

## Gender asymmetry in cybersecurity: Socioeconomic causes and consequences

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### **Abstract:**

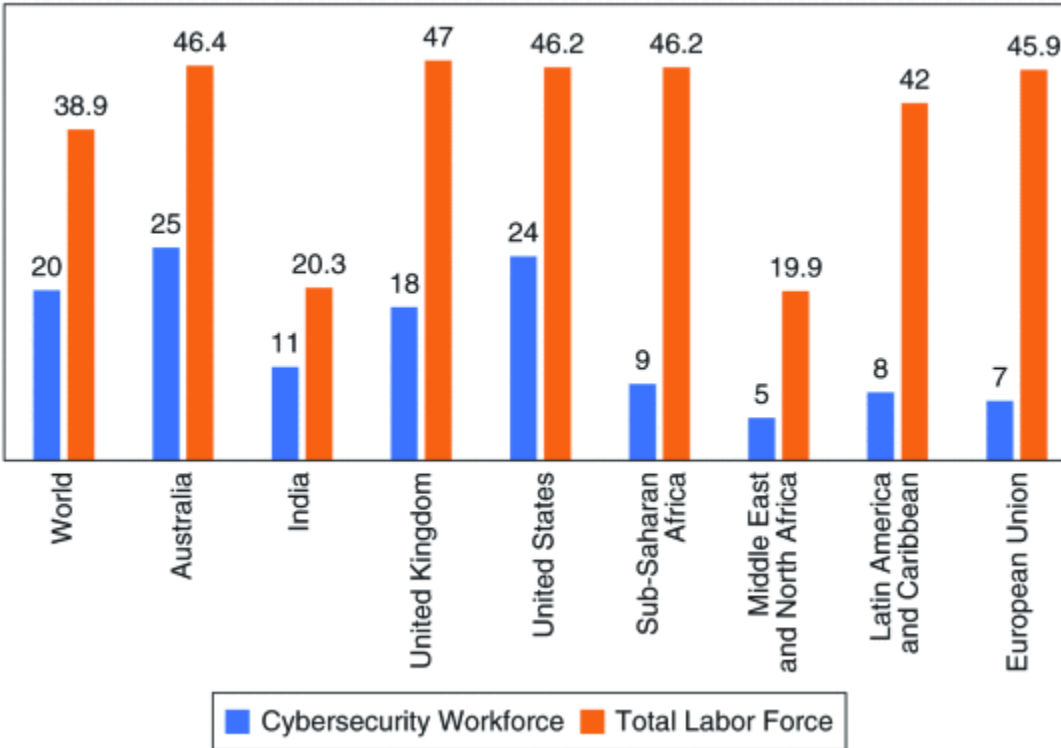
This article reviews the causes of gender asymmetry in cybersecurity and argues that women's increased participation can strengthen the industry and improve business outcomes. It also discusses ways to attract and retain women in the field.

**Keywords:** gender bias | cybersecurity | IT workers

### **Article:**

Women are highly underrepresented in the field of cybersecurity. In 2019, their share of the worldwide cybersecurity workforce was 20%, compared to 38.9% in the general workforce (Figure 1). In all the economies presented in Figure 1, there are significantly lower proportions of females in the cybersecurity workforce than in the total labor force. Women have even less representation in cybersecurity leadership roles at larger U.S. corporations such as Fortune 500 companies. For instance, according to Cybersecurity Ventures, only 70 of the Fortune 500 companies, or 14%, had female chief information security officers in 2020,<sup>2</sup> which was lower than the proportion of females in the cybersecurity workforce (Figure 1). Likewise, while 27% of the programmers in the Israeli army are women, the proportion is 12% in cyberunits and only about 3% in the top cyberunits.<sup>2</sup>

Cybersecurity requires strategies beyond technical solutions. Women's representation is important because they tend to offer viewpoints and perspectives that are different from men's, and these underrepresented perspectives are critical in addressing cyber-risks. This article highlights the causes of gender asymmetry in cybersecurity and discusses how women's increased participation can strengthen the field and improve business outcomes. It also looks at some possible ways to attract and retain women in cybersecurity.



**Figure 1.** The percentage of females in the cybersecurity and total labor forces. (Sources for the cybersecurity labor force: world;<sup>3</sup> Australia;<sup>4</sup> India (forecast for 2025);<sup>5</sup> United Kingdom;<sup>6</sup> United States;<sup>7</sup> Sub-Saharan Africa;<sup>8</sup> Latin America, Caribbean, Middle East, and North Africa;<sup>9</sup> and European Union.<sup>10</sup> Source for the total labor force: World Bank.<sup>11</sup>)

### Causes of Gender Asymmetry in Cybersecurity

Table 1 lists the major sources of gender disparity in cybersecurity. Some are more general barriers such as those related to political, legal, and cultural factors that are encountered in all types of jobs, while others are specific to technology-related careers. First, in some countries, women’s participation in economic activities is hindered by defective legal and regulatory systems. In a related statistic, women worldwide have only three-quarters of the legal rights that men have.<sup>12</sup> For instance, 18 countries are reported to require women to have their husband’s permission to work outside the home.<sup>13</sup> Yemen is one such country, where females account for only 7.9% of the labor force.<sup>11</sup> Likewise, 17 countries restrict women from traveling without permission from a guardian.<sup>14</sup>

Second, in some societies, cultural barriers prevent women from participating in formal labor markets. In Israel, among women with high test scores on psychometric exams, which are standardized tests used in admission to institutions of higher education, a greater proportion of Jewish women than Arab–Israeli women were reported to pursue technology-related careers. According to the chief economist of the country’s Finance Ministry, in 2017, only 10% of Arab–Israeli women in the high-test-score category worked in technology, compared to 30% of Jewish women.<sup>2</sup> It is argued that cultural expectations and practices work against Arab women’s involvement in the workforce. The culture encourages women to stay home to care for their children.<sup>15</sup>

**Table 1.** The major causes of gender asymmetry in cybersecurity.

Cause	Explanation	Example
Regulatory and legal	Defective legal and regulatory systems	Women lack legal rights in some countries, for example, facing requirements to have their husband's or a guardian's permission to work outside the home and travel.
Cultural differences in gender roles	Hindered participation by women in formal labor markets in some cultures	In Israel, Arab–Israeli women are more likely than Jewish women to stay home to care for their children.
Societal view of gender	Mistaken societal belief that cybersecurity and technology jobs are only for men	There is low representation of women in science, technology, engineering, and mathematics fields worldwide.
Stereotypes and bias in organizational decision making and practices	Mistaken impressions among potential employees that men are more appropriate for the jobs	There is an undue emphasis on technical skills and a lack of gender-neutral language in job ads.

A Kaspersky Lab survey of women younger than 16 in Europe, Israel, and the United States found that 78% of the respondents had never considered a career in cybersecurity.

Third, the societal view is that cybersecurity is a job that men do,<sup>16</sup> though there is nothing inherent to gender that predisposes men to be more interested in or more adept at the work. The low number of women in Internet security is linked to the broader problem of their poor representation in the science, technology, engineering, and mathematics (STEM) fields. While women make up half of the U.S. college-educated workforce, they account for only 30% of the science and engineering workforce<sup>17</sup> and 26% of the professionals in the computer and mathematical sciences.<sup>18</sup>

A Kaspersky Lab survey of women younger than 16 in Europe, Israel, and the United States found that 78% of the respondents had never considered a career in cybersecurity. In addition, 42% considered it important to have a gender role model in their career, and about half preferred to work in an environment that had an equal male–female balance. Cybersecurity professionals also have an image problem. For instance, one-third of the respondents thought cybersecurity professionals were “geeks,” and one-quarter viewed them as “nerds.” A related challenge concerns negative connotations of terms such as *hacker* that are often associated with cybersecurity roles. Due to that, two-thirds of the respondents reported that cybersecurity jobs did not appeal to them. The respondents expressed a desire to pursue careers they were more passionate about.<sup>18</sup> A related outcome of this bias is that women are generally not presented with opportunities in IT fields. In a survey of women pursuing careers outside IT, 69% indicated that the main reason they did not pursue jobs in the field was because they were unaware of them.<sup>30</sup>

Finally, stereotypes and bias in organizational decision making and practices hinder women's entry into technology jobs in general and cybersecurity-related roles in particular. For instance, the industry mistakenly gives potential employees the impression that only technical skills matter in cybersecurity,<sup>20</sup> which can give women the impression that the field is overly specialized and even boring. Organizations often fail to try to recruit women to work in cybersecurity. According to a survey conducted by IT security company Tessian, only about half of the respondents said their organizations were doing enough to recruit women for cybersecurity roles.<sup>21</sup> Gender bias in

job ads further discourages women from applying. Online cybersecurity job postings often lack gender-neutral language.<sup>22</sup>

### **Women's Increased Participation: Strong Security and Good Business**

Boosting women's involvement in cybersecurity makes both security and business sense. The cybersecurity field is facing a huge skills shortage. The gap between demand and supply in this field is predicted to reach 1.8 million workers worldwide in 2022.<sup>10</sup> Boosting women's participation is one way to close this gap. More importantly, women cybersecurity professionals bring important benefits that translate into strong cybersecurity. For instance, female leaders in this area tend to prioritize some key areas that males often overlook. This is partly due to their backgrounds. About 44% of women in cybersecurity have degrees in business and social sciences, compared to 30% of men.<sup>9</sup>

Female cybersecurity professionals put a higher priority on internal training and education in security and risk management. Women are also stronger advocates for online training, which is a flexible, low-cost way of increasing employees' awareness of security issues. Females are also adept at selecting partner organizations to develop secure software.<sup>23</sup> They tend to pay more attention to partner organizations' qualifications and personnel, and they assess partners' ability to meet contractual obligations. They also prefer partners that are willing to perform independent security tests.

Increasing women's participation in cybersecurity is a business issue as well as a gender concern. According to Boston Consulting Group, by 2028, women will control 75% of discretionary consumer spending worldwide.<sup>24</sup> Security considerations such as encryption, fraud detection, and biometrics are becoming important in consumers' buying decisions.<sup>25</sup> Product designs require a tradeoff between cybersecurity and usability. Women cybersecurity professionals can make better-informed decisions about such compromises for products that are targeted at female customers.

Security issues associated with major technologies and platforms, such as the Internet of Things (IoT) and social media, disproportionately affect women. For instance, smart home technologies have been highly ineffective at preventing domestic abusers from harassing and harming their former partners and child predators from gaining access to children.<sup>26</sup> It is reported that major U.S. technology companies—Amazon, Facebook, Apple, and Google—fill less than one-third of their leadership roles with women, and the proportion is as low as 19% at Microsoft.<sup>27</sup>

Apps have been widely available in the App Store (iOS), Play Store (Android), and other repositories that pose a risk to a women's safety. Some have made use of location data for stalking people in real time. For instance, the iOS app Girls Around Me, which was developed by the Russian company I-Free, leveraged data from Foursquare to scan for and detect women checking into a user's neighborhood. The user could identify a woman he would like to talk to, connect with her through Facebook, see her full name and profile photos, and send her a message. The woman would have no idea that someone was "snooping" on her. As of March 2012, the app had been downloaded more than 70,000 times.<sup>28</sup> It is argued that by increasing women's involvement in decision making regarding privacy and security issues, it is possible to

make IoT devices more secure and reduce predators' ability to target children and share abusive images on social media.<sup>27</sup>

Attracting more women to cybersecurity requires governments, nonprofit organizations, professional and trade associations, and the private sector to work together.

### **Attracting Women to Cybersecurity**

Attracting more women to cybersecurity requires governments, nonprofit organizations, professional and trade associations, and the private sector to work together. Public-private partnership projects could help solve the problem in the long run. Parents and primary school teachers are among the most important people that can play a role in creating young girls' interest in cybersecurity and technology in general. Surveys have found that girls' interest gradually fades as they get older. For instance, a study conducted by the nonprofit trade association that issues professional certifications for the IT industry, the Computing Technology Industry Association, found that 27% of middle-school girls consider a career in technology, but the proportion reduces to 18% by the time they reach high school.<sup>29</sup>

This does not mean that high school is too late to develop girls' interest and engagement in cybersecurity careers. Indeed, some notable cybersecurity initiatives have targeted high-school girls. One example is Israel's Shift community, previously known as the CyberGirlz program (<https://rashi.org.il/en/programs/shift-community/>), which is jointly financed by the country's Defense Ministry, the Rashi Foundation, and Start-Up Nation Central. It identifies high-school girls with aptitude, desire, and natural curiosity to learn IT and helps them develop those skills. The girls participate in hackathons and training programs and get advice, guidance, and support from female mentors. Some of the mentors are from elite technology units of the country's military. The participants learn hacking skills, network analysis, and the Python programming language. They also practice simulating cyberattacks to find potential vulnerabilities. By 2018, about 2,000 girls had participated in the CyberGirlz Club and the CyberGirlz Community.

In 2017, cybersecurity firm Palo Alto Networks teamed up with the Girl Scouts of the United States of America to develop cybersecurity badges.<sup>30</sup> The goal is to foster cybersecurity knowledge and develop interest in the profession. The curriculum includes the basics of computer networks, cyberattacks, and online safety.<sup>30</sup> Professional associations can also foster interest in cybersecurity and help women develop relevant knowledge. For example, the nonprofit European private foundation Women4Cyber (<https://women4cyber.eu/>) was established, in 2019, to "promote, encourage, and support" women's participation in cybersecurity. By July 2021, Women4Cyber had approved national chapters in 10 European countries, and seven of the groups were fully operational.<sup>31</sup> Likewise, Women in Cybersecurity of Spain has started a mentoring program that supports female cybersecurity professionals early in their careers.<sup>21</sup>

Some industry groups have collaborated with big companies. In 2018, Microsoft India and the Data Security Council of India launched the CyberShikshaa program to create a pool of skilled female cybersecurity professionals.<sup>3</sup> Some technology companies have launched programs to

foster women's interest in and confidence to pursue Internet security careers. One example is IBM Security's Women in Security Excelling program, formed in 2015.<sup>32</sup>

At the organizational level, attracting more women to the cybersecurity field requires a range of efforts. Cybersecurity job ads should be written so that female professionals feel welcome to apply. Recruitment efforts should focus on academic institutions with high female enrollments. Corporations should ensure that female employees see cybersecurity as a good option for internal career changes. And governments should work with the private sector and academic institutions to get young girls interested in cybersecurity.

Increasing women's participation in cybersecurity is good for women, good for business, and good for society. In the absence of appropriate measures by the private sector and policymakers, the gender disparity can lead to a vicious circle. This is because women are less likely to be attracted to a field dominated by males, and the failure to attract women can result in the further dominance of men. This, in turn, makes it even more difficult to attract women. The government and private sector should collaborate to try to create a more positive image of cybersecurity professionals. It is thus important to encourage girls and women to pursue STEM courses and degrees in K–12 and colleges. Women cybersecurity professionals should also be provided mentorships and support at all job levels.

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