, and prosecuting patent applications. By focusing on practical, legal, and technical training, the USPTO’s program enriches the STEM ecosystem, fostering an environment in which students from various backgrounds can contribute to and thrive in the national and global innovation economies.

Other agencies are also active in such outreach. In alignment with the objectives of the NSF’s Established Program to Stimulate Competitive Research,¹⁴⁰ the NSF’s Centers for Research Excellence in Science



and Technology (CREST)¹⁴¹ and Experiential Learning for Emerging and Novel Technologies (ExLENT)¹⁴² programs, together with the EDA's STEM Talent Challenge, are orchestrated to bolster the nation's capacity for innovation, with a special focus on HBCUs and MSIs. The CREST program specifically supports these institutions by enhancing their research infrastructure and competitive edge, particularly in disciplines in which minority representation is lacking, thereby nurturing a diverse and robust research community. NIST, in partnership with the NSF, leverages the CREST program as well as the Partnership for Research and Education in Materials to provide students from HBCUs Morgan State University and Fayetteville State University with hands-on experience in materials innovation at the National Center for Neutron Research.¹⁴³ The ExLENT program, through its provision of experiential learning opportunities, aims to tailor education to meet the varied needs of learners, thereby accelerating innovation.¹⁴⁴ Meanwhile, the EDA's STEM Talent Challenge is designed to cultivate STEM skills aligned with regional innovation needs, fostering collaboration among key stakeholders to predict and fulfill the workforce demands of tomorrow.¹⁴⁵ These concerted efforts underscore a comprehensive strategy to advance STEM education and research, improve workforce development, and stimulate economic growth, with HBCUs and MSIs playing an integral role in this transformative journey toward a more inclusive and innovative future.

To have an optimal impact on our country, these types of efforts must be scaled and widely available to all.

RECOMMENDATION 6

Provide post-secondary mentoring and internship opportunities to enable innovation

Students need more than research projects and courses and training in innovation. They need support and resources. The support can include mentorship, and the resources can include equipment, tools, and funding.¹⁴⁶

It is never too early to help support under-represented students through mentorship.¹⁴⁷ This can be done by faculty or by those external to the institution, such as local inventors. The USPTO encourages companies and other organizations to start their own mentoring programs. A mentoring toolkit that provides information to help start and maintain a program is available on the USPTO website at www.uspto.gov/initiatives/equity/mentoring-programs.

A 2020 NSF-funded project that brought together leaders from scores of universities and national organizations unanimously recommended that faculty promotion and tenure standards recognize faculty support for student innovators through teaching and mentoring.¹⁴⁸ For collegiate-level female students, being mentored by a top inventor—irrespective of gender—is associated with a higher rate of patenting.¹⁴⁹ The Lemelson Foundation has also encouraged federal scientists to engage as mentors to K-12 and college students, in addition to early-stage inventors and innovators.¹⁵⁰

A number of organizations provide mentoring opportunities for their members. For example, the National Society of Black Engineers,¹⁵¹ the Society of Hispanic Professional Engineers,¹⁵² the National Academy of Inventors Global Academic Inventors Network Mentorship program,¹⁵³ and the National Science and Technology Medals Foundation's inSTEM program¹⁵⁴ each provide targeted support for those in need of mentoring.

Universities are especially well positioned because their alumni associations have huge pools of prospective mentors that are largely untapped. One commenter to the USPTO pointed to Georgia Tech's "GT Mentor Jackets" program as providing an example for other schools and organizations.¹⁵⁵

In partnership with the National Science and Technology Medals Foundation, as part of the inSTEM program, USPTO employees mentor undergraduate students at Howard University, the University of Texas at Arlington, and California State University-East Bay. The inSTEM program aims to provide students pursuing undergraduate degrees in STEM: (1) a community that helps students address the benefits and challenges of being a member of an under-represented community in STEM, (2) professional development for undergraduates seeking experience relevant to their majors, and (3) mentors on campus and role models off campus to whom they can turn for guidance and support. Beyond mentorship, and especially in the absence of research, students need to have hands-on opportunities to build, develop, and explore.

Vanderbilt University provides a model for deploying those resources. Vanderbilt's Wond'ry offers the tools and resources for students, faculty, staff, and community members to invent and innovate.¹⁵⁶ It provides mechanical, electrical, and other maker spaces, as well as design studios, along with experts to assist. The Wond'ry recently ramped up a studio dedicated to exploring quantum computing. As Vanderbilt recognizes, it is critical that as technology advances, the types of spaces and tools made available advance with it. If a broad cross-section of the population is to have an impact on the technologies of tomorrow—whether quantum, artificial intelligence (AI), green-tech, or others—accessible tools and facilities for those technologies will need to be widely deployed. Gallaudet University is another pioneer in making such resources more accessible. The Gallaudet Innovation and Entrepreneurship Institute provides facilities, training, and mentorship in both American Sign Language and English.¹⁵⁷

In addition to providing important work experience, establishing academic or corporate internships that are inclusive of under-represented groups can provide critical mentorship opportunities. Such programs also demonstrably increase the likelihood of more diverse non-internship (permanent) hiring. For example, employers with internships for people with disabilities were 5.7 times more likely to have hired a person with a disability in the last year than employers without internships for people with disabilities.¹⁵⁸ To provide a

longer-term benefit for those being mentored, these programs should endeavor to continue the mentorship after the internship has concluded.

Along this same line, through CI² the USPTO established paid internships, called Innovation Internships, to provide hands-on training to college and university students who will learn about the USPTO's role in protecting IP, granting patents, registering trademarks, and fostering innovation. This program aims to teach the next generation of innovation professionals the importance of innovation and IP protection and to foster a more inclusive talent pipeline. The current pilot program has successfully onboarded two cohorts that include a number of students from MSIs and several veterans. The USPTO expects to expand this program and hopes it can serve as a model for other government agencies.

These efforts, like others discussed in relation to Cornerstone 2, must be scaled and widely available to all in order to have an optimal impact on our country.

THE THIRD CORNERSTONE: **ADVANCING INCLUSIVE INNOVATION IN OUR GOVERNMENT AGENCIES, INDUSTRY, NONPROFITS, AND ACADEMIC INSTITUTIONS**

Inspiring and enabling more expansive and inclusive innovation by providing more education and resources through our schools as well as other learning resources is vital. But more is needed for innovators or those who would be innovators. When innovators are inventing, improving business processes, or creatively solving problems, innovative thinking reaps benefits not only for the individual but also for employers and the U.S. economy. People with disabilities, for example, pioneered technologies including some critical to the pandemic and post-pandemic shift to work-from-home.¹⁵⁹ Therefore, it is vital to support innovators within their own organizations—as professors in academic institutions, employees in private sector or government organizations, or otherwise—by removing barriers in those institutions and organizations and empowering everyone to reach their maximum innovation potential.

While women and under-represented minorities have increasingly entered fields that traditionally give rise to invention and entrepreneurship, a number of factors may be preventing these innovators from being recognized for their innovations. STEM employees of color face barriers to their success and commonly identify biases in recruitment and promotions and a lack of organizational inclusivity as being detriments to their success.¹⁶⁰ For Black corporate employees, many perceive inequities in the workplace and a lack of belonging as contributing to a lack of career development.¹⁶¹





For women, working conditions can be inhospitable to promotion and success, often leading them to prematurely exit patent-intensive fields without realizing their patenting potential.¹⁶² There is also the risk of gender-based harassment.¹⁶³ Female academic faculty patent at less than half the rate of their male counterparts.¹⁶⁴ A study has shown that becoming a mother further reduces patenting for female faculty.¹⁶⁵ Women disproportionately leave engineering fields because of dissatisfaction over promotion opportunities and disparate pay.¹⁶⁶

For women and Black people, social, professional, and financial networks for inventive and business activities are often lacking.¹⁶⁷ For all under-represented individuals, the ability to exchange information with and be empowered by other successful innovators who share their characteristics is critical to realizing their full potential.¹⁶⁸

Many cultural biases—conscious or unconscious—exist within workplace organizational practices. Likewise, many existing practices can ward off potential candidates, especially people with disabilities.¹⁶⁹ Organizations that rely on “one size fits all” management policies, or that do not reject overt and implicit discrimination, will not be able to reap the full potential of a diverse workforce of innovators. It is critical that government agencies, as well as academia and private industry, provide an environment that promotes inclusion, institutes policies that support diverse employees, and nurtures innovative thinking.

The Department of Commerce developed the draft Business Diversity Principles (BDP) Initiative as part of its 2022-2026 Strategic Plan goal of promoting inclusive capitalism and equitable economic growth for all Americans and in response to the equity Executive Orders 13985 and 14091. In November 2023, the Department of Commerce solicited public comments on its draft BDP Initiative, which relies on “encouraging businesses to learn from each other’s successes and adopt best practices and strategies that help promote economic growth in under-served communities through” diversity, equity, inclusion, and accessibility (DEIA) initiatives.¹⁷⁰ Through the USPTO’s leadership of CI² and through its own experience with its employees, the USPTO has identified five best practices or principles to attract, support, and retain new innovators:

- **Elevate diversity, equity, inclusion, and accessibility as central organizational values**
- **Recruit more diverse talent into the workplace**
- **Create an inclusive and respectful workplace to improve the retention of under-represented employees**
- **Cultivate a shared vision of inclusive innovation**
- **Improve equity within the academic research community**

RECOMMENDATION 7

Encourage and support an inclusive workforce across public and private organizations

Elevate Diversity, Equity, Inclusion, and Accessibility as Central Organizational Values

Advancing diversity, equity, inclusion, and accessibility begins at the top. There must be a commitment from the leaders of the organization. Management must vocalize its commitment to inclusion and demonstrate that commitment by establishing and promoting an organizational code of conduct regarding DEIA. The CI² member organizations have identified a library of existing best practices for causing cultural change. For example, corporate leaders can elevate their existing corporate DEIA stance by signing the CEO Action for Diversity & Inclusion™ pledge,¹⁷¹ which outlines a specific set of actions signatory CEOs will take to cultivate a diverse and trusting environment. Many organizations have taken the extra step of designating a senior manager as a Chief DEIA Officer or creating a diversity board that strategically guides and reviews an organization's progress in implementing DEIA policies. Requiring upon hiring and periodically thereafter unconscious bias and diversity training that complies with anti-discrimination laws sets the tone for all employees that diversity is a core value. Researchers have studied what makes for an effective training program.¹⁷² Some hallmarks of successful training programs include focusing on employee self-growth, relying on empathy, encouraging interacting with people from other groups, and committing to improvement and continued learning.¹⁷³ Recently, the USPTO, for the first time in its history, required unconscious bias training for everyone in the organization. Training managers and leadership on disability inclusion has also been shown to be critical for the inclusion of employees with disabilities.¹⁷⁴



2023 National Inventors Hall of Fame inductee Rory Cooper

Rory Cooper is an innovator, athlete, and professor who turned a tragic accident from his time in the U.S. Army, which left him paralyzed, into a springboard to create technology ranging from advanced wheelchair designs to wearable instruments. His innovations aim to help people with disabilities live better, more inclusive lives. He holds 25 U.S. patents and is one of the world's leading experts on human mobility.

"Accessibility helps drive social inclusion. If you think about it, the wheelchair I use, the adaptive vehicle I use, the home modifications I use, they all allow me to be productive and creative and contribute to society. What's important is to create a world where everyone belongs and everyone can contribute. Accessibility is a tool to facilitate that."

Learn more about Rory's story at www.uspto.gov/learning-and-resources/journeys-innovation/audio-stories/engineering-better-life

Rory Cooper, Distinguished Professor,
University of Pittsburgh

Many institutions have also recognized that it is critical to have leadership teams that reflect the diversity of their workforce. It is crucial that organizations identify and eliminate any barriers to equal opportunity in the workplace, including any barriers impacting the consideration of employees from under-represented groups for promotion into the ranks of management and onto governing boards. In addition to the moral imperative to have diverse management teams, these efforts can have a positive performance impact. For example, one comprehensive study of over 12,000 firms across 45 countries determined that firms with gender diverse boards have more patents overall, obtain more novel patents, improve innovative efficiency, and increase inventor gender and ethnic diversity.¹⁷⁵

Equitable workplace policies must be established and monitored. Any successful retention strategy must ensure that there is an equitable distribution of resources and opportunities for all employees. All performance metrics should be fair and measurable, including when used as criteria for advancement and awards. Blind review mechanisms should be implemented wherever possible to guard against unconscious bias. Emerging technologies, such as AI, may assist with blind review, though organizations should be mindful of the risk that such technologies can sometimes perpetuate bias. All promotion and award boards should, to the greatest extent possible, have diverse membership. When innovation plays a prominent or complementary role in an employee's job description, it should specifically be included as a metric for performance evaluations and bonuses.

Inclusion practices must be institutionalized, and progress must be actively measured. Once a robust DEIA program is in place, organizations should take extra steps to assess their state of diversity and inclusion, understand the root causes of any uncovered disparities, design policies and programs to effect change, and monitor and measure their progress. The USPTO has partnered with the Diversity Pilots Initiative and the U.S. IP Alliance's Diversity Pledge to facilitate connections between firms piloting diversity initiatives with researchers willing to support rigorous evaluation of such initiatives.¹⁷⁶ In this way, diversity and inclusion policies can truly become institutionalized. The Intellectual Property Owners Association has published a "Diversity in Innovation Toolkit" that pulls together a number of publications about the benefits of diversity in the innovation community and some of the causes of disparity, and proposes short- and long-term programs to implement and measure change.¹⁷⁷

As part of a process to improve, organizations should devote resources to measuring, benchmarking, and understanding diversity and employment experiences. These analyses can uncover any existing problems and help chart a course to achieving progress. Some benchmarks to consider for monitoring organizational progress for each under-represented demographic are: rates of inventorship, management, board membership, and overall employee diversity. As with any benchmarking exercise, it is critical to establish routine measurement and monitoring of best practices and to continue to refine DEIA policies based on the objective findings. This process, however, must be done in a way that does not result in demographic-based quotas or encourage decision-making based on race, sex, or another protected category in the context of employment. Rather, the results of these efforts can be used, for example, to expand the awareness of vacancies to broaden the applicant pool, or to address retention issues in particular positions.

Another step that organizations can take to codify their DEIA programs is to routinely publish program metrics and progress against benchmarks. This practice demonstrates to their workforces, as well as to external stakeholders, potential recruits, and the general public, that the organizations are committed to making progress toward full inclusion. Organizations can also strive for accolades in industry diversity (e.g., the National Organization on Disability's Leading Disability Employer Seal,¹⁷⁸ the "Top 50 Companies for Diversity"¹⁷⁹ and "Catalyst"¹⁸⁰ awards). In doing so, organizations can truly position themselves as employers

of choice, with important benefits reflected in recruitment, retention, performance, and expanded access to the innovation ecosystem.

The USPTO is committed to reporting statistics related to diversity and inclusion and publishing its efforts to provide an equitable, fair, and inclusive environment for its employees. The USPTO's CI² team is working with agency leaders to ensure that the data collection, analysis, and reporting are robust and actionable. To accomplish



this, the USPTO has introduced a novel online resource called the Diversity Information (DI) Platform.[¶] The DI Platform reports the latest public data on U.S. geographic and industry demographics based on population and employment. It allows organizations to benchmark their own diversity against industry data and offers resources on best practices and current research. Through this platform, the USPTO reports on the diversity of its overall workforce, including by major job function, as well as on relevant benchmarks. The DI Platform also includes information to assist organizations in choosing what types of information to collect and measure (for example, the number of, the types of positions held by, and the influence of historically under-represented individuals). Assessing how often and to what extent the targeted entities cite inclusive innovation as a key business goal or strategy, as well as enumerating what organizations do to facilitate access to and participation in the IP ecosystem, can serve as key metrics of success. Outputs with correlations to inclusive innovation, such as broader access to financial capital or R&D resources, provide additional indicators of success in advancing inclusive innovation.

NACIE recently recognized the importance of this USPTO platform to help “[e]stablish and measure the appropriate local and national performance metrics for entrepreneurship ecosystem success, inclusion, and capital investment.”¹⁸¹ NACIE also recognized the importance of further “expansions of this platform to improve data collection/sharing on innovation and entrepreneurship participation.”¹⁸²

This effort to share information, to publicize it, and to establish norms for championing inclusive innovation is critical to any success at the national level. Without measuring one’s success and comparing it to the success of others, there is too great an incentive to move on to other priorities and to let progress within an organization stagnate or even regress. Different organizations need not only to understand benchmarks, but also to compete, in a sense, just as some corporations discussed above already do. And those corporations that have yet to embrace such efforts should be encouraged to do so.

Recruit More Diverse Talent into the Workplace

Every university, business, and organization that helps cultivate innovators should seek to expand its recruitment efforts beyond traditional candidates and traditional feeder schools. Organizations should develop and formalize recruitment relationships with HBCUs, TCCUs, and MSIs, such as HSIs. Similarly, in the academic sector, departments and programs that are focused on applied research and innovation should

¶ U.S. Patent and Trademark Office, “[Diversity Information Platform](#)”

actively recruit student and faculty candidates from the same institutions that serve minority populations. All organizations should actively develop relationships with and recruit from professional associations such as the Society of Women Engineers and the National Society of Black Engineers; consortia that focus on inclusion, such as the Higher Education Recruitment Consortium; and conferences such as the Grace Hopper Celebration of Women in Computing and the CMD-IT/ACM Richard Tapia Celebration of Diversity in Computing Conference. With sufficient resources, some organizations could take this strategy a step further by helping to sponsor conferences that focus on under-represented demographic groups. NIH and private industry have recently taken steps to improve recruitment among people with disabilities.¹⁸³

In addition to tapping into relationships with diverse institutions and events, establishing academic or corporate internships shared with institutions serving traditionally under-represented groups can help transition students from education to productive employment. The aforementioned professional associations can be effective partners in recruiting interns. Industrial postdoctoral fellowships that train early-career scientists and engineers in innovation and business practices are another mechanism to bridge the gap between the corporate and academic sectors. Fellowships like these have already been federally funded by the NSF for small businesses,¹⁸⁴ and corporations could model similar programs internally. In the process, many of the same innovation education goals discussed earlier can be reached with these gateway employment programs focused on under-served individuals.

It is also important to remove as many potential biases during the hiring process as possible. Companies that have a centralized human resources system—and that do not rely on the personal preferences of select supervisors and managers—show the least discrimination when vetting applications.¹⁸⁵ Organizations should use any tools or procedures available to them to remove unconscious bias from the screening process. To this end, the USPTO has begun implementing a process in which certain identifying information is removed from an employment application to reduce the possibility of conscious or unconscious bias in screening decisions.

The Biden-Harris Administration recognizes the rewards and perils of the use of AI. One risk is that AI can be used “to disadvantage those who are already too often denied equal opportunity and justice.”¹⁸⁶ Accordingly, when using AI systems in the context of employment, care must be taken to avoid bias. For example, when an AI tool is trained with predominantly male employees’ curricula vitae (CVs), the result can discriminate against female applicants, including sometimes downgrading them when the word “female” is used on a CV.¹⁸⁷ The Equal Employment Opportunity Commission and NIST have provided technical assistance on how to avoid this bias.¹⁸⁸ An additional concern is that if hiring institutions rely on outside providers for the screening software, it may be difficult for an employer to understand the screening algorithms to assess whether and how AI is engaged in or perpetuating unfair decision-making. Even when an employer uses an AI system or decision-making tool developed by a vendor, the employer may be responsible under federal law if the tool discriminates on a basis protected by law.¹⁸⁹

At the post-screening stage, and consistent with applicable equal employment opportunity laws, organizations should endeavor to have interview panelists with diverse perspectives. Not only does this help mitigate any potential bias in considering job candidates, but it also models the organization’s embrace of diversity. Many corporations, including those represented by CI², are already employing these best practices for recruitment and are seeing positive effects.

Strategies are all too often exclusively focused on traditional four-year STEM degree programs. But attaining a post-secondary degree is not a prerequisite for becoming a productive, innovative employee. Reexamination of which positions truly require a four-year or graduate degree, combined with targeted

vocational training, can help broaden the pool of individuals who show promise in innovation. Dozens of corporate employers that are part of the OneTen.org coalition have reached the same conclusion. OneTen's goal is to upskill, hire, and advance "Black talent and others who do not have a four-year degree."¹⁹⁰ As coined by former IBM CEO Ginni Rometty, the focus should be on "new collar jobs," in which employees acquire necessary skills via non-traditional pathways such as community colleges, vocational schools, software boot camps, certification programs, tech education, apprenticeships, and internships.¹⁹¹ One of IBM's programs enables students to graduate with high-school diplomas, no-cost associate degrees tailored to industry needs, and workplace experiences (including mentoring and internships).¹⁹²

IBM/P-TECH

Pathways in Technology Early College High Schools (P-TECH) is an IBM program that promotes access to opportunities in technology jobs through non-traditional education paths. Designed to reach under-served populations and better prepare them for "new collar jobs," P-TECH is a public-private partnership that provides work experience and education in an individualized high school and college model. P-TECH students can graduate with high school diplomas while concurrently earning a free associate degree and potentially gaining additional experience through paid internships.

For example, at P-TECH Brooklyn, students complete coursework in workforce learning, which teaches them the soft skills vital in any professional position. IBM also provides each student with an IBM mentor and uses in-person and platform-based communications to help them develop both workplace and technical skills. In addition, students have the opportunity to observe professional office environments first-hand through local IBM site visits.

Building on the success of the P-TECH model, IBM is expanding its outreach. Open P-TECH is a free online platform for students and educators that provides technical and professional learning. Students can acquire digital credentials and career guidance, while educators receive foundational training in emerging technologies, including Cloud Computing, AI, and Blockchain. Another benefit is the platform itself: the online module will facilitate outreach to individuals in under-represented communities.

Create an Inclusive and Respectful Workplace to Improve Retention of Under-Represented Employees

Retaining and supporting the career development of diverse employee innovators is as important as recruitment. Job satisfaction, compensation, recognition, skills development, and promotion potential should all be key components of an organization's retention strategy. And importantly, different groups of employees consider these criteria using their own value systems, which makes deploying a "one size fits all" human resources approach ineffective. By focusing on understanding their employees' diverse work experiences and developing a retention strategy to reflect those unique needs, employers will empower talented and diverse employees to advance their professional and creative development.

Organizations should provide a sense of community. Retention of a productive, diverse cadre of employees is integral to any organization's success. The key is to recognize and consider the unique challenges faced by under-represented employees.



For example, large organizations have discovered that employee resource groups (ERGs, also known as affinity groups) provide a valuable way for employees to find colleagues with whom they identify. Race, gender, sexual orientation, disability, veteran status, and hobbies are common factors around which ERGs are organized, though membership is open to everyone and not limited to a particular demographic group. Employees should be empowered and given resources to help establish new groups. Many organizations have developed programming, including training, career development, and mentoring, and promoted that programming to ERGs. For some employees, ERGs provide a chance to socialize and connect with their peers. For others, they offer a chance to network, find a mentor, or broaden one's knowledge base.

The USPTO has recognized the importance of voluntary employee organizations through which employees can support one another. Of the 31 USPTO voluntary employee organizations, each of which is open to all

employees, two-thirds are affinity groups formed around a shared cultural background.¹⁹³ These affinity groups assist the USPTO Diversity Program Office in planning initiatives, programs, training, and events. For example, the National Society of Black Engineers, USPTO chapter, created a coaching and mentoring program focused on the specific needs of the participating employee. The program's goals include increased employee retention and employee career advancement.

Recognizing that the need for such affinity groups extends beyond the agency, the USPTO has published templates for charters and bylaws that other organizations can use to establish their own affinity groups.**

Organizations should strive to retain employees and support career development. Workplace strategies to retain employees should be designed to appeal to a broad spectrum of individuals. The COVID-19 pandemic, and repeated post-pandemic calls to return to the office, have taught us that many employees prefer remote work and flexible schedules. But that widespread preference can be a necessity for retaining working parents, especially mothers, and individuals with disabilities.¹⁹⁴ Likewise, firms can offer lactation spaces^{††} and travel support for nursing mothers. Others are making sure that employees have input or oversight into all decision-making processes so those with specific needs, including pregnant and nursing workers, caregivers, and individuals with disabilities, can feel supported in their work and get customized assistance. Community partnerships can help provide special support for workers with disabilities, including assistance with transportation.¹⁹⁵

On the skills development front, some companies are creating reentry training programs that help onboard employees after an extended personal or military absence. Importantly, these programs recognize that professional journeys are often circuitous, with unforeseen challenges and opportunities. Other firms are offering retraining programs that allow their employees to shift fields without leaving the organization entirely.

A key retention strategy is establishing demographically specific leadership and career development programs. Compared with their peers, women and disadvantaged minorities face unique cultural, professional, and personal challenges that make it more difficult to climb their career ladders. For example, one study determined that due to numerous cultural factors, workers who come from lower socioeconomic origins in the United States are 32% less likely to become managers than those who come from higher socioeconomic origins; women are 27% less likely than men, and Blacks are 25% less likely than Whites.¹⁹⁶

A robust career development program provides employees access to a wide range of training and apprenticeship opportunities, regardless of their field. The Department of Labor, for example, provides resources for DEIA in apprenticeship.¹⁹⁷ Organizations that do not have a wide catalog of their own resources should consider outsourcing training or find creative ways of ensuring that their employees have sufficient opportunities to improve their skills and keep up with changing technology. One way to support novice and diverse inventors is through the creation of early professional development opportunities. For example, these new employees could be targeted for inclusion in high-profile projects that are likely to

** U.S. Patent and Trademark Office, "Establishing Employee Resource Groups," www.uspto.gov/initiatives/equity/employee-resource-groups.

†† The Fair Labor Standards Act (FLSA), as amended by the Providing Urgent Maternal Protections for Nursing Mothers Act (PUMP Act), requires employers to provide reasonable break times for an employee to express breast milk for their nursing child for one year after the child's birth each time such employee has need to express the milk. See 29 U.S.C. § 218d. Employees are entitled to a place to pump at work, other than a bathroom, that is shielded from view and free from intrusion from coworkers and the public. Information about FLSA protections to pump at work is available from the U.S. Department of Labor's Wage and Hour Division at www.dol.gov/agencies/whd/pump-at-work.



Natalia Bilenko, Founding Organizer of Queer in AI

As a visible role model in the AI community, **Natalia Bilenko** works to ensure the field welcomes ideas and perspectives from all scientists. “AI is a profession that excludes a lot of people from participating, and that’s a huge problem,” she says. “A lot of the motivation I had for starting the organization *Queer in AI* with other folks, it was about some of these impacts of technology on people who are marginalized—both in society in general and in access to these technologies.” *Queer in AI* found that most queer scientists the group surveyed do not feel completely welcome in the field, partially due to a lack of a visible community and role models. The group organizes community building activities and workshops and provides scholarships for students interested in graduate work in AI.

Learn more about Natalia’s story at www.uspto.gov/learning-and-resources/journeys-innovation/field-stories/artificial-intelligence-all.

Natalia Bilenko, scientist and founder of *Queer in AI*

have innovation success, either as team members or as participants in a shadowing process. Another method is the adoption of a rotational development program for new employees, allowing them to gain the skills, knowledge, and personal connections that will serve them well in their innovation journeys. Career development programs should be customized for each employee, taking into account their field of work and the skills needed to attain their career goals. By actively participating in career development planning, organizations demonstrate their investment in their employees and empower the employees to succeed.

Organizations should increase access to mentors and networks. Professional mentorships in the workplace are instrumental in creating a diverse and engaged employee community.¹⁹⁸ Learning from peers who are also navigating innovation processes and from mentors who have been in one’s shoes can create an environment ripe for collaborative thinking and knowledge sharing.

Mentorship programs have been shown to be more effective in increasing the representation of under-represented minorities in management positions compared with other diversity initiatives.¹⁹⁹ Mentorship programs also help promote and retain minority men and women when compared with non-mentored individuals.²⁰⁰ However, because innovators tend to seek mentors who share similar backgrounds, mentorship opportunities can be frustratingly limited for women and people of color.²⁰¹ The problem is even more acute in smaller organizations or for independent innovators who may especially need access to external mentors and peer networks.

Organizations in the innovation ecosystem should develop and establish mentorship programs for novice R&D employees that match them with experienced innovators and, where the mentor and mentee desire it and where consistent with law, align demographic characteristics of the mentor and mentee. Mentoring could also be project-oriented and include an innovation milestone such as completing a patent disclosure during the program or including the mentee in designing a solution to a specific problem.



Recognizing the importance of employee mentorship, the USPTO offers an enterprise-wide mentoring program to its employees. This unique program is consistently rated by participants as over 90% effective in professional growth and development. Moreover, participants emphasize how the program helped them to expand their own networks and learn more about the USPTO's values and mission. Notably, several USPTO ERGs, such as the NSBE and the USPTO Military Association, offer additional mentoring programs for their members. The USPTO also offers a toolkit, a template, and forms to assist other organizations with starting their own mentoring programs.²⁰²

Networking programs allow employees to share lessons learned about the innovation process. Companies should take advantage of any existing ERGs to help make these connections among peers, or they could consider creating virtual networking opportunities that span across an organization's innovation landscape. Where an organization lacks the size or resources to offer effective mentoring and networking itself, nonprofit organizations and government entities can help. Some organizations are national, with local club offices or chapters (e.g., United Inventors Association and SBA-funded programs such as Service Corps of Retired Executives (SCORE) mentoring and Small Business Development Centers), and they help facilitate networking at the community level to varying degrees. Others, such as the NSF's National Innovation Network, focus on the invention-commercialization pathway but are limited to serving already funded grant recipients who are affiliated with universities.

Organizations should equitably recognize employee contributions. It is also important to recognize, both internally and externally, the contributions of innovative employees from all backgrounds. They must be appropriately incentivized and then properly recognized once they achieve success. On the incentives front, companies should have established, equitable financial award structures for being named an inventor on a patent application, for patent allowance, and for commercialization or licensing of an invention. In addition, companies should ensure that inventorship, innovative thinking (in all its forms), and scientific or technical advancements are included as components of performance evaluation and promotion reviews.

In addition to recognizing top-producing innovators, companies should also consider establishing peer-to-peer or crowdsourced award programs. Being recognized by colleagues and managers alike signals to innovators that their workplace values their contributions. Awardees could be recognized internally at meetings, via intranet publications and emails, or via a special innovation notation attached to their email signature block. Contributions toward a project that falls short of inventorship should still be recognized, as those contributions help incentivize and facilitate future inventorship opportunities.²⁰³ Externally, awardees could be featured in newsletters, social media posts, website content, and video productions. Some forms of recognition, such as IBM's notation of "Master Inventor," acknowledge highly inventive activity but also tie the responsibility of mentorship to the award. In this way, the awardee's successes are reinvested in a new generation of innovators. In all cases, care should be taken to ensure that employees from under-represented groups are provided equal opportunities to be among those showcased and that such decisions are free from bias.

RECOMMENDATION 8

Cultivate innovation more broadly and equitably in organizations that innovate, including academic research institutions

Regardless of how well an organization—whether public, private, or nonprofit—welcomes and maintains employees of different backgrounds, there cannot be inclusive innovation without innovation. Policies need to foster and cultivate innovation across the breadth of an organization and to incentivize, reward, and support those who may be new to the innovation ecosystem. Organizations should explore new approaches to inclusive innovation, they should assess what succeeds and what does not, and through such assessments they should advance learning in promoting inclusive innovation.

Cultivate a Shared Vision of Inclusive Innovation

It is critical that inclusive innovation be promoted across an entire organization. Doing so increases the pool of potential innovators within an organization. For example, holding annual campus- or organization-wide innovation showcases celebrates the benefits of innovation across the board. Innovation and entrepreneurship workshops can promote basic literacy and appreciation for how innovation underpins the organization's growth. An innovation challenge, similar to hackathons, is another collaborative and rewarding activity. While such fairs and events should naturally be open to all employees, organizations should take extra steps to ensure participation from under-represented groups.

Diversity is especially valuable to research, development, and design teams. Institutions should build diverse research and design teams whenever possible to ensure that the organization is setting the stage for an inclusive work environment that cultivates diverse perspectives, including among different races, genders, and disability types.²⁰⁴ Indeed, research demonstrates that mixed-gender teams are more likely to produce patents²⁰⁵ and that they tend to be more highly cited patents (i.e., of higher quality) than those from male-only teams.²⁰⁶

Companies should also infuse innovation education into training. A lack of sufficient access to information about innovation and IP is a significant barrier to entry for innovators at any institution. Many employees—even those who have been educated in patent-intensive fields—have not received the innovation education recommended in Cornerstones 1 and 2. All employers in the innovation ecosystem should ensure that their workers have access to basic information or training about IP and its processes, as well as the overall value and contributions of innovation to the institution.

For corporations, that could mean creating and delivering a training program for newly hired employees that covers innovation processes like how to patent, how new products and services are linked to corporate strategy, and how an employee can navigate internal innovation and IP processes. Moreover, corporations should establish and promote an internal message board or collaboration tool as a hub for exchanging IP information and resources. Additionally, corporations should have a strategic innovation structure in place that includes networking, education, and initiatives to inspire new innovators (e.g., IBM's Academy of Technology). As part of this strategy, all employees should be able to readily see how their individual innovations intersect with the bigger picture of the company's strategy and emerging consumer markets. These improvements result in better jobs for Americans by making organizational culture more egalitarian

and by providing additional opportunities for skills and career development.²⁰⁷

For institutions of higher learning, this type of innovation literacy training could be provided by collaborating with the TTO, by building department-specific innovation seminars for faculty and graduate students, or by obtaining these resources from a partner organization. Academic institutions should foster this learning across all departments, including art and design, to ensure that all faculty and graduate students understand the value in developing and protecting creative works and inventions. Nonprofit and government support organizations could aid innovators by helping to develop, market, and deploy innovation education materials to small businesses and entrepreneurs. Any opportunity to educate potential innovators—at conferences, events, or workshops—is a valuable means for spreading information about innovation development and protection.

Improve Equity Within the Academic Research Community

Universities face special challenges in fostering a culture of innovation compared to the private industry and government agencies discussed above. Research dollars are conspicuously absent from many campuses where under-represented minorities study and teach.

One recent study examined why Black applicants for NIH funding have had difficulty obtaining financial support for their research. One reason is that these applicants' interests are more likely than others' to include community-based concerns that are misaligned with the interests of grant reviewers.²⁰⁸ To the extent that such community-based research interests are not adequately served by existing grant-awarding criteria, expanding grants to encompass these research interests expands the repertoire of federal research in practical ways that may have commercial benefits. This type of expansion may also provide important incentives for faculty to pursue research that addresses societal problems, while simultaneously offering university students practical experience in commercialization.²⁰⁹ This can potentially result in



National Medal of Technology and Innovation Laureate and National Inventors Hall of Fame inductee James (Jim) West is passionate about diversifying the STEM fields. Through the Ingenuity Project, Jim mentors students at Baltimore Polytechnic Institute and helps them develop independent research projects.

Jim West is the co-inventor of the electret microphone, which has advanced the sound industry and become the standard microphone used in products from music recording equipment to hearing aid devices.

In college, Jim was often the only person of color in his classes, and though he says the challenges he faced there were typical of any student, he found it difficult to get into study groups because of his race. *“So my solution was to solve the most complicated problem and throw it at the first [study] group.”* At that point, they wouldn't raise any objections.

“[O]ne of the other reasons that I joined Bell Labs was that I met and saw other black scientists,” Jim says.

Learn more about Jim's story at www.uspto.gov/learning-and-resources/journeys-innovation/field-stories/going-beyond-horizon.

—Jim West, Professor at The Johns Hopkins University's Whiting School of Engineering

a positive cycle, bringing more students and faculty, in turn attracting more research dollars, and in turn attracting more faculty and students.

Even within the schools that attract research funding, the traditional tenure process has historically failed young women faculty. A publish-or-perish mindset still exists for untenured faculty. Junior faculty report a general unwillingness to engage in commercially viable work at a time when “publishing is what counts” for tenure and promotion,²¹⁰ especially for female faculty with caregiving responsibilities.²¹¹ Achieving publication and patenting success are not mutually exclusive, but adequate faculty incentives are typically not in place to support both.²¹²

Since its inception in 2010, the National Academy of Inventors has supported and advocated for the addition of patenting and commercialization to promotion and tenure criteria for faculty. Several universities have changed their criteria as a result, such as the state institutions in Florida. Changing the rewards culture drives benefits for the institution as well, not just with the potential for license income and other investments, but also with increased opportunities for research funding and prestige for the institution.²¹³

Prompted by these concerns, the NSF funded a summit in 2020—titled “Promotion & Tenure—Innovation & Entrepreneurship (PTIE).” Led by Oregon State University, PTIE brought together 65 coalition institutions and 10 stakeholder organizations to identify best practices for the inclusive recognition of the impact of innovation and entrepreneurship within promotion and tenure guidelines.²¹⁴ PTIE has become a movement that seeks to incentivize and reward the societal contributions of academic faculty engaged in innovation and entrepreneurship.²¹⁵ This initiative aims to address inadequate attention by universities to innovation-based contributions by faculty, including in connection with tenure. Academic institutions whose missions align with this philosophy should consider joining the PTIE coalition or, as a first step, consider implementing PTIE recommendations for modifying faculty promotion and tenure guidance.

Closing the gender gap is vital to advancing success in technology transfer. In 2014, Washington University in St. Louis’s Office of Technology Management implemented the Women in Innovation and Technology program, educating female scientists on technology transfer and commercialization, and providing networking and mentoring support. The program resulted in substantial increases in the number of invention disclosures and patents filed by female faculty.²¹⁶

Ohio State University REACH for Commercialization

Female academic researchers are much less likely than their male counterparts to patent an invention and commercialize their product. To address this, Ohio State University’s (OSU) REACH for Commercialization™ program was launched in 2010 as the signature program of OSU’s ADVANCE Institutional Transformation grant, funded by the NSF.²¹⁷

The program introduces participants to successful OSU female entrepreneurs, who serve as mentors and with whom participants can consult privately about their ideas and projects. The program also connects female researchers to the resources and personnel at the university’s Technology and Commercialization Office; to partners such as Rev1 Ventures, an innovation incubator that nurtures startup companies in Columbus; and to patent attorneys, federal agency program directors, angel investors, and venture capital investors.

In addition to reaching a wider swath of faculty and students, TTOs should make every effort to support the entire campus population, including women and under-represented groups. This could include funding and promoting applied research mini-grants, internships, pitch competitions, or teaching assistantships to expose all, including under-represented students and faculty, to innovation concepts and information. In addition, TTOs could be a natural hub for mentorship and networking, helping to connect novice and under-represented STEM researchers across the campus. AUTM has begun to develop best practices, including the creation of a “women inventor’s toolkit,” to help provide support for female faculty.²¹⁸

THE FOURTH CORNERSTONE: BRINGING INNOVATION TO MARKET

The goal in incentivizing more innovation is to bring that innovation to impact to bolster economic prosperity, shore up national security, and solve global problems. Developing a great idea and protecting it with IP are often the first steps for commercialization. Ideas can be commercialized by the innovator through entrepreneurship or by others through tech transfer and licensing.

In February 2024, NACIE released a report and recommendations to the Secretary of Commerce.²¹⁹ NACIE’s recommendations recognize that innovation is fueled by entrepreneurship, which enables individuals to take risks to create businesses that bring innovation to market. As discussed in the Background section above, many of NACIE’s recommendations and action items complement the USPTO’s own recommendations.²²⁰ The USPTO is working to support NACIE. In addition to following through on the NACIE recommendations, there is more to do to bring innovation to market.

RECOMMENDATION 9

Equitably facilitate IP protection for all innovators and entrepreneurs

An immediate opportunity—and challenge—for new innovators is determining how and when to protect their IP, a key step for attracting funding and securing business interests into the future.

Patent protection provides exclusive rights to an invention for a limited time, facilitating financing and deterring copycats. Patenting is therefore often key to building a successful business.²²¹ By linking an invention to one or more trademarks, the owner can establish a powerful brand that can be a key driver of growth, especially for young firms. Those filing their first federal trademark application exhibit faster employment and revenue growth in the five years after filing than those firms that do not file for trademark protection.²²² Taken together, the combination of patent and trademark protection provides a strong foundation for firms seeking to bring innovations into commercial use. Copyrights, like trademarks, can be critical to protecting technology, including by protecting software code, instructions, and certain design elements from copying and theft.

Access to readily available and understandable information about securing IP rights can help innovators overcome the complicated legal process of applying for patents and trademarks. These resources fall into two categories: information about IP and direct assistance to secure rights. The institutions at the forefront

of efforts to provide these resources are the government agencies in the United States that issue patents and register trademarks and copyrights, namely the USPTO and the U.S. Copyright Office. Other interested organizations also provide help.

Because of the importance of patent and trademark protection, for many innovators the USPTO is the organization most critical to securing their IP rights and starting their entrepreneurial journey. But the barriers to securing and maintaining IP protection can be formidable, especially for first-time innovators. An application for a patent or trademark entails considerable work that may include extensive searching for similar patents that have already been granted to others. Furthermore, the patent or trademark application only begins the examination process. Applicants frequently interact with their USPTO examiners, resulting in amendments to the application and arguments having to be made by the applicant to support their claims.



To address some of these barriers, the USPTO launched an “IP Identifier” tool to help innovators determine if their ideas and brands can be protected through the issuance of a patent or registration of a trademark or copyright.²²³ The USPTO also recently launched a pilot program called AccessUSPTO²²⁴ that works with national organizations that do not focus on IP, but whose members include aspiring creators, entrepreneurs, and inventors. Through the program, the USPTO evaluates the needs of an organization’s membership and helps to create tailored outreach plans that provide their members with the information they need to gain protection for their IP through patents, trademarks, copyrights, and trade secrets.

Recognizing the importance of patent protection for new innovators, the USPTO recently introduced its First-Time Filer Expedited Examination Pilot Program.²²⁵ This program provides new applicants having micro entity status an early indication as to whether their idea could be granted a patent. By lowering time-based barriers for inventors who might otherwise be unable to participate in the patent system, this initiative will enable them to bring their innovations to impact more rapidly. Along similar lines, the USPTO recently established a Pre-Prosecution Pilot designed to help first-time patent applicants and to assess the strengths and weaknesses of a prospective patent application even before the application is filed.²²⁶



To help innovators with both patents and trademarks, the USPTO is committed to supporting and expanding its network of approximately 100 Patent and Trademark Resource Centers (PTRCs) located in 46 states, the District of Columbia and Puerto Rico. The PTRCs are a network of public, state, and academic libraries that help the USPTO support the IP needs of the public.

In an era in which many services have moved online, it remains important to have a local presence for individuals who have limited online access or who need personalized attention. The services offered by the PTRCs include guidance and training in patent and trademark search tools, strategies for obtaining IP protection, access to USPTO application forms and instructions, and manuals of patent and trademark

examining procedures.²²⁷ Each PTRC has library personnel trained to assist the public in all matters related to patents and trademarks.²²⁸ The USPTO provides ongoing training for PTRC representatives, and it maintains a telephone hotline for representatives who have difficult questions.²²⁹ The USPTO has been aggressively expanding the footprint of resources available at libraries and has recently increased the number of PTRCs at HBCUs.²³⁰ All participating institutions can do more to raise public awareness of PTRC resources, particularly institutions in under-served communities. Academic institutions can also serve a particularly important role in fostering collaborative initiatives between their PTRCs and the communities they serve.

The USPTO has also expanded support for patent and trademark applicants. For example, the USPTO recently introduced an “Innovation Portal” that is a revision of the “Patent Basics” section of its website. This service provides an interactive option to individuals and small enterprises.²³¹ On the trademark side, the USPTO now offers a downloadable “Trademark Basics Registration Toolkit” that provides a streamlined, step-by-step guide to federal trademark protection and the trademark registration process.²³² The USPTO is in the process of translating that toolkit and other materials into Spanish and is exploring whether there is a demand for translation into additional languages.

Beyond that online introduction, the USPTO also provides extensive training resources to assist applicants and prospective applicants. The eight-part “Path to a Patent” series covers everything from IP basics, to searching patent databases for similar inventions, to providing effective techniques needed to draft and submit patent applications.²³³ A high-quality patent application substantially increases the chance of a patent being granted. The “Trademark Basics Boot Camp” is a similar eight-part series that provides a comprehensive overview of trademarks and the federal trademark registration process, including walking participants through the application filing process. Potential applicants can also engage in a live question-and-answer session with USPTO trademark experts.²³⁴ In addition, the USPTO offers a three-day Stakeholder



After receiving a patent and a trademark, Tanya Bryant and her two daughters focused on marketing their product and growing their brand through social media. (photo courtesy of Tanya Bryant)

Tanya Bryant, along with her two daughters Sarah and Anna, created the first prototype for their Netcessity seat caddy from cargo netting, buckles, elastic, and grommets in their family home garage. With help from the USPTO’s Pro Se Assistance Center, Tanya filed a provisional patent application.

“The pro se process was time consuming, and you had to be diligent and detail-oriented. All of those things are skillsets that I do possess, and it’s the reason why we got as far as we did, I think.”

Tanya later relied on a regional pro bono IP law clinic at the University of Illinois Chicago School of Law for help with her non-provisional patent application, which ultimately resulted in the issuance of her patent.

Tanya credits the support she received from the USPTO and the IP law clinic as instrumental to her success. *“The USPTO made all the difference to us in terms of getting the credibility behind our product that we wanted patented and now trademarked,”* she says. *“I’m just grateful to have had that support. Going forward, our dream is for this to be in every car that’s on the road. So, we’ve got a lot of work to do.”*

Learn more about Tanya’s story at www.uspto.gov/learning-and-resources/journeys-innovation/field-stories/second-act.

—Tanya Bryant, small business owner and entrepreneur

Application Readiness Training program focused on helping pro se applicants learn the fundamentals of the patent application process.²³⁵

The USPTO also has two extremely successful programs that match under-resourced applicants with independent IP experts who have volunteered to assist them in filing patent and trademark applications. The Patent Pro Bono Program is a nationwide network of independently operated regional programs that match volunteer patent professionals with financially under-resourced inventors and small businesses for the purpose of securing patent protection. A similar program called the Law School Clinic Certification Program allows applicants to obtain pro bono legal assistance, not only for patents but also for trademarks, from law students enrolled in a participating law school's IP clinic program, under the strict guidance of a law school faculty clinic supervisor. The USPTO has expanded the program to more than 60 law schools, including three law schools located at HBCUs. The expansion of these programs should help to increase the diversity of IP attorneys involved in the highly specialized IP legal profession.

The USPTO is expanding its pro bono programs with the allocation of additional funding aimed at reaching more pro se inventors and entrepreneurs. The USPTO has established the Pro Se Champions program, which includes USPTO representatives from all patent areas. These representatives are specially trained in the agency's initiatives to assist pro se applicants who contact the agency for support. The USPTO is also working with its Pro Bono Advisory Council, regional program operators, and IP legal associations from across the country on how to implement meaningful changes and improvements for pro se services. The Unleashing American Innovators Act of 2022 also called for the expansion of income eligibility to allow more innovators to benefit from these programs. Congress has increased the threshold of an individual's gross household income in order to qualify for pro bono IP services to 400% of the federal poverty line.²³⁶

The USPTO has expanded its drive to make pro bono assistance more widely available, including to under-resourced inventors or trademark applicants involved in proceedings at the Patent Trial and Appeal Board (PTAB) or the Trademark Trial and Appeal Board (TTAB). Specifically, the PTAB has collaborated with the PTAB Bar Association to establish the PTAB Pro Bono Program, and the TTAB has collaborated with the International Trademark Association to establish the TTAB Pro Bono Clearinghouse Program, so that patent and trademark applicants can now receive free legal services to appeal a decision by their examiner to reject their application.²³⁷

In a November 2022 analysis of its outreach programs, the USPTO found that additional support, such as that provided by the Pro Se Pilot Examination Unit, helped those navigating the USPTO without the assistance of a lawyer and reduced gender disparities in patent application allowance rates.²³⁸ The USPTO also recognized that its routine, but formal, government communications were having a disparate impact on those already working with the USPTO on patent protection, causing a disproportionate number of women to opt out. Consequently, for the first time in its history, the USPTO now sends welcome letters to both patent and trademark applicants, providing them with information on USPTO training programs and contacts at its assistance centers.²³⁹

Copyrights, like trademarks, can be critical to protecting technology. Copyrights protect a broad range of creative output—such as literary works (including software code, manuals, and instruction) and certain design elements—from copying and theft. The U.S. Copyright Office, a CI² Co-Vice Chair partner and a part of the Library of Congress, cites “Copyright for All” as one of its overarching strategic goals, with an aim to make the copyright system as understandable and accessible to as many members of the public as possible, including individuals and small entities as well as historically under-served communities.²⁴⁰ The U.S.

Copyright Office provides authoritative information to the public about copyright law, including answering public inquiries, offering extensive public outreach and education programs, and producing and distributing free educational materials about copyright for innovators at all levels.^{‡‡}

In addition to the IP resources described above, a number of private and nonprofit organizations also provide IP support for innovators and creators. As discussed under Cornerstone 2, edX, a nonprofit online education provider, offers a number of courses specifically on IP and its applicability to management, media, and corporate performance. Institutions involved in similar innovation and entrepreneurship educational



outreach programs may find it valuable to post their own content online in order to reach a broader audience of potential entrepreneurs. In addition to such educational material, innovators would benefit from a wider range of practical IP resources. For example, the American Intellectual Property Law Association maintains a collection of sample IP agreements that can be used to negotiate licenses, establish restrictions on the disclosure of proprietary information, and provide for the sharing of trade secrets and know-how that may be necessary for innovators to commercialize their ideas.²⁴¹ These sample documents are a valuable resource for those who are new to the world of IP.

But more is needed. As reflected above, the USPTO is committed to expanding its outreach efforts and support across the United States, both on its own and in partnership with other organizations. The USPTO continues to expand the number of PTRCs available throughout the country, and the agency will continue to look for additional ways to assist innovators navigating the IP ecosystem. Meanwhile, existing pro bono providers have not nearly exhausted the demand for those services, and more widespread pro bono commitments are needed.

^{‡‡} The U.S. Copyright Office's services are available at www.copyright.gov.

RECOMMENDATION 10

Make entrepreneurship resources and support available to all

Navigating the commercialization process can be a struggle for inventors. Some large companies offer this type of specialized training as part of their employee, product development, and R&D programs. Entrepreneurs outside of such organizations either learn on their own or turn to nonprofit organizations, community colleges, or government agencies to help bridge the gap.

Local, state, and national chambers of commerce, along with numerous nonprofit organizations and state economic development organizations, are increasingly offering courses and seminars in entrepreneurship. For example, the Ewing Marion Kauffman Foundation provides a broad suite of entrepreneurial educational services for Blacks and Latinos in Kansas City. These types of community-based institutions are indispensable because they reach people where they are. However, these locally focused organizations have challenges associated with scaling up to reach a much larger audience of would-be entrepreneurs.

Some of the resources available to first-time entrepreneurs are the result of cooperation between nonprofit organizations and government agencies. For example, the National Consortium for Graduate Degrees for Minorities (GEM) has partnered with the NSF to develop the Inclusion Innovation Initiative, or GEM/NSF i4.²⁴² This i4 initiative aims to promote the NSF's preexisting Innovation Corps (I-Corps™) program within the large network of GEM's minority graduates. The I-Corps™ program was created in 2011 to provide scientists and engineers with an immersive seven-week training course to learn the basics of entrepreneurship and the means by which they can determine if an invention has market potential. The goal of i4 is to increase the diversity and inclusiveness of the U.S. innovation ecosystem.

Mentorship also provides a crucial opportunity to train and support first-time entrepreneurs. One organization leading the way is SCORE, a nonprofit that has partnered with the SBA. SCORE is dedicated to supporting small businesses through mentoring and education using a matchmaking service involving

volunteer, expert business mentors. So far, SCORE has helped facilitate the mentoring of more than 11 million entrepreneurs and small business owners.

The entrepreneurial education programs that have been developed by entities such as SCORE and the Kauffman Foundation could be used as models for setting up similar programs at the local and regional levels to help expand the pool of innovators who are preparing to commercialize their ideas. Their matchmaking services can also serve as a model for other

organizations hoping to connect experts with budding entrepreneurs.

The SBA offers the T.H.R.I.V.E. Emerging Leaders Reimagined program. This innovative program provides advanced strategies for established business owners looking to expand their businesses in under-served





areas. Participants receive a three-year business expansion plan and more than 100 hours of professional training and counseling over a period of seven months. Since its founding in 2008, the program has trained more than 8,000 small business owners, helped them create over 11,000 jobs, generated nearly \$1 billion in new financing, and helped participating firms secure over \$4 billion in government contracts. The program has expanded into 51 locations across the United States and has the potential to expand even further.

The SBA also offers support through its Office of Entrepreneurial Development. The SBA funds the Small Business Development Center Network, providing free counseling and access to capital through 63 lead

centers and over 850 service centers around the country. The SBA also manages the Women's Business Center program and the Veteran Business Outreach Center program, providing free or low-cost counseling and training for those who want to start, grow, and expand their small business. The SBA Learning Center Platform contains a series of free online courses beginning with business planning and progressing through federal procurement readiness. For example, the planning module has four topic areas: preparing business plans, legal requirements, buying a business, and young entrepreneurs. The SBA, in partnership with the National Disability Institute, has also developed the Small Business Hub, which provides entrepreneurial tools, training, and counseling to people with disabilities.²⁴³

The USPTO also offers a multitude of programs to support entrepreneurship. One example is the USPTO's Invention-Con series that provides information on IP, innovation, and invention resources to independent inventors, small businesses, entrepreneurs, and under-represented or underserved populations.²⁴⁴ The USPTO also conducts annual events for specific communities, including discussions with remarkable innovators, explorations of entrepreneurship, seminars on how to obtain and use IP, information about USPTO resources, and training and networking opportunities. These events include Black Innovation and Entrepreneurship, Hispanic Innovation and Entrepreneurship, Veterans Innovation and Entrepreneurship, and Proud Innovation (focused on the lesbian, gay, bisexual, transgender, queer, intersexual, and asexual community).²⁴⁵ The USPTO also conducts webinars to assist Native American, Alaska Native, and Native Hawaiian visual artists with building their brands and businesses through e-commerce.²⁴⁶

In addition, the USPTO recognizes the unique innovation and entrepreneurship needs of the military community. The agency is focusing on military spouses who frequently turn to entrepreneurship for career continuity and transitioning service members and veterans who are uniquely poised for post-service entrepreneurship and innovation. To help target





resources and education to these individuals, the USPTO co-leads a U.S. Department of Commerce Military Affairs Working Group, participates in the First Lady's Joining Forces Initiative,²⁴⁷ and has developed its inaugural military community outreach program. A core component of that program includes centralizing access to IP and entrepreneurship resources in a web portal²⁴⁸ and delivering education on military bases and

installations to meet military spouses, service members, and veterans where they are living. The USPTO's efforts complement the Department of Defense's own efforts to instill a more innovation-focused mindset in its servicepeople. The U.S. Air Force has collaborated with the Innovatrium, whose members include the University of Michigan, to create Project Mercury.²⁴⁹ Project Mercury includes a 13-week curriculum to provide innovation challenges, education, tools, and support to its participants. The program focuses on addressing military challenges, and hundreds of Certified Professional Innovators have been credentialed among those who have participated.

As a means to increase the number of women involved in the innovation economy, the USPTO recently launched a major Women's Entrepreneurship (WE)²⁵⁰ initiative. This initiative serves to empower more women leaders and to advance the conversation around challenges and opportunities for women-owned businesses. It seeks to inspire more women and to tap into their potential to increase equity, job creation, and economic prosperity by taking risks and starting new businesses. The initiative includes a new hub dedicated to providing resources to help women find mentors, identify sources for funding, and launch their own enterprises. In addition to its sponsorship of the Women in IP Symposium, held in March 2023 and March 2024, in part to celebrate International Women's Day, the USPTO conducts regular symposia throughout the country to promote and celebrate the efforts and achievements of innovative women, and it hosts events where best practices are shared.²⁵¹



The SBA's Office of Investment and Innovation is specifically focused on building the innovation ecosystem to ensure more support and training is available for technology-focused and growth-oriented companies as they commercialize new technologies. Through the Federal and State Technology Partnership program,²⁵² the Growth Accelerator Fund Competition,²⁵³ and the Regional Innovation Cluster Initiative,²⁵⁴ the SBA provides funding to entrepreneur support organizations that are focused on directly delivering training and support to startups and more established small businesses. These three programs also provide diverse services to small businesses, such as federal funding proposal writing assistance and consulting on IP protection.

NACIE itself notes the need to "break down the barriers for anyone, anywhere" so they can contribute to the innovation economy.²⁵⁵ Universities throughout the United States, for example, could be critical resources for disseminating knowledge across the nation. The USPTO could also meet this need. The USPTO already has an extensive national footprint to help deploy entrepreneurial training and resources. The agency has regional offices in Dallas, Denver, Detroit, and San Jose, with a new regional office coming to Atlanta and a community outreach office coming to New Hampshire. Beyond the USPTO's own offices, its network of nearly 100 PTRCs,

spread throughout the country and with trained staff, could be deployed to offer entrepreneurship resources (and not merely IP resources) across the nation. NACIE recently recommended that the federal government launch a National Innovation Accelerator Network (NIAN), which it has called a “network of networks” to “promote entrepreneurship across all aspects of society and at scale.”²⁵⁶ NACIE’s recommendation for the NIAN could and should take advantage of the USPTO’s extensive and existing outreach through PTRCs.

But what resources and support should be distributed? As demonstrated throughout this Strategy, the resources across the entire innovation community—for students, teachers, university faculty, entrepreneurs, and private industry—are distributed across the United States, but often in a fragmented and local way. A variety of programs comprise a useful crucible to see what works best. An abundance of interested parties also serves as a hopeful sign. But at the same time, that abundance may reflect a duplication of work that hinders the ability of any program to scale more broadly.

The USPTO and the CI² Co-Vice Chair agencies have begun discussions about how to curate and disseminate information across the country to lower the information costs of participating in innovation. But it is not clear that either the USPTO or these other agencies have the resources to establish this type of one-stop shop online resource, or to maintain and update it as providers and best practices change. The NIAN recommended by NACIE would contain these resources and deliver them across the country. NACIE would place the NIAN in the hands of a new entity, the National Innovation Council. The USPTO supports that recommendation and is working to make that happen.

But the National Innovation Council does not yet exist and does not have funding. The federal government must decide now how this urgent need will be met and by whom.

RECOMMENDATION 11

Leverage and expand commercialization support and tech transfer for all

Traditional sources of entrepreneurial funding such as venture capital largely bypass under-represented inventor communities. For example, studies in 2017 and 2018 found that 2% of venture capital was invested in startups with exclusively female founders, 1% of venture capital was invested in companies with Black founders, and less than 2% was invested in companies with Hispanic founders.²⁵⁷ And it appears that the numbers are getting worse, not better. In 2023, less than 0.5% of venture capital dollars were invested in businesses with Black founders.²⁵⁸ There are training programs that address conscious and unconscious bias, and venture capital firms need to proactively adopt programs and policies to eliminate the systemic prejudices of their investments. There is no question that this bias exists across the venture capital community, within which White men control 93% of the venture capital dollars.²⁵⁹ Funding data as to entrepreneurs with disabilities in the United States does not exist,²⁶⁰ but in the United Kingdom, entrepreneurs with disabilities may be up to 400 times less likely to obtain funding than their counterparts who do not have disabilities.²⁶¹

Such funding also skips over most of the country geographically. San Francisco, New York, Boston, San Jose, and Los Angeles account for well over half of all venture capital investment.²⁶² Only about 1% of venture capital funding goes to rural entrepreneurs.²⁶³ Vast swathes of the country are largely out of reach of such funding.



Daniela Blanco and colleague Aaliyah Dookhith suit up in the lab (Photo courtesy of Daniela Blanco)

Ph.D. student and chemical engineer **Daniela Blanco** was looking for ways to make nylon production more sustainable, when she discovered that her innovative use of artificial intelligence technology might be able to help scientists across the entire chemical industry. She founded Sunthetics, and with the help of a SBIR Phase I grant from the National Science Foundation, she was able to commercialize the innovative AI-powered tools behind the initial discoveries.

"I myself am an immigrant. I didn't necessarily have a safety net of, you know, a lot of money or savings. I started the company knowing that I needed a salary. I needed the company to have some funds to be able to pay me, because otherwise I couldn't live. So it's very scary. It's a lot of risk that is involved, and you really have to hope for the best, work really hard, but also trust that you're building something that is worth it," said Blanco.

To learn more about Daniela's story at www.uspto.gov/learning-and-resources/journeys-innovation/audio-stories/sustainable-pivot.

—Daniela Blanco, CEO of Sunthetics

Although private investors' support is insufficient, local organizations and the federal government can offer assistance. Many organizations with regional focuses have stepped in to help provide financing and other support for under-represented businesses in their local communities. For example, JumpStart, a venture capital investor located in Northeast Ohio,²⁶⁴ actively invests in companies in its region owned by women and minorities, and those that are committed to diversity. JumpStart also provides mentoring and advisory services and connects entrepreneurs through their network of collaborators and service partners. Similarly, ThriveTN helps direct investments in the Tennessee entrepreneurial community,²⁶⁵ and Boyd Street Ventures supports startups in Oklahoma.²⁶⁶ Such organizations entrenched in innovators' communities can serve as models for similar organizations throughout the country.²⁶⁷

Numerous states have government-sponsored venture capital funds that are capitalized by state, local, and national partners. For example, California has IBank, the California Infrastructure and Economic Development Bank that supports under-represented venture capital managers and invests in under-represented and under-served entrepreneurs and business owners. In addition, Indiana has the Indiana for the Bold program that manages the Elevate Venture, Indiana's venture development organization that invests in high-potential cross-sector innovative companies at the pre-seed, seed, and Series A stages.²⁶⁸

The MBDA, a CI² member, is the only federal agency solely dedicated to the growth and global competitiveness of minority business enterprises. Barriers to capital—including, but not limited to, growth capital—limit expansion and scale opportunities for many minority businesses. In fiscal year (FY) 2020, an MBDA award established the Minority Growth Equity Fund Initiative, expanding access to capital by facilitating the deployment of \$1 billion in growth equity capital to minority business enterprises. In FY 2021, the MBDA announced the Equity Multiplier Project, which funds technical

assistance to expand access to capital. The Equity Multiplier Project focuses on capacity building; venture capital readiness; and increasing access to equity, venture investment, and investors. In FY 2022, the MBDA issued a Notice of Funding Opportunity designed to leverage non-traditional financial resources to address barriers to capital access. In FY 2023, the MBDA announced another Notice of Funding Opportunity designed to fund technical assistance providers that would help entrepreneurs build capacity and expand access to capital opportunities through the Capital Readiness Program. The program focuses on assistance for entrepreneurs who are socially and economically disadvantaged.²⁶⁹

America's Seed Fund, the Small Business Innovation Research (SBIR) program, and the Small Business Technology Transfer (STTR) program each invest in innovative small businesses to develop their ideas and pathways to commercialization. A network of federal agencies injects over \$4 billion each year into more than 7,000 R&D projects with the potential for commercialization. The Small Business Innovation Development Act of 1982 established the SBIR program with a key goal to "foster and encourage participation in innovation and entrepreneurship by women and socially and economically disadvantaged individuals."

The SBA coordinates the federal agencies providing funds to break down barriers and increase access to funding. Examples of recent efforts include events such as the virtual America's Seed Fund Week, the in-person America's Seed Fund Road Tours (formerly the SBIR Road Tour), and bi-annual SBIR/STTR conferences where potential applicants can meet directly with agency program managers and entrepreneur support organizations to learn about ways they help small businesses better compete for funding and access resources. In addition, as authorized by the CHIPS and Science Act of 2022, the NSF recently expanded the opportunity for innovation through a new Directorate for Technology, Innovation and Partnerships (TIP).²⁷⁰

But ultimately, if innovators do not know that these resources exist, they are of no support. Likewise, if first-time innovators have difficulty competing for funding with more experienced or better-supported competitors, the resources will have no meaningful effect.

Another mechanism for commercialization of innovation is technology transfer from universities and federal research laboratories. Comments on this Strategy received by the USPTO in 2021 demonstrate the importance of university technology transfer to bringing innovation to impact.²⁷¹ Technology transfer from universities is a major driver for the U.S. economy, contributing (according to the universities) \$591 billion to the GDP over the past two decades and supporting more than 4 million jobs in the United States.²⁷² In 2019 alone, over 1,000 startups were formed from accessing innovations from academic institutions.²⁷³ Because universities are distributed throughout the country—and not merely in high-tech urban and suburban corridors—they bring the potential to distribute innovation more evenly than private industry. Indeed, nearly three-quarters of startups are located in the same state from which they license technology from a research university.²⁷⁴

However, as discussed earlier, federal funding going to universities is unduly concentrated in too few schools. If funding were to be distributed more equitably, researchers at schools, including HBCUs, TCCUs, and MSIs, could be navigating the commercialization process, including interacting with TTOs, for the first time. Organizations, including AUTM and its members, can help train and ramp up universities new to the process, and the universities themselves will need to help train and prepare their faculty. Schools with robust TTOs can partner with schools needing additional support, such as HBCUs, TCCUs, and MSIs. The USPTO agrees with NACIE's recommendation that the federal government "incentivize technology transfer coalitions so that universities can pool their resources."²⁷⁵ However, such coalitions should not exist merely to pool



together existing R1 schools for the sake of operational efficiency,²⁷⁶ but should instead mix R1 schools with MSIs, for example, for the sake of national prosperity.

A model for such a coalition could be the XLeator Network (XLN), which is led by XLeateHealth in partnership with the University of Kentucky. XLN brings together the biomedical research activities of more than 25 participating academic institutions, including HBCUs and MSIs. The network provides extensive entrepreneurial, licensing, and IP support to the member institutions.²⁷⁷

Technology transfer also happens through licensing directly by inventors to licensees. But when inventors lack resources and connections, would-be licensees have no way of knowing of the inventors' interest in licensing. The USPTO is committed to helping to lower this barrier and to facilitate technology transfer. As part of its "Patents 4 Partnerships," the USPTO enables inventors to indicate on a USPTO platform which, if any, patents owned are available for licensing. Thus, when an interested party searches for a patent or patent application, that party can learn whether it may be worth approaching the patentee for business discussions. With this new search tool, the USPTO seeks to facilitate the arrival of critical inventions to the market.

Personal success and national prosperity both count on innovations making it to the real world. Financing needs to be more equitable, and the opportunities for technology transfer and licensing more available, in order for that to happen.

CONCLUSION

The United States faces great challenges in addressing demographic, economic, and geographic underrepresentation in the innovation economy. Actively encouraging, endorsing, and implementing diversity and inclusion strategies promotes innovation and ultimately achieves long-term business success. Every sector of the innovation ecosystem—industry, associations, governments, and schools—must take tangible steps to diversify and broaden their ranks, ensuring that all Americans can fully realize their inventive and entrepreneurial potential. Without each individual’s contribution, the nation will not innovate at its full potential.

To avoid the risk of industry stepping back from diversity commitments, and to further inclusive innovation, there must be accountability within organizations and across their ecosystems. The Department of Commerce has recognized the need for “businesses to learn from each other’s successes.”²⁷⁸ The USPTO’s Diversity Information Platform aims to aid organizations in assessing, enhancing, and publicizing their talent expansion efforts. Doing so will help organizations maintain their progress and can help them compare that progress to the progress of similar organizations and other benchmarks.

Although this Strategy has demonstrated that there are numerous organizations helping to expand the inclusiveness of the innovation ecosystem, those efforts are too often local, fragmented, and difficult to find. As discussed repeatedly in this Strategy, the country lacks a comprehensive directory of resources for inventors, entrepreneurs, teachers and schools, and industry. The USPTO calls for collaboration among organizations across all sectors of the innovation community to collect and disseminate information, best practices, and resources. This combined effort will provide guidance and reduce barriers to entry into the innovation economy for individuals and groups seeking to innovate or those who want to train innovators. The positive outcomes will not only benefit current and future innovators but will also propel global technological leadership and long-term economic sustainability for the United States.



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The USPTO and CI² have relied heavily on consultations with all sectors of the IP and innovation communities to identify strategies and best practices required to meaningfully include more women and other under-represented groups in the innovation ecosystem as inventors, patentees, and entrepreneurs. This appendix lists many of the consultants who have made this Strategy possible.

Council for Inclusive Innovation Leadership

- **Gina M. Raimondo, Chair**
Secretary, Department of Commerce
- **Kathi Vidal, Co-Chair**
Under Secretary of Commerce for Intellectual Property and Director of the USPTO

Co-Vice Chairs

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Register of Copyrights and Director, U.S. Copyright Office

Council for Inclusive Innovation Members

- **Victor Aguilar**,
Procter & Gamble
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Qualcomm Incorporated
- **Mary T. Barra**,
General Motors
- **Chris Boerner**,
Bristol-Myers Squibb
- **Safra A. Catz**, Oracle
Corporation
- **Dr. Javier Diez, Ph.D.**,
SubUAS, LLC, & Co-founder
and CTO at XTT
- **Barbara Fiacco**,
American Intellectual Property
Law Association
- **Scott Frank**,
AT&T Intellectual Property,
LLC
- **Dr. Wayne A. I. Frederick**,
M.D., MBA, Howard University
- **Alex Gorsky**,
Johnson & Johnson
- **Isabella Casillas Guzman**,
Small Business Administration
- **Dr. Kathryn Guarini, Ph.D.**,
IBM
- **Dr. Lonnie Johnson**,
Johnson R&D
- **Dean Kamen**,
DEKA Research and
Development
- **Brennon Marcano**,
The National GEM Consortium
- **Dr. Deepa Pakianathan, Ph.D.**,
Delphi Ventures
- **Dr. Sudip Parikh, Ph.D.**,
American Association for the
Advancement of Science
- **Dr. Karl W. Reid, Ed.D., CDP**,
50K Coalition, Northeastern
University
- **Dave A. Ricks**,
Eli Lilly
- **Michael Roman**,
3M Company
- **Dr. Stephen J. Susalka, Ph.D.**,
AUTM
- **Dr. Timothy Sands**,
Virginia Tech
- **Warren Tuttle**,
United Inventors Association
- **Mallun Yen**,
Operator Collective VC Fund
- **Dr. Wendy Wintersteen**,
Iowa State University

USPTO National Strategy Development Staff and Advisors

- **Mindy Bickel**
- **Richard Heddlesten**
- **Julian Kolev**
- **Martin Rater**
- **Sidney Rosenzweig**
- **Michelle Saksena**
- **Janine Scianna**
- **Andrew Toole**
- **Juan Valentin**
- **Joyce Ward**
- **Gail Wentworth**

USPTO Council for Inclusive Innovation Staff and Advisors

- Kimberly Alton
- Joshua Benitez
- Patricia Bianco
- Donovan Bryant
- Michael Diavolikis
- Cameron Earle
- NaThanya Ferguson
- Sarah Harris
- John Heaton
- Tiffany Jesse
- Molly Kocialski
- Bismarck Myrick
- Fideline Rosius
- Valencia Martin Wallace
- Angela Wilson
- Jorge Valdes

National Strategy Working Group

- 3M Company
- 50K Coalition
- American Association for the Advancement of Science
- American Intellectual Property Law Association
- AT&T Inc.
- AUTM
- Bristol Myers Squibb
- Covington and Burling, LLP
- Cummins Inc.
- Delphi Ventures
- Eli Lilly and Company
- FIRST, DEKA Research and Development
- General Motors Company
- Howard University
- IBM
- Intel
- Invent Together
- Iowa State University
- Johnson & Johnson
- Johnson R&D Co. Inc.
- Minority Business Development Agency
- National Inventors Hall of Fame
- National Science Foundation
- Northeastern University
- Operator Collective VC Fund
- Optum
- Oracle Corporation
- Procter and Gamble
- Qualcomm Incorporated
- SubUAS LLC
- Texas A&M University
- The Lemelson Foundation
- The National GEM Consortium
- U.S. Copyright Office
- U.S. Department of Commerce
- U.S. IP Alliance
- U.S. Small Business Administration
- United Inventors Association
- University of California
- University of Pittsburgh
- Virginia Polytechnic Institute and State University

Acronyms

CI²	Council for Inclusive Innovation
COP	centers of practice
DOC	Department of Commerce
EDA	Economic Development Administration
ERG	employee resource group
GDP	gross domestic product
FLSA	Fair Labor Standards Act
HBCU	historically black college or university
HSI	Hispanic-serving institution
IP	intellectual property
MBDA	Minority Business Development Agency
MSI	minority-serving institution
NACCE	National Association for Community College Entrepreneurship
NACIE	National Advisory Council on Innovation and Entrepreneurship ²⁷⁹
NACIE Report	Competitiveness Through Entrepreneurship A Strategy for Strengthening U.S. Innovation ²⁸⁰
NCEAI	National Council for Expanding American Innovation
NIAN	National Innovator Accelerator Network
NIHF	National Inventors Hall of Fame
NIST	National Institute of Standards and Technology
NSF	National Science Foundation
PTRC	Patent and Trademark Resource Center
R&D	research and development
SBA	Small Business Administration
SBIR	Small Business Innovation Research
SCORE	Service Corps of Retired Executives
STEM	science, technology, engineering, and math
STTR	Small Business Technology Transfer
TCCU	tribally controlled college or university
TTO	technology transfer office
USPTO	United States Patent and Trademark Office

Consulting Organizations

- AnitaB.org
- ASM International
- Association for Women in Science
- Association of University Research Parks
- Benjamin N. Cardozo Law School
- Bill & Melinda Gates Foundation
- Black Girl Ventures
- Black Women in Science and Engineering
- Boston Patent Law Association
- CableLabs/NAPP
- Carnegie Mellon University
- Center for Strategic & International Studies
- ChIPs Network Inc.
- CompuDopt
- Computer & Communications Industry Association
- Drexel University
- Empowering a Billion Women
- Examiner's Edge
- Facebook
- FICPI
- Harvard University-Opportunity Insights
- High Tech Inventors Alliance
- HOPE Global Forums
- Institute for IP and Social Justice
- Intellectual Property Owners Association
- IP Law and Management Institute
- KnowIt
- Lemelson-MIT
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- NAI-USF Research and Innovation
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- National Academy of Inventors
- National Society of Black Engineers-USPTO Chapter
- North Carolina State University
- Northern Illinois University
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- University of Minnesota Law School
- University of Southern California IP Law Institute
- University of Wisconsin-Madison
- US Inventor Inc.
- USF Research and Innovation
- VentureWell
- WiSys

APPENDIX:

Best Practices for Expanding Inclusive Innovation

There are many organizations within the innovation community that offer programs to support building a more inclusive innovation ecosystem. This Appendix lists a number of representative programs and sources for additional information. While not exhaustive, this Appendix does provide a helpful starting point for fostering inclusive innovation in your community or organization. The Appendix is aligned with the 11 recommendations set forth in the *National Strategy for Inclusive Innovation*. Thus, this Appendix will help you learn more about each recommendation and how to implement that recommendation more widely.

RECOMMENDATION 1

Standardize and scale youth innovation education

1.1. Recommended Action: Implement integrated STEM education, inclusive of underrepresented groups.

Primary Actor: Secondary and post-secondary educational institutions

Example Programs

- **Cleveland's MC² STEM High School**—delivers a rigorous STEM education in a nontraditional environment through transdisciplinary curricula, hands-on projects, and community partnerships (www.clevelandmetroschools.org/mc2stem).
- **North Carolina Science House Catalyst Program**—STEM opportunities for high school students with disabilities (sciencehouse.ncsu.edu/studentprograms/catalyst).

1.2. Recommended Action: Develop curriculum linkages across STEM subject matter.

Primary Actor: All educational institutions

Example Program

- **Kettle Moraine High School Campus**—applies a university model for a cluster of high schools, using portfolio models, allowing students choices in how they learn; also offering micro-credentialing so that teachers have freedom to experiment (www.edutopia.org/article/university-model-high-school).

Additional Resources

- **Federal STEM Education Strategic Plan**—Charting a Course for Success: America's Strategy for STEM Education, a five-year strategic plan for STEM education (www.energy.gov/sites/default/files/2019/05/f62/STEM-Education-Strategic-Plan-2018.pdf).
- **Next Generation Science Standards (NGSS)**—contains science and engineering design standards, often calling for students to develop a new or improved product, to test and compare, and to collect data to support the idea (www.nextgenscience.org/search-standards).

RECOMMENDATION 1

Standardize and scale youth innovation education

1.3. Recommended Action: Include project-based team learning, ideally focused on identifying and solving a community problem in conjunction with community partners at the high school and secondary level.

Primary Actor: All educational institutions

Example Program

- **Project Invent**—provides training, resources, and experiences to support real-world learning experiences in classrooms across the country; includes a fellowship program to support educators with training, 1:1 coaching, and a nationwide community of experts ([/projectinvent.org/mission](https://projectinvent.org/mission)).

Additional Resources

- **Lemelson-MIT Invention Education**—provides case studies on educators and students who have participated in the program; 12 patents have been issued:
 - **Lemelson-MIT InventTeams**—this program promotes the work of inventors through annual awards and competitions; also suggested for Recommended Action 1.9 (lemelson.mit.edu/lemelson.mit.edu/all-inventteams).
 - **JV InventTeams**—activity guides for grades 6–10, including educator and student versions; also suggested for Recommended Actions 1.6, 1.9, and 2.1 (lemelson.mit.edu/resources/curriculum-invention).

1.4. Recommended Action: Develop STEM instruction to holistically incorporate foundational tenets of invention education.

Primary Actor: All educational institutions

Example Programs

- **University of Iowa BizInnovator StartUp**—a curriculum toolkit and professional development program for high school business and marketing teachers that provides an accessible solution for innovation and entrepreneurship education (jacobsoninstitute.org/bizinnovator).
- **STEM Innovator**—this University of Iowa program aims to widen the talent pipeline of students prepared for STEM careers and future entrepreneurial pathways (jacobsoninstitute.org/steminnovator).

Additional Resources

- **Framework for Invention Education**—identifies the principles and characteristics of both formal and informal K–12 invention education (inventioneducation.org/framework-for-invention-education).
- **Researching Invention Education White Paper**—consolidates the current knowledge base that informs the work by researchers, educators, funders, and nonprofits in the field of invention education (inventioneducation.org/researching-invention-education).

RECOMMENDATION 1

Standardize and scale youth innovation education

1.5. Recommended Action: Establish public-private partnerships to create project-based learning opportunities for students in STEM.

Primary Actor: Private sector organizations

Example Programs

- **Qualcomm Thinkabit Lab**—a STEM focused corporate initiative designed to reach students from all cultural and socioeconomic backgrounds (thinkabitlab.com).
- **Camp Invention**—hands-on learning, STEM, and invention-focused summer camps for students in K-6, operated by the National Inventors Hall of Fame; also suggested for Recommend Actions 1.6 and 2.1 (www.invent.org/programs/camp-invention).

RECOMMENDATION 1

Standardize and scale youth innovation education

1.6. Recommended Action: Incorporate aspects of invention education into existing curricula (including IP literacy at age-appropriate levels) by using free and open-source resources.

Primary Actor: Primary and secondary educational institutions; public sector organizations; nonprofit organizations

Example Programs

- **California Community College Chancellor's Office and MIT**—this program provides integrated STEM education through the lens of invention and entrepreneurship (www.cccco.edu/About-Us/News-and-Media/Press-Releases/2021-new-initiative-to-catalyze-innovation).
- **Michelson IP Foundation and the National Association for Community College Entrepreneurship (NACCE)**—embeds IP curricula within current courses (www.nacce.com/news/intellectual-property-educators-in-residence-reflect-on-2020-and-look-ahead-to-the-new-year-).
- **Michelson Institute for Intellectual Property**—open-source materials on IP developed by the foundation and respected IP scholars (michelsonip.com).
- **National Inventors Hall of Fame preK-8 Invention Project Curriculum**—introduces preK-8 students to innovation through themed modules with hands-on challenges involving problem finding and solving, risk-taking, and exploration (www.invent.org/educators/invention-project).

Additional Resources

- **Next Generation Science Standards (NGSS)**—sets the expectations for what students should know and be able to do at the K-12 levels (www.nextgenscience.org/search-standards).
- **Framework for Invention Education**—identifies the principles and characteristics of both formal and informal K-12 invention education (inventioneducation.org/framework-for-invention-education).
- **Researching Invention Education White Paper**—consolidates the current knowledge base that informs the work by researchers, educators, funders, and nonprofits in the field of invention education (inventioneducation.org/researching-invention-education).
- **USPTO Equip HQ**—provides a variety of remote IP educational resources at the K-12 levels (equiphq.uspto.gov).
- **InventEd Network**—provides a directory of free after-school invention education curriculum resources to introduce students to invention education, problem-based learning, STEM, and STEAM; also suggested for Recommended Actions 1.7, 1.9, 1.10, and 2.1 (inventioneducation.org/curricula).
- **Project Invent Resource Library**—free curriculum on making innovation, project-based learning, social emotional learning, collaboration, empathy, and other topics (projectinvent.org/resource-library-1).

RECOMMENDATION 1

Standardize and scale youth innovation education

- **Henry Ford Foundation K-12 Invention Convention**—free curriculum using a framework that follows the seven steps of the invention process; also suggested for Recommended Action 2.1 (inhub.thehenryford.org/curriculum-resources/invention-convention-curriculum).
- **HOWTOONS**—for ages 7-12, utilizes cartoons to walk students through building and invention activities; there are also activities on learning about visualization, creating patent drawings, and building prototypes; also suggested for Recommended Action 2.1 (lemelson-dev.mit.edu/resources/howtoons).

1.7. Recommended Action: Add STEM and invention training to after-school programming.

Primary Actor: Primary and secondary educational institutions; public and private sector organizations

Example Programs

- **Club Invention**—an after-school hands-on, immersive, invention program for students in grades K-6 (www.invent.org/programs/club-invention-afterschool).
- **Nita M. Lowey 21st Century Community Learning Centers (21st CCLC)**—the only federal funding source dedicated exclusively to supporting local, after-school, before-school, and summer learning programs for children, particularly those in high-poverty, low-performing schools (www.afterschoolalliance.org/policy21stcclc.cfm).

Additional Resources

- **ESSA Toolkit**—authorized by Congress and administered through the U.S. Department of Education to States, this toolkit provides resources to anyone seeking information on how to bring resources to their area (essa.afterschoolalliance.org).
- **Design Squad Global**—hands-on activities and videos for use in classrooms, after-school programs, libraries, museums, and at home with a wide range of free lesson plans, guides, activities, and resources; funded in large part by NSF and WGBH Public Television (pbskids.org/designsquad).
- **Spark!Lab**—provides hands-on invention learning for educational and cultural organizations:
 - **Spark!Lab Network**—(www.invention.si.edu/sparklab-network).
 - **Draper Spark!Lab Virtual Invention Experience**—(www.instructables.com/member/SparkLab_SI).

RECOMMENDATION 1

Standardize and scale youth innovation education

1.8. Recommended Action: Volunteer, promote, and facilitate participation in external partner programming in STEM, invention, and entrepreneurship.

Primary Actor: Primary and secondary educational institutions; public and private sector organizations

Example Programs

- **Henry Ford Museum's Invention Convention Worldwide**—a global community of educators, business leaders, parents, and students; provides competitions, events, and project-based curricula aligned to education standards with a network of affiliates across the United States (inhub.thehenryford.org/icw/about).
- **FIRST Global Innovation Awards**—through the nonprofit *FIRST* programs, students ages 9-18 explore what it means to be an innovator by finding solutions to real-world problems (www.firstinspires.org/community/innovation).

Additional Resources

- **USPTO Partnerships**—collaborations that explore STEM invention, making, entrepreneurship, and problem-based learning are listed below:
 - **Inventing Merit Badge**—pamphlet of instruction for the Boy Scouts of America merit badge for inventing (filestore.scouting.org/filestore/merit_badge_reqandres/inventing.pdf).
 - **Intellectual Property Patch**—IP patch program that familiarizes students with innovation and, intellectual property (www.ipoef.org/ip-patch).
 - **NSTA/Toshiba ExploraVision**—a competition for K-12 students to engage the next generation in real-world problem solving with a strong emphasis on innovation (www.exploravision.org).
 - **YMCA Thingamajig Invention Convention**—children's program designed to utilize creativity and strategic thinking skills to learn, play, and be inspired through STEM (dc-thingamajig.zfairs.com).
 - **Congressional App Challenge**—district-wide Congressional App Challenges for middle school and high school students to encourage learning to code and inspire the pursuit of careers in computer science (www.congressionalappchallenge.us).
 - **MakerEd**—this initiative provides training, support, and resources to individuals, institutions, and communities who are integrating maker education into their learning environments (makered.org).
 - **VEX Girl Powered Initiative**—this initiative is designed to introduce all students to the robotics community (recf.org/girlpowered).

RECOMMENDATION 1

Standardize and scale youth innovation education

1.9. Recommended Action: Develop and support STEM clubs, invention clubs, pitch competitions, etc.

Primary Actor: Four-year academic institutions

Example Programs

- **Georgia Tech InVenture Prize**—a faculty-led innovation competition for undergraduate students and recent Bachelor of Science graduates of Georgia Tech (inventureprize.gatech.edu).
- **Pennovation**—a University of Pennsylvania student-run hub that supports students in the creation, development, and commercialization of innovative technologies (pennovation.upenn.edu/pennovation-center).

Additional Resource

- **FIRST Global Innovation Awards**—prepares preK-12 students for the future through a suite of inclusive, team-based robotics programs; the programs are suitable for schools or structured after-school activities (www.firstinspires.org).
- **Lemelson-MIT Invention Education**—activity guides include educator and student versions for grades 6-10 (lemelson.mit.edu/resources/curriculum-invention).

1.10. Recommended Action: Leverage and coordinate existing public education and outreach efforts.

Primary Actor: All educational institutions; public and private sector organizations

Example Programs

- **Organizational K-12 Initiatives**—K-12 subcommittees of IP professional organizations:
 - **Intellectual Property Owners Education Foundation**—(www.ipoef.org).
 - **U.S. Intellectual Property Alliance**—(www.usipalliance.org).

Additional Resource

- **STEM Learning Ecosystems**—global community of practice with extensive sharing of resources and expertise for effective preK-16 STEM learning (hstemecosystems.org/about).

RECOMMENDATION 1

Standardize and scale youth innovation education

1.11. Recommended Action: Join NSF's INCLUDES network to connect with other institutions that share the goal of broadening access to STEM.

Primary Actor: All educational institutions

Example Programs

- **NSF INCLUDES National Network**—focuses on broadening participation and expanding opportunities in STEM; provides webinars, networking, job postings, funding opportunities (see below), internships, podcasts, mentors, and seminars (www.includesnetwork.org/home):
 - **Louis Stokes Alliances for Minority Participation (LSAMP)**—(new.nsf.gov/funding/opportunities/louis-stokes-alliances-minority-participation).
 - **STEM + Computing (STEM+C)**—(new.nsf.gov/funding/opportunities/stem-computing-k-12-education-stemc/505006).
 - **Innovative Technology Experiences for Students and Teachers Resource Center (ITEST RC)**—(new.nsf.gov/funding/opportunities/innovative-technology-experiences-students/5467).
 - **Established Program to Stimulate Competitive Research (EPSCoR)**—(new.nsf.gov/funding/initiatives/epscor).

RECOMMENDATION 2

Provide resources, training, and support to empower educators to teach innovation

2.1. Recommended Action: Incorporate aspects of invention education into existing curricula (including IP literacy at age-appropriate levels) by using free and open-source resources.

Primary Actor: All educational institutions

Example Programs

- **California Community College Chancellor's Office and MIT**—provides integrated STEM through the lens of invention and entrepreneurship (www.cccco.edu/About-Us/News-and-Media/Press-Releases/2021-new-initiative-to-catalyze-innovation).
- **Michelson IP Foundation and the National Association for Community College Entrepreneurship (NACCE)**—embeds IP curricula within current courses (www.nacce.com/news/intellectual-property-educators-in-residence-reflect-on-2020-and-look-ahead-to-the-new-year-).
- **The Inventor's Patent Academy**—online course created by Invent Together to help anyone understand intellectual property and the patenting process and prepare them to apply for their own patent (learn.inventtogether.org).

Additional Resources

- **Next Generation Science Standards (NGSS)**—set the expectations for what students should know and be able to do at the K-12 levels (www.nextgenscience.org/search-standards).
- **Framework for Invention Education**—identifies the principles and characteristics of both formal and informal K-12 invention education (inventioneducation.org/framework-for-invention-education).
- **Researching Invention Education White Paper**—consolidates the current knowledge base that informs the work by researchers, educators, funders, and nonprofits in the field of invention education (inventioneducation.org/researching-invention-education).
- **EquipHQ**—a USPTO remote, IP educational resource (equiphq.uspto.gov).
- **Michelson Institute for Intellectual Property**—open-source materials on IP developed by the foundation and respected IP scholars (michelsonip.com).
- **Project Invent Resource Library**—free curriculum on making innovation, project-based learning, social emotional learning, collaboration, empathy, and other topics (projectinvent.org/resource-library).

RECOMMENDATION 2

Provide resources, training, and support to empower educators to teach innovation

2.2. Recommended Action: Promote the use of existing, open-source instructor development resources in STEM, invention education, IP, and innovation.

Primary Actor: All educational institutions; private sector organizations

Example Program

- **University of Colorado at Boulder, PhET Interactive Simulations**—supports math and science learning through the use of free interactive simulations that are accessible to all learners; funded by NSF, Google, the Gordon and Betty Moore Foundation, and the Hewlett Foundation (phet.colorado.edu).

Additional Resources

- **Indiana Department of Education, I-STEM Resource Network, the Eli Lilly and Company, and the Lilly Endowment**—program to reform K–8 science education through the Indiana Science Initiative (ISI) (www.istemnetwork.org).
- **USPTO's Office of Education**—provides the following programs for K–12 educators and learners:
 - **Free Educator Resources**—(www.uspto.gov/learning-and-resources/kids-educators/connecting-educators-uspto).
 - **Science of Innovation Video Series**—a multi-part series highlighting innovations and explaining the specific processes that help bring them about (www.uspto.gov/learning-and-resources/outreach-and-education/science-innovation-video-series).
 - **Inventor Stories**—(www.uspto.gov/learning-and-resources/journeys-innovation).
 - **Hands-on Activities**—(equiphq.uspto.gov).
- **Smithsonian Science Education Center**—provides free science resources, including curriculum and professional development for educators (ssec.si.edu).

2.3. Recommended Action: Expand and/or fund train-the-trainer programs to support instructors.

Primary Actor: All educational institutions

Example Programs

- **USPTO's National Summer Teacher Institute (NSTI) on Innovation, STEM, and Intellectual Property**—an annual, five-day professional development program for educators that provides K–12 teachers with strategies and tools to integrate IP into their classroom instruction (www.uspto.gov/learning-and-resources/kids-educators/nsti).
- **USPTO's Master Teacher of Invention and Intellectual Property Education Program (MTIP)**—(www.uspto.gov/learning-and-resources/kids-educators/master-teacher-invention-education-program).

RECOMMENDATION 2

Provide resources, training, and support to empower educators to teach innovation

2.4. Recommended Action: Target “second career” instructors with professional STEM fields experience as educators.

Primary Actor: All educational institutions; state and local governments

Example Program

- **EnCorps**—transitions STEM professionals to teaching as a second career in high-poverty schools (encorps.org/about).

2.5. Recommended Action: Pursue collaborative public-private partnerships to help finance teacher training in STEM and invention education and connect teachers to real-world innovation environments.

Primary Actor: All educational institutions; public and private sector organizations

Example Programs

- **VentureWell**—awards course and program grants to faculty/staff at U.S. higher education institutions to support curriculum that engage students in science and technology innovation and entrepreneurship (venturewell.org/course-program-grants).
- **3M's TWIST (Teachers Working in Science & Technology)**—in partnership with the Minnesota Technology Association, provides middle and high school math, science, and technology teachers with an opportunity to work alongside 3M scientists (equity.3m.com/STEM-and-skilled-trades).
- **National Science Foundation's Research Experiences for Teachers (RET) in Engineering and Computer Science Program**—supports authentic summer research experiences for K-14 educators to foster long-term collaborations between universities, community colleges, school districts, and industry partners (new.nsf.gov/funding/opportunities/research-experiences-teachers-engineering-computer).

RECOMMENDATION 2

Provide resources, training, and support to empower educators to teach innovation

2.6. Recommended Action: Partner with STEM organizations that support underrepresented students.

Primary Actor: Four-year academic institutions; private sector organizations; nonprofit organizations

Example Programs

- **Society for Women Engineers Youth Programs (SWE)**—provides opportunities to volunteer STEM and inventorship programs such as “Invent It. Build It.” (alltogether.swe.org/2019/09/announcing-a-new-swe-committee-the-student-programs-committee).
- **The Society of Hispanic Professional Engineers**—offers STEM education to K-12 students:
 - **Virtual STEM Labs**—provide K-12 students pre-college virtual STEM lab offerings to access a variety of opportunities and experiences that spark excitement for science, technology, engineering, and math (shpe.org/engage/programs/virtual-stem-labs).
 - **Noche de Ciencias**—provides “family science nights” for K-12 students and families to bring STEM to life so students can imagine themselves in different STEM careers and discover what excites them (shpe.org/engage/programs/noche-de-ciencias).

Additional Resources

- **USPTO’s Affinity Group Toolkit**—provides information to help establish and maintain community groups (www.uspto.gov/initiatives/equity/employee-resource-groups).
- **NSBE Jr. Pre-College Initiatives**—this initiative from the National Society of Black Engineers provides opportunities for K-12 STEM and engineering specific engagement ([www.nsbe.org/collegiate/regions/region1/programs/pre-college-initiative-\(pci\)](https://www.nsbe.org/collegiate/regions/region1/programs/pre-college-initiative-(pci))).
- **American Indian Science and Engineering Society (AISES)**—a national nonprofit focused on substantially increasing the representation of indigenous peoples of North America and the Pacific Islands in STEM studies and careers (www.aises.org/about).

RECOMMENDATION 3

Provide youth coaching, mentoring and career awareness to foster and support long-term interest and capabilities in innovation

3.1. Recommended Action: Provide career counseling and career shadowing services that convey information about STEM careers

RECOMMENDATION 4

Expand research opportunities to a broad and diverse set of institutions in higher education

4.1. Recommended Action: Provide more grant funding opportunities for HBCUs, TCCUs, and MSIs to support research, promote innovation, and strengthen regional economies.

Primary Actor: Public and private sector organizations involved in the funding of innovation

Example Programs

- **EDA University Center Competition**—in 2023, the EDA awarded a total of \$16.5 million to 23 colleges and universities in 14 states to administer programs to leverage their assets, promote innovation, and strengthen regional economies (www.eda.gov/funding/programs/university-centers).
- **DOE Reaching a New Energy Sciences Workforce (RENEW)**—aims to build foundations for Office of Science (SC) research at institutions historically underrepresented in the SC research portfolio (science.osti.gov/Initiatives/RENEW).
- **CREST Center**—provides support to enhance the research capabilities of MSIs through the establishment of centers that effectively integrate education and research (new.nsf.gov/funding/opportunities/centers-research-excellence-science-technology-1).

RECOMMENDATION 5

Foster innovation and entrepreneurship learning and experiences in post-secondary education

5.1. Recommended Action: Develop dual-enrollment programs that provide opportunities for underrepresented STEM students to transition into post-secondary programs.

Primary Actor: Secondary and post-secondary educational institutions; private sector organizations

Example Programs

- **IBM P-Tech**—provides free digital learning resources and support focused on core technology and workplace skills; students earn a high school diploma, an industry-recognized associate degree, and work experience (www.ptech.org).
- **Invention and Inclusive Innovation Initiative (I3)**—Lemelson-MIT Program, in collaboration with the California Community College Chancellor's Office, formed I3 to address the inclusion challenge through community college courses, workshops, and event offerings that teach integrated STEM through the lens of invention and entrepreneurship (www.mtsac.edu/president/cabinet-notes/2020-21/04-apr/1c_1_WEDD_Invention_and_Inclusive_Innovation.pdf).

RECOMMENDATION 5

Foster innovation and entrepreneurship learning and experiences in post-secondary education

5.2. Recommended Action: Add mandatory first-year course in IP and innovation in engineering programs; consider requiring the course for all majors, “Why IP Matters to You?”

Primary Actor: Post-secondary educational institutions

Example Program

- **Howard University Introduction to Engineering Class**—Howard University integrates IP content into the curriculum for all first-year students in the College of Engineering (www.uspto.gov/learning-and-resources/kids-educators/outreach-minority-serving-institutions).

RECOMMENDATION 5

Foster innovation and entrepreneurship learning and experiences in post-secondary education

5.3. Recommended Action: Add transdisciplinary learning, with a focus on teamwork and collaboration-based learning in STEM, business, and design degree programs.

Primary Actor: Post-secondary educational institutions

Example Programs

- **Bachelor of Innovation Degree**—University of Colorado at Colorado Springs offers this degree, which requires IP courses at the undergraduate level (innovation.uccs.edu).
- **Thomas Jefferson University's School of Design and Engineering**—supplements traditional STEM with critical thinking, business, and communication skills development (www.jefferson.edu/academics/colleges-schools-institutes/kanbar-college-of-design-engineering-commerce/school-of-design-engineering.html#programs).
- **University of Iowa STEM Innovator Program**—this program provides online, self-paced educator workshops on STEM innovation and entrepreneurial thinking (jacobsoninstitute.org/steminnovator).
- **Transdisciplinary Sports Product Design Program**—provided by the University of Oregon (artdesign.uoregon.edu/pd/grad/sports-product-design).
- **Rensselaer Polytechnic Institute Dual Major Program in Design, Innovation, and Society**—combines the technical aspects of engineering or management curricula with the aesthetic and cultural insights and vision of the humanities and social sciences disciplines (eng.rpi.edu/academics).

Additional Resources

- **Gallaudet Innovation and Entrepreneurship Institute**—the world's only business incubator offered in American Sign Language and English that delivers background knowledge and experience to complement the skills and motivations of young entrepreneurs (gallaudet.edu/innovation-entrepreneurship-institute).
- **Association to Advance Collegiate Schools of Business**—accredits educational institutions in commercialization, entrepreneurship, and business plan development instruction (www.aacsb.edu).
- **Project Invent**—instruction resources and training (projectinvent.org).

RECOMMENDATION 5

Foster innovation and entrepreneurship learning and experiences in post-secondary education

5.4. Recommended Action: Add a mandatory capstone design course in engineering programs.

Primary Actor: Four-year academic institutions

Example Program

- **Olin College of Engineering's Senior Capstone Program in Engineering (SCOPE)**—offers an industry-university collaboration, where, over the course of a full academic year, seniors work in multidisciplinary teams to provide innovative solutions to a company's real-world problems (www.olin.edu/impact-research/scope).

5.5. Recommended Action: Provide more grant funding opportunities for HBCUs, TCCUs, and MSIs to support IP and innovation.

Primary Actor: Post-secondary educational institutions; private sector organizations

Example Program

- **VentureWell Course and Program Grants**—awarded to faculty or staff at U.S. higher education institutions to support curricula that engage students in science and technology innovation and entrepreneurship (venturewell.org/course-program-grants).

5.6. Recommended Action: Build community-based entrepreneurship programs at community colleges to support and help build skills and capacity for an entrepreneurial mindset for students from historically underserved communities.

Primary Actor: Two-year collegiate institutions

Example Program

- **NACCE**—a network of locally based entrepreneurship programs at community colleges nationwide where faculty and staff learn skills and have access to information and resources for commercialization (www.nacce.com/centers-of-practice).

5.7. Recommended Action: Leverage university TTOs to deliver outside-the-classroom student programs (e.g., IP workshops, pitch competitions, mentorships, and internships).

Primary Actor: Four-year academic institutions

Example Program

- **WiSys Student Ambassadors Program**—University of Wisconsin's WiSys serves as the TTO for 11 universities and communities in Wisconsin (www.wisys.org/about-us/ambassador-program).

RECOMMENDATION 5

Foster innovation and entrepreneurship learning and experiences in post-secondary education

5.8. Recommended Action: Leverage university's TTOs to deliver IP training to community members.

Primary Actor: Four-year academic institutions

Example Programs

- **Purdue Foundry**—this Purdue University program provides support to universities and communities through education, funding, mentorship, and events (purdueinnovates.org/ventures).
- **University of Wisconsin's WiSys Startup Program**—provides a network of resources and community initiatives to assist local entrepreneurs with startup (www.wisys.org/realize-your-idea).

Additional Resource

- **AUTM Toolkits**—provides information on technology transfer, material transfer agreements, women inventors, global health, and more (autm.net/surveys-and-tools/tools).

5.9. Recommended Action: Leverage existing consortia to consolidate resources for innovation in higher education.

Primary Actor: Post-secondary educational institutions; nonprofit organizations

Example Programs

- **Association of Higher Education and Disability**—provides relevant learning opportunities for post-secondary education professionals and professional development offerings designed to support professionals in all stages of their careers (www.ahead.org/home).
- **VentureWell**—creates and builds networks of innovation and entrepreneurship experts to support inventors, innovators, and entrepreneurs (venturewell.org/ie-networks).

Additional Resources

- **National Association for Equal Opportunity in Higher Education**—advocates for a system of higher education where race, income, and previous educational levels are not the determinants of either the quantity or the quality of higher education (www.nafeonation.org).
- **AUTM (formerly the Association of University Technology Managers)**—works to expand the knowledge/tech transfer community to include broad and diverse perspectives globally (autm.net).

RECOMMENDATION 6

Provide post-secondary mentoring and internship opportunities to enable innovation

6.1. Recommended Action: Create mentoring programs where local inventors, college faculty, and/or STEM professionals can mentor students.

Primary Actor: All educational institutions; public and private sector organizations

Example Programs

- **The National Science and Technology Medals Foundation's inSTEM Mentorship Program**—a multi-year program for undergraduate students from underrepresented groups in STEM, intended to strengthen students majoring in STEM (nationalmedals.org/instem-apply).
- **GAIN Mentorship Program**—by the National Academy of Inventors, connects seasoned academic inventors with collegiate innovators (academyofinventors.org/gain-mentorship-program/#:~:text=How%20it%20Works,most%20relevant%20to%20their%20goals).
- **Georgia Tech's Mentor Jackets Program**—this program pairs students with industry champions (www.gtmentorjackets.com/s/1481/alumni/17/home.aspx).

Additional Resource

- **USPTO Mentoring Programs**—toolkit that provides information to help start and maintain a mentoring program; (www.uspto.gov/initiatives/equity/mentoring-programs).

6.2. Recommended Action: Establish academic programs or paid internships that provide real-world innovation experience.

Primary Actor: Public and private sector organizations

Example Program

- **Design Tech High School (d.tech)**—a free public charter high school in California started through the Oracle Education Foundation and housed on Oracle's campus (www.oracle.com/social-impact/education/dtech).

RECOMMENDATION 7

Encourage and support an inclusive workforce across public and private organizations

7.1. Recommended Action: Elevate diversity and inclusion as central organizational values.

Recommended Sub-Action: Elevate corporate DEIA stance by signing a pledge to make progress and share best practices about DEIA.

Primary Actor: Private sector organizations

Example Programs

- **CEO Action for Diversity and Inclusion**—this coalition provides tools, resources, events, and thought leadership opportunities to support business leaders in taking action and driving progress; also suggested for Recommended Action 7.5 (www.ceoaction.com/pledge).
- **Employee Assistance and Resource Network on Disability Inclusion (EARN)**—this guide provides policy guidance for federal agencies regarding how to use Schedule A to support inclusion of people with disabilities in the federal workforce (askearn.org/publication/schedule-a-resource-guide).

Additional Resource

- **Diversity Pledge**—improving diversity among inventors in the United States by creating momentum among companies to commit to action, establish a data baseline, and work to improve their numbers for their chosen underrepresented inventor group (increasingdii.org/pledge).

7.2. Recommended Action: Elevate diversity and inclusion as central organizational values.

Recommended Sub-Action: Designate a Chief DEIA Officer and/or establish a diversity board.

Primary Actor: All employing organizations

Example Program

- **Award-Winning Chief Diversity Officers**—recipients include Eli Lilly, 3M, and other technology companies (nationaldiversityconference.com/2020/awardees/top-chief-diversity-officers).

RECOMMENDATION 7

Encourage and support an inclusive workforce across public and private organizations

7.3. Recommended Action: Elevate diversity and inclusion as central organizational values.

Recommended Sub-Action: Identify and remove potential biases from processes that determine salary, promotions, awards, and performance evaluations. Enhance the diversity of any screening board.

Primary Actor: All employing organizations

Example Program

- **Unconscious Bias Training That Works**—guidelines on teaching people to manage their biases, change their behavior, and track their progress (hbr.org/2021/09/unconscious-bias-training-that-works).

Additional Resource

- **Actively Addressing Unconscious Bias in Recruiting**—addresses what can be done as individuals and as employers to improve diversity, inclusion, and understanding in an organization. (www.hbs.edu/recruiting/insights-and-advice/blog/post/actively-addressing-unconscious-bias-in-recruiting).
- **Reducing the Impact of Bias in the STEM Workforce: Strengthening Excellence and Innovation**—published by the Office of Science and Technology and Office of Personnel Management, provides best practices for federal agencies and recipients of federal research funds (www.si.edu/content/OEEMA/OSTP-OPM_ReportDigest.pdf).

7.4. Recommended Action: Elevate diversity and inclusion as central organizational values.

Recommended Sub-Action: Take steps to assess the state of DEIA understand root causes of uncovered disparities. Design policies and programs to effect change and monitor and measure progress.

Primary Actor: All employing organizations

Example Program

- **Employee Survey Programs**—Eli Lilly’s extensive employee survey program (esg.lilly.com/social#tab-control-tab3).

Additional Resources

- **Innovator Diversity Pilots Initiative**—the program pairs researchers with firms and organizations to advance diversity and inclusion in innovation by coupling the understanding of institutional details and dynamics associated with patenting, law firm advancement, and innovation processes with econometric and social science approaches (diversitypilots.org).
- **IPO’s Diversity in Innovation Toolkit**—a resource to improve gender parity in innovation within an organization; also suggested for Recommendation Action 8.4 (ipo.org/wp-content/uploads/2023/04/Toolkit-Final-delivered-1.28.22-standard-pdf.pdf).

RECOMMENDATION 7

Encourage and support an inclusive workforce across public and private organizations

7.5. Recommended Action: Elevate diversity and inclusion as central organizational values.

Recommended Sub-Action: Routinely publish diversity metrics and progress against benchmarks; strive for accolades in industry diversity.

Primary Actor: All employing organizations

Example Programs

- **USPTO's Diversity Information Platform**—provides the latest available data on demographic trends among industries across the United States and facilitates the sharing of information and best practices and reports on USPTO's geographic and workforce diversity (developer.uspto.gov/diversity-data/home).
- **Intel Annual Publication of Diversity Metrics**—provides organization transparency with data for accountability purposes to encourage industrywide action (www.intel.com/content/www/us/en/diversity/diversity-at-intel.html).

Additional Resources

- **National Organization on Disability's Leading Disability Employer Seal**—recognizes companies for measuring and achieving strong talent outcomes for people with disabilities (staging.nod.org/leading-disability-employer-seal).
- **Top 50 Companies for Diversity**—assesses the performance of companies in six key areas of workplace fairness; the rankings provide a trusted measure of employer and investor data transparency, equitable human capital outcomes for U.S. employers, and the effectiveness of fairness strategy, policies, and practices (www.fair360.com/top-50-list/2023).
- **Catalyst Awards in Diversity and Inclusion**—collect and share leading practices and build positive change to accelerate progress for women through workplace inclusion (www.catalyst.org/solution/catalyst-award).
- **Disability Equity Index**—resource for the annual benchmarking of corporate disability inclusion policies and programs (disabilityin.org/what-we-do/disability-equality-index).

RECOMMENDATION 7

Encourage and support an inclusive workforce across public and private organizations

7.6. Recommended Action: Recruit more diverse talent into the workplace.

Recommended Sub-Action: Strengthen recruitment relationships with HBCUs, TCCUs, and MSIs and professional associations that have a focus on underrepresented groups.

Primary Actor: All employing organizations

Example Programs

- **National GEM Consortium**—network of universities and employers that help place underrepresented groups of engineers and scientists in postgraduate work and employment (www.gemfellowship.org).
- **Employee Assistance and Resource Network on Disability Inclusion (EARN)**—this guide provides policy guidance for federal agencies regarding how to use Schedule A to support inclusion of people with disabilities in the federal workforce (askearn.org/publication/schedule-a-resource-guide).
- **National Employment Team (NET)**—provides a coordinated approach to serving business customers through a national vocational rehabilitation team specializing in employer development, business consulting, and corporate relations (www.csavr.org).

7.7. Recommended Action: Recruit more diverse talent into the workplace.

Recommended Sub-Action: Develop paid internships and fellowships that provide an employment pathway.

Primary Actor: All employing organizations

Example Program

- **NSF's Innovative Postdoctoral Entrepreneurial Research Fellowship (I-PERF) Program**—recruits, trains, mentors, matches, and funds early-career science and engineering doctoral degree recipients to participate in innovative entrepreneurial activities (iperf.asee.org).

Additional Resource

- **Institute for Broadening Participation's "Pathways to Science"**—an online resource library for STEM internships (www.pathwaystoscience.org).

RECOMMENDATION 7

Encourage and support an inclusive workforce across public and private organizations

7.8. Recommended Action: Recruit more diverse talent into the workplace.

Recommended Sub-Action: Expand skills-based hiring by providing vocational training and requiring a four-year or graduate degree only when necessary.

Primary Actor: All employing organizations

Example Programs

- **IBM's Resources**—initiatives to reassess required skills for employment positions:
 - **Tech Re-Entry/Apprenticeship Program**—(www.ibm.com/blogs/jobs/return-to-the-workforce-with-the-ibm-tech-re-entry-program).
 - **"New Collar Jobs"**—(www.ibm.com/impact/feature/apprenticeship).

Additional Resource

- **OneTen.org**—promotes a skills-first movement for a more equitable and inclusive future workforce to hire, promote, and advance opportunities for those who do not have a four-year degree into family-sustaining careers (oneten.org).

7.9. Recommended Action: Create an inclusive and respectful workplace to improve the retention of under-represented employees.

Recommended Sub-Action: Provide a sense of community by establishing employee resource groups or affinity groups to enable employees to find colleagues with whom they identify.

Primary Actor: All employing organizations

Example Program

- **Voluntary Employee Organizations Charter and Bylaws Templates**—USPTO has 31 voluntary employee organizations that include affinity groups (www.uspto.gov/initiatives/equity/employee-resource-groups).

7.10. Recommended Action: Create an inclusive and respectful workplace to improve the retention of under-represented employees.

Recommended Sub-Action: Develop leadership training programs and encourage participation from underrepresented groups.

Primary Actor: All employing organizations

Example Program

- **3M's Women's Leadership Development Forum**—develops leaders at every level of the organization to accelerate the inclusion and advancement of women globally (equity.3m.com/our-people).

RECOMMENDATION 7

Encourage and support an inclusive workforce across public and private organizations

7.11. Recommended Action: Create an inclusive and respectful workplace to improve the retention of under-represented employees.

Recommended Sub-Action: Create career development programs, customized training plans for employees, and internal/external courses to continually invest in employee skill development.

Primary Actor: All employing organizations

Example Program

- **U.S. Department of Commerce's Individual Development Plans**—specifies an individual's development goals and how to accomplish them (www.commerce.gov/hr/employees/learning-and-development/idp).

7.12. Recommended Action: Retain underrepresented employees with targeted support and recognition.

Recommended Sub-Action: Survey employees to determine effective compensation, benefits, and schedule flexibilities.

Primary Actor: All employing organizations

Example Program

- **Qualcomm's Survey of Desired Benefits Organizations**—focused on areas providing flexibility and accessibility, prioritizing communication, championing balance, and supporting engagement of employees (enterpriseproject.com/article/2021/5/hybrid-work-model-6-keys).

7.13. Recommended Action: Create an inclusive and respectful workplace to improve the retention of under-represented employees.

Recommended Sub-Action: Develop reentry training plans for employees returning to the workforce.

Primary Actor: All employing organizations

Example Programs

- **Retaining Employment and Talent After Injury/Illness Network (RETAIN)**—this initiative implements early intervention strategies to improve stay-at-work/return-to-work outcomes of individuals who experience a work disability while employed (www.dol.gov/agencies/odep/topics/saw-rtw/about).
- **"Take 2"**—General Motors' program for parent reentry (www.gm.com/stories/take-2).

RECOMMENDATION 7

Encourage and support an inclusive workforce across public and private organizations

7.14. Recommended Action: Retain underrepresented employees with targeted support and recognition.

Recommended Sub-Action: Offer comprehensive professional development programs across the workforce to help prepare future managers.

Primary Actor: All employing organizations

Example Program

- **Deloitte's Emerging Leaders Development Program for Minority Managers**—prepares emerging leaders, through learning and networking opportunities, for the next steps in their career (www2.deloitte.com/us/en/pages/about-deloitte/articles/inclusion-leadership-development.html).

RECOMMENDATION 8

Cultivate innovation more broadly and equitably in organizations that innovate, including academic research institutions

8.1. Recommended Action: Host events that celebrate innovation (e.g., IP showcases, hackathons, and innovation fairs).

Primary Actor: All employing organizations; nonprofit organizations

Example Program

- **University of Michigan's (U-M) "Celebrate Invention" Event Organizations**—an annual event that honors University of Michigan inventors and the growing impact of U-M innovations (innovationpartnerships.umich.edu/about-us/celebrate-invention).

8.2. Recommended Action: Establish and broadcast innovation as a core institutional value.

Primary Actor: All employing organizations

Example Program

- **Innovation as an Institutional Value**—Penn State University establishes innovation as one of six institutional values (strategicplan.psu.edu/plan/institutional-values).

RECOMMENDATION 8

Cultivate innovation more broadly and equitably in organizations that innovate, including academic research institutions

8.3. Recommended Action: Mandate diversity in research and design teams and patent review panels.

Primary Actor: Post-secondary educational institutions; private sector organizations

Example Programs

- **Cisco Women's Inventor Network (WIN++)**—a guided mentorship program matching small teams of diverse employees with an experienced mentor, with the goal of submitting an invention disclosure by the end of the program for consideration by one of Cisco's patent committees (www.cisco.com/c/en/us/about/legal/win.html).
- **Western Digital's She Invents**—initiative that mandates women membership on patent review committees (www.westerndigital.com/en-il/company/corporate-responsibility/people/diversity-inclusion).

8.4. Recommended Action: Assess employees' experiences with the organization's innovation processes, understand barriers for underrepresented inventors, and design policies and programs to remove barriers.

Primary Actor: All employing organizations; private sector organizations

Example Program

- **IPO's Diversity in Innovation Toolkit**—a resource to improve gender parity in innovation within an organization (ipo.org/wp-content/uploads/2023/04/Toolkit-Final-delivered-1.28.22-standard-pdf.pdf).

8.5. Recommended Action: Design and execute a strategic plan that includes networking, education, and initiatives to inspire new innovators.

Primary Actor: Public and private sector organizations

Example Program

- **Center of Excellence for Collaborative Innovation**—a coalition of innovators across NASA and the federal government that generate ideas and solve problems by working with global communities via the NASA Tournament Lab (www.nasa.gov/coeci).

8.6. Recommended Action: Use TTOs or cross-department seminars to deliver IP literacy to faculty and graduate students.

RECOMMENDATION 8

Cultivate innovation more broadly and equitably in organizations that innovate, including academic research institutions

Primary Actor: Post-secondary educational institutions

Example Program

- **Texas A&M's Basics of Technology Transfer Online Course**—technology transfer course for faculty and students (innovation.tamus.edu/about/educational-programs/online-course-basics-of-technology-transfer).

8.7. Recommended Action: Develop, market, and deploy IP education materials to small businesses and entrepreneurs.

Primary Actor: Nonprofit and public sector organizations

Example Program

- **Business Guide to IP Rights**—guidance from STOPfakes.gov to help U.S. companies protect their innovations and safely market their products at home and overseas (www.stopfakes.gov/business-guide-to-intellectual-property-rights).

Additional Resource

- **USPTO Inventor and Entrepreneur Resources**—information to learn about IP and how to protect it (www.uspto.gov/learning-and-resources/inventors-entrepreneurs-resources).

8.8. Recommended Action: Create a recognition program for highlighting innovation success, including management-determined and peer-sourced awards.

Primary Actor: Private sector organizations

Example Programs

- **General Motors' Black Engineer of the Year Award**—award given to engineers who demonstrate achievement, leadership, and impact on their companies and industries (www.gm.com/stories/beya-awards).
- **IBM's Master Inventor Badge Program**—given to employees who have mastered the patent process, mentored broadly, added value to IBM's portfolio, and demonstrated sustained innovation leadership and service (www.ibm.com/training/badge/master-inventor.1).

RECOMMENDATION 8

Cultivate innovation more broadly and equitably in organizations that innovate, including academic research institutions

8.9. Recommended Action: Assign a mentor of a similar background to new inventors to help navigate the corporate patent review process, including project-based mentorship programs for novice R&D employees.

Primary Actor: Public and private sector organizations

Example Program

- **IBM's Master Inventor Badge Program**—given to employees who have mastered the patent process, mentored broadly, added value to IBM's portfolio, and demonstrated sustained innovation leadership and service (www.ibm.com/training/badge/master-inventor.1).

8.10. Recommended Action: Create and mandate early professional development opportunities, including new employees in high-profile projects that are likely to have innovation success.

Primary Actor: Private sector organizations

Example Program

- **Honeywell's Project-Based Rotational Development Program**—provides recent chemical and mechanical engineering graduates with the opportunity to be exposed and trained across multiple businesses and functions (careers.honeywell.com/us/en/job/P-100003/Early-Career-Engineering-Rotation-Program-ECERP-Engineer).

8.11. Recommended Action: Identify ways of including innovation and entrepreneurship impact within promotion and tenure guidelines.

Primary Actor: Four-year academic institutions

Example Programs

- **Oregon State University's Promotion and Tenure Initiatives**—nationwide effort to identify best practices for the inclusive recognition of innovation and entrepreneurship impact within promotion and tenure guidelines:
 - **Promotion and Tenure - Innovation and Entrepreneurship (PTIE)**—(ptie.org).
 - **PTIE's Recommendations**—(ir.library.oregonstate.edu/concern/defaults/jw827k251).

RECOMMENDATION 8

Cultivate innovation more broadly and equitably in organizations that innovate, including academic research institutions

8.12. Recommended Action: Hire a rotating “entrepreneur-in-residence” from the private sector to assist faculty and students in navigating IP and commercialization processes.

Primary Actor: Post-secondary educational institutions

Example Program

- **University of Illinois' Entrepreneur-in-Residence Program**—provides free consulting to new startup ventures and prospective technology entrepreneurs (researchpark.illinois.edu/resource/eir).

8.13. Recommended Action: Use TTO personnel to train faculty “invention ambassadors” to serve as an innovation liaison with their home departments.

Primary Actor: Four-year academic institutions

Example Program

- **University of Wisconsin's WiSys Ambassador Program**—this program enhances the connection between tech transfer and the research community on Universities of Wisconsin campuses, engaging students to serve as WiSys Ambassadors to augment visibility and presence among researchers and students on each of the campuses (www.wisys.org/about-us/ambassador-program).

8.14. Recommended Action: Fund or promote applied research mini-grants, internships, pitch competitions, or teaching assistantships to expose underrepresented students and faculty to innovation concepts and information.

Primary Actor: Four-year academic institutions

Example Program

- **MIT Innovations Fund**—supported by the Industrial Advisory Council for Minority Education, this fund provides small grants of seed money for individual or group projects for underrepresented minority undergraduate students (ome.mit.edu/resources/innovations-fund).

RECOMMENDATION 8

Cultivate innovation more broadly and equitably in organizations that innovate, including academic research institutions

8.15. Recommended Action: Use TTOs as a vehicle for cross-campus mentorship and networking.

Primary Actor: Four-year academic institutions

Example Program

- **State of Michigan's Cross-University TTO Networking Initiative**—program to create a statewide network to provide critical expertise in the support of the commercialization of university technologies and the creation of startups with talent and business expertise (michigan3n.org/about-t3n).

Additional Resource

- **AUTM Women Inventor's Toolkit**—assist and support TTOs in initiating programs and making it easier to increase the number of women disclosing inventions and participating in the technology transfer process (autm.net/surveys-and-tools/tools/women-inventor%E2%80%99s-toolkit).

RECOMMENDATION 9

Equitably facilitate the procurement of IP protection for all innovators and entrepreneurs

9.1. Recommended Action: Increase awareness of IP protection and how innovators can respond to infringement through outreach and educational programs.

Primary Actor: All institutions in the innovation ecosystem, such as companies, educational institutions, law firms, and public IP organizations

Example Programs

- **USPTO's Assistance Centers**—provide patent and trademark assistance and information, with a focus on making the process of filing patent and trademark applications simple and efficient:
 - **USPTO's Inventors Assistance Center**—(www.uspto.gov/learning-and-resources/support-centers/inventors-assistance-center-iac).
 - **USPTO's Trademark Assistance Center**—(www.uspto.gov/learning-and-resources/support-centers/trademark-assistance-center).

Additional Resource

- **USPTO Community Outreach, Intellectual Property (IP) Champions: Connecting USPTO Employees with Their Communities**—USPTO employees serve as IP Champions to deliver awareness and educational programs on the IP system and the importance of IP and innovation in their local communities (www.uspto.gov/initiatives/ci2/ip-champions).

RECOMMENDATION 9

Equitably facilitate the procurement of IP protection for all innovators and entrepreneurs

9.2. Recommended Action: Implement and expand programs that reduce the cost of obtaining a patent for those with limited financial resources.

Primary Actor: All innovation-focused institutions

Example Programs

- **USPTO Legal Resources**—provide access to patenting to a wider range of innovators and creators through the following USPTO programs:
 - **USPTO's Patent Pro Bono Program**—(www.uspto.gov/patents/basics/using-legal-services/pro-bono/patent-pro-bono-program).
 - **Law School Clinic Certification Program**—(www.uspto.gov/learning-and-resources/ip-policy/public-information-about-practitioners/law-school-clinic-1).
 - **Pro Se Assistance Program**—(www.uspto.gov/patents/basics/using-legal-services/pro-se-assistance-program).

9.3. Recommended Action: Expand the cooperation and cross-promotion between private organizations and government agencies to clarify commercialization processes and build partnerships.

Primary Actor: All institutions in the innovation ecosystem

Example Program

- **Department of Commerce's HBCU Conference**—helps innovators from Historically Black Colleges and Universities discover government resources and connect to potential industry partners (www.uspto.gov/learning-and-resources/general-help/learn-about-helpful-resources-innovators-during-virtual).

RECOMMENDATION 10

Make entrepreneurship resources and support available to all

10.1. Recommended Action: Develop “centers of practice” to combine education with practical experience and participation in the innovation ecosystem.

Primary Actor: All educational institutions

Example Programs

- **Gallaudet Innovation and Entrepreneurship Institute**—the world’s only business incubator offered in American Sign Language and English that delivers background knowledge and experience to complement the skills and motivations of young entrepreneurs (gallaudet.edu/innovation-entrepreneurship-institute).
- **Portland Small Business Hub**—access to free business advising services to get help accessing loans, grants and other business support programs such as technical assistance and workshops (pdxsmallbizhub.com/how-it-works).
- **NACCE’s Centers of Practice**—promote greater participation in the innovation ecosystem with specialized centers targeting women, veterans, and historically underserved communities (www.nacce.com/centers-of-practice).

10.2. Recommended Action: Partner with online courseware providers to reach innovators and entrepreneurs beyond a normal commuting radius.

Primary Actor: All educational institutions

Example Program

- **USPTO’s Global IP Academy**—provides IP training that focuses on enforcement, patents, trademarks, and copyrights (www.uspto.gov/ip-policy/global-intellectual-property-academy).

Additional Resources

- **edX Online Learning Platform**—offers a range of free courses in entrepreneurship and related topics, such as business plans and IP:
 - **Entrepreneurship**—(www.edx.org/learn/entrepreneurship).
 - **Business Plans**—(www.edx.org/learn/business-plan).
 - **IP Courses**—(www.edx.org/learn/intellectual-property).

RECOMMENDATION 10

Make entrepreneurship resources and support available to all

10.3. Recommended Action: Expand outreach to innovators and foster networks between innovators and research universities.

Primary Actor: Post-secondary educational institutions; TTOs; nonprofit organizations

Example Program

- **AUTM Regional Meetings**—bring together representatives from TTOs around the country and organizes regional meetings to foster collaboration and mentorship (autm.net/events/region-meetings).

Additional Resources

- **AUTM Resources**—AUTM offers a range of resources, including webinars and survey datasets, that can help innovators to identify and access technologies being developed in academic institutions:
 - **AUTM Webinars**—(autm.net/careers-and-courses/webinars/free-webinars).
 - **AUTM Survey Datasets**—(autm.net/surveys-and-tools/surveys/licensing-survey/2022-licensing-survey).
- **NSF's STEM Access for Persons with Disabilities (STEM-APWD)**—seeks to increase the engagement of persons with disabilities (PWD) in science, technology, engineering, and mathematics (STEM) fields across seven directorates at NSF (www.nsf.gov/pubs/2023/nsf23160/nsf23160.jsp).

10.4. Recommended Action: Expand access to mentoring for small businesses.

Primary Actor: Public and private sector organizations

Example Program

- **The Service Corps of Retired Executives (SCORE)**—has partnered with the SBA to support small businesses through mentoring and education using a matchmaking service of volunteer, expert business mentors (www.score.org).

Additional Resource

- **National Inventor Club**—a network of inventors, innovators, startups, entrepreneurs, and young inventors across the United States and a community of resources to assist one another along the invention journey (nationalinventorclub.com).

RECOMMENDATION 10

Make entrepreneurship resources and support available to all

10.5. Recommended Action: Expand support for high-potential small businesses via community-based access to training, coaching, and networking.

Primary Actor: Public and private sector organizations supporting small businesses

Example Program

- **T.H.R.I.V.E. (Train. Hope. Rise. Innovate. Venture. Elevate)**—an executive-level training series by the SBA designed to accelerate the growth of high-potential small businesses across the United States (www.sba.gov/sba-learning-platform/thrive-emerging-leaders-reimagined).

RECOMMENDATION 11

Leverage and expand commercialization support and tech transfer for all

11.1. Recommended Action: Develop and expand programs to guide innovators through technology transfer and commercialization.

Primary Actor: Four-year academic institutions; public and private sector organizations

Example Program

- **The Ohio State University (OSU) REACH for Commercialization Program**—guides women innovators through technology transfer and commercialization (keenan.osu.edu/reach-commercialization).

Additional Resource

- **OSU's Keenan Center for Entrepreneurship**—provides programming resources to promote social and economic impact (keenan.osu.edu).

RECOMMENDATION 11

Leverage and expand commercialization support and tech transfer for all

11.2. Recommended Action: Expand funding for businesses aiming to develop key technologies.

Primary Actor: Public and private sector organizations involved in the funding of innovation

Example Programs

- **JumpStart**—a venture capital investor located in Northeast Ohio that purposefully invests in women and minority-owned businesses (www.jumpstartinc.org).
- **ThriveTN**—coordinates capital, relationships, and data intelligence across Tennessee to catalyze social innovation (www.thrive-tn.com).

Additional Resources

- **Small Business Innovation Research (SBIR)**—offers a competitive funding process that encourages domestic small businesses to engage in federal research / research and development (R/R&D) with the potential for commercialization (www.sbir.gov/about).
- **Technology, Innovation and Partnerships (TIP)**—NSF recently expanded the opportunity for innovation through a new Directorate for TIP (new.nsf.gov/tip).

11.3. Recommended Action: Support and expand funding opportunities dedicated to the growth and global competitiveness of disadvantaged business enterprises.

Primary Actor: Public and private sector organizations involved in the funding of innovation

Example Program

- **MBDA's Capital Readiness Program**—funds and builds a geographically dispersed network of providers helping underserved entrepreneurs build the skills to launch or scale existing businesses, access capital, and participate in other governmental programs that support small businesses (www.mbda.gov/crp).

Additional Resource

- **MBDA**—invests in a national network of Business Centers, Specialty Centers, and Grantees; its programs offer customized business development and industry-focused services to provide greater access to capital, contracts, and markets (www.mbda.gov/who-we-are/overview).

11.4. Recommended Action: Facilitate the arrival of critical inventions to the market.

Primary Actor: Public and private sector organizations involved in the commercialization of inventions

Example Program

- **USPTO's "Patents 4 Partnerships" Platform**—brings together those who have technologies and want to make them available for licensing and those who have an interest and ability to commercialize the technologies (developer.uspto.gov/ipmarketplace/search/platform).

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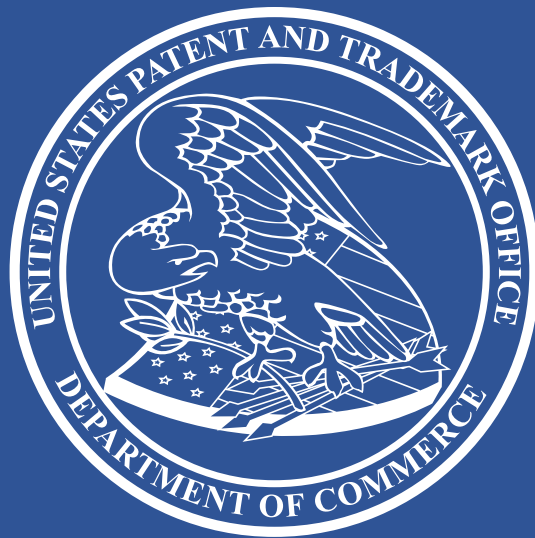
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