

Entrepreneurial-Minded Postdocs in High-Tech Startups: Their Industry Chances and Success

Teddy Ivanitzki

Dir. Fellowship & Research
American Society for Engineering Education
ASEE, Washington DC, USA
t.ivanitzki@asee.org

Elsabeth Mekonnen,

CEO of Glob-Health LLC
Montgomery Village, Maryland, USA
driliza34@gmail.com

Abstract

In launching small businesses, particularly in advanced sectors like artificial intelligence (AI), Internet of Things (IoT), or biotech, disadvantaged groups like low-income people encounter extra challenges in accessing funding and investment. While federal and private sector efforts are underway to support businesses owned by women and minorities, there is still much progress to be made in bridging the investment gap. The Small Business Administration (SBA 2013) started providing \$3.5 billion annual support through its Small Business Innovation Research (SBIR) program, with a directive from the Small Business Act to prioritize women and underserved groups. Moreover, the traditional Science & Engineering (S&E) PhD degree in the US requires a significant time investment by students, in most cases six to seven years after completion of the bachelor's degree. Typically, PhD degrees at US institutions focus on preparing graduates for academic positions, while only 11% of STEM PhDs would successfully achieve tenure-track faculty positions. To foster innovation and increase the participation of underrepresented minorities in emerging industry startups and secure U.S. competitiveness in the global arena, the National Science Foundation (NSF) introduced the Innovative Postdoctoral Entrepreneurial Research Fellowship (IPERF) program managed by the American Society of Engineering Education (ASEE). IPERF advances the best practices in STEM-postdoctoral research and provides interdisciplinary expertise to high-tech startups and innovative industries grounded in interdisciplinary technology.

Keywords

Entrepreneurship and Innovation, Engineering Education

1. Introduction

In 1960 the United States accounted for 69% of global Research and Development (R&D) spending in private and defense industries (Graves 2013). By 2016 however, this share had declined to just 28% (Sargent and Gallo 2018), primarily due to China's rapid growth and technological advancements. If this trend continues, China's R&D expenditure as a percentage of GDP is projected to surpass that of the U.S. by 2030 (Sargent and Gallo 2018). To remain competitive and sustain its leadership in innovation, the U.S. must tap into the talents of all its citizens. Historically, access to high-tech startups has been largely limited to privileged individuals. Disparities in the private sector remain stark, as highlighted by Diversity VC, a nonprofit focused on improving diversity in venture capital. Their 2019 survey of approximately 10,000 venture capital-backed founders found that only 9% were women and just 1% were Black (Azevodo 2019).

“While many VCs have publicly declared they are working on diversity initiatives, that dialog is just lip service,” said Anthony Zhang, chief growth officer at RateMyInvestor (Azevodo 2019). A 2019 Harvard Business Review analysis of 200 VC-backed startups further underscored this issue, stating, “Our findings show that the boards of elite private firms are incredibly homogenous. Women held just over 7% of board seats in our study. But most strikingly, roughly 60% of the businesses in our sample did not have a single female board member” (Rivera and Shepherd 2019). Another study from the same year found that women occupied only 7% of board seats in VC-backed companies (Teare 2019). Gender disparities extend to leadership roles in venture capital firms as well. In 2017, HuffPost reported that only 6% of VC firm partners were women, down from 10% in 1999 (Berman 2017). By 2019, Axios found that just 10% of decision-makers at U.S. venture capital firms were women, marking only a modest 9% increase from the previous year (Primack 2019).

Earning a traditional Science & Engineering (S&E) PhD in the U.S. requires a substantial time commitment, typically taking six to seven years beyond a bachelor’s degree. Historically, PhD programs at U.S. institutions have been designed to prepare graduates for academic careers. However, only 11% of STEM PhD holders successfully secure tenure-track faculty positions in the U.S. have grown by just 18% over the past decade, non-tenure-track roles have increased by 126% during the same period (Helble 2018). At the same time, the industry has significantly expanded its research and development (R&D) efforts (NSF 2018), driving a growing demand for doctoral-level expertise. According to a study by NCSSES/NSF (2019 and 2025), only 26% to 44% of S&E doctorate recipients choose to pursue careers in academia, while the remaining 56% secure competitive positions in industry and government, leveraging the research experience gained during their graduate studies. This shift toward industry careers highlights the need for greater collaboration and support from the private sector in training PhD students in the U.S.

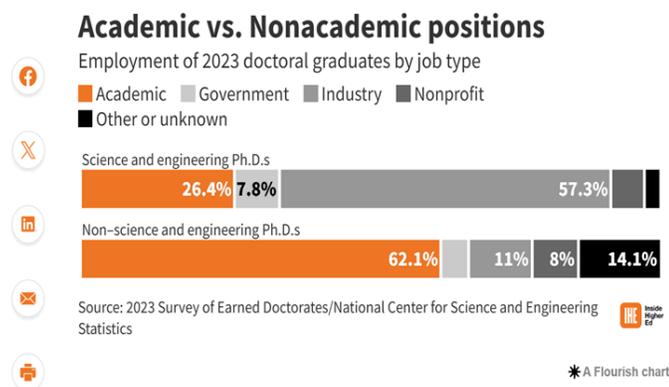


Figure 1. Academic vs. Nonacademic positions (based on NCSSES 2025)

2. Solution on the Horizon

Recognizing the negative trend, Congress authorized eligible agencies under the SBIR Reauthorization Act of 2011 to allocate 3% of their small business grant budget to support disadvantaged groups (SBA 2013). Consequently, several other agencies began utilizing this fund to reach out to those communities. To maintain its position as a global leader in Research and Development (R&D), alongside the SBA the National Science Foundation (NSF) initiated the Innovative Postdoctoral Entrepreneurial Research Fellowship (IPERF) program targeting high-tech startups in the US. Building on the lessons learned from the COVID-19 pandemic, particularly in remote and online engagement, the IPERF team effectively implemented innovative communication strategies to connect with applicants and scholars despite geographical barriers. A key component of this approach was hosting monthly webinars, providing a cost-effective and accessible platform to reach a diverse audience. These webinars became the cornerstone of professional development activities sponsored by IPERF for the fellows.

By leveraging ASEE’s extensive network, the program featured a wide range of Subject Matter Experts (SMEs), entrepreneurs, consultants, and NSF program officers who delivered valuable insights on entrepreneurship and grant funding opportunities. These sessions proved to be highly beneficial, sparking increased interest among fellows and applicants in entrepreneurship. Participants also expressed a strong interest in expanding training topics to include STEM grant and contract application processes, identifying key resources, launching and managing startups,

effectively pitching innovative ideas, understanding intellectual property fundamentals, and fostering collaboration in high-tech environments.

Overall, the IPERF program offers a structured and comprehensive approach to preparing postdoctoral scholars for careers in entrepreneurship and the high-tech industry. Through a combination of training, mentorship, personalized consultations, and professional development opportunities, the program equips participants with the essential skills and knowledge needed for success in these competitive fields.

3. Interim Results

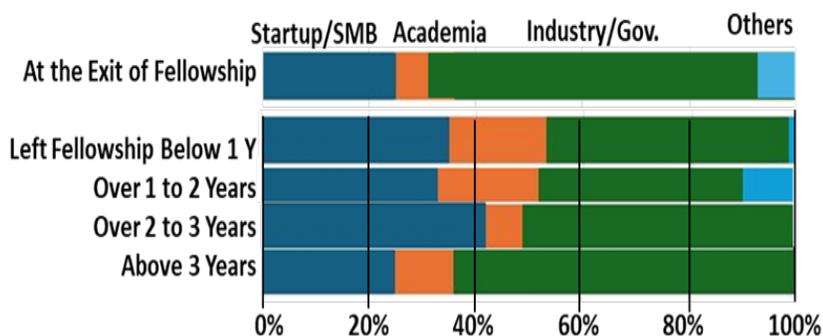
Over five years, the IPERF team awarded over 100 fellowships, with 17 fellows continuing in the final phase-out stage until May 2025. All fellows were placed at NSF-supported program SBIR/STTR (Small Business Technology Transfer Research) high-technology startups called America’s Seed Fund. Each fellowship was typically granted for a one-year term, with occasional extensions made possible by financial savings. During 2024, the ASEE team received 136 applications, pre-approving 29 fellows for potential placement with startup companies. These candidates successfully met all required prerequisites, leading to the final approval of 14 fellowship awards during 2024, following endorsement from both the host companies and ASEE.

Status of IPERF Awards as of September 2024:

- 2020 440 Applications -> 90 Approved Matches -> 23 Awards.
- 2021 330 Applications -> 61 Approved Matches -> 25 Awards.
- 2022 210 Applications -> 37 Approved Matches -> 21 Awards.
- 2023 184 Applications -> 38 Approved Matches -> 17 Awards.
- 2024 136 Applications -> 29 Approved Matches -> 14 Awards.

To gain deeper insight into the experiences and post-fellowship entrepreneurial journeys of both fellows and host companies, ASEE has launched a series of short- and long-term surveys. These surveys were distributed to postdoctoral participants from the previous program and former IPERF Fellows. Meanwhile, the IPERF team is analyzing the survey responses to identify potential areas for immediate program improvements. The initial survey findings are being compared with exit interviews conducted with each Postdoc fellow upon leaving the program, as well as with exit surveys from host companies. The most recent longitudinal survey of 60 IPERF fellows, who completed the program between one and four years ago, found that while 35% were hired by their host companies within the first year, 25% remained employed at various startups three years later. Additionally, approximately 64% secured positions in industry or government labs, while around 11% returned to academia within three years of completing their fellowship. A detailed breakdown can be found in Table 1. identified three key reasons for not securing permanent employment with their host organizations:

Table 1. IPERF Fellowship distribution in Longevity SuFellows and host companies



Lack of Funding or Resources: Many companies lacked the financial resources to extend permanent job offers. Interviews with departing fellows indicated a correlation between company size and the availability of funding—smaller startups had fewer employment opportunities. While 74% of startups stated they would consider hiring the fellow if financial conditions allowed, only 10% ruled it out entirely. Given that most of these startups had fewer than seven employees, financial constraints posed a significant challenge to offering permanent positions (see Chart 1).

Lack of Fellow Interest: About 27% of fellows were not interested in continuing their careers with their host company. However, 48% expressed a desire to remain, and 19% were indifferent. Six percent did not provide a response.

Timing of Employment Decisions: For some fellows and host companies, it was too early in the process to make a definitive decision regarding permanent employment.

Interdisciplinary expertise is increasingly recognized as a key factor in identifying suitable candidates for high-tech startups. Consequently, some startups faced challenges in finding the right candidates and investing significant time and effort in the selection process. This effort aligns with the program's goal of increasing participation from underserved populations. The IPERF team is currently analyzing the impact of interdisciplinarity on the program.

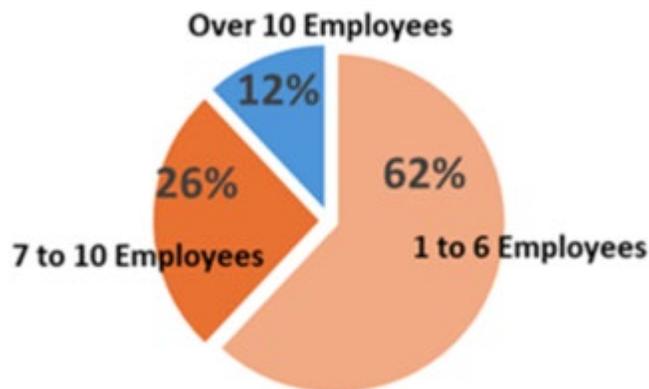


Figure 2. Size of the IPERF Startup Company

Survey results revealed that 68% of host companies were interdisciplinary, and nearly 40% of the startups were in the biotechnology sector (Ivanitzki and Agrawal 2024). Fellows rated their entrepreneurial experiences highly, with 61% considering it extremely valuable, 34% valuable, and 5% not very valuable. Additionally, nearly 90% of postdocs reported that the fellowship gave them a competitive advantage in the job market, particularly through experience in grant writing and business-related skills.

Case Studies: Ross Stein, CEO of Temblor Inc., a startup specializing in seismic risk information for the construction industry, praised his fellow, Jennifer Schmidt: "She has been proactive in developing an app to track stories related to our earthquake studies and has quickly become a valuable and reliable member of the Temblor team," Stein said. "Her research skills are phenomenal. We are incredibly grateful to IPERF for helping us find such a fantastic match." (Ivanitzki and Johnson 2024). Lindsey Tropf, CEO of Immersed Games, Inc., a company developing augmented reality video games, mentored fellow Holly Pope: "Holly quickly built strong connections with schools and teachers by interviewing them about potential tools to support their teaching plans. During her time at Immersed, she also gained valuable skills for launching her own startup, including understanding launch requirements and applying for next-level funding. Additionally, she learned about resources available to women and underrepresented groups." (Ivanitzki and Johnson 2024).

4. Proposed Improvements

More Effective One-on-One Consultations: Fellows should be required to participate in personalized consultations, totaling approximately three hours per quarter during their assignment, to discuss their career paths with a strong focus on entrepreneurship and post-IPERF opportunities. These sessions should be led by experienced professionals from the venture capital sector and former fellowship recipients, including individuals from underrepresented backgrounds. Topics should cover mentoring, commercialization, transitioning into startups, time management, and work-life balance.

Strengthened Professional Development: Fellows are encouraged to allocate up to 20% of their time to professional development, with access to a budget of up to \$3,000 each. However, this opportunity has not yet been fully utilized. To maximize its impact, the selection of specific professional development activities should be a collaborative effort between the host company, fellow, and ASEE team.

Enhanced Host Company Mentorship: Each IPERF host company commits to assigning a dedicated mentor to every fellow. These mentors provide guidance throughout the fellow's postdoctoral tenure. Currently, mentors submit progress reports every six months, assessing research progress, documenting joint publications, and identifying potential areas for future collaboration. To improve feedback quality, the reporting frequency should be increased to once per quarter.

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Improved Program Evaluation & Feedback: The ASEE team reviews all mentor and fellow progress reports and currently provides informal Zoom feedback sessions every six months. To ensure more timely and actionable support, the feedback frequency should be increased to once every three months.

5. Conclusion

The IPERF program has achieved several key successes:

1. Increased underserved and disadvantaged groups in Entrepreneurship: IPERF has significantly boosted the participation of women and underrepresented groups in entrepreneurship, surpassing national averages and even representation in STEM fields.
2. Support for High-Tech Startups: Startups benefited from expert support in daily research activities without the burden of extensive hiring efforts, as the IPERF team acted as an HR department, matching fellows to their specific needs.
3. Employment Opportunities: Over 35% of IPERF fellows secured jobs with their host startups.
4. Long-Term Impact: Nearly 90% of fellows continued to value their entrepreneurial training and experience, even years after completing the fellowship.
5. Continued Entrepreneurial Engagement: About 30% of fellows remained involved in small business ventures post-fellowship.
6. Competitive Advantage in the Job Market: More than 90% of fellows reported gaining a competitive edge, which is particularly beneficial for underserved participants as they pursue new opportunities.

The program's emphasis on entrepreneurship is expected to enhance the economic status of both fellows and their communities, many of which face financial challenges. By providing hands-on training, IPERF equips highly educated yet traditionally theory-focused fellows with practical skills in modern entrepreneurship. Upon completing the program, fellows have the opportunity to either join a high-tech startup or launch their own business. The professional development and education they receive not only foster personal growth but also contribute to bridging the diversity gap in high-tech entrepreneurship and leadership across the United States.

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Biographies

Dr. Teddy Ivanitzki is one of ASEE's directors within the Fellowships and Research Opportunities (FRO) department. He has more than 25 years of experience in managing the commercialization of technologies within IT industries and as the CTO/CEO of multiple high-tech startups in Europe and the United States. Before joining ASEE, Dr. Ivanitzki was managing director of the Ethiopian Institute of Technology in Mekelle, Ethiopia; previously, he served as dean of the College of Engineering and IT at DeVry University in Houston, Texas.

Dr. Elisabeth Mekonnen serves as the CEO of Glob-Health LLC in Maryland focusing on global health and educational aspects of young international students in the U.S. and Africa. She also volunteers in diverse health-related research aspects as well as in consulting the higher education market in Africa.