



Equity in Academic Commercialization: Towards Systemic Change

**A Workshop on Emerging Research Themes
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Executive Summary

Researchers in academic institutions want their work to matter, but few engage in commercialization activities that could expand their potential impact. Numerous factors discourage STEM faculty, postdocs, and graduate students from engaging in technology transfer, particularly marginalized faculty like women, faculty of color, disabled faculty, and LGBTQ2S+ faculty, among others. Considerable research has demonstrated that gendered and racialized disparities are particularly salient in the overlapping spaces of science, technology, engineering, and mathematics (STEM) and commercialization, both of which have historical and ongoing patterns of harm, exclusion, and social inequity (Blume-Kohout, 2014; Carpentier & Raffo, 2023; Cook, Delgado & Murray, 2023; Fechner, Schreurs, & Chung, 2022; Fechner & Shapanka, 2018; Gangas et al., 2024; Gerson, & Kuan, 2021; Giczy, Pairolero & Toole, 2024; Goins, et al., 2022; Goodman, 2022; Hendricks Sturup, 2022; Holly Jr., & Comedy, 2022; Jackson et al., 2023; Jennings & Brush, 2013; McAlear et al., 2023; Metcalf et al., 2020; Mickey & Smith-Doerr, 2022; Milli & Branch, 2024; Muir et al., 2022; Nelson, 2020; Schelhorn & Herbers, 2022; Shaw & Hess, 2018; Shaw & Mariano, 2021; Subramani & Saksena, 2024; Swanson, 2022; Van der Linden et al., 2024). This body of literature points to systemic and structural barriers to being credited for invention and intellectual property creation; access to commercialization knowledge, pathways, and support structures; equitable processes and outcomes; and funding mechanisms.

To address these barriers, the ADVANCE Resource and Coordination (ARC) Network convened scholars, policy makers, and practitioners across sectors and from multiple disciplines for a 2-day workshop to prioritize understudied research questions and policy issues within the general theme of **Equity in Academic Commercialization: Towards Systemic Change**. The Research Board of the ARC Network, a National Science Foundation-funded initiative at the Women in Engineering ProActive Network (WEPAN), identified this theme as a primary area in need of further exploration with respect to intersectional equity in academic STEM work.

Members of the workshop planning committee nominated scholars and practitioners working in this area who represent a diverse array of disciplines, research specialties, institution types, career stages, and social demographic backgrounds. The committee also nominated inventors with firsthand experience navigating commercialization ecosystems, ecosystem developers and advocacy groups focused on equity, and researchers and practitioners from federal departments and agencies. We convened more than two dozen participants in July 2023 to participate in a series of facilitator-led discussions. Our aim was to identify emerging themes related to intersectional gender equity in academic STEM commercialization and suggest directions for new research, intervention, and policy development.

By the end of our time together, the group identified the following priorities:

- **Understand innovator pathways from an intersectional perspective**
- **Invest in equity-centered innovation infrastructure in under-resourced areas**
- **Expand our metrics for and our understanding of the impacts of commercialization**



- **Tie the impacts of equitable commercialization to institutional mission, metrics, and interests**

These priority topics emerged from extensive discussion among workshop participants and are elaborated upon in the following sections along with additional focal areas for consideration. We encourage researchers, policymakers, and change agents to pursue these topics and explore the questions described within this report, which will be aided by collaboration among and between researchers and practitioners across disciplines, including social sciences and humanities.

Background

The ADVANCE Resource and Coordination (ARC) Network is funded by a cooperative agreement to the Women in Engineering ProActive Network (WEPAN) from the National Science Foundation ADVANCE program (HRD-1740860, HRD-2121468). Its overarching goal is to curate and disseminate resources and support a community that shares research and promising practices for intersectional gender equity in higher education science, technology, engineering, and mathematics (STEM) departments. Toward those goals, the ARC Network hosts Emerging Research Workshops, the topics of which are guided by the ARC Research Board.

Through the Emerging Research Workshops, the ARC Network team works with scholars, policymakers and practitioners to identify emerging research questions and themes related to intersectional gender equity in STEM and suggest directions for new research, intervention, and policy development in those areas. In the autumn of 2022, the Research Board recommended that the ARC Network host an Emerging Research Workshop on the general topic of academic commercialization and systemic change.

Considerable research has demonstrated that gendered and racialized disparities are particularly salient in the overlapping spaces of science, technology, engineering, and mathematics (STEM) and commercialization (Blume-Kohout, 2014; Carpentier & Raffo, 2023; Cook, Delgado & Murray, 2023; Fechner, Schreurs, & Chung, 2022; Fechner & Shapanka, 2018; Gangas et al., 2024; Gerson, & Kuan, 2021; Goins, et al., 2022; Goodman, 2022; Hendricks Sturup, 2022; Holly Jr., & Comedy, 2022; Jackson et al., 2023; Jennings & Brush, 2013; McAlear et al., 2023; Metcalf et al., 2020; Mickey & Smith-Doerr, 2022; Milli & Branch, 2024; Muir et al., 2022; Nelson, 2020; Schelhorn & Herbers, 2022; Shaw & Hess, 2018; Shaw & Mariano, 2021; Subramani & Saksena, 2024; Swanson, 2022; Van der Linden et al., 2024). For example, in 2019, 12.8% of inventors listed on U.S. patents² were women (Toole et al., 2020) and of the inventors listed on U.S. patents in 2016, 1.6% were Black, 0.3% were American Indian or Alaska Native, 0.2% were Native Hawaiian or other Pacific Islander, 3.7% were Hispanic,

² Race, ethnicity, and gender are not currently recorded in patent data; Rather, researchers and data analysts deploy a variety of techniques, such as name disambiguation algorithms, to identify inventor race, ethnicity, and gender. Advocacy efforts over the last several years have resulted in the Inventor Diversity for Economic Advancement (IDEA) Act of 2024 which is currently under consideration (S.4713/H.R.9455). The IDEA Act would require the USPTO to collect voluntary, self-reported demographic data on patent applicants in a way that would allow for intersectional analyses. The data would be kept separate from the patent examination process.



21.9% were Asian, 1.4% were multiracial, and 74.6% were white (Akcigit & Goldschlag, 2022). Little data are available that consider the intersections of gender, race, and ethnicity and/or other demographics, like disability or sexuality.

Moreover, research has also illustrated how bias and discrimination affect commercialization support at every step in the process, including in technology transfer offices; federal funding programs like I-Corps, Small Business Innovation Research (SBIR), and Small Business Technology Transfer (STTR); industrial partners; and angel and venture capital investment (Fechner and Schreurs, 2022; Hendricks-Sturup, 2022; Joshi et al., 2018; Kanze et al., 2018; Metcalf et al., 2020; Nelson, 2020; Schelhorn and Herbers, 2022; Shaw & Mariano, 2021).

Many efforts to remedy these disparities have focused on helping individual inventors navigate inequitable systems. At worst, this approach has centered on perceived deficits in marginalized innovators' knowledge, skills, and abilities, pushing marginalized inventors to assimilate to existing commercialization and entrepreneurship systems (Cook, Delgado, & Murray, 2023; McAlear et al., 2023; Mickey & Smith-Doerr, 2022; Metcalf et al., 2020). At their best, however, these efforts have explicitly invested in ventures founded and led by marginalized innovators and/or provided programmatic support centering marginalized innovators in carving out commercialization and entrepreneurial pathways that align with their values, needs, and goals (Gangas et al., 2024; Goins et al., 2022; Jackson et al., 2023; McAlear et al., 2023; Shaw & Hess, 2018). Some examples include Angeles Investors, Backstage Capital, Black Girl Ventures, the Convergence Program, the Fearless Fund, Golden Seeds, Natives Rising, Pow Wow Pitch, Startup Unidos, and the WEPAN Accelerator. Unfortunately, these approaches have largely been under attack by conservative groups targeting diversity, equity, and inclusion efforts and affirmative action policies. For example, the conservative group American Alliance for Equal Rights sued the Fearless Fund for racial discrimination, forcing the Fearless Fund to shut down its Fearless Strivers Grant program that provided \$20,000 to small businesses led by at least one woman of color (Franklin, 2024). Concerted retrenchment efforts like this highlight the critical need for systemic change.

A growing body of scholarship and practice seeks to directly address exclusionary, harmful, and inequitable systems. This work points to systemic and structural roots of inequities in being credited for invention and intellectual property creation; access to commercialization knowledge, pathways, and support structures; commercialization processes and outcomes; funding mechanisms, and more. For example, a report co-produced by the Kapor Foundation and AISES: Advancing Indigenous People in STEM “make(s) explicit the connection between the deficit nature of the figures presented and the systems which create and profit from these disparities,” highlighting the importance of situating ongoing disparities within their social, economic, historical, and epistemic contexts (McAlear et al., 2023).

These disparities are deeply tied to the ways in which systemic racism, colonialism, and sexism have shaped and are embedded within U.S. technological development as well as educational, economic, and legal systems (Cook, Delgado, & Murray, 2023; Holly Jr., & Comedy, 2022; Jackson et al., 2023; McAlear et al., 2023; Mickey & Smith-Doerr, 2022, Swanson, 2022). Take patenting, for example. Historically, although the Patent Act of 1790 did not limit patentees



based on gender or race, the U.S. Patent and Trademark Office (USPTO) refused to grant patents to enslaved Black inventors and many state laws prohibited married women from becoming patentees in their own names. Women and Black inventors, particularly Black women inventors, once intentionally concealed their identities, assimilating to white men's practice of using false non-inventors to receive patents to try to protect themselves from discrimination and to profit from their inventions (Cook, Delgado, & Murray, 2023; Swanson, 2022).

In addition, innovation and commercialization often has harmful effects on Black, Indigenous, and Latine communities, including the theft, destruction, and pollution of land (e.g., Dakota Access Pipeline, the thirty-meter telescope on Mauna Kea) and water (e.g., Flint water crisis, the positioning of data centers in arid regions) and the use of Black and Brown people, particularly women, and their genetic material as sites of experimentation and commodification (e.g., Tuskegee Syphilis Experiment, HeLa cells, theft of Indigenous DNA, the development of hormonal birth control) (McAlear et al., 2023; Metcalf, 2017; TallBear, 2021). With these patterns of harm and dehumanization, it is not surprising that recent research demonstrates the critical role that trust plays in the commercialization experiences of women, particularly women of color (Milli & Branch, 2024).

Drawing on this knowledge, we designed a workshop with the goal of identifying the most promising research questions, interventions, and policies that would advance systemic, intersectional gender equity in academic commercialization. The Research Board recruited a Planning Committee (see page 3) to further define the theme, outline potential topics for discussion, identify scholars and change leaders working in the area, and plan the workshop itself. The Committee started its work in spring 2023. Members of the workshop planning committee nominated scholars and practitioners working in this area who represent a diverse array of disciplines, research specialties, institution types, career stages, and social demographic backgrounds. The committee also nominated inventors with firsthand experience navigating commercialization ecosystems, ecosystem developers and advocacy groups focused on equity, and researchers and practitioners from federal departments and agencies.

The Emerging Research Workshop took place in July 2023 in Madison, Wisconsin, home of the first technology transfer office, where we convened more than two dozen participants. Our aim was to identify emerging themes related to intersectional gender equity in academic STEM commercialization and suggest directions for new research, intervention, and policy development. The results and recommendations from this workshop are included in this report. During our facilitator-led conversations, participants also identified a suite of equity-centered resources available to academic inventors, technology transfer professionals, and ecosystem builders. A partial list is given in Appendix I and we invite readers to recommend additional equity-centered resources as part of the community feedback survey connected to this report.



Workshop Description

The Planning Committee designed the workshop to proceed from a general overview of equity in academic commercialization towards prioritizing specific research questions and areas for intervention. We began the workshop by establishing group norms and a shared understanding to create a space where authentic conversations could take place over the course of two days. See Appendix II for the full agenda.

-----Day 1-----

The overall goal for the first day was **Developing a Shared Understanding for a Research and Intervention Roadmap**. Participants engaged in conversations designed to elicit varying perspectives, come to a consensus about workshop goals, and identify priority topics for further research.

Task 1

Our first task was to gain an appreciation for the expertise, experiences, and perspectives of participants with respect to academic commercialization. In pairs, participants spent five minutes in deep conversation with one another. Each pair then introduced their partners to the entire group. We learned that participants work in academia, government, nonprofit, and industry. The group included entrepreneurs, researchers, policymakers and administrators, and consultants, among others and covered a wide range of disciplinary backgrounds.

Areas of expertise of our participants included:

- Biomedical Engineering
- Sociology
- Law
- Technology Transfer
- Economics
- Public Policy
- Higher education administration
- Chemistry
- Biology
- Physics
- Health Science
- Electrical Engineering
- Statistics
- Gender Studies
- Library Science
- Computer Science
- Business/Entrepreneurship

We then invited participants to form small groups of 5-7 individuals to engage in more structured conversations guided by the following two questions:

1. *What do we know about marginalized STEM faculty, graduate students, and postdocs, and their experiences in entrepreneurship and commercialization ecosystems?*
2. *What are the mindsets, drivers, and gatekeepers of commercialization activities for STEM faculty, graduate students, and post-docs?*



What do we know about marginalized STEM faculty, graduate student, and postdoc experiences in entrepreneurship and commercialization ecosystems?

In response to this question, participants discussed a range of research findings and experiential knowledge. This included that women are more likely to patent in academic institutions than in industry or government environments (Sugimoto et al., 2015; Giczy et al., 2024). Participants also discussed gender and racial differences in self-identification and self-confidence as an inventor or entrepreneur as well as in available time to engage in commercialization, particularly when it does not count toward promotion and tenure (Bouwma et al., 2021; Carter et al., 2021; Schelhorn & Herbers, 2022). Taking on additional labor is more challenging for women and faculty of color, particularly women of color, who are already overburdened with undervalued and unpaid labor, carrying heavier service, teaching, and/or caregiving loads than faculty who are white and/or men (O'Meara et al., 2017; Misra et al., 2021).

The discussion also covered myriad inequities such as exclusion from key networks of collaborators, investors, commercialization professionals, and mentors; lack of access to commercialization and legal support and knowledge; lack of access to generational wealth; and bias and discrimination in

- venture capital and angel investment,
- selection for and experiences in incubator, accelerator, and I-Corps programs,
- experiences with technology transfer offices (TTOs),
- patent examination timelines and outcomes,
- opportunities to form academic-industry partnerships,
- SBIR/STTR and industry funding, and
- Assessment of the worth or value of technologies created by and/or for marginalized communities (Fechner and Schreurs, 2022; Hendricks-Sturup, 2022; Kanze et al., 2018; Metcalf et al., 2020; Nelson, 2020; Schelhorn and Herbers, 2022; Shaw & Mariano, 2021).

Participant conversations also covered effective interventions. For example, the USPTO's patent pro bono program was highlighted as a successful intervention that, in providing free legal services for patent applicants, significantly reduced gender disparities in patent applications. Recent efforts and successes at Historically Black Colleges and Universities (HBCUs) were also looked to as potential models for future interventions, including effective mentoring (McCrary, 2021; McEwen et al., 2022). Policy advocacy efforts, such as the Inventor Diversity for Economic Advancement (IDEA) Act, and coalition building, like the work of groups like Invent Together were also discussed.

Workshop participants then touched on what may be missing when thinking of the experiences of marginalized STEM faculty, graduate students, and postdocs. Participants discussed the challenges to intersectional research and analysis related to equity in academic commercialization. Participants noted that patent data are analyzed using problematic methods to identify an inventor's gender, race, and/or ethnicity based on their name; few studies consider the experiences of women of color; and virtually no research discusses the academic



commercialization experiences of disabled (see Duvall et al, 2022), LGBTQ2S+, first-generation, veteran, and/or immigrant innovators.

Lingering questions that participants would like to explore in future work included:

- How do model programs that provide support that center the needs, values, and goals of marginalized innovators sustain their efforts, particularly in light of recent legislative challenges?
- What additional policy interventions at the institutional, state, and federal levels are needed?
- What are the career trajectories of individuals who commercialize?
- How can we scale successes? What kinds of resources are needed?

What are the mindsets, drivers, and gatekeepers of commercialization activities for STEM faculty, graduate students, and post-docs?

In terms of barriers and gatekeeping, several participants noted that commercialization is often framed within the context of revenue rather than social impact. For many marginalized academics, the financial payoff is often secondary or tertiary, whereas addressing problems that impact the communities they care about is of primary importance. One participant explained, “As part of this project we are working on we did focus groups with a lot of people – most interesting was a group of academic women inventors – having more altruistic motives for pursuing industry. They wanted their idea to benefit a specific population. They wanted the world to be better for having this idea.”

In addition, extractive capitalism contributes to social problems many marginalized innovators want to address. An emphasis on profit or the use of for-profit messaging by technology transfer offices can disincentivize social entrepreneurs and may be detrimental to engaging inventors interested in their work entering the public domain or benefiting the community for which it was invented. Showing alternatives to consumption-oriented models that prioritize quantity over quality, large scale exits over sustainability, individualism over community, and profit for few over the prosperity of many expands what commercialization can look like to include innovators who are focused on social impact.

Participants discussed faculty as potential gatekeepers to commercialization for graduate students and postdocs. Academic faculty who are uninvested in commercialization may actively discourage their students and postdocs from such activities (Delgado & Murray, 2023) despite evidence showing that this point in an innovator’s career strongly influences likelihood of future commercialization activities (Blume-Kohout, 2014). Graduate students and postdocs who see entrepreneurial activity as a viable career path may be blocked if they are working with a principal investigator who does not give graduate students and postdocs access to or credit for intellectual property or is discriminatory or biased in determining who gets access to or credit for intellectual assets that could be commercialized. Additionally, an important source of knowledge about the tech transfer and patenting processes for new inventors is being able to work on teams with those who have gone through the patent process (Milli & Branch, 2024).



Universities and the TTOs within them are important drivers and gatekeepers to commercialization activities for STEM faculty, graduate students, and postdocs. Such activities are often not valued in tenure and promotion cases (Bouwma et al., 2021; Carter et al., 2021; Schelhorn & Herbers, 2022), and there are few standards guiding the work of TTOs. Research has shown that TTOs tend to act passively in their outreach efforts and tend to only work with those with established commercialization success (Metcalf et al., 2020; Shaw & Hess, 2018). One participant noted, “If you look at the tech transfer office, if there are metrics there, they want to have number of startups formed, patents issued, etc. If they would engage as many people as possible, these metrics would be improved. But they don’t do this. They tend to work with the same folks repeatedly. They could engage in intentional outreach to get information on commercialization in front of more people.” In the context of research about the role of trust in commercialization activities for women, particularly women of color, TTOs should work to develop authentic relationships with all members of the communities they are meant to serve (AUTM, 2024; Golden & Mamawala, 2020).

Disclosure can also impact commercialization activities. The Bayh-Dole Act, formerly known as the Patent and Trademark Act Amendments, is a federal law enacted in 1980 that enables universities, nonprofit research institutions, and small businesses to own, patent and commercialize inventions developed under federally funded research programs within their organizations. It regulates how academic institutions commercialize, but few academics understand their responsibilities to disclose inventions. Furthermore, faculty may be concerned with losing control of how their work may be used after disclosing (Shaw & Hess, 2018).

Additional mindsets, drivers, and gatekeepers that participants noted include:

- Professional societies are important gatekeepers of disciplinary culture and could play an important role in broadening access to and equity within commercialization activities in the fields they represent.
- Within an institution, gatekeepers also include Boards of Trustees, central administrators (e.g., VP for Research, Provost), deans, department chairs, senior faculty and faculty on promotion and tenure committees all play a role in setting and reinforcing evaluation standards.
- Academia values the free and fair sharing of research results as a public good. Commercialization need not conflict with these values. Rather, institutions can provide information on balancing sharing research results and protecting intellectual assets.
- There is a false belief that women are more risk-averse than men and that assumption has been tied to gaps in support for commercialization (Nelson, 2020; Nelson, 2014).
- AUTM (formerly the Association of University Technology Managers) collects data from TTOs primarily using metrics of processing (invention reports, patent filings) rather than outcomes (license agreements, funding realized), inventor goals, or inventor experiences. Shifting the data collection expectations of TTOs to align with equity-focused behavioral and process changes could be a strong incentive.
- Funding agencies are important gatekeepers. An excellent example of culture change driven by funders is seen in the NSF change of review criteria to include “broader impact” of the research. Proposals now take that criterion very seriously. Funders could



require prospective grantees to focus on equity in commercialization activities in their proposals.

- Private funders (e.g., angel investors, venture capital firms) are formidable gatekeepers that have shown significant bias against women and inventors of color (Kanze et al., 2018).
- Crowd-funding is more egalitarian than other external sources, but the amounts raised tend to be much smaller (Schelhorn and Herbers, 2022).

Task 2

Our second task utilized a technique known as the World Café. For each conversation, participants engaged in discussion with a small group of colleagues. Within each small group, a host was charged with maintaining focus and ensuring that all voices were heard, and a scribe took notes of the discussion. Once the discussion had concluded, the facilitator asked each group to report out; in that way, everyone had a sense of communal responses. Thereafter, individuals moved to form new groups, which maximized opportunities for creative interaction. Along the way, participants noted salient points on sticky notes.

Questions posed included:

1. *What existing structural and cultural barriers impede equity in commercialization for STEM faculty, graduate students and postdocs?*
2. *What does equity in innovation activities look like? What are promising practices/programs within higher education? What can academia learn from other sectors (e.g., federal labs)? How will we know we have achieved equity in academic commercialization?*
3. *What systemic changes will be most impactful for promoting equity in academic innovation endeavors?*

What existing structural and cultural barriers impede equity in commercialization for STEM faculty, graduate students, and postdocs?

While many structural and cultural barriers to equity in academic commercialization were discussed during Task 1, workshop attendees noted several additional systemic challenges faculty, graduate students, and postdocs may face with respect to commercialization activities. We share these barriers thematically throughout this section, however, several attendees explicitly pointed out that these systemic concerns intersect in a variety of ways that further compound inequities.

One set of barriers centered around ***access to information, resources, and support***. Participants noted that because academic programs rarely provide training that includes information about commercialization processes and pathways, innovators tend to gain access to this information through the principal investigators they work with or via connections to colleagues who have commercialized or know about commercialization opportunities. In addition, technology transfer offices often rely on their existing networks of seasoned inventors and engage in passive outreach, responding to inventors who approach them rather than proactively visiting

departments, labs, and faculty, staff, and student groups to share key information and resources about commercialization. Many of these offices are understaffed and experience high turnover, creating additional barriers to prioritizing authentic relationship-based outreach which takes time and continuity across staffing changes. This leaves much room for bias, discrimination, and exclusion to influence who gets access to what information, opportunities, resources, and support. Lastly, in academic settings, inventors often have few rights to their own inventions because of policies that dictate university ownership of intellectual property invented through the support of university resources.

Another set of equity related barriers that surfaced in the workshop conversations related to ***differences in institutional capacity and infrastructure*** for research broadly and commercialization particularly. Academic institutions are varied in the infrastructure and resources available to support commercialization activities, with doctoral universities and Predominantly White Institutions (PWIs) tending to have more established technology transfer offices and related resources than master's colleges and universities, baccalaureate colleges, community and technical colleges, and Minority-Serving Institutions (MSIs) like HBCUs and Tribal Colleges and Universities (TCUs) who have longstanding histories of being federally underfunded (Dupuis, 2017; McCrary, 2021; McEwen et al., 2022; NSTC CoSTEM, 2024). Participants also shared examples of highly resourced institutions partnering with institutions that have capacity limitations to provide commercialization support across both organizations.

Pervasive structural inequities in non-dilutive federal funding continue to be a large barrier when it comes to securing funds to support commercialization and entrepreneurial activities. While SBIR and STTR programs across the U.S. federal funding agencies have invested in a wider set of communities than venture capital, these programs still have large, persistent disparities in award allocation to marginalized principal investigators, businesses owned by women and/or people of color, and MSIs (Liu & Parilla, 2019; Metcalf et al., 2020; NASEM, 2022). For example, a study of NIH STTR awards found that funded collaborations with HBCUs and Hispanic-Serving Institutions (HSIs) as research and development partners are few and far between and have not increased in over twenty years (NASEM, 2022). These barriers remain despite concerted outreach efforts, suggesting the need to examine the review process. Recent initiatives have sought to address the inaccessibility of SBIR/STTR solicitations and application processes by offering free application assistance programs to new applicants.

What does equity in innovation activities look like? What are promising practices/programs within higher education? What can academia learn from other sectors? How will we know we have achieved equity in academic commercialization?

This set of questions focused on envisioning more equitable futures and building on existing successes to get there. When introducing these questions, attendees were first asked to take a few moments to write their ideas on sticky notes. The attendees then grouped similar ideas together resulting in the vision that follows.

A variety of commercialization pathways are valued, supported, and available to innovators as part of their career development



- Reward structures, such as promotion and tenure, not only incorporate metrics for commercialization among many possible ways to demonstrate impact, including social impact, and success.
- Technology transfer offices build authentic, trustworthy relationships with innovators, are inclusive in their communications and interactions, and support innovators without bias.
- Academic innovators are provided dedicated, paid time to engage in entrepreneurial activities.
- Inventor demographics align with institutional, local, regional, and/or national demographics.
- Women, innovators of color, disabled innovators, queer innovators, etc. and their intersections:
 - are supported in solving problems that they care about and that affect their communities,
 - are deeply integrated within innovation ecosystems that have effective mentors and role models,
 - can focus on their ideas without the additional labor that is caused by racism, sexism, homophobia, ableism, classism, colonialism, and more,
 - see themselves reflected in the stories, curricula, and pedagogical approaches related to invention and commercialization.

Resources, including funding, are distributed equitably and shared transparently

- Decisions about resource allocation (e.g., space, money, training) and invention ownership are made in ways that build trust.
- SBIR/STTR programs, investors, and more fund innovators without bias and discrimination.
- The processes by which funding and resources are obtained are transparent, accessible, and easy to navigate.
- Innovators have autonomy to ensure that the outcomes of their work benefit, rather than harm, marginalized communities.
- Innovators are able to benefit financially, socially, and professionally from their intellectual property.
- A range of academic institutions have the capacity to support innovation and commercialization and collaborate to address local and regional challenges.
- Entrepreneurship and commercialization programs enroll and provide effective and harm-free professional development to marginalized innovators.

Lessons from other sectors

Participants also discussed lessons from other sectors, first discussing Federally Funded Research and Development Centers (e.g. federal labs). Federal labs have an explicit emphasis on commercialization, including support from the Federal Laboratory Consortium for Technology Transfer, which facilitates technology and knowledge sharing across federal laboratories. Federal labs often have special funds to promote technology transfer, with an emphasis on licensing, and commercialization metrics are incorporated into annual reviews of research staff. Staff are



provided with consistent and layered commercialization training. Little is known, however, about the impacts of these commercialization supports on equity.

Second, participants turned to industry, which has commercialization as a primary focus. This part of the discussion covered the ways in which larger, more established companies streamline invention disclosures, opting to take an approach whereby departments and research groups are regularly visited by team members on the lookout for commercialization opportunities. Companies often provide training to staff on commercialization and market trends and provide monetary and other incentives for invention. Some research does show that industry environments, however, do not fare as well as academic environments where equity in commercialization is concerned (Sugimoto et al., 2015).

What systemic changes will be most impactful for promoting equity in academic innovation endeavors?

During this portion of the workshop, attendees discussed a variety of changes academic institutions could make that would have the greatest impact on equity in academic commercialization and innovation. These included:

1. Develop commercialization metrics that cover a range of activities and outcomes (e.g., licensing, patenting, small business development) and center social impact, sustainability, and community needs.
2. Carefully incorporate commercialization metrics within the academic reward system, including those developed above.
3. Create policies and resources that support more equitable workloads and address the needs of STEM faculty caregivers.
4. Include commercialization and entrepreneurial pathways as part of graduate and postdoc training, allowing trainees to envision a wider range of career possibilities.
5. Draw explicit connections between higher education's mission and the societal impacts that can accompany commercialization.
6. Leverage and scale effective programs, practices, and toolkits that are already developed.
7. Collect institutional data on commercialization experiences, analyze the data intersectionally, and use the findings to inform changes to policies, programs, and practices.
8. Hold funders accountable for equitable resource allocation.
9. Promote and/or require collaboration between TTOs and Offices of Sponsored Projects so intellectual property developments are tracked more holistically.

Participants also discussed ways in which federal funding agencies can incentivize social impact commercialization, akin to the NSF's inclusion of broader impacts in its solicitations. Professional societies, particularly AUTM and STEM professional societies, are also well positioned to set expectations around equitable commercialization for their respective fields.



Task 3

Our final session on Day 1 was designed to build the research, intervention, and policy roadmap to alleviate inequities within the commercialization ecosystem. Participants first placed on a wall their collected sticky notes from the above discussions. Then all engaged in a sorting exercise to identify major themes from those notes. That sorting served as the starting point for Day 2.

-----Day 2-----

On the second day of the workshop, we reconvened to first recap the previous day's work and put it into the context of mapping out the most promising areas for future research, policy, and intervention. After discussion, the group prioritized four themes for additional discussion.

Priority Areas for Research, Policy, and Practice:

- **Understand innovator pathways from an intersectional perspective**
- **Invest in equity-centered innovation infrastructure in under-resourced areas**
- **Expand our metrics for and our understanding of the impacts of commercialization**
- **Tie the impacts of equitable commercialization to institutional mission, metrics, and interests**

The participants then assembled into four groups (one per area) for focused discussions centered on the following questions.

1. For research-centric areas:
 - a) Given the research area/issue, what question or set of questions, if answered, will make the greatest contribution to equity in STEM?
 - b) What research methods will prove most useful for answering these questions?
 - c) What new collaborations might foster the greatest success for these research questions?
2. For policy/intervention-centric areas:
 - a) Define the problem and purpose of the intervention
 - b) Identify stakeholders, audience, content, and distribution of intervention activities
 - c) What new collaborations might foster the greatest success for these interventions?

Priority Area 1:

Understand innovator pathways from an intersectional perspective

The group that explored this priority area focused on research that would fill gaps in understanding innovator journeys, particularly from an intersectional perspective. They discussed the literature that shows women, Black, Indigenous, and Latine innovators participate in all components of academic commercialization at lower rates than do white and Asian men. These findings are largely quantitative in nature, are derived from analyses of NSF survey data



on the science and engineering workforce, and rely heavily on USPTO data on commercialization, using names as proxies for gender, race, and ethnicity (Cook, Gerson, & Kuan, 2021; Cook, 2010). Additionally, regardless of method, intersectional analyses of innovation, entrepreneurship, and commercialization are largely absent (Mickey & Smith-Doerr, 2022). There is a strong need for research, particularly qualitative research, that explores the experiences of marginalized innovators and situates those experiences systemically.

Key research questions to explore intersectionally:

- How do marginalized innovators describe their innovation pathways? What systems and gatekeepers shape their experiences, both positively and negatively? How do these experiences vary demographically?
 - What resources, policies, and practices foster sustained interest in commercialization?
 - What are the critical points along innovation pathways in need of change?
 - What do the experiences of marginalized innovators tell us about how innovation, entrepreneurship, and commercialization need to change? How can these ecosystems incorporate the needs and values of marginalized inventors and communities?
 - What do the experiences of marginalized innovators tell us about effective interventions?
 - What changes do gatekeepers need to make to provide equitable opportunities, access, support, and investment?
- What departmental, institutional, local, regional, national, and geographic contexts are at play? What disciplinary, social, political, economic, historical, and programmatic contexts? What differences or similarities are there across these contexts?
 - How do state regulations, local industry, existing partnerships, local community needs, institution type, disciplinary field, institutional policy, etc. impact marginalized innovators' experiences?
 - How can funding opportunities and distribution be made more equitably?

Priority Area 2:

Invest in equity-centered innovation infrastructure in under-resourced areas

Inventors are often reliant on local resources to help them commercialize, yet resources vary substantially based on location. For example, an academic inventor working at a research-intensive university in the Bay Area is embedded within a resource-rich entrepreneurial environment while an academic working in a small rural college has few such resources. Institutions with a strong service mission similarly may not provide deep support for academic inventors (McCrary, 2021). Thus, geography, institutional mission, local culture, and effectiveness of entrepreneurship ecosystems can promote or hinder participation in commercialization.

This group outlined a pilot project to address the issue of uneven access to commercialization resources with the goal of developing a local network of commercialization support to equitably



serve inventors across different kinds of institutions. They identified Alabama as a promising location, due to its strength in automobile manufacturing and its aerospace infrastructure. Furthermore, as an Established Program to Stimulate Competitive Research (EPSCoR) state³, Alabama may be able to leverage existing resources for this purpose. Finally, Alabama has a strong network of HBCUs with expertise to engage in the state-wide innovation ecosystem.

The pilot project would create a fellowship for a researcher to develop a detailed pilot implementation plan. A 2-3-year fellowship would attract broad interest and help to secure participation by constituents and gatekeepers across the region. It is important that such a fellowship be sanctioned by an appropriate state office from the outset. The group thought that a federal agency like NSF might be interested in funding such a pilot project, or perhaps Alabama EPSCoR itself might wish to.

First steps include:

- Collecting and analyzing baseline data intersectionally, documenting existing equity issues. Examples include:
 - Federal grants and contracts to institutions
 - Number of invention reports/ patent filings/ startup companies reported by institutions in the state
 - Additional information concerning the state labor force and environment for commercialization
- Assessing resources and infrastructure:
 - What is already in place?
 - Which institutions have commercialization infrastructure, and which do not?
 - What cooperation agreements are already in place to support infrastructure sharing across the institutions in Alabama?
 - Are there existing statewide consortia, industry-university partnerships, federally funded initiatives, incubators, and/or accelerators that might be leveraged?
- Assessing the policy environment:
 - What is the legal environment for commercialization?
 - Are there state/ local laws that regulate issues like use of space for startup companies within public colleges and universities, conflicts of interest, and the like?

Next, the project would engage institutions and inventors in a meaningful dialogue to understand their experiences, needs, and goals for inclusive and equitable commercialization. These would include:

- Qualitative interviews and focus groups with key constituents and gatekeepers (e.g., research offices, technology transfer offices, state agencies, inventors, local industry, STEM faculty who haven't yet commercialized their research, local communities, etc.)
- Needs assessment via surveys of institutions (developed in conjunction with a state agency) and individual faculty (transmitted through institutional channels)

³ <https://alepscor.org>



Throughout, the project would require building trust across institutions and constituents, taking explicit steps to embed equity within the regional infrastructure and ensure that multiple needs are met, mutually beneficial collaborations are formed, sustainable models are advanced, and local communities are served. This includes engaging marginalized constituents in meaningful leadership and decision-making roles. The ultimate outcome would be a series of recommendations for setting up an equitable state-wide program to foster commercialization that would serve communities and institutions, including MSIs and community and technical colleges, across Alabama, in a format that could provide a playbook to other states wanting to implement initiatives with similar goals. A well-developed assessment plan should be included to ensure programmatic discussions and development stay on track and advance the desired outcomes.

Priority Area 3:

Expand our metrics for and our understanding of the impacts of commercialization

Institutions routinely report certain metrics from their technology transfer and research and development efforts, including the number of invention disclosures, patent applications, patents received, startups created, licenses secured, license volume, SBIR/STTR funds procured, private investments made, industry partnerships brokered, etc. For example, AUTM produces reports from data it collects from participating technology transfer offices on aggregate invention disclosures, patent applications, patent awards, licenses secured, and more.

While these are important measures to track, they are not the only metrics for understanding the impacts of commercialization. In addition, when the above metrics are collected, they are rarely disaggregated demographically or intersectionally. Moreover, few institutions collect self-reported innovator demographics that would be helpful in discerning key areas for improvement. This group focused on exploring what additional impact metrics for commercialization might look like, especially related to equity concerns.

What data do we need?

- Self-reported demographic data on innovators such that existing metrics can be disaggregated and aggregated in ways that allow for intersectional analyses (while also preserving and protecting the confidentiality of innovators), including but not limited to:
 - Gender (not sex and with options that are inclusive of non-binary and transgender innovators)
 - Race
 - Ethnicity
 - Sexual orientation
 - Disability
 - Veteran status
 - Department/discipline
 - Position and rank at the university



- Data that discern material and data transfer agreements (MTAs/DTAs) from licenses to external entities that generate revenue and that capture characteristics about the licenses (e.g., size, term, licensee)
- Metrics about innovators’ experiences with university commercialization support services (e.g., technology transfer offices)
- Metrics about the contributions of commercialization activities to innovators’ goals
- Positive social impact metrics like communities served and contributions to sustainable development goals⁴

Such a research agenda would benefit from enlisting the cooperation of established entities that collect such data, such as:

- University offices of institutional data
- University technology transfer offices
- AUTM
- Licensing Executives Society
- Institute for Research on Innovation and Science
- NSF
- USPTO
- Centers for entrepreneurship within an institution
- State and regional economic development offices
- Government-University-Industry-Philanthropy Research Roundtable (GUIPRR) at the National Academies of Sciences, Engineering, and Medicine

This group also discussed possible funders for this work, which included:

- The Ewing Marion Kauffman Foundation (focused on the Kansas City area)
- The Lemelson Foundation
- Chan Zuckerberg Initiative
- NSF, particularly the Directorate for Technology, Innovation, and Partnerships (TIP) and programs under EPSCoR
- The Gates Foundation
- The Small Business Administration

Priority Area 4:

Tie the impacts of equitable commercialization to institutional mission, metrics, and interests

Researchers, advocates, policy makers, and practitioners have made a variety of arguments about why diversity and inclusion matter to innovation. These arguments are typically made through one or more imperatives including:

⁴ The United Nations put forward 17 Sustainable Development Goals that include: No poverty, Zero hunger, Good health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, and more. See <https://sdgs.un.org/goals> for the full list.



- the business, financial, or competitiveness case;
- the shifting demographics case; and
- the ethical, moral, or social justice case (Elsesser, 2022; Forbes Business Development Council, 2023; Hebl & King, 2024).

Regardless of the imperative, the overarching conclusion is that, to support diversity, equity, and inclusion work, decision makers often need to see the direct connection to outcomes they care about (e.g., funds raised, students served).

To that end, the fourth group focused on ways to tie the impacts of equitable commercialization to the mission, metrics, and interests of institutions of higher education. In directly connecting equity in commercialization to what institutions already care about, researchers, policymakers, and practitioners can develop buy-in from senior administrators and governing boards charged with advancing institutional interests. This requires developing a deeper understanding of institutional mission, goals, strategic plans, and metrics that demonstrate progress toward those ends as well as other factors that motivate institutions of higher education to meaningfully invest in equitable commercialization infrastructure, programming, and support.

The group listed out important steps to connect equitable commercialization to institutional aims:

- Conduct research on institutional missions, values, goals, and interests across institution types (e.g., public, private, research-intensive, teaching-intensive, PWIs, MSIs, community and technical colleges, land grant institutions, etc.)
- Connect the research and data on the positive impacts of equitable academic commercialization to the institutional missions, metrics, and goals for a wide range of institution types.
- Incorporate expanded commercialization metrics that include social impact alongside economic impact.
- Study institutions with equity-promoting policies (e.g., caregiver and flexible tenure policies, diversity of university leadership) to better understand the impacts of those policies on commercialization outcomes and leverage the findings to make institutional recommendations.
- Leverage the recommendations, outcomes, and lessons learned from successful equity-based entrepreneurship and commercialization programs such as those listed in Appendix I.
- Draw on the strengths and leadership of institutions and institutional consortia with explicit missions to serve marginalized communities.

Furthermore, researchers and practitioners can enlist the help of other entities to better understand opportunities and failures. A few examples include:

- Professional societies with diversity, equity, and inclusion missions (e.g. AISES, WEPAN, NAMEPA, NSBE, etc.) and for disciplines with strong presence in commercialization (e.g., engineering, pharmaceutical sciences) and technology transfer (e.g., AUTM)



- National organizations for institutions of higher education (e.g., Association of Public and Land-grant Universities, Association of American Colleges and Universities) and federally funded national networks focused on academia (e.g., the ARC Network)
- Regional consortia (e.g., EPSCoR jurisdictions)

Additional Priorities

Participants identified additional topics, ideas, and questions for further research and policy development that were not explored in further depth at the workshop:

- What linguistic alternatives to “commercialization” might better represent the social impact possibilities of such activities?
- What additional funding mechanisms might better support academic innovators without access to generational wealth or networks of well-resourced friends? How might different funding models and mechanisms, for example crowdfunding or models that retain founder ownership, support social equity in access to capital?
- How might a range of innovation activities be best incorporated into promotion and tenure criteria, particularly in ways that do not further workload inequities?
- What are the most effective ways for communicating and supporting many different pathways for commercialization?
- What are effective strategies for fostering gatekeeper accountability for equity in commercialization in academia as well as non-academic organizations?
- How can federal funding agencies best support and incentivize equity in commercialization?

-----**End of Workshop**-----

Evaluation by participants

We asked participants to assess the workshop via a survey instrument about their experiences. Overall, participants gave the effort high marks for posing important questions, stimulating discussion, highlighting inter-disciplinary approaches, and converging on the most important next steps for the research community. Several indicated they had met others with whom they hope to collaborate in future.

Conclusion:

This workshop built on the current understanding of the impediments to full participation in commercialization by marginalized academic scientists and engineers. Its focus was to question the very systems that support technology transfer and to query how those systems can be made more equitable. While support of individual inventors will always be helpful, the workshop called for an examination of the very systems that produce inequities among academic inventors.



Our emphasis on academic inequities puts the spotlight on institutional structures, policies, and procedures surrounding faculty affairs, graduate education, academic reward systems, commercialization training, technology transfer operations, and affiliated units like accelerators and incubators. As a result, we outlined a series of areas in need of further study as well as potential interventions to address systemic inequities in academic commercialization. These include intersectional research on innovator journeys, data collection and metric development efforts to better reflect the social impacts of commercialization, and interventions focused on building out innovation infrastructure in under-resourced areas and leveraging the connections between institutional mission and equitable commercialization outcomes to incentivize change.

In addition to these academia-focused topics, we encourage readers to explore research and interventions in non-academic spaces as well. Such work might further investigate the role of federal agencies in shaping equity in innovation, intervene in the decision-making processes of venture capitalists and angel investors, study the influence of industry on commercialization patterns regionally and nationally, and more.

For readers in decision-making and leadership roles that influence commercialization, we encourage you to examine your own processes and policies for areas of improvement and help pave the way for more equitable academic commercialization. We also invite readers to contribute their ideas to this body of work by completing the community input survey connected to this report.



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APPENDIX I. A sample of equity-focused resources for academic inventors, technology transfer offices, and entrepreneurship and commercialization support staff

Type	Name	Website
Report, Guide, or Toolkit	AUTM – Nine points to consider for fostering greater inclusion	https://autm.net/AUTM/media/About-Tech-Transfer/Documents/Nine_Points_to_Consider_for_Fostering_Greater_Inclusion.pdf
Report, Guide, or Toolkit	Intellectual Property Owners Association Women in IP Committee - Gender Diversity in Innovation Toolkit	https://ipo.org/wp-content/uploads/2019/09/GenderDiversitytoolkit-final.pdf
Policy and Advocacy Group	Invent Together	https://inventtogether.org
Report, Guide, or Toolkit	Kapor Foundation and AISES - State of Diversity: The Native Tech Ecosystem	https://www.kaporcenter.org/native-tech/
Report, Guide, or Toolkit	Kapor Foundation and NAACP - The State of Diversity: The Black Tech Ecosystem	https://www.kaporcenter.org/black-tech/
Report, Guide, or Toolkit	Kapor Foundation, Hispanic Heritage Foundation, SomosVC, and the Congressional Hispanic Caucus Institute - State of	https://kaporfoundation.org/latine-tech-ecosystem/



	Diversity: The Latine Tech Ecosystem	
Report, Guide, or Toolkit	National Association for Community College Entrepreneurship (NACCE) Diversity, Equity, Inclusion, & Belonging Center of Practice	https://www.nacce.com/equity-and-diversity-center-of-practice
Commercialization Support	National Institutes of Health Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) Applicant Assistance Program	https://seed.nih.gov/entrepreneurial-training/aap
Commercialization Support	NSF I-Corps Hub Northeast Region's I-Corps Fellowship	https://icorpsnortheasthub.org/explore/inclusive-innovation
Commercialization Support	Small Business Administration Growth Accelerators	https://www.americasseedfund.us/accelerators
Ecosystem Builder	The Ewing Marion Kauffman Foundation (Kansas City focus)	https://kauffman.org
Commercialization Support	The Inventor's Patent Academy – a free, three-part online patent education course that centers marginalized inventors	https://learn.inventtogether.org
Ecosystem Builder	The Lemelson Foundation	https://lemelson.org
Ecosystem Builder	The National GEM Consortium's Inclusion In Innovation Initiative (i4)	https://new.nsf.gov/funding/initiatives/i-corps



Ecosystem Builder	The New Jersey Equity in Commercialization Collective	https://www.njeccadvance.com/
Commercialization Support	United States Patent and Trademark Office (USPTO) – Intellectual property free legal assistance programs	https://www.uspto.gov/learning-and-resources/patent-and-trademark-practitioners/intellectual-property-legal-assistance
Commercialization Support	USPTO – Inventor and entrepreneur resources	https://www.uspto.gov/learning-and-resources/inventors-entrepreneurs-resources
Report, Guide, or Toolkit	Venture Well’s Advancing Equity Initiative	https://venturewell.org/advancing-equity/





Appendix II. Agenda for the Workshop

Emerging Research Workshop Equity in Academic Commercialization: Towards Systemic Change

**July 28-30, 2023
The Madison Concourse, Madison, WI**

PARTICIPANT AGENDA

WORKSHOP GOALS

- To identify emerging research themes, policy development opportunities, and other interventions, to stimulate systemic changes that lead to intersectional gender equity in academic commercialization.
- To move from an approach of “fixing the marginalized innovator” to “fixing the system.”

FRIDAY, JULY 28, 2023

- 4:30 PM CT **Participant arrival & registration (Assembly Room)**
- 6:00 PM **Welcome Reception (Assembly Room)**
- 7:00 PM **Dinner (Assembly Room)**

SATURDAY, JULY 29, 2023

- 8:00 **Breakfast available (Senate Room)**
AM CT
- 9:00 **Workshop introduction (Assembly Room)**
- 9:30 **Partner introductions**
- 10:00 **Small group discussion 1**
- 10:30 **Break**
- 11:00 **Small group discussion 2**



- 12:00 **Lunch (Senate Room)**
PM
- 1:00 **Developing shared understanding for an equity roadmap (Assembly Room)**
Participants will engage in a series of conversations designed to elicit varying perspectives, develop shared understanding, and reach conclusions about emerging research areas, policies, and interventions to move the academy towards greater equity for STEM faculty.
- 2:40 **Break**
- 3:10 **Continue developing equity roadmap**
- 4:10 **Summarize the day**
- 6:00 **Dinner (Senate Room)**
PM

SUNDAY, JULY 30, 2023

- 8:00 AM **Breakfast (Senate Room)**
CT
- 9:00 **Review workshop outcomes from Saturday, introduce plan for the day (Assembly Room)**
- 9:30 **Identify prioritized research areas/issues and self-organize into groups to begin in-depth planning**
- 10:30 **Break**
- 11:00 **Resume in-depth planning in small groups**
- 12:00 PM **Lunch (Senate Room)**
- 12:45 **Report-outs from groups to share about their discussions and planning (Assembly Room)**
- 1:30 **Workshop review and next steps**
Evaluation survey
- 2:00 PM **Depart**

