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Developing more women in managerial roles in information technology and cybersecurity

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Abstract

With significant shortages of employees and managers in cybersecurity and technology management, the need for more professionals in the field has never been more important and necessary. Meeting these workforce development shortfalls and developing innovative business strategies requires leaders from all genders and backgrounds. To effectively meet the most challenging concerns related to organizational technology management strategy will require the contributions of women. This paper explores the barriers, complexities, and innovative approaches related to developing more women in executive and supervisory roles in information technology and cybersecurity.

Overview

Information security analysts (ISA) positions are expected to grow 18% through 2024 and this growth creates a need for more employees with expertise in information technology (Morgan, 2016). As a result, organizations need to seek out untapped sources to address these critical workforce shortages. Crimes related to cyber costs businesses upwards of \$400 billion annually accompanied by the rapid integration of technology, electronic communications, and digitalization efforts project the cost of cybersecurity breaches to \$2.1 trillion globally by 2019 (Morgan, 2016). Magid (2014) states that cybersecurity is an organizational-wide responsibility and the need to hire more employees is critical to the execution of business strategy, business operations, and business information security. Information technology companies and merchants have complex responsibilities to protect customers' payment information and personal private information (Magid, 2014).

Although women comprised slightly more than half of the population of U.S. residents in over half the college population, the rate of their intention to major in the STEM disciplines (33.5 percent) was lower than that of males (45.8 percent) in 2012 (National Science Foundation, 2013). Similarly, even though women earned over half the bachelor's degrees in the STEM disciplines in 2012, disaggregating the data reveals that females were underrepresented in computer sciences (22.3 percent), engineering (19.2 percent), and physics (23.6), among other disciplines. Beyond college, females were employed at much lower rates in STEM occupations (24.1 percent) than their male counterparts (75.9 percent) (National Science Foundation, 2013).

Meiksins et al. (2017) state that there are many studies around women in technology but an area in need of more intense research focus includes challenges faced by women after

they transition from being a student to working in a technical job role. There are several issues on the front end of the problem of the limited number of women in technical fields that lead the lower number of women in managerial roles in information technology.

According to Meiksins et al. (2017) research states that women's self-efficacy is an important factor in influencing the career selections and career progressions of women in technology fields. Research by Tellhed, Bäckström, and Björklund's (2017) outlines that lower self-efficacy in women is a powerful factor explaining their lack of interest in STEM. Having female mentors can assist with addressing this issue.

Blair, Miller, Ong, and Zastavker (2017) outline in their research how interactions between faculty and female students can impact their interest in pursuing technology careers. They identify three discourses that professors use to construct gender expression and their identities as teachers: 1) gender blindness, 2) gender acknowledgment, and 3) gender intervention. They conclude that professors "most frequently utilized discourses acknowledging gender inequity, which limited their responsibilities to promote equity and highlights the pernicious nature of systemic gender bias" (p. 14). Cross and Cutler (2017) outlined the importance of training and awareness around diversity and inclusion as it relates to gender. Their research revealed even faculty members that want see the importance of more diversity in the field often do not have the expertise to know how to engage in the process constructively (Cross & Cutler, 2017).

Research in the U.S. by Cardador (2017) found that there were many challenges for women moving from employee to managerial roles in technical fields. As more women became supervisors, they become more isolated from other female peers. They also faced challenges of stereotypes and gender role biases driven by assumptions that certain positions and job roles were better suited for men than for woman.

Meiksins et al. (2017) outlined how public revelations of sexual harassment, sexual abuse, the emergence of the #MeToo, and discoveries of sexual misconduct men often created hostile, unhealthy, and uncivil workplaces for women in technical roles and technical organizations. Often men hold an overwhelmingly majority of the supervisory and leadership roles in technical organizations. As a result, the organizational culture is shaped by men and women find themselves as a voiceless minority around their concerns about gender equity (Meiksins et al., 2017).

There were, of course, some studies that touched on the issue of climate, or at least perceptions of climate. Earlier in the review, we summarized several studies that examine how women's feelings about whether they "fit in" in technical fields affect their willingness to enter the field (Tellhed, Bäckström, & Björklund, 2017). Schuster and Martiny (2017) found that stereotypes led women to develop fewer positive mindsets around working in technical fields. Alfrey and Twine (2017) stated the challenges to women assimilating into technical organizations. They reported experiencing a range of micro-aggressions in their interactions with male co-workers (Alfrey & Twine, 2017). All these studies point areas of concern that create a leaky pipeline from college to workplace around retention and organizational culture.

There continues to be a history of unsolved issues related to women in senior managerial roles in technology in organizations and businesses (Vafaei, Ahmed, & Mather, 2015; Ely, Stone, & Ammerman, 2014; Rincón, González, & Barrero, 2017). Women comprise 51% of the professional workforce in all fields (Lennon, 2013), yet, the number of women in senior management positions remains low at only 24% (Thornton, 2013). Only 9 % of Chief Information Officers are female (Fidelman, 2012). Females represent 46% of the advanced placement tests for calculus and yet 80% of them never take a computer science class and even less pursue a career in computer science (Fidelman, 2012). Those do pursue careers in information technology and computer science find additional challenges (Fidelman, 2012).

According to several research studies, gender diverse teams have positive impacts on organization performance (Eagly & Heilman, 2016; Gröschl & Arcot, 2014). In a meta-analysis of 146 studies, Van Dijk et al. (2012), found that diversity is important in the performance of the team and can result in creative thinking which is highly beneficial to the performance of the firm.

Gender Metaphors

The most widely known metaphor is the glass ceiling, which suggests that women face unnoticeable obstacles during career development in organizational cultures that are not woman friendly or that are not committed to diversity (Sabharwal, 2013).

Additional metaphors have been used to illustrate the difficulties to the advancement of women including the glass cliff, maternal wall, glass escalator, sticky floor, and labyrinth (Carli & Eagly, 2016; Sabharwal, 2013). These metaphors are used to describe circumstances that undermine women's management opportunities. The metaphor of glass cliff is considered as an organizational barrier that women encounter when seeking leadership positions (Elliott & Stead, 2017). The glass cliff refers to the likelihood of women to be appointed to leadership positions that have offer limited opportunities or limited viability (Ryan, 2016).

After collecting interviews from 62 women holding leadership positions in technical organizations, Yaghi (2017) concluded that men target women and place them in difficult and risky positions where the chances of them to fail are high. When women occupy such risky leadership positions, their capabilities come into question and stereotypical assumptions are reinforced (Yaghi, 2017).

Maternal wall describes the unique challenges placed on working women (Carli & Eagly, 2016). According to Williams (2005), maternal wall bias tends to be used when a woman becomes pregnant, looks pregnant, or requests parental leave. A study of 122 college students discovered that when businesswomen became mothers they are were not perceived as being competent for the workforce and were considered less for hiring and promotions (Cuddy, Fiske, & Glick, 2004). In contrast, when men become fathers, they do not experience any setbacks and are still perceived as competent. As a result, when women return to the workforce after childbirth they are often perceived as less suited for managerial roles (Williams, 2005).

The glass escalator metaphor refers to faster promotion rates that men have over women in female-dominated occupations (Carli & Eagly, 2016). Hultin (2003) examined both the career chances of men and women in both predominately male-dominated and female-dominated occupations. The study revealed that men in characteristically female-dominated occupations

benefit from upward mobility far more than women with the same qualifications and occupations (Hultin, 2003).

The sticky floor metaphor describes the discrimination practices that women experience early on in their careers that result in low-paying, low-status occupations and can result in women remaining stagnant in their careers (Carli & Eagly, 2016). Researchers examined the pattern in which women are less likely to be considered to climb the job ladder compared to men (Baert, De Pauw, & Deschacht, 2016). The findings concluded that when women apply for their first promotion jobs, they received on average of 33% fewer interview invitations and 19% fewer positive callbacks when compared to men (Baert, De Pauw, & Deschacht, 2016).

According to Carli and Eagly (2016) the labyrinth metaphor describes that women often only reach managerial roles after navigating through a maze of obstacles and barriers that many of their male counterparts do not often have to face. The labyrinth summarizes the various paths that women pursue to leadership within the organization (Bruckmüller et al., 2013). Addressing organizational cultural issues requires an organizational focus on employee engagement activities that are geared on organizational cultural change and the importance of diversity and inclusion (Burrell, 2015).

Mentorship and Role Models

Scholars have pointed to the vital role that mentoring and role models have on the careers of women in leadership positions (Ely et al., 2014; Gipson et al., 2017). Mentoring is an “intense development relationship of relatively long duration in which protégés receive a range of career and psychosocial help exclusively from senior managers (Whitely et al., 1991). Role models are individuals that have their behaviors within in a role imitated (Hill & Wheat, 2017). To be an effective leader, it is important to understand the culture and politics within the organization (Hill & Wheat, 2017). Mentors can aid women in navigating the power structures and role models can demonstrate how to advance despite unfavorable stereotypes of women being leaders (Hill & Wheat, 2017).

Sponsorship

Another form of mentorship that scholars have begun to focus on is “sponsorship” (Gipson et al., 2017; Hewlett, 2013). Sponsors defer from mentors because use their contacts and influence to help those that they sponsor (Gipson et al., 2015). Sponsors are advocates for those that they sponsor by proactively seeking opportunities that will advance their careers or help in their development (Hewlett et al., 2013).

Sponsorship is more effective than mentorship because of the long-term benefits (Hewlett, 2013; Hill et al., 2016). Although sponsors are very similar to mentors, they do more than just listen mentees and provide feedback (Hewlett, 2013; Hill et al., 2016). They use their resources to personally advocate those that they sponsor that can lead to promotions and career development opportunities (Hewlett et al., 2013).

Networking

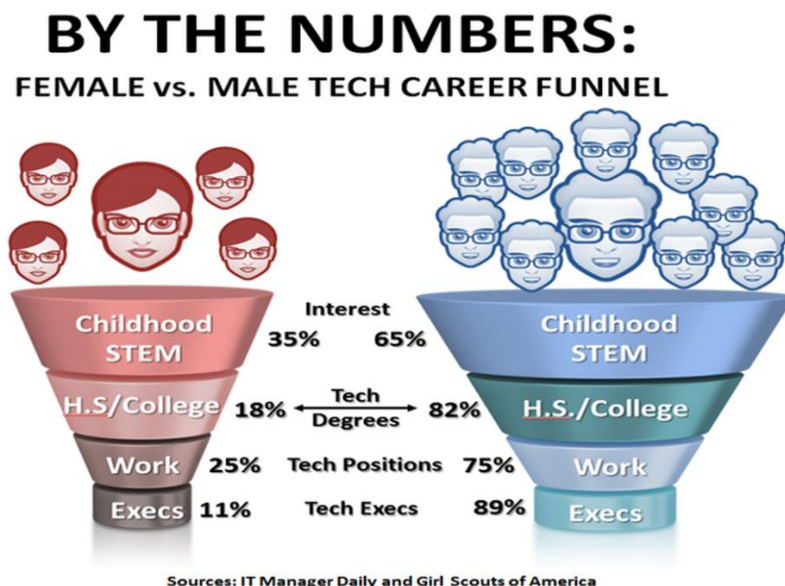
Professional networks are highly instrumental in the development of women leaders by providing access to relationships that can lead to promotions, job assignments, and professional credibility (Gipson et al., 2017). Networks are a variety of connections professionals in a given

field that can provide advice, professional introductions to people of influence, and recommendations for job opportunities (Linehan & Scullion, 2008). Networks can assist women with connections with others who can provide emotional support for women who feel isolated in a male-dominated occupations and organizations (Gipson et al., 2017; Hill et al., 2016).

Obtaining multiple mentors and networks of professionals are two methods that can assist women obtaining senior leadership roles (Gamble & Turner, 2015). Evidence suggests the important role that mentors, and networks play in helping woman overcome barriers that can often hinder the career progression of women from staff jobs to managerial jobs (Linehan & Scullion, 2008). Data was collected from the interviews of 50 senior female managers to explore the role of mentoring and networking during the development of global female managers (Linehan & Scullion, 2008). The researchers found that female managers are overlooked for global assignments due to lack of mentors, role models, sponsorships, or relevant networking opportunities that are on a comparable level to their male counterparts (Linehan & Scullion, 2008). The researchers conclude that if women had access to the same networks and mentoring opportunities of men, they would be able to advance their career (Linehan & Scullion, 2008).

For those women who are given the opportunity to have mentors find that they are often paired with male mentors since many of the managerial positions are held by men (Gipson et al., 2017). The pairing of women with male leaders can cause issues because gender and power subtleties could influence how effective these relationships are (Gipson et al., 2017). In response to the challenges associated with gender bias issues, Hopkins et al. (2008) conducted a non-empirical study that focused on the needs of women in leadership development practices. The findings encouraged women leaders to have both male and female mentors. In addition, women are also encouraged to be both a mentor and a mentee (Hopkin et al., 2008).

Solutions for developing more females in tech



There is a clear pipeline and numbers problem that creates a limited number of women in technology jobs which ultimately leads to a limited number of women in leadership roles. Create more women in managerial roles, there needs to be an organizational focus on bring more highly qualified women into technology fields and technology job roles at all levels.

Methods and results

The focus of this research approach uses applied research methods. The goal in mind is to influence the world of practice. A qualitative research approach stratifies the purpose of this study because it provides an avenue to capitalize on the strengths of using the direct voices of study participants and provides a path for detailed observation of the natural settings by the participant observers “to avoid prior commitment to any theoretical model” (Yin, 1994, p. 14). Through an inductive approach to seek descriptive participant feedback, this strategy provides a unique possibility for the study of people and groups in the world of practice with an emphasis on the meaning and understandings of their experiences.

The three focus groups of 5 female leaders in information technology that were either the director level for a total of 15 participants. 13 were Caucasian American, one was African-American, and one was Asian-American. The groups met separately, and each group were asked;

What do you see are the top strategies to help more women get into technical jobs in information technology?

Each of the three focus groups came out with a group list. The lists were combined from each group to create a master list minus any duplicate responses. The collective group was brought together to vote on what they thought were the top ten topic areas. The results were:

There are strategies to help channel more women into tech related leadership professions. The following solutions include:

1. Theme result 1-Creating more programs in middle school and high school that encourage women into technical careers, especially in private and charter schools for women. An example of this is “Girls who code,” which is a summer camp coding program that teaching women about coding.

A participant in focus group 1 stated, “Girls only camps where girls can collaborate with other girls, develop self-efficacy through a culture of camaraderie, develop a level of comfort dexterity about technology, and an affection and dexterity for technology fields while they are in middle school and high school provides a foundation framework for future success and interest in technology fields. These experiences are very important in helping young women explore their interests, identify their strengths, and build their confidence.”

2. Theme result 2- Make diversity goals a part performance evaluation goals of all managers especially those on the senior level. These goals could include listing and cataloging the results of activities focused on recruiting and retaining more women in the organization.

A participant in focus group 3 stated, “Diversity and inclusion requires management and support and by-in. If managers don’t diversity a priority and important, employees won’t either. Management allocates the budget. It requires management allocating staff resources and other financial resources towards diversity and inclusion in order to make the culture more welcoming and woman gender friendly. If managers at every level see that diversity and inclusion is an important part of the organization’s values or even how managers are evaluated, then they will focus on it.”

3. Theme result 3- Promoting a better vision of today’s technical paths within the organization to leadership roles.

A participant in focus group 2 stated, “Women and all employees need to see a clear and logical path of how their careers can progress. Organizations need to invest in career development planning, executive coaching, and even strategic organizational development planning to ensure that the organizational structure supports organizational mobility. This process includes helping employees identify their strengths and finding opportunities to help them leverage those strengths to the benefits of the employee and the organization. These processes can include financially supporting training activities that allow employees to better develop their strengths in the form of professional development training courses and even job rotations.”

4. Theme result 4- Creating formal mentoring programs where women can be mentored by other women even those outside of the organization.

A participant in focus group 1 stated, “It’s hard to be what you can’t see. Meaning that if you never see anyone that looks like you in a leadership role then it might be hard for you, as a woman to visualize being a manager or senior leader if you never see one. Role models and mentors are important to helping people understand their own possibilities. Mentors can share strategies of their own successes that worked for them and can also tell them stories about mistakes that they made for the benefits of mentees.”

5. Theme result 5- Creating partnerships with women’s colleges. These partnerships can lead internship programs and professional development workshops.

A participant in focus group 2 stated, “It’s easy for organizations, government agencies, and non-profits to take the lazy approach and say that their just not enough quality women to hire and promote. Committing to diversity takes strategic effort and outreach in places that have a higher propensity of results. Most

organizations cast a wide net when it really requires targeted strategic focus in order to really recruit and hire more women. This means that organizations need to put resources in the efforts that focus on colleges and universities that have successful track records of graduating women in science and technology areas. This includes women's colleges and even Historically Black Colleges and Universities (HBCUs) like North Carolina A & T which graduates more African-American women with undergraduate degrees in engineering and technology than any other university in U.S. Companies can even use their resources and expertise to help these colleges and universities develop curriculum and degree programs that is most relevant to current and future technical workforce needs and deficits for corporations.

6. Theme result 6- Partner with professional organizations like:
 Women in the Enterprise of Science and Technology (WEST)
 Women in Science & Engineering (WiSE)
 The European Association for Women in Science, Technology, Engineering and Mathematics (STEM)
 Society of Women Engineers (SWE)
 To sponsor events, conferences, and activities that held by professional organizations and associations that support woman in computing, Information technology, and cybersecurity.

A participant in focus group 1 stated, "Corporations need to partner with and fund career development workshops and conferences with professional organizations that have access to women members that already technically credentialed and have an interest in technical careers. These organizations can be centers of influence that can connect highly qualified women with hiring organizations."

7. Theme result 7- Hire a chief diversity officer that can create initiatives focused on recruiting more women and making organizational cultures more woman friendly.

A participant on focus group 2 stated, "Firms that are really committed to diversity and inclusion will hire someone and give them the staff, financial, resources and the authority to help in making the organizational culture more welcoming and inclusive for women and all minorities. This person needs should be certified and experienced and have skills in the following areas:

**Workplace equity
 Political savvy
 Change management
 Conflict Management
 Bias- conscious and unconscious
 Gap analysis
 Business process improvement
 Applied research**

**Curriculum development
Training facilitation**

All these skills are required to be effective in addressing these issues as a Chief Diversity Officer or V.P for Diversity and Inclusion.”

8. Theme result 8- Creating leadership development programs in organizations that create pipelines for highly qualified women to move from staff jobs to managerial roles.

A participant in focus group 3 stated, “Organizations need to create their own internal leadership develop programs for women that include courses, coaching, and other development activities to help women develop the competencies to be effective as managers. If there are internal problems with creating a course just for women than the organization could develop and fund a course offered by a professional association for women in information technology. Creating this program is not about discriminating against men because most organizations already have existing cultural aspects that assist men in ascending to leadership roles. The numbers of men versus women in leadership roles prove this out. Creating these programs is about workplace equity and leveling the playing field for women.”

9. Theme result 9- Create women oriented advisory boards that assist organization with focusing on best practices to around recruiting and retaining women in IT roles.

A participant in focus group 2 stated, “Companies can benefit from advisory boards because they have the ability to bring intellectual capital and expertise that is critical bring fresh perspectives, best practices, and cutting-edge approaches to recruiting, hiring, retaining, and promoting more women in information technology.”

10. Theme result 10- Create developmental programs in the corporate world the mimic those offered by the federal government including:

The Presidential Management Fellows (PMF), www.pmf.gov which is a two year leadership development program for people with advance degrees to be recruited into permanent job positions in the federal government. The PMF program offers 160 hours of training and even student loan repayment of up to \$60,000 (10K a year for up to 6 years), which include a service commitment of 3 years for every year of payment.

The “Cyber-corps for Service” program provides scholarship money to pay two years of undergraduate tuition or two years of graduate tuition for students to pursue cybersecurity studies. Each year of tuition paid requires a year of government service.

A participant in focus group 1 stated, “Competitive selection programs that allow employees training and a fast track to management roles are enticing. Student loan

repayment and specialized leadership development programs for women in college with technical majors are recruiting incentives that show students that a company is willing to invest in the development and career success of their employees. Why wouldn't an IT graduate want to work for an organization that helped them fund their undergraduate education or that would pay for them to get an executive or weekend graduate degree or even a non-traditional doctoral program? My colleague works for a company where they paid for several of their employees to attend cohort hybrid executive doctorate program in Cybersecurity at Capital Technology University in Laurel, Maryland. Many that pursue a graduate degree, or a doctorate degree have to pay for it with their own money. These students often graduate with student loan debt, so it is a great recruiting incentive that can build employee loyalty to know that your place of employment paid your student loans off or even paid up front for you to pursue your graduate degree or doctorate degree."

These results provide a starting point on where technical organizations with no foundation to address their gender equity issues could start. Addressing this area of concern requires investment approaches from pipeline development to organizational cultural change to leadership development. According to Meiksins et al. (2017) there are more areas in need of research focus around gender inclusiveness in technical job fields and technical organizations including:

1. The nature and impact of sexual harassment, incivility, and bullying that woman in technical organizations face on the part of their male counterparts in the workplace?
2. What is the climate or influences that cause males to engage in behaviors that create cultures that are unwelcoming to women in technical organizations?
3. In what ways does organizational culture impact the numbers of women in leadership roles in technical fields and technical organizations?
4. Are women being discouraged from technical careers because of gender role stereotypes?
5. What roles to academic experiences around gender inequity positively or negatively influence women's perspectives and interests in technical career fields?

Future research on the part of consulting firms, corporations, and organizations need to address these questions more effectively in order to comprehensively address the issue of gender equity and gender inclusion technical fields.

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