

To Strengthen the American STEM Workforce, Empower Workers

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Executive Summary: A just, healthy, and robust science, technology, engineering, and math (STEM) workforce is vital to social organization and human well-being in the modern world. However, economic elites can shape scientific and technological priorities by defining the “national interest” and “needs” of the market, which greatly influences the future of human power relations and material conditions. When contemporary policy debates in STEM education and workforce development focus on how K-12, university, and technical education can provide a workforce for businesses and advance the “national interest”, the resulting policy agenda centers the interests of these socio-economic elites. This paper seeks to reframe debate on STEM education and workforce development policy from a paradigm of nation-state competitiveness and market demand to one centered on workers and democracy. We argue that “who governs” the science and technology workforce and “who benefits” from the status quo of STEM education and workforce development policy is not who *should* govern and who *should* benefit, but rather the political and economic elites which steer the world’s largest companies and states. This reframing not only recognizes the fundamental interdependence of economic and political power, but that power is a feature of a social order co-produced with and through scientific inquiry, technological change, and knowledge creation. We advocate for the reimagining of the status quo to recognize that the STEM workforce is composed of, first and foremost, working people. We argue for science and technology workers to recognize common solidarity with all workers and organize to determine their own futures. Lastly, we propose a policy agenda which would empower them to do so by strengthening labor rights and expanding the worker-owned economy.

I. Power matters in STEM education and employment

Growth of the knowledge economy has and continues to define the 21st century. Science, technology, engineering, and mathematics (STEM) is a significant part of said knowledge economy, essential to maintaining and improving the modern world. Educating, recruiting, and retaining people as participants and workers across STEM has become a topic of growing importance as companies and governments vie for talent in pursuit of profits and power. People usually pursue STEM jobs to earn a living, often while striving to realize visions for themselves and the future

through the creation of knowledge and value for fellow persons (Konrad, Van Lente, Groves and Selin 2016). States have witnessed the immense value of the products of scientific and technical labor, the awe-inspiring power they could deliver, and the destruction they could wreak. As a result, governments recognize a strong STEM workforce is vital to international power and well-being of citizens (Weiss 2005). With such a prominent role for science and technology in systems of economic and political power, those who can influence their direction stand to shape the future of such systems.

Systems of public investment and research funding affect all sectors of STEM. In an ideal democratic system, public funds would subsidize investment in science and technology research which serves the interests of all. However, systems of modern government are far from perfectly representing their constituents. Concentration of economic and political power in the hands of a wealthy few ensures their outsized influence in setting priorities for science and technology investment (Hess et al. 2016). A robust, diverse, and just STEM workforce is not possible in a system dominated by elite interests.

Historically, unions have helped workers gain power. Labor unions have negotiated higher wages, improved health insurance and other benefits, and often participated in politics outside the workplace to advocate for the collective interests of members (Dubofsky and McCartin 2017). Workers in jobs which require expertise in STEM fields are no different. STEM industries rely on complex networks of labor from people with diverse expertise and experience, such as educators, machinists, technicians, engineers, and graduate students. Data from the Bureau of Labor statistics suggests union membership for employees in lower-paying STEM jobs have strong benefits. In 2011, among workers for which data was available, unionized technologists, technicians, and computer support specialists earned approximately 30% more weekly wages than their non-union counterparts (AFL-CIO 2012). A 2021 study found collective bargaining laws boost the annual earnings of teachers with STEM degrees, concentrating benefits among women. Furthermore, women teachers with STEM degrees in states with mandatory collective bargaining had more years of experience, suggesting labor power improves wages and retention for women STEM teachers (Regmi and Ju 2021). Despite critics' arguments that unions limit productivity and competitiveness, research concludes that public education institutions with unionized faculty are more effective than schools without a union (Cassell and Halaseh 2014).

While unions provide a useful framework for building worker power, their numbers have dwindled over the past half-century. Society has failed to act in the best interests of workers or

adequately respond to suppression, demonstrating that workers need alternative modes of building power (Hurd 2013 and Hansmann 1993). A combination of strengthening workers' rights to organize collectively and own the companies they work for is the best way to re-envision the STEM workforce for the 21st century.

II. Understanding labor power in America and the STEM workforce

Literature across the social sciences broadly supports that the power of workers in American society relative to their employers has declined drastically since its peak in the mid-20th century (Schrank 2019). Researchers attribute the decline in American worker power to weakened unions and collective bargaining protections, industrial fragmentation, and outsourcing of jobs to jurisdictions without protections for worker organization (Dorn, Schmieder, and Spletzer 2018). Corporate leadership have actively participated in this process and seen profits and valuations rise while wages decline relative to productivity.

Union membership in the United States has declined from more than a third of the private sector workforce in the 1950s to just over 6% in 2021 (Schrank 2019). As unions have weakened, workers have lost both bargaining power and influence over policymakers. Workers can do little to improve their terms of employment while political and economic power concentrate in the hands of a wealthy elite, who use their wealth to expand power through appropriating economic rents from workers and consumers in an oppressive cycle. Studies broadly attribute wage differentials between industries and across firm sizes to rents. Rents create advantages in pricing means and products due to technical advantage, political power, or collusion, and manifest as increased corporate profits or wage premiums for employees (Gibbons and Katz 1992). Economists have argued that declining labor power has resulted in a transfer of rent premiums from workers to their managers and company shareholders (Stansbury and Summers 2020). The inverse relationship between income equality and union density over the past 100 years implies a strong relationship between union membership and social inequality (Farber et al. 2021; Stansbury and Summers 2020).

Social scientists have sparsely studied labor power in the STEM workforce or hot-button issues like labor organizing among university students and faculty. Scholars and practitioners rarely agree on which jobs are considered “STEM” and which aren’t. A 2021 report by the National Science Foundation estimated that including workers without bachelor’s degrees in the total STEM workforce amounts to 36 million workers, nearly a quarter of the American Workforce (Okrent and Burke 2022). Overall, the NSF report and its recommendations reflect the state of STEM workforce policy discussions: while it emphasizes expanding participation of historically underrepresented groups, it leaves little space to discuss power relations between workers and employers, between professions and fields, or the public and the governing elite.

III. Barriers to empowering STEM workers

STEM workers face significant challenges to organization efforts. Classifying workers as non-employees endows academic employers with unilateral control of working conditions. Multiple states have legislation designed to undercut organizing rights, including “right-to-work” laws barring requirements that non-union members pay union dues, despite all employees benefiting from collective bargaining contracts (Feigenbaum 2018). In the 2018 case *Janus vs. AFSCME*, the Supreme Court ruled against the American Federation of State, County, and Municipal Employees, arguing that required agency fees are unconstitutional. These policies deprived unions of resources while maintaining their responsibility to represent non-paying workers (Eisenberg-Guyot & Hagopian 2018).

Organizing efforts have been slow to reach the STEM workforce despite patterns of unequal pay, discrimination, harassment, and other poor working conditions (Alegria 2015; Oh 2011). Beyond legal barriers, entrenched cultural attitudes among STEM workers hinder advancements. Anecdotally, STEM workers, often white-collar professionals, may perceive themselves as above the working class and therefore above unions. This perception has the bilateral effect of deterring union organizers who may grow frustrated with “snooty” academics (Shapley 1972). In this way, identity politics

disrupts solidarity between those STEM workers with higher education degrees and those without; in many cases, to support organizing efforts, white-collar workers must choose to join with blue-collar workers. STEM employers often implement hierarchical workforce stratification, incentivizing “higher-skill” positions. These employer practices demotivate well-compensated workers from identifying with their fellow workers.

Achieving worker power in STEM demands financial, time, and personnel resources. While owning capital is financially beneficial, starting or owning a business requires access to considerable initial capital, along with tools and resources to effectively achieve these goals. Financial concerns are arguably the biggest hurdle to worker burnout, and financing workers’ takeover of a company is crucial to the success of these endeavors (Walsh et al. 2018). Conversion of businesses to employee ownership in the U.S. remains low, while workers highly seek home ownership, often seen as “a reflection, and indeed a guarantee, of American democracy” (Harris 1990). Thereby, the national ethos incentivizes Americans to invest in personal capital, while business capital remains in the hands of business owners. STEM workers who seek to collectively bargain with employers often confront large, powerful administrative bodies. Given these systemic obstacles, organizing a collective effort against administrations averse to unionization is a daunting and penalizing endeavor for STEM workers, despite entitlement to collective bargaining rights.

Meanwhile, legal obstacles confront college and university workers at every level of the STEM academic hierarchy. The 1980 Supreme Court decision in *NLRB v. Yeshiva University* set the precedent that faculty members are not employees as defined by the National Labor Relations Act, but rather “managerial or supervisory personnel” and therefore do not possess the right to organize. Furthermore, the National Labor Relations Board (NLRB) has historically narrowed the scope of who qualifies as an employee, making unionization difficult for STEM workers in ambiguous positions, like “independent contractors,” student workers, and tenure-track faculty members at private colleges and universities. Until 2016, students who performed services for financial compensation at a

private college or university in connection with their studies were not considered employees. Still, students must confront powerful forces to achieve unionization and often fight for many years. The Columbia University student union fought for union recognition for seven years until finally being recognized in 2019, followed by years of student strikes until a contract was finalized in 2022. University of California (UC) administrators attempted to prevent a student researchers union for over a decade, leading up to the recent formation of the largest union in over a decade: the Student Researchers Union (Student Researchers United 2020). Upon presenting the UC administrators with a verified majority in 2021, they formally notified the Public Employment Relations Board of their denial. The union achieved recognition only after a majority of student researchers signed strike authorization cards; however, to date, the students and university have yet to finalize a contract. Unionization presents a way forward for historically underpaid academic STEM workers: a systematic analysis found that graduate student unionization leads to higher remunerations and benefits for graduate students including higher stipends and lowered student fees (Schenk 2007).

IV. A policy agenda for building labor power in the STEM workforce

i. Approach 1: Reinforce institutions of labor power by strengthening workers' rights to organize

Pass legislation to protect the collective bargaining rights of STEM workers.

Retention of STEM workers is crucial to STEM innovation. Historically, robust retention of workers has been achieved through preserving workers' right to organize. Passing the Protecting the Right to Organize (PRO) Act (H.R.842) would protect and expand all workers' rights to organize by forbidding employer interference and influence in unionization efforts and penalizing companies and executives that violate workers' rights. This policy would require employers to negotiate with unions quickly and in good faith, establishing a mediation and arbitration process with a concrete timeline for reaching a contract. Such protections enable all workers, including STEM workers, to organize for better wages and benefits. Raises for

low- and middle-income workers, along with improved protections from harassment and discrimination, would help address historical inequities in STEM industries. The act would provide workers with resources to navigate workplace procedures and facilitate rights disputes. Finally, unionization leads to better protection for immigrant workers, whose labor is vital to both industry and academic STEM fields (Schmitt 2010). We expect this policy to create economic growth and innovation as well as improve quality of life, workplace health, and safety.

Expand the scope of protected workers at academic institutions.

The President should issue an executive order or Congress should pass a bill prohibiting the NLRB from enforcing any rule that excludes non-administrative workers including teaching assistants, graduate student researchers, post-doctoral workers, and faculty from the definition of "employee" under federal labor laws. Under this policy, STEM workers at public and private institutions are granted every right and responsibility conferred to them under the definition of "employee," including the right to collective bargaining. As a result, research workers are protected from classification as "manager" or other statuses exempting them from worker rights. Prohibiting these classifications empowers workers to negotiate with administrators as equals to democratically approve a binding, enforceable contract.

Challenges to Approach 1

An approach aimed at strengthening collective bargaining rights for workers poses a political challenge. Unions have largely failed to deliver on the promise of a share in power and profits they and liberal capitalists promised in the 20th century (Hurd 2013 and Hansmann 1993). A combination of factors—decades of unqualified neoliberalism, changing economic circumstances, and an aggressive, well-funded campaign by corporations to dismantle the power of labor unions—has produced a precipitous decline in union density from 35% of the workforce in 1953 to just under 10.8% today (Domhoff 2019). Labor power threatens economic elites who own the lion's share by threatening to withhold work for a greater share

of power and profit. Owners and investors would certainly mount a concerted campaign to maintain the status quo, aided in their effort by a systematically biased political system. Furthermore, decades of suppression and neglect have strengthened systemic barriers to building labor power in the U.S., meaning these policies may be able to increase union density, but likely will fall short of the strength of historic labor power. Finally, collective bargaining is not a panacea for workers' liberation and economic democratization.

*ii. Approach 2: Support employee ownership
Expand availability of financial resources for worker-ownership*

Workers and business owners that might seek to convert a company or start an employee-owned business frequently suffer from a lack of access to the financial tools and resources to move forward. To increase formation of and conversions to worker-ownership models, we propose expanding capital and the diversity of financial tools available to would-be and existing worker-owners. One policy that could have the largest impact in expanding financial access for worker-ownership would be the establishment of an Employee Ownership Bank by the U.S. Congress. This bank would resemble the structure and mission of the pilot within the Employee Ownership Bank Act, part of the Build Back Better legislative package, and provide financial support for ESOPs or Cooperatives to purchase their companies through direct loans or loan guarantees. Ideally, such a system of financial incentives and tools would incorporate a democratic business governance, where employees control over 50% of the board of directors, ensuring maximum benefit to employees and reducing shareholder rent-seeking.

The provision of a large pool of funds explicitly to support worker-ownership would increase the amount capital employees can raise to buy companies. Policymakers might go further by subsidizing worker ownership conversions with the capital gains taxes raised from the sale, or in the case of company or facility closure, allowing workers to borrow against the future value of social insurance payments. Such policies would bring the U.S. closer to the Italian Marcora framework, a series of laws giving employees resources and rights to buy their company as a

worker cooperative and borrow against accrued unemployment insurance. The Marcora Laws have helped more than triple the share of national employment in Italian cooperative businesses to over 7% between 1980s and 2017 (Holmström 1985; Borgaza et al. 2019). This growth adds to the more than 30% of Italian workers represented by a labor union.

Support employee ownership education

Beyond increasing worker-owners' access to finance and financial tools, information availability on worker ownership practice and policy is vital to impactful policy. Several states already have centers for public education on worker ownership (Chandler 2017). A few universities have added programs for studying employee ownership and training participatory business management (Josephs 2019). Governments, universities, and private foundations should fund existing and new institutions to support public knowledge and skills relevant to employee ownership and cooperative economies. Academic programs centered on worker ownership and economic democracy could serve as laboratories of thought and development for democratic governance of productive organizations. This would support employee-ownership policy knowledge and practice, lowering barriers and broadening the potential pool of convertible companies (Gowen 2019).

Congress should support the public by directing the Department of Labor to establish an Employee Ownership and Participation Initiative within the Employment and Training Administration by enhancing and passing the Worker Ownership, Readiness and Knowledge (WORK) Act (H.R.2387). This program could direct funds to support worker ownership and participation education centers. The Department of Education (DOE) could also support the study and teaching of cooperative business and economics at colleges and universities by creating incubators for technical and legal frameworks to improve social outcomes in cooperatives. Policymakers should use this program as an opportunity to enhance equitable policy impact and access to employee ownership by reserving funding for community and technical colleges, Historically Black Colleges and

Universities (HBCUs), and Minority Serving Institutions (MSIs).

Establish a workers' Right-to-Own framework

Despite improved access to financing and information, barriers to worker ownership will likely remain high. Policymakers should encourage democratizing economic power by passing a cooperative conversion framework to alter tax and regulatory incentive structures in favor of employee ownership. This framework, based on the successful Italian Marcora laws, would guarantee workers' rights to purchase their companies, in the event of sale or closure of the company or a subset of its facilities (Gowen 2019).

A Right-to-Own framework for the U.S. should be informed by knowledge of the U.S. economy and scholarship on international cooperatives. Studies of the Marcora laws in Italy have indicated they were most effective for small and medium firms with ~50 to ~250 employees (Vieta et al. 2017). Congress could incorporate the results of such research into the American framework, with stepped-effect scales for certain regulations, ramping-up for firms with more than ten employees and down for firms with more than 250 employees. Workers would be allowed to purchase their companies as either a cooperative or ESOP. Under this framework, its core would cover firms employing a quarter of the American workforce and its periphery at least another quarter (Bureau of Labor Statistics 2022).

Challenges to Approach 2

Many workers in STEM fields work for public or non-profit institutions. In such organizations, workers share the role of directing resources to scientific and technical work. For example, public or private universities have responsibilities to

students, the public, funders and donors, and therefore require alternative frameworks for democratization. Additionally, STEM work can be capital-intensive, requiring large amounts of investment and support, making worker ownership buyouts prohibitively expensive. Finally, workers at large firms, like government contractors and technology companies would face numerous logistical and governance challenges to and after the worker ownership conversion due to the lack of examples at-scale globally. With such challenges in mind, we must recognize that worker ownership may not be the best solution for empowering workers and recommend a diversity of policy approaches to fostering democratization in the STEM workforce.

V. Conclusion

We believe that the most important way to re-envision the STEM workforce for the 21st century is to empower people. While this paper posits few novel policies, policy recommendations for improving the STEM workforce development and education in the U.S. seldom consider the importance of empowering STEM workers and others directly affected by policies. By centering people within STEM workforce policy and recognizing a workforce as composed of workers, this paper recommends an agenda which moves towards building social power to further democratize labor and governance in science and technology. We recommend two main approaches: strengthening worker power to organize and supporting democratic governance of productive organizations through worker ownership. We believe that these policies, as part of a wider agenda, will empower workers to improve their conditions and collectively shape the future through the coproduction of both political and economic democracy.

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