CRDFGLOBAL

BREAKING BARRIERS

Best Practices for the Advancement and Inclusion of Women in STEMM and National Security

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Executive Summary

Increasing girls' and women's participation in Science, Technology, Engineering, Mathematics and Medicine (STEMM) is growing ever more critical to national security and maintaining a country's economic primary and competitiveness. In an interconnected world, robust national security depends on the openness and strength of the scientific and technology community. The scarcity of girls and women pursuing science and technology (S&T) careers represents an opportunity to tackle gender disparity and enhance the STEMM workforce. Most women working in leadership positions agree that reinvigorating S&T and maintaining healthy, inclusive pipelines should be critical priorities in our national security strategy. Available data demonstrate that female experts in science and national security domains are negligible. Women are frequently overlooked for participation in forums where thoughts and ideas are exchanged and deliberated. However, simply writing in gender equity as a political priority is far from enough. Organizational policies need to be expanded and implemented to revitalize a focus on inclusion and increase participation.

This report identifies six major barriers and their potential consequences which lead women to either not pursue or to eventually leave their STEMM and security careers:

1

A lack of career knowledge and mentors

Make it difficult to find and connect important dots leading to relevant classes, careers, and interests

2

Imposter Syndrome

Women feel inadequate or below par compared to their actual abilities, leading to resignation or a lower rate of vying for positions for which they are qualified

3

Inflexibility of career parameters

Disproportionately affect women, who may quit, retire, or feel ostracized due to biological and societal pressures

4

Absence of visibility or recognition of women's contributions

Can prevent career advancement or discourage continuation of that career path

5

Women treated as tokens to fill quotas despite their achievements

Send the message to women and minorities that they are inadequate

6

Lack of visible career pathways

Leaves women feeling trapped into positions or career paths that may not be best suited to their long-term professional goals

Each barrier is investigated using insights from peer-reviewed literature, interviews, in-depth case studies, and the "Breaking Barriers" discussion roundtable hosted by CRDF Global in March 2019 which brought together women experts in scientific and security fields to reflect on systematic challenges they face. Drawing on those sources, the authors present the following as implementable and necessary best practices to incorporate into company and organizational policy and a movement for change:

- Provide personal mentorship opportunities between women in the same industry or organization
- Encourage STEMM or security employees to become involved in the classroom, to provide mentorship outside of the industry, to prevent a reduction in the STEMM pipeline
- Public and private sector recognition of organizations implementing initiatives to dismantle the above barriers
- Use of external auditors to do comparative analyses of salaries for employees in the same positions, providing transparency and equal opportunities for women to negotiate raises
- Conduct self-assessments for enterprise-wide disparities in resources for women or unconscious bias in the hiring process and implement systemic plans to rectify them
- Encourage more participation from men in gender equality and equity initiatives
- Offer "pick your benefits," or "cafeteria plans", so individuals can find an incentive structure and flexibility in their benefits package that works for their specific circumstances
- Call upon national governments to include STEMM-related priorities in their National Action Plans
- Adapt benefits and workplace options to technological advancements to allow for increased employer competitiveness, employee productivity, workplace satisfaction, and reduced gender inequality parameters
- Develop manuals of former and existing women leaders in their history and elaborate on the instrumental role that women played in their growth and success
- Publish data sets on women leaders, employees, and grantees annually for a focused spotlight on women's active role in that organization's success
- Conduct blind hiring and blind grants awarding and have external auditors to check the process regularly
- Discourage skewed gender ratios of research teams
- Increase women-centric research grants and funding opportunities geared towards empowering scientists who identify as women and gender minorities
- Incorporate several women panelists in panels that address topics such as promotions, networking, career paths, career switching, etc.
- Work together with other organizations to create mentorship programs or networks across entire cities and regions

While not exhaustive, the above list of best practices and guidelines serves as a snapshot of fundamental good practices and proven methods to maintain a healthy pipeline of women experts and simultaneously improve STEMM or national security organizations' effectiveness. The sections following this summary will provide the data, personal insight from women in the field, and explanations to substantiate these recommendations and illustrate the importance of incentivizing women's continued pursuit of STEMM and national security careers.

Finally, although the report provides the above best practices as starting points, the authors hope that organizations and their leadership will utilize the subsequent chapters to understand how best to implement these best practices, adjust them to their needs, and then design their own initiatives fit for their organizations. Organizations should fine-tune these recommendations in order to maintain quality, sustainability, and thoughtfully contribute to the world of women in STEMM and security.

Foreword from the Authors

When we first began working on this best practices guide, we were not sure where to even begin. We knew that despite a greater number of women entering the national security field, the national security and Science, Technology, Engineering, Mathematics and Medicine (STEMM) sectors remain dominated by men.[1] Women scientists and security experts have continued to fight for inclusion for years, and organized movements and efforts have sought to accelerate change, but disparities nonetheless still exist. Our research of various studies, surveys, and interviews showed us that there are actual risks involved when women are left out of professional panels, organizational decisions, or the general resource networks that men have traditionally dominated and propagated. From there, our direction for the guide was born. Our project involved not only urging society that it remains crucial to take more proactive steps to tackle the roots of the gender gap and underrepresentation, but also providing potential steps.

Most literature that we compiled as data sources have separated STEMM from national security. However, it is clear to us that the intersection of STEMM and national security is far from trivial. From developing new military technologies used on the battlefield and in space, to researching antidotes to biological and chemical weapons, to coding algorithms for Unmanned Underwater Vehicles (UUVs) and creating the environment for disassembling nuclear warheads –STEMM is national security. Furthermore, the importance of inclusion of women in STEMM and how it impacts national security policymaking is even more under-studied and under-explored. Women's participation in careers in STEMM is crucial overall but especially for its effect on national security. In the 21st century, as we are witnessing unprecedented challenges in navigating the intersection of scientific technologies and policy decisions, it is undeniably vital to explore how best to advance organizational strategies to include women's participation in high-level decision-making and encourage women to continue pursuing STEMM or security careers.

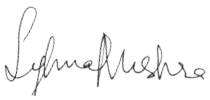
We have structured this guide to break down the obstacles facing women into six specific barriers. Building on the best practices listed in the executive summary, the following chapters take deeper dives into the barriers that constrict women from embarking on this career path to build awareness, highlight specific best practices to tackle each barrier and advance women's progress in STEMM fields, and ultimately seek to strengthen the pipeline of women contributing to national security.

Knowledge is power, and the world will be stronger if we are able to utilize that power for the greater good. We implore the consumers of this report to read carefully through the subsequent sections, and then discuss with your leadership or colleagues about what positive impact your organization can have. Our goal is to start somewhere, because even if we all start small, the entire world will have begun to move in a better direction.

Thank you,

Kimberly Ma

Kathryn Hewitt



Sylvia Mishra

Chapter I
LAWYER, DOCTOR, SCIENTIST: LACK OF CAREER KNOWLEDGE AND MENTORS

MYTH: Boys are better at STEMM.

FACT: A 2018 study of 1.6 million students showed that across the board, including in math and science, girls get better grades than boys do at ALL ages. Overall, girls had significantly higher grades than boys by 6.3%.

DATA AND LITERATURE REVIEW

"What do you want to be when you grow up?"

A 2017 study found the top five professions desired by young children are: doctor, veterinarian, police officer, firefighter, and scientist. For young girls, doctor and veterinarian remain the top two professions of choice, and scientist comes in third.[2] But in 2016, only 6% of women graduated with a degree that could be classified as "STEMM" (science, technology, engineering, mathematics, and medicine).[3] Additionally, for each of those STEMM degrees, women are less likely than men to work in the fields they studied in college.

What happens between the age when girls say they are interested in becoming scientists and the time they can pursue those careers professionally?

MESSAGING STEMM AS "MALE-DOMINATED"

Ironically, the current efforts to recruit women and girls into STEMM fields may be reinforcing the presumption that STEMM professions are reserved for men. Many initiatives and programs which are designed to overcome the masculine STEMM stereotype can send subtle signals to women that lead them to underestimate their success in that field when they overemphasize the skewed gender ratio.[4] Instead of implying the recruitment of women for their gender into a male-dominated field, messaging should emphasize empowerment, drawing parallels between the skills and strengths of individuals as valuable assets to STEMM fields.

CONNECTING THE DOTS OF STEMM AND GENDER-LINKED INTERESTS

Another difficulty lies in young women connecting interests to technical STEMM skills and careers. Several claims have been made about the socialization of gender-linked interest. For example, the authors of "Why So Few? Women in Science, Technology, Engineering, and Mathematics," state:

Another common but somewhat misguided explanation for female underrepresentation in STEM is that while girls and young women may be just as able as young men, they are not as interested in science and engineering. From early adolescence, girls report less interest in math and science careers than boys do (Turner et al. 2008), and among children identified as mathematically precocious, girls were less likely than boys to pursue STEM careers as adults (Lubinski and Benbow 2006). Girls' lower reported interest in STEM may be partially explained by social attitudes and beliefs about whether it is appropriate for girls to pursue these subjects and careers.[5]

While some reports demonstrate young women having less interest in technical subjects, further investigation shows that gender-linked preferences emerge in human development before any socialization begins. Research continues to show that women have a natural tendency to focus on living things while men often focus on inanimate objects.[6] It is therefore not surprising that women who do pursue STEMM careers tend to major in biology, the study of living beings, and enter into healthcare—a field defined by helping people. Extrapolation from this research shows that to help promote and stimulate interest for women in both STEMM and national security, messaging should draw better connections between interest in helping people and STEMM careers.

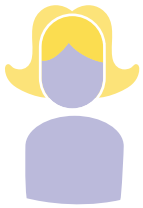
CONNECTING THE DOTS OF STEMM TO CAREERS

Even before women choose their college degrees, however, limited knowledge about STEMM careers or career requirements among middle school students may be preventing women from entering those fields from the start. One study found that 70% of middle school students reported mathematics as an important requirement for a career in mechanical engineering and pharmacy; but 50% or less were aware that it was also important in careers such as ophthalmology and oral hygiene.[7] The same study found that when asked, 56% of middle school girls said they knew how to pursue STEMM careers, a number that peaked to 63% in high school but dropped significantly to only 42% in young women aged 18 to 30.[8] One step further is a lack of understanding of the connection between STEMM and national security. Nearly 40% of the national security workforce is "high-STEMM" and yet, if students do not even know how STEMM skills play into pursuing ophthalmology, it would be a stretch to assume students are drawing parallels between STEMM and national security.[9]

56%
of middle school girls said they knew how to pursue STEMM careers

In high school that number peaked to
63%

But for women aged 18 to 30 that number dropped to
42%



MENTORSHIP AND ROLE MODELS

The discussion of mentorship and its impact on recruiting and retaining the next generation seems to be buzzing everywhere today. But how effective is it? A study by Microsoft found that the role of mentorship or role models has a dramatic impact on how girls and young women perceive STEMM. The study asked the following three questions to three demographics: middle school girls, high school girls, and young women (ages 18–30).

Do you feel powerful doing STEM?

Do you know how to pursue a STEM career?

Do you understand the relevance of STEM?

The affirmative answers to all three questions increased exponentially when the respondents personally knew women with established STEMM careers. Only 41% of females said they felt powerful pursuing STEMM, but that number increased to 59% when girls in the same demographic had a personal connection with a woman in a STEMM field. Understanding the relevance of STEMM and how to pursue a STEMM career also increased from 54% to 74% and 56% to 76%, respectively.[10] This is qualitative evidence that a lack of mentorship can lead to drastically reduced numbers of motivation or capabilities for pursuing STEMM.

Literature further provides evidence that, once in the "real world," mentoring also greatly improves career outcomes for mentees. Several studies have drawn a positive correlation between women's attitudes and improved performance when provided early mentorships.[11,12] With mentors as guides and role models, students are more likely to be proactive and take the first step in pursuing a career if they know how to begin.[13] As a final, powerful numerical data point, mentorship more than doubles the likelihood that someone will stay with an organization for more than five years, from 32% to 68%.[14] Unfortunately, however, the current disproportionate number of women in STEMM makes readily available access to female role models and mentorship difficult.

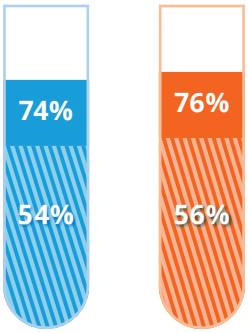
A CASE STUDY FOR SUCCESS: GIRL SECURITY

Girl Security[15] is a nonpartisan, 501c(3) organization that is increasing the representation of women in national security by building a pipeline for girls and young women through learning, training, and mentorship. Girl Security is interested in having more women in national security; however, their primary focus is increasing girls' understanding of the ways that national security affects their lives. The modules, designed by women and vetted by adolescent mental health specialists, focus on core competencies that are foundational to understanding national security and use topical modules on subjects such as national security ethics, counterterrorism, and nuclear security. The organization also endeavors to expose girls to careerwomen in their repository network of female mentors, which includes a multitude of career levels and a variety of fields from STEMM to foreign policy. Girls who have been part of this program have expressed that it is the reason they decided to pursue careers in national security.[16]

THE POWER OF **ROLE MODELS**

ONLY 41% of females felt **POWERFUL** pursuing STEMM

When girls in the same demographic had a personal **CONNECTION** with a women in a STEMM field, **59%** felt **EMPOWERED**



Understanding the relevance of STEMM and how to pursue a STEMM career also increasedfrom **54%** to **74%** and **56%** to **76%**

SUGGESTED BEST PRACTICES

As stated above, increasing girls' interest in STEMM is the first step to balancing the gender ratios. To this end, STEMM and national security fields need to engage girls earlier and more often. Such engagements can range from discussing careers connected to national security; ensuring the subject matter is interactive so girls feel agency and empowerment; providing personal mentorship opportunities and role models to foster personal connections; and finally, changing the narrative to reflect the value of women in STEMM as significant members of an important community and not as gender tokens (Chapter V will expand more on the latter topic).

One way organizations can contribute to dismantling barriers is by encouraging STEMM employees to participate in classrooms in the local community. Organizations should provide staff engagement and continued mentorship with students and teachers in schools, classrooms, or clubs. One option is for organizations to create internal initiatives that train, connect, and fund employees to participate in such engagements. Funders and philanthropists should reward and monitor these types of engagements in grant making decisions. Industries are encouraged to highlight and reward organizations, provide opportunities for leadership and individuals who have strong proven records of personal engagement with students, as incentive to maintain their programming and for other organizations to follow suit.

These interactions should not happen only in metropolitan cities, but a conscious effort should be made to reach students nationally and in rural or suburban areas as well. Should individuals not know where to begin, they should initiate projects with mentorship programs already in place like those below:

girlsecurity

CybHER

girl up

The Girls' Network
Unlimited futures for all young women

STEM MENTORING

MWM
Million Women Mentors
Advancing Women and Girls in STEM Careers Through Mentoring

I'm a Scientist Get me out of here

Raytheon

national center for women & INFORMATION TECHNOLOGY

Chapter II
IMPOSTER SYNDROME

MYTH: "Men are just better at working in the sciences; women are more fit for the humanities or social work."

FACT: Gaps in performance are not differentiable by gender until stereotypes take root in adulthood environments, such as the workplace, as unconscious biases.[17]

DATA AND LITERATURE REVIEW:

Data reporting on the actual numbers of men and women in STEMM has demonstrated that the gender gaps have slowly begun to close.[18] However, the gaps in individuals' self-perception—that is, their belief in their own ability to perform effectively—remain significant enough to fully justify continued efforts to promote workplace gender equity and equality.[19] As large gaps persist in men and women's perceptions of themselves as professionals in the STEMM fields, there remains the risk of the "leaky pipeline," in which women lose interest or choose not to pursue further education, certain careers, job promotions or tenure.[20]

The combined phenomena of diminished self-perception, lowered aspirations, and low self-efficacy lead to lowered career aspirations for women in STEMM and contributes to the commonly dubbed imposter syndrome. Imposter syndrome is described as a feeling of not belonging or lacking credentials to deserve being a part of the community into which one has entered. Although not an officially diagnosable disorder, the American Psychological Association acknowledges that this phenomenon is "a very real and specific form of intellectual self-doubt."[21] In the case of STEMM, women report feeling that they do not fit in due to the continuing stereotype—conscious or unconscious—that males are inherently "better" at STEMM.[22] Oftentimes it subsequently leads to self-sabotaging coping mechanisms such as perfectionism, overcommitting, or even the opposite extreme: procrastination and avoidance. All of the above consequences lead to lowered productivity, which creates a negative feedback loop that confirms the stereotype as fact to the woman in question.[23] This phenomenon perpetuates itself both in academic environments and workplaces, as STEMM and security work continue to be male-dominated fields and women often feel isolated in their surroundings.[24]

These stereotypes are compounded with other factors that make defeating imposter syndrome even more difficult for women in STEMM or security fields. Women often have less access to networking opportunities in male-dominated fields, and due to unequal gender ratios, women have fewer female role models and mentors to help them navigate the professional world.

Harassment continues to be more prevalent in spaces where males significantly outnumber females and reporting and policing remain under-publicized and under- enforced.[25] It is difficult to assign precise correlations due to underreporting, but there is little doubt that harassment is often a contributing factor in women leaving employment in male-dominated environments. [26]

While imposter syndrome can affect anyone, women and other gender minorities habitually suffer its effects more than men, especially in male-dominated spaces.[27]

The effects of imposter syndrome on women goes beyond simply "not belonging." Situations are often exacerbated by inadvertent pressures that stem from workplace environments, and these pressures vary depending on the cultural or societal expectations of the country in which they are employed. In many Western countries such as the United States, male-dominated spaces such as STEMM and national security workplaces incorporate underlying mindsets that unconsciously prefer and reward masculine over feminine ways of doing and being.[28] Unconscious preference for traditionally masculine behavior in scientific and security workplaces imposes major, pernicious obstacles for non-male identifying individuals. Women must walk the fine line of behaving like their male counterparts while remaining alert to the possibility of being branded as "too" assertive, "too" bold, and thus "too" undesirable. Across the world, women are faced with the dilemma of pursuing too aggressively and losing an opportunity or not pursuing aggressively enough and losing the opportunity anyway.[29] Each workplace must make a conscious and ongoing effort to examine the underlying biases and mindsets that permeate their environment.

WORDS FROM WOMEN IN SCIENCE AND SECURITY:

When asked about her experiences as a prominent figure in national security, Ms. Mara Rudman of Quorum Strategies, LLC and Center for American Progress noted that while she is grateful to the many mentors who helped her along in her career, one person was "at the time, and [...] for a long while thereafter, the only woman who helped shape my career path in foreign policy/ national security." Ms. Rudman's story exemplifies the skewed gender ratio in positions that can have a significant impact on the retention rates of women and gender minorities. It is important to note that this imbalance continues to this day and warrants immediate correction.

Stories like this one are an extreme example of some men who blatantly reinforce imposter syndrome by discounting women's contributions and merits that warrant their selection:

> "Early in my career I worked for a company that had a very strong diversity program which worked to help women and minorities get the skills and opportunities necessary to advance their careers. One time after I had been promoted, the other candidate who happened to be male, came up to me and said, "Well of course you got the job, we needed our token female." "

Tina Dolph
of Siemens Government Technologies, Inc.

A CASE STUDY OF SUCCESS:

In October 2010, Texas A&M University embarked on a journey to improve itself as a more supportive workplace for women and other minorities. Their approach was based on the goal of creating a psychologically healthy workplace (PHW); the three categories of their endeavors pointed towards reducing bias and improving the workplace climate, professional development of women STEMM faculty, and recruitment and retention via a PHW.[30]

One notable characteristic of Texas A&M's PHW initiative, Advancing Faculty Diversity, Inclusion and Success (ADVANCE), that made it pioneering was that the implementation process itself was inclusive.[31] The Design and Implementation Committees pulled in individuals from outside the ADVANCE core project members to encourage inclusivity and stimulate employee involvement. This is a model worth emulating, as making initiatives like ADVANCE organization-wide encourages workplaces to model the values they aim to promote.

In a publicly available report, Texas A&M stated that they had seen positive results in multiple aspects: the combating of bias in hiring and evaluation processes; accountability for programming of ADVANCE and that of the diversity offices; trust in the new system by employees that encouraged them to become involved in the processes and empower themselves and those around them; and, sustainability of the ADVANCE center through support and commitment by the university's administration to equity goals.[32]

SUGGESTED BEST PRACTICES:

The authors recommend the following best practices to decrease the widespread presence of "imposter syndrome" amongst women working in STEMM and security.

Organizations should use external auditors to do comparative analyses of salaries for employees in the same positions. This maximizes transparency of compensation such that all who are being promoted or hired into specific positions are on the most level possible "playing field" in negotiating. This prevents unconscious bias from entering the hiring, promotion, or bonus-granting processes. Transparency in job descriptions and salary raise criteria will also encourage women and minorities to be comfortable negotiating for pay equal to their peers in the case of an unwarranted pay gap.

Organizations should conduct their own self-assessments for enterprise-wide disparities in resources for women or unconscious bias in the hiring process and implement systemic plans to rectify them. This measure would ideally be accompanied by the establishment of an internal quality or monitoring and evaluation team to make these assessments happen on a regular and objective basis.

As noted in an interview with Miyoko Watanabe, deputy executive director and director of the Office for Diversity and Inclusion at the Japan Science and Technology Agency, women often feel the need to join committees that strive for gender equality.[33] This creates an unequal burden between men and women and sends the message that (1) gender equality is only for women and (2) women are hired into the organization to be gender equality champions instead of for their technical and professional expertise. In reality, gender equality means equal opportunities for all genders, and everyone benefits from being at the same starting point and on equal footing in their community. Thus, organizations should encourage more participation from men in gender equality and equity initiatives. This would help balance the burden that women and gender minorities carry in these initiatives and simultaneously show them that they are not alone in these endeavors, reducing the feeling of not belonging.

Chapter III
INFLEXIBILITY OF CAREER PARAMETERS

MYTH: Women value salary over flexibility.

FACT: The majority of women surveyed (88%) consider flexibility to be as, if not more, important than salary. For some (42%), flexibility outranks salary all together.

DATA AND LITERATURE REVIEW

In tackling women's professional barriers, there is one reality that needs to be accounted for: women have some responsibilities that men simply do not and cannot take on, such as birthing and breastfeeding children. These responsibilities can place strain on women reentering the work force in any career, but in STEMM and national security, research has shown that women identify the inflexibility of this field for parenting and/or work-life balance as a major barrier in continuing or returning to their career. Even if a mother is ready to return to work, the parameters of the field often restrict or prevent her re-involvement.

FLEXIBILITY TO BALANCE WORK MATTERS

Due to the nature of STEMM and national security work, if working with classified materials, there is rarely the option of teleworking. These same positions may also require frequent long-haul travel, or working long hours with meetings outside of a typical 9 to 5 day. Several studies show that one of the most important characteristics for a desirable career resides in an organization's work-life balance and hour flexibility. According to the Mom Project, 86% of working mothers will leave a job for an opportunity that better supports their work and life considerations,[34] while 75% of working mothers believe employer support of work-life balance is the most critical criteria for feeling respected at work.[35] Given the massive emphasis on having control over balancing work and personal circumstances, it is no wonder that women are discouraged from their jobs; not to mention, women face extra personal and biological constraints, such as childbirth, that men do not.

MARRIAGE AND FAMILY PLANNING

On the note of work-life balance, one comment routinely made is regarding how marriage and family planning affect women in STEMM. One research study found that women in STEMM are just as likely to get married or have families as non-STEMM female professionals, but women in STEMM are much less likely to remain in their field over time as compared to female professionals in other fields.[36] Findings showed that:

> Women in STEM move to non-STEM jobs at very high rates, not because women in STEM fields disproportionately move out of the labor force. Moves out of the labor force are in fact quite rare for both groups, confirming analyses that show growing labor force attachment among professionals in all fields over time, particularly when workplace supports for parenting exist (Herr and Wolfram 2009; Percheski 2008). Moreover, the women who leave STEM occupations are unlikely to return; only a handful of women ever moved back into a STEM job following a job move out of the field.[37]

In other words, society is losing women in STEMM to other areas of the labor force most likely due to constraints with their STEMM jobs that are incompatible with their personal lives, thus preventing them from continuing despite their passion and love for their work.

FAMILY LEAVE AND BREASTFEEDING

Some government contractors have faced criticism regarding their failure to offer paid family leave. Given how many federal contractors there are in national security (an estimated 641,428 at over 50,000 companies working with the Department of Defense alone in 2015)[38] and at national laboratories, employees who are working parents are disproportionately impacted by these policies.

Inflexible work hours, meetings & conferences often only allow for **10 OR 15 MINUTE BREAKS**

The average time required to pump is **20 TO 30 MINUTE BREAKS**

Most U.S. based companies have sparse breastfeeding policies (if they have them at all). Inflexible work hours, meetings and conferences often only allow for short 10 or 15-minute breaks when the average time required to pump is 20 to 30 minutes. These short intervals force women to miss parts of meetings or sessions in order to pump, which can negatively impact their work quality or reputation.

Perhaps most problematic is that equitable structures to accommodate working parents through measures such as maternal or paternal leave, healthcare benefits, or childcare are the exception, not the norm. As Claire Cain Miller of the New York Times phrases it, long hours or strict workplace requirements have traditionally been a "major driver of gender inequality: The increasing wage premiums of long hours have pushed many couples with equal educations to take on unequal roles, because if they're parents, they can't be on call at work unless someone else is on call at home."[39] Thus, in most countries, where women are often regarded by default as the necessary parent within a nuclear family, they are therefore pushed by societal expectations to halt or deprioritize their careers to focus on raising children.[40] Gendered expectations such as these can cause more difficulty in finding a work-family balance for women compared to their male counterparts.[41] None of the research conducted for this report uncovered any incentive structure for working mothers to remain in the field — only a variety of gendered challenges at all stages of a woman's life.[42]

WORDS FROM WOMEN IN SCIENCE AND SECURITY

While more research needs to be done to understand how workplace inflexibility disproportionately affects women in STEMM and national security, women routinely share their experiences with others. Here are some of their stories:

ON CHILDCARE

"Childcare for working mothers (and fathers) is a constant challenge. The DOD started an on-site childcare program after I had left the Office of the Secretary of Defense. The State Department started a nearby childcare program after my children were too old for childcare. And other government agencies now have childcare facilities on-site. This is an excellent development, but spaces are limited and waiting lists are long. I still consider the situation a "glass half full." It is better than it used to be and it's great once you have gained entry to these facilities but you always need a back-up: children get sick and someone needs to stay home. [...] My positions routinely required foreign travel, on occasion for up to a month. I avoided becoming 'committed' to outside activities that would require my presence because I could not guarantee I would be in town."

Ambassador Susan Burk
Former Special Representative to the President of the United States for Nuclear Nonproliferation

ON INFLEXIBLE WORK SCHEDULES

"Years ago, the Diplomatic Service instituted a job share so working moms could share shifts given the demands of positions. The consensus among women was that the job share was personally rewarding (they could still work and be home) and women agreed they felt more productive. The program was repealed without much perceived understanding as to why."

Lauren Buitta
Co-founder of Girl Security

CONTRACTING AND MATERNITY LEAVE:

"My federal contracting company does not have maternity or paternity leave. What's worse, short term disability clauses make it difficult to use but almost impossible if you had an unexpected pregnancy? Pretty regularly, after childbirth, the contracting men take a few weeks off but then are back in the office."

Midcareer Professional
Federal Contractor in the Defense Industry

A CASE STUDY FOR SUCCESS: PWC PHASE-IN BENEFIT

A few companies are thinking outside of the box to help women (and men) return to work after a period of time off for personal or parental leave. BP and Mom Project have a program called "Returnships", while PwC, a networked set of firms operating as partnerships, introduced a groundbreaking return-to-work program that operates in phases. The PwC phase-in benefit permits employees to work 60% of their normal schedule at 100% of their pay for four weeks when returning to work after parental leave.[43] The benefit will be offered to men and women who also have eight weeks paid parental leave.

This program resulted from an employee survey conducted after PwC found itself struggling with high turnover rates, especially among millennials. PwC found that "millennials want more flexibility, the opportunity to shift hours—to start their workdays later, for example, or put in time at night, if necessary. But so do non-millennials, in equal numbers." In other words, although the program was initially targeted towards millennials, the option of increased flexibility would be beneficial and desirable for all employees. PwC recognizes that the idea is not revolutionary and the transition back to work after leave remains difficult, but the company continues to actively look to enhance the work-life experience of its employees.

SUGGESTED BEST PRACTICES

Most organizations offer some sort of incentive structure in the form of vacation time, health care, childcare reimbursement, 401k matching, or bonuses. But what works for an expecting father may look different for a mother of three or a young woman not interested in having children at all. Instead of prescribing specific benefits, the STEMM field should seek innovative options to attract and retain women.

One innovative approach for organizations to consider is offering "pick your benefits," or "cafeteria plans" as the online platform Workest describes, so individuals can find an incentive structure and flexibility in their benefits package that works for their specific circumstances.[44] Thoughtful, new options for benefits packages also benefit everyone else in that organization and can increase the workplace satisfaction or even influence competitors to improve their own incentive structures.

As technology continues to evolve, organizations should do everything within their power to use cost-benefit analysis in its implementation. In the past decade, organizations have debated seemingly everything from use of Bluetooth technology in classified settings to telework policies within the United States government. Adapting benefits and workplace options to technological advancements allows for increased employer competitiveness, employee productivity, workplace satisfaction,and reduced gender inequality parameters like those discussed in this report from breastfeeding, single-parent homes, and so on.[45]

While classified work has strict parameters, if there is opportunity to conduct meetings or work from home, organizations should be adapting to include and encourage these types of policies in an effort to embrace work-life balance and reduce the undue gendered burden that comes with inflexible office hours. As stated in a report by RAND, "national security agencies interested in exploring options for working remotely must balance the need to secure and protect classified and sensitive information with their desire to recruit and retain a millennial workforce;" the Federal Emergency Management Agency (FEMA) has implemented telework to encourage work-life balance and increase agency responsiveness.[46] FEMA established a system of allowing pre-approved employees to access sensitive information as they telework off-site and providing employees with the necessary equipment.[47] Other organizations can follow FEMA's example as this is an upwards trend and increasingly sought-after job search criteria.

Chapter IV
WHERE IS THE DATA?

> "If you want *something said*, ask a man; if you want *something done*, ask a woman."
>
> **Margaret Thatcher**

MYTH: Girls and women are not as good as boys and men in science and technical fields. Women are failing at science.

FACT: Women's contributions in science have been ignored and not promoted. Women have not been given the due credit in science history for their discoveries and contributions.

DATA AND LITERATURE REVIEW

History often ignores women's contributions as collaborators in scientific discoveries, often instead focusing on the big scientific discoveries made by men.[48] Margaret Rossiter's study, 'Women Scientists in America' archived and brought buried and forgotten contributions of women to scientific disciplines to light.[49] Rossiter argues that women's historically subordinate place in science was not a coincidence or because of a lack of merit on their part. Instead, it was due to the "camouflage intentionally placed over their presence in science."[50] One well-known example of this is Rosalind Franklin, who remains in the shadows of science history, despite her crucial contribution to research work and the discovery of the double helix structure of DNA.[51]

While data is available about the contribution of women in science, one of the persisting challenges is the lack of widespread dissemination of these contributions, especially in school textbooks and curriculum. The lack of literature in textbooks on women's contribution in science is creating a missed opportunity to inspire young girls through providing them with female role models.

These "symptoms:" little proper attribution, low visibility of women's accomplishments, or even purposeful obscuring of their contributions, all indicate the rampant implicit biases towards women in STEMM and national security that need to be countered and controlled. Proactive steps must be taken to: (1) promote the works of women in science history, (2) encourage authorship of women in science journals, (3) change the narrative that men are intrinsically better in science through storytelling of successful women in science, and (4) promote women leaders in science as role-models for young girls keen to pursue STEMM.

In science, as with many other disciplines, the question of fair and accurate attribution of scholarly research is a matter of great concern. A recent article in The Atlantic suggests that authorships in science journals is a valuable tool that "can advance reputations and careers."[52]

Unfortunately, more often than not, women are not recognized as authors and instead thanked in the acknowledgment sections.[53] A team of students from Brown University and San Francisco State University engaged in related research, digging through two decades' worth of genetics papers. The researchers discovered there were women who were never given the credit for the research they had conducted, and several female programmers who made important contributions had never been acknowledged at all. The study showcased that women have been consistently thanked in the acknowledgment sections of scientific papers but not given the due recognition as authors.[54]

A study conducted by Luke Holman from the University of Melbourne, published in 2018, examined the gender gap in authorship of more than 10 million scientific papers.[55] Holman and his team looked at the list of authors for all scientific papers that had been published between 2002 and 2016. Holman's study found that 87 out of 115 STEMM disciplines have "significantly fewer than 45% women authors" and estimated that it would take 16 years before the number of attributed female authors of scientific papers equaled that of men.[56] However, there naturally was variability of that time estimate based on each field. An even more astonishing conclusion was their estimate that physics research would take 258 years before reaching within 5% parity.[57]

Simultaneously, a 2-year study of 40 scientific evaluation committees found that those committees held implicit biases and a tendency to unconsciously associate the concept "science" with the concept of "male."[58] The Nature Human Behavior noted that evaluation committees hold implicit biases against women in science and so promote fewer women than men to elite research positions.[59] In tandem, all of these studies together showcase not only the size of the gender-gap that still exists in science, but also the compounding factors that lead to women being undeservingly snubbed and promoted less often compared to their male counterparts.

WORDS FROM WOMEN IN SCIENCE AND SECURITY

The presence of literature properly attributed to pioneering women in science fields is essential to inspire young girls to pursue careers in STEMM. All scientists have an obligation to ensure that their colleagues are given the appropriate representation. This simple step will bolster the amount of attributed women in science, and help ensure that women in the field are first and foremost viewed as scientists, rather than women in science, which perpetuates a focus on their gender above the quality of their work. Donna Strickland, a Canadian professor and Nobel laureate in physics, was surprised by the focus on her gender. She stated, "I know there is certainly a lot of effort right now being placed on equity, diversity and inclusivity. We consider that in our hiring practices, and I've sat on many of the hiring committees. So, I'm certainly aware of the climate. But I don't see myself as a woman in science. I see myself as a scientist. I didn't think that would be the big story. I thought the big story would be the science."[60]

> "It means being able to follow my curiosity and work on what I'm passionate about. And it also means being grateful for all the pioneering women who made it possible for our generation to work in science and who fought for the rights that we have today."
>
> **Dr. Francesca Fragkoudi**
> *Astrophysicist working on galaxies, dynamics & Dark Matter at The Max Planck Institute for Astrophysics, Germany.*

CASE STUDIES FOR SUCCESS

Initiatives that have been successful to promote and amplify the substantive contribution of women and thereby creating a data and record of their successes include:

#IAMREMARKABLE—AN INITIATIVE BY GOOGLE

#IAmRemarkable is an impactful project, promoted and implemented by Google, aimed at empowering underrepresented groups to celebrate their achievements in the workplace and beyond.[63] The idea is to challenge social perceptions around self-promotion and motivate women to embrace the practice. #IAmRemarkable workshops encourage women to write down all the reasons they believe they are remarkable. By practicing self-promotion, women can bolster their self-perception and recognize the full scope of their achievements in the workplace. The workshops provide women training and opportunity to showcase their skillsets and develop the art of advocating for oneself in the workforce, an essential component of career advancement. As of 2019, Google had enrolled 85,000 participants in the #IAMRemarkable initiative and hosted 4,800 workshops in more than 99 countries.[64]

SUGGESTED BEST PRACTICES

It is important to share success stories of women's earlier and existing contributions to science. To bring recognition to the significant role women have and will continue to play in STEMM and national security, and to inspire confidence in upcoming generations of young women to pursue STEMM careers if they desire to, leadership in STEMM and national security should establish the following as best practices in their organizations:

> "I grew up watching both my mother and my father work as top scientists in their respective fields. It wasn't until I was in the university that I really understood how rare that was. Today, I make it a priority to promote gender equality in science and international security, and take every opportunity to encourage underrepresented groups."
>
> **Melissa Hanham**
> *Deputy Director,*
> *Open Nuclear Network*

1. Organizations can develop manuals of former and existing women leaders in their history and elaborate on the instrumental role that women played in their growth and success. This step would counter the historical "wiping" of women from the history of STEMM and national security, and doubly serve as an inspiration for women in the company to vie for positions they may otherwise dismiss as an unviable possibility because of gender discrimination or their own low self-efficacy.

2. Organizations can publish these data sets on women leaders, employees, and grantees annually for a focused spotlight on women's active role in that organization's success. Honoring the legacy of women in a public fashion similarly inspires young girls' interests in STEMM, and it may inspire other organizations in the same field or industry to follow a similar path of acknowledgment of women's contributions to the organization's success.

3. Organizations should also encourage employees to be allies to the women around them. One of the most effective ways of doing so is to amplify a female colleague's point of view when it does not receive the deserved attention. Joan Rohlfing, President and Chief Operating Officer of Nuclear Threat Initiative, referred to this particular method as being practiced often by women professionals at the White House to assist their fellow women colleagues in situations where they were being silenced, ignored, or unacknowledged.[65] This also nicely serves a second purpose of preventing idea appropriation, or taking credit for ideas generated by another individual.

Chapter V
THE "TOKENIZED" WOMAN

MYTH: Women are less frequent speakers because they do not want to travel as much for conferences, due to laziness or personal and familial reasons.[66]

FACT: Studies show that women value conference and panel invitations to speak and present their research as much as men. Compared to their male counterparts, women are asked less frequently to contribute to intellectual discourse or speak at conferences than their male counterparts.[67]

The term "tokenized" is used in this report to imply that there is often an elevated focus on gender quotas relative to the merits of one's qualifications in the evaluation of candidates. The authors' use of "tokenized" does not imply undeserving. Women of color are particularly impacted by tokenization. Not only do they face discrimination due to their gender, they frequently face an additional hurdle of discrimination because of their race. While there is a problem of gender disparity in science conference panels, there are times when there is only a single woman (often a minority or woman of color) in the panel. The inclusion of just one woman in a panel -and then overfocus on how her gender factors into her work- perpetuates the idea that despite strong academic credentials, she is on the panel purely for being a woman. In other words, it gives the impression that she has been brought on for optics, so that the panel does not earn the reputation of being a manel (an all-male panel).

DATA AND LITERATURE REVIEW

In the paper "Tokenism and Women in the Workplace: The Limits of Gender-Neutral Theory" by Lynn Zimmer, the concept of tokenism has been used to explain some of the many challenges that women face when they enter fields which have traditionally been dominated by men. Zimmer explains that hiring more women in organizations highly skewed towards men is a strong first step towards overcoming barriers to women's full occupational equality or tokenism.[68]

To better understand the social, cultural and environmental pressures dealt through tokenization and hyperfocus on women's gender, it is essential to take a closer look at Rosabeth Moss Kanter's 1977 classic theory of proportional representation. Kanter, in "Some Effects of Proportions on Group Life: Skewed Sex Ratios and Responses to Token Women," showcases the results of a field study conducted in a large industrial corporation. The study developed a framework for conceptualizing the processes that occur between dominants and tokens: "three perceptual phenomena are associated with tokens: visibility (tokens capture a disproportionate awareness share), polarization (differences between tokens and dominants are exaggerated), and assimilation (tokens' attributes are distorted to fit preexisting generalizations about their social type)."

Kanter's study was foundational in establishing how feeling tokenized adds additional stress that might likely prevent women's ability to excel in their work. She stated that heightened visibility as the 'only' woman generates performance pressures; gender polarization leads dominants to restrict their group boundaries; and assimilation leads to the tokens' role entrapment.[69] In line with Kanter's work, a more recent study by Isis H. Settles found that female faculty members in STEMM often reported a sense of scholarly isolation and the feeling of being excluded from scholarly interactions with other faculty members.[70] Even with the best of intentions, focusing on a woman scientist's gender instead of her scholarly accomplishments can lead to irreversible psychological harm.

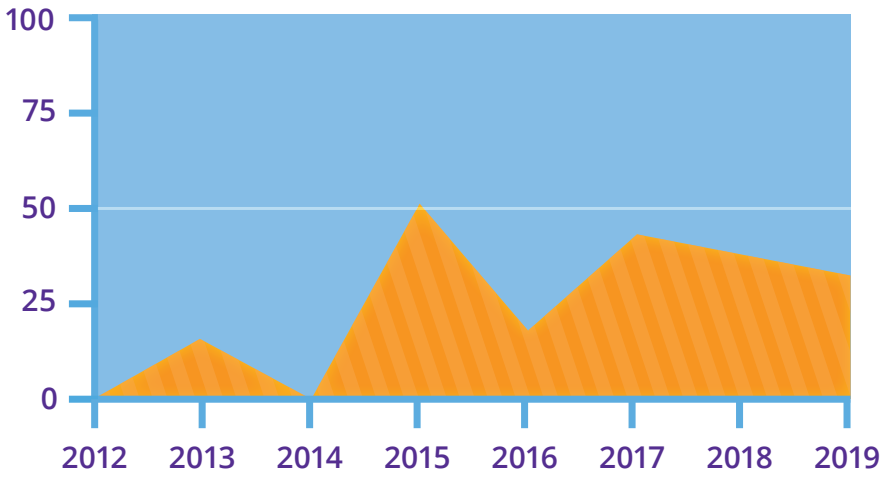
WORDS FROM WOMEN IN SCIENCE AND SECURITY

Analysis by Nature suggests that it takes persistent and constant efforts to reduce and banish manferences (all male conferences), and that having good intentions by itself will not work to make conferences gender balanced. Instead, the study emphasizes that there needs to be established, enforced gender policies that would result in diversity. Additionally, calling out manels has also gained traction on social media. In 2015, Saara Sarma, a Finnish political scientist, set up a Tumblr site to upload photographs and screenshots of manels under the tagline: 'Congrats, you have an all-male panel!' Since then, the site has documented more than 2,000 manels.[71]

INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION

The Ratio of male-to-female invited speakers is heading towards equality, but has seen dramatic swings. Percentages of invited speakers who are:

MALE **FEMALE**



"Engineering definitely was not something I had a passion for at a young age.I was quite the opposite. I think my earliest memories of math and science were definitely one of like nervousness and anxiety and just kind of an overall fear of the subject. I had this idea that I wasn't good at math and my high school math and physics teacher helped to peel away the mindset. They showed me that it's more of a growth situation, that you can develop an aptitude for this and you can develop a skill. It's just like a muscle, and you have to work for it."

Mareena Robinson Snowden
Senior Engineer, National Security Analysis Department, Johns Hopkins Applied Physics Laboratory (Dr. Snowden is the first black woman to earn a Ph.D. in nuclear engineering from MIT)

A CASE STUDY FOR SUCCESS

Several studies have emphasized (1) the need to build a strong and large network of women scientists so that women in STEMM will have a network to turn to; (2) the need to speak up and call out manels and manferences; (3) hold people and institutions accountable.[73]

The organizational psychology literature reveals that receiving mentoring and social support have also lessened stressful working environments for tokens. A study was conducted to examine whether social, emotional or organizational support acted as buffers of the relationship between incivility and outcomes in workplace. The study showed that mentoring and strong leadership promoting the voices of women allowed employees to have a greater sense of job satisfaction and also incentivized women's STEMM participation.[74]

All of the above taken into consideration, one of the most important strategies to encourage greater numbers of female participation in science conferences and panels is to expand the listserv and existing searchable databases of women in STEMM. There are organizations like Women of Color Advancing Peace and Security (WCAPS), Women in International Security (WIIS), and 500 Women Scientists, which are developing searchable databases to assist research institutions, political institutions, university search committees, and conference organizers among others to identify women working in specific STEMM areas.[75]

WCAPS PIPELINE OF EXPERIENCE

The Women of Color Advancing Peace and Security (WCAPS) is a platform which identifies, amplifies and augments the work and perspectives of women of color in national security and peace and security issues. The organization has created a Pipeline of Experience—a listserv which makes it easier for organizations seeking women of color as panelists or specialists on different issue areas. WCAPS has a category for women of color experts in STEMM. Creating listserv is important and every organization can have an organization member's specific listserv or a broader database which can help quickly locate women experts.[76]

> "As a first generation Black American woman, elevating the impacts of emerging technology and cyber security on communities of color, and in particular women of color, is not just me adding a unique perspective; it is me giving voice to my mother, sisters, cousins, friends, community members, and future daughters. Not only are these unheard perspectives a missed opportunity and potentially lost revenue for businesses, it may be the difference between these communities thriving or dying on the vine. [...] We must invest in STEMM education for women of color and young girls because this often ignored or silenced demographic holds the key to untold innovations."
>
> **Camille Stewart**
> *Cyber Security Policy, Google*[72]

SUGGESTED BEST PRACTICES:

Institutions, organizations, and grant-making bodies should structure research grants in a two-pronged manner:

A. Grants-making needs to be blind, peer-reviewed and awarded on the basis of merit of ideas regardless of the lead scientist's gender;

B. Grants should stipulate that a mix of men and women researchers work on the grant.

Following up on **(B)**, organizations should use incentives to highly discourage a skewed ratio of men vis-à-vis women researchers working on the grant. Stipulating general equality of numbers -with the exception of circumstances that completely bar a team from doing so- would help tackle the issue of tokenization. The authors recognize that the language of these stipulations must be chosen carefully, as the point of this recommendation is not to create quotas for any gender and conversely discredit women scientists of their contributions. The goal is to kickstart more equal hiring of women before top-down decisions such as blind hiring and blind grants-awarding are properly put into place. Done correctly, it will go a long way to banishing this construct of tokenization as women will not feel isolated or solely chosen for their gender identity and that they rightfully deserve to work on certain projects.

Research foundations should increase women-centric research grants and funding opportunities geared towards empowering scientists who identify as women and gender minorities. The development of these grants will help to amplify women's contributions to STEMM by promoting the celebration of women's involvement, research, and professional successes. At the core of the lack of women presenting in conferences and the "token woman" phenomenon is the reality that women in STEMM are not provided enough opportunities to lead funded research. In a study conducted by the Chicago Tribune's Alison Bowen, a total number of 54,000 NIH grants awarded from 2006–2017 were analyzed. The data revealed that female applicants received a median grant of $126,615, while men received an average median amount of $165,721.

CHICAGO TRIBUNE'S
ALISON BOWEN GRANT STUDY
54,000 Grants from 2006–2017

Such gaps in funding place women in a disadvantageous position for multiple reasons. They are unable to recruit the same number of graduate students in comparison to their male counterparts, and securing less funding compared to that of male scientists means a reduced capability for women to showcase their original research, scientific discoveries, and publish their findings.[77] The lack of equitable funding and research grants won by women scientists due to implicit biases of evaluation committees is a self-sustaining process of leaving women unsupported and unable to showcase their contributions.

Chapter VI
THE SUPPOSED "ONLY" PATH

MYTH: There is only one field and one way to navigate the field that an individual who has studied a STEMM security discipline can choose.

FACT: There are always multiple paths one can take in their career; but women and minorities often lack the networking, mentorship, and resources that men have to find those new opportunities.

WORDS FROM WOMEN IN SCIENCE AND SECURITY:

In March 2019, CRDF Global held "Breaking Barriers," an event that brought together women from scientific and security backgrounds in a roundtable and discussion activity regarding obstacles that non-male individuals face in their fields regularly (a list of the attendees is included in our dedication and thanks page.)

One of the biggest obstacles cited in the discussion at Breaking Barriers was a lack of flexibility in security careers; not always in the day-to-day functions, but rather that only one path exists in that field for advancement. Oftentimes the only visible options are the paths that male predecessors have taken. However, those male predecessors often have had different experiences than their female counterparts—where they did not have to prove themselves at every turn. Due to a lack of visible role models, self-navigated paths, and externally gendered expectations of what they are expected to pursue, women can feel trapped into a preset career sequence.

The attendees of the event strongly advocated for removing these obstacles by providing mentorships and role models with structure, a recommendation echoed previously in this report. Some of these mentorships could simply be storytelling to allow women to share perspectives with each other about opportunities or tips to navigate the professional world, as also suggested in Chapter IV.

Some mentorships may involve teaching women how to think critically about the trainings or advice they are given, to make sure that women do not feel pressured to change how they act or handle work to how men traditionally do; rather, providing options for a variety of circumstances. Overall, the resounding objective from Breaking Barriers 2019 was to ensure women's confidence in asking questions and critically assessing what may be the standard practices for their organizations' diversity initiatives, hiring processes, or retention practices.

A CASE STUDY OF SUCCESS:

GCNP
GENDER CHAMPIONS IN NUCLEAR POLICY

Launched in 2018, Gender Champions for Nuclear Policy (GCNP) has served as a central spot for organizations involved in nuclear nonproliferation to strive together towards gender equality and gender equity, by directly involving their leadership and the accountability of their entire organizations. On their website, they state that their objective lies in "building networks, skills, mentorship, visibility, voice, and community among women working in the nuclear policy field," and that "the engagement of male and female leaders is critical to the kinds of policy, behavioral, environmental, and cultural changes that are needed."

GCNP has succeeded in gaining 45 local and international member organizations with a mix of male and female leadership as Gender Champions. These organizations include the Nuclear Threat Initiative, The Stimson Center, Women of Color Advancing Peace and Security, King's College London, and many others. Furthermore, with GCNP's template as a guideline, these member organizations have committed to pledges—modified when necessary—to benefit the field's gender balance as best as they can.[78] GNCP is a good example of a cross-community, international organization that is providing women professional knowledge, mentorship, and networks to pursue career paths that may be untraditional or initially unknown to them.

GCNP has succeeded in gaining

45 LOCAL & INTERNATIONAL MEMBER ORGANIZATIONS

with male & female leadership as

GENDER CHAMPIONS

SUGGESTED BEST PRACTICES:

Organizations should pledge or commit to the best of their ability to incorporating several women panelists in panels that address topics such as promotions, networking, career paths, career switching, etc. This is especially helpful as a potential space to display to women at any stage of their careers that there is a strong interconnectivity between STEMM fields and national security work, along with opportunities to work in either field or serve as a liaison between both to increase multidisciplinary efforts. By organizing panels or networking events with individuals with whom women identify, organizations will provide women attendees with the understanding that they can pursue goals beyond a simple vertical escalation in their current organization or field.

Given that panels are not always guaranteed to be regular components of an organization's programming, be it government, nonprofit, or for-profit groups, we recommend that organizations establish mentorship programs internally. While this is intended to provide equity for women and gender minorities, mentorship programs are beneficial to all staff members. By passing on knowledge that they wish they had as an individual in their field and as a staff member of that organization, mentors benefit and guide mentees in assisting them to become more confident and effective colleagues.

After establishing their own organization-wide mentorship programs, organizations should work together to create mentorship programs or networks across entire cities and regions. This will allow women to connect across fields and organizations and gain a wider understanding of what other women in their fields are doing, or what opportunities are open to them. It is important to note that organizations also benefit from increased networking, as this allows development of potential partnerships with like-minded leadership and organizations in other spheres, as well.

As of 2020, 83 UN Member States have National Action Plans (NAPs) regarding women, peace, and security. However, it is important to note that STEMM is not included in those categories. Given the connection between STEMM, emerging technologies, and national or international security, regional mentorship or support programs built up by multiple organizations (with internal mentoring programs) would be powerful voices in encouraging governments to include STEMM in the NAPs. Not only would this help to increase collaboration and the flow of knowledge between professional fields, this would also assist in eliminating the misconception that there is only one path to either STEMM or security work.

Conclusion

The literature review conducted in this guide strongly supports the sentiments expressed at the CRDF Global Breaking Barriers roundtables and other events hosted over the last few years by other organizations. These sentiments are not groundbreaking nor do we anticipate them surprising many of our readers. However, this guide does compile strong evidence, using both academic publications and firsthand accounts from women in STEMM and national security fields, to substantiate statements that are dismissed even today as mere complaints or isolated incidents.

Beyond the individual merit in the findings of this report, perhaps the most important takeaway from our research on these barriers is that they compound and exacerbate each other. The failure to recruit and retain women in the STEMM pipeline is a product of a combination of factors outlined in this report, including but not limited to: sparsely distributed resources and mentorship from women role models in the field, low self-efficacy and its disproportionate impact on women, a long and sustained history of ignoring the contribution of women in scientific discoveries, the perpetuation of women as "tokens" and not equals, and the lack of information on STEMM career options or methods to navigate different pathways.

However, there is always a silver lining. Amidst the gloomy picture depicting the day-to-day struggles for women in these fields, there are clear opportunities for today's organizations and leadership to actively encourage change and improve access for women interested in science and national security careers.

The problems facing the world of today -and the future- will require continued innovation and solutions that incorporate the needs, visions, and representations of all communities and populations. The case studies and recommended best practices stated in this report are certainly not exhaustive of the way in which we can reinvigorate the STEMM and national security pipelines, nor are they prescriptive of the only ways to improve the lives of women in the field. However, we believe that implementing these recommendations would be promising first steps to revolutionizing the inclusion and retention of motivated, curious women throughout our next generations.

About the Authors

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