WOMEN IN STEM: A GLOBAL BUSINESS IMPERATIVE AND OPPORTUNITY

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Abstract

There is an increasing workforce need for women professionals in science, technology, engineering and mathematics (STEM) disciplines. Evidence of bias, however, remains a key factor negatively impacting the recruitment, retention, and advancement of women in STEM professions in spite of a clear business case and business imperative for gender equality in STEM. This translates into a need to promote gender equality and to create a community, or ecosystem, in support of women, especially in STEM, at all stages of their professional lives and careers. The need to continue to develop a sustainable and supportive professional climate within and across nations that promotes the recruitment, retention, and advancement of professional women in STEM disciplines is real and persists.

Keywords: women; STEM; gender equality

Resumen

Existe una creciente necesidad de mano de obra de mujeres profesionales en las disciplinas de ciencia, tecnología, ingeniería y matemáticas (STEM). Sin embargo, la evidencia de sesgo sigue siendo un factor clave que afecta negativamente el reclutamiento, la retención y el avance de las mujeres en las profesiones STEM a pesar de un caso comercial claro y un imperativo comercial para la igualdad de género en STEM. Esto se traduce en la necesidad de promover la igualdad de género y crear una comunidad o ecosistema en apoyo de las mujeres, especialmente en STEM, en todas las etapas de sus vidas y carreras profesionales. La necesidad de continuar desarrollando un clima profesional sostenible y de apoyo dentro y entre las naciones que promueva el reclutamiento, la retención y el avance de mujeres profesionales en las disciplinas STEM es real y persiste.

***Palabras clave**: mujeres; STEM; igualdad de género*

The Business Case and Business Imperative

Globally, and locally, the fourth industrial revolution and impact of automation are resulting in high demand for workers with STEM skills across economic sectors and industries. This reality continues to emerge within the context of a global workforce that does not align with actual need. Over half of the potential workforce, i.e., women, continues to be underrepresented in STEM occupations, especially in computer science and engineering.

Meyers (2021) quotes statistics showing that in the United States alone, 10.7 million STEM jobs will be open by 2029; an increase of 8% over the predicted 3.7 % increase in other occupations. Women make up about 50% of the potential US and global workforce. In the US, women earn 40% of STEM degrees awarded (up from 29% in 1995), but only make up 29% of the STEM workforce today (up from 22% in 1995). These statistics become even more acute for minority women. Some data show that over 70%+ of jobs across the workforce already require some level of STEM skills. McKinsey Global (2019) further predicts that the impact of automation on jobs across the globe may result, by 2030, in 40-160 million women needing to transition across occupations and skill sets to remain employed.

So, an anticipated high demand and short supply of qualified workforce in STEM fields already exist largely due to the fact that almost 50% of the workforce is not well represented in the STEM disciplines needed to grow the economy and competitive advantage. The situation is further exacerbated by the reality that, prior to the pandemic, over 50% of women leave their STEM jobs in the first 10-12 years of their careers (Hewlitt et al, 2008). The further impact of the pandemic on women in the workforce, and how they are experiencing work, has resulted in an estimated 1 in 4 women considering an exit from the workforce to include women in STEM professions (Lean In, 2020; McKinsey, 2020). So, beyond recruiting challenges, women in STEM face very real retention issues that will be explored in more depth later in this paper.

That said, women, in mature economies, are largely graduating at rates on par with men. As far back as 2008, more girls were studying in STEM disciplines. The Harvard Business Review (Hewlitt et al, 2008) stated that 41% of qualified scientists, engineers, and technologists in entry-level jobs on corporate career ladders were, in fact, women. Over time, however, 52% of these women quit their jobs or leave to pursue another occupation and career. In 2020, twelve years later, not much progress was made with 33% of entry level jobs in the engineering and industrial manufacturing sectors being filled by women while only 16% of women occupy senior leadership positions in the same sector (Lean In,2020). This indicates some (not much) parity at early career stages in engineering with significant disparity in evidence across a woman's career in engineering. Again, indicating retention issues.

So, compounding the issue of a workforce shortage in STEM, given the limited participation of women in STEM fields, is the loss of women in these fields within their first 10-12 years in STEM careers, and the impact of the pandemic on women in the workforce overall. This loss comes at a

tremendous replacement cost and a further shrinking of a population of qualified STEM professionals who have already invested in their education and competence. The Kapor Center for Social Impact estimates that turnover in technology fields costs employers at least $16 billion each year. Further, the loss of over 50% of intellectual capital in these fields cannot help but also have further negative implications in terms of competitiveness and potential innovation lost. Particularly since research shows that diversity and inclusiveness support economic and competitive advantage through better decision making, more innovation, and higher earnings.

In fact, diversity, equity, and inclusion, particularly as it relates to women in STEM professions, and beyond a moral and social justice imperative, is now considered a business imperative based on the research. Organizations that pay attention to diversity and inclusion outperform their counterparts who do not from financial, innovation and productivity perspectives (Meyers, 2021; McKinsey, 2020). McKinsey (2020) studied 1,000 large companies across 15 countries to determine to what level the companies were adopting business-led approaches to diversity and inclusion. They found that companies in the top quartile for gender diversity on their executive teams were 25% more likely to have above average profitability. Companies with women representing over 30% of executives outperformed their counterparts by between 10% – 30%. Finally, companies demonstrating high levels of ethnic and culture diversity outperformed others by 36% in profitability. These outcomes make a strong case for organizations to ensure the representation of diverse talent across the organization to include senior and executive positions, and the case for a focus on systematic and business-led approaches to diversity and inclusion from multiple perspectives including gender.

Again, despite the business case and business imperative outlined above, progress toward gender parity and equality has been marginal as tracked by McKinsey (2020) from 2015-2019. This progress, at least in the short-term, has been set back further by the impact of the pandemic on women in the workforce. So, while a majority of companies (in North America) recognize that decreasing the gender gap will increase performance and productivity, big gaps in terms of pay, opportunity, and advancement for women within those organizations solidly remain in place.

There is strong evidence of the need for women to fully participate in the STEM workforce and to be represented at all levels of an organization. Such demonstrated need and tremendous opportunity begs the question as to why women are not recruited in greater numbers into STEM professions, and why women are leaving STEM careers and fields in such high numbers. The answer to this question is incredibly complex and often depends on a woman's individual situation and context; context that includes consideration of cultural norms, social and economic realities, and political environments. That said, bias, implicit or overt, continues to be a key factor in evidence in male-dominated STEM studies and professions which, in turn, negatively impacts the recruitment, retention, and advancement of women in STEM.

The Barriers to Entry and Why Women Leave

Recruitment

At local levels, much is being done to interest girls and young women in STEM through, for example, STEM exploration camps, dual enrollment opportunities with colleges and universities, and community-based organizations such as the Girl Scouts, Tech Girlz, Tech Sistas, and Girls Who Code, among others. Organizations and initiatives, such as Women Who Code, have also been created to focus on supporting women transitioning into science and technology fields. These efforts are in support of more women studying in, and being recruited into, STEM occupations and are making some good headway. Yet, women, even prior to being recruited for a position in STEM, remain underrepresented (and often isolated) as students engaged in STEM studies and as key faculty in STEM disciplines. This ongoing lack of overall gender parity in STEM students and their faculty role models and mentors is a barrier to persistence in earning a credential in a STEM discipline. So, there remains a real "leakage" of women interested in pursuing STEM careers starting in high school, until the time they enter post-secondary studies, through graduation and into a STEM profession. Those that persist often face bias in recruiting processes and procedures that further hamper their resolve to build a career in STEM (Scott et al, 2018). To begin to counteract bias in recruiting practices, organizations, especially in male-dominated industries such as technology and engineering, need to better prepare for an inclusive recruiting process by critically answering several key questions. For example, is the search process inclusive? Who is represented as part of the search process, and have they reflected on their own bias? Have organizational structures, policies, and practices been designed for equality? Unfortunately, preparation for diverse and inclusive recruitment often does not consider these questions and, therefore, reverts to bias inherent in the recruitment process and practices. For example, in various experiments when identical resumes are nuanced to reflect gender differences, e.g., the font used, a bias is repeatedly demonstrated toward choosing the more "masculine" resume and candidate.

Retention – Why Women Leave

Experts and reports (Binns, 2021; McKinsey, 2019) point to pay inequality as a primary driver out of STEM professions for women. For example, women still earn about 82% of what men earn for the same or comparable job. This divide is narrowed, but not eliminated, for women working in STEM who realize 33% higher wages than their female counterparts in non-STEM occupations. As indicated earlier, women remain underrepresented in the highest paying occupation categories such as executives and managers.

A second factor often cited is work life balance, particularly difficult life choices such as the trade-off between starting a family over career advancement. Rosser & Taylor (2009) point specifically to work-life balance (especially in terms of family formation and dual career couples), a lack of networking and mentoring opportunities, and policies and practices that either overtly or inadvertently support gender disparity in hiring and advancement as the key reasons for the "leakage" out of the academic faculty and workforce pipelines on the part of women and as key barriers to advancement.

While work life balance is cited by both men and women in the workforce as a reason to either change careers or not to pursue more senior and leadership positions, these are not the sole reasons cited for the high attrition rate for women in STEM. The research shows that there are additional and highly compelling factors that must be considered as well (Rosser & Taylor, 2009; Lean In, 2020; McKinsey, 2020). These factors include a(n):

- Non-supportive organizational climate and supervisors
- Lack of flexibility;
- General incivility;
- Hostile work environment;
- Dispiriting sense of isolation;
- Research and accomplishments are often questioned and less valued;
- Strong disconnect between women's preferred work style to the styles recognized and rewarded in male-dominated STEM fields;
- High internal competition;
- Lack of leadership role models;
- Lack of clear pathways for advancement;
- Lack of mentors and professional support networks.

Also, working conditions and traditional expectations within STEM industries are cited as why women (and men) leave STEM professions. These include norms such as long hours, heavy travel, low pay and, again, unclear (or no) pathways for advancement.

Coincidentally, the research on why highly educated, academic women in STEM leave the Academy (universities and colleges) points to very similar, well understood factors. For example, McKinsey & Company's (2016) *Women in the Workplace* reports that "women get less access to the people, input, and opportunities that accelerate careers." Of the 132 companies surveyed for this report, two broad themes emerged: women are promoted and hired at lower rates than men (only one in five senior executives is a woman) and women are less inclined to pursue senior positions (90% of new CEOs were promoted or hired from line roles, and 100% were men) often because organizational climate and working conditions conflict with some measure of work life balance.

Retention of women in the workforce, to include STEM careers, has been further complicated by the pandemic. Over 2 million women in the U.S. alone are considering scaling back or leaving the workforce in the face of unsustainable pressure and anxiety. Women have shouldered most of the responsibility for housework and caregiving while facing little change in work expectations (McKinsey, 2021). For example, less than one-third of companies tracked as a part of the 2020 *Women in the Workplace* report (Lean In, 2020; McKinsey, 2020) have changed their performance evaluation criteria since the onset of the pandemic. This has resulted in women facing a heightened lack of flexibility in work; a sense of always being "on" at work; a "double shift" of never-ending work, housework, and caregiving; discomfort in sharing individual challenges (like financial insecurities and mental health) and tragedies with work – adding up to burn out and exit. This is proving true for women at all levels to include women exiting from the hard-won senior positions in many organizations.

Advancement

In 2020, the *Women in the Workplace* report (Lean In, 2020; McKinsey, 2020) speaks to painstaking progress toward gender diversity when tracked with 600 companies and 250,000 people over a 4-year period (2015-2019). In that timeframe, for example, women holding senior vice president level positions rose from 23% in 2015 to 28% in 2019; senior executive positions held by women rose from 17% to 21% in the same time frame. The pandemic appears to be unwinding even that marginal progress. Even for early career women, addressing their first opportunity to step into management, they are still less likely to be promoted over their male counterparts. This "broken rung" phenomenon is evidenced by women occupying only 38% of early career manager positions while 62% are occupied by men. These persistent realities in gender inequality are often supported by advancement pathways that are biased toward singles and individuals who are marriage supported. So, bias continues to negatively and severly impact recruitment, retention and advancement of women in STEM professions.

Call to Action

While much work remains to be done to achieve gender parity and equality for women in STEM in both specific countries and across the globe, knowing what issues need to be addressed is a solid first step toward a solution. Again, this is a complex goal with many variables to consider on multiple levels including the specific context for groups of, and individual, women. That said, there is a tremendous and obvious opportunity for universities, companies, countries and communities to help themselves by ensuring that more women enter, persist, advance and thrive in STEM professions. Based on research reviewed over the past decade, events attended, presentations given and hundreds of conversations, here are some common (and sometimes obvious) takeaways that can apply across the board in support of advancing gender equality in STEM professions.

1. Getting young women and girls interested in STEM early on will continue to be key in developing the pipeline into these occupations. Encouraging colleges and universities to work with employers and community groups to develop opportunities for young women to engage with STEM disciplines through, for example, camps and dual enrollment (taking entry-level college courses while still in high school for college credit) is one strategy. A second strategy is to partner college professors in STEM disciplines with teachers in K-12 to provide professional development in those STEM disciplines. These partnerships create opportunities to raise awareness and skills levels for teachers and seed ideas for programs and activities early on that engage and support girls' interest in STEM.

2. Once girls are interested and engaged in pursuing studies in a STEM discipline, it is critical that colleges and universities, as well as workforce development organizations, develop access to clear and supportive post-secondary pathways and experiences for young women to study and persist in STEM disciplines. This may require a critical and objective examination of organizational structure, policies and practices to ensure that they are designed for equality. For example, ensuring that the recruiting processes and practices for faculty in STEM disciplines is inclusive and not gender biased toward male faculty is needed.

This is important because students are motivated by, and often learn best from, faculty with whom they can identify. So, developing more women faculty role models in STEM, therefore, can positively impact both recruitment and persistence in those disciplines. Further, awareness building of implicit bias in, for example, classroom management is needed to ensure equitable treatment of students during their higher education and/or workforce development experience. Finally, providing appropriate support services is important. For example, it is often assumed that faculty members somehow inherently know how to be good mentors and advisors which is often not true. So, coaching faculty on how to be good mentors for all students, including women, should be considered.

An aspect of post-secondary education that is often not adequately addressed is school to work transition. Colleges and universities, beyond verifying a student's skills and capabilities with a credential, need to prepare students for the transition to work by providing robust opportunities for students to develop life skills, business acumen, goal setting skills, and job search and career navigation tools. This can be accomplished through integration of experiential learning, civic engagement, and career services in the curriculum and experience.

3. Once successfully transitioned into a STEM occupation, women need organizations to authentically address bias in hiring, pay inequality and bias in advancement in order to design inclusive and equitable practices that do not put women at a disadvantage. This means making work sustainable by resetting norms around flexibility and taking steps to minimize gender bias. For example, are performance standards impossible for women with primary caregiving responsibilities to maintain? In many organizations, women are held to higher performance standards, are judged more harshly for mistakes, and incur penalties for taking advantage of flexible work options. Policies and practices need to better support all employees. With remote work being more broadly accepted as a norm resulting from the pandemic, 70% of companies believe remote work will support diversity in hiring and help build a more flexible and empathetic workplace (Lean In, 2020; McKinsey, 2020).

   Beyond practices and norms, organizations need to address and resolve some of the other key reasons that women leave STEM professions relatively early in their careers. Is the culture and climate within the organization inclusive or does it clearly favor a particular group of leaders and workers who (consciously or not) are interested in maintaining the status quo? This favoritism often results in isolationism, hostile work environment, micro-aggressions, bias, and harassment that send the clear message of who is a part of the team and rewarded as a team member and who is not. Critically addressing these cultural norms and practices is necessary if there is interest in having a more diverse, inclusive and equitable organizational culture.
   Women professionals in STEM occupations need real-world strategies and relationships that will support and guide them to persist, thrive, and advance in their chosen careers. McKinsey (2019) make the case that "women don't have access to the same extent as men to networks that help them to develop their skills, achieve career progression, and transition into new jobs." Some organizations (to include colleges and universities) are taking major initiative to create more opportunities for women, but more needs to be done. Efforts within

organizations are being expanded through communities like the STEM-UP Network (www.stemupnetwork.org) which focuses on working with women across different organizations to set career goals, to find mentors and allies, to develop leadership perspectives and skills, to be able to negotiate for what they want and deserve, to navigate male-dominated situations and cultures, and to be a part of a supportive and multi-disciplinary, professional community.

There is a clear business case for increasing the number of women professionals in STEM occupations and a clear business imperative for taking action to make organizations (including universities and colleges) more diverse, equitable, and inclusive. Yet, factors persist that drive women to rethink their interest in STEM studies, and to leave their STEM professions relatively early in their careers. To counteract those drivers, multi-faceted groups must work together to get girls interested in STEM early on; provide access and support to women studying in STEM and transitioning into the workforce; and provide a continuum of support and a non-biased path forward so women can persist, thrive and advance in their chosen STEM professions. In short, to create an inclusive ecosystem that supports women in STEM across their educational and professional experience.

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