The Case for Gender-Based Affirmative Action in STEM

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Abstract

The staggering underrepresentation of women in the STEM industry is well-documented. Through an investigation of the effects of specific gender-based affirmative action, this paper combines quantitative and qualitative analyses to argue that gender-based affirmative action must be implemented in the STEM industry in order to address existing discrepancies in gender representation. When designed correctly, gender quotas are found to be effective tools for improving gender diversity, and so are other policies like women-specific mentorship programs. Gender diversity, in turn, is found to have a positive local and regional economic impact and to correlate strongly with good decision-making and problem-solving. In addition, gender-based affirmative action can serve as a major stepping stone on the road to greater social sustainability. Finally, this paper offers a variety of moral justifications for gender-based affirmative action.

Keywords: STEM, gender quotas, affirmative action, women in STEM

The Case for Gender-Based Affirmative Action in STEM

Of the 613 laureates ever awarded a Nobel Prize in science, only 23 have been women (Wetzel, 2021). This statistic, though troubling in its own right, is but a reflection of the steep gender inequality that characterizes the global science, technology, engineering, and math (STEM) industry. According to data gathered by UNESCO (2019), women make up just 29% of all industry researchers globally; in developing regions like East and South Asia, the share of women is particularly low, at 24% and 19% respectively.

Even among developed countries that are often portrayed as being at the forefront of feminist movements, women in the STEM industry remain underrepresented. In the United States, for instance, women comprise just 25% of those working in computer-related positions and just 15% of engineering positions (Fry et al., 2021); these numbers are especially alarming considering that the computer and engineering fields are two of the best-paying and fastest-growing in STEM (U.S. Bureau of Labor Statistics, 2021). Moreover, in healthcare, one of the few sectors where women in the US are overrepresented (Fry et al., 2021), women nonetheless remain a minority in higher-paying jobs, including as practicing physicians (Brooks, 2015) and in executive positions (Russell et al., 2019). This trend is evident in the EU too, where in countries such as Germany and Finland less than a third of scientists and engineers are women (Sykes, 2018), and where the healthcare sector is predominantly female but suffers from job insecurity and a significant gender pay gap (Pillinger, 2010).

In addition, the share of women in the STEM industry is disproportionately small in comparison to the share of female STEM graduates and students. In fact, a recent report by UNESCO (2021) has shown that while women make up roughly 45% to 55% of students at all levels of higher education, they constitute barely a third of active researchers worldwide, and while 20% of all US engineering graduates are women (Silbey, 2016), only 11% of active engineers are female (Fleur, 2014). In Scotland, studies also show that a whopping 73% of female STEM graduates abandon their STEM careers (The Royal Society of Edinburgh, 2012). This specific type of female underrepresentation, sometimes referred to as the leaky STEM pipeline, is prevalent across the STEM industry (Mueller, n.d.). Thus, the evidence is clear: women in the STEM industry are severely underrepresented, and taking steps at the industry level is essential to challenging the problematic yet long-ignored status quo of a male-dominated STEM industry.

To that end, this research paper aims to help combat gender inequality by exploring different gender-based affirmative action policies. Gender-based affirmative action, which includes policies such as gender quotas, is defined as a set of policies intended to include underrepresented gender minorities (AAAED, n.d.). Gender-based affirmative action must be implemented in the STEM industry because it is effective in achieving gender diversity, can boost economic output, and will contribute toward greater social sustainability.

For the purposes of this research paper, the STEM industry will refer to computer, mathematical, engineering, natural and social sciences, architecture, and the healthcare sectors (Martinez & Christnacht, 2021). The following question will serve as the primary research question: Should gender-based affirmative action be implemented in the STEM workplace? It is answered through a comprehensive study of the effects of specific gender-based affirmative action policies. In addition, secondary research

questions include "Which policies are most effective in increasing women's participation in the STEM workforce?" and "What are the benefits of a workplace with gender diversity?" The paper will address these questions by accounting for metrics such as gender diversity of the workplace and the economic productivity of the STEM industry. Qualitative analyses will also be used to determine the contribution of gender-based affirmative action toward achieving social sustainability and to assess the moral and ethical grounds for such policies. Answering these questions is imperative, especially in light of the recent COVID-19 pandemic, which has already exacerbated the conditions for women in STEM (Moes et al., 2021).

The Effectiveness of Gender-Based Affirmative Action Policies

Gender Quotas

Gender-based affirmative action can take several different forms, many of which have proven effective in achieving gender diversity in their respective fields. One such policy is the gender quota, which works to increase the representation of women directly, typically by designating a minimum number of positions for women (Paxton & Hughes, 2015). In past decades, the effectiveness of gender quotas in increasing women's participation has been consistently demonstrated in case studies all around the world (Paxton & Hughes, 2015).

In many representative democracies, gender quotas have been employed to successfully increase the representation of women in politics. In Belgium, for example, implementing gender quotas led to an increase in the percentage of parliament seats held by women, from 16% to over 40% (Long, 2019); this is despite only 33% of seats being mandated by the government's quota (IPU, n.d.), suggesting that gender quotas can facilitate the organic participation of women. Even more remarkable is the impact of gender quotas in Latin America, where they have allowed countries like Ecuador and Bolivia to achieve near-total gender parity in government (Piscopo, 2020).

Education is another sector where gender quotas have been successful in increasing female representation. In one case study, researchers found that implementing gender quotas at college engineering programs in India caused an upsurge in college attendance for women (Bagde et al., 2016). It is therefore reasonable to assume that, as in government and education, gender quotas can significantly improve gender diversity in the STEM workplace.

Furthermore, gender quotas have been shown to increase long-term female representation in the STEM industry, too. In Denmark, for example, "voluntary gender quotas were introduced by political parties in the 1970s, but were removed two decades later as gender-balanced candidate pools became the norm" (Zahidi, 2014, para. 10). Prime examples also include post-Soviet states in Eastern Europe, which tend to excel in most metrics of STEM gender equality compared to their Western counterparts ("Why half the scientists," 2019); this is in large part due to socialist policies that actively and aggressively encouraged the participation of women in the STEM workforce (Ghodsee, 2019). Although said policies are no longer enforced, extensive evidence points to these Soviet initiatives as the root cause behind the continued STEM gender diversity in these post-Soviet states today (Friedman-Sokuler & Senik, 2020, para. 6). As an article in the *Economist* puts it, "the coercion has gone, but the habit of women working in labs has

remained" ("Why half the scientists," 2019, para. 2). Today, the former socialist countries of Bulgaria, Lithuania, and Latvia stand out among EU member-states for having the greatest share of female scientists and engineers, exceeding 50% (Thornton, 2019).

Finally, while opponents of gender quotas criticize 50-50 quotas for their perceived impracticality, they disregard that quotas can be designed specifically to be compatible with the fields they are introduced in. To illustrate, Saadia Zahidi (2014), a managing director at the World Economic Forum and a long-time proponent of gender quotas, has argued that quotas in the STEM industry must first match the available female talent pool, with larger quotas being gradually introduced. Since women in the STEM industry are generally underrepresented in relation to the available pool of female graduates (UNESCO, 2021; Fleur, 2014; The Royal Society of Edinburgh, 2012), quotas that reflect existing talent pools can serve as effective starting points for achieving greater gender parity in STEM.

Beyond Gender Quotas

In the absence of gender quotas, however, there are several initiatives that the STEM industry can still take to increase the representation of women. For one, companies in the STEM industry should design their hiring process to be gender-blind, with exceptions only when absolutely necessary, such as during face-to-face interviews in the final stages of the process. By censoring the gender of applicants, companies can counteract the implicit male preference that studies show is prevalent in the STEM industry (Kong et al., 2020; Asare, 2018).

Moreover, companies should introduce women-specific mentorship programs that simultaneously develop women's relevant skills—allowing them to climb the corporate ladder—and create support systems for women in hostile, male-dominated sectors. Researchers Hund et al. (2018) describe this form of mentorship as a "key component of academic and career success" (p. 9962) as it substantially improves mental health as well as industry retention for women in STEM. Further, mentorship programs have already been implemented with demonstrated success at multinational companies like Sanofi, where an annual, women-targeted leadership program has enabled the promotion of a third of its participants (Fuhrmans, 2020).

In addition, companies and organizations can increase the representation of women simply by spotlighting the achievements of other women in STEM, which can encourage more and more women to view STEM careers as viable and attainable (Kong et al., 2020). A study has found that merely including images of female scientists in STEM textbooks can boost the performance of female students (Good et al., 2010). This issue is especially pressing since women in STEM are severely underrepresented in popular culture. According to an international study conducted by the Geena Davis Institute, women in STEM appear with significantly less frequency in popular films than men do; overall, only 12% of characters with an identifiable STEM job are women (Smith et al., 2015). Therefore, by showcasing the achievements of women, the STEM industry can begin to reverse these deep-rooted biases, thereby mitigating the resulting gender discrepancies.

The Effects of Gender Diversity in the STEM Industry

Economic Impact

Gender diversity can increase economic output and productivity. In fact, in a study published in the *Journal of Economic Behavior & Organization*, researchers found that enforcing gender quotas leads to an increase in human capital (the net economic value of workers) by motivating qualified women to apply to positions they otherwise would not have considered (Stark & Hyll, 2014). In addition, a meta-analysis published by MSCI has shown that firms with more women in senior leadership roles tend to have higher productivity growth (Eastman, 2018). This correlation between female representation and efficiency can be explained by a failure of companies to utilize available female talent:

> Companies failing to employ women – at any level – in numbers proportional to their availability are by definition limitin the size of their talent pool. In contrast, higher numbers of women, especially in senior positions, might indicate a savvier approach to talent – one that just might promote productivity and economic growth along with gender equality. (Eastman, 2018, para. 3)

Moreover, gender diversity in the workforce can also have a far-reaching impact that extends not only to the companies employing women but also to entire national economies. Indeed, Pollitt et al. (2017) estimate that more gender diversity in the EU will generate up to 10.5 million additional jobs by 2050 as well as an increase of up to 10% in GDP per capita. Tatli et al.'s (2013) research led to similar findings, indicating that gender quotas can unlock wasted female potential in developing economies.

Notably, there is also a wealth of evidence to suggest that gender diversity, in and of itself, can have a positive impact on the efficiency of a STEM team. For example, gender-diverse teams tend to have better decision-making and problem-solving skills, which in turn translates into better quality science, technology, engineering, and math as well as greater economic output. This social phenomenon is more deeply explored by authors David Rock and Heidi Grant (2016) in the *Harvard Business Review*, where they write that:

> enriching your employee pool with representatives of different genders, races, and nationalities is key for boosting your company's joint intellectual potential. Creating a more diverse workplace will help to keep your team members' biases in check and make them question their assumptions. At the same time, we need to make sure the organization has inclusive practices so that everyone feels they can be heard. All of this can make your teams smarter and, ultimately, make your organization more successful, whatever your goals. (para. 14)

Although metrics like intellectual potential cannot necessarily be quantified, this expert assessment serves as further evidence of the positive impact a gender-diverse workplace can have.

Gender diversity as such can also drive innovation. In a study of more than 18,000 firms across 15 developing countries, gender diversity was shown to increase innovation; research shows this is the case in developed countries as well (Ritter-Hayashi et al., 2019). Likewise, a team of ten distinguished researchers from several US universities has argued that "gender diversity may also

spark new discoveries by broadening the viewpoints, questions, and areas addressed by researchers" (Nielsen et al., 2017, p. 1741). In other words, achieving gender diversity in the STEM workforce can intrinsically improve the quality of science being produced while also contributing to economic growth.

Social Impact

In addition, gender-based affirmative action is extremely relevant to the common, global goal of sustainability, and social sustainability in particular. In fact, the UN Department of Economic and Social Affairs has listed gender equality as a major goal towards achieving sustainable societies that will, in turn, produce social, economic, and environmental sustainability (UNDESA, n.d.). This is because gender equality is positioned at the intersection of several other sustainable goals (Dugarova, 2018).

For one, promoting gender diversity in the STEM industry will help sustain economic growth (Tatli et al., 2013). Promoting women's inclusion in the workforce will also help redistribute unpaid care work, which has long hindered women and societies at large from achieving their full potential (Dugarova, 2018). Furthermore, there is evidence that including women in boards addressing climate change, whether through science or science-driven policymaking, can lead to more robust environmental protection (Dugarova, 2018).

Increasing gender representation in STEM can directly reduce gender discrimination in the workplace (Segal, 2015). Also, while opponents of gender-based affirmative action cite the possible propagation of negative gender stereotypes, research by Bagde et al. (2016) suggests otherwise. Overall, gender-based affirmative action, if implemented, will enable better-integrated and more sustainable societies.

Is Gender-Based Affirmative Action Unfair?

Many of affirmative action's opponents claim that policies intended to increase the representation of women are inherently unfair (Menand, 2020). However, a deeper analysis of the ethical and moral foundations of gender-based affirmative action reveals that the opposition's claims are generally superficial and built on shaky grounds. Gender-based affirmative action is at least compatible with, if not driven by, several schools of moral philosophy.

From a utilitarian perspective, for instance, where emphasis is placed on the overall utility or happiness produced as a result of an action (Gillon, 1985), the answer is clear: utilitarianism favors gender-based affirmative action for the overall net positive utility it generates (Broxill, 2010). In this case, the positive utility takes the form of the aforementioned economic growth (Stark & Hyll, 2014; Eastman, 2018; Pollitt et al., 2017), better-quality science (Rock & Grant, 2016), and greater social sustainability (UNESDA, n.d.).

Others object to gender-based affirmative action on the grounds of protecting meritocracy, a social system where individuals are selected and elevated into positions of power based on their accomplishments and merit (Merriam-Webster, n.d.); such opponents include entrepreneurs David Sacks and Peter Thiel (1996) who once argued against affirmative action writing that gender

is a "trait, not [an] achievement" (para. 10). However, what David Sacks and Peter Thiel ignore is the harsh reality that the world is not a meritocracy (Mark, 2020). In the STEM industry, where male bias in the selection process is prevalent, where women have faced decades of suppression and exclusion, and where traditional gender roles and societal expectations continue to restrict women, it is hard to argue that equal opportunity truly exists for women in the first place (Chamorro-Premuzic, 2021). On the contrary, introducing gender-based affirmative action will only serve to counteract the barriers that prevent women from accessing equal opportunities in STEM. In the words of the business psychologist Chamorro-Premuzuc, "the bigger problem is not the potential drawbacks of quotas, but the assumptions of quota-skeptics that our current system is mostly gender-, race-, or class-blind – and that it already produces optimal results" (para. 15).

Still others argue against affirmative action, and gender quotas in particular, on libertarian grounds; they claim that gender quotas are intrinsically unethical, as they bar men from opportunities they supposedly deserve (Meshelski, 2016). Yet, many proponents of gender-based affirmative action are themselves libertarians who believe gender quotas are perfectly compatible with libertarian notions of individual freedom (Sandel, 2009). There are several reasons for this.

For one, many appeal to liberal Rawlsian ethics, which dictate that merit alone does not necessarily entitle an individual to a reward, at least no more or less than do other traits like gender (Wenar, 2021). To illustrate this view in the context of university admissions, political philosopher Michael Sandel (2009) writes:

> What right . . . has Hopwood [a student rejected due to affirmative action policies] been denied? Perhaps she believes that people have a right not to be judged according to factors, such as race, that are beyond their control. But most traditional criteria for university admission involve factors beyond one's control. It's not my fault that I come from Massachusetts rather than Idaho, or that I'm a lousy football player, or that I can't carry a tune. Nor is it my fault if I lack the aptitude to do well on the SAT. ("Do Racial Preferences Violate Rights," para. 3)

In the context of the STEM industry, this means that, at least according to Rawls, merit alone gives you no inherent right to any specific STEM position.

Therefore, Rawlsian liberals argue that the hiring criteria should instead be determined by the purpose of the hiring process (Sandel, 2009), which in STEM is generally to produce the best quality of science, to find the most effective engineering solutions, or to build the most efficient technology. As such, if as previously established there is an objective need for diverse teams to produce the best quality of work (Rock & Grant, 2016; Ritter-Hayashi et al., 2019; Nielsen et al., 2017), it is not inherently unfair to set gender quotas to hire the best and most diverse scientists and engineers.

Meshelski (2016) makes a similar argument: affirmative action is compatible with liberalism because it leads to desirable outcomes, such as productivity and integration, without corrupting the procedure in question, like the STEM hiring process, for a purely merit-based system is, according to Rawls, no more or less just than one that accounts for gender in reaching the desired outcome. In other words, even in a true meritocracy, merit alone does not necessarily entitle individuals to employment opportunities.

A common objection to this line of reasoning is that it could potentially be misused to justify gender segregation, as long as the purpose of the hiring process aligns with such goals driven by bigotry. However, this objection is flawed for the simple reason

that Rawlsian ethics does not condone bigoted segregation, which is unethical for different reasons. Grounded in individual freedom, Rawlsian ethics only arise in this context in response to objective needs (Meshelski, 2016). One of the most prominent 20th-century philosophers of law and a proponent of affirmative action, Ronald Dworkin (1977 as cited in Sandel, 2009) made the same point many years ago, commenting that racial segregation was driven by "the despicable idea that one race may be inherently more worthy than another" (para. 7); this is in contrast to gender-based affirmative action, which is driven by no such prejudice.

Conclusion

Gender-based affirmative action should be implemented in the STEM industry in order to achieve gender diversity. Policies like gender quotas, coupled with women-specific programs and incentives, are effective at increasing the representation of women in the STEM workplace. By extension, implementing the aforementioned policies can boost the economic output of the STEM industry while building more socially sustainable societies. Finally, gender-based affirmative action is justifiable on utilitarian, libertarian and communitarian grounds.

With all of this in mind, it should be apparent that gender-based affirmative action is the way forward. After decades on the margin, it is time women gained an equal foothold in the STEM industry. By supporting gender-based affirmative action, you support not only women in STEM but also advancing the well-being of society as a whole and the long-term sustainability of humanity at large.

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