UQ Business School / ITEE
20 March 2023

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
CREATE CHANGE

Women in Cyber
Exploring the Barriers, Redesigning the Profession

Report by Ivano Bongiovanni and Megan Gale

Contact
Dr Ivano Bongiovanni, UQ Business School | The University of Queensland
Email: i.bongiovanni@uq.edu.au

Contents

Executive Summary **3**

1. Project Description **4**

2. Project Team **5**

3. Background **6**

4. Phase 1: Cybersecurity programs enrolment analysis **10**

5. Phase 2: Interviews on challenges for women in cyber **11**

5.1 Collective themes 14
5.1.1 Cybersecurity: A technical profession 14
5.1.2 Women in cybersecurity: The skills gap and the 'boys club' 14
5.1.3 Limited encouragement to enter the cybersecurity industry 15
5.2 Specific themes: Cybersecurity industry professionals 17
5.2.1 Industry's biased perceptions 17
5.2.2 Diversity quotas and positive discrimination 17
5.2.3 Women versus women 18
5.2.4 Stereotypes of 'women in cybersecurity' 19
5.2.5 Culture: Workplace, industry, and conferences 19
5.3 Specific themes: Hiring Managers for cybersecurity roles 22
5.3.1 Experience and position descriptions: Favouring males in cybersecurity 22
5.3.2 Positive discrimination 22
5.3.3 Role models in cybersecurity: Lack of women leaders 23
5.3.4 Industry expectations 23
5.4 Specific themes: Students of cybersecurity 26
5.4.1 Technical cybersecurity studies 26
5.4.2 Accessing industry experience 26
5.4.3 Pathways into cybersecurity studies 27
5.4.4 Perceptions of gender equality in the industry 27

6. Phase 3: Design-led Workshops **29**

6.1 Feedback on findings from semi-structured interviews 30
6.1.1 Cybersecurity has a 'woman versus woman' problem 30
6.1.2 Women are not seen as technically competent 31
6.1.3 Diversity quotas are misused 31
6.2 Solutions to the challenges faced by women in cybersecurity 32
6.2.1 Short term solutions 33
6.2.2 Medium term solutions 36
6.2.3 Long term solutions 39

7. Final recommendations **42**

8. Conclusion **44**

Appendix A: Templates and solutions from Phase 2 (Design-led Workshops) **45**

Executive Summary

It is well recognised that **women are under-represented in the cybersecurity industry**. This under-representation impacts the ability of organisations and institutions in the industry to draw on diversity of thought, skills, and experiences and, in short, *be innovative*. Under-representation is the most evident symptom of the challenges that women face when entering, or remaining, in the industry. While the impacts of under-representation are relatively well acknowledged, it is the causes of the under-representation which need to be understood, further researched, and ultimately, resolved.

This project first explored the barriers women face in the cybersecurity industry. Barriers to entry, retention and progression were discussed during interviews with participants from three groups within the industry: students, professionals and hiring managers. Three significant challenges within the industry are experienced by participants in all groups. First, the **perception of cybersecurity as a technical profession**. It is a misnomer that only technically educated and skilled people participate in the industry. Conflated with the misplaced perception of women in cybersecurity as non-technical, this misnomer directly impacts the perceived competency (and hiring) of women in the profession. Second, and further devaluing the capability of women generally as cybersecurity professionals, is the **reported 'boys club' attitude** in cybersecurity. This attitude extends beyond workplaces, into seminars and professional retreats. Activities for attendees at cybersecurity events are masculine, speakers are typically males, and females are rarely in attendance. We also found that the 'boys club' mentality is adopted by some women in the profession who self-identify as technically skilled. These women align themselves with their male colleagues by actively dissociating themselves from other women in the industry who they consider non-technical; perhaps a self-preservation technique in a male dominated industry. Lastly, a common finding is the **limited encouragement received by women to enter cybersecurity as a profession**. Reflecting on their primary and secondary schooling, participants were not encouraged to pursue a career in Science, Technology, Engineering, and Mathematics (STEM). For women with higher education in cybersecurity, the source of discouragement stems from the industry itself: long hours, unfriendly work environments, male dominated teams, and masculine work cultures. All challenges participants identified as needing rectification.

The project then presented the identified barriers to members of the cybersecurity industry. In design-led workshops, participants worked collaboratively to develop short-, medium- and long-term solutions to reimagine the profession in ways encouraging and engaging to women. **Short-term solutions** focused on actions that individuals could take immediately to encourage and retain women in the industry, particularly actions available to women themselves. Supporting fellow women in the workplace and industry, through self-learning and upskilling, and networking development are accessible solutions to women currently in the industry. Greater male advocacy, and education around unconscious bias for males and hiring managers are considered necessary. **Medium-term solutions** revolved around actions that organisations and industry in general can take. The development of industry partnerships, mentoring programs, marketing campaigns, leaderships pipelines and training and development programs are among these solutions. Positive discrimination hiring practices and diversity, inclusion and equity programs within organisations also emerged as solutions. High-level and macro solutions to be progressed by government and industry were discussed as **long-term solutions**. Amendments to primary and secondary schooling curricula to include data and security topics, critical thinking development, and confidence building in young girls are among these. In the participants' opinion, policies need to be developed to support women in the workplace, women returning to the workforce, and working mothers. Similarly, government support and planning for industry growth in cybersecurity should be a priority. Participants also suggested the cybersecurity industry itself requires reframing to demystify its societal perceptions.

By engaging with women in cybersecurity and hiring managers at different career levels, this project identified challenges that women are currently facing in entering, progressing, and remaining in cybersecurity. Participants also proposed practical solutions to those challenges. **Such solutions can be used by industry and government to inform future workforce planning, policy development and cultural workplace and industry practices to encourage more diversity, and women, into cybersecurity.**

1. Project Description

Despite the lack of agreed-upon statistics on the phenomenon, **imbalance in the gender representation in the cybersecurity profession** is an evident reality of how the industry's hiring practices have been evolving in recent years[1]. Anecdotal evidence suggests that the discrepancy between male and female cybersecurity professionals currently in the workforce could be as dramatic as a 75:25 ratio[2]. Reflecting similar trends in STEM and other technical disciplines (and probably exacerbating them)[3], cybersecurity does seem to be a **'perfect storm'** in terms of women's representation: it combines elements of security and IT/technology, two areas that, traditionally, do not represent top choices for female graduates and professionals when it comes to joining the workforce or pivoting their careers.

In 2021 a research and engagement project was formulated to better comprehend the status quo of such under-representation; highlight the challenges that the cybersecurity profession seems to throw at women; and identify solutions to such challenges. The phases, with associated methods, are as follows and shown in Figure 1:

1. Gaining a better understanding of the numbers of male and female students currently enrolled in postgraduate programs in cybersecurity at the University of Queensland (UQ)[4] (***enrolment analysis***);
2. Interviewing cybersecurity professionals, cybersecurity students, and hiring managers in cybersecurity to unpack existing challenges, workforce barriers, and associated dynamics to lay the foundations for solution co-creation (***semi-structured interviews***);
3. Designing practice-oriented, short-, medium-, and long-term solutions to face those challenges, particularly from an organisational perspective (***design-led workshops***).

Figure 1: Project structure

This report presents findings and solutions developed during the three phases of the project. The report findings are intended for industry to review, adjust, and guide future organisational behaviours and workforce planning to encourage, develop, and support women in cybersecurity teams. Government organisations can find these results useful when considering future workforce and capability building, policy-making, and women in the workforce or gender reviews in cybersecurity.

[1] https://www.isc2.org/-/media/ISC2/Research/ISC2-Women-in-Cybersecurity-Report.ashx
[2] https://www.mcafee.com/enterprise/en-au/assets/reports/rp-cybersecurity-talent-study.pdf
[3] Beede, D. N., Julian, T. A., Langdon, D., McKittrick, G., Khan, B., & Doms, M. E. (2011). Women in STEM: A gender gap to innovation. *Economics and Statistics Administration Issue Brief*, (04-11).
[4] https://study.uq.edu.au/study-options/programs/master-cyber-security-5257

2. Project Team

Dr Ivano Bongiovanni (Project Lead)
Lecturer in Information Security, Governance, and Leadership
UQ Business School
E: i.bongiovanni@uq.edu.au

Professor Ryan Ko
Chair & Director UQ Cyber Security
UQ School of Information Technology and Electrical Engineering
E: ryan.ko@uq.edu.au

Professor Tyler Okimoto
Professor in Management
UQ Business School
E: t.okimoto@uq.edu.au

Dr Karen Renaud
Reader in Computer and Information Sciences
University of Strathclyde
E: karen.renaud@strath.ac.uk

Miss Megan Gale
Research Assistant
UQ Business School
E: m.gale@business.uq.edu.au

3. Background

Cybersecurity is a male dominated industry, with several reasons being anecdotally used to explain this phenomenon. A prevalent stereotype states that men are more technically minded, educated, and interested in STEM. The reasons for this mainly arise from ingrained cultural and societal norms about the role of men and women in business and the home[5]. However, the growing role of data in our society, and the need to protect it effectively, is quickly outgrowing the size of this *masculine* industry. As an industry, cybersecurity requires critical thinking, problem solving and management by innovative teams. Research and practice have time and again shared the key ingredient for high performing, innovative teams, is diversity[6]. Nevertheless, the cybersecurity industry has limited diversity. While the actual number of women working in cybersecurity is unknown, **it is estimated to be between 11% and 24%** globally[7]. **In Australia, an estimated 16% of cybersecurity professionals are women**; considering the current cybersecurity workforce in the country being around **68,400 individuals**[8], this means **around 11,000 professionals identify themselves as women**[9].

Attracting and retaining women in the industry has been a topic of interest for researchers and industry alike. From a practical standpoint, cybersecurity is experiencing a dramatic shortage of staff, with estimates indicating that **30,000 more cyber-professionals will be needed by 2026**[10]. Despite advancements in the field[11], the industry agrees that much more work needs to be done. Research, on the other end, is still limited, and has mainly focused on the historical, underlying reasons for the lack of women in professional and technical industries, and then applied a cybersecurity lens to those findings.

A substantial review of existing literature on the topic of women's under-representation in cybersecurity is outside the scope of this report[12]. Nonetheless, **it is important to address here two crucial questions and synthesise how current literature answers them: '*What barriers exist for women in cybersecurity?*' and '*Why do we need more women in cybersecurity?*'**. We present learnings and findings from literature in Tables 1 and 2, grouping them by themes, as foundations for our project. References are included as footnotes for further reading.

Women in cybersecurity, globally: 11%-24%
Women in cybersecurity, Australia: 16%
Total cybersecurity professionals, Australia: 68,400 (~11,000 women)
Additional cybersecurity professionals needed by 2026 in Australia: 30,000

[5] See for example Millar, K., et al. (2021). Gender Approaches to Cybersecurity: Design, Defence and Response. Geneva: United Nations Institute for Disarmament Research, available at: https://doi.org/10.37559/GEN/21/01 and Bagchi-Sen, S. et al. (2010). Women in Cybersecurity: A study of career advancement. *IT Professional*, 12(1): 24 – 31.

[6] We acknowledge the importance of considering diversity in all its facets, not just gender diversity (e.g., culture, skills, educational background, abilities, neurological factors, religion). Gender diversity is however the focus of our project and will be used in this report as an application of the more generic term "diversity". See Weiss, M., et al. (2018). Team Diversity in Innovation – Salient Research in the *Journal of Product Innovation Management. Journal of Product Innovation Management,* 35(5): 839-850.

[7] Risse, L. et al. (2022). Women in Security Preliminary Insights Report. RMIT University, available at: https://www.rmit.edu.au/content/dam/rmit/au/en/research/networks-centres-groups/centre-for-cyber-security/preliminary-insights-report.pdf; Aspen Institute (2021). Diversity, Equity, and Inclusion in Cybersecurity. Aspen Institute Research, available at: https://www.aspeninstitute.org/blog-posts/a-more-diverse-cyber-industry/; and Hoteti, L. (2022). Empowering women can help fix the cybersecurity staff shortage. *World Economic Forum,* available at: www.weforum.org/agenda/2022/09/cybersecrutiy-women-stem/

[8] Australian Financial Review (2022). "Cyber skills shortage 'to hit 30,000 in four years'", available at: Cybercrime surge will leave Australia 30,000 professionals short in four years: CyberCX research (afr.com)

[9] Risse et al. (2022).

[10] Australian Financial Review (2022).

[11] From 2016 to 2021, the cybersecurity workforce in Australia has grown by 240%, with a three-fold increase for men and a four-fold increase for women. See Risse et al. (2022).

[12] Excellent overviews of this topic are in James, S. (2019). The Underrepresentation Of Females In The United States Cybersecurity Workforce: A Multiple-case Study, PhD thesis, ProQuest Number: 22624480, available at: https://www.proquest.com/docview/2308204414?pq-origsite=gscholar&fromopenview=true and in University of New South Wales (2017). Women in Cyber Security Literature Review. Canberra: UNSW, available at: https://www.homeaffairs.gov.au/cyber-security-subsite/files/cyber-security-literature-review.pdf

What barriers/factors are limiting women's presence in the cybersecurity industry?

Table 1: Barriers for women in cybersecurity, learnings from literature

Theme	Learnings/Literature findings	References
Individual factors	Low interest by women in cybersecurity, associated with perceptions of: a) cybersecurity as a "nerdy", "young-white-males", and monotonous profession; and b) entry-level positions requiring sophisticated skillsets	13 14 15
	Female professionals tend to overcompensate for education but undercompensate for building strong professional networks, fundamental in cybersecurity	16
	Lack of awareness on career opportunities in cybersecurity	17
	In their careers, women rely more on women-based networks, which are limited in cybersecurity	18
	Differences in leadership styles: transformational, inclusive, and participative (women); transactional (men)	19
Organisational factors	HR and marketing materials for cybersecurity job positions are not designed in attractive ways for women	20
	Cybersecurity competitions (e.g. hackathons) used to attract graduates to cybersecurity are tailored for men	21

[13] McBrearty, C., & Wainwright, J. (2013). Women in cybersecurity, available at: https://www.womenssecuritysociety.co.uk/wp-content/uploads/2013/07/Women-in-Cyber-Security-Final.pdf
[14] Kaspersky. (2017). Beyond 11% - A study into why women are not entering cybersecurity, available at: https://d1srlirzdlmpew.cloudfront.net/wp-content/uploads/sites/86/2017/11/03114046/Beyond-11-percent-Futureproofing-Report-EN-FINAL.pdf
[15] Weingarten, E., & Garcia, M. E. (2016). Cybersecurity initiative, available at: https://static.newamerica.org/attachments/12219-decrypting-the-cybersecurity-gendergap/updated_women_cyber_12.17.8a99a9bbe8824a72aa6b542e17a9ebf8.pdf
[16] Mohr, T. S. (2014). Why women don't apply for jobs unless they're 100% qualified. Harvard Business Review, available at: https://hbr.org/2014/08/why-women-dont-apply-forjobs-unless-theyre-100-qualified
[17] Kaspersky (2017).
[18] Krivkovich, A., Robinson, K., Starikova, I., Valentino, R., & Yee, L. (2017, October). Women in the workplace 2017, available at: https://www.mckinsey.com/featured-insights/gender-equality/women-in-the-workplace-2017
[19] Chandler, D. (2011). What women bring to the exercise of leadership. *Journal of Strategic Leadership*, 3(2), 1-12.
[20] Dallaway, E. (2016). Closing the gender gap in cybersecurity, available at https://www.crestapproved.org/wp-content/uploads/CREST-Closing-the-Gender-Gap-in-Cyber-Security.pdf
[21] Pittman, J. M. (2015). Does competitor grade level influence perception of cybersecurity competition design gender inclusiveness? *Proceedings of the 2015 ACM SIGMIS Conference on Computers and People Research* (pp. 49-54). New York, NY: ACM.

	Companies approach gender diversity as *fat funnels* or *steady pipes*	22
	Ineffective attraction, hiring, and retention practices for women in cybersecurity	23
Systemic/cultural factors	Cultural behaviours and social perceptions: 'jobs for men' and 'jobs for women'	24
	Lack of role-models for women in cybersecurity; lack of female leaders in cybersecurity	25 26
	Women mostly make their career choices between the ages of 15 and 21, when there is a systemic lack of promotion for STEM careers for women	27
	Terminology in cybersecurity repels women	28
	Cybersecurity promotes male in-group dynamics, problem-solving approaches, and values	29
	Common forms of discrimination: unconscious bias, unexplained delays in career advancements, tokenism, blame culture, overt discrimination	30

[22] Barsh, J., & Yee, L. (2011). Unlocking the full potential of women in the US economy. New York, NY: McKinsey & Company, available at: https://www.wsj.com/public/resources/documents/womenreportnew.pdf
[23] Peacock, D., & Irons, A. (2017). Gender inequality in cybersecurity: Exploring the gender gap in opportunities and progression. *International Journal of Gender, Science and Technology*, 9, 25-44.
[24] Spafford, G. (2014). We are out of balance. *ACM SIGCAS Computers and Society*, 44(4), 9-12, doi:10.1145/2695577.2695579
[25] University of New South Wales (2017).
[26] Kaspersky (2017).
[27] *Ibidem.*
[28] Raytheon. (2015). Securing our future: Closing the cybersecurity talent gap, available at: https://www.raytheon.com/news/rtnwcm/groups/cyber/documents/content/rtn_278208.pdf
[29] LeClair, J., Shih, L., & Abraham, S. (2014). Women in STEM and cyber security fields. *Proceedings of the 2014 Conference for Industry and Education Collaboration* (pp. 5-7), Atlanta, GA: CIEC.
[30] University of New South Wales (2017).

The second question is only apparently provocative. *Starting with why* as a fundamental query to lay the foundations for solid, evidence-based thought leadership on *wicked* organisational challenges is an acknowledged approach[31]. Understanding why we need more female professionals in cybersecurity is a step forward to tackle under-representation.

Why do we need more women in cybersecurity?

Table 2: Evidence-based reasons for supporting increased presence by women in cybersecurity

Theme	Learnings/Literature findings	References
Individual factors	Women tend to be more educated than men and have complementary skills that apply well to cybersecurity (e.g. communication, coaching, problem-solving, empathy)	32
	Women are prime targets for cyber-crime and may foster a more nurturing and empathetic approach to this career	33
Organisational factors	Group diversity fosters creativity, innovation, and performance	34 35
	Women are needed to address shortage of cyber-professionals	36
Systemic/cultural factors	Historically, women have greatly contributed to computing science and technology, but their contributions are not effectively acknowledged	37
	Male cyber-professionals are unaware of challenges experienced by women; more women are needed to increase awareness	38

Existing research is even more limited on recommendations and practical solutions to overcome women's challenges in entering, or staying in, the cybersecurity industry. Women that express an interest in landing a job in cybersecurity have typically been largely exposed to STEM subjects in primary and secondary school, supporting the belief that schools and families need to break current stereotypes around gender-based, academic interests[39]. From an organisational perspective, research suggests that solutions to the challenges lie in changes to workplace practices and professional cultures[40]. Encouraging women into an otherwise male-dominated industry will open up an underutilised part of the workforce, assisting to reduce shortages. More importantly, a prominent presence of women in the industry signifies a greater opportunity for innovation and growth and will introduce new thinking, varied experiences, and alternative views on working methods[41]. Achieving change in the industry requires a collaborative effort by academia, industry, and government. Research has demonstrated the benefits of change, and women in cybersecurity are advocating for change[42].

[31] See Sinek, S. (2009). *Start with why: How great leaders inspire everyone to take action*. New York: Penguin.
[32] Poster, W. R. (2018). Cybersecurity needs women. *Nature, 555,* 577-580, available at: https://www.nature.com/articles/d41586-018-03327-w
[33] *Ibidem*.
[34] Weiss, M., et al. (2018).
[35] Hunt, V., Price, S., Dixon-Fyle, S., & Yee, L. (2018). Delivering through diversity, available at: https://www.mckinsey.com/business-functions/organization/our-insights/deliveringthrough-diversity
[36] Risse, L. et al. (2022).
[37] Poster, W. R. (2018).
[38] Krivkovich, A. et al. (2017).
[39] World Economic Forum (2022). Empowering women can help fix the cybersecurity staff shortage, available at: https://www.weforum.org/agenda/2022/09/cybersecurity-women-stem/
[40] Risse, L. et al. (2022).
[41] Weiss, M. et al. (2018).
[42] World Economic Forum (2022).

4. Phase 1: Cybersecurity programs enrolment analysis

Existing literature has emphasised the importance of 'starting early' with advocating for an increased role for female professionals in cybersecurity. To offer an indication of the gender balance in cybersecurity courses existing at the University level, we analysed **data about students enrolled with the postgraduate cybersecurity programs at UQ**, for the academic years 2020, 2021, and 2022[43]. Despite not being representative of the whole population of students enrolled in cybersecurity courses in Australia, the sample provides an overview of current enrolment trends in one institution. The percentage of commencing female students varied from 24% (2020), through 22% (2021), to 36% (2022), indicating an overall growing trend[44].

Table 3: Enrolment trends by gender in postgraduate programs in cybersecurity at UQ (2020-2022)

Program		2020		2021		22 (provisional data)	
	Gender	Continuing	Commencing	Continuing	Commencing	Continuing	Commencing
Master Cybersecurity 32 credits	M	-	6	3	12	14	14
	F	-	1	1	5	4	10
Master Cybersecurity 24 credits	M	-	10	7	11	14	14
	F	-	3	2	1	1	7
Grad Cert Cybersecurity	M	-	14	4	30	8	17
	F	-	3	2	10	2	6
Grad Dip Cybersecurity	M	-	1	1	4	1	2
	F	-	3	2	-	1	1
TOTAL	**M**	**-**	**31**	**15**	**57**	**34**	**43**
TOTAL	**F**	**-**	**10**	**7**	**16**	**8**	**24**
GRAND TOTAL			**41**		**73**		**67**

[43] These programs were launched in semester 2, 2020. For further details, see: https://study.uq.edu.au/study-options/programs/master-cyber-security-5257

[44] At the launch of the Master of Cybersecurity in sem. 2 2020, HP Australia offered five scholarships for women enrolled in the program.

5. Phase 2: Interviews on challenges for women in cyber

Phase 2 of our project had the main goal of casting light on the barriers that women experience when entering, and staying in, the cybersecurity profession.

In line with the *exploratory approach* of our project[45], the data collection method adopted for Phase 2 were **semi-structured interviews**. Semi-structured interviews enable researchers to gauge rich, reflective, and context-specific data around participants' experiences; in our case, barriers and challenges typically experienced by women in the cybersecurity profession[46].

Participants in our study were grouped into three categories reflecting a combination of their professional and educational involvement within the cybersecurity industry: **cybersecurity industry professionals** (female, 10), **hiring managers for cybersecurity roles** (male and female, 10) and **university students in cybersecurity** (female, 10), for a total of 30 interviewees (see further details in Table 4 below).

Table 4: Sample for semi-structured interviews (n=30)

	Cyber-professionals (n=10)		Hiring Managers (n=10)		University students (n=10)	
	Job title	Organisation	Job title	Organisation	Year	Program
1	Senior CSOC Specialist	Education & Training	CEO	IT	II	Master
2	Special Counsel	Legal advice firm	Director	Oil & Gas	II	Master
3	Director	Legal advice firm	Senior Consultant	Consulting	I	Master
4	Analyst	Oil & Gas	Director	IT	II	PhD
5	Consultant	Consulting	Senior HR Manager	Consulting	III	PhD
6	Senior Manager	Financial Services	HR Manager	Recruiting agency	I	Master
7	Manager	Education & Training	CISO	Transportation	II	Master
8	CEO	IT	CISO	Government	I	Master
9	Senior Manager	Government	Director	Education & Training	II	PhD
10	Analyst	Consulting	Director	IT	II	Master

[45] Babbie, E. R. (2013). *The practice of social research* (13th ed.). Belmont, Cal: Wadsworth - Cengage Learning.
[46] Marshall, C., & Rossman, G. B. (2011*). Designing qualitative research* (5th ed.). Sage Publications.

Data collected from participants was analysed both inter- and intra-group. **Collective themes** as well as **specific group themes** emerged using this form of analysis. The findings are organised under four headings, starting with the collective findings, followed by the findings of each group of participants. Sub-headings are used to identify the primary themes that emerged within each group of participants.

A summary of the findings is presented in Table 5, with representative, synthetic quotes extracted from the interviews:

Table 5: Synthetic finding themes and representative quotes: barriers to women in cybersecurity

5.1 Collective Themes (across three categories of interviewees)	
Sub-theme	**Quote**
5.1.1 Cybersecurity: a technical profession	"People probably think that women have less technical ability." [Cyber-professional]
5.1.2 Women in cybersecurity: the skills gap and the 'boys club'	"I feel like the difference between other people, so the majority were males and myself, and in terms of competency, they were much more into the field." [Student]
5.1.3 Limited encouragement to enter the cybersecurity industry	"Recruiters will go out of their way to source female candidates, and I guess the issue that they're running up against, is there's not that many to choose from." [Hiring Manager]
5.2 Specific themes: Cybersecurity industry professionals	
5.2.1 Industry's biased perceptions	"I think these biases [have been] embedded for so long that we don't even know how to recognise them well, where and when."
5.2.2 Diversity quotas and positive discrimination	"I don't want to be hired because I'm a woman. I wanted to be hired because I'm good at my job irrespective of…whether I am male or female."
5.2.3 Women versus women	"There are not many females around you, and they almost become representative of the females [in the industry] … You're putting pressure on these very few females…to show you…this role can be done by females."
5.2.4 Stereotypes of "women in cybersecurity'	"quirky", "a bit strange", "not a feminine female", and "very, very strange people, especially those ones that get the really, really technical stuff."
5.2.5 Culture: Workplace, industry, and conferences	"An event by the pool which had women dressed as mermaids and weird stuff."
5.3 Specific themes: Hiring Managers for cybersecurity roles	
5.3.1 Experience and position descriptions: favouring males in cybersecurity	"Females have a better soft skill set and that's why I think you'll tend to find them more in the GRC (*Governance, Risk and Compliance*) sort of space rather the engineering space."
5.3.2 Positive discrimination	"Women that are in the cybersecurity industry at the moment are in a great position where they can pick and choose from roles, which wasn't the case, say, even five years ago."
5.3.3 Role models in cybersecurity: lack of women leaders	"There's probably not enough women at the top to inspire the younger generation to move up."
5.3.4 Industry expectations	"Very costly kind of recruitment agency services to focus on getting those viable female candidates."

5.4 Specific themes: Students of cybersecurity	
5.4.1 Technical cybersecurity studies	“There is a general thinking girls like design.”
5.4.2 Accessing industry experience	“To start, even if I don’t have experience…they are looking for already experienced people…skilled people…I’m not one.”
5.4.3 Pathways into cybersecurity studies	“It’s not that you need to do it [cybersecurity courses] at school, but it’s getting used to the idea that you can do it.”
5.4.4 Perceptions of gender equality in the industry	“But to be honest…I didn’t realise there is a [gender] imbalance.”

5.1 Collective themes

5.1.1 Cybersecurity: A technical profession

A common theme of cybersecurity as a *'technical'* profession emerged across **all participant groups**. All participants groups considered the industry divided starkly between technical and non-technical roles, with the professional participants and student participants frequently self-identifying into one of the two groups.

The strongest views on technicality emerged from **hiring managers** (male and female), who considered those skilled in non-technical aspects of cybersecurity sit outside the core, technical business functions of the cybersecurity industry. Most hiring managers considered that a technical background in cybersecurity is advisable, and that industry participants should accept this position.

All participant groups commonly spoke about the experience and technical requirements expected for entry into the industry. **Students** (female only) shared experiences of struggling to obtain experience in an industry which requires *'two to three years' experience'* for entry level positions. **Professionals** (female only) likewise shared experiences of needing to accept employment in positions for which they were overqualified because of the perception that their experience or technical skills were not sufficient to meet industry expectations.

5.1.2 Women in cybersecurity: The skills gap and the 'boys club'

It was commonly agreed by **all participant groups** that women in cybersecurity are perceived as being non-technical or being technically inferior.

It was common for participants to draw three distinctions between men and women in cybersecurity. First, that men in cybersecurity are technical, and women are generally considered non-technical. Second, that women in cybersecurity have *'soft skills',* whereas men have *'technical'* skills. Third, that men in cybersecurity are in the majority, particularly in leadership positions, and women in cybersecurity are in the minority, holding non-technical, junior positions, with no female leaders to whom to aspire.

Participants had mixed self-identifications as either technical or non-technical. Those participants who identified themselves as technical clearly distinguished themselves from other women in the industry, whom they considered to be non-technical, regardless of their participant group. It was common for technically skilled participants to dissociate themselves from non-technical women in the industry, with some participants considering the prevalence of non-technical women in the industry as negatively impacting the perception of all women in the industry, leading to the stereotype of women in cybersecurity being non-technical.

It was apparent from the experiences shared by the participants that the introduction of *positive discriminatory hiring practices* was ultimately not a solution to the advancement of technically skilled women in the industry, again, because the prevalence of non-technical women in the industry and the stereotype of women as non-technical that follows. Most participants considered that the industry should recruit *the 'best person for the role*'. **Professionals** were most aware of unconscious bias in the selection of the *'best person for the role'.* That is, in a male dominated industry, this is likely to be a male regardless of experience and qualifications.

While it was a common theme across participant groups that the cybersecurity industry is considered a *'boys club',* gender disparity appeared to only impact women in professional practice, or women seeking experience in professional practice.

While **students** of cybersecurity reported being a gender minority, they did not report any overwhelming negative experiences as a result. In comparison, **professionals** reported being directly impacted as a gender minority, including difficulty in obtaining roles, not receiving appropriate acknowledgement or positions based on their technical skills, and being the subject of workplace discrimination (e.g. bullying, harassment).

5.1.3 Limited encouragement to enter the cybersecurity industry

All participants had similar reflections on their experiences with cybersecurity at a school level – it did not exist. Participants were not encouraged at primary or secondary school levels to pursue cybersecurity related degrees, or STEM disciplines. No participants recalled understanding the pathways into cybersecurity before attending university or a professional work environment, except for a minority of participants whose parents were in a similar technical industry.

Participants were almost unanimous in expressing the need for primary and secondary schools to introduce technology studies into their curriculums. Several participants also said that "cybersecurity does not necessarily have to be studied at a school level, but that girls and young women should understand that they can study technical degrees and can enter technical professions". This emphasis on instilling confidence within young women, and breaking gender stereotypes at a young age, was commonly expressed by **hiring managers** and **professionals**.

As to whether the participants were encouraged into the industry, or to stay in the industry, having completed their studies, most participants shared experiences of being dissuaded. Long hours, unfriendly work environments, male-oriented teams and industry conferences, male-driven work cultures and inflexible working conditions were often cited as characterising the cybersecurity industry (with **students** having read literature to this effect).

‘The boys club’

5.2 Specific themes: Cybersecurity industry professionals

5.2.1 Industry's biased perceptions

All participants shared the view that the cybersecurity industry was a *'male-dominated industry'.* Some participants also referred to the industry as a *'boys club'.* Some observed that the number of women in the industry was slowly increasing.

Gender was considered to be a factor in industry hiring decisions, with one participant describing herself as the *"token female"* in her team. Another participant said she was *"the only female in [her] team":*

> *"I always thought people would hire based on your capability…but…I realised gender actually [impacts hiring decisions]."*

One participant considered that there remains a general perception in the industry, and potentially a perception with recruiters, that you require programming qualifications to enter the profession. They said, *"If you're not a programmer, it's going to be impossible for you to get into cybersecurity".* One professional echoed a similar sentiment, reflecting on her experiences that women were not treated as equally competent in the industry as their male counterparts.

> *"…very common that…all technical roles are offered to males and non-technical roles are offered to females."*

One participant shared her experience of being consistently asked by her male manager to undertake work below her skill level and qualifications. She said, *"but you have data centre engineers for that. I'm an […] architect".*

A common experience of male colleagues being promoted above the female participants was also shared:

> *"I just realised that people who used to work with me, and who used to report to me…. now they are in…leadership…and I don't see any exceptional talent with those males."*

As to perceptions about how the industry is dealing with gender disparity, one participant reflected that the industry is generally dismissive of the issue, and is not agitating the matter in any significant, or continuous, manner. One participant shared the example of limited discussions of the topic at cybersecurity conferences:

> *"[Gender imbalance] was a big thing like three years ago, and then people were like 'we spoke about it last year, so we don't need to talk about it again this year [referring to a discussion about gender disparity at a major cybersecurity conference]."*

Summarising the industry's perception of, and action to improve, gender disparity, one participant remarked:

> *"I think these biases [have been] embedded for so long that we don't even know how to recognise them well, where and when."*

5.2.2 Diversity quotas and positive discrimination

While a minority of participants discussed the introduction of diversity quotas in the cybersecurity industry as a positive step *("there are opportunities, because you are female, and there are so few of them [females]")*, most professionals questioned the benefits of quotas and positive discrimination processes. One participant said that, if she were offered a role because of a diversity quota, she *"Wouldn't take the role because would always have imposter syndrome that I wouldn't belong there".* Another participant likened quotas to an insincere box-ticking exercise, saying, *"Just tick the box…. every year they'll hire women…but it's just for the sake of it. They don't mean it".*

Conversely, another participant considered being a woman in the industry to be an advantage: *"Take advantage of the fact that if we need to hire a woman then be that woman".* She also reflected that *"a lot of other industries could actually learn from cybersecurity in terms of the way that it's trying to increase diversity".*

One participant suggested that positive discrimination should be promoted differently. That is, rather than actively seeking women hires, recruiters should seek diversity of thought, regardless of gender.

Some participants were directly opposed to quotas, holding the view that all positions in the cybersecurity industry should be filled based on abilities and skills with no regard to gender. This sentiment was expressed by participants who self-identified as being technical. Several professionals said recruitment should target *"the best person for the job",* with one participant remarking, *"I don't want to be hired because I'm a woman. I wanted to be hired because I'm good at my job irrespective of…whether I am male or female".*

One participant considered the impact of quotas resulted in the appointment of incapable women into cybersecurity roles:

> *"So, what are we talking about – hiring capable women in cybersecurity to meet a quota? Or are we hiring anyone that looks pretty in a camera…. looks pretty in a board and knows how to speak but has no knowledge on cybersecurity…. because then it's not about cybersecurity, it's about meeting any kind of quota."*

Other participants similarly rejected positive discrimination practices: *"I am against positive discrimination because I do believe this is tackling the issue too late in the spectrum".* One participant considered positive discrimination sets women up for failure.

5.2.3 Women versus women

Women who self-identified as technical professionals drew distinctions between themselves and women whom they considered to be non-technical. One participant said, *"I'm a very technical person"* and another, *"I know there were technical females because I was one of them".* One participant drew this distinction between technical and non-technical women by reference to different interests and workplace behaviours:

> *"I don't actually get on very well with a lot of women because I don't understand handbags, stiletto shoes, dresses. I don't understand high emotions and things like that so there's a lot of stereotypical women who are like that and I don't actually understand them. The women I get on with are people like me who are extremely nerdy."*

Some participants considered the lack of women in the industry to have two effects. First, non-technical women have the potential to hamper the reputation of technical women in the industry. Several participants considered fellow women in the industry to lack the technical skills they considered are needed to participate effectively in the industry, and to be recruited into or hold leadership positions despite a lack of technical expertise. Some participants considered this lack of technical skills and experience of women in the industry to be the predominant reason why other women were unable to enter into, or succeed, within the industry:

> *"I recall, there was one incident where one of my colleagues furiously said, 'I wouldn't want to hire a female'. His reasoning was because the previous female that he hired was not good, so he wanted a male."*

> *"There were very few females, and if they were females, they wouldn't last very long and end up crying…. They leave because of the pressure or the expectation of the environment."*

> *"You know, stop blaming the pronouns."*

Second, that the women in the industry were pressured into being representative for all women in the industry. One participant considered technical women bore this responsibility of representation, and that women were required to be more capable, skilled, and qualified than their male counterparts in order to impress and hold equal positions.

> *"There are not many females around you, and they almost become representative of the females [in the industry] … You're putting pressure on these very few females…to show you…this role can be done by females."*

One participant commented that the problem with diversity in cybersecurity is that *"When people talk about diversity in cyber, they only ever talk about women".* Despite acknowledging that the industry is *"definitely a male dominated industry",* that participant considered diversity to be lacking, but not with regards to gender. Another participant agreed that *"diversity comes in many ways"* and reflected that diversity of thought within the industry is more important than simply gender.

5.2.4 Stereotypes of 'women in cybersecurity'

Most professionals considered women in cybersecurity to be stereotyped as non-technical:

> *"Women by default are not technical."*
>
> *"People probably think that women have less technical ability."*

For women in the industry who are considered to be technical or hold technical roles, they were stereotyped as *'quirky',* '*a bit strange', 'not a feminine female',* and *'very, very strange people, especially those ones that get the really, really technical stuff'.*

A participant recalled a conversation with a male colleague, who described her as not *"looking like an IT person"* because *"first of all, [an IT person] is a guy, not a woman".*

Three participants expressed the view that women in cybersecurity were considered *'hard'* or *'tough'.* One participant mentioned that in the industry there is an implicit questioning whether women are tough enough to handle cybersecurity, as, culturally, there is still a perception that women *"are the ones who are to be mothers and look after the children".*

5.2.5 Culture: Workplace, industry, and conferences

A number of participants described the cybersecurity industry as *'inflexible', 'not family friendly',* and *'challenging'*. Participants characterised the industry as having *'long hours', 'urgent',* and *'time consuming'.* One participant said, *"I was surprised by the work culture. It's very demanding".* Several participants described the difficulty women face in having children while working in the industry. For instance:

> *"If you're working on an incident and you are the direct contact to the client, you…get worried about taking a shower for five minutes because you might miss a call. So, it's not conducive for someone that is looking after a small child."*

The domination of cybersecurity leadership positions by males was discussed by a number of participants – *"The senior people are all men".* One participant expressed difficulty in getting visibility at senior levels, believing this to be because cybersecurity hiring practices focus on filling *'token female'* roles in teams.

Several professionals reflected on their workplace catering to a mostly male workforce in terms of team building activities and extra-curricular team events being male orientated. Examples provided by participants included beer drinking, pub tours and cricket games:

> *"Whenever there are team building exercises…. [they] keep it more…. male oriented in things which boys like to do, like cricket."*

This male-centric activity extended to industry conferences. In discussing cybersecurity conferences, all participants considered conferences to be male focused, comprised of mostly male targeted presentation materials, mostly male presenters and panels, male-focussed activities, and almost exclusively male attendees *("ninety percent male and it is uncomfortable").* One participant referred to the overt male focus of conferences as *'comical'* and said, *"Women don't want to rock up to a conference and feel kind of 'uneasy' because they can't see other women in the same room".* Participants provided some examples of male-focussed conference activities such as, *"An event by the pool which had women dressed as mermaids and weird stuff"* and *"The entertainment was…a pirate metal band".*

Another participant explained that she used the absence of females at conferences to her advantage to be appointed to conference panels. She said, *"What has…assisted me in the last five years is being a female and people wanting [me] on panels".*

Reflecting on the culture of the industry, one participant suggested that a two-pronged culture shift was required. First, at a primary and secondary school level – *"Stop bringing up young women to believe they can't do something because they're a woman".* Second, at a professional level – *"What are we doing as a society that makes [women] feel that they might be right for this job".* Another participant commented similarly*, "I think that's how we can tackle the issue, telling young girls that they can do those jobs is better than positive discrimination".*

Hiring trends and gender bias

I recall, there was one incident where one of my colleagues furiously said, “I wouldn’t want to hire a female”. His reasoning was because the previous female that he hired was not good, so he wanted a male.

Cybersecurity professional

5.3 Specific themes: Hiring Managers for cybersecurity roles

5.3.1 Experience and position descriptions: Favouring males in cybersecurity

In reflecting on their expectations of job candidates, all participants considered experience in the industry and technical skills as essential. With these requirements, most participants considered males were more suitable for the cybersecurity roles they advertised because male candidates met the experience and skill requirements. Some participants drew distinctions between subsets of the industry to demonstrate the skillsets they considered matched female candidates. An example was that software engineering might be more suitable to female candidates than cybersecurity. One participant reflected that, particularly for more senior roles, women in the industry generally do not have the necessary experience to fulfil senior or leadership positions:

> *"If you look into higher experience roles, obviously there's going to be less females in the pool than men."*

A few participants considered the way that cybersecurity roles are advertised, and how the industry presents itself to job candidates, is '*male oriented*'. One participant referred to the imagery and the words that are put out by, and used to describe what work is done in, the industry, as being 'male orientated'. One participant directly described the language used in job ads as geared towards men, and as being a product of the responsibilities required of the role being advertised:

> *"In terms of cybersecurity, the language that's used in writing those job ads, just naturally based off the role and responsibilities, is probably always going to be a bit more gendered towards men."*

One participant said that *"Only males tend to respond to the ads that we put out".* It was suggested by another participant that, *"Maybe if we change the job description, we're going to have more diversity".*

On the skill sets of women in cybersecurity, one participant reflected that female candidates had better interview skills than their male counterparts, but only in relation to interviews for *'certain types of roles'* which required *'soft skills':*

> *"Females have a better soft skill set and that's why I think you'll tend to find them more in the GRC sort of space rather the engineering space."*

Discussing soft skills, another participant agreed that women were generally more empathetic. She distinguished stereotypical traits of women from the traits she witnessed (and expected) of women in cybersecurity, which she considered more typically males: *'Harsh exterior',* could be from a *'military background'* and *'a bit less warm and more matter of fact'.* That participant considered that female candidates with *'more male dominated'* backgrounds might be *'seen more favourably'* as candidates.

5.3.2 Positive discrimination

A number of participants shared experiences of actively seeking female candidates in response to job advertisements. Most participants who proactively engaged in positively discriminatory hiring practices reflected that they had to *'pressure'* and *'force'* recruiters to find female candidates. Other participants had to specifically request *'good'* female candidates be sought, as opposed to just female candidates being put forward to meet candidate gender quotas. One participant empathised with the difficulty recruiters were facing in finding female candidates due to a shortage of females in the industry:

> *"Recruiters will go out of their way to source female candidates, and I guess the issue that they're running up against is there's not that many to choose from".*

One participant remarked that for every ten male candidates, there is one female candidate. Recruiters not putting forward female candidates or limiting the number of female candidates was a shared experience by a few participants:

> *"I actually did say to the recruiter, I would like to get females put forwards, but, actually, they didn't provide me too many females".*

One participant was content with the limited number of female candidates being proposed, taking the view that encouraging women into the industry who were not technical, did not *'have their heart in it'* and, *'Who were not really interested in being good at it',* was damaging the industry. That participant considered some women were interested in cybersecurity for the *'prestige and the money'* and that positively discriminating in favour of those women would *'do more damage to the companies'.*

Despite several participants actively engaging in positively discriminatory hiring practices, they also shared that ultimately successful candidates were chosen because they were considered *'the best person for the job'.* One participant confirmed that on one occasion, the best candidate was a female candidate.

One hiring manager reflected positively on the impact of positive discrimination and considered that women in the industry are now in a position to pick and choose roles:

> *"Women that are in the cybersecurity industry at the moment are in a great position where they can pick and choose from roles, which wasn't the case, say, even five years ago."*

Another participant viewed no barriers for women entering the industry, believing that, *"It's just like any industry – if you're good at something, and you're trying hard…. doors will open…. it's not about if you're a male or female".*

5.3.3 Role models in cybersecurity: Lack of women leaders

Some hiring managers reflected on the lack of women in leadership positions in cybersecurity impacting the ability of women to see viable career paths. One termed the *'executive level'* of the cybersecurity industry a *'boys club'* while another reflected on women leaders often facing the assumption that they *'got [to leadership] on the diversity ticket'.*

Some participants expressed the view that there are very few female role models and rare examples of successful women in the industry from whom other women could seek inspiration. One participant also commented on the negligible representation of women at cybersecurity conferences delivering keynote speeches and material on *'core cybersecurity subjects'.*

> *"There's probably not enough women at the top to inspire the younger generation to move up through that as a career option – as a viable career up front."*

Two participants commented on the aspiration of cybersecurity leaders to have prodigies. One participant mentioned prodigies in reference to male leaders, commenting that male leaders in cybersecurity are proactive in mentoring junior males who they consider their prodigies. The other participant noted that the lack of women in leadership roles in cybersecurity means that there are fewer opportunities for women in cyber to be mentees and prodigies of cybersecurity leaders, lacking aspirational figures to emulate in their career development.

5.3.4 Industry expectations

Participants generally considered three factors contributed to the barriers of entry to women into the industry. First, organisations are not ready to accept female candidates. Some participants reflected that hiring organisations held a presumption that quality candidates are those with experience, and that male, not female, candidates have experience. One participant reflected on the readiness of organisations to meet the costs of recruiting talented female candidates, which they suggested was costly:

> *"Very costly kind of recruitment agency services to focus on getting those viable female candidates."*

Others also considered organisations are not ready to meet the perceived flexibility needs of female employees, with organisations in the industry being described as *'not family friendly'* and *'inflexible'* by some participants:

> *"At the end of the day, she ended up withdrawing her application because she was looking for more flexibility than the company was able to give her."*

Other participants described industry expectations that roles were *'24/7'* and that, *"If you've got a young family, it's not the lifestyle you want to live".* The experience and skills gap that is created by women taking maternity leave was seen as negatively impacting the ability of women to succeed in the industry, and for which organisations are not offering appropriate support.

Second, the pool of available talent in the industry is limited, and talented, and most culturally fitting, candidates are predominantly male. Participants said that while discriminatory hiring practices are often encouraged, ultimately positions are filled based on *'the best person for the job',* which included hiring candidates who are *'culturally', 'demographically'* and *'socially'* the right fit for the organisation and team (with some participants acknowledging that the predominance of males in the industry often meant men were seen as better cultural fits for male-based teams). On this point, one participant said that cybersecurity managers need to *"really stand our ground that we need good people. It's not just about men and women".* That participant expressed an issue with the concept of attracting more women to cybersecurity, saying, *"We don't need women, we need good people",* and suggesting that the *'drive for women'* in the industry might be because of social media and questioning whether there is a *"genuine need and…genuine benefit"* to having more women in the industry.

Third, as one participant described *'the biggest challenge of women'* entering and progressing within the industry is other leading women not supporting the next generation of females in the industry:

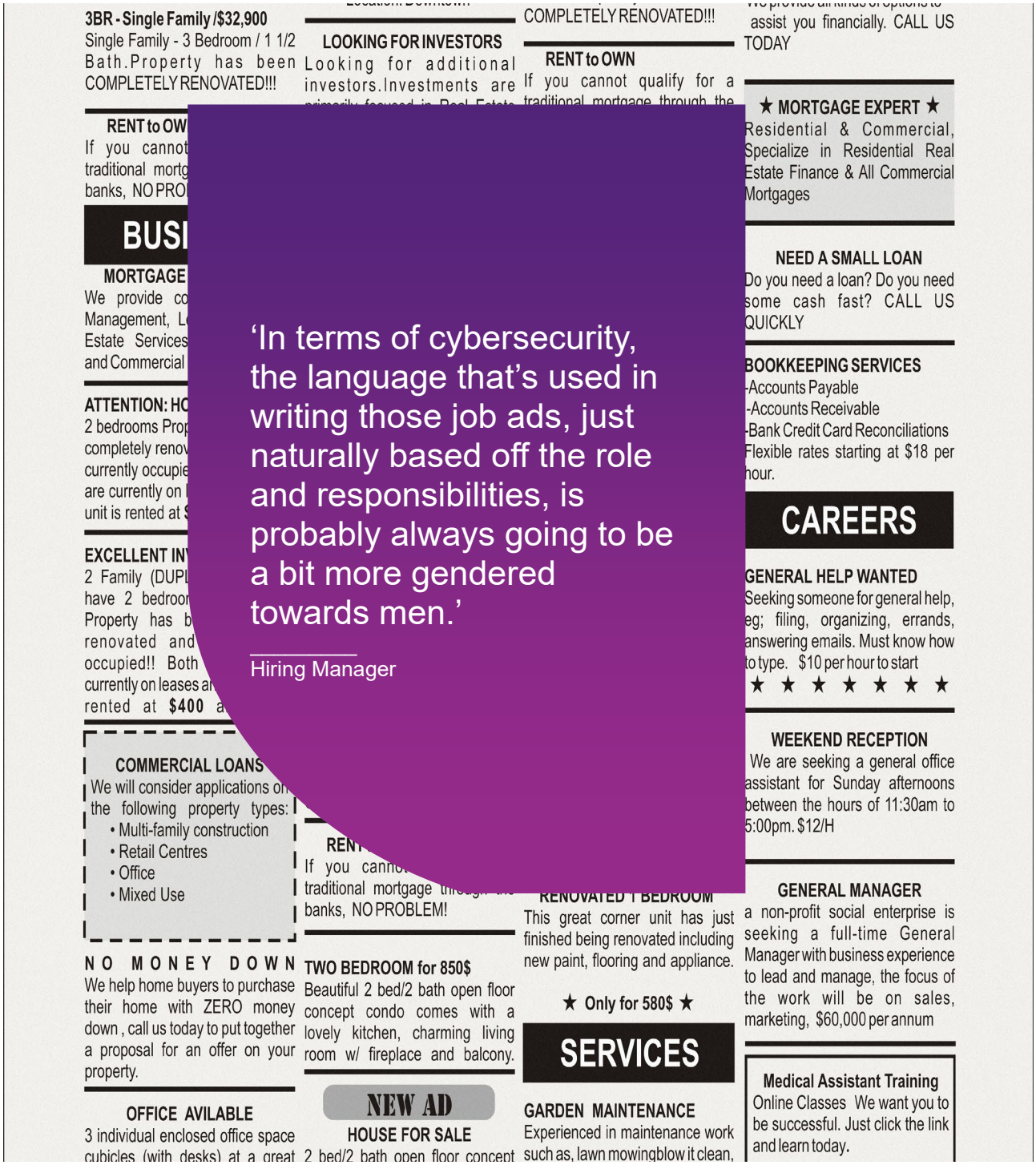
> *"A lot of the leading females you'll see out there, who are very visible and vocal about it, don't help the next generation…. they jump on a trend and a topic to make themselves look better….and that is disruptive and destructive…they're not helping the situation at all…. it's for personal vanity."*

Some hiring managers were more general, and suggested women are themselves the barrier to entering the profession *('women do it to themselves'*), describing women as being *'inherently modest'* and having a *'fear of failure'.* Other participants considered both the amount of non-technical women in the industry, and quotas for women, as damaging technically skilled women from progressing within the industry. One participant reflected on the impact of non-technical women in the industry on technical women:

> *"You get a female candidate…. just because they're female. Not because they have skills. They do a bad job in that company. That company is more likely to reject another female candidate…with a woman, you're more likely to associate that with [gender]. While she's probably not that technical or she's probably, you know, not that good in technicality, [the company will think] we should hire a man next."*

Another participant considered that women with non-technical backgrounds in the industry were *'driving away'* technically skilled women from the industry and *'creating a gender split between men and women'* in cybersecurity. That participant shared observations of technically skilled women attempting to dissociate themselves from other women in the industry, including examples of women discouraging other women from entering the profession.

Job ads jargon



3BR - Single Family /$32,900
Single Family - 3 Bedroom / 1 1/2 Bath.Property has been COMPLETELY RENOVATED!!!

RENT to OW
If you cannot
traditional mortg
banks, NO PRO

BUSI

MORTGAGE
We provide co
Management, L
Estate Services
and Commercial

ATTENTION: HO
2 bedrooms Prop
completely renov
currently occupie
are currently on
unit is rented at $

EXCELLENT IN
2 Family (DUPL
have 2 bedroo
Property has b
renovated and
occupied!! Both
currently on leases a
rented at $400 a

COMMERCIAL LOANS
We will consider applications on
the following property types:
• Multi-family construction
• Retail Centres
• Office
• Mixed Use

NO MONEY DOWN
We help home buyers to purchase their home with ZERO money down , call us today to put together a proposal for an offer on your property.

OFFICE AVILABLE
3 individual enclosed office space
cubicles (with desks) at a great

LOOKING FOR INVESTORS
Looking for additional investors.Investments are

REN
If you canno
traditional mortgage
banks, NO PROBLEM!

TWO BEDROOM for 850$
Beautiful 2 bed/2 bath open floor concept condo comes with a lovely kitchen, charming living room w/ fireplace and balcony.

NEW AD
HOUSE FOR SALE
2 bed/2 bath open floor concept

COMPLETELY RENOVATED!!!

RENT to OWN
If you cannot qualify for a traditional mortgage through the

RENOVATED 1 BEDROOM
This great corner unit has just finished being renovated including new paint, flooring and appliance.

★ Only for 580$ ★

SERVICES

GARDEN MAINTENANCE
Experienced in maintenance work such as, lawn mowingblow it clean,

assist you financially. CALL US TODAY

★ MORTGAGE EXPERT ★
Residential & Commercial, Specialize in Residential Real Estate Finance & All Commercial Mortgages

NEED A SMALL LOAN
Do you need a loan? Do you need some cash fast? CALL US QUICKLY

BOOKKEEPING SERVICES
-Accounts Payable
-Accounts Receivable
-Bank Credit Card Reconciliations
Flexible rates starting at $18 per hour.

CAREERS

GENERAL HELP WANTED
Seeking someone for general help, eg; filing, organizing, errands, answering emails. Must know how to type. $10 per hour to start
★ ★ ★ ★ ★ ★ ★

WEEKEND RECEPTION
We are seeking a general office assistant for Sunday afternoons between the hours of 11:30am to 5:00pm. $12/H

GENERAL MANAGER
a non-profit social enterprise is seeking a full-time General Manager with business experience to lead and manage, the focus of the work will be on sales, marketing, $60,000 per annum

Medical Assistant Training
Online Classes We want you to be successful. Just click the link and learn today.

> ‘In terms of cybersecurity, the language that’s used in writing those job ads, just naturally based off the role and responsibilities, is probably always going to be a bit more gendered towards men.’
>
> Hiring Manager

5.4 Specific themes: Students of cybersecurity

5.4.1 Technical cybersecurity studies

Students described themselves as either technical or non-technical when discussing both their professional and educational backgrounds and their current study course selections. All participants were very clear in identifying themselves into one of these categories without prompting from the researcher:

> *"I know I'm not technical."*
>
> *"And of course, I don't have technical skills."*
>
> *"I'm a very technical person."*

Participants did, however, share varying stereotypes about women in cybersecurity being both technical and non-technical:

> *"Yeah, it's just for technical people."*
>
> *"There is a general thinking, girls like design."*
>
> *"It's very technical and they are game and they know what they're doing. They can easily hack into a system…. I think it's 'Ocean's 12' where she can easily hack back."*

Following from their self-identification as either technical or non-technical, three students then generalised that they consider their fellow male students in their cybersecurity courses to be technical in comparison to themselves and other female students. One participant considered her male counterparts to be more competent than her in the cybersecurity field simply by reference to gender-based interests:

> *"I feel like the difference between other people, so the majority were males and myself, and in terms of competency, they were much more into the field."*
>
> *"So, for the [website] design course you can see like half boys and girls, but for the programming…. you can see all the students waiting outside of the exam room and it's like all boys."*

Another participant suggested that fellow male students simply appear more technically inclined than female students because of social posturing:

> *"There's a lot of posturing…. where it's like, we've done this, so we know what to do, even though perhaps the grade doesn't necessarily reflect how often they come to class…. [there] is a lot of talk about what they can do…but it always is a group of males that hadn't done it before."*

5.4.2 Accessing industry experience

Most students expressed interest in gaining, or having attempted to gain, professional cybersecurity experience during the course of their studies. Of those that had attempted, they expressed great difficulty in gaining experience and entry level positions, with only one participant successfully obtaining a corporate position. A few participants were interested in pursuing academic careers and did not consider previous work experience in the industry or the extent of their technical skills, as an inhibitor to their future career plans. One participant applied for twenty corporate cybersecurity positions and received only one response. Other students described difficulty in obtaining industry experience because the positions being advertised required *'more technical'* skills, which the participants considered they did not have. Participants who expressed interest in pursuing corporate cybersecurity positions after their studies, generally considered recruitment in the industry to be focussed on technical roles.

One participant considered it difficult to gain initial industry experience because of expectations that women need to be more capable than men to obtain the same role:

> *"I do think you see sometimes that people expect females should be more capable than males even though that's probably not a fair expectation."*

A couple of participants commented on the high level of experience requested for entry level cybersecurity positions and rhetorically asked how they would obtain experience in the industry when entry level positions have experience pre-requisites:

> *"To start, even if I don't have experience…they are looking for already experienced people…skilled people…I'm not one."*

5.4.3 Pathways into cybersecurity studies

No student was encouraged during their primary or secondary schooling years to enter the cybersecurity industry. Some participants described their schooling as including *'very basic traditional subject[s]'* and having *'no computer science'.* One participant encouraged her child's school to introduce technology as a subject and was met with resistance – *"policies are not there…lab is not there".*

Most participants commented that primary and secondary schools should be proactive in exposing students to the career options available in the cybersecurity industry, and more broadly, technology related disciplines. One participant said specifically, of exposing female students to the cybersecurity industry, *"It's not that you need to do it [cybersecurity courses] at school, but it's getting used to the idea that you can do it".*

5.4.4 Perceptions of gender equality in the industry

Whilst it was noted by all student participants that as females, they were a gender minority within their course, no student reported experiences of exclusion within their academic cybersecurity courses. One participant identified that she was the only female in her cybersecurity course:

> *"I didn't feel uncomfortable because more, of course, are very hardworking and the boys are very welcoming to the community [of female students]."*

> *"I thought, oh God, I'm the only one [female] in the course."*

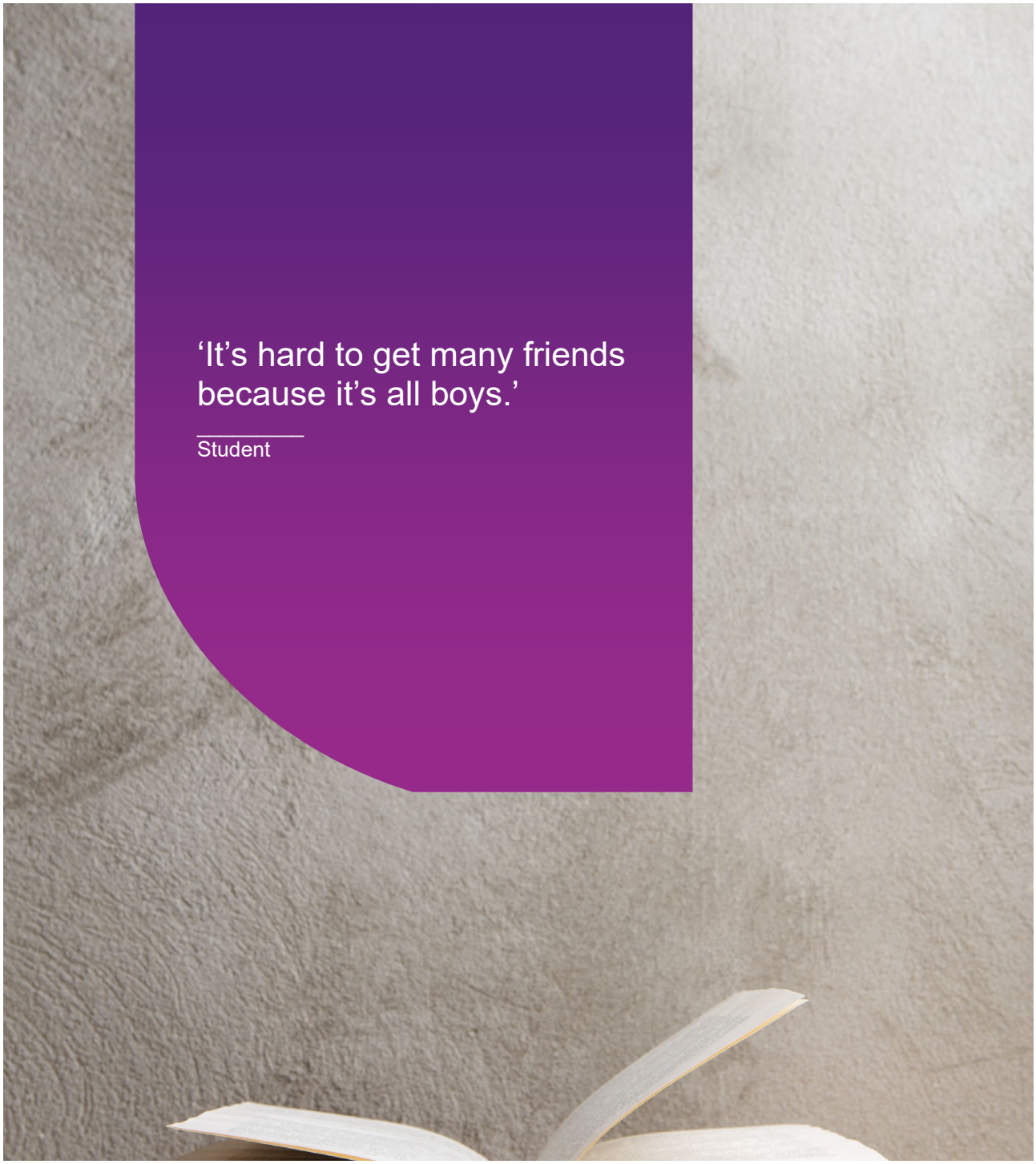
Gender emerged as a factor in students' capacity to make friends with other students (because of the limited number of fellow female students, compounded by the online nature of many of their classes due to COVID-19 restrictions), some perceived shyness in their fellow male students in speaking to fellow female students or because of cultural reasons (one participant described being in a classroom of mainly male counterparts as a 'culturally new experience'). One participant reflected on the effect of not having many female friends in the course as impacting on her ability to share, and discuss, stories and emotions:

> *"It's hard to get many friends because it's all boys."*

When discussing the student participants' views of being a female professional in the cybersecurity industry, no-one had considered the impact gender disparity might have on their career development or ease of access into the industry. Many student participants reflected that their knowledge of gender disparity in the industry stemmed from course assignments on the topic, and had not considered the existence of, or the impact of a gender imbalance, in the workforce. One participant said:

> *"But to be honest…I didn't realise there is a [gender] imbalance."*

Gender imbalance at university



6. Phase 3: Design-led Workshops

The main goal for the last phase of the project was to engage relevant stakeholders in the co-creation of practical solutions to address the challenges highlighted by interviewees as barriers for a growth of female professionals in the cybersecurity industry. Phase 3 of data collection involved two design-led workshops held in November-December 2022 in collaboration with the **Queensland Government Department of Communities, Housing, and Digital Economy (CHDE).**

Design-led workshops are particularly useful for participants in co-creation related to, and exploration of, shared experiences[47]. They support participants in building upon others' responses, creating an environment ripe for collaboration from collective perspectives. Of great benefit to this project, the workshops allowed participants to share and compare their experiences and elaborate on the conversation and ideas shared by other participants[48].

The workshops were exploratory brainstorming sessions; developed based on the findings from Phase 2 of the project. Both workshops had two purposes:

1. To gather **feedback from the participants on the findings** of Phase 2 (semi-structured interviews) and record additional views on barriers to women in cybersecurity;
2. To identify **co-created short-, medium- and long-term solutions** to such barriers.

Participants for the workshops were selected based on their involvement within the cybersecurity industry and/or study in cybersecurity courses. There were 16 female cybersecurity professionals, and three female cybersecurity students. One participant was a director and hiring manager in the cybersecurity industry (male) (see Table 6 below). Some participants (four) also participated in the Phase 2 semi-structured interviews. Workshop 1 had 6 participants, while workshop 2 had 14 participants. Findings are presented here in aggregate form, as the workshops were organised around the same activities and discussion prompts.

Table 6: Participants in the two design-led workshops (n=20)

	Category	Job title (or student year)	Organisation (or student program)
1	Cyber-professional	Senior Manager	Government
2	University student	Third-year student	Master program
3	Cyber-professional	Manager	Government
4	Cyber-professional	Manager	IT and Consulting
5	Cyber-professional	Senior Manager	Government
6	Cyber-professional	Manager	Government
7	Cyber-professional	Senior Manager	Government
8	Hiring manager	Director	IT and Consulting
9	Cyber-professional	Consultant	Consulting
10	Cyber-professional	Manager	Government
11	Cyber-professional	Senior Manager	Government
12	Cyber-professional	GRC Consultant	Consulting
13	Cyber-professional	Manager	Government

[47] Ravtich, S.M. and Carl, N.M. (2021). *Qualitative Research: Bridging the Conceptual, Theoretical and Methodological.* SAGE Publications, Inc.: UK.
[48] Billups, F.D. (2021). *Qualitative data collection tools: Design, development, and applications.* SAGE Publications, Inc.: UK.

14	Cyber-professional	Analyst	IT and Government
15	Cyber-professional	Analyst	IT and Government
16	Cyber-professional	Analyst	Government
17	Cyber-professional	Analyst	Government
18	University student	Second-year student	Master program
19	University student	Third-year student	Master program
20	Cyber-professional	Consultant	Consulting

6.1 Feedback on findings from semi-structured interviews

When presented with findings from semi-structured interviews, workshop participants offered opinions that we aggregated around three key themes (see Table 7 below), with representative quotes from participants included.

Table 7: Synthetic finding themes and representative quotes (design-led workshops)

	Theme	Quote
6.1.1	Cybersecurity has a *woman versus woman* problem	*"Women are happy to help each other at these types of conferences and workshops, but that's about it."*
6.1.2	Women are not seen as technically competent	*"I've been given the administrative tasks as a woman, and not used my actual skills."*
6.1.3	Diversity quotas are misused	*"One woman doesn't work, because she is just there to fill the quota."*

6.1.1 Cybersecurity has a 'woman versus woman' problem

During the workshop discussions, participants shared similar stories of difficulties working with other women in the industry. The difficulties arose at three different levels, and participants overwhelmingly attributed their difficulty in progression within the industry to fellow women in the industry.

First, participants shared stories of female managers and leaders. The workshop groups agreed that it was female leaders who hampered their skill development and career progression. One participant was told by her female manager, *"Stop wasting your time doing technical things".* Another participant reflected:

> *"When women leaders came into the organisation, it is the worst leadership I ever experienced. They put each other down. They don't listen to each other. They are still fighting to keep it [their leadership positions]. Male leaders have been fine, but female leaders are terrible."*

Those participants concluded that the male leadership they had experienced had been generally more supportive and inclusive than female leadership. However, not all participants shared this experience, identifying that leadership training and skills vary greatly between individual leaders and within different organisations and cultures.

Second, the participants reflected on their female colleagues that is, colleagues in comparatively similar positions or roles within their organisation. It is these colleagues that the workshop groups discussed were competitive and critical of each other. Participants shared stories of their female colleagues taking credit for

their work, spreading unsavoury rumours about them, and undermining other women's career progression in lieu of their own. One participant said:

> *"Women versus women is the problem. I've been in the industry for four years, and the only issues I have had is women."*

On discussing the competitive nature of women with other women in the industry, another participant said:

> *"Women think that they have done more work than other women, so don't skip the queue. Wait your turn [to be promoted]."*

Third, the workshop groups reflected generally on women supporting women in the industry. While the participants tended to agree that women are interested in supporting each other generally within the industry by joining industry groups, this does not flow well into the workplace. One participant said, *"Women are happy to help each other at these types of conferences and workshops, but that's about it"* with another participant supporting that view, saying, *"Women are happy to help at the practitioner level, but not in the workplace".* It was a generally accepted view by the workshop groups that women are self-interested and *'too busy trying to be at the top'* to offer any significant ongoing support to other women in the industry.

6.1.2 Women are not seen as technically competent

Supporting findings from Phase 2, the workshop groups shared the view that women in the industry are generally viewed as technically incompetent. Women are considered non-technical and placed in non-technical roles, with one participant considering women were not hired in technical roles because of their low skill levels. Conversely, one participant shared her experience of being tasked with administrative duties, despite her technical capabilities, while another suggested that women would be *"working with all the boys"* if placed in a technical role.

The workshop groups also perceived women as being less confident in their own abilities, with one participant commenting:

> *"Women underestimate their capabilities. Men will just go in whether they are qualified or not."*

This was supported by another participant who suggested that women in the industry view the industry as *"a man's world."* It is this engrained perception that the participants said contributed to women casting themselves in a non-technical light within the industry. One participant said:

> *"Women need to change their mindset. Women are their own worst enemy."*

6.1.3 Diversity quotas are misused

Like participants in the interviews, the workshop groups shared experiences of disingenuous diversity quota use. One participant shared that diversity targets within her organisation were met by filling lower-level positions with women. That participant considered her organisation's behaviour as a misuse of diversity targets. Another participant shared that women had recently joined her team, in an effort by management to fill a quota, and that those women *"do nothing because [they are] there to fill the quota".*

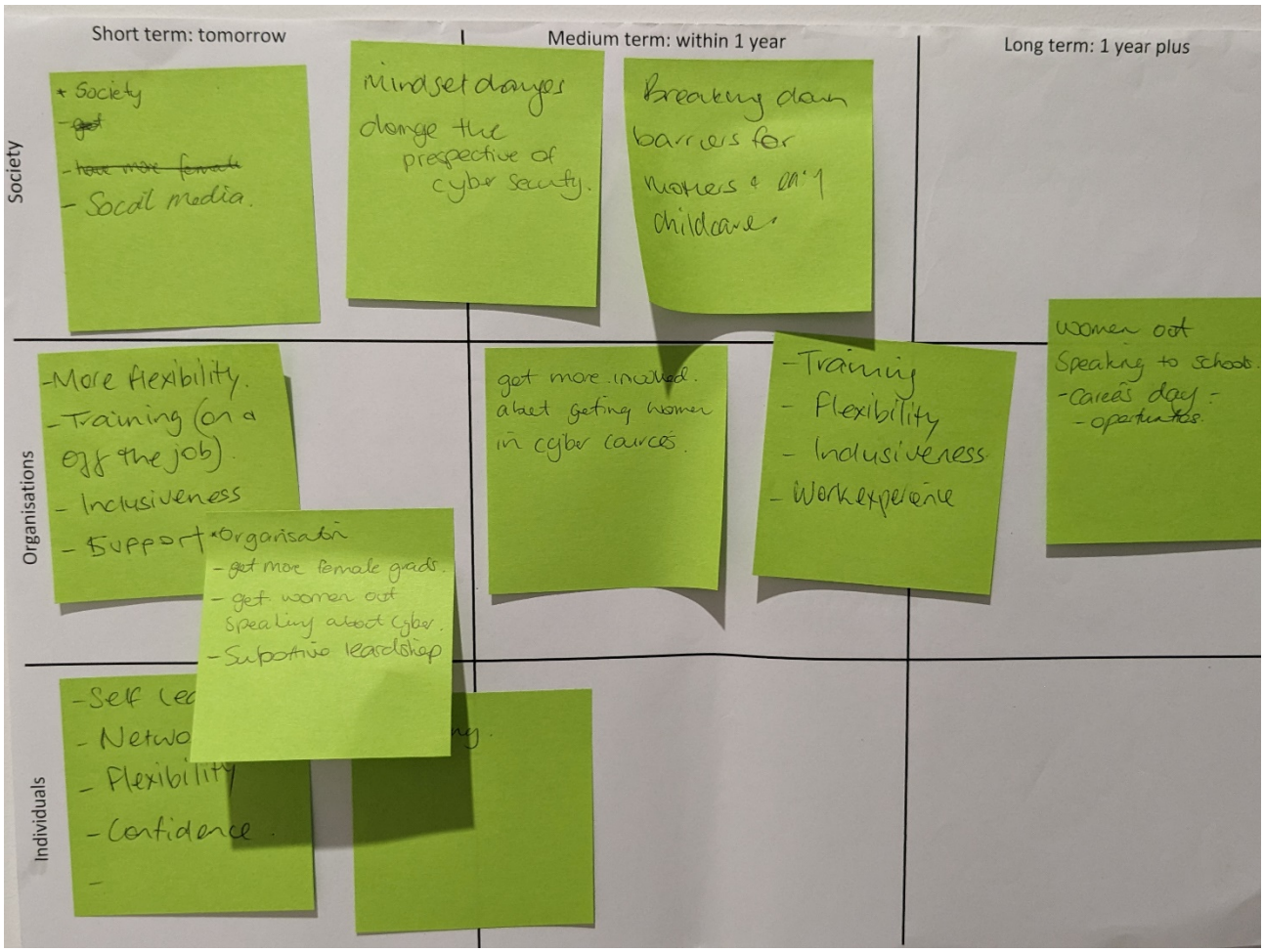
Another participant reflected that, even when diversity is pushed, women are not supported once hired because, *"the expectation is that women will leave to have children".*

No participants were able to share positive experiences with diversity quotas. But rather than being critical of quotas being introduced, they were critical of their respective organisations' use of quotas. The experiences shared by participants are of organisations manipulating quotas for diversity hiring targets, with no support or interest in the retention and development of the women hired.

6.2 Solutions to the challenges faced by women in cybersecurity

In the second part of each workshop, participants were asked to discuss solutions to the challenges women typically experience in cybersecurity. To help framing discussions, a template was given to participants, who were tasked to individually identify solutions based on **timeline for their implementation** (**'Timeline'** ranging from short term, being immediate implementation; medium term, within 1 year; and long term, 1 year plus) and **main constituency in charge** (**'Owners'** ranging from Individuals: the cybersecurity professionals themselves; Organisations: companies and businesses; and Society: government and institutions in charge of systemic changes). The templates were designed based on findings extracted from preliminary analysis of the literature.

Figure 2: Timeline and Owners template completed by a participant



Given the value of individual contributions in this exercise and the different views participants had around their classification along the 'Timeline' and 'Owners' axis, **Appendix A contains all individual templates as completed by participants**.

After individual identification of solutions using the templates, the floor was open for participants to discuss their priority solutions. The ensuing discussion yielded a large quantity of qualitative data, primarily presented by participants according to the 'Timeline' axis. Table 8 illustrates a summary of such data, aggregated around the most recurring themes in the participants' discussion.

Table 8: Summary of solutions to the challenges faced by women in cybersecurity

	Solution
6.2.1	**Short Term Solutions**
	Training for hiring managers
	Women supporting their fellow women in the workplace
	Male advocacy in the home, workplace, and industry
	Self-learning, education, and upskilling by women
	Individual networking by women in the industry
6.2.2	**Medium Term Solutions**
	Positive discrimination hiring practices
	Industry partnerships to build awareness of women in cybersecurity
	Compliance programs for diversity, inclusion, and equity within organisations, including leadership training
	Mentorship programs for women
	Training and development programs for women
	Marketing campaigns for hiring women in cybersecurity
	Targeted research on women in cybersecurity, including gathering and releasing metrics on women in cybersecurity
	Organisations to adopt flexible working arrangements
6.2.3	**Long Term Solutions**
	Education campaigns and programs commencing in primary school for girls
	University program development for technical and non-technical cybersecurity skills
	Industry growth and job creation, including the development of more entry-level positions
	Government policy development and support to address key challenges faced by women in the workforce (for example, day-care availability and costs)
	Reframing cybersecurity as a term and an industry

6.2.1 Short term solutions

In designing short-term solutions, participants identified and focused on individuals participating in the industry, and the actions those individuals could take to encourage and support women in cybersecurity.

Women in cybersecurity

Participants initially focussed on actions women in the industry could take themselves. At a basic level, women should reframe their perceptions of other women in the industry, including their colleagues. Women should actively engage with their colleagues and offer support. Put simply, by one participant:

> *"Learn how to support the woman next to you. Bring them with you, speak to them. Give the woman next to you the chance to speak. Learn to support under-represented groups."*

Participants suggested women themselves should strive to be good role models to other women in the industry. As one participant suggested, women need to be *"honest and transparent"* with their colleagues, while another said, *"We need more women to step up and become models and mentors".* Workshop participants agreed that women in the industry need to foster a culture where women *"have the ability to ask other women for their advice and opinion about what has worked for them in the industry".* This was considered a key solution to the identified challenges of 'women versus women' which participants considered to be a systemic problem within the industry.

Further focusing on women in the industry, participants suggested women need to *'help themselves'.* That is, women need to put themselves forward for training and development opportunities, be proactive in undertaking self-learning and upskilling, be vocal in career progression, and generally advocate for themselves. Participants considered it necessary that women assign responsibility to themselves for progressive change

in the industry and reframe their identity as being technically capable. One participant suggested women need to receive coaching to *"get past their imposter syndrome".*

Along with individual skill development responsibilities, participants suggested women in the industry should be proactive in creating their own professional networks. Participants considered the development of extensive professional networks to be a key solution for women in overcoming the barriers to entry and progression within the industry. Some participants suggested that women utilise networking to gain professional clout by advertising their technical capabilities. This would ultimately advertise the presence of technically capable women in the industry.

Hiring managers

Moving beyond individual solutions focused on women in the industry, participants considered solutions that could be employed by individual hiring managers. Having identified the challenges women face in obtaining roles within the industry, often at the hands of hiring managers, the participants identified the need to train recruiters to *'not discriminate unconsciously'.* In response to some women's lack of confidence in their capabilities, it was suggested hiring managers should also be trained to *'distinguish between a perceived lack of confidence or lack of training'.*

Participants impressed that hiring managers need to take accountability for the ways in which they personally view women in cybersecurity, reflect upon their personal biases, and consider their role in encouraging, promoting, and supporting women into cybersecurity roles.

Men in cybersecurity

'More genuine male advocacy' was considered to be a key solution to the challenges faced by women in cybersecurity. Many participants observed that their male industry colleagues were passive in their support of women in the industry. Participants suggested that *'male champions of change'* need to become more present and common in the industry and that *'men should be part of the solution'.*

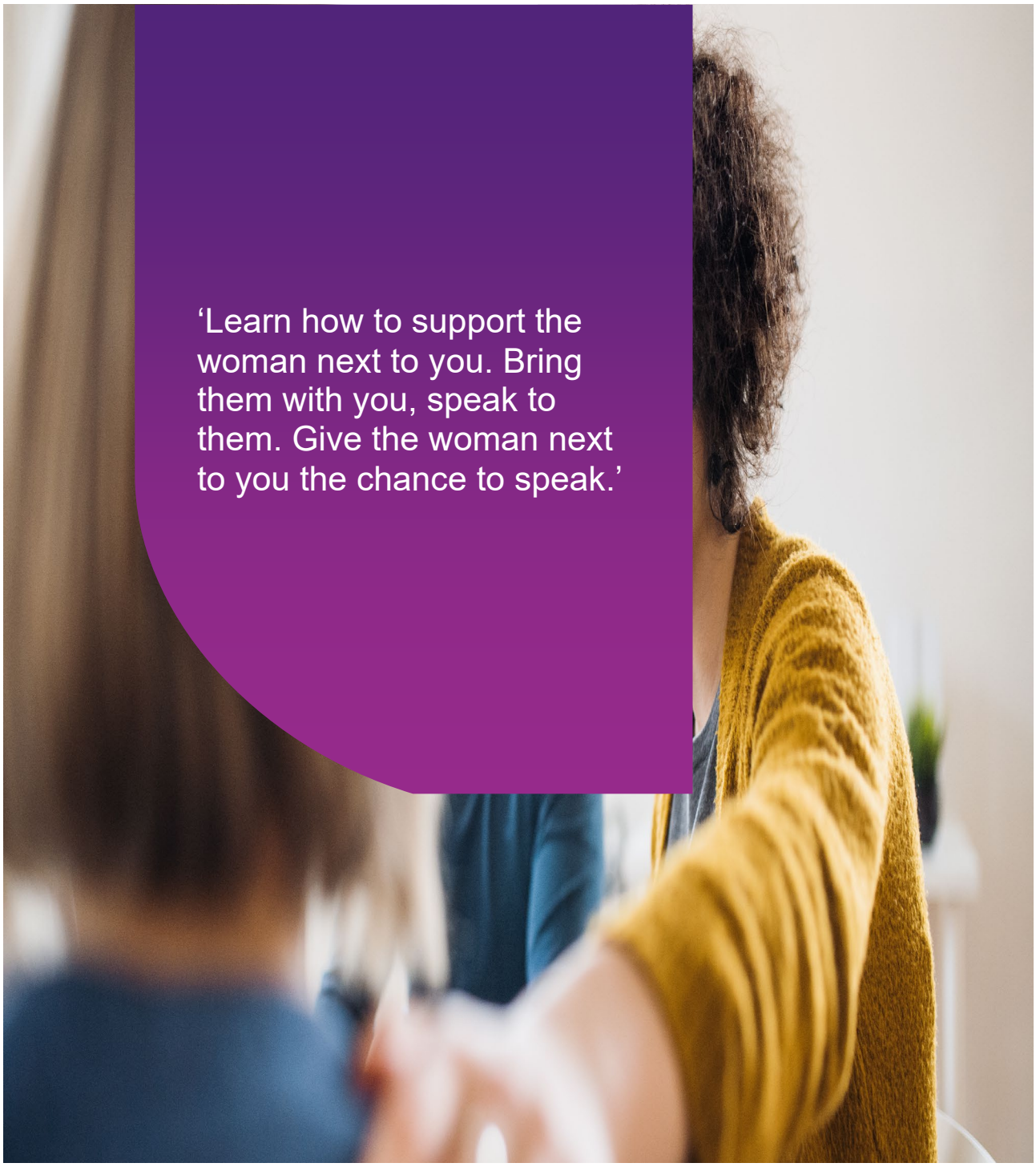
From a skills perspective, male colleagues need to identify and acknowledge the skill set of their female counterparts, and advocate for their inclusion in capability-appropriate work tasks, training and development opportunities and equal career progression. The prevalence of men having *'male prodigies'* or supporting *'male buddies'* in receiving workplace benefits was discussed, with the solution being the self-development and self-reflection of males upon the challenges their industry faces in supporting women. It was considered an important, introverted task, which is necessary for progression within the industry. As one participant suggested *"grown men need to learn to behave in a grown man fashion".*

Participants considered support by male colleagues also needed to focus on the responsibilities of women outside the workplace, such as:

> *"Helping women not to feel guilty about being at work, and not mothering."*
>
> *"Make sure men in the team understand the responsibilities on women to run family life."*

This was considered necessary to adjust the expectations of working mothers in the workplace, and to address what some participants considered to be the ultimate challenge women in the industry face, the '*patriarchy'*.

Women supporting other women



6.2.2 Medium term solutions

In designing medium term solutions, the workshop groups mainly considered actions and initiatives that could be taken at an organisational and industry level to change the attitudes, perception, and support of the industry towards women.

Organisational level

From a hiring perspective, participants considered there are several solutions organisations could implement. First, the way cybersecurity positions are advertised needs to be re-considered. A few participants reflected that, often, it appears cybersecurity job advertisements are written by people with no understanding of the role being advertised. Second, and similarly, interview practices need to be refined as interviewees often have no understanding of the role, or what education or experience in cybersecurity looks like. One participant commented:

> *"Organisations need to stop asking ridiculous things in interviews. Don't ask non-technical position interviewees technical questions."*

Third, despite negative perceptions from several participants towards quotas, it was generally agreed that positive discrimination hiring practices are required for women in cybersecurity to secure roles. Some participants were strong proponents of such practices, viewing the practice as necessary, in combination with other diversity, inclusion and equity programs, to bolster the number of women in the industry.

From a retention perspective, participants suggested that better internal development pathways are needed. Two pathways were suggested. First, internal leadership programs are needed to promote and support women into leadership positions. Whilst these programs do exist in some organisations, participants suggested the programs need to include content, and quotas, that require the development of women in cybersecurity into leadership positions. As part of career progression programs, participants were supportive of internal mentoring programs. Mentoring programs were considered by almost all participants as being necessary regarding the retention and progression of women in the industry.

Second, women need internal pathways into cybersecurity within their organisations. Several participants shared that they had entered cybersecurity mid-career, having interest and transferable skills to gain positions in the industry. It was a shared view between workshop participants that this is a common story among women in the profession. For this reason, internal pathways into cybersecurity roles within an organisation were considered to be beneficial to encouraging more women into the industry. That includes programs deployed by organisations to recognise and reward transferable skill sets, and talent, of women, and to subsequently encourage, support, and foster the development of technical cybersecurity capabilities.

Further, from a retention perspective, participants proposed mandatory management training in empathy and emotional intelligence. This solution is intended to address the challenges women face with unsupportive managers, and the 'boys club' culture, of many cybersecurity teams. The participants considered this 'top-down approach' necessary for cultural changes to support fairness, equity, diversity, and inclusion within organisations at a team level.

Flexible work arrangements were considered to be essential within the industry by participants. Most commonly, those arrangements were discussed in the context of working mothers or the additional roles and responsibilities of women, compared to men, within households. Due to the evolving nature of the cybersecurity industry, it was also considered important that organisations offer flexible work arrangements to encourage women to undertake further study, training or upskilling to pursue cybersecurity positions. Importantly, participants expressed that organisations need to support (not just offer) flexible work arrangements. As one participant commented, *"people need to stop making comments about flexible work arrangements. Women feel guilty about it. Men need to stop commenting on it".*

Industry level

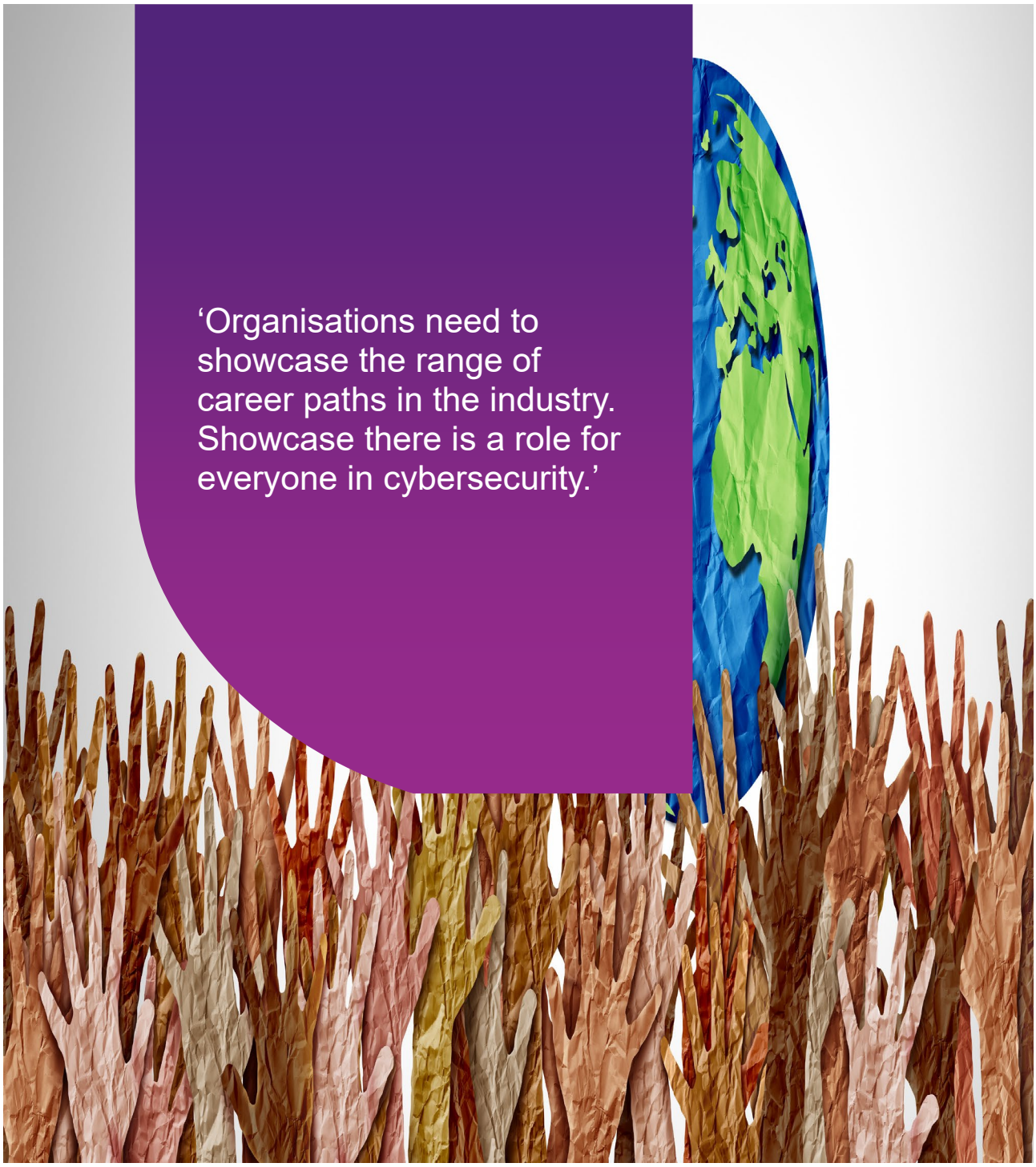
The most common solution proposed by participants were industry-led mentoring programs. Participants wished to see more successful women in the industry participate in mentoring programs, ensuring that those women are visible to other women as a source of both inspiration and aspiration. Participants considered mentoring programs vital to *'building a sense of community in cybersecurity'.*

A solution for the attraction and promotion of women in the industry was industry marketing campaigns. Campaigns were suggested for a range of subjects. First, a campaign to promote women in the industry, such as *'women in the spotlight'* type of promotions. Showcasing and celebrating successful women, and their achievements, in the industry would provide appreciation and recognition to the women showcased, and inspiration for women in, or entering, the industry. It could also serve as a demonstration of the technical skills of women to the industry at large and support more women securing technical presenter roles at industry conferences and events. Second, campaigns targeting diversity in the industry were discussed by participants. It was suggested that diversity campaigns be used to *'change stereotypes of who is good at IT'* and to *'make men stop considering women as a threat in cyber'.* Third, participants considered women would benefit from an industry campaign that *'showcases the range of career paths in the industry. Showcase there is a role for everyone in cyber'.* One participant suggested that, to encourage women into cybersecurity, the industry should reframe itself *"away from being seen as an IT thing. Cyber is a business risk".*

Of particular interest to the participants was the potential solution for more *'women-only'* cybersecurity events. Networking events, technology forums and working groups for women were discussed as being necessary within the industry to create a comfortable space for women. Online attendance options for these events were also discussed to enable working mothers to attend after business hours.

Industry partnerships, particularly with universities and the education sector, were considered vital to ensuring women in the industry have access to training and development opportunities. Participants also discussed the benefits of research into women in the industry, as a means of promoting and upskilling women and highlighting diversity and equity challenges that need resolving.

A role for everyone in cybersecurity



6.2.3 Long term solutions

In identifying long term solutions, participants reflected on high level industry, government, and societal changes to support significant and sustained changes within the cybersecurity industry for the betterment and inclusion of women.

Schooling and education

Participants discussed curriculum changes to the primary school education system as necessary to change the participation and perception of women in cybersecurity. It was suggested girls be introduced to information and data logic structures during primary school years, and taught thought processes that are conducive to careers in STEM, such as analytical thinking and critical problem solving. Other participants suggested students be taught about data privacy and social media, laying the foundations for students to understand, and become interested in, data and cybersecurity.

Looking beyond purely academic changes to curriculum, the workshop groups advocated for confidence building exercises in young girls, particularly in relation to their ability to develop skills and capabilities in STEM. Identifying STEM careers as achievable and desirable to young girls, teens, and young women, should be pursued as a solution to encourage confidence and interest in the industry.

Participants also reflected upon the way tasks and occupations are discussed with young girls, often with reference to stereotypical gender roles. Participants suggested tasks and occupations be referred to in gender neutral terms, so as not to dissuade young girls from certain subjects and career aspirations.

Moving onto high school education, participants identified these schooling years as a significant contributor to the skills gap in the development of technical skills between men and women in the industry. One participant summarised the situation as:

> *"The skills gap needs to be addressed. Women are mostly non-technical and males are mostly technical. It is a cycle. We need to go back to high school and encourage children. Technology needs to be better designed and incorporated into high school. STEM should be studied on a weekly basis. There is no interest in STEM building in female high school students. Schools should focus on encouraging women in STEM and building interest."*

Looking to university level education, the participants were supportive of universities creating new cybersecurity courses and programs which offer education in both technical and non-technical cybersecurity capabilities. The participants considered this would encourage more mid-career women into cybersecurity courses to upskill and transfer into the industry.

Government

The workshop groups considered government intervention necessary to address some of the wider, systemic challenges faced by women in cybersecurity. Government support for working mothers was considered important and requiring reform (such as the availability and costs of day care or other childcare arrangements and maternity leave benefits). Policy development addressing the challenges faced by women in the workforce was discussed at a high level (such as skills training for women re-entering the workforce, quotas for women in male dominated industries, and workplace harassment and discrimination actions). Equal pay was also discussed in reference to inequality in the cybersecurity industry, and more broadly as a discrimination within Australian workplaces. While these solutions are high-level, participants considered them essential to improve the industry.

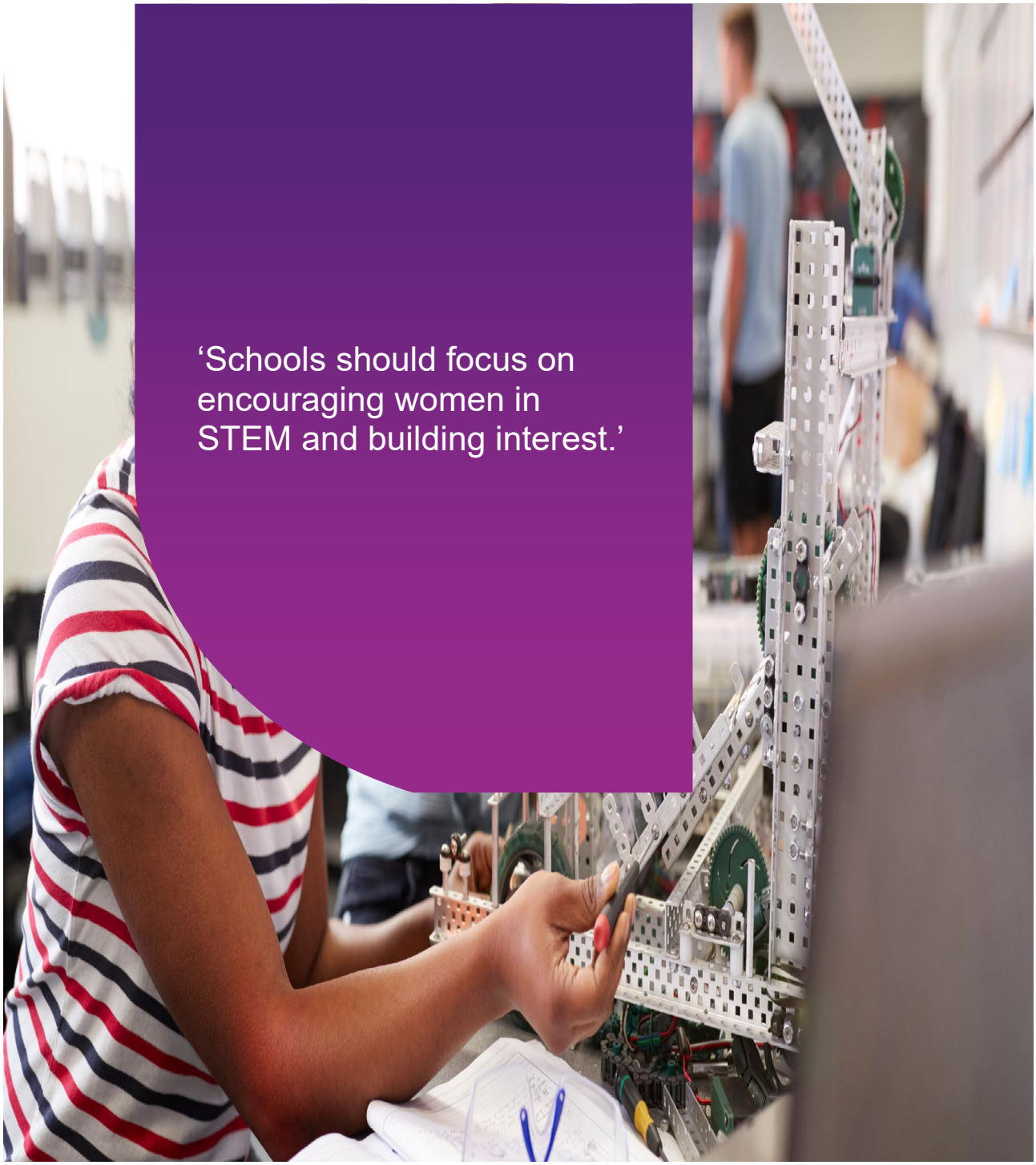
At a similarly high level, participants identified the need for more entry level positions in cybersecurity for women. At a macro-economic level, government employment and workforce planning were identified as necessary to grow the Australian cybersecurity industry and domestic skill level.

Industry

Looking for long-term change within the industry, the participants suggested that ‘cybersecurity’ needs to be reframed within society, and the mindset of people within the industry needs to be changed. As one participant said *“we need to demystify cybersecurity. People are scared by cybersecurity”.* Another followed with *“we need to define cybersecurity as different from IT”*. Moving forward with these views, participants went on to suggest the industry needs to change its view of ‘non-technical' cybersecurity work. The solution suggested was:

> *“We need to change titles and narratives in our industry. We need to dissociate non-technical descriptions from women and consider unisex titles. We need to stop referring to cybersecurity as two streams [technical and non-technical]. It should just be cybersecurity. Remove the division within ourselves.”*

Girls and STEM



7. Final recommendations

In synthesis, the following recommendations can be extracted from the project. They refer to actions that can be taken at the **individual**, **societal**, and **organisational** levels.

Genuine male advocacy

Self-learning, training, and upskilling

Focus on networking with female professionals in the industry

Volunteer to be mentors for other women

Individual Level

Societal Level

Education campaigns for women in STEM and cyber (primary school)

Increase of entry-level roles in cybersecurity

Improvement of education offerings in non-technical cybersecurity (higher ed)

Reframing of cybersecurity as a term and an industry

Policy development for women in cyber (e.g. day care support etc.)

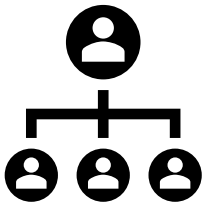
Organisational Level

Female-friendly job descriptions for cybersecurity (HR)

Enhanced flexibility of work arrangements (e.g. WFH, leave, etc.)

Discrimination/bias training for hiring managers

Internal mentorship programs for women in cybersecurity



HR marketing campaigns targeted to women in cybersecurity

Compliance programs on diversity, inclusion, and equity

Carefully crafted practices of positive discrimination

Cross-industry initiatives for women in cyber awareness

Leadership development programs for women in cyber

8. Conclusion

The project *'**Women in Cyber'*** identified common themes of challenges faced by women in the cybersecurity industry, irrespective of professional or career stage. In particular, the prevalent **'boys club' mentality**, the **scrutiny of women's technical skills**, **barriers to gaining experience** (including entry level positions with excessive experience requirements), and the **lack of female leader role models** were identified as significant contributors to the under-representation of women in the cybersecurity profession.

When considering how to address the challenges faced by women in the industry, the introduction of **diversity quotas and positive discrimination** practices were generally dismissed. The emphasis those solutions placed on gender, rather than skills, were seen by professional participants as limiting the identification and acknowledgment of women in the industry who possess technical skills and significant experience. This **divide between women with technical and non-technical skills** in cybersecurity was a recurring theme across the findings, and a clear challenge needing resolution.

Identifying avenues to resolve these barriers faced by women entering, and progressing within, the cybersecurity industry was addressed in the last phase of this project. It involved an exploration into the redesign of the profession in a way that supports women in the industry.

Using design-led workshops focusing on collaboration, problem solving and critical thinking activities, short-, medium- and long-term **solutions** were developed by participants with lived experiences in the industry and a passion for problem-solving. Practical solutions such as **women supporting other women** in the industry, **unconscious bias training** of hiring managers and leadership, **training and development programs for women** to up-skill in cybersecurity and **flexible working arrangements** were suggested. As were more macro solutions, such as **introducing young girls to data and security curriculum early** and creating **policies that support working mothers**.

Those solutions now require the support of women within the industry, their organisations, and the government. As identified, attracting, and retaining women in cybersecurity is a complex matter, involving historical societal norms which affect professional women more generally, but complexity should not excuse progress.

Acknowledgement

We acknowledge the significant contribution of the participants to this project and thank them for their time and insight. They dedicated time to participate in interviews and design-led workshops with the researchers. They shared their lived experiences, educational and career journeys and knowledge, personal stories from their time in the cybersecurity industry, and thoughts about the future of the industry, including the attraction and retention of women. They also engaged in critical thinking exercises, sharing their ideas for developing and supporting women in cybersecurity.

We acknowledge the collaboration and support of the Queensland Government Department of Communities, Housing, and Digital Economy to facilitate the design-led workshops.

We also acknowledge funding from the University of Queensland Business, Economics, and Law Faculty support scheme for 2021-2022 for this project.

The research presented in this report has obtained ethical clearance by the University of Queensland (2021/HE001922).

Appendix A: Templates and solutions from Phase 2 (Design-led Workshops)[49]

Participant A	Short term: tomorrow	Medium term: within 1 year	Long term: 1 year+
Society	-Influence through social media	- Mindset change around cybersecurity - Support to break down barriers (e.g. childcare support)	
Organisations	- More flexibility - Training on the job - Inclusiveness - Supportive leadership - More female graduates - Facilitate public speaking by women in cyber	- Organisational programmes - Better training options - Building work experience	- Women in cyber speaking to schools - Female-oriented career days
Individual	- Self-learning - Networking - Flexibility - Confidence-building		

Participant B	Short term: tomorrow	Medium term: within 1 year	Long term: 1 year+
Society	- Hooded black hackers – make them female! - Phishing models at school: embed into society early - Teach more: social media to encourage less shaming in teens; biometrics	- Encourage school teachers to have work experience in cyber-space - Aim for age: year 10-12	- Helping to support breaking 'mothering guilt': it's OK to feel guilt
Organisations	- More genuine male advocacy - More working from home and childcare support	- Equal salaries! - Aim for neurodiverse target audience	
Individual	- More genuine 'women for women' support (not just face value)	- Encourage other women from 'soft skills' to develop 'hard skills'	- Breaking down 'imposter syndrome'

Participant C	Short term: tomorrow	Medium term: within 1 year	Long term: 1 year+
Society	- Design programmes for cyber-role models - Initiatives for kids	- Showcase cyber as an exciting career for women - Create communities for speaking opportunities for women in cyber - Cross-pollinate initiatives with LGBTQ communities	- More partnerships across industries to support women in cyber - Gender awareness initiatives
Organisations	- Hire for aptitude and enthusiasm	- Prioritise mentoring to support women in cyber	- Compliance programs for diversity and inclusion

[49] In random order. Please note several participants worked together on one template.

	- Teach men how to support female colleagues in a professional environment	- Sponsorship programs for foreigners - Diversity-inclusion-equity programs implemented on onboarding and in corporate strategy	- Grow the next generation of leaders with empathy
Individual	- Be a positive role model - Be brave and call out bad behaviours - Walk the talk for change - Men to learn how to support women in a group setting		- Life-long learning - Never too old or too young to move to cyber

Participant D	**Short term: tomorrow**	**Medium term: within 1 year**	**Long term: 1 year+**
Society	- Women helping women (no catfight) - Don't sugar-coat women: cyber is stressful!	- Start early to promote the industry to younger generations - Promote stories of women in cyber publicly (e.g. news)	- Tech is often just solving problems in an organised way: promote this to avoid stigma put on women in tech
Organisations	- Rely on line managers to draft job descriptions (HR does not know about cyber) - Team events: make them appealing to all! - Story-telling initiatives about successful women in cyber	- Training for interviews (e.g. confidence building; enthusiasm; empathy) - Improve policies around women's personal lives - Interviewee quotas: must consider equal numbers in all genders	- Be ambitious about hiring goals - More leadership training for women (e.g.Toastmasters)
Individual		- Acquire technical and non-tech skills to build confidence - Networking - Confirm that there is no skill imbalance in your mind	

Participant E	**Short term: tomorrow**	**Medium term: within 1 year**	**Long term: 1 year+**
Society		- Cyber training for teachers - Promote change of view around what a cyber profession looks like - Addressing parents' role into talking to children differently based on gender (e.g. 'jobs for men' and 'for women')	- Encourage girls to undertake practical tasks - More paternity leave for men - Training school teachers not to promote gender-based conversations
Organisations	- Encourage management to look at variety of competencies - Promote managerial change of view: until a team has a woman they	- Training for male managers to raise awareness around women's challenges in cyber	- Universities to encourage multidisciplinary courses in cybersecurity (tech and non-tech) - More entry-level positions for women

	don't realise the benefits of this	- Change in workplace culture - Increased workplace flexibility to allow for personal commitments (e.g. kids pick-ups/drop-offs; WFH)	- More workplace programs with a focus on women (e.g. temp secondments)
Individual	- Women uplifting each other and looking after each other - Improving self-esteem - Women individually starting positive talk - Shape internal biases through confronting personal views		

Participant F	**Short term: tomorrow**	**Medium term: within 1 year**	**Long term: 1 year+**
Society	- Support for female students in cybersecurity	- Promote infosec as a viable career path for seniors	- Promote logical thinking for women in schools - Help female students in schools build their confidence in being able to excel in maths, and STEM subjects in general
Organisations	- Stop asking technical questions in job interviews for non-tech roles	- Improve transition opportunities for women from IT, compliance, into infosec	- Provide extra support to women in cyber courses at university - Introduce VET courses in various aspects of cybersecurity (Cert III, IV, Dip and Adv Dip levels)
Individual	- Individual support for women to cyber	- Advocacy – Male champions of change	- Develop mentoring skills for women in cyber

Participant G	**Short term: tomorrow**	**Medium term: within 1 year**	**Long term: 1 year+**
Society	- Equal representation in cybersecurity initiatives		- Build awareness on pathways in cyber careers
Organisations	- Develop networking opportunities (connect with role models)	- Supportive management (e.g. training, awareness, culture) - Improve WFH flexibility	
Individual	- Nurture upskilling opportunities		

Participant H	**Short term: tomorrow**	**Medium term: within 1 year**	**Long term: 1 year+**
Society			- Educate about unconscious bias - Promote neurodiversity

			- Involve more men in solution design - Education in sector through targeted conferences, presentations, sessions
Organisations	- Networking for women - Build women in cyber communities through social media - Dedicated mentoring/coaching	- Positive discrimination - Flexible work arrangements	
Individual		- Seek opportunities to develop tech skills	

Participant I	**Short term: tomorrow**	**Medium term: within 1 year**	**Long term: 1 year +**
Society		- Promote STEM with girls in primary school	- Smash the patriarchy! - Address gender stereotyping and gender socialisation/norms
Organisations	- Commitment to diversity in organisational structure, industry events (e.g. 'diversity check') - Promote transferable skills as core competencies through coaching in right labour market - Dispel the jargon - Mindset change about cyber: it's not just IT - Showcase variety of careers in cyber	- HR strategies: quotas, blind recruitment, gender-check in job descriptions - Showcase cyber-career pathways and attract diverse talent	- Industry-university collaboration to facilitate women into cyber - More women in technology leadership roles (e.g. Australian Minister for Cybersecurity)
Individual	- Be aware of unconscious bias and challenge yourself		

Participant J	**Short term: tomorrow**	**Medium term: within 1 year**	**Long term: 1 year+**
Society	- Grown men to behave like grown men - Awareness by parents on gender roles and stereotypes		- Change the biased view of women being non-technical
Organisations	- Champion existing women in cyber to be a voice in the sector - Mentoring programs for female graduates	- Flexible work arrangements in all sectors - Rely more on online community working groups (e.g. WFH)	- In third-level education, feature more gender diversity in advertisements - More tech courses in secondary school - More tech classes for girls only to build confidence
Individual	- Women's working groups	- If there is no scene, create the scene	

Participant K	Short term: tomorrow	Medium term: within 1 year	Long term: 1 year+
Society	- Give women a voice to learn STEM	- Encourage development of skills and attitude in young people	- Promote diversity to reverse stereotyping of who is good at cyber
Organisations	- Revise expectations and timelines for career shifts	- Promote mentoring	- Positive discrimination and associated metrics
Individual	- Job skills training (e.g. practical coaching)	- Engage in mentoring - Networking (events)	

Participant L	Short term: tomorrow	Medium term: within 1 year	Long term: 1 year+
Society	- Celebrate achievements by women in cyber - Promote research on barriers for women in cyber	- Promote female-only tech forums - Better marketing campaigns for women in cyber (e.g. Australian Army campaigns)	- Elevate female cyber leaders (articles, blogs, events)
Organisations	- Encourage women internally to consider a career change to cyber	- Women mentoring women programs - Women only events (e.g. hackathons, red teaming, white hats)	- Set ambitious KPIs for diversity hiring
Individual	- Multiply job applications (even if you don't have the skills)	- Seek out other women in cyber for advice	- Women supporting women (instead of projecting roadblocks)

Participant M	Short term: tomorrow	Medium term: within 1 year	Long term: 1 year+
Society		- Campaigns of women role in life and community (men to accept change)	- More equal rights for men and women (family and support) - More modern thinking
Organisations	- Equal recruitment practices	- Support career development for women in cyber - Simplify job applications	- Set clear career paths
Individual	- Talk/support at least one woman to achieve her goal	- Ongoing support in mentoring	- No division between technical and non-technical roles

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Contact details:

Dr Ivano Bongiovanni
T 07 3443 1210
E i.bongiovanni@uq.edu.au
W uq.edu.au

CRICOS Provider 00025B | TEQSA PRV12080