Advancing APEC Women in STEM - Challenges, Good Practices, and Recommendations

Prepared for the APEC Business Advisory Council (ABAC)

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Acronyms

ABAC	APEC Business Advisory Council
AI	Artificial Intelligence
APEC	Asia Pacific Economic Community
ASEAN	Association of Southeast Asian Nations
CEO	Chief Executive Officer
CFO	Chief Financial Officer
DEI	Diversity, Equity, and Inclusion
DJSI	Dow Jones Sustainability Indices
ESG	Environmental, Social and Governance
GEM	Global Entrepreneurship Monitor
ICT	Information and communication technology
ILO	International Labour Organisation
OECD	Organization for Economic Cooperation and Development
PISA	Program for International Student Assessment
PPWE	Policy Partnership for Women in the Economy
RAP	Reconciliation Action Plan
SOM	Senior Official Meetings
STEM	science, technology, engineering, and mathematics
UNESCO	United Nations Educational, Scientific and Cultural Organization
WEF	World Economic Forum
WGEA	Australia Workplace Gender Equality Agency
WIPO	World Intellectual Property Organization
WIT	Women in Technology

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Acknowledgements

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ABAC to please insert their standard disclaimer.

Executive Summary

The APEC Business Advisory Council (ABAC) has commissioned this report to provide an overview of the current status of women in STEM in APEC economies, highlight good practices in the corporate, public and non-profit sectors to attract, retain, and promote women with STEM skills, and provide recommendations for APEC governments as they implement the APEC Women in STEM Principles and Actions. This work supports the APEC Women in STEM Principles and Actions (2019) and the La Serena Roadmap for Women and Inclusive Growth (Key Action Area D). Findings are summarized below for each stage of the Women in STEM "pipeline." Data is derived from a literature review, new aggregated data provided by LinkedIn especially for this report, and interviews with ABAC members.

Education. Research on women in STEM consistently identifies the middle school years as the point at which girls begin to demonstrate diminished interest in math and science disciplines. Objective measures of math and science aptitude do not show significant differences between 15-year-old girls and boys. Girls' lack of interest is linked instead to bias and gender stereotypes in the family and in schools about what pursuits are deemed suitable for girls. Emphasis on STEM in the curriculum, female role models, mentorship opportunities, and female teachers in STEM subjects have been found to increase the share of girls selecting STEM subjects in high schools and university.

While little data is available on STEM vocational training, the number of women enrolling in STEM fields in university is increasing over time. There is a strong bifurcation seen by field: biological and life sciences, particularly health-related degrees, have much higher female participation rates (avg. 30-35% across APEC economies with data) than more math-based disciplines. Female share of enrolment in engineering and information technology degrees is particularly low (approximately 20-25%). This divergence has been evident for at least a decade and does not appear to be improving significantly. Interestingly, some Southeast Asian members of APEC appear to have more gender equitable education results than some of the larger APEC economies.

Workforce. LinkedIn data finds that women with STEM degrees do not go into STEM employment at the same rate as men, with a roughly 6-8 point drop off in the first year after graduation. According to ILO data, women make up 41% of the STEM workforce, including the health sector. Consistent with areas of study, women tend to be clustered in the health care and life sciences sectors and under-represented in technology and engineering, where they make up only 25% of workers on average. This underscores the importance of considering sector when examining women's participation in STEM. Women also tend to be under-represented in the private sector and instead are concentrated in academia and public research institutions. The share of female researchers is 38% across APEC (increasing to 45% for ASEAN members of APEC). This concentration in the not-for-profit sector contributes to the fact that women earn less than men in STEM jobs. However, even controlling for this, women are found to earn less, on average, than men in STEM jobs. A handful of APEC economies, including Australia and the U.S., are requiring larger companies to report on their gender wage gap and the prevalence of women at various levels of seniority.

For women who do go into STEM employment after university, childbearing years are correlated with women leaving the workforce, as is true for other professions. Research on whether women are more likely to drop out then for other professions is not conclusive but it appears that that women are more likely to leave male dominated workplaces, which may apply to STEM careers. Dropout rates are particularly high in the technology sector, where creating a gender-equitable organizational culture is

found to be key to improving retention rates. Consistent with women's economic participation across the economy, the higher the level of seniority, the smaller the proportion of women. This is true even in sectors such as health care, where women now predominate, indicating that prevalence is insufficient to reach gender parity in positions of power.

Efforts by companies to increase the number and seniority of women in their workforce include: partnerships with educational institutions to promote STEM careers and encourage girls to pursue STEM higher education; work to enlarge recruiting pools and applying Artificial Intelligence to reduce bias in hiring processes; forming Diversity Committees at the Executive Committee level, and issuing Diversity & Inclusion policies that are monitored by internal audit and/or third-parties as part of ESG commitments; implementing programs to support women employees from diverse backgrounds including mentoring, sponsorship, and employee experience research and support groups for minority groups; implicit bias training for managers and linking performance in promoting women to annual bonuses; providing flexible work conditions and generous benefits; offering paternal as well as maternal leave so that women are not perceived as more expensive or more likely to take time off; conducting compensation and benefit audits to ensure women and men are receiving equal pay for equal work; and setting targets for the proportion of women managers and female representation on their Boards. Companies in traditionally male-dominated sectors, such as energy, construction, and defense, are taking extra steps such as making it explicit that all job categories are open to women (including hardship and remote posts) and developing personal protective equipment (PPE) that is suitable for women.

Entrepreneurship. Female researchers and founders receive less financing for their ideas and research than male counterparts. Several APEC economies are setting targets to improve gender equity in the award of public research funds. Other measures to support female researchers include grants for research assistants, anonymized grant applications, and rules allowing public funding to be withdrawn from laboratories with proven cases of sexual harassment. Among technology startups, the incidence of female founders, and the funding they receive, is extremely limited - well under 10% - although this issue requires more research outside of the U.S. The number of women obtaining international patent protection is showing slow but steady progress over the last two decades, now reaching an average of 20% of international patent applications across 17 economies (with non-OECD or recent OECD members having a higher percentage). There is extremely limited data on women-owned SMEs in STEM across the region.

Enabling Environment. The ability of women in STEM to grow their careers are affected by the same factors that impact women's paid labor generally; these include issues of work life balance, the cost and availability of dependent care, and gendered expectations around the care economy. Violence against women is another cross-cutting issue impacting women in STEM, with reportedly high incidence of gender-based violence for female STEM students and workers. Governments have an important role to play in issuing laws to protect women against unequal treatment and penalize gender-based violence.

Overall, APEC economies have made progress to increase women's representation in STEM since the 2017 Women in STEM Framework, but much remains to be done. The evidence shows that interventions in early education, particularly encouraging girls to pursue math and science courses in middle and high school, are critical to ensuring enough girls are entering the pipeline to achieve more equal representation at later points of the career path. Among STEM fields, emphasis must clearly be placed on improving girls' interest in engineering and computer sciences, where women lag most significantly in almost all economies. Recommendations in each of the areas above are provided in Chapter VI.

I. Introduction

Over the last decade, gender disparities in the economy have received growing attention from APEC governments and the private sector. The APEC Putrajaya Vision 2040 envisages "strong, balanced, secure, sustainable, and inclusive growth as a key economic driver towards achieving an open, dynamic, resilient, and peaceful Asia-Pacific community by 2040, with prosperity for all its people and future generations. The Vision commits APEC Leaders to pursuing quality growth that brings economic potential, benefits, greater health and wellbeing to all, including women."[1]

The relative dearth of women in sectors of the economy that are driving economic growth and innovation has become a particular topic of concern. Under-representation of women in science, technology, engineering, and mathematics (STEM) fields results in health and technological products and solutions that are not adapted to the whole population, limits the talent pool available to companies, reinforces the low status and comparative wages of women in the economy, and will make it harder for economies to succeed at the dual transitions to a digital and green economy. In recognition of the importance of promoting women in STEM, APEC endorsed the APEC Women in STEM Principles and Actions in 2019. The Principles and Actions build on the 2016 APEC Women in STEM Framework, which examined the factors that influence women's ability to enter STEM fields and highlighted examples across APEC of programs to promote women in STEM. The La Serena Roadmap for Women and Inclusive Growth further calls for economies to address barriers to women and girls' access to STEM education and careers (Key Action Area D). In recognition of the importance of this issue, advancing women in STEM has been selected as one of APEC USA's 2023 host priorities.

The APEC Business Advisory Council (ABAC) has long advocated for and supported women's economic empowerment, including the advancement of women in STEM. STEM employers have a strong impetus to expand their talent pool given global shortages of workers with STEM skills.[2] In the U.S. alone, it is estimated that some 3.5 million STEM jobs will need to be filled by 2025.[3] In addition, the growing importance of Environmental, Social and Governance (ESG) investing means that many private firms are now pursuing strategies around gender equity for financial, as well as social, motives.[4] Increased attention to gender equity as a potential risk and performance factor means that investors are now examining issues such as female representation on corporate boards, in C-suites and among executives, as well as pay equity and mobility for women and other disadvantaged groups.[5] Recent research has also found that companies with more equal gender representation perform better in terms of operating margins, credit rating, and share price.[6]

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[1] See APEC's website. The Policy Partnership for Women in the Economy (PPWE) was established in 2011 with a mandate to "advance the economic integration of women in the APEC region for the benefit of all members and to coordinate gender activities across other APEC working groups."
[2] See New York Academy of Sciences, "The Global STEM Paradox."
[3] IDTech, The State of STEM education told through 26 stats," Jan 20, 2023.
[4] The US SIF Foundation's 2022 Report on US Sustainable Investing Trends identified $8.4 trillion in US-domiciled assets under management (AUM) using sustainable investing strategies as of year-end 2021.
[5] For a summary of growing attention in this area see S&P's website.
[6] Credit Suisse, The CS Gender 3000 in 2021.

II. Objective

In response to these issues, ABAC has commissioned this report to provide an overview of the current status of women in STEM in APEC economies, highlight good practices in the corporate, public and non-profit sectors to attract, retain, and promote women with STEM skills, and provide recommendations for APEC governments as they implement the APEC Women in STEM Principles and Actions. This report complements the ongoing U.S.-sponsored APEC Women in STEM Principles and Actions Monitoring Framework project which is focused on assisting economies to improve the availability of data on women in STEM.[7]

III. Methodology

Approach and Scope

In line with the APEC Women in STEM Framework, this study examines gender issues along the women in STEM "pipeline." This entails examining factors that encourage or dissuade women's career progress in education (secondary and tertiary), the workforce (as employees and as leaders), and as entrepreneurs. Explicit in this examination is inclusion of the enabling factors that affect women's participation in the economy more broadly, including women's unpaid caretaking responsibilities, cultural stereotypes, and gender-based violence (including sexual harassment in the workplace).

There is no internationally agreed definition of STEM. APEC economies include different sectors in their definitions of STEM, including some APEC economies that include social sciences (referred to in the literature as STEAM). This can significantly affect the data on incidence of women in STEM. This study focuses on sectors that depend on skills in the physical sciences and mathematics, as these are the sectors where gender disparities are most pronounced and interventions to redress imbalances are more likely needed and justified.[8] Within those sectors, core research questions included:

- What is the current status of women along the pipeline within APEC economies and is it possible to determine the direction of change since APEC began addressing this issue in 2017?
- What efforts are being made to encourage increased participation of women in STEM by the public, private and nonprofit sectors (highlighting successful examples that may be of interest to APEC and ABAC members)?
- What further steps can APEC governments take to support increased participation of women in STEM?

Data Sources

The findings and recommendations in this report are based on data from:

i. Literature Review – with an emphasis on data from multilateral organizations and academic research in the public domain (bibliography in Annex 1);

[7] The Monitoring Framework will be presented at APEC SOM3 2023. The project proposal can be found here.

[8] Agriculture and forestry is another sector that may rely heavily on STEM skills but is generally reported separately from other types of STEM data and is therefore not examined in this report.

ii. Interviews – key informant interviews were conducted with eight (8) firms headquartered and operating in APEC economies. A list of participating firms is provided in Annex 2. These interviews were used to develop the case studies highlighted throughout the report;
iii. Partnership with LinkedIn – ABAC partnered with LinkedIn, which generously agreed to provide insights from LinkedIn's Economic Graph in APEC economies (see methodological note in Annex 3).

Challenges and Limitations

It was beyond the scope of the research to conduct a comprehensive examination of the status of women in STEM across APEC. Many APEC economies are not yet publishing sex-disaggregated education and employment data, or they are publishing only microdata which requires significant manipulation.[9] Efforts have been made to focus on studies that cover a range of APEC economies, recognizing that data availability on women in STEM is higher in more advanced economies. The data presented in this report should therefore be considered illustrative rather than representative of the status of women in STEM in APEC.

Moreover, while many APEC economies and companies are looking at diversity and inclusion issues beyond simply gender or women's economic participation, the report focuses more narrowly on inclusion of women from diverse backgrounds, in line with APEC declarations to date. The evidence suggests that across economies, women who are also members of other disadvantaged groups have even lower participation rates in STEM than evident from the data cited below.

IV. Current Status of Women in STEM in APEC

This chapter provides a brief overview of recent research and data on the status of women in STEM, highlighting trends, continued barriers, and contributing factors that support or dissuade girls and women at each stage in their STEM career path.

Education

The ability to pursue a STEM career lies on a foundation of math, inquiry, and research skills that is developed from the earliest years of a child's education. There is therefore a large literature examining the educational, psychological, and even biological factors that influence girls' achievements in math and science. This literature is summarized below, focusing on education at secondary and tertiary level.

Secondary School

Research on women in STEM consistently identifies the middle school years as the point at which girls begin to demonstrate diminished interest in math and science disciplines, affecting their subsequent ability to pursue higher education in these subjects.[10] These findings are based on analysis of math scores, perception surveys, and course selection in high school, with most research conducted in Organization for Economic Cooperation and Development (OECD) economies. However, most economies do not publish sex disaggregated information on course enrolment at the high school level. This makes it difficult to

[9] The APEC Women in the Economy Dashboard (2021) notes the continued lack of sex disaggregated data on women in STEM.
[10] See Charlesworth, T.E.S., & Banaji, M.R (2019); also, Khan and Ginther (2017).

determine the size of the potential female population with STEM aptitude and interest prior to entry into university and the workforce.

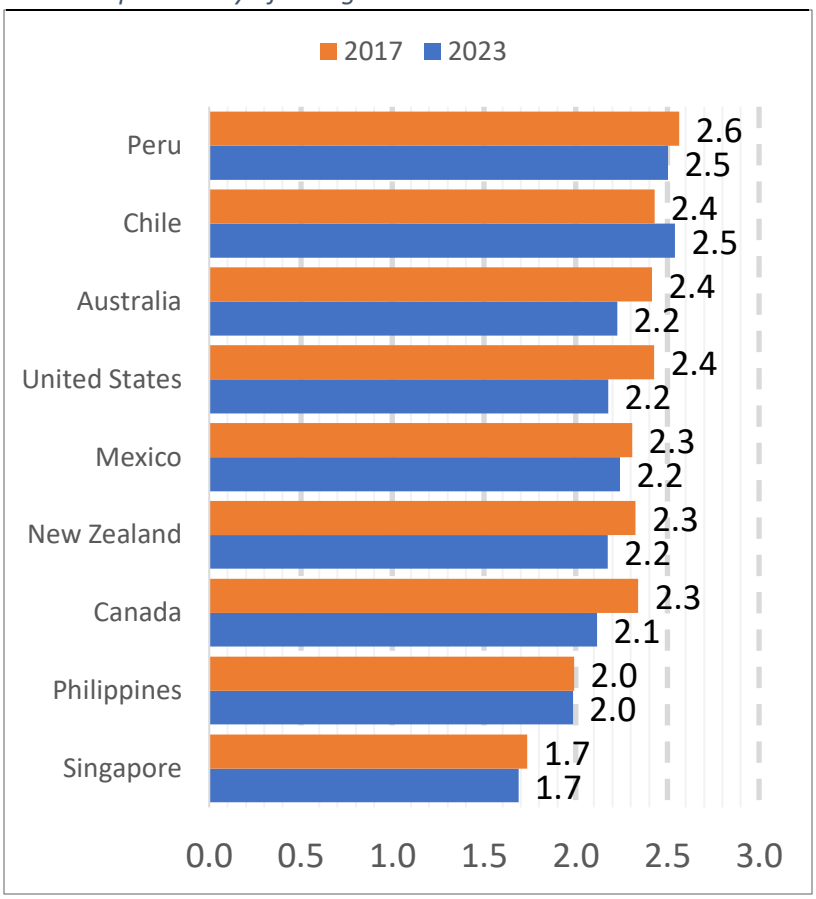
Objective measures of math and science capabilities do not show substantial differences on average between 15-year-old girls and boys. While studies find that boys have higher math and science scores than girls in most economies, the objective differences are under five percent, on average.[11] In the most recent (2018) edition of the OECD Program for International Student Assessment (PISA), shown in Figures 2 and 3 below, girls' scores exceed those of boys in 6 of 18 APEC economies covered, with the differences again being small on average. In these tables, ASEAN economies appear to outperform other APEC regions. Studies to determine whether higher math and science grades in secondary school are correlated with subsequent pursuit of STEM fields in higher education are inconclusive.[12]

Vocational School

APEC economies publish limited sex disaggregated data on vocational training, making it difficult to ascertain the prevalence of women in STEM-related vocational programs. As many APEC economies are beginning to emphasize STEM skills rather than STEM degrees in analysing their workforces, this is an area where more work could be done in future.

LinkedIn analysis of self-reported skill sets by members in their database finds that while men are more likely to report STEM skills than women, this ratio has improved slightly between 2017 and 2023 in all examined APEC economies except Chile, as shown in Figure 1. These skills may reflect vocational, educational, or work experience, as well as propensity to list skills in general, and are not necessarily related to a degree.[13]

Figure 1: Ratio of men's probability of listing STEM skills to women's probability of listing STEM skills



Source: LinkedIn

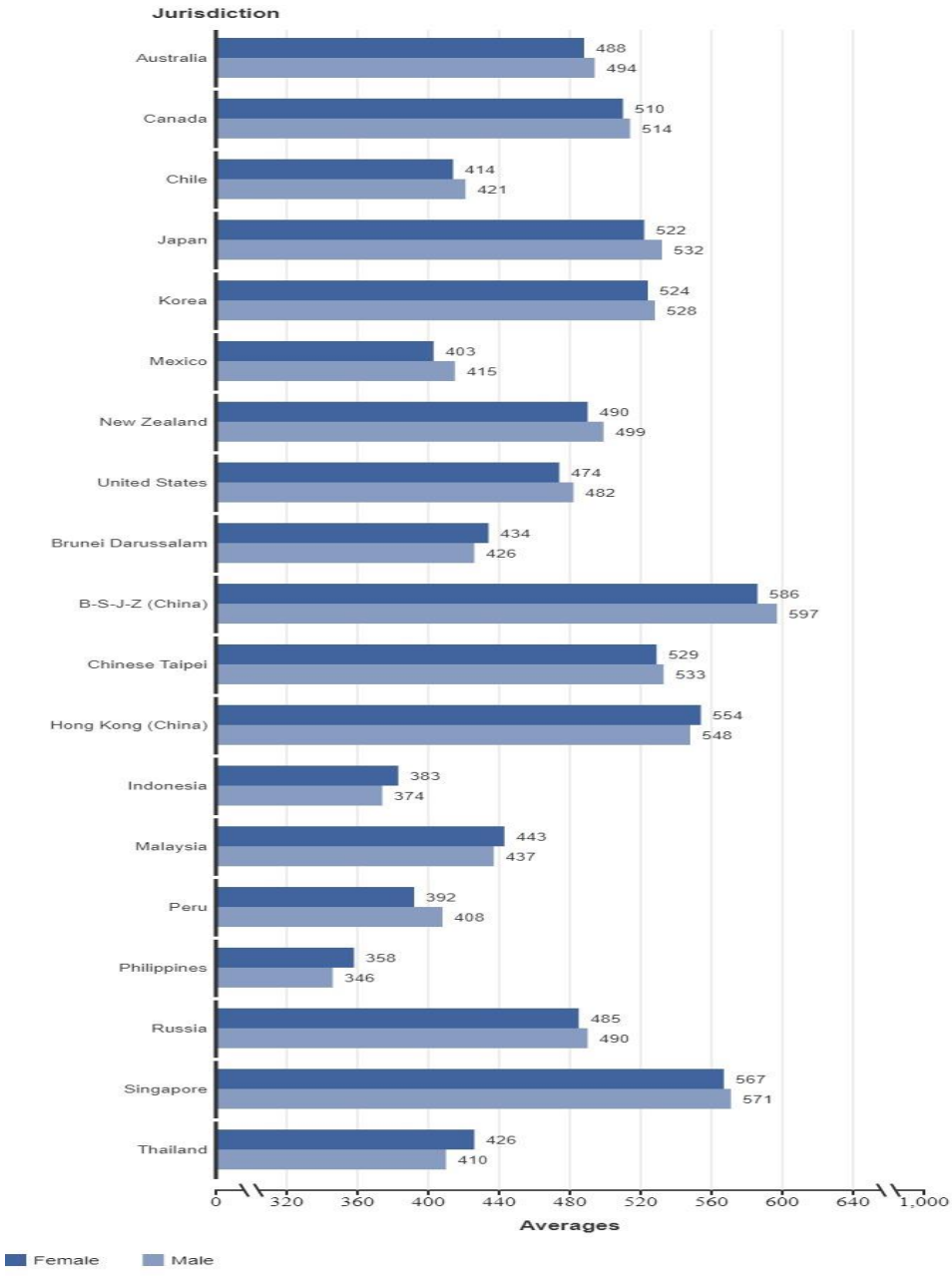
[11] For example, Stoes and Geary (2013) (cited in Kahn and Ginther) analysed data from 1.5 million 15-year-olds in 33 countries and found a difference at the median of .11 standard deviation.

[12] Kahn, S. and Ginther, D. "Women and STEM," NBER Working Paper 23525, June 2017.

[13] Baird, M., Lara, S., Hood, R., Gahlawat, Ni., & Ko, P. (2023). International comparisons of gender representation in STEM skills and employment. LinkedIn Economic Graph White Paper.

Figure 2: OECD PISA Average Math Scores (By APEC Economy, By Sex) (2018)

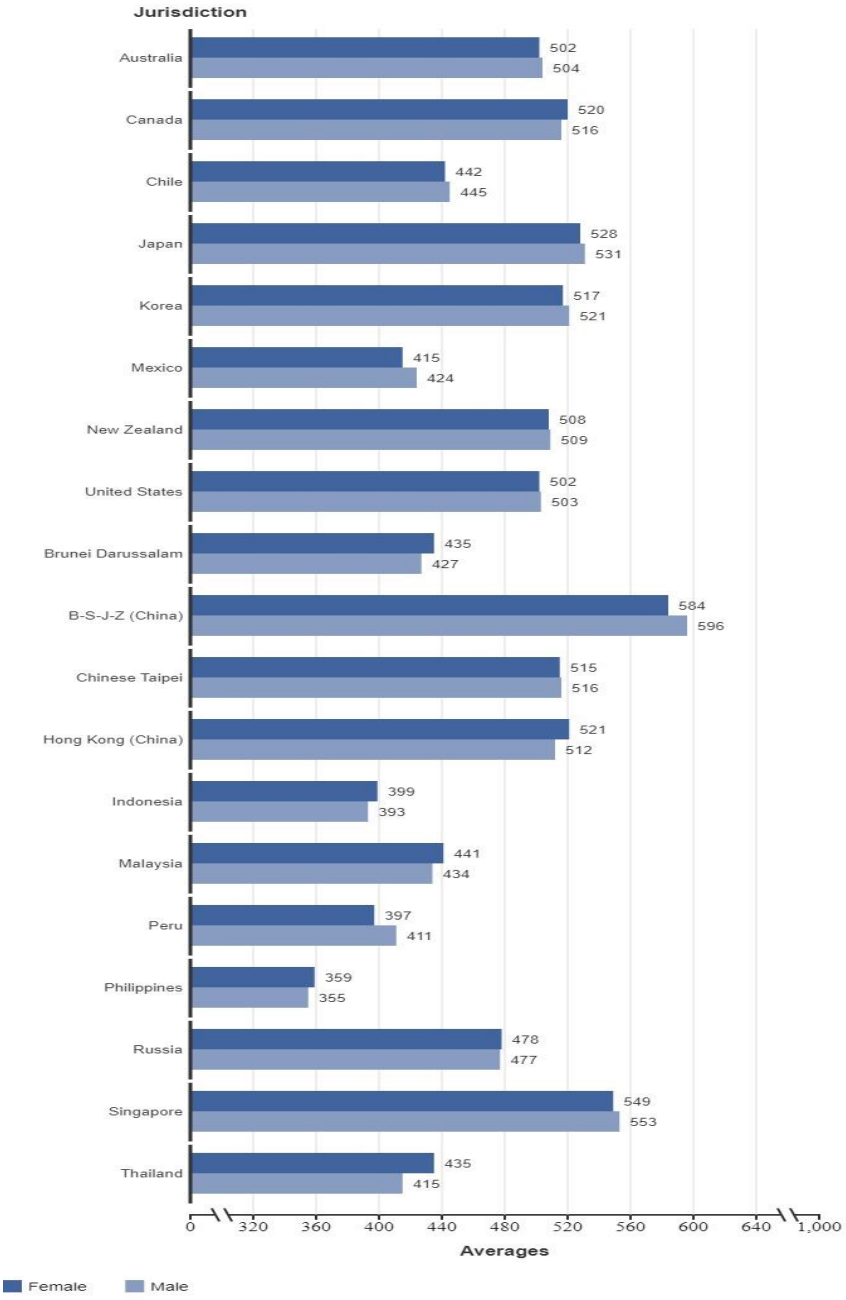
Averages for 15 years PISA mathematics scale: overall mathematics, by Student (Standardized) Gender [ST004301] for Australia, Canada, Chile, Japan, Korea, Mexico, New Zealand, United States, Brunei Darussalam, B-S-J-Z (China), Chinese Taipei, Hong Kong (China), Indonesia, Malaysia, Peru, Philippines, Russia, Singapore and Thailand: 2018
2018



NOTE: B-S-J-G (China) refers to the four PISA participating China provinces: Beijing, Shanghai, Jiangsu, and Guangdong. | B-S-J-Z (China) refers to the four PISA participating China provinces: Beijing, Shanghai, Jiangsu, and Zhejiang. | CABA (Argentina) refers to Ciudad Autónoma de Buenos Aires (Argentina). | North Macedonia refers to the Republic of Macedonia. | Russia refers to the Russian Federation. | The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law. | Information on data for Cyprus: <u>https://oe.cd/cyprus-disclaimer</u> | Argentina, Kazakhstan and Malaysia in 2015: Coverage is too small to ensure comparability (see PISA 2015 Results [Volume I]: Excellence and Equity in Education [OECD, 2016], Annex A4). The Reading, Mathematics and Science scale ranges from 0 to 1000. Some apparent differences between estimates may not be statistically significant.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2018 Reading, Mathematics and Science Assessment.

Figure 3: OECD PISA Average Science Scores (By APEC Economy, By Sex) (2018)

Averages for 15 years PISA science scale: overall science, by Student (Standardized) Gender [ST004301] for Australia, Canada, Chile, Japan, Korea, Mexico, New Zealand, United States, Brunei Darussalam, B-S-J-Z (China), Chinese Taipei, Hong Kong (China), Indonesia, Malaysia, Peru, Philippines, Russia, Singapore and Thailand: 2018 and 2012
2018



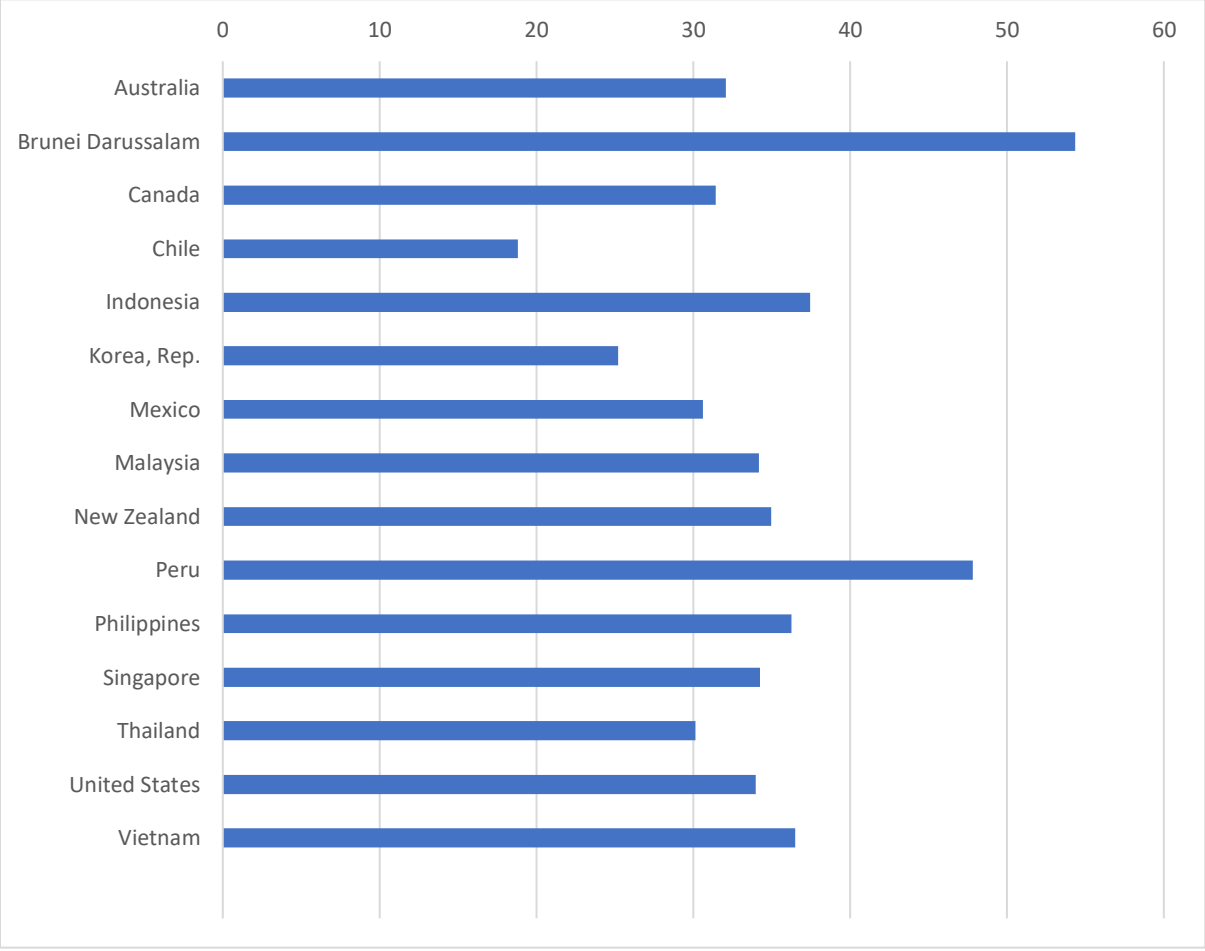
NOTE: B-S-J-G (China) refers to the four PISA participating China provinces: Beijing, Shanghai, Jiangsu, and Guangdong. | B-S-J-Z (China) refers to the four PISA participating China provinces: Beijing, Shanghai, Jiangsu, and Zhejiang. | CABA (Argentina) refers to Ciudad Autónoma de Buenos Aires (Argentina). | North Macedonia refers to the Republic of Macedonia. | Russia refers to the Russian Federation. | The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law. | Information on data for Cyprus: <u>https://oe.cd/cyprus-disclaimer</u> | Argentina, Kazakhstan and Malaysia in 2015: Coverage is too small to ensure comparability (see PISA 2015 Results [Volume I]: Excellence and Equity in Education [OECD, 2016], Annex A4). The Reading, Mathematics and Science scale ranges from 0 to 1000. Some apparent differences between estimates may not be statistically significant.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2012 and 2018 Reading, Mathematics and Science Assessments.

Tertiary Education

For tertiary education, the key parameter studied in the literature is the selection of math and science majors by women. APEC economies collect sex disaggregated data more consistently on this parameter than they do for secondary school. Researchers on women in STEM express concern that even girls who enjoy math and science subjects in high school do not go on to select STEM-oriented university programs. This represents the first "leak" in the pipeline analogy.

The 2021 APEC Women in the Economy Dashboard found that, "Although a few economies have participation rates at, above, or close to 50 percent, most of the APEC economies that have data on female graduates from STEM programs in tertiary education recorded participation rates at or below 35 percent for more than a decade now."[14] More recent data suggests this is still the case, as shown in Figure 4.

Figure 4: Female share of graduates from Science, Technology, Engineering and Mathematics (STEM) programs, tertiary (%)

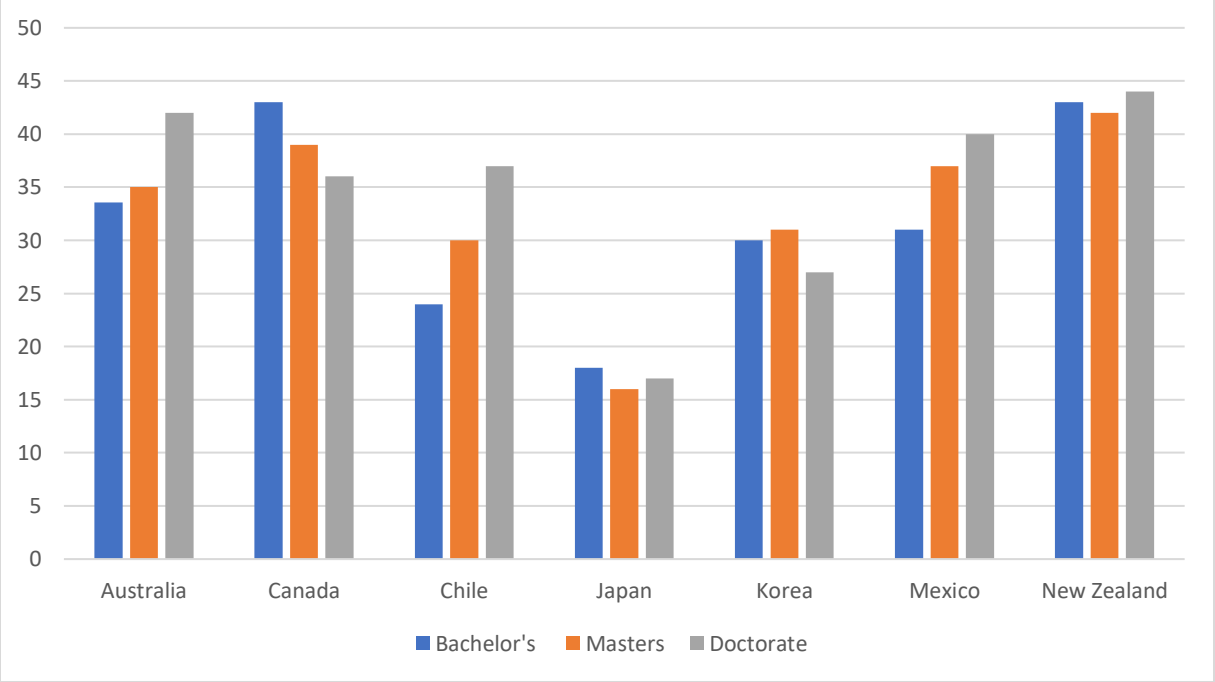


Source: World Bank Gender Portal. Data extracted on April 24, 2023.
Note: Data unavailable for China, HK, Chinese Taipei, PNG, and Russian Federation.

[14] APEC Women in the Economy Dashboard (2021).

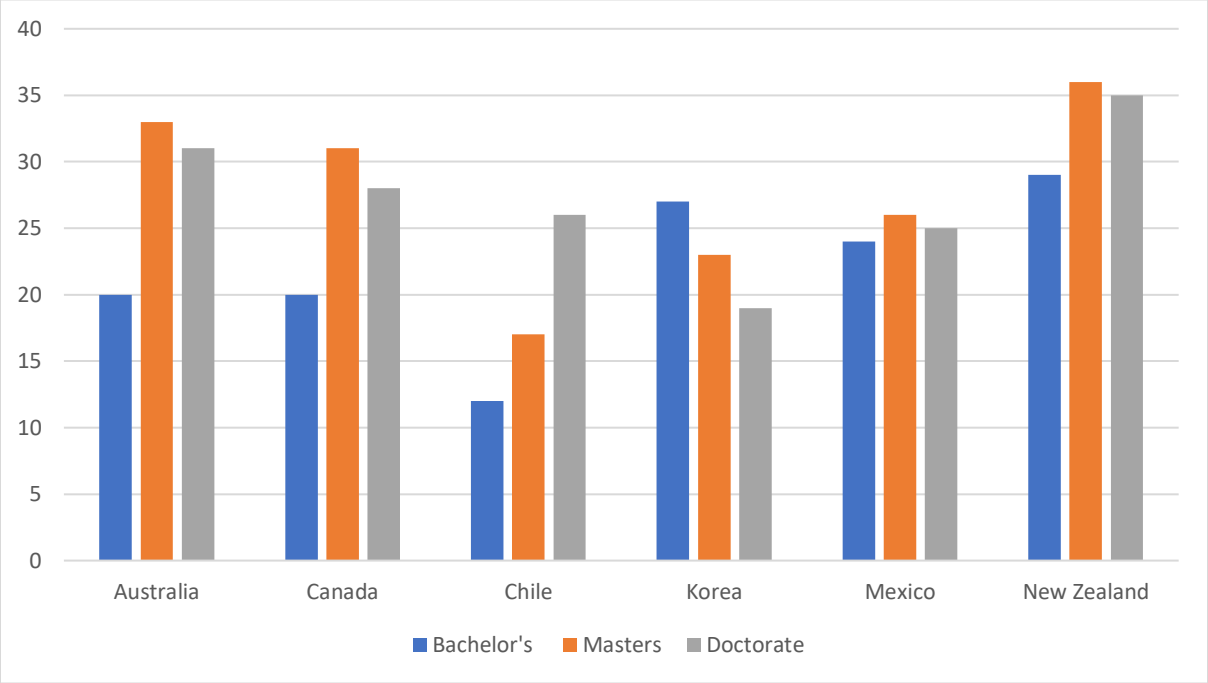
Overall averages mask significant differences by discipline. The literature makes a distinction between math-intensive STEM fields (e.g. engineering, math and computer science, physical sciences, and economics), where women have consistently low rates of participation, and less-math-intensive STEM fields (e.g. life sciences), where women have increased their participation in the last two decades and are now in the majority in some economies (and in the large majority if health-related fields are included). This bifurcation in STEM fields was already evident in 2017 when the APEC Women in STEM Framework found that "although women increasingly study and work in the life sciences disciplines, they are vastly outnumbered by men in degree programs relating to engineering and technology." For example, the most recent OECD data (covering 7 APEC economies) shows that against an aggregate average 33% female enrolment rate in STEM fields (B.Sc., M.Sc, & Ph.D) overall (excluding health and education) as shown in Figure 5 below, female enrolment in computer science drops to an average 26% across APEC economies, as shown in Figure 6.

Figure 5: Share of Women in STEM Tertiary Enrolment, by Degree, by Economy



Source: OECD/UIS/Eurostat (2022)

Figure 6: Share of Women in ICT Tertiary Enrolment



Source: OECD/UIS/Eurostat (2022). NB: Data unavailable for Japan.

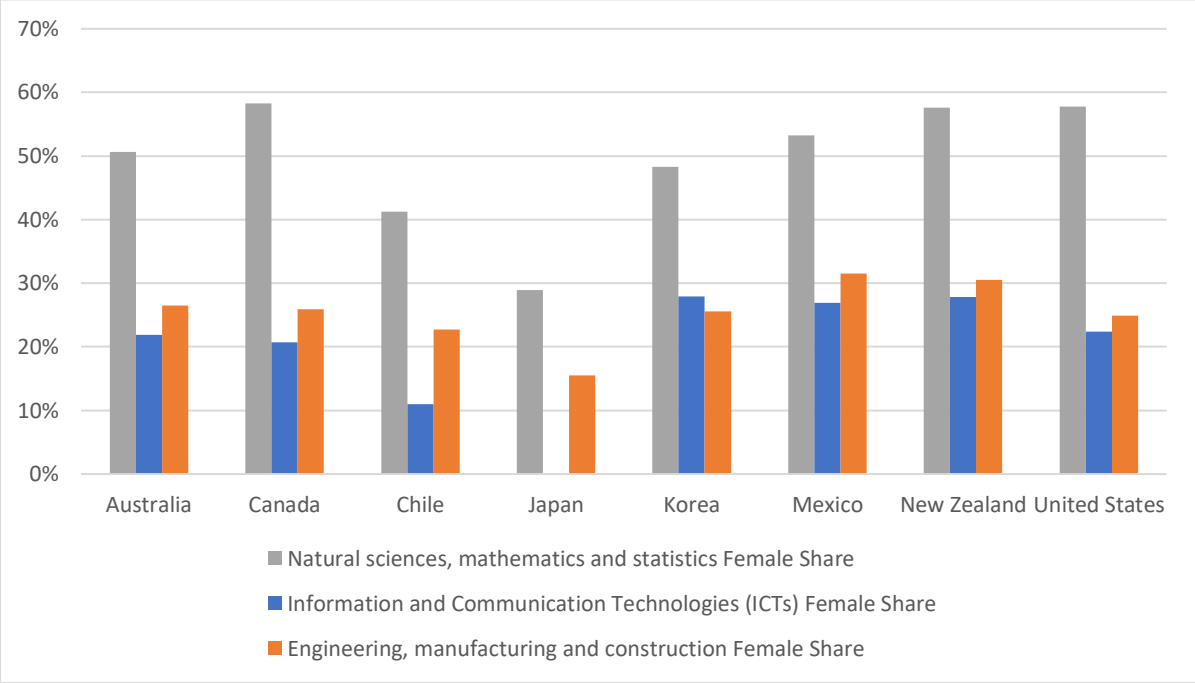
Interestingly, the share of women completing graduate degrees (Masters and Doctorate) is slightly higher than their proportion at Bachelors' level in several APEC economies. As will be discussed in the next section, the higher proportions of women pursuing graduate degrees in STEM may be linked to their apparent preferences for careers in academia and public research centres, where a PhD is more frequently required.

Looking specifically at Bachelors graduates, the proportion of female graduates across economies averages 50% in natural sciences, mathematics, and statistics, but drops to 25% for engineering, and 23% for ICT, as shown in Figure 7. Studies have found that the number of women is particularly low in the most competitive universities.[15]

Unfortunately, the categories of STEM used in the OECD enrolment data (Figs. 5 and 6) is not comparable to the graduation rate data (Figs. 7) and thus it is not possible to extrapolate what percentage of female students who enrol in STEM degree programs go on to complete their degrees. Studies comparing female and male dropout rates for STEM degree programs are inconclusive and only a handful of economies publish enrolment versus completion rates. Therefore, the size of the leak at this stage in the pipeline cannot be determined with available data.

[15] Charlesworth, T.E.S., & Banaji, M.R (2019).

Figure 7: Share of Women STEM Bachelors Graduates, by Field, by Economy



Source: OECD/UIS/Eurostat (2022). Processed by author.

Workforce

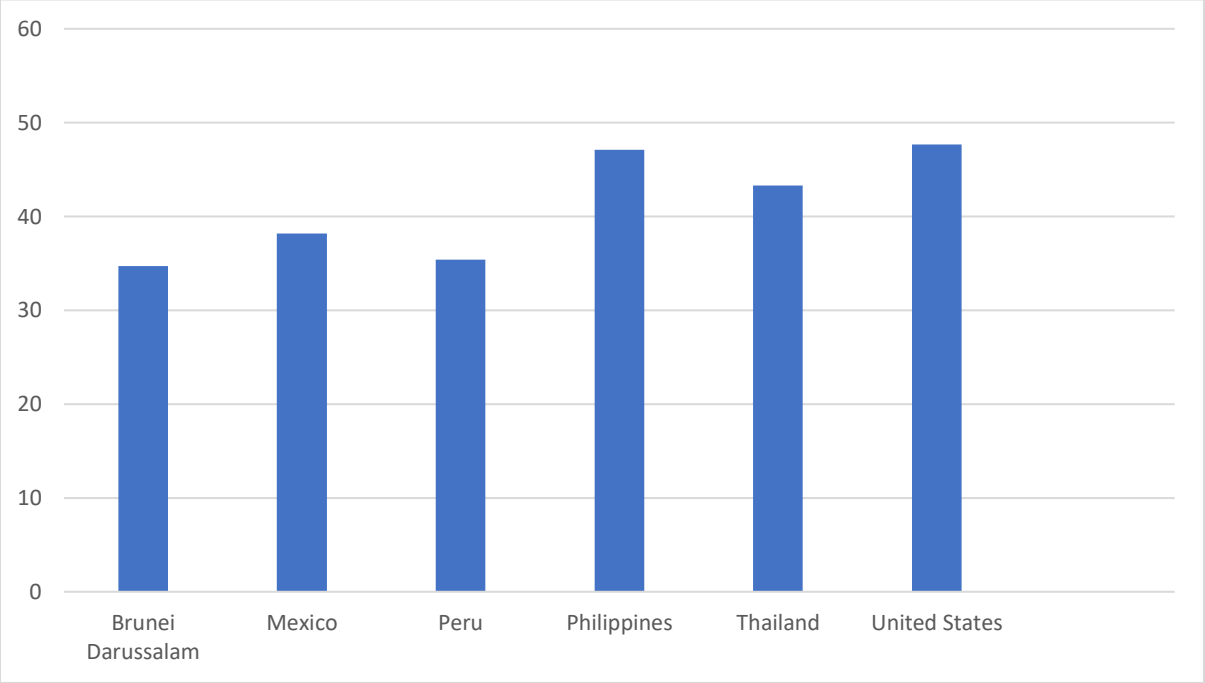
Core issues regarding women in the STEM workforce include whether female STEM graduates choose to go into STEM fields, and for those who do, whether they progress in those careers, have the same opportunities and compensation, and attain levels of seniority on par with their male colleagues.

STEM Workforce participation rates

If approximately 35% of university graduates holding STEM degrees are women, how many of them are choosing to enter STEM careers? Data on this question is relatively difficult to collect in the absence of surveys of graduates, mandatory reporting by the private sector, or longitudinal statistical analyses using government administrative data.[16] According to the latest International Labor Organization (ILO) report (2020), women's share of STEM occupations (including health professionals) across the six APEC economies for which data was available averaged 41%, as shown in Figure 8, although this includes health professionals.

[16] Some of the ways in which this is being monitored at the economy level includes a longitudinal survey commissioned by the government of Australia to track a cohort of STEM graduates over time. In Canada, social security numbers are being used to link student records with tax records to track earnings and job placements of STEM graduates.

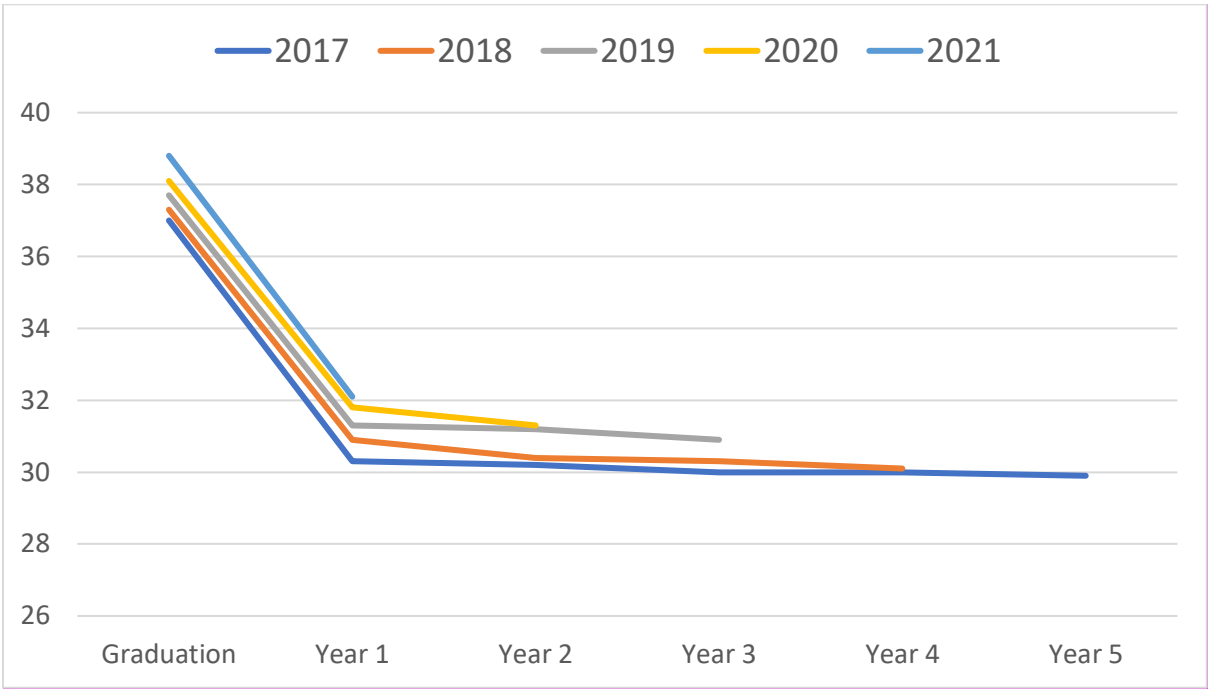
Figure 8: Female share of STEM occupations



Source: ILOSTAT. Data extracted on: 25 April 2023.
Note: includes health professionals.

LinkedIn data analysis conducted for this report finds that women's share of the STEM workforce is smaller than their share of the overall workforce in the 9 APEC economies where sufficient data quality thresholds are met. This is consistent with government-reported datasets such as the OECD and ILO. The dataset also demonstrates that a relatively large proportion of female STEM graduates do not go into STEM jobs, as shown in Figure 9. Across the 9 APEC economies where LinkedIn has sufficient data, there is a 6-8 point drop off in female graduates who do not go into STEM employment. Looking at the longitudinal data, the increasing proportion of female graduates with each graduating class is offsetting the drop, indicating that representation is increasing over time.

Figure 9: Proportion of STEM workers who are women, by graduation cohort and by year since graduation with a STEM degree (average for 9 APEC economies)



Source: LinkedIn (unpublished) 2023.
Data is for Australia, Canada, Chile, Mexico, New Zealand, Peru, Philippines, Singapore, United States.

Women in Technology and the Green Economy

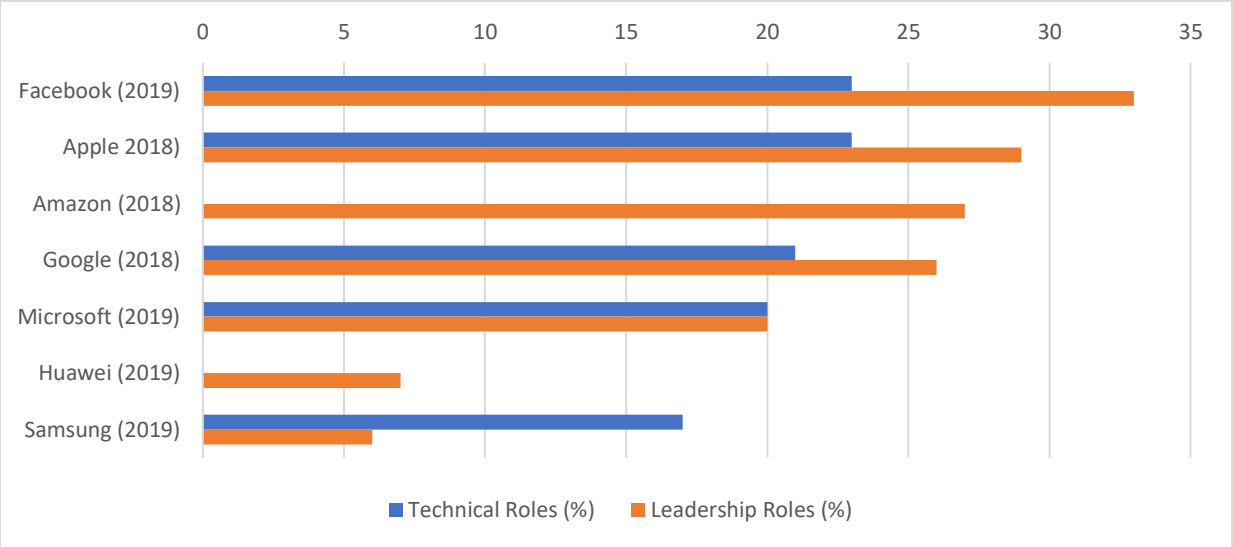
There is a specialized literature regarding the under-representation of women in the technology field, mostly examining the U.S. case. The low female enrolment and graduation rates in ICT fields discussed above are reflected in low representation in technical roles in technology companies. For example, an analysis of female representation at some of the largest multinational technology companies is shown in Figure 10.

The literature on women in technology identifies challenges including hostile work environments, lack of worklife balance, and bias, which causes women to drop out at higher rates than their male colleagues. For example, in a TrustRadius survey, 39% of women in tech cited gender bias as a barrier to promotion.[17] Research by Accenture on the U.S. found that female students had a dropout rate of 37% for technology classes vs. 30% for other programs; leave tech roles at a 45% higher rate than men; and dropout of STEM jobs at a higher rate than other jobs (2.5x more likely to drop tech roles than other roles by age 35). The same survey found that building an "inclusive culture" is key to attracting and retaining women both in universities and in the workforce.[18] Finally, recent research on the impact of Covid on women in technology found that women had a higher drop-out rate, steeper reduction in research time, and that

[17] TrustRadius *2021 Women in Tech Report*.
[18] Accenture & Girls Who Code, Resetting Tech Culture (2019).

women's publishing rate fell relative to men. These affects were linked to care responsibilities in the home.[19]

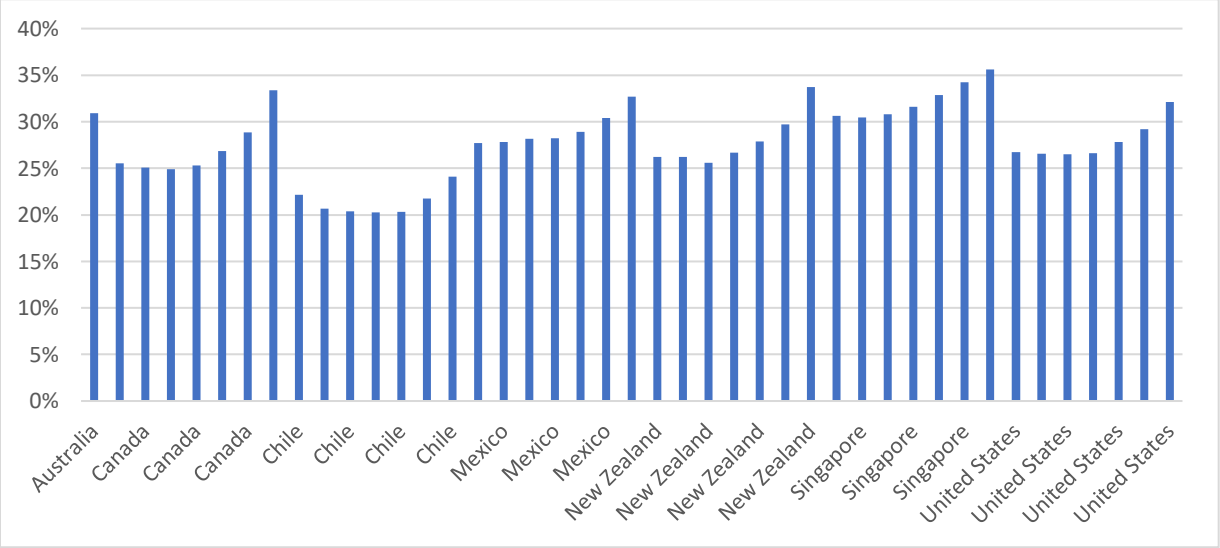
Figure 10: Women in Technical and Leadership Roles in Selected Top Multinational Technology Companies 2018-2019



Source: Reproduced from Bello et al (2021).

One area of technology where there is particular concern about the lack of representation is Artificial Intelligence (AI). LinkedIn data in five APEC economies finds that on average women make up 32% of professionals with skills in AI, as shown in Figure 11; this is an increase from 23% in 2017.

Figure 11: Share of women among professionals with AI skills, 2020, (%)

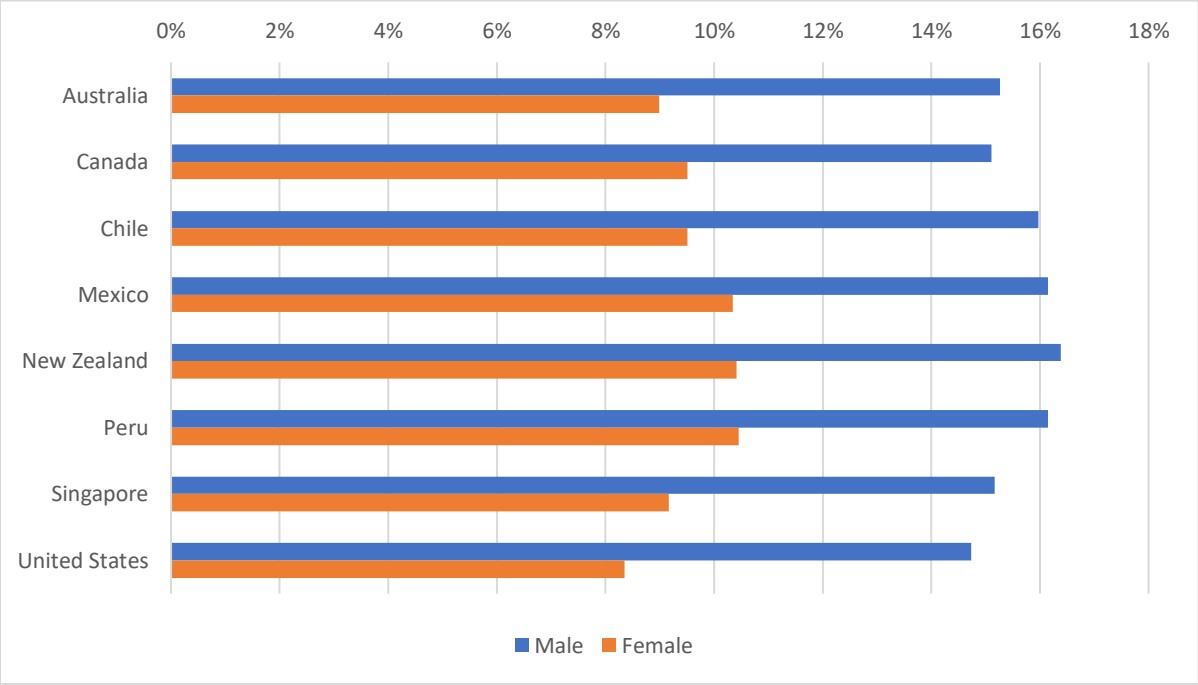


Source: LinkedIn.

[19] Bello, The UNESCO Science Report (2021).

In the growing sector of "green" jobs, just under 10% of women on LinkedIn (averaged over 8 economies) have green jobs or skills, compared to approximately 16% of men, as shown in Figure 12. The proportion of workers with green jobs or skills has increased over the last decade for both genders.

Figure 12: Share of LinkedIn members listing "green" economy jobs or skills, out of all members of the selected gender (2023)



Source: LinkedIn (unpublished) 2023.

Gender Pay Gaps

There is limited data available on wages for women and men in the STEM sector but the data that is available finds that women earn less than men, on average. This is consistent with gender wage gaps seen in most other industries. The literature suggests that the largest part of this gap is due to the specific sectors women are going into, as life sciences and the health sector are generally remunerated at lower levels than the technology and engineering fields where women are least prevalent.[20]

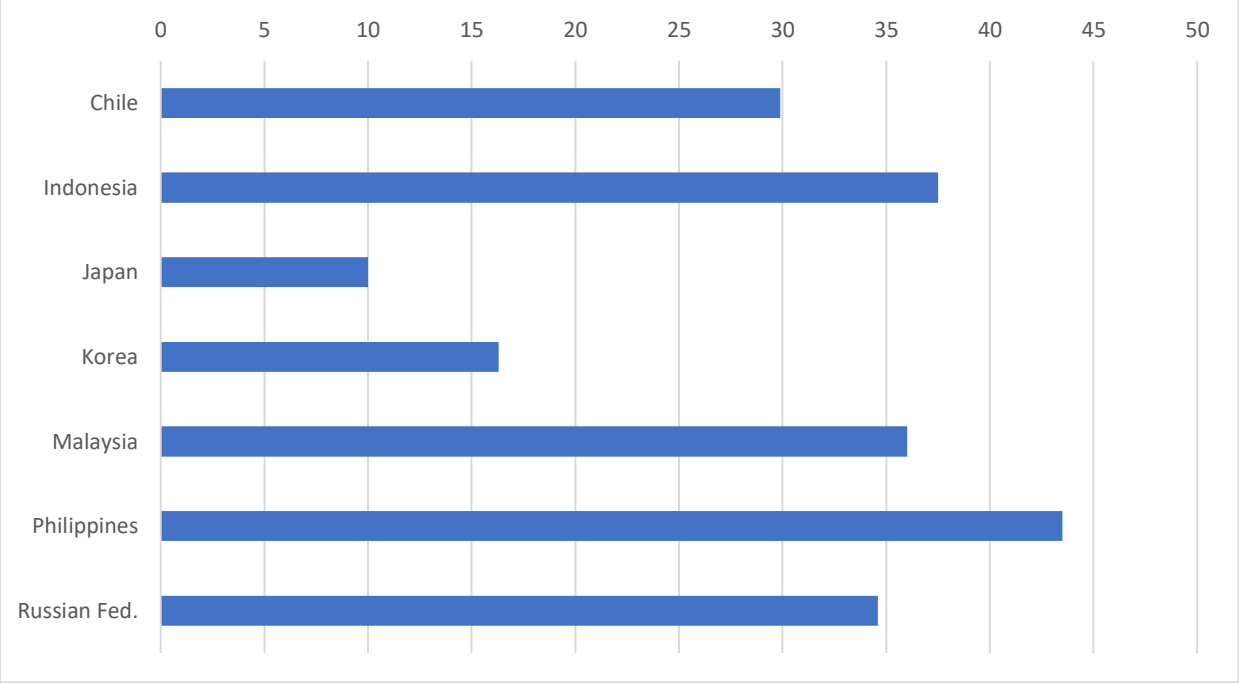
In the U.S., women in the STEM workforce earn the equivalent of 79% of men's earnings, generally due to their position and seniority; however, even after controlling for these variables, research finds that women receive 9% less than men.[21] Researchers postulate that this gap is due to well documented gender bias in salary negotiations as well as the "motherhood penalty" whereby women with children have been shown to receive lower wages in many fields. Another factor appears to be that women in STEM are more likely to pursue careers in government, academia, and the non-profit sectors than in the higher-

[20] Charlesworth & Banaji (2019).

[21] Ibid. Also, see Kahn & Ginther (2017).

compensated private sector.[22] For seven APEC economies for which UNESCO has data, only an average of 30% of women researchers are in the private sector, as shown in Figure 13. Researchers postulate that this choice is based on perceived better worklife balance in the public/non-profit sector, women placing a higher premium on job security and benefits than men, or women being attracted to more mission-oriented or altruistic organisations.

Figure 13: Share of women among researchers in the business enterprise sector (2018 or most recent year)



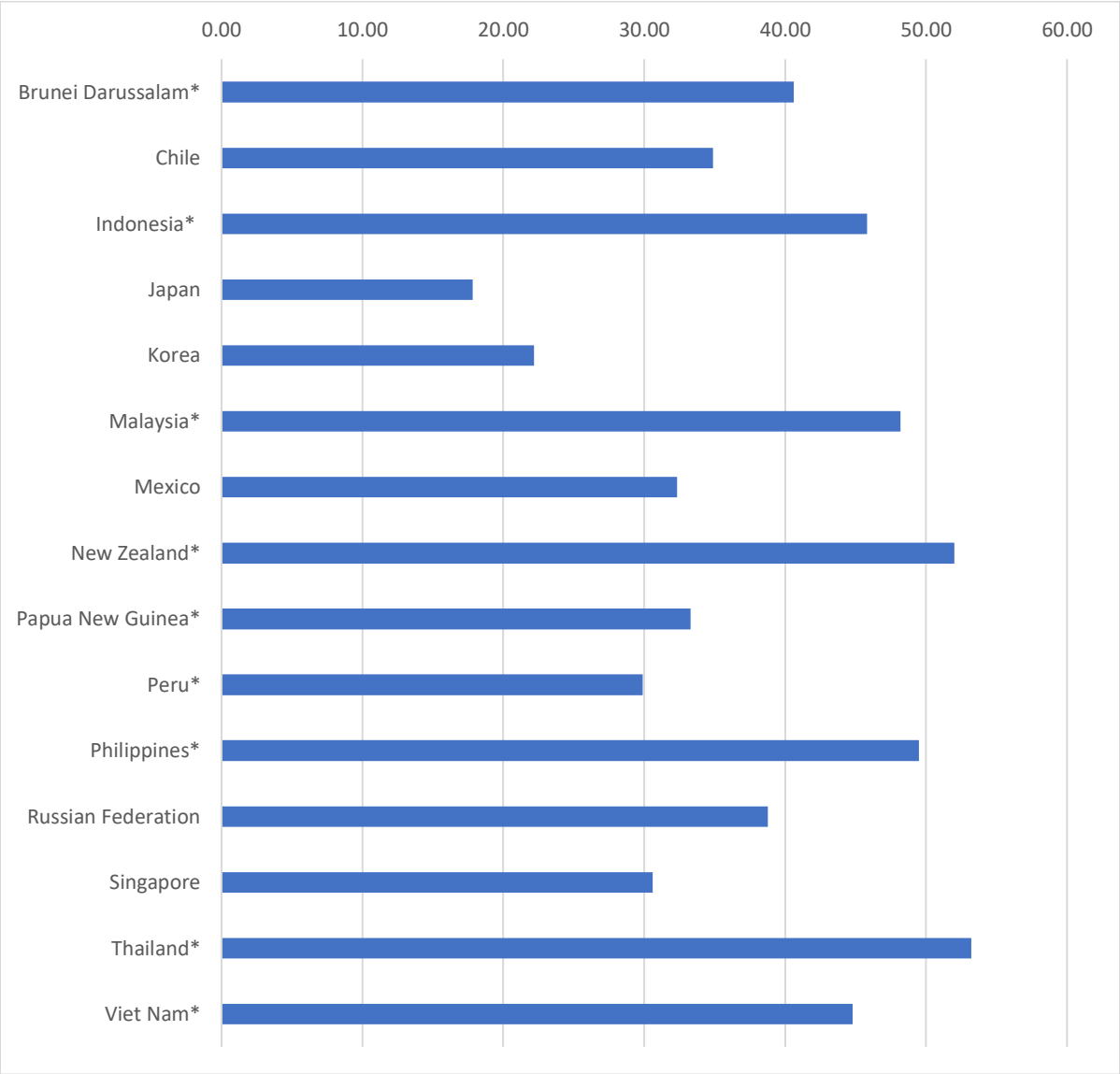
Source: UIS in Bello (2021). Data for Philippines, Malaysia, and Chile are from earlier years than the other economies.

Women in Academia and Research

Specific to women's participation in scientific research, available data suggests that across the APEC region women represent approximately 38% of total researchers on average (for 15 APEC economies), with individual economy results shown in Figure 14. ASEAN economies reporting data are closer to gender parity, consistent with the higher percentage of female STEM graduates in Southeast Asia. For APEC economies that are also members of ASEAN, the averaged proportion of women researchers increases to 45%.

[22] Bello (2021), Charlesworth & Banaji (2019).

Figure 14: Percentage of women among researchers



Source: OECD STI Scoreboard. Data extracted on April 27, 2023. * Source: UNESCO Institute of Statistics, June 2019. Note: UNESCO excludes North America and China due to data incomparability issues.

Despite the higher proportion of women obtaining PhDs, as shown above, the number of full-time tenured professors appears to be low: in the U.S., for example, although women obtain 41% of STEM PhDs, they hold only 27% of full-time tenured positions.[23] Women's publication rates, which are crucial to promotion in academic settings, are consistently lower than men's and women-authored articles are less likely to be cited.[24] Recent research in the U.S. has also documented what has long been reported in perception surveys of women scientists: women are less likely to be credited in publications and patent applications

[23] Charlesworth (2019) based on National Science Foundation data (2018).
[24] Bello (2021).

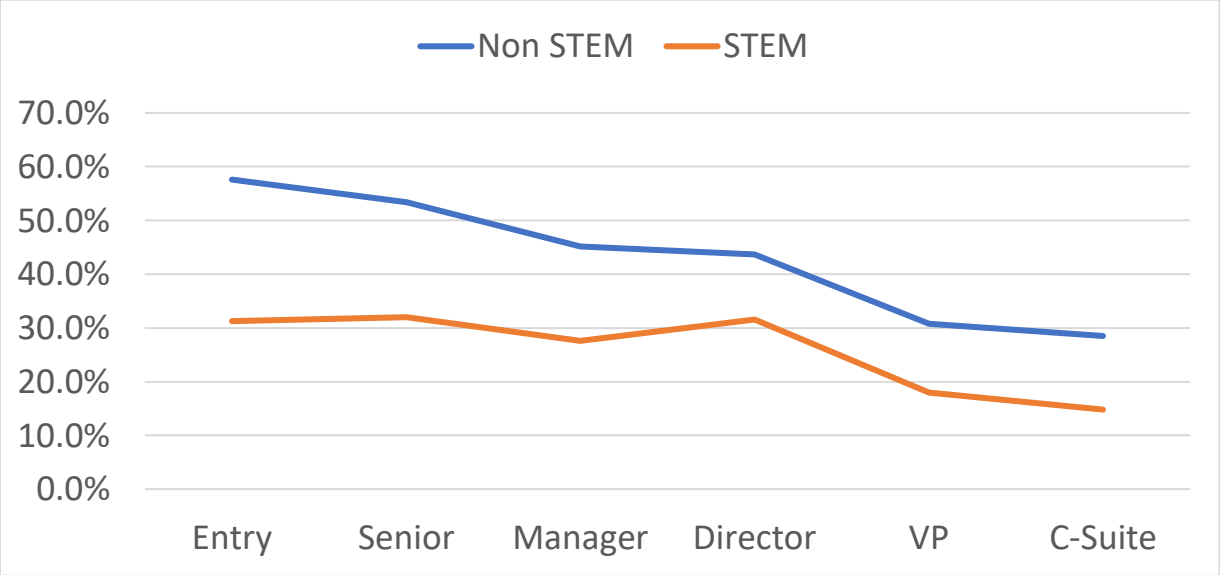
when working in teams even when they conduct as much work as the men in the teams.[25] There is also research that women's articles are more likely to be rejected during peer reviews, and that women researchers are less likely to engage in international collaborations, have fewer industrial partners, and have less access to networks.[26] Researchers have also demonstrated gender bias in academic salaries.[27]

Women in STEM Leadership Roles

Women remain under-represented in the ranks of C-suite and executive management in the private sector for all sectors and in all economies. Research by Credit Suisse in 16 APEC economies found that the average proportion of women in CEO or CFO positions (all sectors) is only 6% and 22% respectively, with only 3 economies, all in ASEAN, reaching double digit results for CEO positions (see Annex 4). Specific to the technology sector, the World Economic Forum Global Gender Gap report (2021) finds that the share of women in technology leadership roles (Chief Information Officer or Chief Technology Officer) globally is in the 15-25% range,[28] whereas the Credit Suisse report finds 17% women in management for the information technology sector.

LinkedIn data is consistent with those findings, with women's representation in STEM leadership roles lower than men's, and lower than women in non-STEM sectors, at every stage of career progression, as shown in Figure 15.

Figure 15: Representation of Women by Seniority (Average for 7 economies)



Source: Baird, M., Lara, S., Hood, R., Gahlawat, Ni., & Ko, P. (2023). International comparisons of gender representation in STEM skills and employment. LinkedIn Economic Graph White Paper. Data is for Australia, Canada, Mexico, Peru, Philippines, Singapore, United States.

[25] Ross et al (2022).
[26] Jebsen et al (2022). This report notes the gatekeeping role of internal review by research institutes and the bias that may result in male researchers' proposals being forwarded by committees to the funder for consideration over proposals from women researchers.
[27] Brower and Jame (2020) cited in Bello et al (2021).
[28] WEF (2023).

The Credit Suisse research finds that there is a correlation between economies with high levels of ESG investing and higher representation of women in leadership positions. They also find a broad correlation between political representation of women and Board representation. The growing importance of ESG investing and its positive impact on bringing attention to gender issues was also evident among the company interviews conducted for this research.

Although the issue of female representation on corporate boards is receiving increased attention, there is limited data that sex disaggregates board representation by sector. Research by Credit Suisse finds that in 16 APEC economies covered, the average representation of women on corporate boards of all sectors is approximately 18%; this includes a 6-point increase over the period 2015 to 2021.[29] Female representation on corporate boards in North America (all sectors) is now 28.6%, in Asia Pacific excluding Japan it is 17.3%, and in Latin America, it is 12.7%.[30] During this time, several APEC economies have set mandatory quotas for female representation on Boards. Although it is not possible to determine whether these quotas are the main cause behind this increase, there is clearly a correlation if not causality.

The same study analyses female representation on corporate boards by sector, but not by economy. Among STEM relevant sectors, such as energy, industrials, materials and health care, the share of female representation on boards averaged 23% in 2021, a nearly 10% increase over 2015. Technology companies have the lowest female board representation of any sectors covered in that report, at an average 20%. Interestingly, representation of women on boards of health care companies are not significantly higher, at 26%, even though women are now at gender parity (or above) in tertiary degrees and workforce participation for the health sector. This indicates that it is not merely prevalence in a field that will help women rise to leadership positions; women appear to face structural issues that impede them from reaching seniority.

Entrepreneurship

The literature on women in STEM and entrepreneurship focuses, on the one hand, on innovation and R&D by women in science, and on the other hand, women's role in technology start-ups. Unfortunately, there is very little data available on SMEs in STEM.

Research & Development (R&D)- Financing and Intellectual Property

Entrepreneurship for scientific researchers often involves monetizing research by patenting inventions or findings and then partnering with a firm for production. High and growing fixed costs for pure scientific research means that it is becoming more common for research to be conducted in teams, often mixing academic and commercial institutional settings. This type of R&D relies heavily on Government (public) funds which remain a significant, or even primary, source of research funding in many APEC economies. Although women researchers tend to favour positions in academia or publicly financed research institutes, as noted above, the literature documents gaps in access to R&D financing. Particularly related to the size of grants, women appear to receive smaller grants than men, and a smaller proportion of the requested budget compared to men.[31]

[29] Credit Suisse (2021).
[30] Ibid.
[31] Jebsen (2022).

In recognition of this problem, an increasing number of APEC economies are collecting data on what proportion of government research funding is applied for, and awarded to, women. In Australia, for example, both the proportion of women applying for government grants and the percentage of female applicants successfully winning grants has increased steadily over the last two decades. The ratio of men applying as Chief Investigators for government grants compared to women has improved from 2.45 in 2001 to 1.41 in 2020, and the award rate to women (as a percentage of applicants) has almost reached parity with the award rate to male Chief Investigators since 2017.[32] In Chile, 38% of projects awarded government R&D funding in 2021 were led by women researchers.[33] In Canada, 34% of 2021 R&D funding from the Natural Sciences and Engineering Research Council of Canada was awarded to under-represented individuals (including women).[34] In the United States, the success rate for female applicants for National Institute of Health (NIH) research grants is approximately 20% and award rates are roughly at parity for men and women.[35]

Monetizing inventions depends upon intellectual property protections, and this is an area where sex disaggregated data has become more available in recent years. The World Intellectual Property Organization (WIPO) has issued sex disaggregated historical data going back to the year 2000 on issuance of international patents, and updates this database annually.[36] In the most recent data (2021), women made up an aggregate average of approximately 20% of named inventors (primary or in a research team) receiving Patent Cooperation Treaty (PCT) protection across 17 APEC economies.[37] Progress even towards this low base has been slow: for 10 APEC economies where historical data is available, the average proportion of women inventors has increased only 5 points over two decades, from 10% in 2000 to 15% in 2021. Interestingly, it is the non-OECD (or recent OECD) economies in most cases where higher-than-average participation of women as inventors is seen, as shown in Figure 16 below.

In line with the data above on tertiary enrolment and workforce participation rates, WIPO finds that "women inventors are often concentrated in specific industries, such as biotechnology, food chemistry, and pharmaceuticals, while fields like mechanical engineering have fewer women inventors.'' WIPO also finds that women inventors are more commonly employed in academia rather than the private sector, and that women commonly file in mixed sex research teams, with all-women teams being extremely rare.[38]

[32] STEM Equity Monitor (2022).

[33] Radiografía de Género en Ciencia, Tecnología, Conocimiento e Innovación, April 2022.

[34] Natural Sciences and Engineering Research Council of Canada, "2020–21 Departmental Results Report."

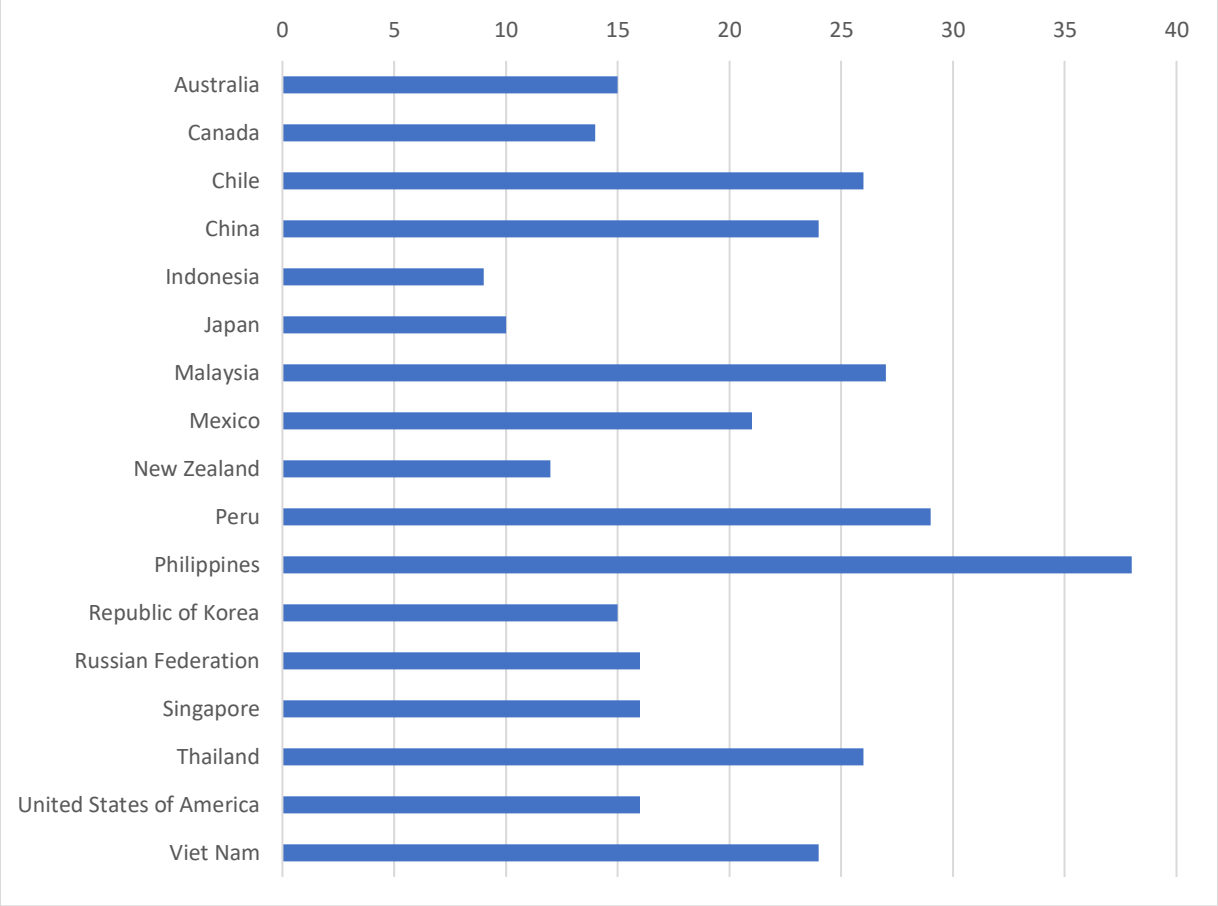
[35] NIH Databook.

[36] See WIPO Guidelines for producing gender analysis from innovation and IP data.

[37] See Annex 4, Figure 8 for the WIPO data updated September 2022.

[38] See: https://www.wipo.int/about-ip/en/ip_innovation_economics/gender_innovation_gap/gender-parity-patenting.html.

Figure 16: Share of patent applications with at least one women inventor (2017-2021)



Source: WIPO statistics database. Last updated: September 2022

Technology Start-Ups

Meanwhile, entrepreneurs in technology start-ups have generated historic returns, with significant attention on firms related to the so-called fourth industrial revolution, which is an important area of economic growth for APEC economies. However, the Global Entrepreneurship Monitor (GEM) 2021/2022 Women's Entrepreneurship Report found that, worldwide, only 2.7% of women started businesses in the ICT sector, compared to 4.7% of men.[39] However, there are regional variations. Women in lower-income countries were more likely to report starting a business in the ICT sector than men (1.7% women vs. 1.5% men), and women in Canada and the U.S. were 78% more likely to report startup activity in the ICT sector (8.9% women vs. 5.0% men). The latter figure represents a significant change in trend from the recent past and is possibly due to the increased attention this issue is receiving. However, the overall numbers of women's startups remain small. The literature review identified one study for the U.S. which finds 28% of startups had at least one female founder in 2020, up from 22% in 2017.[40] A 2020 survey in South Korea

[39] Global Entrepreneurship Monitor (GEM) 2021/2022 Women's Entrepreneurship Report. Their sector breakdown disaggregates ICT but not other STEM fields.
[40] Silicon Valley Bank (2020) cited in Credit Suisse (2021).

found that only six percent of startup founders there were women.[41] The literature review did not find studies specific to small, medium enterprises in STEM outside of the technology sector. This is an area that would benefit from study, particularly as trade in services (including environmental and green services) takes on growing importance.

In advanced economies with large technology sectors, venture capital is another source of financing that is being subject to increased scrutiny. Studies have found that women face significantly more challenges than men obtaining venture capital for technology start-ups, although the literature on this issue is concentrated on the U.S. The *2020 Women in Tech Report* found that only 2.3% of venture capital investment goes to women-owned start-ups in the U.S.[42]

Enabling environment

A review of the literature finds that more gender equal societies, or those with less prevalent gendered stereotypes around math and science, are correlated with girls' STEM achievement.[43] As discussed above, implicit bias arising from stereotypes and attitudes is a significant factor limiting girls and women's advancement in STEM.[44] Efforts to promote women in STEM must therefore consider how to raise awareness on the contributions of women to STEM fields and achieve more positive attitudes towards women in technical areas.

Women in STEM are also limited by the same factors that impact women's paid labour across all sectors. Issues of work life balance, the cost and availability of dependent care, and gendered expectations around the care economy, are issues that economies must address in order to increase women's participation, productivity, and fulfillment in the labour force, including in STEM. Companies interviewed in the research consistently spoke to the need to ensure that family benefits and allowances under the law should benefit men as well as women so that women are not unintentionally penalized by measures that reinforce the perception that care responsibilities are gendered as "female."

Violence against women is another cross-cutting issue impacting women in STEM. Gender bias and sexual harassment is reportedly "frequent in the STEM environment."[45] A study in the U.S. found that women majoring in STEM fields may be at higher risk of sexual violence than women majoring in non-STEM fields.[46] The 2020 Women in Tech Survey found that 44% of women founders in their survey (not necessarily from APEC economies) said they had been harassed, including sexual harassment by investors. In that survey, 48% of women working in tech experienced harassment compared to 11% of men, with 42% saying the harassment was from a supervisor.

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[41] Yoon, L. (2022)

[42] See World Economic Forum (2016), Credit Suisse (2021).

[43] Khan and Ginther (2017), pg. 14.

[44] Charlesworth, T.E.S., & Banaji, M.R., Gender in Science, Technology, Engineering, and Mathematics: Issues, Causes, Solutions. Journal of Neuroscience 11 September 2019, 39 (37) 7228-7243; DOI: 10.1523/JNEUROSCI.0475-18.2019.

[45] Freedman, G., Green, M.C., Kussman, M. et al. "Dear future woman of STEM": letters of advice from women in STEM. IJ STEM Ed 10, 20 (2023). https://doi.org/10.1186/s40594-023-00411-0. See also Women Who Tech 2020 survey.

[46] Reidy, D. E. et al (2023)

V. Current Efforts and Good Practices to Promote Women in STEM

If most APEC economies have still not reached gender parity in STEM, there has clearly been a much higher level of attention and action brought to this topic in the last decade. This chapter provides an overview of promising measures in APEC economies to encourage girls and women to launch, sustain, and progress STEM careers. Case studies of corporate good practices among STEM sector ABAC members are also provided. This section is not exhaustive but highlights approaches APEC government and business leaders may wish to consider replicating or promoting in their economies.

Secondary Education

The literature suggests that overall emphasis on math and science in the curriculum and gender-neutral materials are important in ensuring that girls pursue these subjects at the same rate as boys. One recent qualitative study of course selection among secondary school girls found that supportive teachers, a school culture that emphasizes science, and encouragement by family members, were important factors influencing girls' selection of science subjects in secondary school.[47] This is consistent with other studies that find that gendered stereotypes by parents and teachers have a direct bearing on girl's willingness to pursue math and science classes. Related to this, research finds that a mindset that math skills are learned rather than innate is correlated with higher math performance, interest, and course selection in middle and high school and that boys are more likely than girls to have this type of "growth mindset."[48] Thus, cultural factors appear to have the strongest influence on whether girls develop an interest in STEM in these important formative years. This suggests that families, educators, and role models have an important part to play in supporting an inducive environment that can start girls on a lifelong path of interest in STEM. These factors mean that many of the efforts to increase girl's interest in STEM focus on mentorship, female role models, and exposure to a curriculum that includes ICT skills, such as coding.

University

Studies at both secondary and tertiary levels have found positive effects for girls and women of having female teachers.[49] Studies have found that girls with female STEM teachers in high school were more likely to major in STEM subjects in college; after entering university, studies find that female students are more likely to declare STEM majors if they have female professors. While an increasing number of APEC economies are collecting sex disaggregated data on university faculty, for the most part the data cannot be sorted by academic subject and thus it is not possible to examine what share of STEM faculty in APEC is currently comprised by women. Qualitative work on factors that increase retention of women in STEM studies at university level also highlight the importance of peers and finding a support community.[50]

Interviews with stakeholders in APEC economies also raise the issue of ensuring that higher education is affordable and accessible to girls and women of all backgrounds, as cost can deter them from pursuing STEM degrees that they need to qualify for relevant job openings. For example, in the Philippines, the Science Education Institute under the Department of Science and Technology provides 11,000

[47] Oliver, Woods-McConney et al (2017).
[48] See Khan and Ginther (2017) for a discussion of this literature.
[49] Dulce-Salcedo, et al. (2022).
[50] Freedman et al (2023).

SUPPORTING WOMEN SCIENTISTS AND RESEARCHERS THROUGH GENDER EQUITY ACCREDITATION

In 2014, the Australian Academy of Science did not select a single woman for their fellowship program. This sparked a debate that led the Australian government to enact a range of policy actions and institutions to promote Women in STEM, including the Office of the Women in STEM Ambassador, the STEM Equity Monitor, and the Advancing Women in STEM Strategy (2019).

Part of this burst of activity included the creation of Science in Australia Gender Equity (SAGE) in 2016. SAGE, which began operating as a pilot with funding from the Australian government, adapted the international Athena Swan Charter to support and transform gender equality within higher education and research to the Australian context. This involves accrediting and granting awards to tertiary education and research institutions for gender equity, diversity, and inclusion.

The accreditation process is available to universities, medical research institutions, publicly funded research agencies, and policy government advisory bodies. Enrolled institutions must:

- Ensure that gender equity, diversity and inclusion work is appropriately resourced, distributed, recognized, and rewarded;
- Undertake transparent and rigorous self-assessment processes;
- Design initiatives based on institutional data;
- Monitor, evaluate, and publicly report on progress;
- Recognize and respond to inter-sectional identities;
- Increase the safety and wellbeing of staff and students; and
- Embed change in institutional governance and accountability structures.

There are three levels of award/accreditation available recognizing different levels of progress. SAGE, which is now an incorporated company, is currently working with approximately 50% of the 100 higher education and research institutions in Australia.

The Athena Swan Charter is being replicated in other APEC economies as well. In Canada, the Natural Science and Engineering Research Council of Canada began a pilot in 2018, which now includes 17 post-secondary institutions. In the U.S., the American Association for the Advancement of Science (AAAS) has created the STEM Equity Achievement (SEA) Change program which similarly looks to promote under-represented groups in STEM.

BUILDING A PIPELINE OF DIVERSE TECHNOLOGY TALENT IN CHILE

Kodea is a non-profit organization founded in 2015 whose purpose is to empower Latin American people to actively participate in the digital world. A large part of Kodea's programs focus on women, because the digital gap in this group is even greater. Women's participation in the digital sphere makes it possible to reduce the gender gap by creating access to information, ideas, knowledge, communities, financial services, online education, telemedicine, and job opportunities, among many other benefits. This leads to greater autonomy and is a crucial element for the economic growth and development of societies.

Kodea works at each stage of the tech pipeline to increase the number of women in Chile's knowledge economy. One of Kodea's focuses is public education, since learning computer science skills early helps increase girls' confidence and interest in technology and fosters STEM interest in girls. Beginning at the K-12 level, Kodea has three education initiatives that seek to install digital skills in the classroom: Hour of Code, Los Creadores, and IdeoDigital.

"It is important to address girls' lack of confidence from the beginning. Our work at K-12 level … addresses the root of the problem. Our other programs [to provide vocational and micro-entrepreneur training] address specific work force shortages, but are less systemic."

IdeoDigital seeks to integrate computer science into the Ministry of Education curriculum, based on the Code.org platform. The program builds the skills and knowledge of teachers to implement innovative learning methodologies in the classroom, helping children develop digital and 21st century skills. The program expects to have trained at least the first 850 teachers by the end of 2025. Funding comes from donors, meaning the program is delivered free of charge to the government.

For women who have left the job market (for example, for maternity leave) and want to pick up their careers, or women who want to change careers and move into tech, Kodea developed the "Women Programmers" reskilling initiative. Kodea works with 20 partners from all over the world who develop content, while within Chile, they partner with eight institutions to deliver the content to low-income women using a boot camp approach. The training institutions are paid for each woman completing the program, with completion rates monitored through the backend of the system. Kodea, in collaboration with the training institution, then helps graduates find jobs in the digital industry. After a phase of several pilots with an average of 120 women per pilot, 80% of whom have found employment, the program went to scale through the "Digital Talent for Chile" public-private initiative that aims to train 16,000 people in four years, with a 70% success rate, measured through employment, new entrepreneurs, or continuity of study. While the government counterparts initially envisioned a "gender neutral" program, Kodea was able to reach agreement on a 50% quota for women participants to ensure that women benefit equally.

For women micro-entrepreneurs, the "Connected Women Entrepreneurs" program trains women in the digital skills and knowledge needed for online marketing and sales, financial education, and sustainability. Using a boot camp approach, the training provides 18 hours of material spread over 1 month. The training is open to any women between the ages of 18 and 69 with an existing micro-enterprise. Most participants start with extremely limited IT knowledge; 11% of enrolled women are migrants. Since 2019, the program has graduated 800 women who now have virtual stores. Kodea is now exploring how to replicate this program in other countries.

Challenges in taking these programs to scale include securing funding (including for monitoring and evaluation to document impact), limited absorption capacity among some government partners, and shifting national policy priorities. Despite these struggles, Kodea is not aware of another organization that is trying to increase the digital skills of girls and women as students, workers, and entrepreneurs.

scholarships annually for tertiary education in STEM fields with 60% of funds reserved for need-based students, and a target of gender parity for grant recipients. In Brunei, citizens receive free university education, regardless of field of study, including housing and supplies.

For the technology sector specifically, an Accenture report found that "studying in a more-inclusive college culture has a strong impact on a woman's decision to look for a job in tech, ranging from making it 21% more likely in freshman and sophomore years, to 19% and 14% more likely among juniors and seniors, respectively. Men also benefit from a more inclusive culture, with 88% in more inclusive universities planning to look for a tech role after college compared to only 69% in a less-inclusive culture." [51] That same report, written in collaboration with the organization Girls Who Code, recommended building an inclusive culture for universities by: (i) setting a target of 35% female faculty for technology, engineering and math departments; (ii) policies and enforcement against sexual harassment and biased language; (iii) support outside of class (e.g. study groups, office hours, mentoring, hands-on internship and practical opportunities); (iv) messages reinforcing the collaborative nature and potential societal contribution of work in tech; and (v) helping students make direct links to employers and highlight success of alumni.

Workplace Diversity, Equity, and Inclusion (DEI)

Interviews with ABAC members for the case studies (see Boxes in this section), and the literature review on good practices,[52] [53] identifies some common approaches to increase the number, retention, and seniority of women in the STEM workforce. These include:

- **Partnerships with schools** to promote STEM among girls and young women, for example, by having women from STEM companies speak at high schools and to undergraduates to serve as role models and encourage women to enter the profession;
- Casting a **wide net when recruiting** and applying AI to reduce bias in hiring processes;
- Forming **Diversity Committees at the Executive Committee level** responsible for creating more inclusive environments, and issuing **Diversity & Inclusion policies** that are monitored by internal audit and/or third-parties as part of ESG commitments;
- Implementing programs to support women employees from diverse backgrounds, including **mentoring, sponsorship, and employee experience research and support groups** for minority groups and creating networking opportunities during work hours to avoid excluding people who have after-work commitments. Related to this, women appear to advance better in organizations with flatter management hierarchies;
- Focusing on **internal talent development**. Practitioners emphasize building a gender balanced pool of talent in firms' succession planning. Surveys of women in technology express a strong desire for clear paths to promotion and a desire to see more women in leadership roles;
- **Implicit bias training** for managers, including role play;

[51] Accenture and Girls Who Code (2019).
[52] Burman, S., 2023.
[53] TrustRadius, 2021 Women in Tech Report.

CORPORATE EFFORTS TO INCREASE GIRLS AND WOMEN IN TECH

> "*The main challenge in Tech companies is that, in general, there are more male than female graduates or those who are committed to tech jobs. Hence, the disparity is a challenge from the beginning as the demographics will take time to balance out until more female students are keen to pursue a tech course earlier in their academic pursuits.*"

NCS, part of the Singtel Group, offers a wide range of services from applications, infrastructure, engineering, cybersecurity, new frontier tech, client service, and corporate functions. The Singtel Group's forthcoming diversity and inclusion (D&I) policy builds on existing core values and covers all categories of employees, from gender, age, ethnicity, and race, to religion and beliefs. Work to increase D&I includes raising awareness, encouraging engagement, cultivating leadership, and enhancing team experiences.

NCS established a Women in Technology (WIT) committee in 2022 which aims to increase the ratio of women in NCS and enhance NCS' gender diversity. The challenges facing NCS are common to the industry. For more junior staff recruits, the pool of female talent in tech is smaller due to lower number of graduates and job seekers in IT. NCS therefore invests heavily in building the pipeline of girls interested in technology. They engage with education institutions through projects like Girls In Tech and organise events like Women In Tech and International Women's Day events to increase awareness of roles and opportunities in the IT sector. Programs include:

- The inaugural *Girls In Tech Hackathon* for 40 girls across Singapore's 5 polytechnic high schools was held in June 2022. The champion team won a trip to NCS Australia and the top 3 winning teams were offered internships at NCS Singapore;
- Tech career sharing, fireside panel discussion, and a hands-on experience on the latest NCS technologies in robotics, augmented reality, virtual reality, and artificial intelligence; and
- The *Star Discovery Open House* was an exclusive session for young female polytechnic and university students to experience the newly renovated NCS Hub.

NCS feels that the abundant and equal opportunities in education in the countries where they operate contributes significantly to their D&I efforts. The openness and willingness of educators and educational institutions to collaborate on the programs above help cultivate young female talent so that they may chart a career path in the IT sector.

Challenges for women already in the workforce relate primarily to family responsibilities that may cause women to drop out as they move up managerial levels. The nature of NCS' services, whereby employees must work at client sites, makes it challenging for employees to balance work and life. The company is offering flexible working arrangements to be more responsive to these needs. NCS has set a target of 32% of female employees in management by FY2025. To help meet this target, NCS is now working towards offering women-specific mentorship and sponsorship programs for female employees. Mentors provide guidance, support, and career advice. Sponsors actively promote women's empowerment, ensure visibility, and break down barriers to career advancement, for example, by highlighting the achievements of the women they are sponsoring or including them in succession planning. NCS also welcomes the recent (2021) decision by Singapore to strengthen workplace discrimination protections.

The Singtel Group issues an annual Sustainability Report as part of their ESG commitments, which includes data on: the gender breakdown of their employees (by seniority); the compensation ratio (wages and bonuses) between men and women; and turnover rate, workplace injury, and absenteeism by gender. Singtel benchmarks their ESG efforts externally and their efforts have been recognized for 5 consecutive years in the Bloomberg GenderEquality Index.

PROMOTING WOMEN IN TRADITIONALLY MALE-DOMINATED INDUSTRIES

Siam Cement Group (SCG) was founded in 1913 and has three core businesses: cement & building materials, SCG chemicals, and SCG packaging. The company has 57,741 employees, 44% of whom are located outside of Thailand in neighbouring ASEAN economies. The company created a Diversity and Inclusion (D&I) policy two years ago (2020) that reflects the company's commitment to human rights and promotes equal rights and treatment for all employees. It is applicable to all SCG's business activities, including suppliers/contractors in the business value chain and joint ventures. The Human Rights and Diversity Committee reporting to the Executive Committee is responsible for implementation; Internal Audit monitors and reports progress annually to the Board of Directors.

> "*Our commitment is belief in the individual value of people. We want people to feel equal in the company. Given our industry, we cannot expect to get to 50% for every role. But the number is not the answer. The answer is that everyone feels treated equally*."

In an industry that is traditionally male-dominated, SCG's is seeking to increase the share of female employees at all levels. Currently, women comprise approximately 25% of all employees and 30% of the management level (2022 figures). Recruitment efforts and job listings no longer specify a desired sex of applicants, and physically challenging positions that were formerly reserved for men are being opened to women. This is increasing the number of women performing quality control, inspection, and maintenance functions in SCG's factories. Still, providing opportunities for all job categories remains a challenge.

In order to attract and retain employees, including women, SCG offers benefits to improve work life balance. This includes "work from home" and "work from anywhere" policies, paid maternity leave that is double the legal requirement (90 days vs. 45 days), paternity leave, an allowance for new parents, and medical benefits for families. Vacation leave is set at 8-21 days annually against a legal requirement of 6 days/year.

Under the Human Rights and D&I policy, all employees are required to pass a code of conduct (e-ethics) exam annually which includes material on gender equality, harassment, forced labour and other human rights issues. A company grievance mechanism is available for employees to report misconduct, including harassment. SCG also engaged an external consultant to conduct research with minority employee groups about their experiences in the company. Interviews were held with women, persons with disabilities, LGBT, and Muslim employees to collect their feedback and suggestions. Their inputs informed subsequent efforts to raise awareness among all employees about "Dos and Don'ts" in the workplace to address implicit and explicit bias. The company also runs special programs, such as guest speakers, to promote women and the disabled, and has a "BE YOU Club" that offers a positive space for employees of diverse backgrounds.

SCG's increased attention to diversity and inclusion reflects greater international attention to this issue from investors and lenders. SCG is listed on several Environmental, Social and Governance (ESG) rankings and engages in third-party rating and benchmarking of its ESG commitments by firms such as DJSI (which ranked it as an industry leader in 2022) and Sustainalytics. The company issues an annual Sustainability Report which includes information on their diversity and inclusion work. They also submit information on the ratio of women to men's remuneration to the Global Reporting Initiative.

Government legislation that supports SCG's D&I include the Thailand Gender Equality Act (2015), and the Labor Protection Act "equal pay for equal work" clause (2019).

- Providing **flexible work conditions** (e.g. telecommuting, hybrid roles, and flexible work hours) and supporting parents through day care subsidies (or onsite facilities), and generous health care and vacation/sick leave policies;
- Offering **equal parental leave** (i.e. paternal as well as maternal leave) so that women are not perceived as more expensive or likely to take time off after a birth and shifting the narrative that reproductive work is gendered female;
- Conducting **compensation and benefit audits** to ensure women and men are receiving equal pay for equal work (these often occur in economies where there is a regulatory requirement to report gender wage gaps such as Australia and the United States); and
- **Setting targets** for the proportion of women managers and female representation on Boards. Progress towards these targets should be monitored (and these KPIs should be weighed when evaluating leaders' bonuses) and published.

Companies in traditionally male-dominated sectors such as energy, construction, and defence are taking extra steps such as making it explicit that all job categories are open to women; developing personal protective equipment (PPE) or equipment that is appropriate for women's morphologies; offering hardship and remote posts to women; and offering upskilling programs to women coming back from personal leave.

Specific to Board representation, a growing number of APEC economies, including Hong Kong, Malaysia, Singapore, and the U.S., are setting quotas for diverse Board representation for all sectors (see Annex 6 for more information on this issue including the current legal and regulatory requirements in APEC economies regarding female Board representation).[54]

Support to Female Researchers

APEC economies are also taking measures to increase the number of women in R&D. Several economies have set quotas for the proportion of public funding that must be directed to women-owned firms or have created new rules for gender parity in medical human trials, or financing research on aspects of women's health that may have been neglected in the past. Some of the examples of measures being taken include:

- **Chile's** Human Capital for Innovation in Women's Enterprises provides co-financing to allow women researchers to hire project staff to cover parental leave and/or improve worklife balance (paying up to 90% of hiring cost for women research assistants and 80% of the hiring cost for men). The National Science Council in **Chinese Taipei** and the National Institute for Health (NIH) in the **U.S.** have similar schemes to fund research assistants to cover parental leave.
- **Australia** is experimenting with anonymized applications for research grants (i.e. all gender markers are removed from the application before it is scored) to address bias in proposal evaluation.
- In the **U.S.**, 11 Federal agencies participate in the Small Business Innovation Research (SBIR) program, and five of those agencies also participate in the Small Business Technology Transfer

[54] Bello (2021). Credit Suisse (2021) notes that companies have been found to manipulate reporting when faced with quotas.

INCREASING DIVERSITY & INCLUSION IN ENGINEERING

BAE Systems is a leading global defence company with a large presence in the APEC region, particularly Australia and the U.S. As a global company, their core Diversity, Equity, and Inclusion (DE&I) commitments are adapted to the legal and regulatory requirements and cultural specificities of each of their markets. A global Diversity and Inclusion Policy is scheduled to be issued later this year (2023).

"Improving DEI is a responsibility for many parties, including businesses and governments. Where a strong regulatory framework exists to advance DEI and to protect those who may be affected, all companies are supported in their efforts to make improvements."

In Australia, BAE System's Gender Equity Strategy is informed by the Workplace Gender Equality Agency (WGEA), an Australian Government statutory agency created by the Workplace Gender Equality Act 2012. The Act requires that companies over 100 employees report annually on the number of women at each level of the organization, as well as gender-disaggregated salary and benefit information. From 2024, WGEA will begin publishing employers' gender pay gap. Similar government regulation to report sex disaggregated data on the number of male/female employees and other categories of diversity exists in the U.S., where BAE publishes a regular DEI Impact Report with this information. In 2023, BAE also joined the Bloomberg Gender Equality Index and the Dow Jones Sustainability Indices (DJSI).

BAE Systems' approach to diversity is broader than female representation. For example, BAE Systems in Australia has recently become the first employer in the Australian defence industry to commit to a Reconciliation Action Plan (RAP) in partnership with the non-profit Reconciliation Australia, with the aim of increasing opportunities and strengthening relationships within the Aboriginal and Torres Strait Islander Communities. The RAP lays out BAE's commitment to work towards increased Aboriginal and Torres Strait Islander workforce participation, community engagement, and investment and business partnerships. As one action under the RAP, BAE Systems is currently consulting with Australian universities to establish an Aboriginal and Torres Strait Islander STEM Scholarship program.

Given BAE Systems' cross-cutting DE&I commitments, targets for representation by disadvantaged people include both women (26% female representation by 2026 and 30% female representation by 2030), and Aboriginal and Torres Strait Islander representation (3.2% by 2026, i.e. parity with the Aboriginal and Torres Strait Islander population in Australia). Current efforts to promote women in the company include the Women in Engineering project to improve female retention and attraction of female STEM talent. The project has 3 streams: a communications plan to increase awareness around attrition of female engineers; a lunchtime series where women engineers share their experiences with senior engineering leaders in the company; and training to recognize and address bias in the engineering workforce.

"By focusing on one demographic at a time we run the risk of excluding others. We are therefore focusing on creating a culture of inclusion and belonging where all employees can bring their whole selves to work."

BAE have also engaged a consulting firm to help them examine and remediate the gender wage gap. That work is currently in the diagnostic phase, analysing pay in like-for-like roles, and identifying any structural or corporate cultural issues affecting pay equity, such as recruitment practices, job bands, any evidence that men are promoted more quickly, or impacts of parental leave. Other recent efforts include participation in the "STEM Returners" program whereby people who have taken a career break are placed in participating firms.

(STTR) program. These two programs administer R&D grant funds set aside from participating agency's procurement budgets. The pool of money available in 2018 was $3.6 billion. Women's chances of obtaining funding through these mechanisms is nearly five times higher than if they applied for venture capital.[55]

- Also in the **U.S.,** the NIH has recently enacted regulations that allow them to monitor and investigate reports of sexual harassment in labs they fund and withdraw funds if the grantee violates the terms and conditions of the award to provide a safe and harassment-free environment.
- Several "Women in Science" prizes exist across the APEC region to highlight the achievements of women scientists. For example, in **Malaysia**, the L'Oréal-UNESCO Fellowship for Women in Science has awarded over RM1,000,000 in grants to more than 40 women scientists since 2006. The annual Underwriters Laboratories-**ASEAN**-**U.S**. Science Prize for Women recognizes senior and mid-career female scientists and is accompanied by a cash award.
- As mentioned above, **WIPO** has developed the WIPO World Gender Name Dictionary to assign sex to inventors based upon classification of first names in 195 different countries. This type of Gender Name Dictionary can be applied by organisations to gender disaggregate existing and historical datasets and is open source.

VI. Conclusion and Recommendations

This research demonstrates that APEC economies are taking concrete actions to improve women's representation in STEM and that progress has been made since the 2017 Women in STEM Framework. However, building up the women in STEM pipeline will take time, and the APEC Women in STEM Principles and Actions remain as relevant as when they were endorsed in 2019. The evidence shows that interventions in early education, particularly encouraging girls to pursue math and science courses in middle and high school, are critical to ensuring enough girls are entering the pipeline to achieve more equal representation at later points of the career path. Cultural and societal factors, including countering gender stereotypes and bias, and encouragement by families and teachers, are shown to be primary factors at these early stages in encouraging girls to retain an interest in STEM subjects. Among STEM fields, emphasis must clearly be placed on improving girls' interest in engineering and computer sciences, where women lag most significantly in almost all economies.

In universities and workplaces, a supportive environment and culture that values and encourages women's contributions is a key factor. Ensuring that education is affordable for women from diverse backgrounds, and providing mentors and support groups for enrolled students, can all help increase inclusion in this step of the STEM journey. More research on why women completing STEM degrees chose other fields after graduation would be useful to understand and mitigate these factors.

Workplaces that support employees to manage family responsibilities alongside their paid employment benefit both women and men and are important to helping women avoid career breaks that impact their compensation and career progression. Government policies can support this through incentives or mandates. Nonetheless, research demonstrates that some of the wage and seniority gap experienced by women is found to be connected to bias by supervisors and colleagues. Many companies are working to

[55] National Women's Business Council

combat these biases and increase the diversity of their workforce; this will increase women in STEM but also provide tangible benefits for those firms. Companies also point to supportive measures governments can take such as legislation for equal workforce treatment and pay or against sexual harassment. Investors and financial regulators also have a supportive role to play by demanding transparency on diversity issues and by critically examining their own practices when it comes to directing resources.

Finally, there is a strong need to increase research on this issue outside of the OECD. Available data suggests that women's representation in STEM education and workforce in some ASEAN economies may outperform other APEC regions, but limited data makes it difficult to draw firm conclusions. There may be lessons those economies can share if it was better understood why they are outperforming some of the larger economies. It was also beyond the scope of this study to conduct an in-depth examination of specific sub-sectors such as information technology, SMEs, or the green economy, which would fruitfully be the focus of additional study.

The findings lead to recommendations for APEC policymakers as follows:

Education

- Governments are encouraged to promote curricula that emphasize the value of math and science subjects for all students, especially girls and students from disadvantaged backgrounds. Educational materials should be gender sensitive and represent examples and role models from diverse backgrounds. Schools and teachers should be evaluated on their success in encouraging girls to select math and science subjects in secondary school.
- Governments are encouraged to collect and report sex disaggregated data on the proportion of female STEM teachers/professors in secondary and tertiary education institutions and to promote policies that contribute to parity in hiring and pay for female STEM teachers and faculty.
- Governments are encouraged to collect and report sex disaggregated data on enrolment and completion in relevant vocational institutions, to allow for a fuller analysis of available skilled labour in STEM fields. This is an area that also would benefit from more research attention by academics, particularly for less developed economies.

Workforce

- Governments may wish to consider setting quotas or voluntary guidelines for women's leadership in publicly-funded research and may wish to replicate good practices in accrediting research institutions according to their performance in promoting gender equality.
- Universities are encouraged to publish transparent pay scales as well as sex disaggregated data on seniority, rank, and tenure.
- Employers are encouraged to conduct salary reviews to ensure that women and men are being paid equally for similar work. While company's salary scales are gender neutral, the results of such an analysis may demonstrate significant disparities in practice that can be addressed through human resource policies to help accommodate care responsibilities (such as "on" and "off" ramps). Offering mentoring and sponsorship opportunities is also a desired and important step to encourage women and ensure they receive visibility in succession planning.

- Economies who have not already mandated female representation on corporate boards should consider putting these in place. While quotas can be controversial, it does appear there is at least a correlation between quotas and increased female representation.

Entrepreneurship

- Financial sector regulators can require venture capital firms to publish data on the number of female-owned and/or led firms they fund and the value of these deals as a percentage of their portfolios. This would increase transparency in this sector and encourage efforts to identify and invest in women founders.
- Domestic patent offices are encouraged to mirror efforts by WIPO to publish gender disaggregated data on patent and trademark protection applicants and to raise awareness among women inventors (especially SME owners) on how to protect their intellectual property.[56]
- Industry groups that represent STEM sectors are encouraged to promote female leadership and role models in their communication and advocacy campaigns. Sponsoring competitions and prizes that bring visibility to women scientists is also helpful in creating role models and advancing careers.
- Researchers and statistical agencies are encouraged to conduct work on women-owned SMEs in the STEM sector.

Enabling Environment

- Economies are encouraged to enact parental leave policies which benefit parents of both sexes (and same-sex households). Policies that increase the supply, affordability and quality of child care would also help women stay in the STEM workforce.
- Laws against sexual harassment and gender-based discrimination in the workplace (including equal pay for equal work type provisions) are helpful in strengthening and reinforcing company-specific policies.

[56] The Peru-sponsored APEC project "Empowering APEC Women Inventors: Patents as a Tool for Gender Equality" is also working on this issue through IPEG in partnership with PPWE.

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Annex 2. List of Respondents

	Economy	Respondent
1	Australia	BAE Systems
2	Brunei	LVK Group of Companies
3	Chile	Kodea Foundation
4	Malaysia	Petronas
5	Philippines	Ayala Corporation
6	Singapore	NCS Singapore Digital and Technology Services
7	Thailand	Siam Cement Group
8	USA	Anonymous life sciences firm

Annex 3. LinkedIn Methodological Note

LinkedIn data provided for this report is from LinkedIn's Economic Graph. With 950+ million members globally (and growing), the LinkedIn platform offers a level of global coverage, analytical granularity, and data timeliness that makes it one of the world's richest sources for insights on both the demand and supply side of labour markets. The indicators shared by LinkedIn come from the anonymized and aggregated profile information of LinkedIn's members around the world. As such, these data are influenced by how members choose to use the platform, which can vary based on professional, social, and regional culture, as well as overall site availability and accessibility. In sharing these insights from LinkedIn's Economic Graph, we want to provide accurate statistics while ensuring our members' privacy. As a result, all data show aggregated information for the corresponding period following strict data quality thresholds that prevent disclosing any information about specific individuals.

The following metrics were provided for this report:

Metric	**APEC country coverage**	**Year**
Proportion of female representation for STEM and non-STEM by APEC economy	Australia, Canada, Chile, Mexico, New Zealand, Peru, Philippines, Singapore, USA	2015-2022
Proportion of female representation in STEM by seniority level, by APEC economy	Australia, Canada, Chile, Mexico, New Zealand, Peru, Philippines, Singapore, USA	2023 snapshot
Proportion of STEM graduates (degree holders) go on to STEM careers, by APEC economy	Australia, Canada, Chile, Mexico, New Zealand, Peru, Philippines, Singapore, USA	2023 Snapshot
Green skills concentration by gender, by APEC economy	Australia, Canada, Chile, Mexico, New Zealand, Peru, Singapore, USA	2015-2022
Proportion of female in Artificial Intelligence, by APEC economy	Australia, Canada, Chile, Mexico, New Zealand, Peru, Singapore, USA	2016-2022

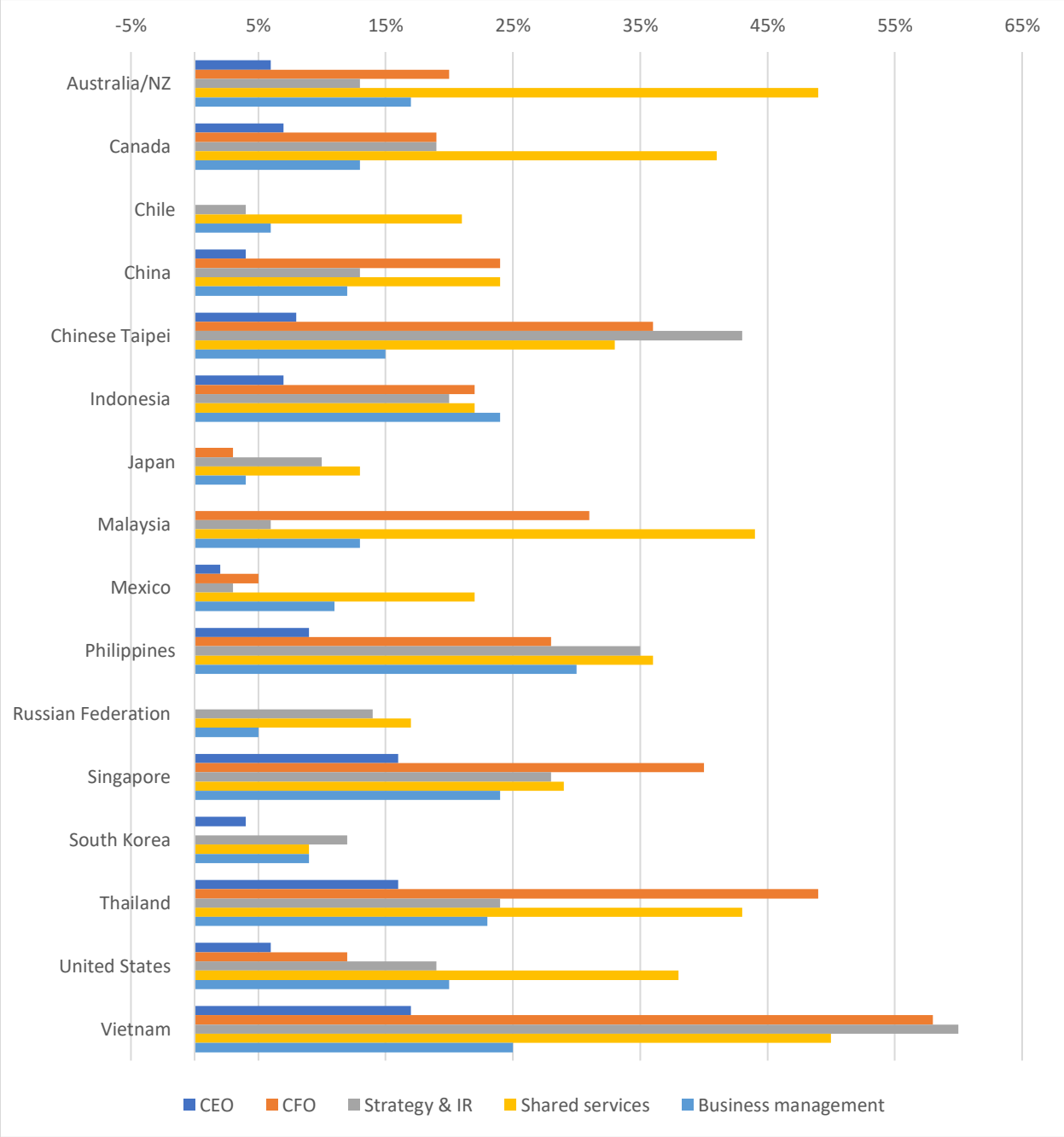
Methodological statements and definitions regarding this data:

Assigning Gender to members	Gender identity isn't binary and we recognize that some LinkedIn members identify beyond the traditional gender constructs of "men" and "women." If not explicitly self-identified, we have inferred the gender of members included in this analysis either by the pronouns used on their LinkedIn profiles, or inferred on the basis of first name. Members whose gender could not be inferred as either man or women were excluded from this analysis.
Share of women in leadership	The share of women in leadership represents the total number of women holding Director, VP, C-suite or Partner positions divided by the total number of men and women holding these positions within STEM or non-STEM buckets.

STEM	STEM (Science, Technology, Engineering, and Mathematics) defines a collection of skills and occupations in these connected fields. We define STEM skills as those for which STEM degree graduates are at least five times as likely to list the skill as non-STEM degree holders. We define STEM occupations as those with at least one of their top ten skills as a STEM skill. For more details about the methodology, refer to Baird, Gahlawat, et al. (2023).
Green Concentration	The share of workers who hold a green job or list at least one green skill on their LinkedIn profile, out of all members of the selected gender
Green talent	A LinkedIn member is considered green talent if they have explicitly added green skills to their profile and/or they are working in a green job
Green skills	Are those (out of the 38,000 listed on LinkedIn) that enable the environmental sustainability of economic activities. Examples include skills in pollution mitigation and waste prevention, environmental remediation, sustainable procurement, energy generation and management, etc.
Green jobs	Are occupations that cannot be performed without extensive knowledge of green skills. Skills are used as a signal for whether the greening of the economy is the primary focus of the occupation. In these jobs workers have the highest green skills intensity as green knowledge needs to be extensive. Examples include sustainability specialists and solar consultant.
AI skills	A LinkedIn member is considered "AI talent" if they have explicitly added AI skills to their profile and/or they are occupied in an AI job. An 'AI' job (technically, occupation representative) is an occupation representative that requires AI skills to perform the job. The AI representation metric is calculated by dividing the AI talent for each gender by the total AI talent for that economy in a given year.

Annex 4. Data on Women in Management

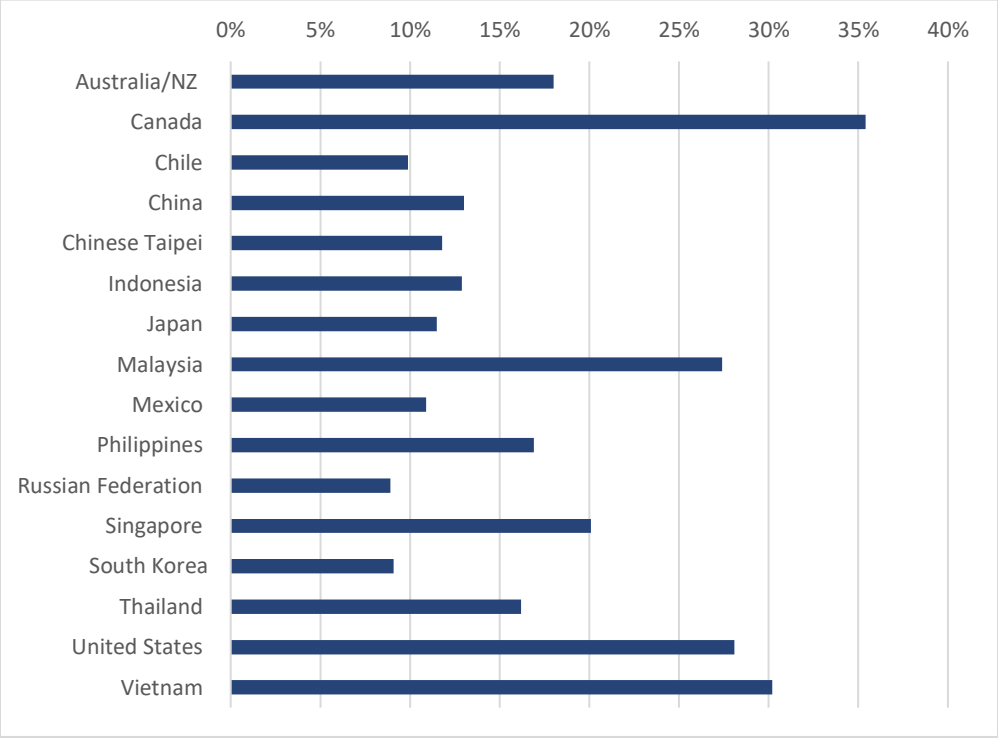
Figure 17: Women in management, all sectors, by economy (2021)



Source: Credit Suisse, CS Gender 3000 (2021).

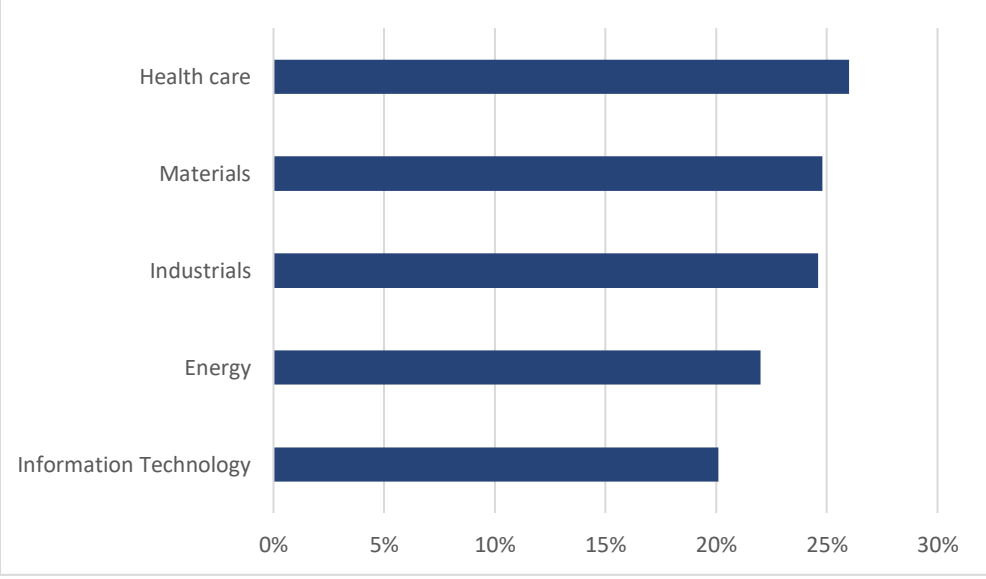
Annex 5. Data on Women on Corporate Boards

Figure 18:Share of female directors on corporate boards (all sectors) 2021



Source: Credit Suisse, CS Gender 3000 (2021). Based on a review of 3,000 firms in 46 countries where Credit Suisse evaluates investment.

Figure 19: Female Board Representation by sector (all regions) 2021



Source: Credit Suisse, CS Gender 3000 (2021).

Table 1: Gender Quotas for Corporate Boards in APEC Economies

Economy	Compliance date/effective from	Board quota or target	Mandatory or voluntary disclosure	Board or senior management disclosure
Australia	February 2019	The 4th edition of the ASX Corporate Governance Council states a non-binding target of 30% of women on board if the company is listed on the ASX 300 Index. The ASX Corporate Governance Council would encourage larger listed entities with significant numbers of employees to provide more granular disclosures of the relative participation of women and men in senior executive roles.	Comply or explain	Board and senior management
Canada	January 2020	Effective January 2020, the Canada Business Corporations Act requires that publicly listed companies provide certain diversity information relating to woman, visible minorities, persons with disabilities and Aboriginals peoples.	Comply or explain	Board and senior management
Hong Kong SAR	Consultation paper published in April 2021	To promote gender diversity, the consultation on review of the corporate governance code and related listing rules requires all listed issuers to set numerical targets and timelines.	Mandatory disclosure requirement	Board level and across the workforce (including senior management)
Japan	June 2021	The Tokyo Stock Exchange revised Japan's Corporate Governance code, effective from June 2021. Companies should present policies and voluntary and measurable goals for ensuring diversity. Furthermore, the OECD Corporate Governance Factbook 2021 states that the current voluntary target is to reach 12% gender diversity for listed companies on the First Section of the Tokyo Stock Exchange by 2022.	Voluntary	Board
Korea	August 2022	Korean companies listed in the KOSPI index, with total assets greater than KRW 2 trillion are	Mandatory disclosure requirement	Board

		required to appoint at least one female director.		
Malaysia	April 2021	All boards should comprise at least 30% women directors.	If the composition of women on a board is less than 30%, the board should disclose the action it has or will be taking to achieve 30% or more and the timeframe to achieve this.	Board
New Zealand	June 2018	New Zealand's government set a target to have 50% female representation on state sector boards by 2021.	Voluntary	Board
Singapore	September 2020	The Council for Board Diversity has a target for woman on boards of 20% by 2020; 25% by 2025; and 30% by 2030 for top 100 listed companies.	Voluntary	Board
Chinese Taipei	2023 for new IPOs; By 2025 for all listed firms.	Listed companies planning IPOs on the TWSE must have at least one woman on their board of directors. All currently listed firms will have to elect at least one woman in their next annual meeting.	Comply or explain	Board
USA	At least one Diverse director by August 2023 and two diverse directors by August 2026	In August 2021, the SEC approved Nasdaq's proposed rule changes related to board diversity and disclosure. The new listing standards will require each Nasdaq-listed company, subject to certain exceptions, to have at least two diverse board members or explain why it does not. The new listing standards also will require disclosure of information on the voluntary self-identified gender, racial characteristics, and LGBTQ+ status of the company's board.	Comply or explain	Board

Reproduced and adapted from: The CS Gender 3000 2021 Report.

Advancing APEC Women in STEM - **Supplement to the Report**

LinkedIn Economy-Specific Data

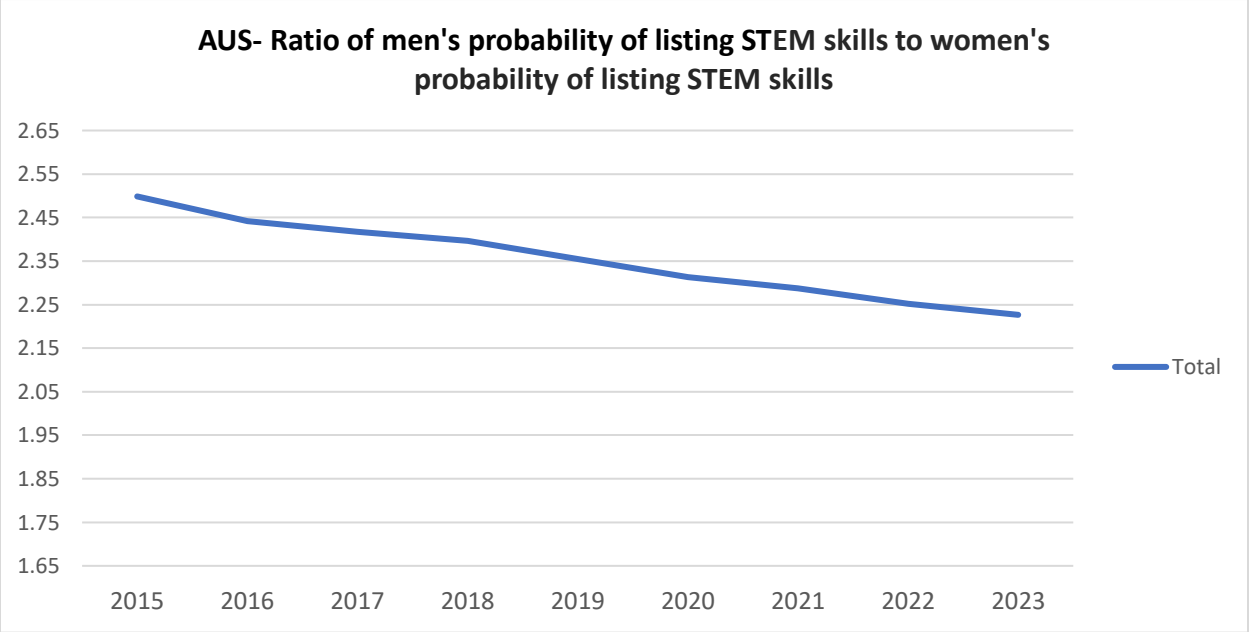
Prepared for the APEC Business Advisory Council (ABAC)

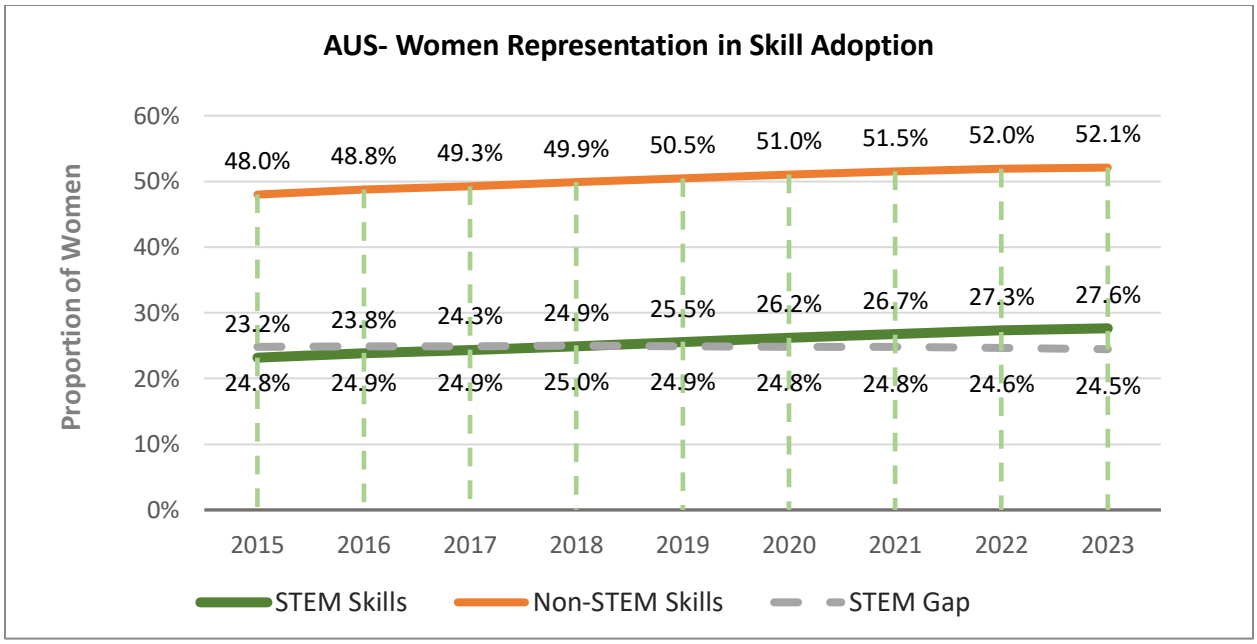
By Erin Thébault-Weiser

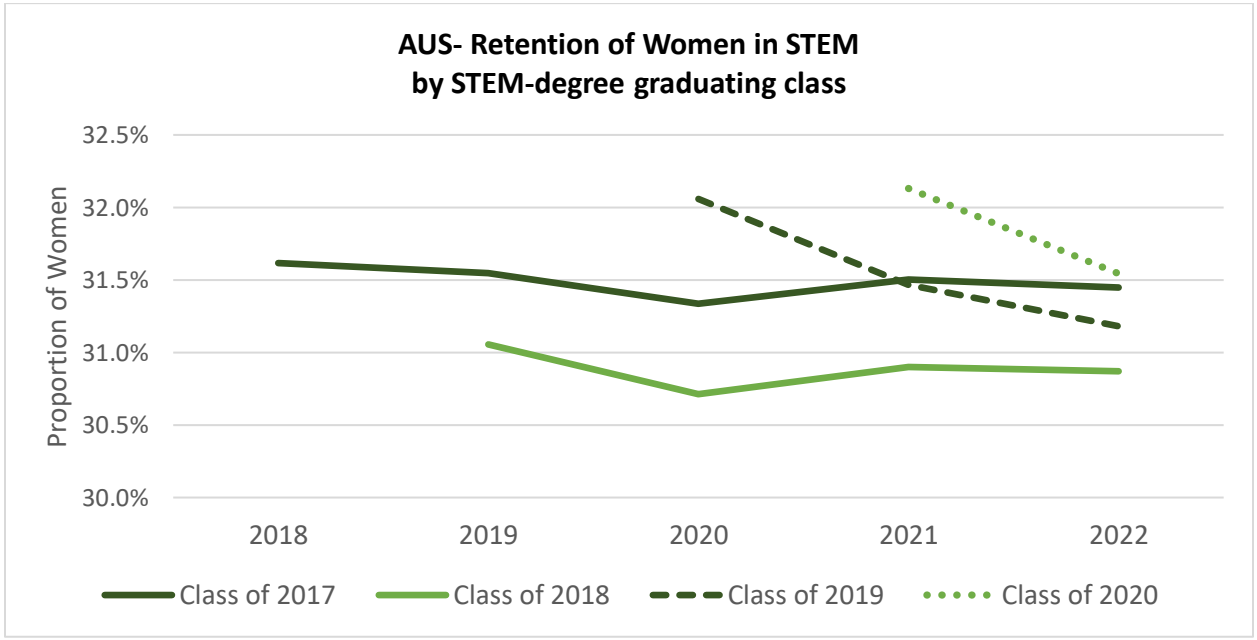
30 October 2023

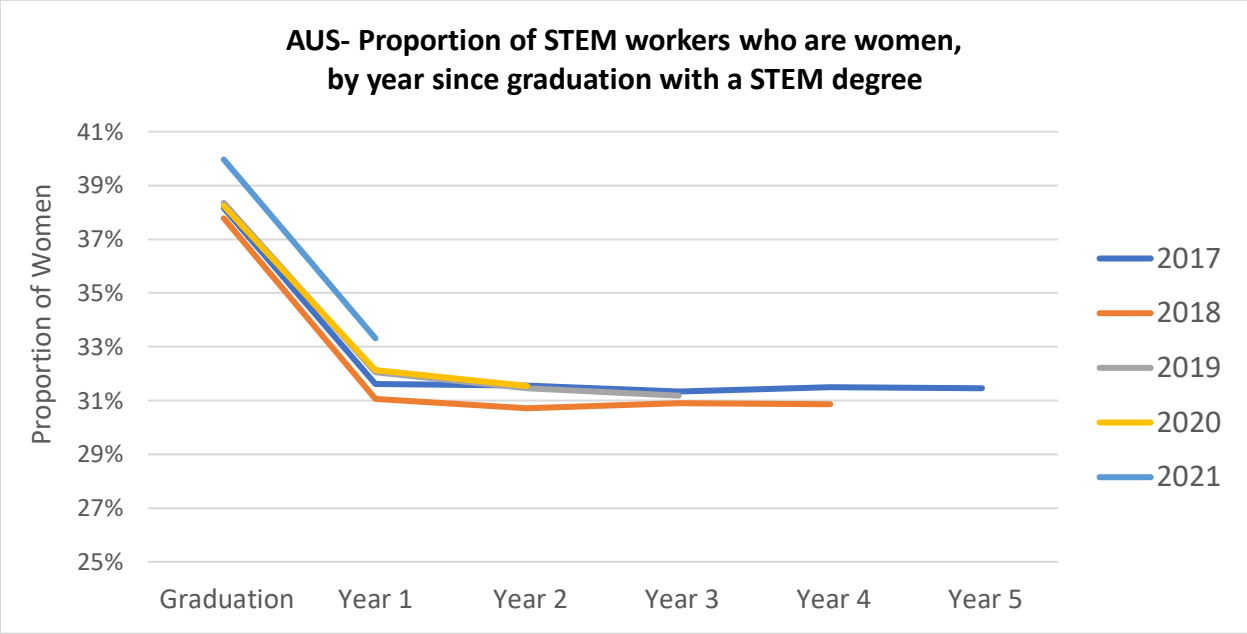
This supplement includes economy-specific data provided where LinkedIn had sufficient member data to report results. The nine economies covered below are Australia, Canada, Chile, Mexico, New Zealand, Peru, Philippines, Singapore and United States. Please see Annex 3 of the main report for the methodological note behind these data points.

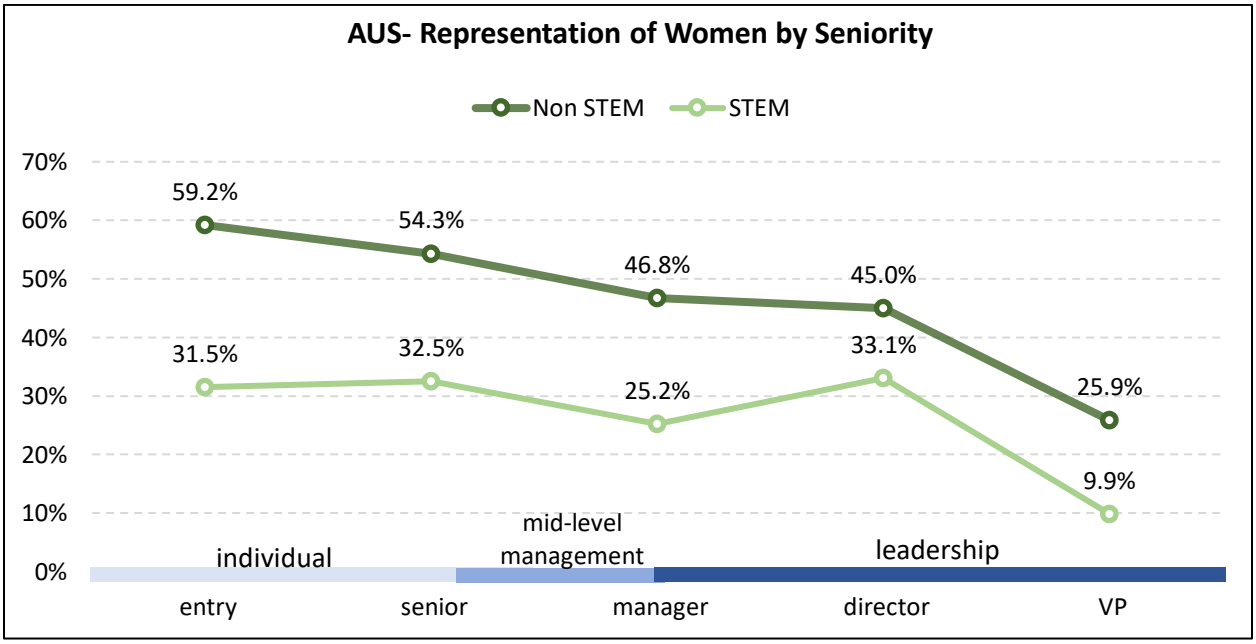
Australia



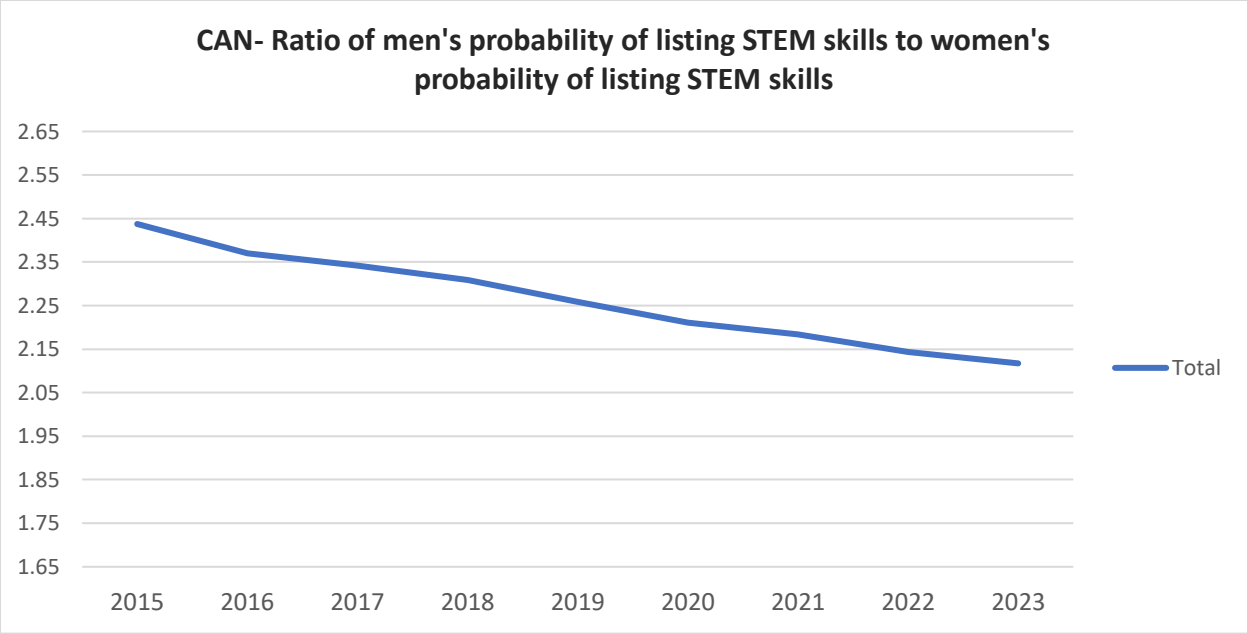

AUS- Women Representation in Skill Adoption
Proportion of Women
60%
50%
40%
30%
20%
10%
0%
48.0%
48.8%
49.3%
49.9%
50.5%
51.0%
51.5%
52.0%
52.1%
23.2%
23.8%
24.3%
24.9%
25.5%
26.2%
26.7%
27.3%
27.6%
24.8%
24.9%
24.9%
25.0%
24.9%
24.8%
24.8%
24.6%
24.5%
2015
2016
2017
2018
2019
2020
2021
2022
2023
STEM Skills
Non-STEM Skills
STEM Gap

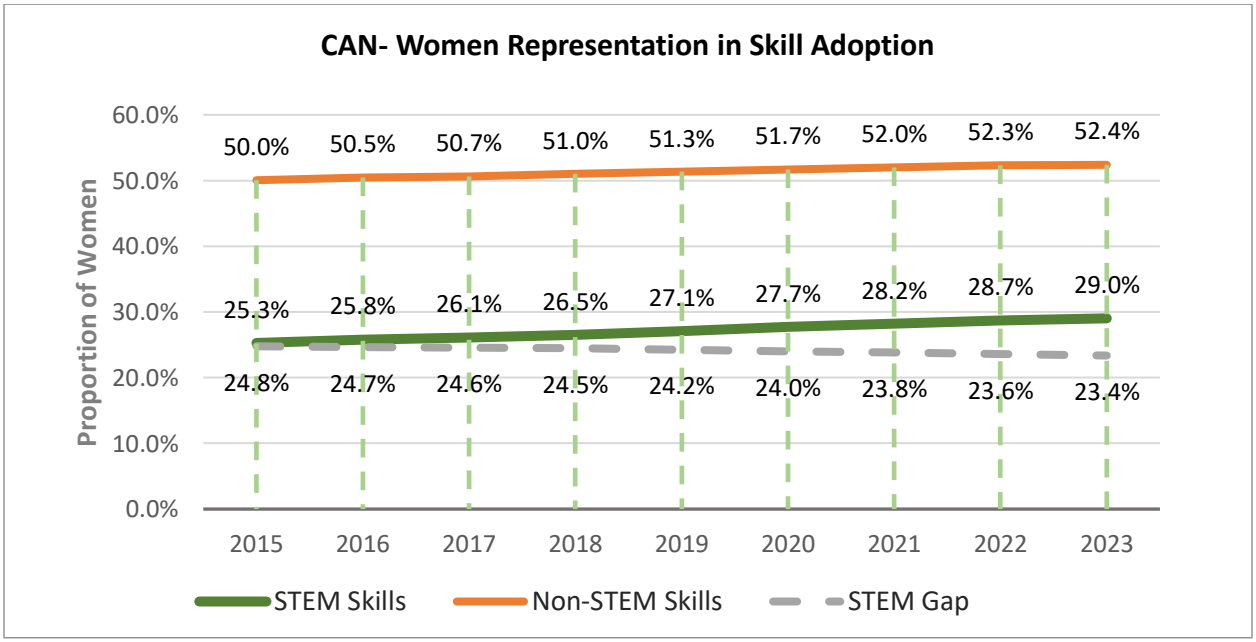

AUS- Retention of Women in STEM
by STEM-degree graduating class
Proportion of Women
32.5%
32.0%
31.5%
31.0%
30.5%
30.0%
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020

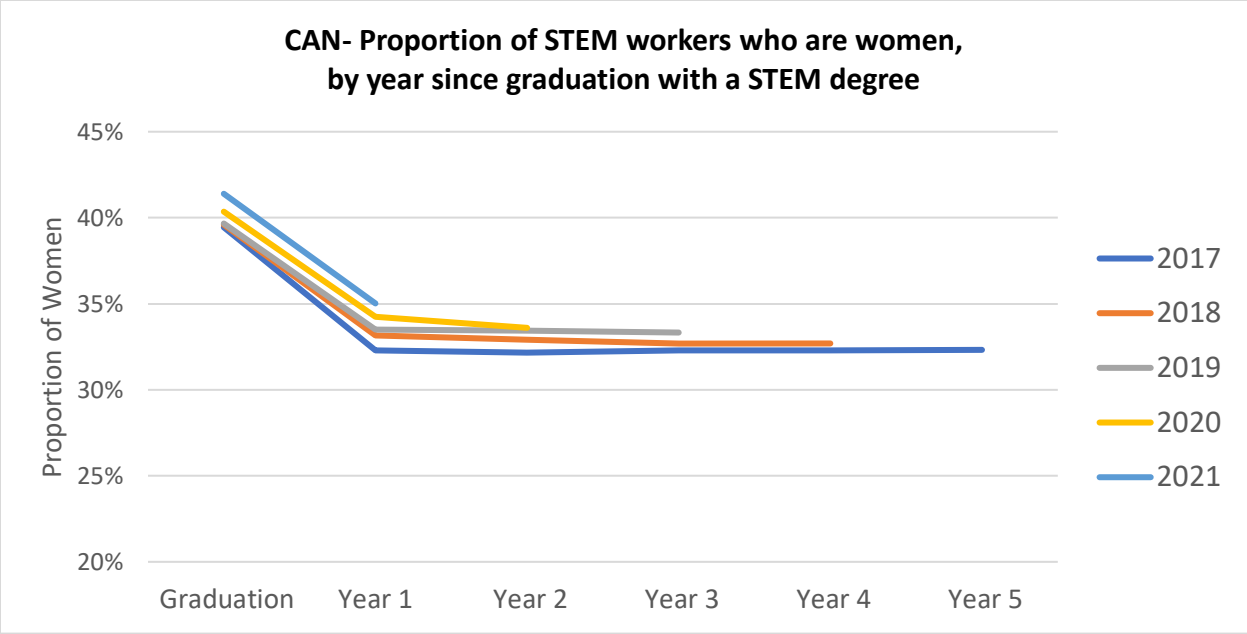

AUS- Proportion of STEM workers who are women,
by year since graduation with a STEM degree
Proportion of Women
41%
39%
37%
35%
33%
31%
29%
27%
25%
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021

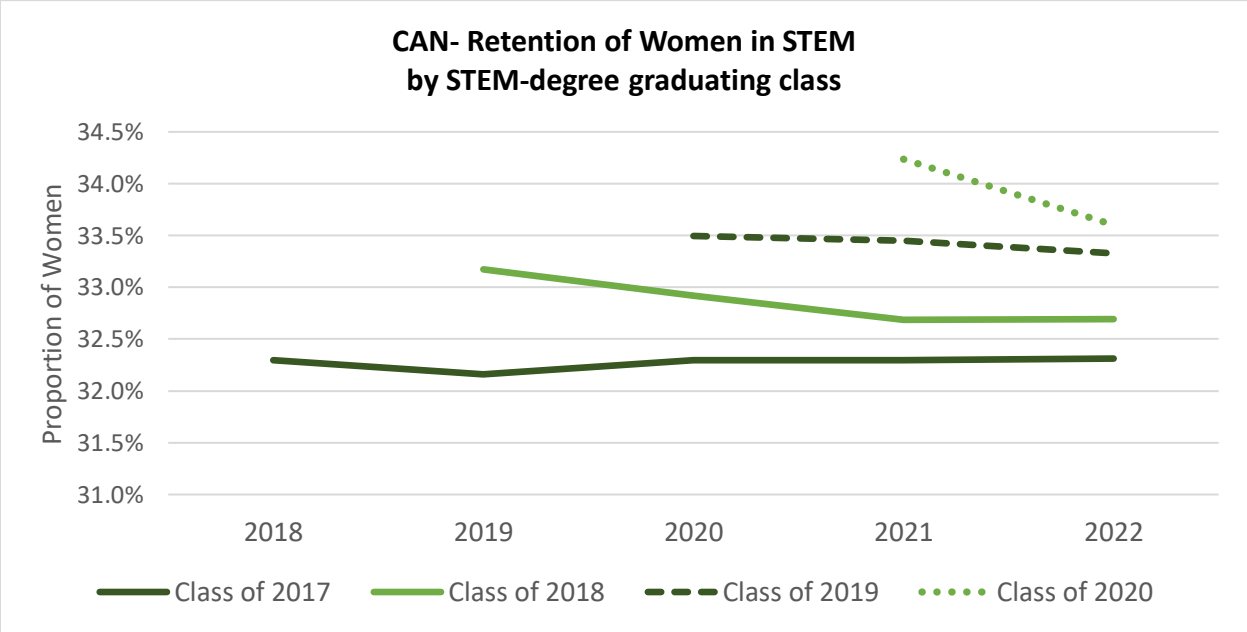

AUS- Representation of Women by Seniority
Non STEM
STEM
70%
60%
50%
40%
30%
20%
10%
0%
59.2%
54.3%
46.8%
45.0%
25.9%
31.5%
32.5%
25.2%
33.1%
9.9%
individual
mid-level management
leadership
entry
senior
manager
director
VP

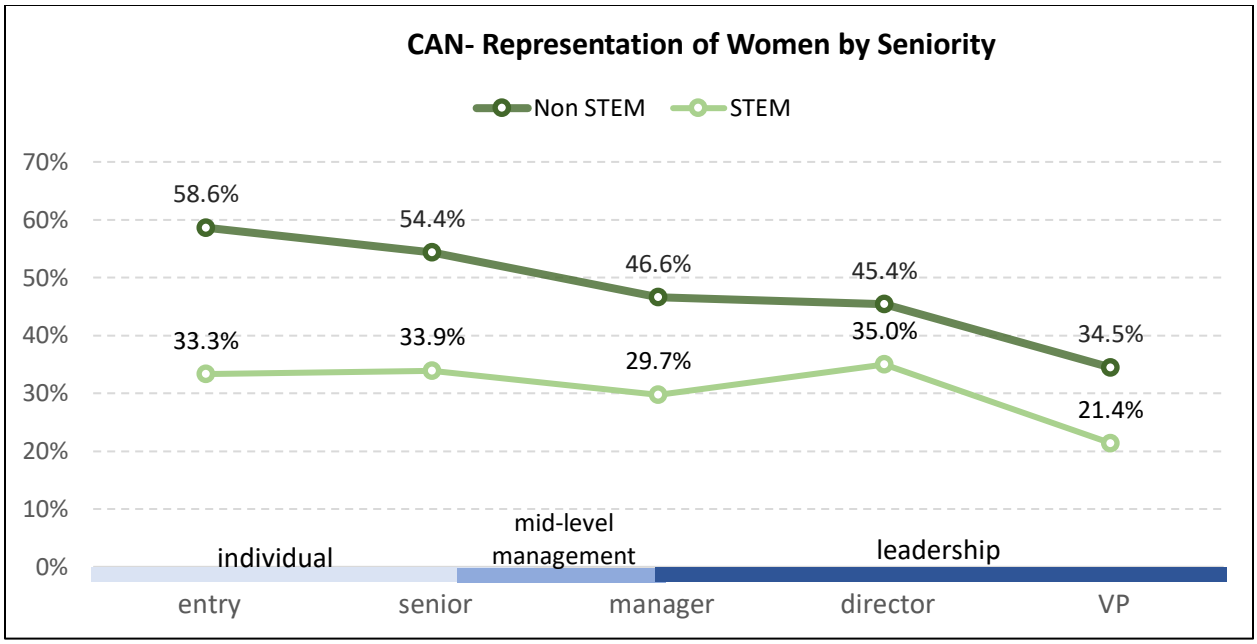
Canada


CAN- Ratio of men's probability of listing STEM skills to women's probability of listing STEM skills
2.65
2.55
2.45
2.35
2.25
2.15
2.05
1.95
1.85
1.75
1.65
2015
2016
2017
2018
2019
2020
2021
2022
2023
Total

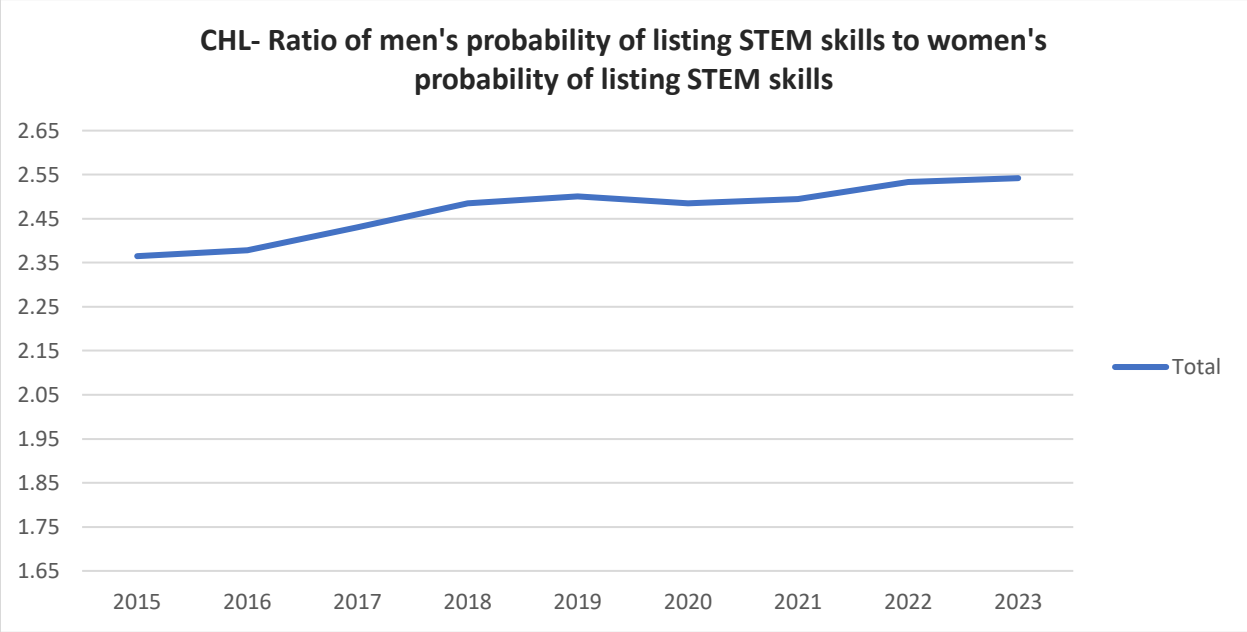

CAN- Women Representation in Skill Adoption
Proportion of Women
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
50.0% 50.5% 50.7% 51.0% 51.3% 51.7% 52.0% 52.3% 52.4%
25.3% 25.8% 26.1% 26.5% 27.1% 27.7% 28.2% 28.7% 29.0%
24.8% 24.7% 24.6% 24.5% 24.2% 24.0% 23.8% 23.6% 23.4%
2015
2016
2017
2018
2019
2020
2021
2022
2023
STEM Skills
Non-STEM Skills
STEM Gap

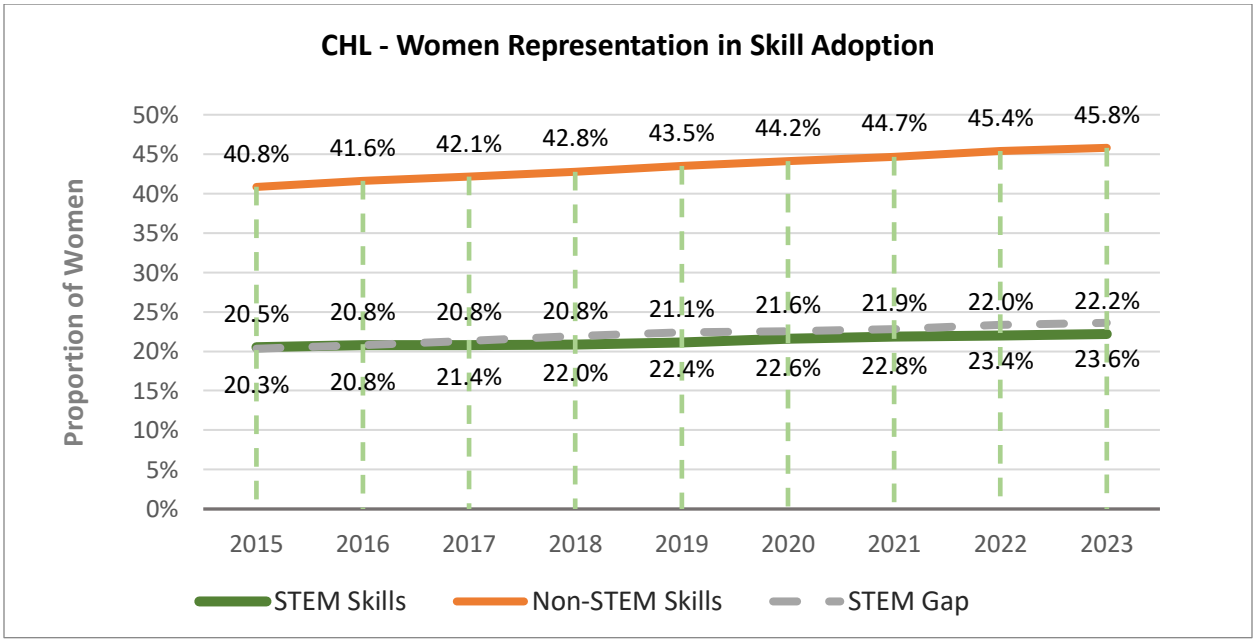

CAN- Proportion of STEM workers who are women,
by year since graduation with a STEM degree
45%
40%
35%
30%
25%
20%
Proportion of Women
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021


CAN- Retention of Women in STEM
by STEM-degree graduating class
34.5%
34.0%
33.5%
33.0%
32.5%
32.0%
31.5%
31.0%
Proportion of Women
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020

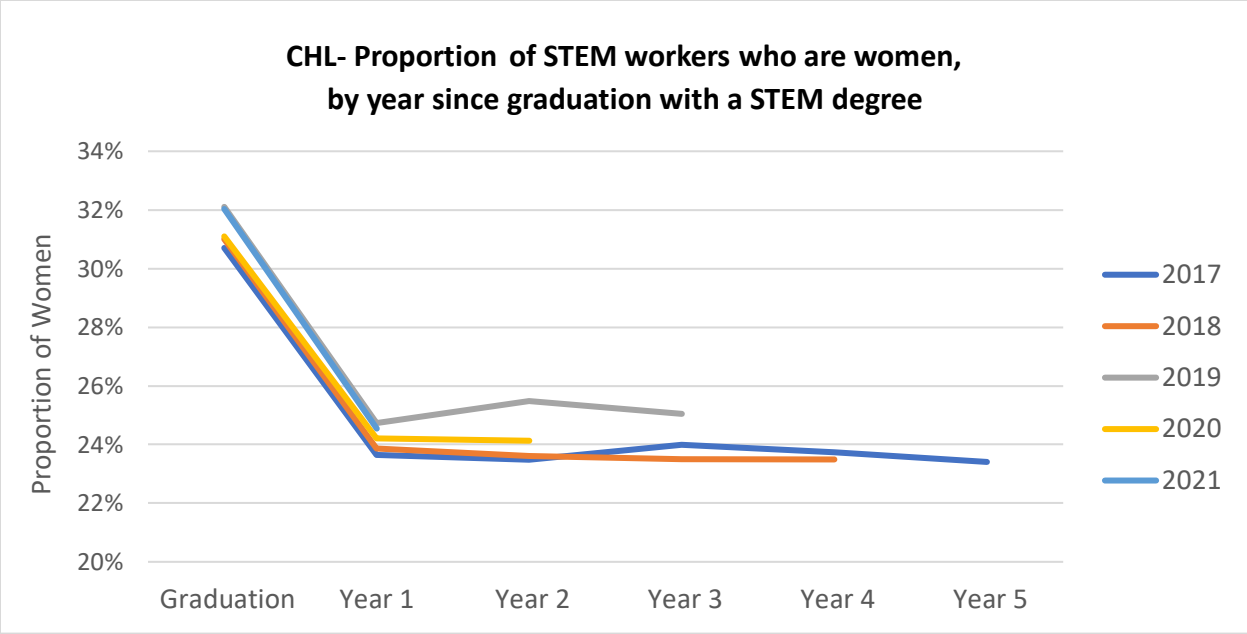

CAN- Representation of Women by Seniority
Non STEM
STEM
70%
60%
50%
40%
30%
20%
10%
0%
58.6%
54.4%
46.6%
45.4%
34.5%
33.3%
33.9%
29.7%
35.0%
21.4%
individual
mid-level management
leadership
entry
senior
manager
director
VP

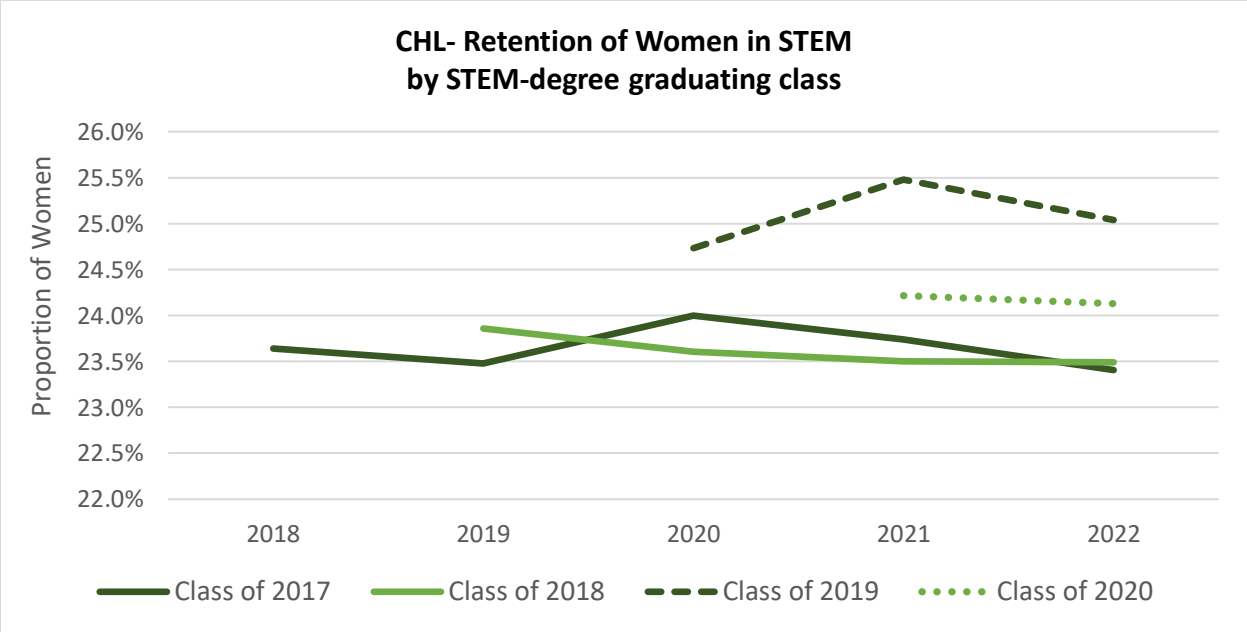
Chile[1]

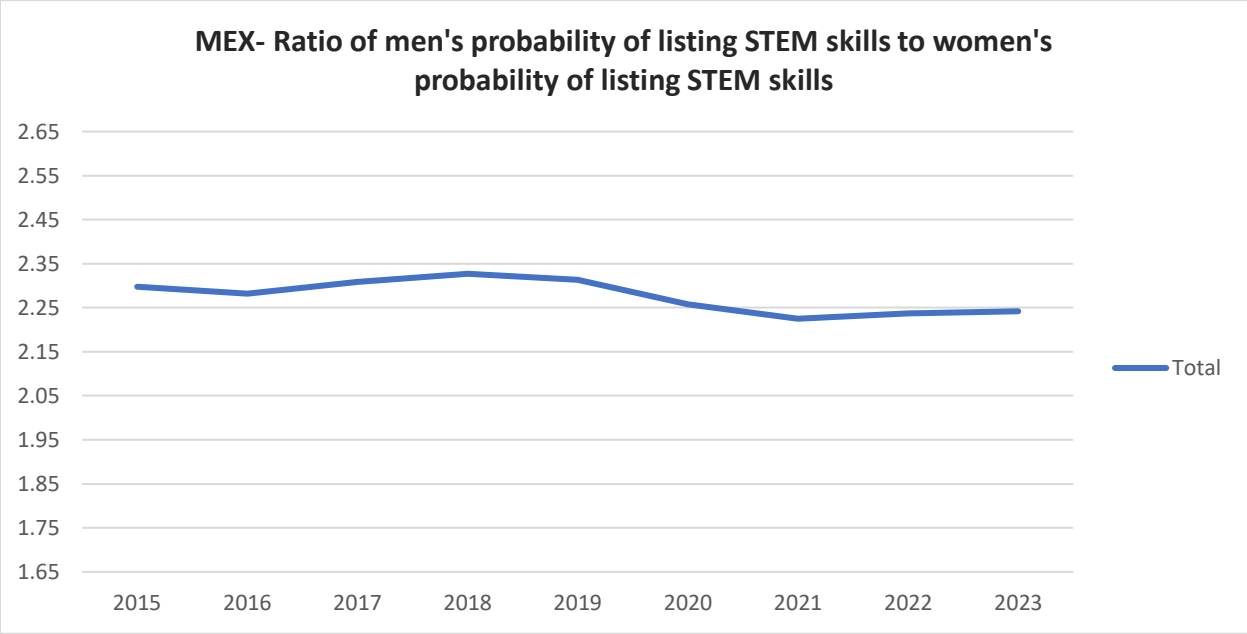


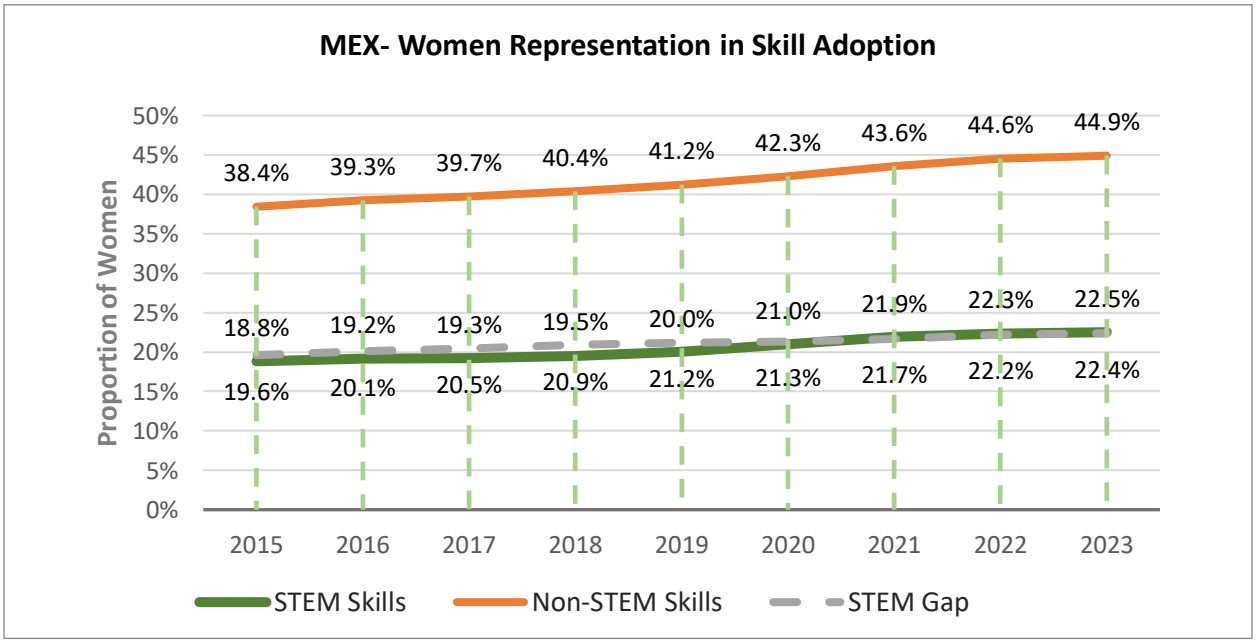


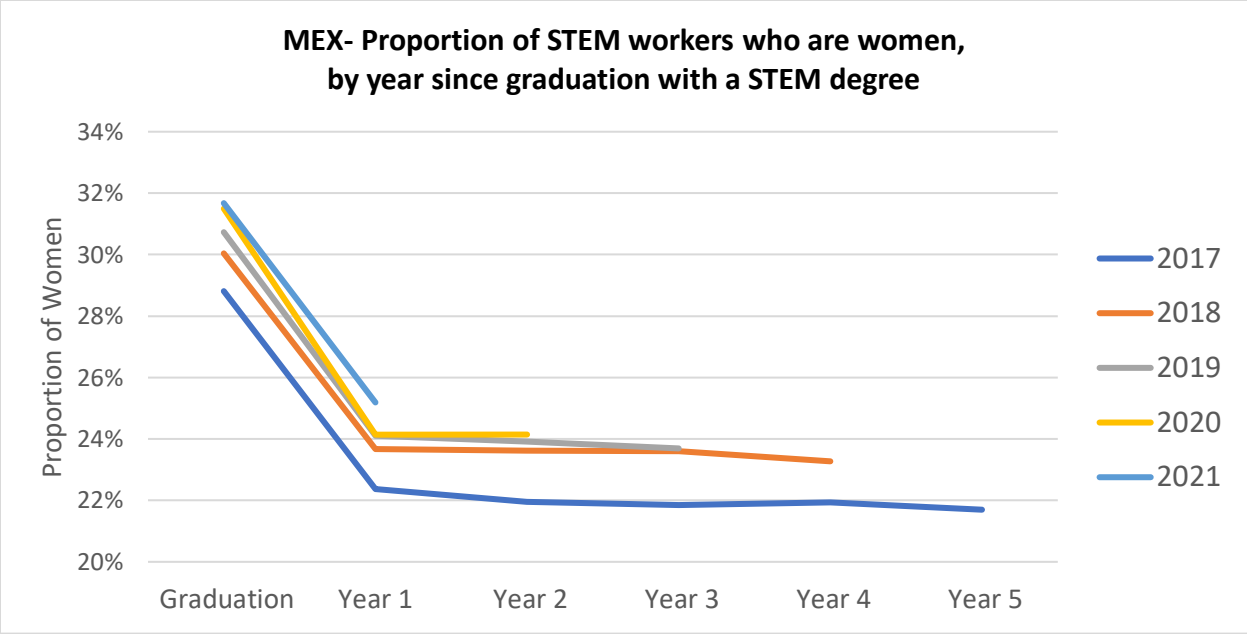
[1] Representation of Women by Seniority not available for Chile.

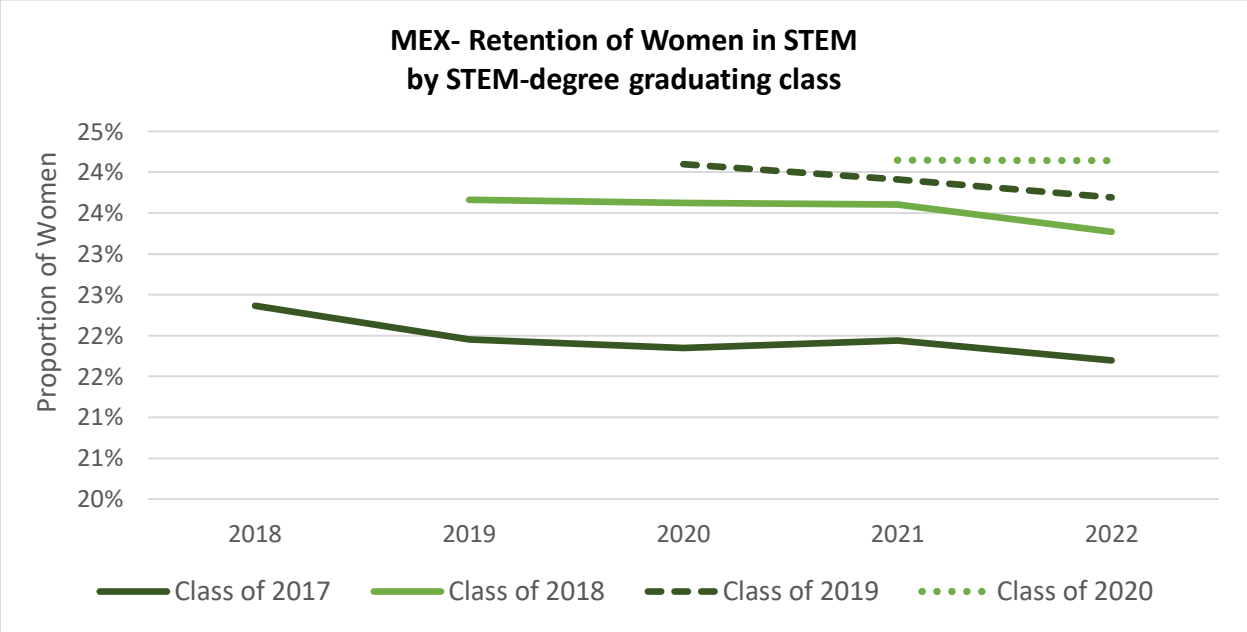

CHL- Proportion of STEM workers who are women,
by year since graduation with a STEM degree
Proportion of Women
34%
32%
30%
28%
26%
24%
22%
20%
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021

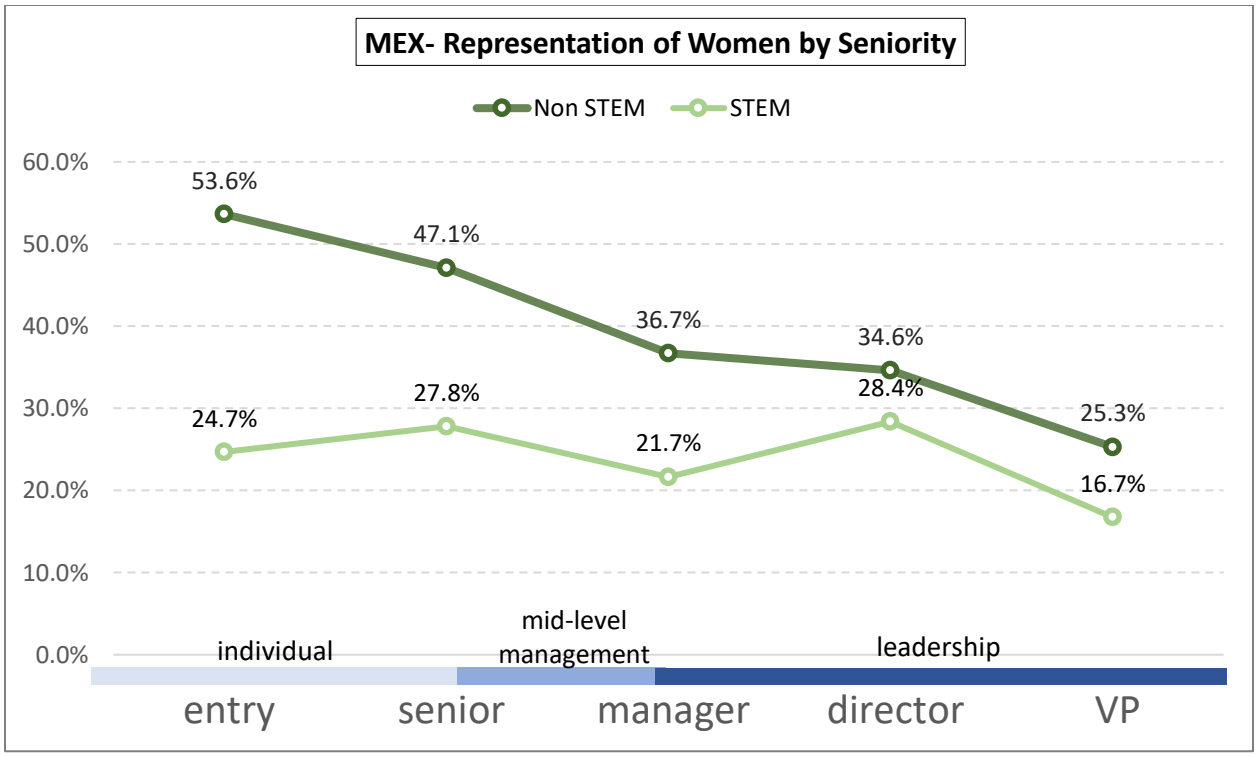

CHL- Retention of Women in STEM
by STEM-degree graduating class
Proportion of Women
26.0%
25.5%
25.0%
24.5%
24.0%
23.5%
23.0%
22.5%
22.0%
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020


MEX- Ratio of men's probability of listing STEM skills to women's probability of listing STEM skills
2.65
2.55
2.45
2.35
2.25
2.15
2.05
1.95
1.85
1.75
1.65
2015
2016
2017
2018
2019
2020
2021
2022
2023
Total

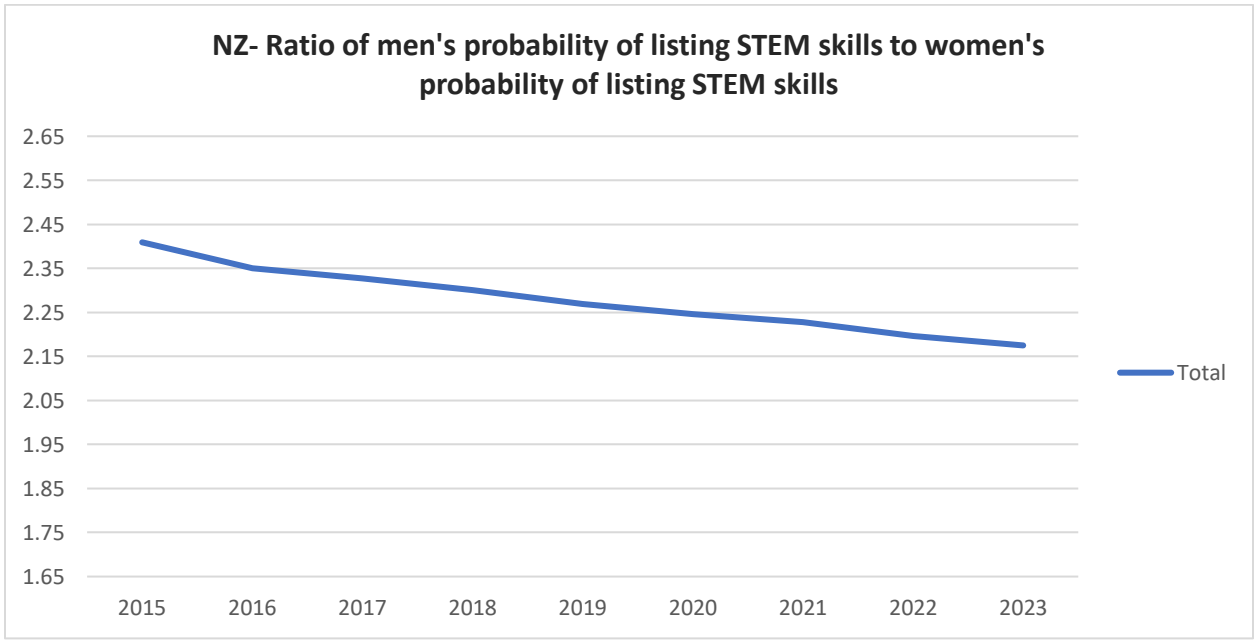

MEX- Women Representation in Skill Adoption
Proportion of Women
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
38.4%
39.3%
39.7%
40.4%
41.2%
42.3%
43.6%
44.6%
44.9%
18.8%
19.2%
19.3%
19.5%
20.0%
21.0%
21.9%
22.3%
22.5%
19.6%
20.1%
20.5%
20.9%
21.2%
21.3%
21.7%
22.2%
22.4%
2015
2016
2017
2018
2019
2020
2021
2022
2023
STEM Skills
Non-STEM Skills
STEM Gap


MEX- Proportion of STEM workers who are women,
by year since graduation with a STEM degree
Proportion of Women
34%
32%
30%
28%
26%
24%
22%
20%
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021

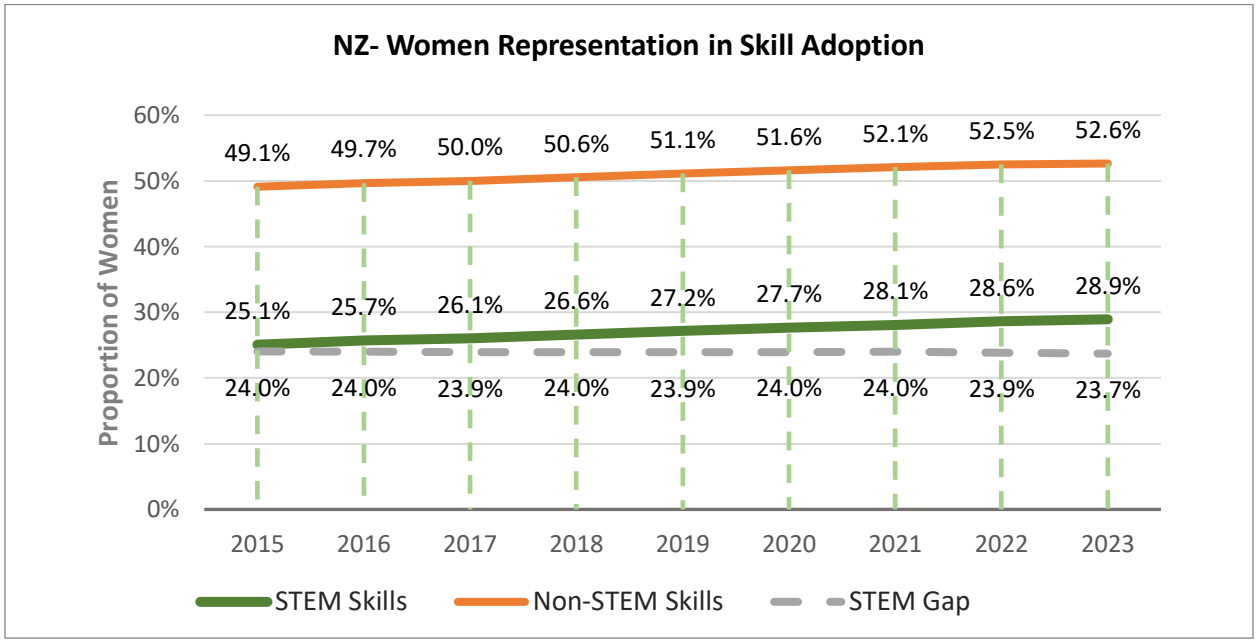

MEX- Retention of Women in STEM
by STEM-degree graduating class
Proportion of Women
25%
24%
24%
23%
23%
22%
22%
21%
21%
20%
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020

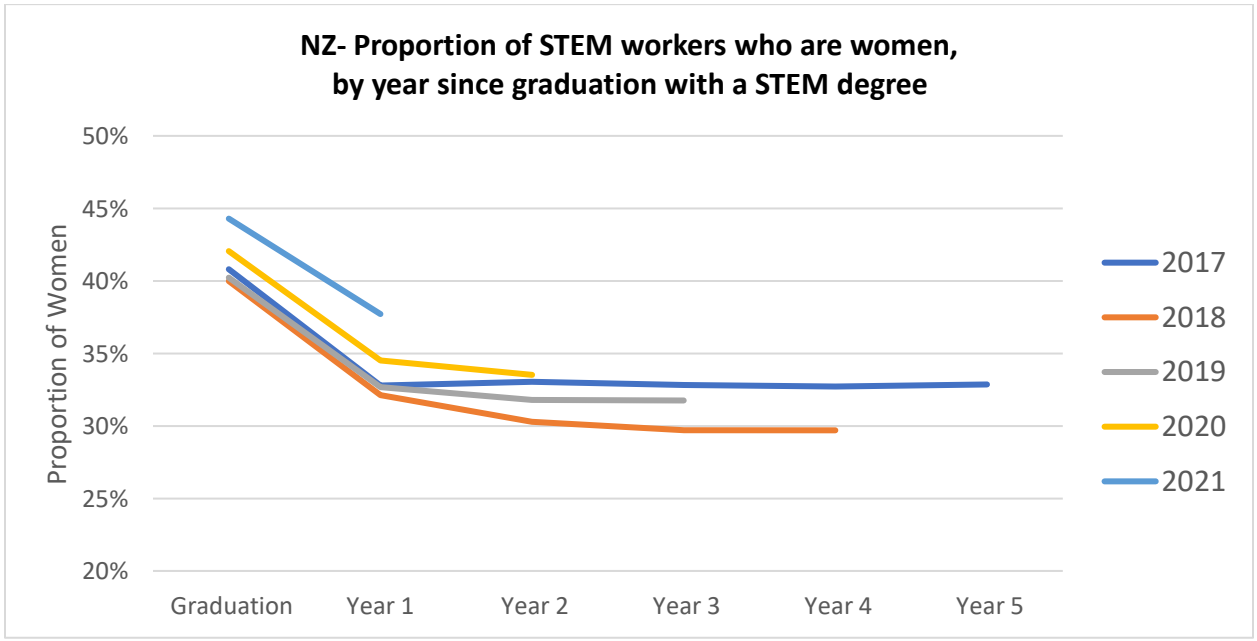


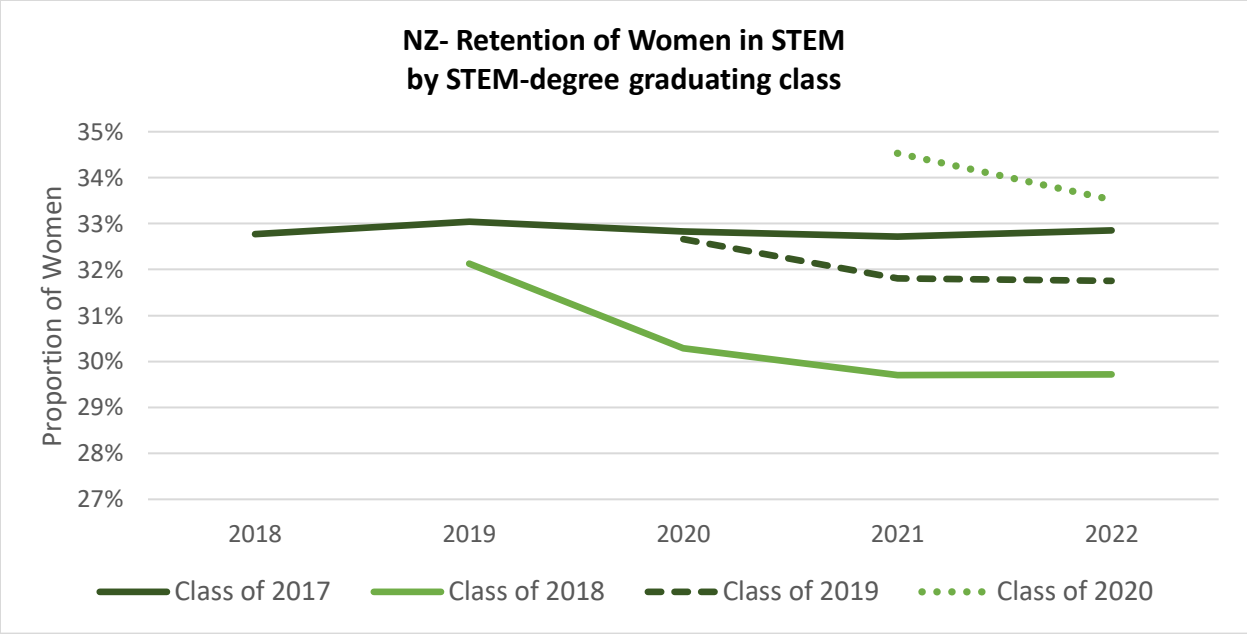
New Zealand[2]



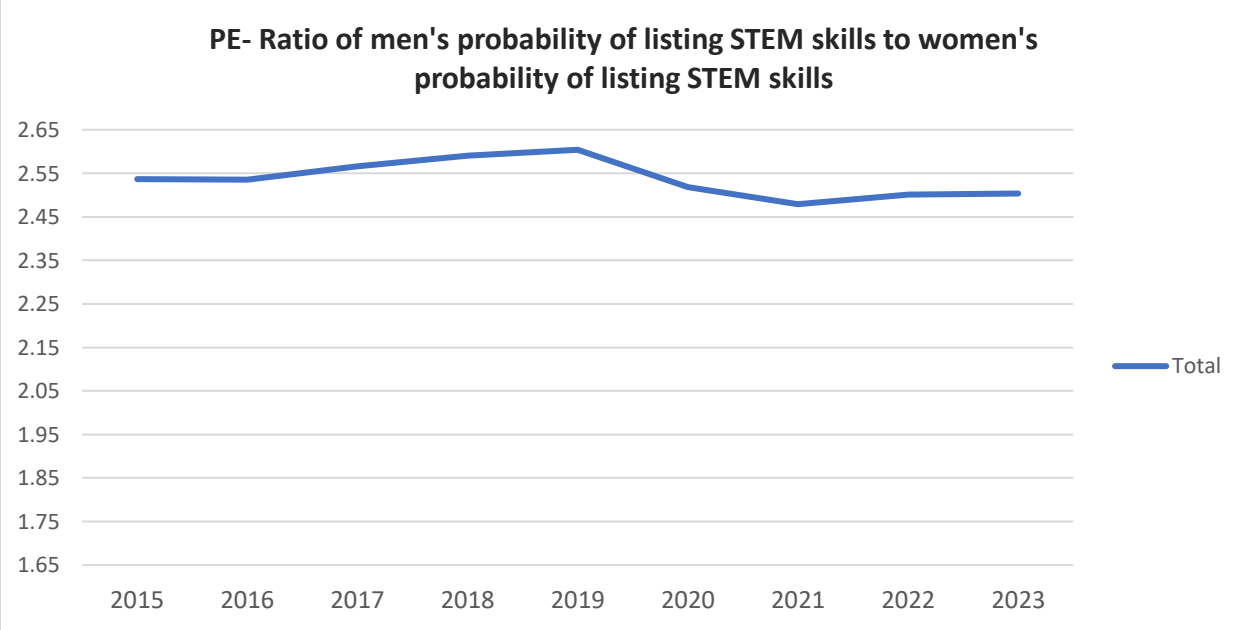
[2] Representation of Women by Seniority not available for New Zealand.

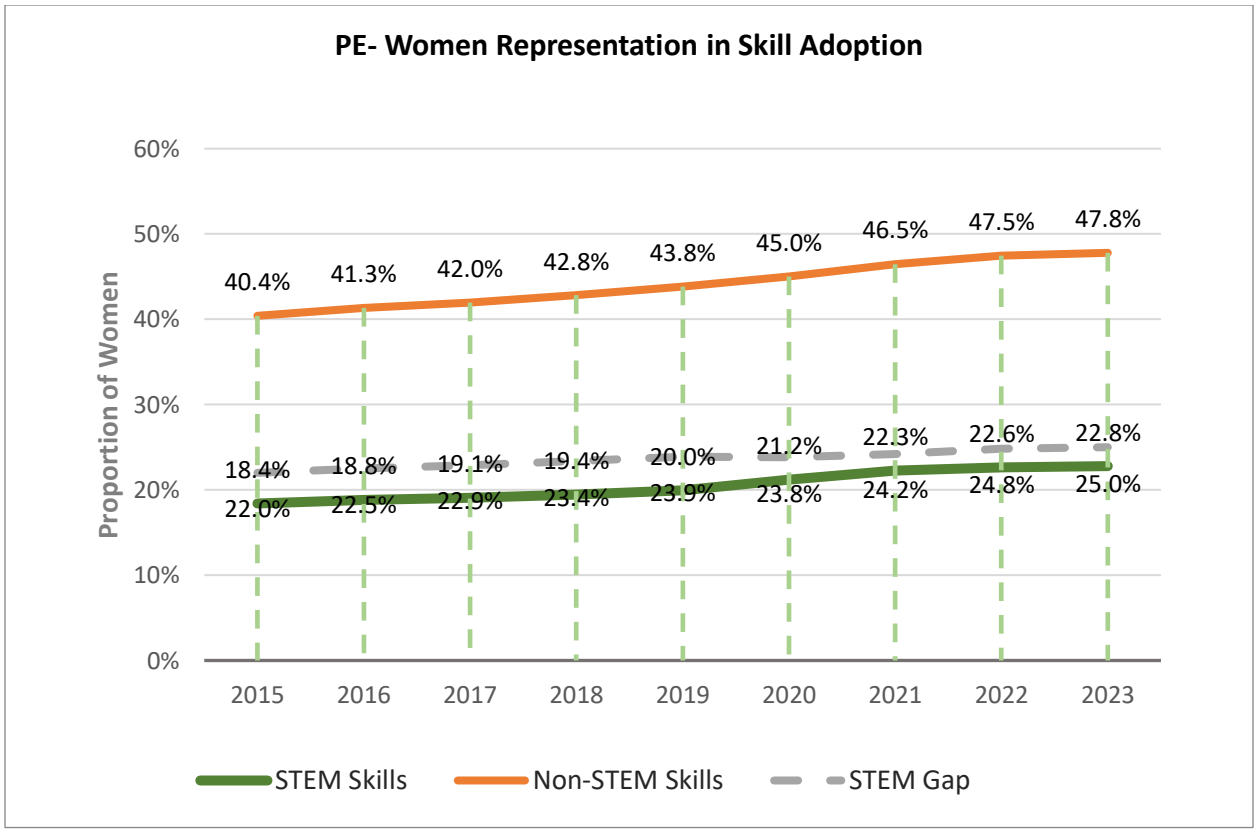

NZ- Women Representation in Skill Adoption
Proportion of Women
60%
50%
40%
30%
20%
10%
0%
49.1%
49.7%
50.0%
50.6%
51.1%
51.6%
52.1%
52.5%
52.6%
25.1%
25.7%
26.1%
26.6%
27.2%
27.7%
28.1%
28.6%
28.9%
24.0%
24.0%
23.9%
24.0%
23.9%
24.0%
24.0%
23.9%
23.7%
2015
2016
2017
2018
2019
2020
2021
2022
2023
STEM Skills
Non-STEM Skills
STEM Gap

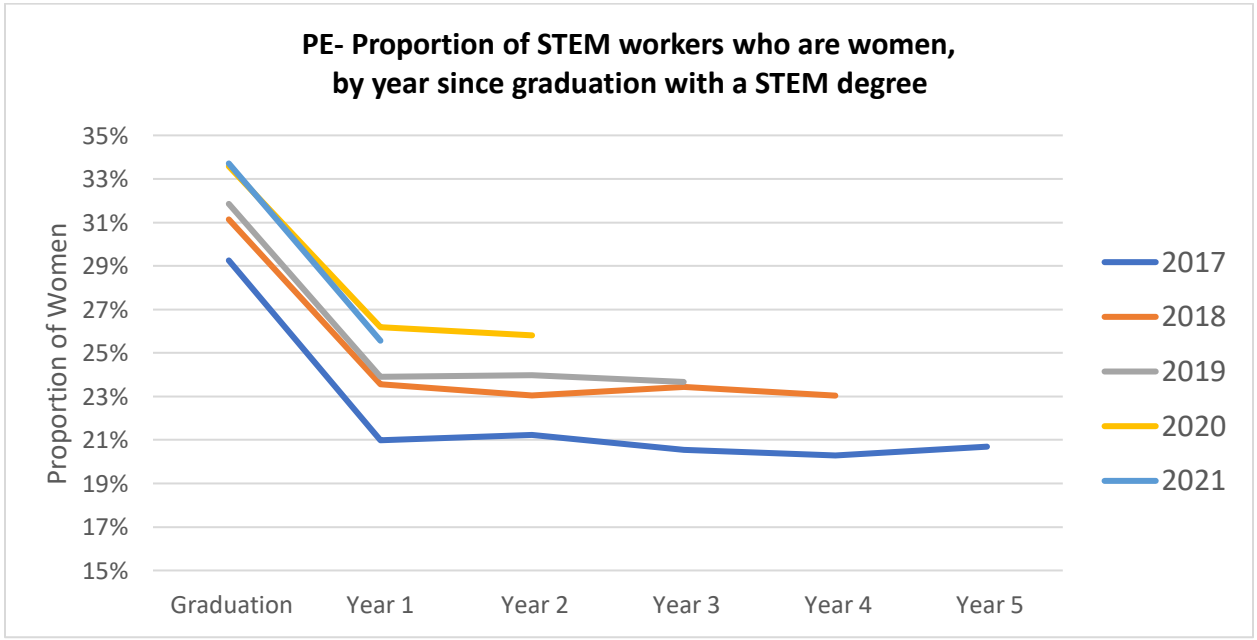

NZ- Proportion of STEM workers who are women,
by year since graduation with a STEM degree
Proportion of Women
50%
45%
40%
35%
30%
25%
20%
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021

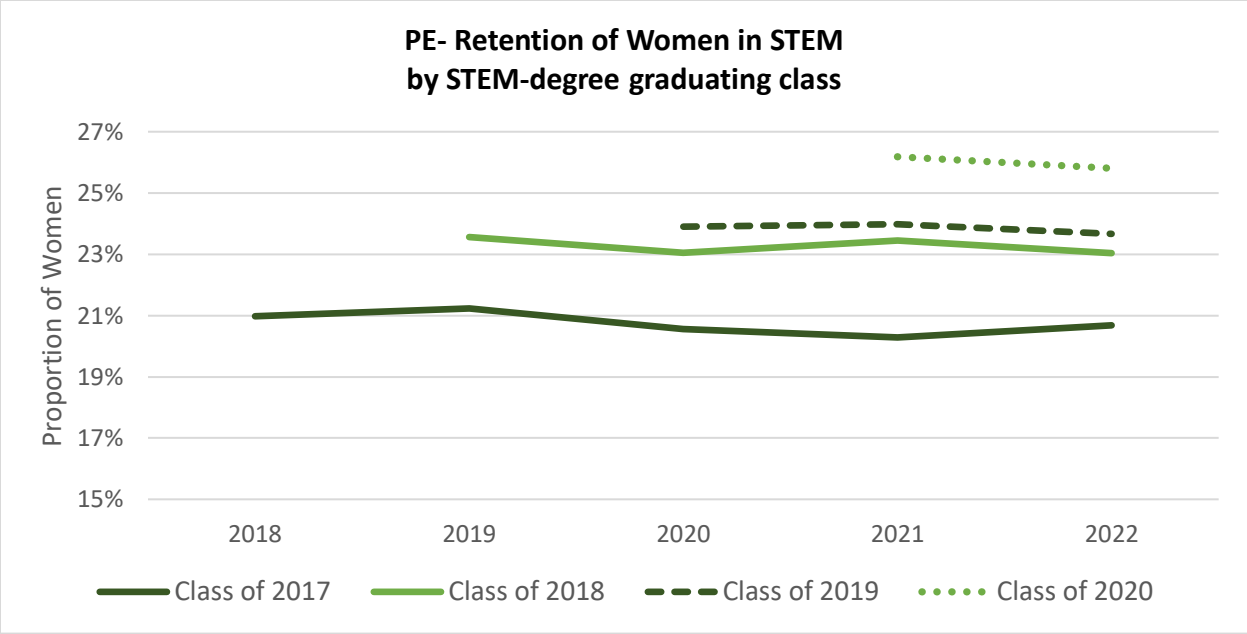

NZ- Retention of Women in STEM
by STEM-degree graduating class
Proportion of Women
35%
34%
33%
32%
31%
30%
29%
28%
27%
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020

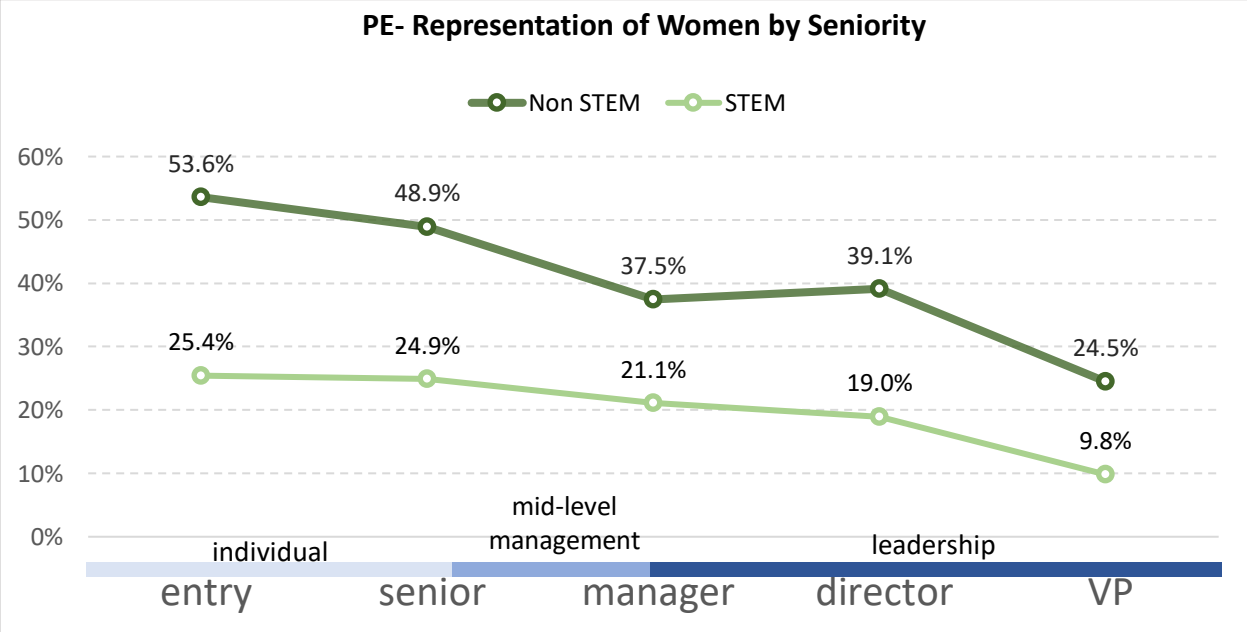
Peru

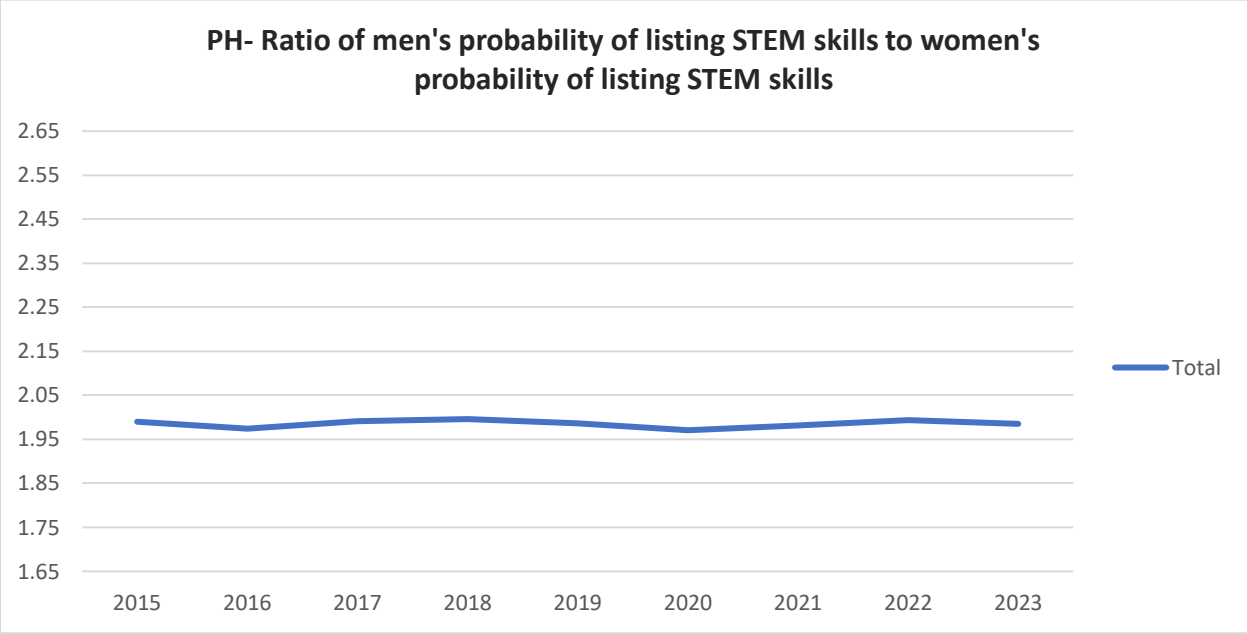

PE- Ratio of men's probability of listing STEM skills to women's
probability of listing STEM skills
2.65
2.55
2.45
2.35
2.25
2.15
2.05
1.95
1.85
1.75
1.65
2015
2016
2017
2018
2019
2020
2021
2022
2023
Total

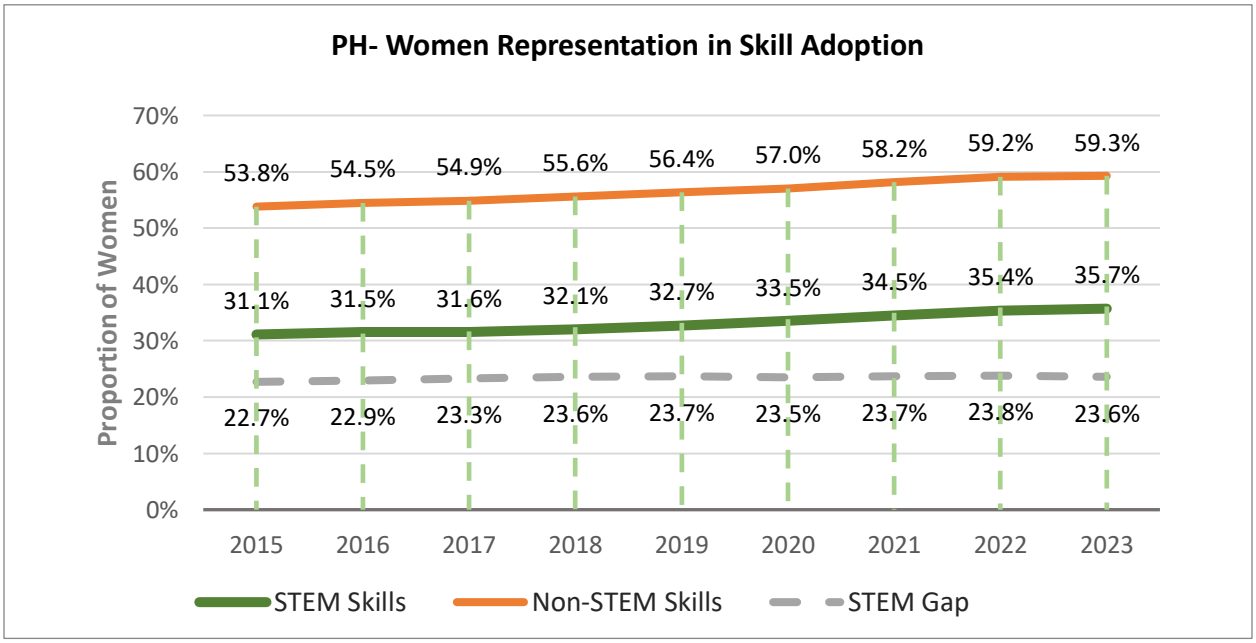

PE- Women Representation in Skill Adoption
60%
50%
40%
30%
20%
10%
0%
Proportion of Women
40.4%
41.3%
42.0%
42.8%
43.8%
45.0%
46.5%
47.5%
47.8%
18.4%
18.8%
19.1%
19.4%
20.0%
21.2%
22.3%
22.6%
22.8%
22.0%
22.5%
22.9%
23.4%
23.9%
23.8%
24.2%
24.8%
25.0%
2015
2016
2017
2018
2019
2020
2021
2022
2023
STEM Skills
Non-STEM Skills
STEM Gap

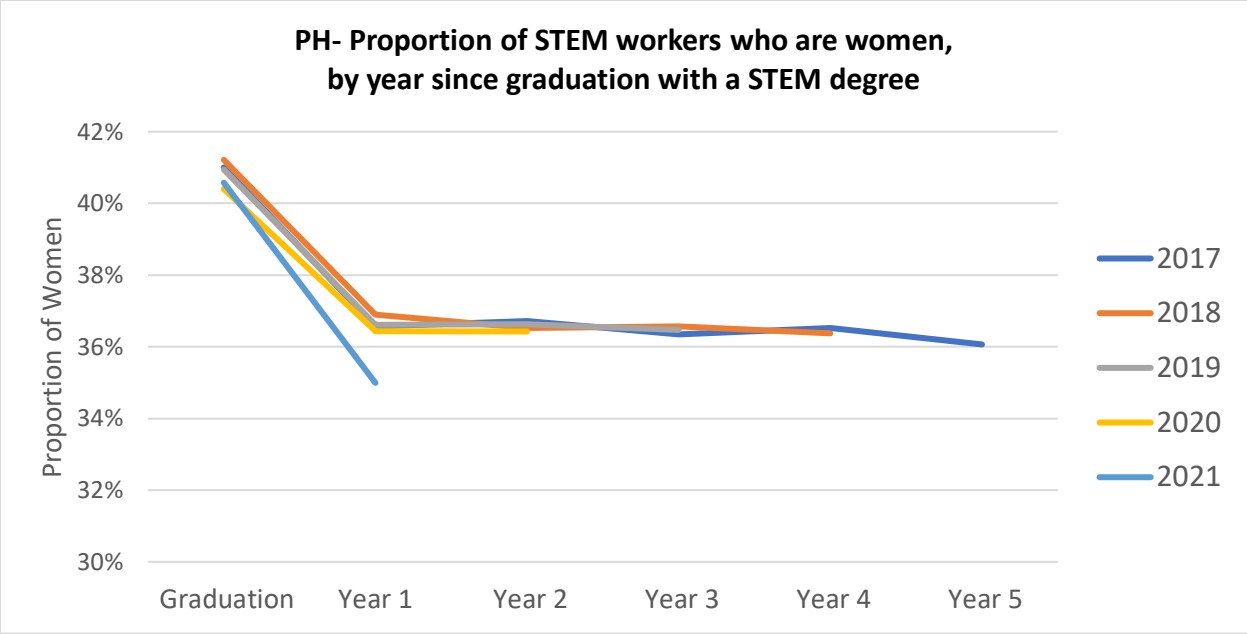

PE- Proportion of STEM workers who are women, by year since graduation with a STEM degree
35%
33%
31%
29%
27%
25%
23%
21%
19%
17%
15%
Proportion of Women
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021

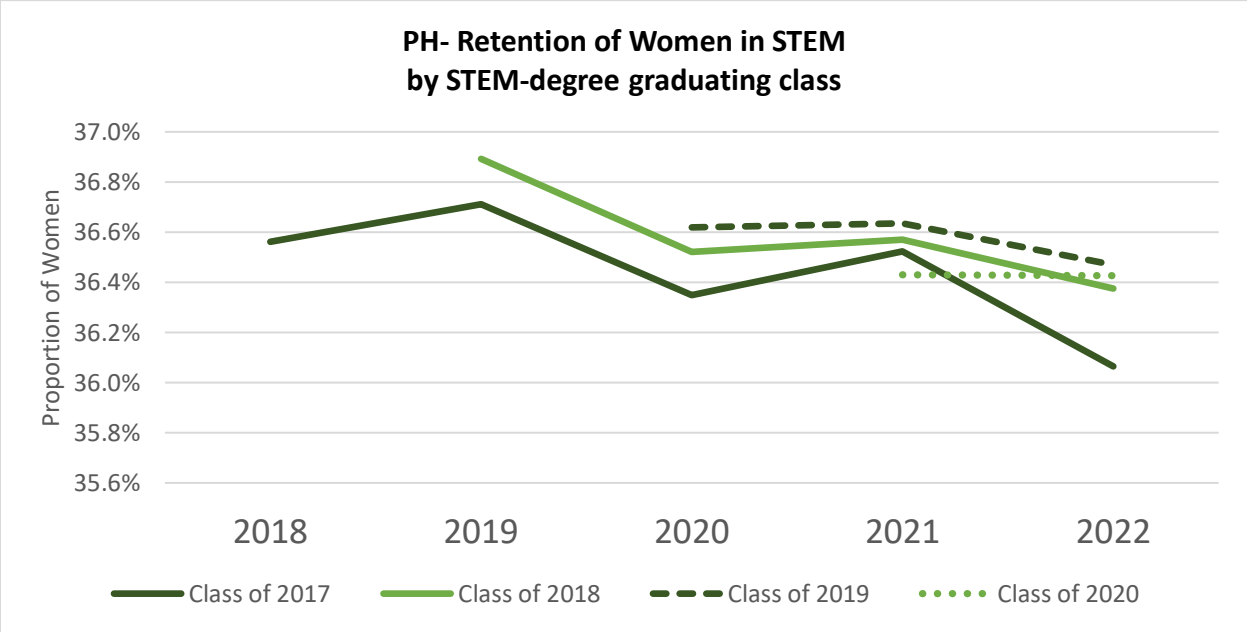

PE- Retention of Women in STEM
by STEM-degree graduating class
Proportion of Women
27%
25%
23%
21%
19%
17%
15%
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020

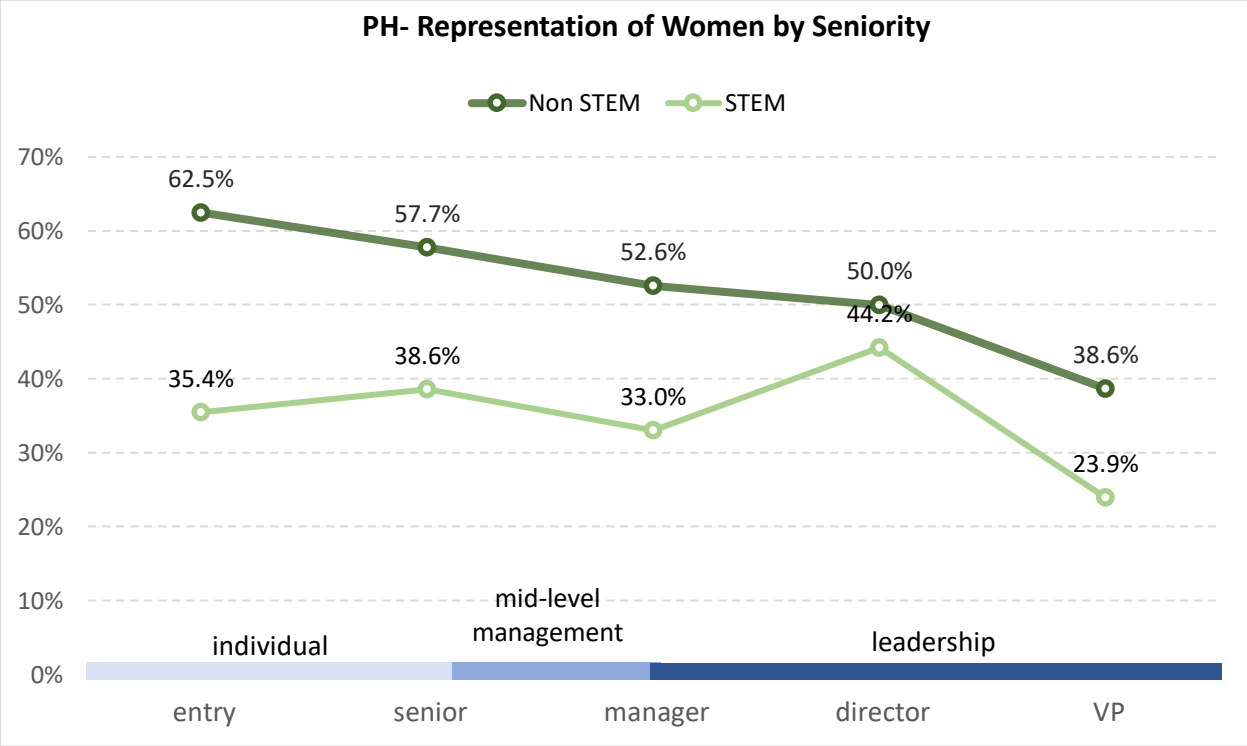

PE- Representation of Women by Seniority
Non STEM
STEM
60%
50%
40%
30%
20%
10%
0%
53.6%
48.9%
37.5%
39.1%
24.5%
25.4%
24.9%
21.1%
19.0%
9.8%
individual
mid-level management
leadership
entry
senior
manager
director
VP


PH- Ratio of men's probability of listing STEM skills to women's probability of listing STEM skills
2.65
2.55
2.45
2.35
2.25
2.15
2.05
1.95
1.85
1.75
1.65
2015
2016
2017
2018
2019
2020
2021
2022
2023
Total

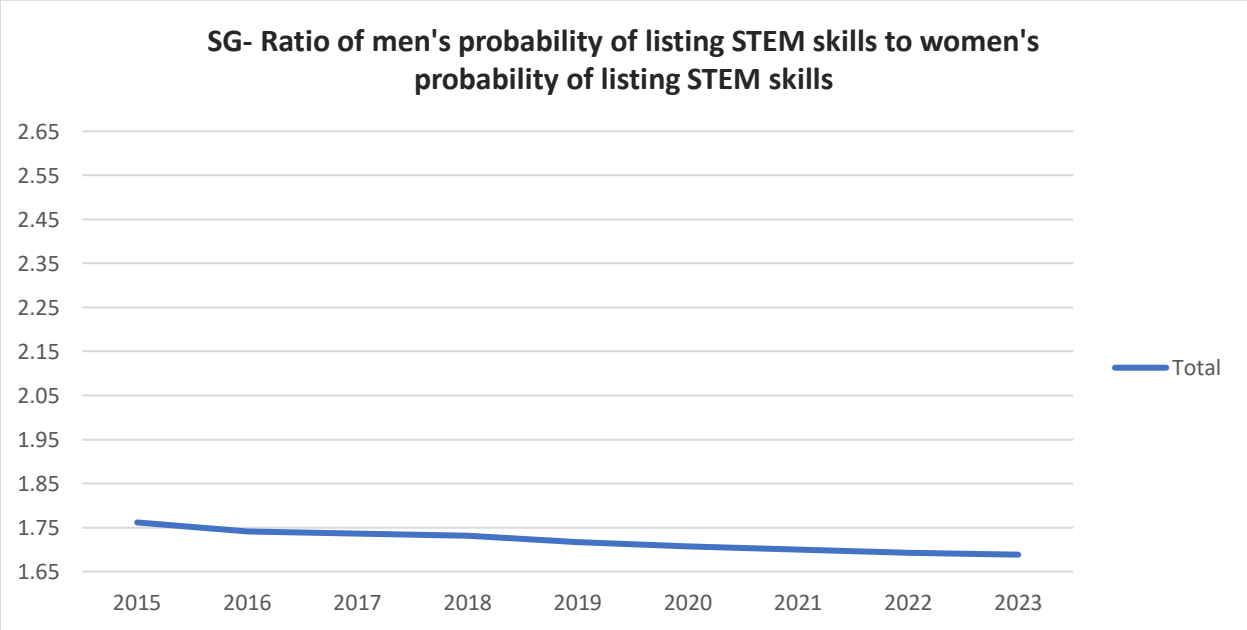

PH- Women Representation in Skill Adoption
Proportion of Women
70%
60%
50%
40%
30%
20%
10%
0%
53.8%
54.5%
54.9%
55.6%
56.4%
57.0%
58.2%
59.2%
59.3%
31.1%
31.5%
31.6%
32.1%
32.7%
33.5%
34.5%
35.4%
35.7%
22.7%
22.9%
23.3%
23.6%
23.7%
23.5%
23.7%
23.8%
23.6%
2015
2016
2017
2018
2019
2020
2021
2022
2023
STEM Skills
Non-STEM Skills
STEM Gap

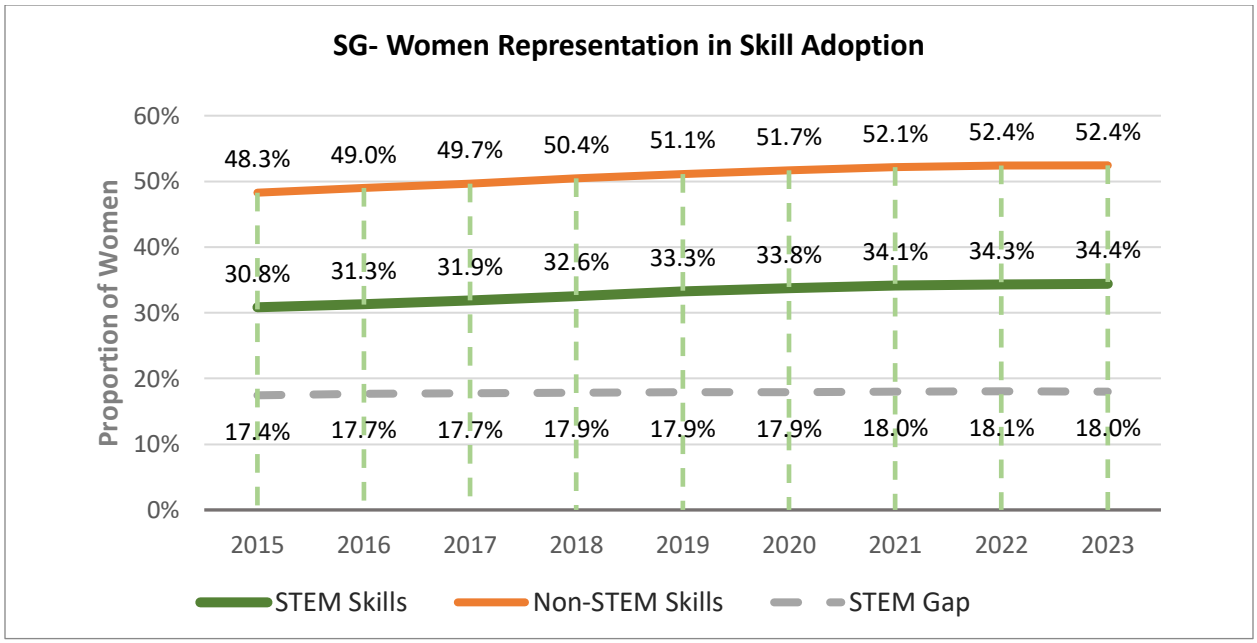

PH- Proportion of STEM workers who are women,
by year since graduation with a STEM degree
Proportion of Women
42%
40%
38%
36%
34%
32%
30%
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021

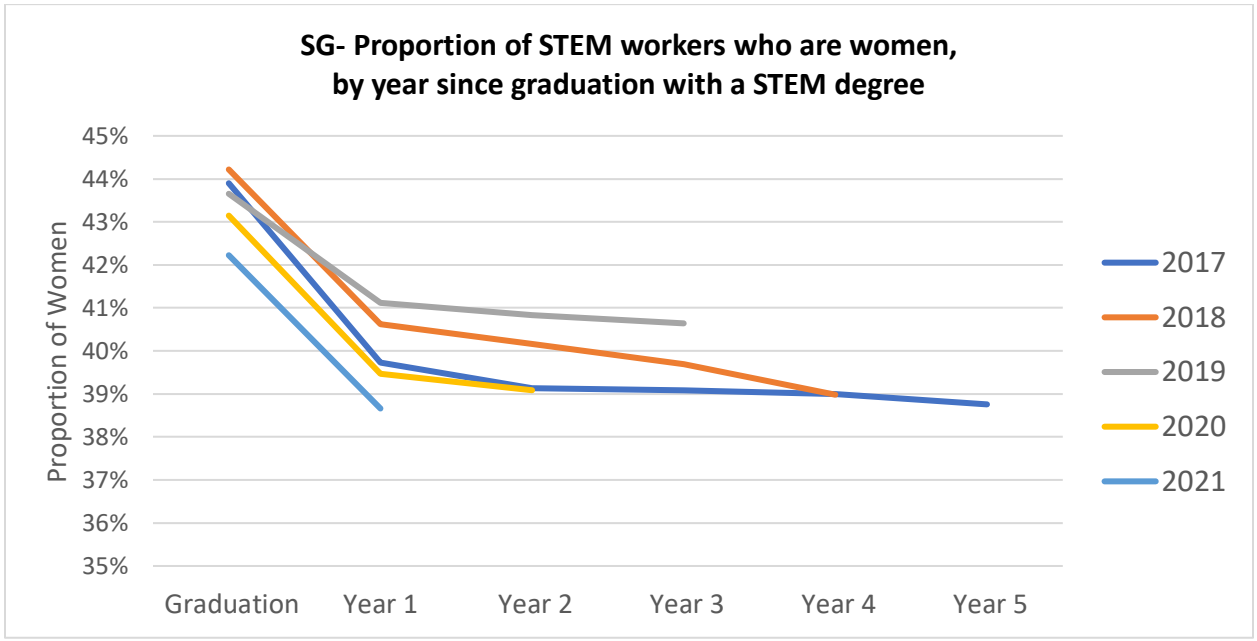

PH- Retention of Women in STEM
by STEM-degree graduating class
Proportion of Women
37.0%
36.8%
36.6%
36.4%
36.2%
36.0%
35.8%
35.6%
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020

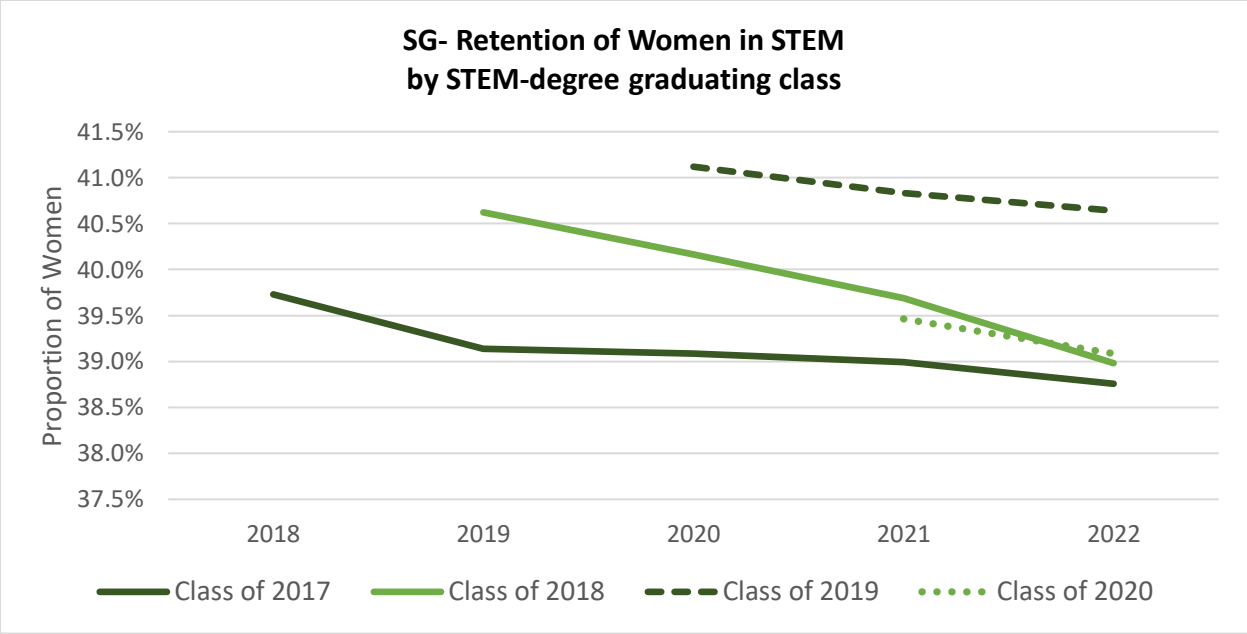

PH- Representation of Women by Seniority
Non STEM
STEM
70%
60%
50%
40%
30%
20%
10%
0%
62.5%
57.7%
52.6%
50.0%
38.6%
35.4%
38.6%
33.0%
44.2%
23.9%
individual
mid-level management
leadership
entry
senior
manager
director
VP

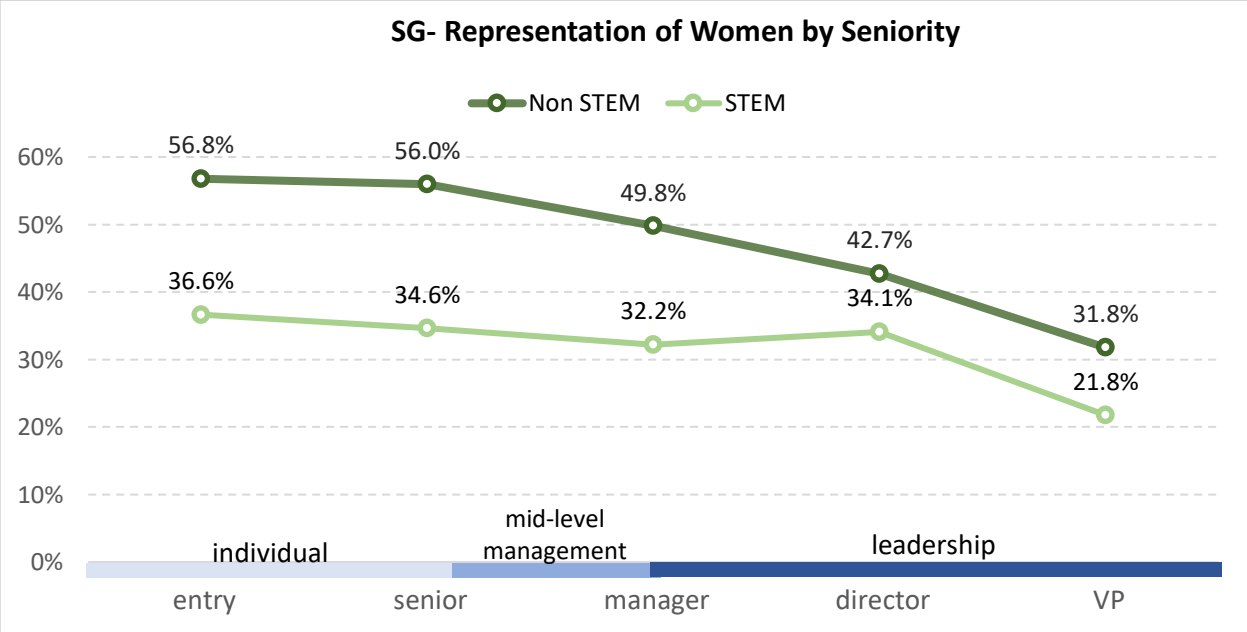
Singapore

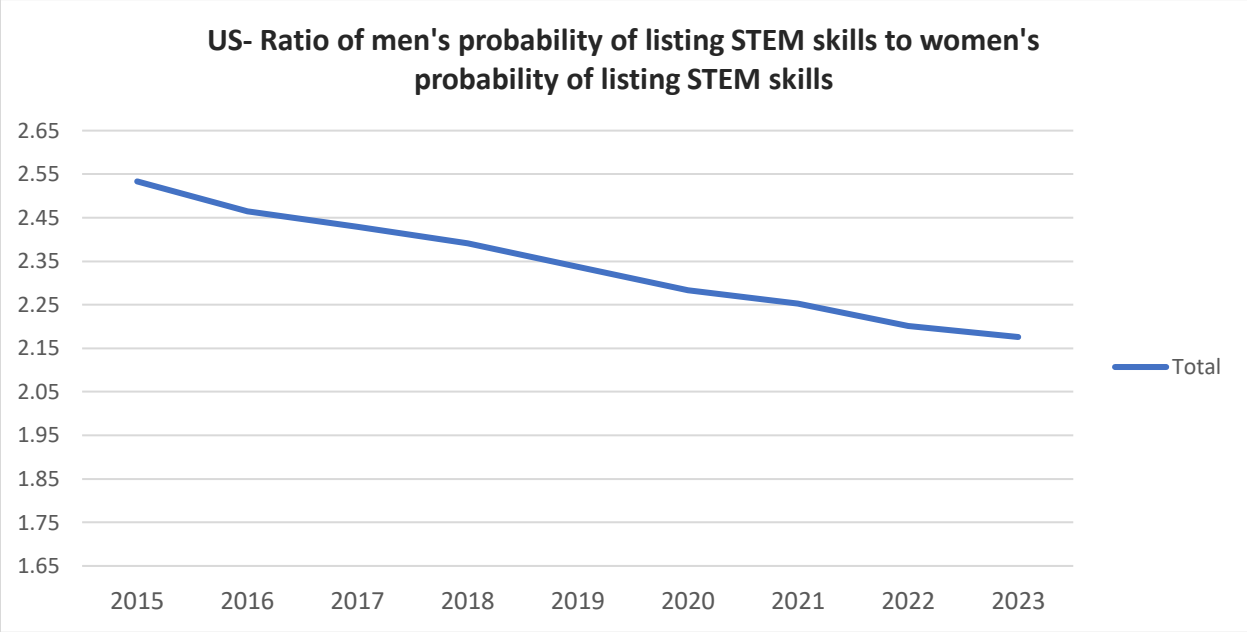

SG- Ratio of men's probability of listing STEM skills to women's probability of listing STEM skills
2.65
2.55
2.45
2.35
2.25
2.15
2.05
1.95
1.85
1.75
1.65
2015
2016
2017
2018
2019
2020
2021
2022
2023
Total

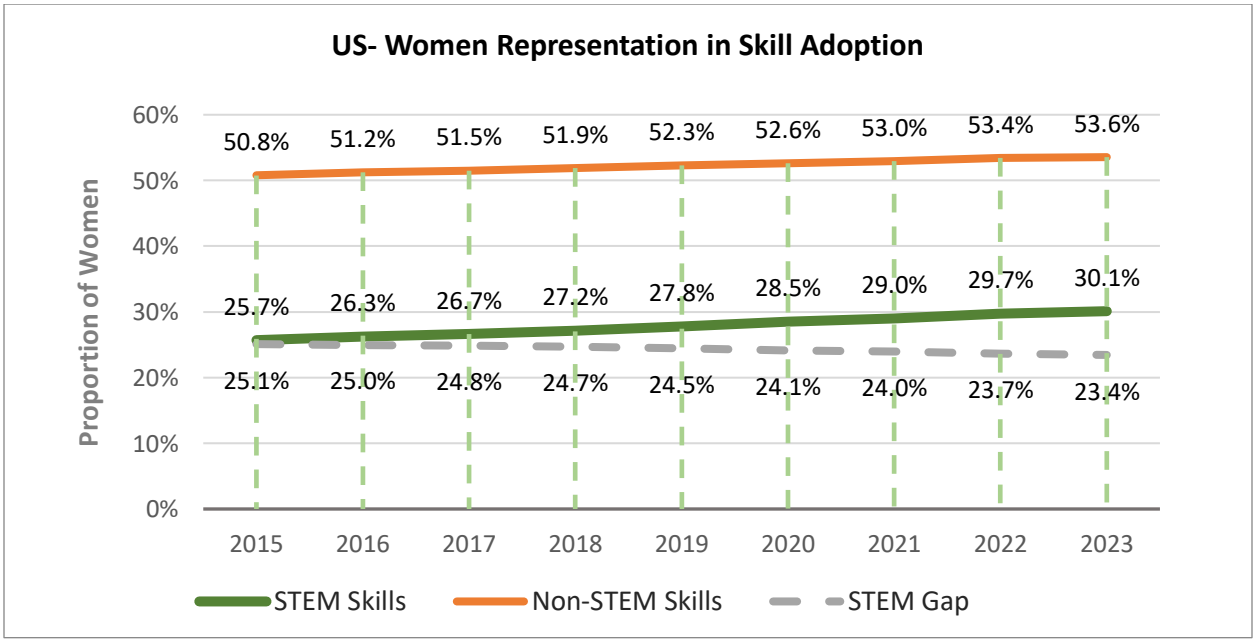

SG- Women Representation in Skill Adoption
Proportion of Women
60%
50%
40%
30%
20%
10%
0%
48.3%
49.0%
49.7%
50.4%
51.1%
51.7%
52.1%
52.4%
52.4%
30.8%
31.3%
31.9%
32.6%
33.3%
33.8%
34.1%
34.3%
34.4%
17.4%
17.7%
17.7%
17.9%
17.9%
17.9%
18.0%
18.1%
18.0%
2015
2016
2017
2018
2019
2020
2021
2022
2023
STEM Skills
Non-STEM Skills
STEM Gap

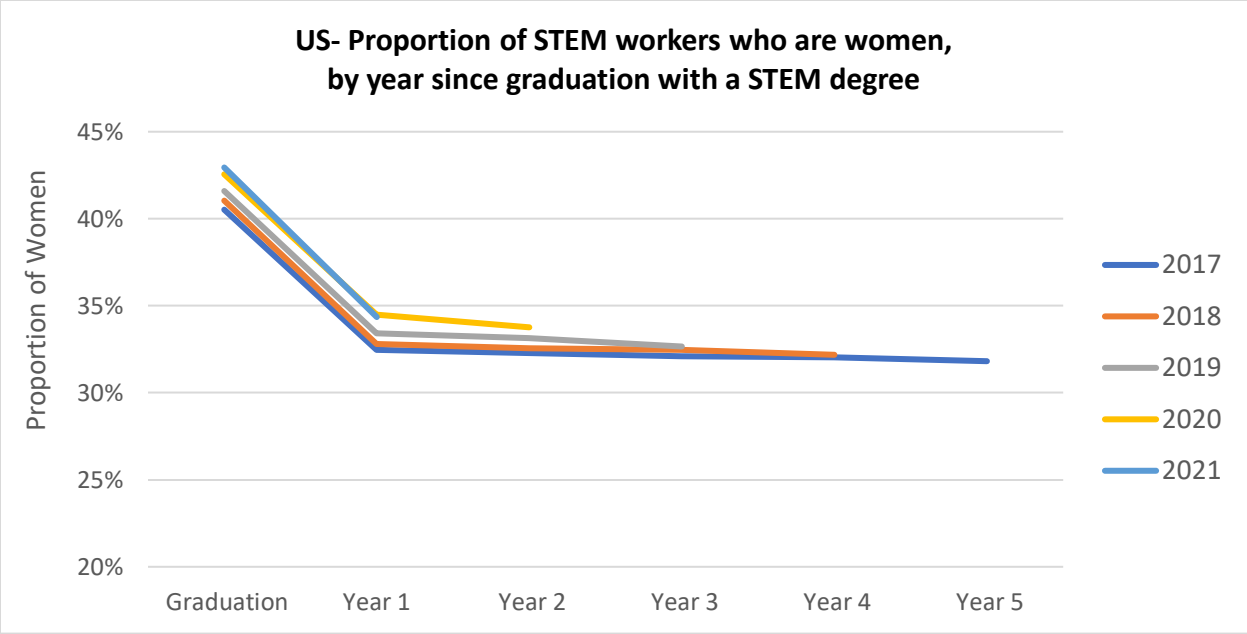

SG- Proportion of STEM workers who are women,
by year since graduation with a STEM degree
Proportion of Women
45%
44%
43%
42%
41%
40%
39%
38%
37%
36%
35%
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021

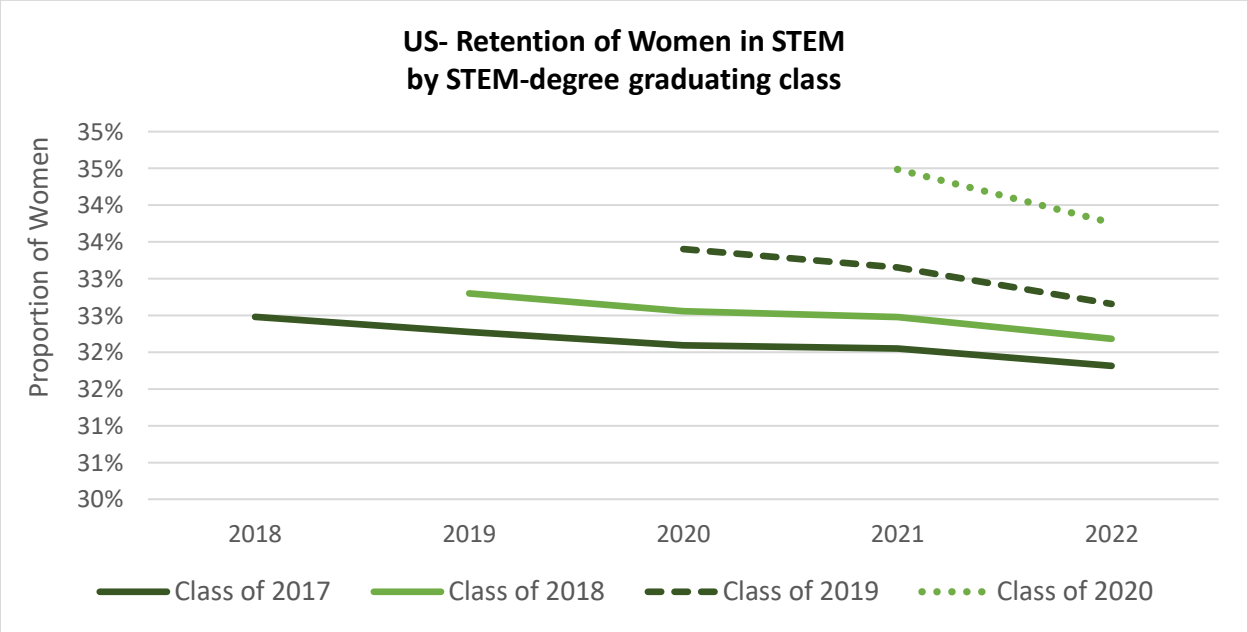

SG- Retention of Women in STEM
by STEM-degree graduating class
Proportion of Women
41.5%
41.0%
40.5%
40.0%
39.5%
39.0%
38.5%
38.0%
37.5%
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020

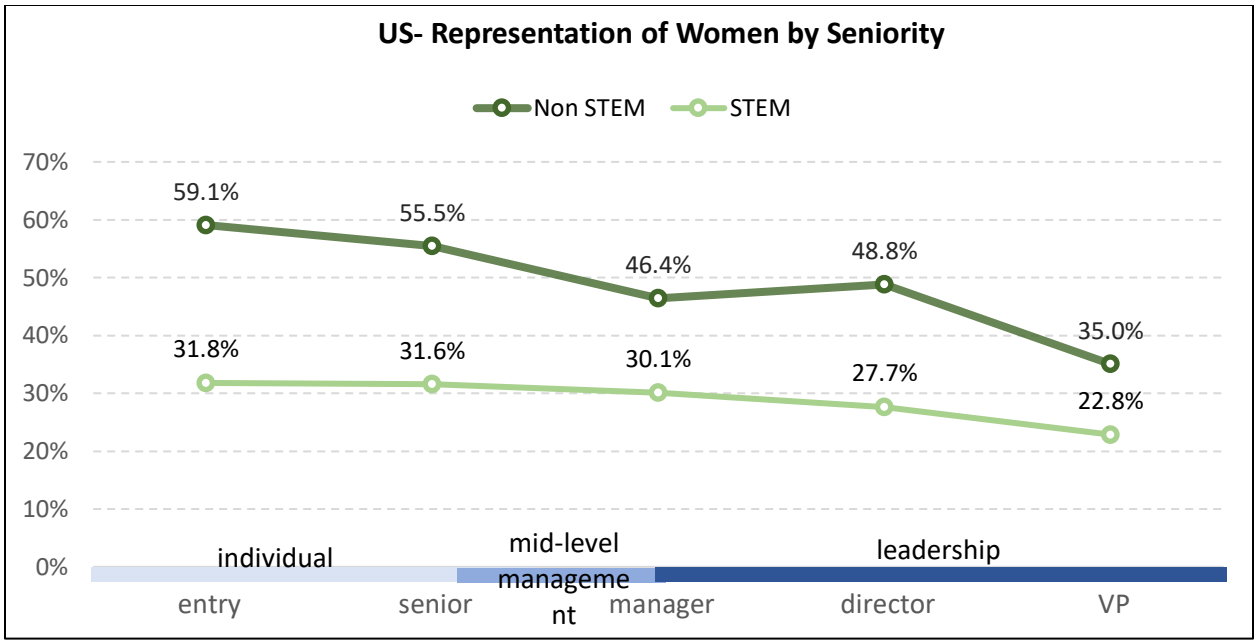

SG- Representation of Women by Seniority
Non STEM
STEM
60%
50%
40%
30%
20%
10%
0%
56.8%
56.0%
49.8%
42.7%
31.8%
36.6%
34.6%
32.2%
34.1%
21.8%
individual
mid-level management
leadership
entry
senior
manager
director
VP


US- Ratio of men's probability of listing STEM skills to women's probability of listing STEM skills
2.65
2.55
2.45
2.35
2.25
2.15
2.05
1.95
1.85
1.75
1.65
2015
2016
2017
2018
2019
2020
2021
2022
2023
Total


US- Women Representation in Skill Adoption
Proportion of Women
60%
50%
40%
30%
20%
10%
0%
50.8%
51.2%
51.5%
51.9%
52.3%
52.6%
53.0%
53.4%
53.6%
25.7%
26.3%
26.7%
27.2%
27.8%
28.5%
29.0%
29.7%
30.1%
25.1%
25.0%
24.8%
24.7%
24.5%
24.1%
24.0%
23.7%
23.4%
2015
2016
2017
2018
2019
2020
2021
2022
2023
STEM Skills
Non-STEM Skills
STEM Gap


US- Proportion of STEM workers who are women,
by year since graduation with a STEM degree
Proportion of Women
45%
40%
35%
30%
25%
20%
Graduation
Year 1
Year 2
Year 3
Year 4
Year 5
2017
2018
2019
2020
2021


US- Retention of Women in STEM
by STEM-degree graduating class
Proportion of Women
35%
35%
34%
34%
33%
33%
32%
32%
31%
31%
30%
2018
2019
2020
2021
2022
Class of 2017
Class of 2018
Class of 2019
Class of 2020


US- Representation of Women by Seniority
Non STEM
STEM
70%
60%
50%
40%
30%
20%
10%
0%
59.1%
55.5%
46.4%
48.8%
35.0%
31.8%
31.6%
30.1%
27.7%
22.8%
individual
mid-level management
leadership
entry
senior
manager
director
VP