Asia-Pacific Economic Cooperation

DRAFT

Enhancing Women's Economic Empowerment in APEC through Greater Participation in High Skill Digitally Delivered Services

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Executive Summary and Recommendations

This study, carried out for the APEC Group on Services (GOS), demonstrates that closing the gender gap in digitally delivered services (DDS)—the fastest-growing segment of APEC's trade and employment—is both an economic and strategic necessity. Women remain under-represented in high-skill, digitally intensive sectors such as ICT, financial, and professional services, and continue to face systemic barriers, including unequal access to STEM education, limited digital and managerial skills, along with persistent biases in finance, workplace culture, and AI development. The underutilisation of women in these economic roles costs APEC economies an estimated USD 17 trillion in lost output, while full gender parity remains decades away. Yet, evidence from fifteen women-led start-ups across eleven economies confirms that when women gain equal access to technology, capital, and supportive ecosystems, they build globally competitive and socially impactful enterprises.

To realise this untapped potential, APEC economies should act on eight fronts: (1) bridge the digital and skills divide through gender-responsive training; (2) expand women's participation in STEM; (3) tackle cultural and workplace barriers; (4) improve access to finance through inclusive and blended models; (5) streamline digital-trade regulation and embed gender-responsive provisions in trade agreements; (6) promote women's career advancement and leadership; (7) ensure inclusive, bias-free AI development; and (8) strengthen ecosystem and institutional support for women-led innovation. Cross-cutting priorities include improving sex-disaggregated data, aligning gender and digital policies across APEC's agendas, and deepening cooperation to monitor progress under the La Serena Roadmap. The overarching message is clear: digitalisation can be a powerful equaliser—if women are enabled to participate fully as professionals, innovators, and entrepreneurs.

Main Messages and Recommendations

This in-depth three-part study examined quantitative evidence, private-sector perspectives, and firm-level case studies to understand how digitalisation—and especially trade in **digitally delivered services (DDS)**—is reshaping women's economic participation across APEC economies. Together, the findings underscore both the **scale of the opportunity** and the **depth of the remaining barriers** to women's full participation and leadership in high-skill, digitally-intensive services sectors.

Main Messages

1. **The gender gap continues to constrain APEC's economic potential.** Persistent disparities in women's economic participation, leadership, and pay represent unrealised output estimated at USD 17 trillion. At the current pace, full parity will not be achieved for more than eight decades. Bridging this gap is not only a social imperative but an economic necessity for the APEC region.

2. **Digitally delivered services are the fastest-growing engine of APEC trade and employment.**
   DDS exports have more than tripled since 2005 and now account for over 40 per cent of total commercial-services trade. The most dynamic subsectors—**ICT, financial, and professional services**—are also those requiring the highest skill levels. Strategies for inclusive growth must target women's access to, and advancement within, these sectors. However, the lack of existing and comparable sex-disaggregated statistics at both the economy and regional levels in APEC creates a challenge to both fully understand the current gender gaps in these areas and to track evolution of women's participation in DDS sectors over time.

3. **Women remain under-represented in digitally intensive, high-value activities.** Women occupy fewer management and professional roles in high-skill services and are less likely to found or lead firms in digital or AI-linked sectors. Fewer than one-third of STEM graduates in APEC are women, and women account for only about 22 per cent of AI professionals globally.

4. **Women-led digital and AI start-ups are proving that they can succeed in these high-skilled services sectors and that inclusive innovation works well**. Case studies of 15 women-led start-ups across 11 APEC economies show that women entrepreneurs are building globally oriented, socially motivated, and technologically advanced firms. Their success, however, is heavily dependent on access to finance, networks, accelerators, and enabling regulation. When such support is present, women-founded firms match or outperform male-led peers in revenue growth, inclusion outcomes, and export diversification.

5. **Barriers to women's success and participation in high-skill, digitally delivered services are structural and mutually reinforcing.** Evidence from Parts I–III identifies seven main interlocking barriers that limit women's participation and advancement:

    - **Skills mismatch and digital divide** – unequal access to training, infrastructure, and reskilling opportunities.
    - **STEM education gap** – insufficient pipeline of women with STEM and digital-tech qualifications.
    - **Cultural and attitudinal barriers** – gender stereotypes, unpaid-care burdens, and bias in workplace norms.
    - **Finance barriers** – limited access to venture, angel, or institutional capital for women-led firms.
    - **Regulatory barriers to digital trade** – complex compliance requirements, weak interoperability, and limited gender-responsive provisions in trade agreements.
    - **Barriers to career advancement and leadership** – glass-ceiling effects and lack of mentorship.

- **Bias in AI design and deployment** – algorithmic discrimination and male-dominated innovation ecosystems.

Recommendations

The following recommendations propose targeted policy measures APEC economies can adopt to address each barrier identified in the study. They align with the *La Serena Roadmap for Women and Inclusive Growth* and the *APEC Internet and Digital Economy Roadmap*.

1. Bridging the Skills Mismatch and Digital Divide

- Integrate **gender-specific targets** in domestic digital-skills and workforce-reskilling strategies.
- Establish **public–private training partnerships** offering subsidised online and in-person digital-literacy and cybersecurity programmes for women, particularly in MSMEs and rural areas.
- Link eligibility for innovation or export grants to evidence of **inclusive workforce development** and equal training access.

2. Expanding Women's Participation in STEM and Advanced Technical Education

- Create **scholarships, apprenticeships, and internships** for women in AI, data science, software engineering, and related fields.
- Embed **gender-responsive STEM curricula** in early and secondary education to counter pipeline attrition.
- Develop **APEC-wide indicators** tracking women's participation in STEM, R&D, and advanced digital training.

3. Tackling Cultural and Attitudinal Barriers

- Introduce or strengthen **family-friendly labour-market policies**—paid parental leave, flexible work arrangements, and affordable childcare—to mitigate the child-penalty effect.
- Launch **public awareness campaigns** and professional-network initiatives promoting women in technology and entrepreneurship.
- Require **non-discrimination audits** and equal-opportunity policies in firms participating in government-supported digital-economy programmes.

4. Expanding Access to Finance for Women-Led Digital Firms

- Develop **gender-responsive blended-finance instruments** (grant → convertible loan → equity) to help women-founded firms scale sustainably.

- Support the creation of **women-focused venture-capital and angel-investment networks**, with tax incentives for gender-diverse portfolios.
- Encourage use of **inclusive fintech solutions**—for example, alternative credit-scoring methods using non-traditional data—to widen women's access to financial services.
- Provide **long-term financing** for inclusive innovation hubs, incubators, and accelerators rather than for short-term projects.

5. Reducing Regulatory Barriers to Digital Trade

- Promote **mutual recognition of digital credentials and e-signatures** across APEC to simplify cross-border operations for SMEs.
- Harmonise **data-governance frameworks** to balance consumer protection with easier compliance for MSMEs.
- Establish **regulatory sandboxes and innovation testbeds** with reserved participation quotas or dedicated windows for women-led firms.
- Embed **gender-responsive language** and monitoring provisions in trade agreements and Digital Economy Partnership Arrangements (DEPAs).

6. Enabling Career Advancement and Leadership

- Require firms benefitting from public support to **report gender composition** at managerial and board levels.
- Support **structured mentorship and sponsorship programmes** linking senior women in digital services with emerging professionals.
- Introduce **regional recognition mechanisms** for women leaders and innovators in high-skill digitally delivered services.

7. Ensuring Gender-Inclusive AI Development and Application

- Conduct **gender-impact assessments** of domestic AI strategies and major public-sector AI procurements.
- Fund **balanced research teams** and inclusive-AI incubators promoting diverse datasets and ethical-AI design.
- Adopt **APEC-wide guidelines** aligned with OECD and UNESCO principles to mitigate algorithmic bias and ensure transparency.

8. Strengthening Data Collection and Institutional Support at the Regional Level

- Mainstream **gender-responsive indicators** into APEC's work on MSMEs, services competitiveness, and digital-trade policy.
- Facilitate **cross-economy peer learning** and exchanges of good practice.
- Strengthen **collection of sex-disaggregated data on employment, wages, trade in services, access to finance, and participation in AI and start-ups**, so as to create comparable standards of measurement for these gender disaggregated statistics along with the ability to monitor progress under the *La Serena Roadmap*, and link to global initiatives at the WTO, OECD, and UN.
- Advance **joint capacity-building initiatives at the regional level** in the areas above that need progress.

Introduction

The digital revolution is reshaping the global services landscape, creating new avenues for trade and employment. Among these, digitally delivered services (DDS)[1] have emerged as the fastest-growing and most dynamic component of the global economy, offering unprecedented opportunities for innovation and economic growth. However, despite the transformative potential of DDS, women across APEC economies continue to face significant barriers that limit their participation and potential as key contributors to this growth. This study aims to identify the existing gaps in women's participation in DDS and explore how targeted interventions can maximize their economic empowerment in high-skill service sectors.

The current project on *Enhancing women's economic empowerment in APEC through greater participation in high-skill digitized service sectors* is a step in the direction of promoting greater awareness of the ways in which the APEC region can make progress on *La Serena Roadmap for Women and Inclusive Growth* which was endorsed by APEC Senior officials in December 2019, after being welcomed by Ministers at the Women and Economy Forum earlier in Chile. The *Roadmap* seeks to provide guidance and catalyze policy actions to promote the empowerment of women in the Asia Pacific region. The Key Action Areas and Targets of the *La Serena Roadmap* previously endorsed by the APEC economies were agreed as follows:[2]

- *Action Areas*
  1. *Empowering women through access to capital and markets*
  2. *Strengthening women's labor force participation*
  3. *Improving access of women to leadership positions in all levels of decision making*
  4. *Support women's education, training and skills development and access in a changing world of work*
  5. *Advancing women's economic empowerment through data collection and analysis*
- *Targets*
  1. *Have in place laws, policies, and regulations that prohibit discrimination on the basis of sex in employment access, opportunities and conditions*
  2. *Have in place non-discrimination laws, policies and regulations that provide equal access to capital and credit for both sexes*
  3. *Increase the region's gender balance among STEM graduates in tertiary education, and in positions in research and R&D*
  4. *Increase the region's gender balance in leadership positions, closing the gap for women.*

[1] Digitally delivered services are defined in Section II, Part I of the Study.

[2] Implementation Plan "*La Serena Roadmap for Women and Inclusive Growth (2019-2030)*", 2020 APEC SOM Report on Economic and Technical Cooperation – Annex 4, https://www.apec.org/docs/default-source/publications/2020/11/apec-senior-officials-report-on-economic-and-technical-cooperation-2020/toc/annex-4---la-serena-roadmap-for-women-and-inclusive-growth-implementation-plan.pdf

This project addresses all of the five Action Areas in the issues that it covers and it addresses two of the four Targets as well in its recommendations.

This project builds upon a prior project carried out for the GOS on *Knowledge Intensive Business Services (KIBS), Digital Services (DS) and Barriers Faced by Women in International Trade in Services* (GOS 02 2022), concluded at SOM3 in Peru in August 2024. The present study expands the analysis of barriers facing women in digitally delivered services by examining employment, wages, leadership, and access to critical skills within the most dynamic digitally traded service sectors. It highlights the structural inequalities in economic opportunity, including disparities in leadership positions, pay, and educational pathways, particularly in key sectors such as financial services, professional services, and telecommunications/information technology services. These services sectors, characterized by both rapid digitalisation and high skill intensity, offer a strategic focus for understanding and addressing gender disparities.

At the core of this project is the conviction that digitalisation, while disruptive, can be harnessed as a powerful equalizer—if inclusive policies, targeted skill development, and innovative approaches are implemented. The research takes a comprehensive approach by examining both quantitative data and qualitative insights, including variations across APEC economies, to identify where gaps exist and what can be done to close them. The study also explores cutting-edge issues such as the role of digital skills, the distinction between formal and informal employment related to digitally delivered services, and the potential implications of artificial intelligence for women's participation in DDS.

The structure of the project reflects its holistic scope. **Part I** analyses key factors shaping women's participation in DDS, including economic opportunity gaps, the state of women's employment in digitally intensive services, required skill sets, and issues of concern for moving forward towards the goal of greater participation in DDS by women. **Part II** discusses the experiences of women's involvement in firms within ABAC that operate in the most digitally intensive services sectors, offering practical insights from the private sector into how digitalisation can be a driver of women's economic advancement as well as those obstacles that must be addressed. **Part III** employs a qualitative methodology based on structured interviews with founders of fifteen women-led or women-founded start-ups across eleven APEC economies, supplemented by secondary literature and contextual data. The start-ups span fintech, professional services, digital health, education platforms, and AI-enabled applications. Each case is analysed through a structured company profile covering firm background, digital and AI content of activities, challenges encountered, and strategies adopted for resilience and growth.

The objective of this study is to provide actionable recommendations to policymakers and stakeholders within APEC, to help design and implement policies that can drive inclusive digitalisation and help to unlock the potential of women as drivers of economic growth. By bridging the gender gap in DDS, APEC economies can foster not only economic inclusion but also sustainable growth that benefits all.

PART I: ANALYSIS OF THE PARTICIPATION OF WOMEN IN HIGH SKILLED, DIGITALLY DELIVERED SERVICES IN APEC AND CURRENT CHALLENGES

Section I. Economic Gender Equality Gaps

KEY TAKEAWAYS

- **Gender Equality Gaps Limit APEC's Economic Potential.** The underutilization of women in economic, social, and political roles results in significant economic losses for APEC economies, estimated at USD 17 trillion. Closing these gaps is essential for strengthening economic performance, resilience and agility.
- **Progress Toward Gender Parity is Too Slow.** While APEC has made progress, reducing the gender gap by only 5.7 percentage points since 2006 is insufficient. At the current pace, achieving full parity will take another 84 years.
- **Gender Disparities in Economic Participation and Opportunity Persist.** Women face disparities in labor force participation, wage levels, and representation in senior decision-making roles. Structural barriers, limited career advancement opportunities, and wage inequality across sectors, including high-skill services drive these gaps.
- **Wide Disparities Exist Across APEC Economies.** Progress is uneven, with economies like New Zealand approaching parity, while others, such as Japan, lag. This variation slows overall regional progress and requires targeted policy responses in falling behind economies

1. Framing the issue

APEC economies have registered solid economic performance over the last decade, despite the shocks brought about by the COVID-19 pandemic. In 2023, the real GDP per capita for the APEC region grew by 3 percent.[3] Still, this performance could have been even stronger if APEC economies had achieved gender parity. As estimated by McKinsey & Co (2015) and the APEC PSU (2024), the underutilization of women as economic, social, and political resources resulted in significant economic losses for APEC economies, quantified at USD 17 trillion.[4]

[3] APEC PSU, 2024, APEC in Charts 2024, https://www.apec.org/docs/default-source/publications/2024/11/224_psu_apec-in-chart-2024.pdf?sfvrsn=1699dc13_1. Furthermore, the estimates for 2024 and further indicate slowing down of this growth- see more in https://www.apec.org/publications/2024/11/apec-regional-trends-analysis--november-2024

[4] Cf. McKinsey report (https://www.mckinsey.com/mgi/overview/in-the-news/the-economic-benefits-of-gender-parity)- Closing the global participation gap alone will deliver USD 28 trillion in GDP annually. This equates to USD 17 trillion in the Asia-Pacific. We are leaving USD 46 billion on the table every day in lost productivity. APEC's Crucial Role in Championing Gender Equity in the Asia-Pacific; By Chantelle Stratford PSM, Arequipa, Peru | 16 May 2024

Given the increasingly complex international environment for growth and development, it is crucial to maximize efforts in addressing challenges that are largely within domestic influence and control—such as economic gender inequality. **This project focuses on identifying strategies to better utilize the opportunities presented by the digitalization of high skill services to enhance the participation of and benefits for women as service providers**.

The rationale for this focus stems from empirical evidence highlighting the dynamism of sectoral growth of digitally delivered services (DDS) in APEC economies, particularly as a response to the transformative changes driven by digital technology. Digitally delivered services, particularly those requiring high-level skills, are a crucial avenue for harnessing women's potential in the workforce, given their pivotal role in shaping evolving economic structures and driving technological progress.

The scope of this research is framed by several dimensions of the current gaps in economic gender equality. It is further informed by an understanding of the estimated time required to achieve gender parity, particularly in high skill, digitized service sectors. Addressing these gaps effectively could accelerate progress towards gender equality while bolstering the overall economic resilience and inclusivity of APEC economies.

2. Focusing on the economic dimension of gender equality gaps

It is useful to begin by defining the key terms and concepts that will underpin the analysis in this study of existing gender equality gaps, both in APEC economies and globally. This approach ensures a common understanding of the metrics and issues involved. This section draws content from the WEF Global Gender Index Reports and ILO statistics and covers as many individual APEC economies as are available in these sources.

While there are numerous indicators and measures of gender inequality, spanning social, economic, and political dimensions, this analysis focuses specifically on those reflecting the economic status of women in APEC economies.

When discussing **economic equality**, **it is crucial to consider gender gaps in both access to and utilization of economic opportunities**. Therefore, we track and compare several indicators, including disparities in access to job opportunities (such as labor market participation), employment in selected sectors, career advancement, and decision-making roles in public and private sectors.

Additionally, another important insight into gender inequality comes from examining gender wage gaps. This dimension of the overall gender inequality is incorporated in the key metrics used in the study to track inequality in economic opportunities for women– the Gender Global Gap Index (see more in the next subsection).

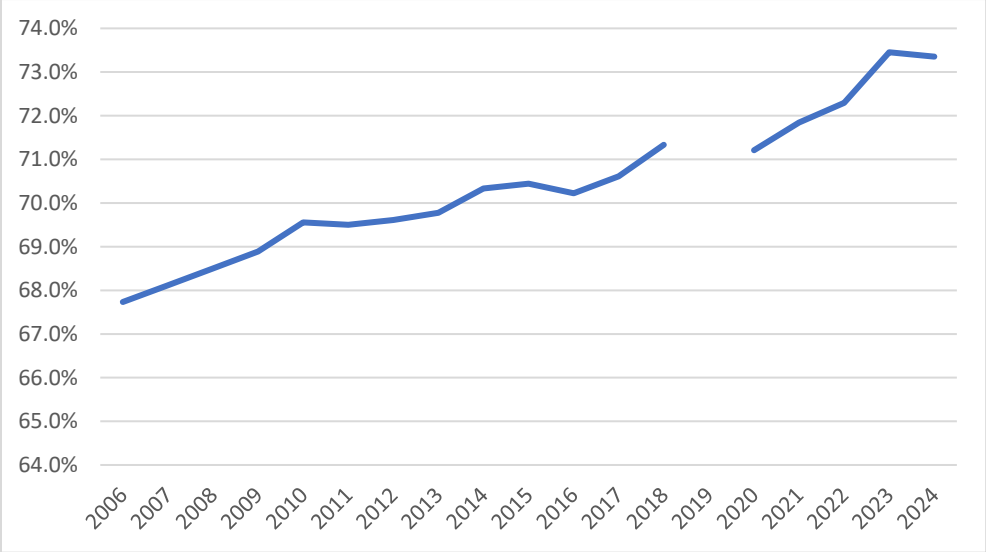
A complementary dimension of monitoring gender economic inequality involves estimates of the time required to close the current economic gender gaps. The WEF Global Gender Gap 2024

Report[5] underscores the sobering reality that generations may still be needed to fully eliminate the current gender gap. These projections serve as a call to action, reinforcing the urgency of addressing gender inequalities in the economic domain.

3. Data tell the story

Let us start with the trends in the global gender gap index across APEC economies (Figure I.1) as presented in the 2024 Report.

Figure I.1: Global Gender Gap Index for APEC, 2006 – 2024



Note: 100%=gender parity, 0%=maximum gender disparity; no data for 2019
Source: Data extracted from WEF Global Gender Gap Report | Download Dataset (downloaded January 2025).

To assist in following the story told by the data, it is helpful to be reminded of the three concepts underlying the Global Gender Gap index:

- the index focuses on measuring gaps rather than levels;
- it captures gaps in outcome variables rather than gaps in input variables; and
- it ranks economies according to gender equality and not women's empowerment.[6]

The Global Gender Gap Index for APEC shown in Figure I.1 is constructed as a simple average of the indices for all those APEC economies with available data, ignoring some significant

[5] World Economic Forum. (2024). Global Gender Gap Report 2024

[6] For more details on these distinguishing features, see the Global Gender Gap Index 2024, World Economic Forum, Appendix B, p. 64-65.

variations between individual APEC economies[7] It is notable that APEC as a group has progressed significantly towards closing this gender gap, but as of 2024 a 26.65 percent gap to parity still exists (compared to a 32.3 percent gap in 2006). The gap closed in 18 years was less than 6 percentage points (5.7 to be exact). This means that in order to close the remaining gap of 26.65 percentage points for the APEC region, it will take **another 84 years under a 'business as usual' model**. While this is roughly three generations beyond the 2030 Sustainable Development Goal target for gender parity, it is relatively better than the prospect at the global level, which will require 134 years to reach full parity.

However, given the dispersion of scores among individual economies in APEC,[8] some economies are much further than others from reaching this target in three generations. For example, New Zealand has achieved the highest score in the APEC region, with a 2024 gender gap score of 84 percent, indicating significant progress toward parity. In contrast, Japan, with a score of 66 percent, lags behind other economies, reflecting persistent structural barriers to gender equality. Moreover, eight out of 19 economies with data for 2024 score less than the APEC average of 73.3 percent. This highlights the need for heightened awareness and targeted policy responses in those economies lagging behind. Otherwise, such economies may continue to face prolonged disparities in achieving gender parity, pulling the region's progress downward and impacting its growth potential.

The Global Gender Gap Index,[9] which benchmarks the current state and annual evolution of gender parity combines four key dimensions

- Economic participation and opportunity
- Educational attainment
- Health and survival, and
- Political empowerment

These four sub-indices are divided into components which are constructed from a total of 14 indicators. Table I.1 provides details on the composition of each of the sub-indices.

[7] The WEF data does not include Hong Kong, China and Chinese Taipei. Data are not available for Brunei Darussalam for 2006 and 2007, Papua New Guinea for 2006-2028 and from 2022 onwards, and for the Russian Federation from 2022 onwards.

[8] Please see Part I – Appendix 1 for more details on the Global Gender Gap Index for each APEC economy individually.

[9] The WEF Global Gender Gap Report that publishes this information states that it is the longest-standing index tracking the progress of major economies' efforts towards closing these gaps over time since its inception in 2006. See WEF Global Gender Gap Report 2024

Table I.1 Composition of Four Sub-indices in the Global Gender Gap Index

Sub-index	Components	Description/Measure
Economic participation and opportunity	The participation gap	The difference between women and men in labor-force participation rates.
	The renumeration gap	The ratio of estimated female-to-male earned income Wage equality for similar work (an indicator gathered through the WEF's annual Executive Opinion Survey).
	The advancement gap	The ratio of women to men among legislators, senior officials and managers The ratio of women to men among technical and professional workers
Educational attainment	The education enrolment gap	The ratios of women to men in: i) primary-, ii) secondary- and iii) tertiary-level education
	The literacy gap	The ratio of women's literacy rate to men's literacy rate
Health and survival	The sex ratio at birth	Sex ratio at birth (aims specifically to capture the phenomenon of "missing women" prevalent in places with a strong son preference)
	The gap between women's and men's healthy life expectancy.	Estimates of the number of years that women and men can expect to live in good health by accounting for the years lost to violence, disease, malnutrition and other factors.
Political empowerment	The gap between men and women at the highest level of political decision-making	The ratio of women to men in ministerial positions The ratio of women to men in parliamentary positions. The ratio of women to men in terms of years in executive office (prime minister or president) for the last 50 years.

Source: Global Gender Gap Index 2024, World Economic Forum, Appendix B, Table B1, p.64-65.

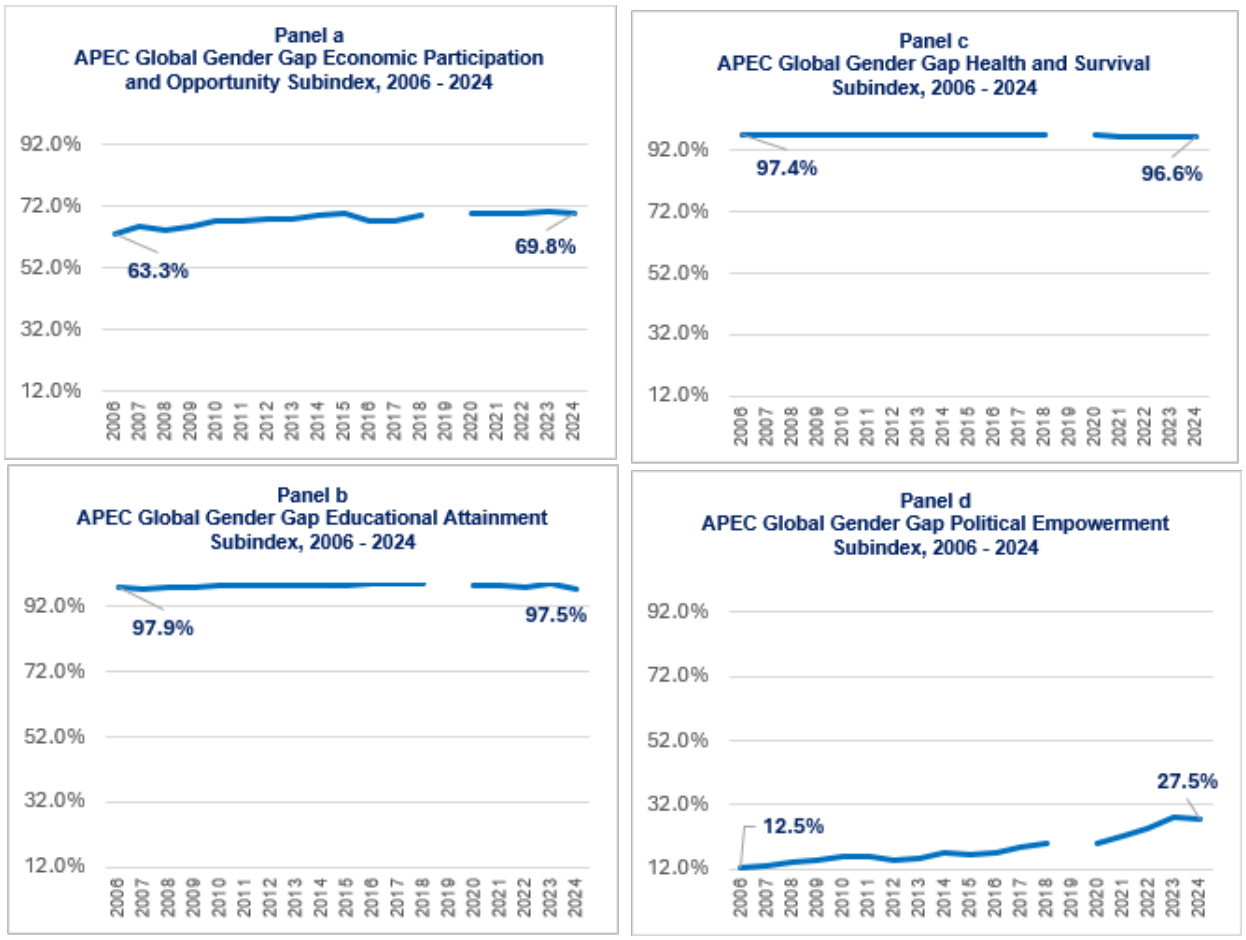
The status in each of these sub-indices as an average for APEC as a whole is shown in Figure I.2 (Panels a-d). Understanding the trends in the evolution of these sub-indices offers insights into what drives the overall gender gap score.[10]

The APEC region on average outperforms global results in each one of the sub-indices. The region's score for educational attainment and health and survival gender parity both stand close to parity, reflecting remarkable achievements in the region in both areas. However, both suffered a small dip in the recent years holding the progress towards the full parity. This is more pronounced in health and survival, as the pandemic period caused the sub-index for health and survival to move in an opposite direction since 2020 reflecting a disproportionate health burden in last three years on women.

[10] Please see Part I – Appendix 2 for more details on the Global Gender Gap Subindexes for APEC, for the years from 2006 to 2022.

A considerable difference is noted for the economic participation and opportunity subindex (the focus of this study), which shows the APEC region at 69.8 percent of parity only, indicating slow progress with a reduction of the gap of only seven percentage points since the start of the monitoring in 2006. The Part I- Appendix 1 (Table 2) reveals significant disparities between APEC economies in labor-force participation rates and workforce representation, which underlie this regional score. Lastly, the political empowerment score is the subindex that has improved the most overall in APEC since 2006 (an increase of 15 percentage points), although its 2024 level of 27.5 percent is still very low and a far cry from parity.

Figure I.2: The State of Gender Gaps in APEC, by Sub-indices (2006-2024)



Source: Data extracted from WEF Global Gender Gap Report 2024 | Download Dataset (extracted October 2024)

As noted above, the economic participation and opportunity gap which is our focus in this study is based on three underlying gaps – participation in the workforce, renumeration and advancement. While full details on the progress of individual APEC economies can be found in the WEF 2024 Report (economy profiles), we would like to draw attention to these three drivers of economic inequality by drawing upon some additional / complementary data.

With respect to the labor force participation gap, Figure I.3 based on ILO statistics, indicates an upward trend in female to male labor force participation rate in APEC.[11] This ratio increased steadily from 76.3 percent to 78.8 percent in all years over the decade except for 2020 when APEC economies experienced the pandemic shock and a temporary dip of female-to-male participation, reflected in both the economic participation and opportunity sub-index and the overall score.

It is important to note that the COVID-19 pandemic has significantly exacerbated gender disparities in the labor market across APEC economies. Women have faced increased demands for unpaid care and domestic work, leading to declines in productivity and, in many cases, decisions to exit the workforce. This surge in unpaid responsibilities is attributed to factors such as school closures, heightened care needs for the sick and elderly, and the reduction of external support services during lockdowns. Consequently, the pandemic has widened existing gender gaps in labor force participation.

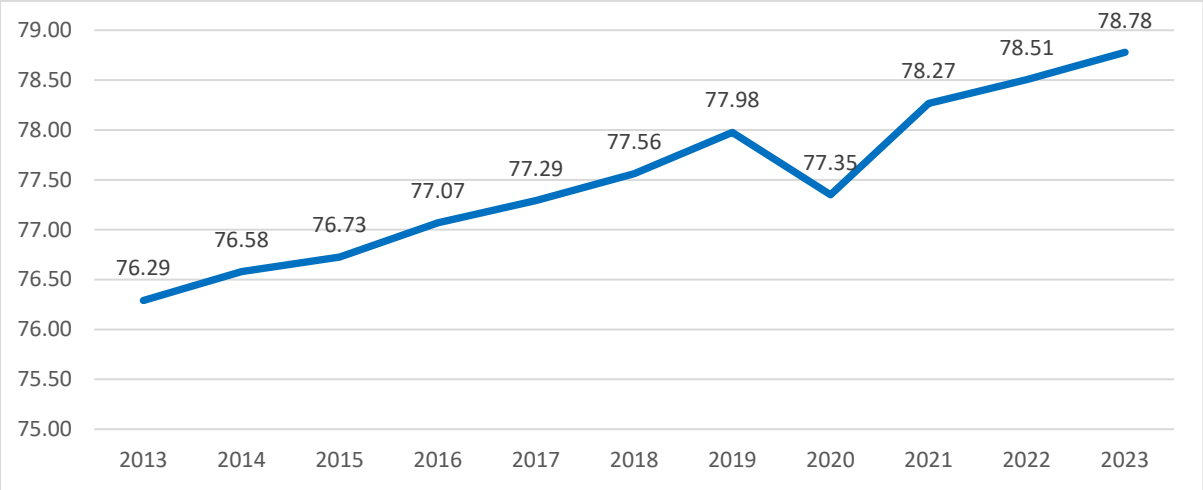
Prior to the pandemic, women in the APEC region already shouldered a disproportionate share of unpaid care work, averaging around 4 hours and 20 minutes daily—almost three times the amount undertaken by men. The onset of COVID-19 intensified this imbalance, further limiting women's opportunities for paid employment and career advancement. The compounded responsibilities have not only strained women's economic participation but also underscored the critical need for policies that address unpaid care work and promote gender equality in the labor market.[12]

Overall, the APEC region has diminished the gap in female to male labor rate participation by two and a half percentage points during the decade 2013-2023. This alignment of market participation rates and overall gender equality underscores the fact that a sustained increase in the inclusion of women in the workforce contributes positively to closing the overall gender economic equality gap.

[11] The ILO defines labor force participation rate as the proportion of the population ages 15 and older that is economically active: namely all people who supply labor for the production of goods and services during a specified period. The ratio of female to male labor force participation is calculated by dividing female labor force participation rate by male labor force participation rate and multiplying by 100. Closer to 100=more equality, further away from 100= greater disparity.

[12] See more in Women, COVID-19 and the Future of Work in APEC, APEC PSU, December 2020, https://www.apec.org/publications/2020/12/women-covid-19-and-the-future-of-work-in-apec

Figure I.3: Ratio of Female to Male Labor Force Participation Rate for APEC 2013–2023 (percentage, modelled ILO estimates)



Note: The trend of APEC ratio of female to male labor force participation rate (in percent) is constructed as an average of 20 APEC economies' participation rate, ignoring some significant variations between individual APEC economies. Please see Part I - Appendix 3 for more details on the ratio of female to male labor force participation rates for each APEC economy, from 2013 to 2023. Source: ILO, Statistics on women - ILOSTAT (downloaded October 2024)

With respect to the remuneration gap, both globally[13] and in many APEC economies,[14] women earn less than men for performing similar roles in high-skill service sectors like IT, financial, and professional services. This wage (or pay) gap often persists even after controlling for education, experience, and other factors.[15]

For instance, in Australia, recent data indicates that women earn approximately A$28,425 (USD 18,590) less annually than men, reflecting a gender pay gap of 21.8%. This gap has seen a marginal decrease of 0.6 percentage points as of March 2024, partly due to wage increases in female-dominated sectors like aged care.

[13] A 2023 report from the International Labour Organization (ILO) estimated global gender wage gaps at 20 percent, with high-skill service sectors showing smaller but still significant disparities, particularly in leadership and senior roles.

[14] The 2022 APEC Women and the Economy Dashboard highlighted that, on average, women earn 15–20 percent less than men in the digital sector across the region. Economies like Japan, Republic of Korea, and China report some of the largest gaps, while Australia and New Zealand show smaller disparities.

[15] The remaining gap in wages between men and women is mostly driven by cultural biases and norms. Data show that the key contributors to the gender wage gaps are 1) concentration of women in lower-paying jobs, and 2) under-representation in leadership position. Women are overrepresented in lower-paying, less specialized roles within high-skill services (e.g., administrative support in IT or customer relations in tech), while men dominate higher-paying, specialized roles (e.g., software engineering or data science). Likewise, women are underrepresented in senior or executive positions across high-skill service sectors, further exacerbating the wage gap since leadership roles often command significantly higher pay. (cf. Enhancing Women's Economic Empowerment in APEC through Greater Participation in High skill Digitally Delivered Services, Discussion Paper presented at APEC SOM3 Lima, Peru, August 2024, mimeo)

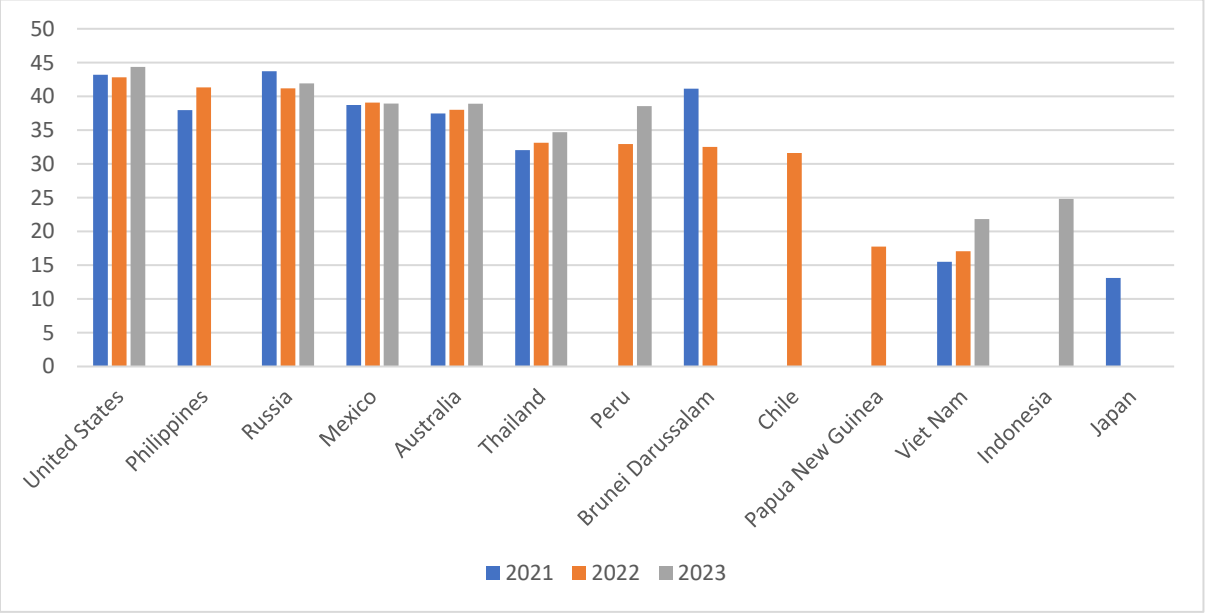
In the Republic of Korea, the gender wage gap is among the highest among the OECD countries. As of 2018, women earned about 65.4 percent of what men did on average, resulting in a wage gap of 34.6 percent. Factors contributing to this disparity include occupational segregation and a higher prevalence of part-time work among women.

Conversely, New Zealand has made notable progress in reducing its gender wage gap. In 2022, the gap stood at 10 percent a significant decrease from 16.3 percent in 1998. This improvement is attributed to various factors, including policy interventions and increased awareness of gender equality issues.

These disparities underscore the ongoing challenges within APEC economies to achieve gender pay equity. Addressing these gaps requires comprehensive strategies, including policy reforms, organizational commitment to equitable pay practices, and societal shifts towards valuing women's contributions across all sectors.

Lastly, the advancement gap indicator highlights the trend in women share of senior / managerial positions (relative to men) in the private sector. Figure I.4 provides the latest data for 13 APEC economies which collect these statistics (the fact that many economies do not have this information speaks for itself). This gap in all APEC economies shown in the figure is significant, with none of the economies reaching even a 50 percent ratio and for several showing this ratio at 25 percent or below. Clearly this gap impacts negatively the overall economic opportunity gap.

Figure I.4. Women's Share of Employment in Senior and Middle Management in APEC (2021-2023, in percent)



Source: Data extracted from World Bank Group, Gender Data Portal | Download Dataset

The findings on gender equality gaps discussed above reflect the status across all the activities of formal economies. We investigate the impact of employment in services on the status of gender inequality and women's economic empowerment in greater detail subsequently in section III of this study. We will see that many services sectors, and especially digitally delivered services, provide better access to work for women with potentially higher remuneration, but there are still systemic and policy barriers that prevent women from exploiting the full potential benefits from employment in DDS.

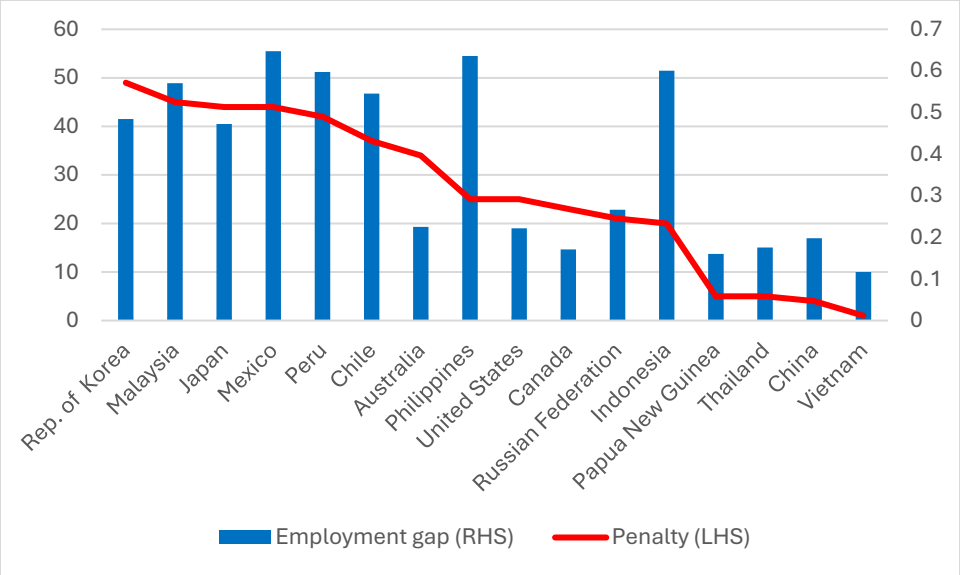
Box I.1: Child Penalty and Economic Opportunities for Women

The connection between the **child penalty** and the employment gender gap in selected APEC economies highlights how parenthood influences gender disparities in labor markets. As shown in Kleven et al. research (2024), the child penalty is the differential impact of having a first child on the employment of mothers relative to fathers. The child penalty contributes significantly to persistent gender gaps in employment and earnings, as well as to slower and lower career advancements, even in regions with relatively high gender equality.

The data from *The Child Penalty Atlas* (Kleven et al., 2024) is extracted for 17 APEC economies covered in the Atlas to show how much childbirth decreases mothers' employment probability compared to fathers.[16] For example if the child penalty is 20 spercent it means that women's employment fell 20 percent behind men's employment after having children (in contrast, a child penalty of 0 percent would imply that there is perfect equality in how men's and women's employment are affected by the arrival of a child).

Figure I.5 Child Penalty and Employment Gender Gaps in APEC

[16] See the details on methodology and the data for all 134 economies covered in the atlas at https://childpenaltyatlas.org. Using a pseudo-event study approach, the Atlas captures the effect of parenthood even in contexts without longitudinal data, making it particularly relevant for diverse APEC economies. The methodology controls for the effects of age and year, to remove potential confounding factors influencing women's and men's employment.



Source: The Child Penalty Atlas, 2024, accessed February 2025 (https://childpenaltyatlas.org/)

Figure I.5 reveals that child penalties vary across the region and in most cases is directly linked to women lagging behind in labor market participation. The linkages reflect differing cultural norms, policy environments, and labor market structures. For example:

- **High child penalties** are observed in economies (Republic of Korea, Japan) where traditional gender roles persist, and access to family-friendly policies (such as paid parental leave and childcare support) is limited.[17]
- **Lower penalties** are often found in economies with stronger labor market policies aimed at reconciling work and family life, including flexible working arrangements and incentives for paternal involvement.

The relationship is also driven by economic development levels. In low-income economies, the employment gender gap may be more related to structural barriers, such as limited access to formal jobs or education. As APEC economies grow and industrialize, child penalties become a more dominant factor in explaining the gender gap, particularly in middle-income economies where women face challenges in balancing family and professional responsibilities.

In conclusion, addressing the child penalty through targeted policies—like affordable childcare, parental leave, and gender-sensitive workplace regulations—can be critical in narrowing the

[17] For more sources on these linkages see. for example, Jayachandran, S. (2021). "Social norms as a barrier to women's employment in developing countries." IMF Economic Review, 69(3), 576-595; Das, S. and Kotikula, A. (2019). "Gender-based employment segregation: Understanding causes and policy interventions." World Bank; OECD (2022). *Parental leave systems and their impact on gender equality.* OECD Publishing; APEC Policy Support Unit (2021). *Women in the economy: Barriers and opportunities for greater participation"; Kleven, H., Landais, C., Posch, J., Steinhauer, A., & Zweimüller, J. (2019). "Child Penalties across Countries: Evidence and Explanations." *AEA Papers and Proceedings*, 109, 122–126.

employment gender gap across APEC. The Atlas's findings underscore the need for tailored policy solutions, as the magnitude of the penalty depends on both socioeconomic and cultural factors.

Source for the BOX: Based on Kleven et al. (2024) "The importance of parenthood for gender inequality around the world" VoxDev, available at https://voxdev.org/topic/labour-markets/importance-parenthood-gender-inequality-around-world and other references cited above.

Section II. Growth of Trade in Digitally Delivered Services

KEY TAKEAWAYS

- **All digital trade is a service, and only services can be delivered digitally.**
- **Digitally delivered services** (DDS) are the **fastest growing** component of international trade and of trade within APEC (growing at more than double the rate of trade in goods and trade in other services), showing a much faster inflection point as of 2016.
- The **services sectors** that demonstrate the **greatest digital intensity** (i.e. those with the largest digital component) in the APEC region are **ICT services** (29 percent), **financial services** (21 per cent), and **professional services** (15 percent). These three sectors, together with computer services, constituted over three-fourths (77.7 percent) of total DDS exports worldwide in 2023.
- These are also the services that have shown the **greatest dynamism in trade** in APEC and have thus been selected as the focus sectors of this study.
- Any exploration of ways to reduce the gender gap around economic empowerment must focus on enhancing the ability of **women to participate more** in both absolute and relative terms in these dynamic digitally delivered services sectors.

There are three reasons why we focus on a subset of digitally delivered services (DDS) in this project on women's economic empowerment. First, DDS in totality are the fastest growing component of international trade, as well as trade within the APEC region. Second, as discussed in Section I, DDS are assumed to be those services that require the highest skill levels to provide, which applies to women as well as men.. Third, the selected sectors of DDS are those that feature prominently in discussion on the economic empowerment of women due to their economic importance and dynamism.

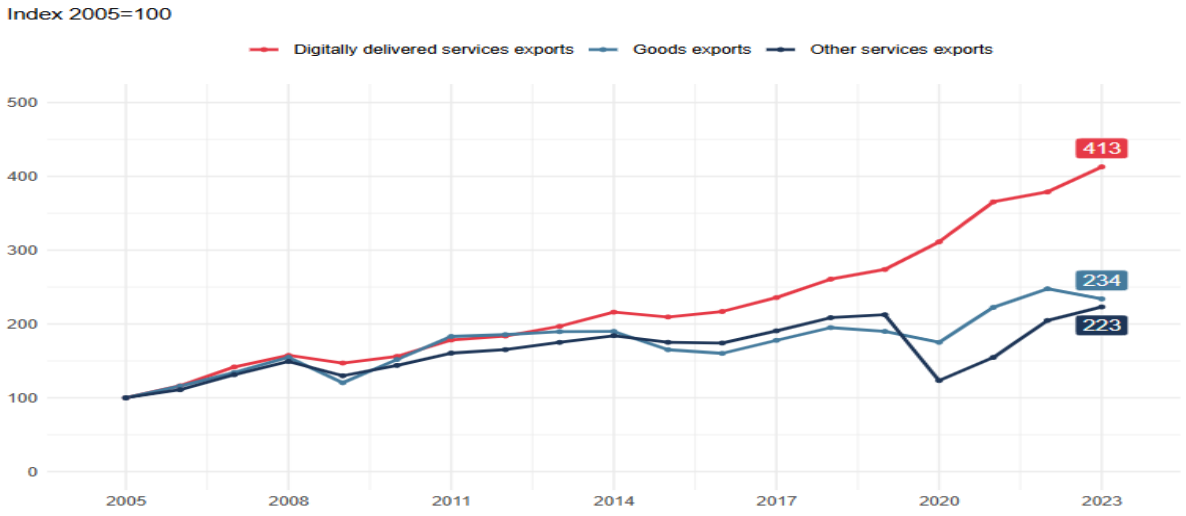
Any exploration of ways to reduce the gender gap around economic empowerment must focus on enhancing the ability of women to participate more in both absolute and relative terms in the economy and especially in the dynamic and high skill digitally delivered services sectors. This section will provide more background on the first and third of the above reasons by presenting statistical evidence of the increased digitalization of services and the recent growth in digitally delivered services exports and imports in APEC. In particular, it will highlight the dynamism of the growth in certain services categories, which are selected as the sectors of focus for Part II of this study. The skills required for these digitally intensive and fastest growing DDS sectors will be discussed in Section IV that examines training, education and women.

1. Dynamic growth of digitally delivered services

Digitally delivered services exports have experienced a rapid expansion, particularly since 2016. As shown in Figure II.1, the growth of global DDS exports was nearly double that of both goods exports and other services exports in 2023.

According to the WTO, digitally delivered services have experienced a fourfold increase in value since 2005, with the value of global exports of digitally delivered services reaching US $3.82 trillion. This was due to the rapid average annual growth rate of 8.2 percent over the period 2005-2023. This growth rate has outpaced that of goods exports (5.6 percent) and of other services exports (4.2 per cent). Digitally delivered services accounted for over 54 percent of total services exports in 2023 (compared to 8 percent in 2005).[18] However, the WTO notes that these trends are influenced by the period of COVID-19 when it was difficult to impossible to trade many services in person due to mobility restrictions. Therefore, the growth of digitally traded services received a tremendous boost. But digitally delivered services have continued to grow dynamically even after the COVID-19 period ended, with some regional and individual economy variations, as consumers largely changed their consumption patterns during the pandemic.

Figure II.1: Growth of Global Digitally Delivered Services Exports 2005 – 2023



Source: WTO estimates.
Note: Digitally deliverable services include financial services, business activities, such as information, administrative and professional services, and other services, such as audio-visual and entertainment services.

Source: WTO, Data Blog by the WTO Secretariat

[18] See WTO, *Thirty Years of Trade Growth and Poverty Reduction*, Data Blog by the WTO Secretariat, April 2024, https://www.wto.org/english/blogs_e/data_blog_e/blog_dta_24apr24_e.htm See also the joint report on Digital Trade for Development, 2023, which was prepared by the staffs of the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), the United Nations Conference on Trade and Development (UNCTAD), The World Bank, and the World Trade Organization (WTO). https://www.wto.org/english/res_e/booksp_e/dtd2023_e.pdf

2. What constitutes digitally delivered services?

Though there is no agreed international definition of what constitutes digitally delivered services, there has been detailed discussion on this in the relevant economic literature. A joint effort of the IMF, OECD, WTO and UNCTAD resulted in a *Handbook* in 2023 that both defines digital trade and describes the various existing ways to measure it. The Handbook sets out this definition of digitally delivered trade:[19]

> *Digitally delivered trade, as defined in this Handbook, refers to* ***"All international trade transactions that are delivered remotely over computer networks"****.*
>
> And
>
> *"……****digitally delivered trade can involve participants from all institutional sectors, and covers deliveries made over the internet (including via mobile devices) and via private networks"****.*

It is important to keep in mind that the *Handbook* explicitly states that **all digital trade is a service**. It also makes explicit the understanding that only services can be delivered digitally. The Handbook emphasizes that the range of technologies relevant to digital delivery is wider than that for digital ordering; services delivered through video calls and manually typed emails, as well as voice calls, fax messages and any other digital communication devices, and through cloud networks, are included in digitally delivered trade.[20] It should also be kept in mind that while services are traded through four modes of supply, digital trade in services refers to mode 1 only. It is also important to note that data flows are considered to be cross-border services, as cross-border data flows refer to the transfer of information across international borders, essentially constituting a service that crosses economy-wide boundaries.

While all types of goods and services can potentially be digitally ordered, the *Handbook* specifies that all goods and some services cannot be delivered digitally. As such, certain services are the only "items" or products that are digitally deliverable. These are the services of concern to this study. The *Handbook* lists those services considered to be "digitally deliverable", derived from the components of the Extended Balance of Payments Services Classification (EBOPS 2010). These services are reproduced in Table II.1.

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[19] See Chapter 4 on "Digitally Delivered Trade" in the *Handbook on Measuring Digital Trade, Second Edition*, OECD Publishing, Paris/International Monetary Fund/UNCTAD/WTO, Geneva, 2023, https://doi.org/10.1787/ac99e6d3-en. This definition builds upon a statistical definition of digital trade which appeared in an earlier edition of this *Handbook* and which combined the two key criteria of digital ordering and digital delivery to formalize for the first time to produce a definition of digital trade as "……all international trade that is digitally ordered and/or digitally delivered". See *Handbook on Measuring Digital Trade, First Edition*, prepared by OECD, WTO and IMF, 2020, https://unstats.un.org/unsd/statcom/51st-session/documents/BG-Item3e-Handbook-on-Measuring-Digital-Trade-E.pdf

[20] Ibid, page 66.

Table II.1: List of Digitally Deliverable Services (supplied cross border by Mode 1)

Insurance services
Financial services
Charges for the use of intellectual property
Telecommunications, computer and information services
Research and development services
Professional and management consulting services
Architectural, engineering, scientific and other technical services
Trade-related services
Other business services n.i.e.
Audio-visual and related services
Education services
Health services
Heritage and recreation services

Source: Digitally delivered services trade dataset, Global Services Trade Data Hub

The WTO has also developed another data base on trade in services (the *Trade in Services by Mode of Supply* or *TISMOS dataset*) with the purpose of providing statistics on services trade by all four modes of supply.[21] Digital trade is captured through estimates and statistics on mode 1 of supplying services, which is carried out across borders. Since the other three modes of service supply are not delivered on a cross-border basis, these modes are not considered to be digitally delivered.[22]

It should be clarified that as of 2022 the services categories included in the TISMOS dataset are not identical to those in the *Extended Balance of Payments Services Classification* (EBOPS 2010) list above since the TISMOS dataset provides a more disaggregated sectoral breakdown of DDS categories. The main categories in the latter are shown in Table II.2.

Table II.2: Services included in the WTO Trade in Services by Mode of Supply dataset

Business and professional services: Accounting, legal, architectural, and engineering services
Communication services: Audiovisual services, postal, courier, and telecommunications
Construction services: Construction and related services
Distribution services: Distribution services
Educational services: Educational services

[21] See WTO Trade in Services by Mode of Supply dataset which covers over 200 economies and regions for 55 service sectors for the period 2005-2022. The dataset builds upon the WTO-EUROSTAT allocation of service sectors to the four GATS mode of supply for the purposes of international trade. The data set also includes country survey statistical results. https://www.wto.org/english/res_e/statis_e/gstdh_mode_supply_e.htm#:~:text=The%20Trade%20in%20Services%20by,2005%2D22%20for%2055%20sectors.

[22] See discussion on the four modes of service supply in the WTO General Agreement on Trade in Services (GATS) and the chart on "Digitally delivered trade and related statistical concepts" on page 25 of the *Handbook on Measuring Digital Trade*, Second Edition, op. cit.

Energy services: Energy services
Environmental services: Environmental services
Financial services: Insurance and financial services
Health and social services: Health services
Tourism services: Tourism and business travel
Transport services: Air, land, and maritime transport; services auxiliary to all modes of transport
Other business services: Other business services, excluding trade-related services
Trade-related services: Distribution services
Maintenance and repair services: Maintenance and repair services not included elsewhere
Charges for the use of intellectual property: Charges for the use of intellectual property
Manufacturing services: Manufacturing services on physical inputs owned by others
Heritage and recreational services: Heritage and recreational services

Source: Trade in services by mode of supply dataset, Global Services Trade Data Hub

Those service sectors that are of primary interest to this study are highlighted in bold in both tables and will be discussed in further detail below, and in Part II. The charts in this section will draw upon both datasets as appropriate.

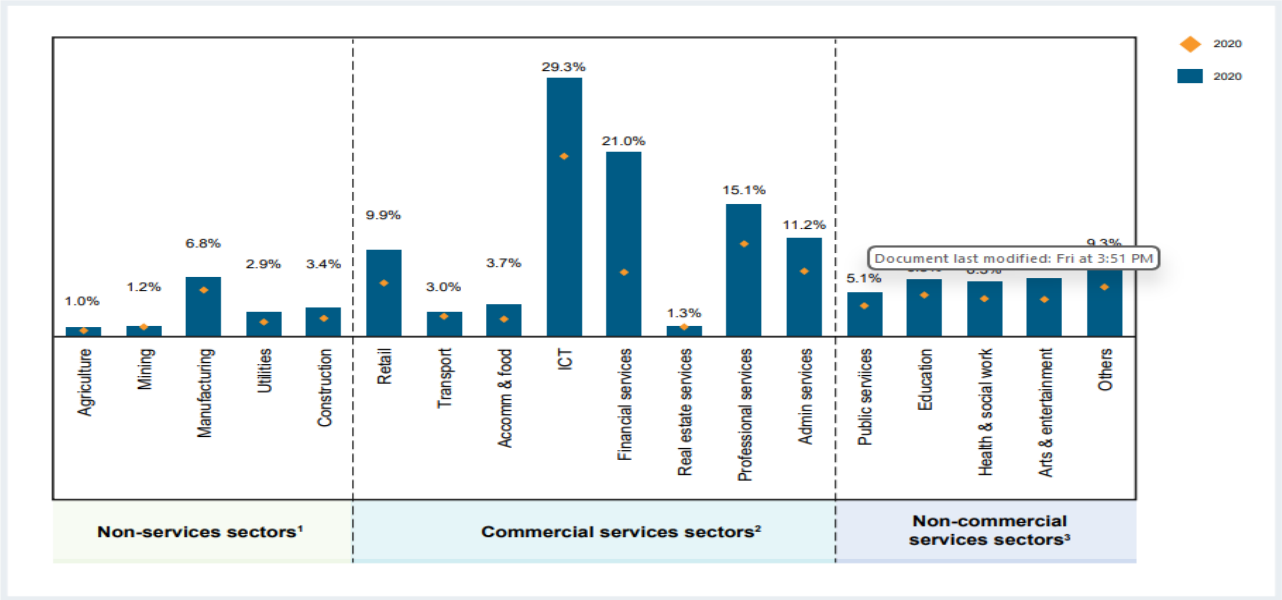
3. Digitalization of services and digitally delivered services trade in APEC

A recent APEC report estimates the extent of digitalization in the APEC region through the development of a measure of digital intensity.[23] It finds that services sectors demonstrate a higher level of digital intensity than non-service sectors and shows that these sectors have 'digitalized' at a faster pace between 2000 and 2020. The pace of increase in services digitalization in APEC shown in Figure II.2 was fastest in the commercial services sectors, with the digital intensity of these sectors increasing by nearly 60 percent between 2000 and 2020, compared to a 44 percent increase for non-commercial services sectors and a 12 percent increase for non-services sectors.[24] This greater digital intensity in the services area is primarily attributed to the high levels of digitalization in three sectors: ICT services (29 percent), financial services (21 per cent); and professional services (15 percent). All three showed the highest digital intensities of all service sectors in APEC in 2020.

[23] *Understanding the Economic Impact of Digitalisation on Digital Trade, report for the APEC Committee on Trade and Investment*, Digital Economy Steering Group, December 2024, https://www.apec.org/ds/default-source/publications/2024/12/224_desg_understanding-the-economic-impact-of-digitalisation-on-digital-trade.pdf?sfvrsn=f4f82549_1. It should be noted that this study relies on the definition of digital trade set out in the OECD-WTO-IMF-UNCTAD Handbook on Measuring Digital Trade (Second Edition), discussed in the previous section.

[24] Commercial services are those services which are produced and sold on a "for-profit" basis by privately owned services providers, while non-commercial services are generally made available for the benefit of public welfare or public interest by the government or non-profit organizations and are provided at a low cost or no cost.

Figure II.2: Digital Intensity by Sectors in APEC in 2000 and 2020 (percentage)



Notes:

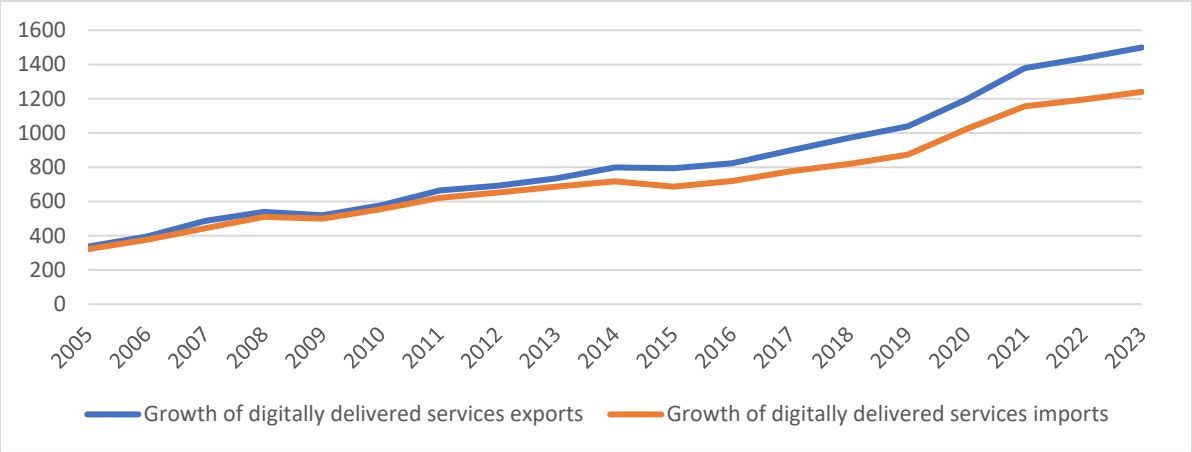
1. Non-services sectors include agriculture, forestry and fishing (ISIC 01 to 03); mining and quarrying (ISIC 05 to 09); manufacturing (sector ISIC 10 to 33); utilities (ISIC 35 to 39); and construction (ISIC 40 to 43).
2. Commercial services include distributive trade, transport, accommodation, and food services (ISIC 45 to 56); real estate services (ISIC 68); information and communication services (ISC 58 to 53); financial and insurance activities (ISIC 64 to 66); professional, scientific, and technical activities (ISIC 69 to 75); and administrative and support services (ISIC 77 to 82).
3. Non-commercial services sectors include public services (ISIC 84); education (ISIC 85); human health and social work (ISIC 86 to 88); arts, entertainment and recreation (ISIC 90 to 93); and other services activities (ISIC 94 to 96).

Source: : Access Partnership analysis, OECD Inter-Country Input-Output Database, The Conference Board

Source: Access Partnership analysis, OECD Inter-Country Input-Output Database, Figure shown as Exhibit 9 on page 20 of the report on *Understanding the Economic Impact of Digitalisation on Digital Trade*

The increase in digitalization of services has been reflected in the growth of digital services trade in the APEC region as well as the world. Figure II.3 shows the growth of digitally delivered services exports and imports by APEC economies over the past nearly two decades. Although the growth of DDS has been steady since 2005 when the data were first published, the inflection point for much faster growth appeared as of 2016. The past decade has witnessed a considerable dynamism in both DDS exports and imports by APEC economies, with a nearly doubling in value. Export growth of digitally delivered services has slightly outpaced that of import growth.

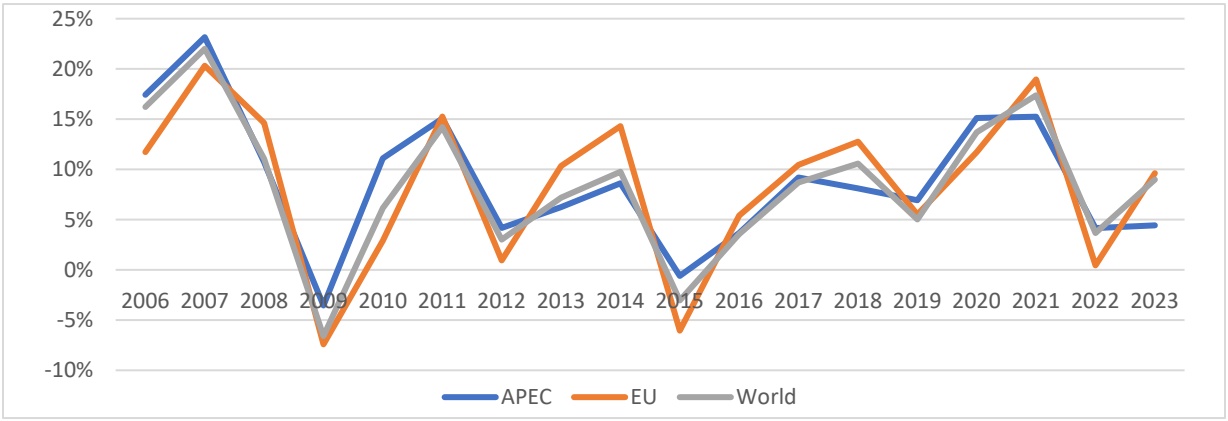
Figure II.3: Growth of APEC Exports and Imports of Digitally Delivered Services 2005 - 2023 to and from World (in US dollar billions)



Source: Data from WTO Digitally delivered services trade dataset, Global Services Trade Data Hub

Examining the growth rates for digitally delivered services exports in APEC in a global context of the past nearly three decades, Figure II.4 shows that the growth trajectory for the APEC region for digitally delivered services exports has closely tracked that of both the European Union (a very dynamic region for DDS output and trade) and the world economy. This is to be expected, as many of the most important commercial services exporters in the world economy are members of the APEC group.[25]

Figure II.4: Growth of Digitally Delivered Services Exports for APEC, the European Union and the World (percentage) 2005 – 2023

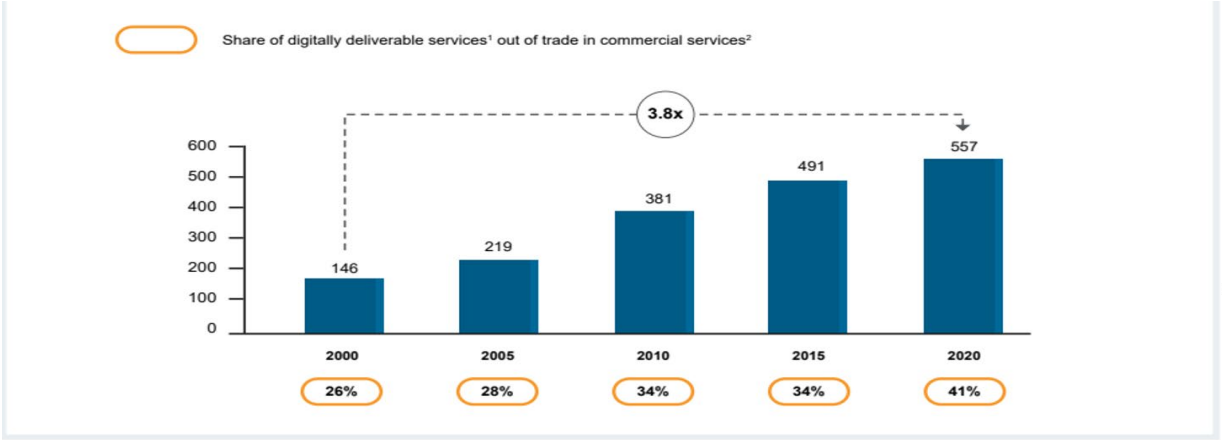


Source: Data WTO Digitally delivered services trade dataset, Global Services Trade Data Hub

[25] Among the top 20 commercial services exporters in the world are seven APEC economies (in order of export value), namely the United States; Singapore; Peoples Republic of China; Japan; Republic of Korea; Canada; and Hong Kong, China. See WTO Digitally delivered services trade dataset, https://www.wto.org/english/res_e/statis_e/gstdh_digital_services_e.htm

Digitally delivered services trade has been growing sharply in APEC as a share of trade in commercial services. Using the definition in the OECD-WTO-IMF-UNCTAD *Handbook on Measuring Digital Trade* (Second Edition), the recent APEC DESG report estimates that trade in DDS more than tripled in value between 2000 and 2020 in the APEC region. As a share of total trade in commercial services – which includes both digitally deliverable services and services that are not digitally deliverable, – trade in digitally deliverable services grew sharply from 26 percent to 41 percent in the same period, as shown in Figure II.5**.**

Figure II.5: Increased Importance of Trade in Digitally Delivered Services in APEC as a Share of Trade in Commercial Services (2000 – 2020, US Dollars Billion)



Notes:

1. Digitally deliverable services include publishing, audio-visual, and broadcasting activities (ISIC 58 to 60); telecommunications services (ISIC 61); IT and other information services; (ISIC 62 to 63); financial and insurance activities (ISIC 64 to 66); professional, scientific, and technical activities (ISIC 69 to 75); and administrative and support services (ISIC 77 to 82). Trade data includes all bilateral digital trade within 20 APEC economies (excluding Papua New Guinea due to lack of data).
2. Commercial services include distributive trade, transport, accommodation and food services (ISIC 45 to 56); real estate services (ISIC 68), and digitally deliverable services as defined below. Trade data includes all bilateral digital trade within 20 APEC economies (excluding Papua New Guinea).

Source: Access Partnership analysis, Trade in Value Added (TiVA) database

Source: Access Partnership analysis, OECD Inter-Country Input-Output Database, Figure shown as Exhibit 3 on page 12 of the report on *Understanding the Economic Impact of Digitalisation on Digital Trade*

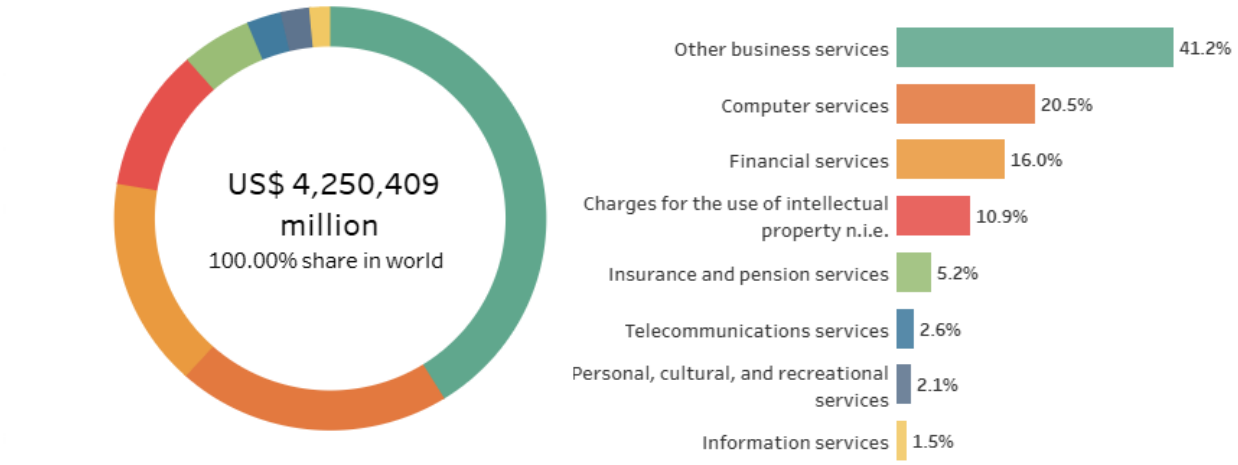
4. Most important sectors for DDS trade in world economy and in APEC

The main services sectors that were digitally traded in the world economy in 2023 are shown in Figure II. 6. The most prominent sector by far is the category of business services (which in the WTO Global Services Trade Data Hub dataset includes the professional services categories). Together with the other two important categories of computer services, and financial services, these three key sectors constituted the large majority or over three-fourths (77.7 percent) of total digitally delivered services exports worldwide in 2023.[26] The importance of the other commercial services exports in the world economy was considerably smaller, at five percent or less (for

[26] These figures are also cited in the report on Digital Trade for Development, 2023, op.cit.

insurance services, telecommunication services, personal, cultural and recreational services, and information services).

Figure II.6: Structure of Digitally Delivered Services Exports in the World Economy, 2023



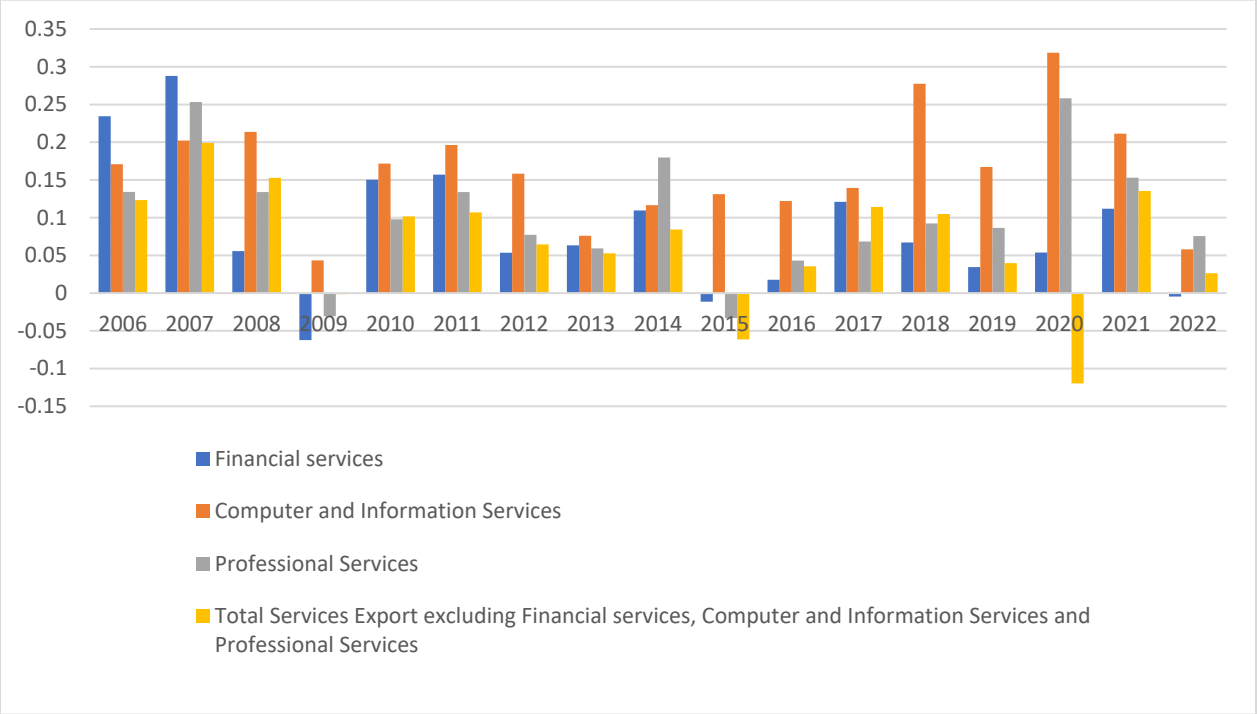
source: WTO estimates

Note: The sector composition of the three most important categories is the following: Computer and Information Services include computer services and information services. Financial services include insurance services and financial services. Professional services include advertising, market research, public opinion polling; architectural engineering, scientific and other technical services; legal, accounting, management, consulting and public relations; professional and management consulting services; and technical, trade-related, and other business services.

Source: WTO, Digitally delivered services trade dataset, Global Services Trade Data Hub

These same three sectors have shown the greatest trade dynamism in APEC as well over the past two decades. Examining the growth of DDS trade in these three areas using data extracted from the WTO trade in services by mode of supply dataset (TISMOS) for 21 APEC economies gives the results shown in Figure II.7. The financial services, computer and information services, and professional services sectors showed a faster annual rate of export growth on a cross-border basis (mode 1) in all but a few years during the period in question 2006-2022, when compared with the annual rates of growth for exports of the remaining services sectors. The dynamism of these three DDS sectors has thus been striking, particularly that of computer and information services, when compared with the growth rates of other services sectors over these 17 years. Professional services also showed very dynamic annual growth in several of these years, while the performance of financial services fluctuated more widely.

Figure II.7: Annual Percentage Changes in Cross-Border Services Exports (Mode 1) in APEC for the Three Focus Sectors (Financial Services, Computer and Information Services and Professional Services), 2006-2022



Source: Data from WTO Trade in services by mode of supply dataset, Global Services Trade Data Hub

5. Selection of service sectors of focus for this study

For the purposes of this study, we will focus on the three main sectors of DDS services which have been shown to be both the most digitally intensive as well as the most dynamic in terms of their trade growth as compared with other services sectors, namely computer and ICT services; financial services; and professional services.[27] These sectors are also those characterized by a considerable degree of digital skills and can therefore be considered among those services activities requiring the most highly skilled workers, as discussed in Box IV.1 of Section IV on "skills required for digitally delivered services". These three sectors are key for the economic empowerment of women in services trade and will be the focus for the case studies in Part II.

[27] It is also notable that these three sectors are often used as intermediate or inputted services into other services or into manufactured or agricultural output, thereby making them among the most "in demand" services across the economic spectrum.

Section III. Women's employment in digitally delivered services

KEY TAKEAWAYS

- More women work in services in the APEC region than in manufacturing and agriculture combined; this proportion more than tripled between 2013 and 2022.
- The **more highly skilled jobs are those of managers, professionals, and technicians/ associate professionals (as per the** ILO International Standard Classification of Occupations)**. These occupations most closely correspond to the high skill, digitally delivered services of focus in this study**.
- In APEC, only the **professional occupation** has shown a marked increase in the number of **women employed** between 2013 and 2023; the number of **women managers** employed in the region actually **declined.**
- According to a survey conducted among firms in APEC economies, those barriers which most hold women back from being employed in these high skill, digitally intensive and dynamic services occupations are:
  - **Skills barriers (access to IT and STEM education and training**)
  - **Cultural and attitude barriers**
  - **Finance barriers (difficulties for women to obtain access to capital)**
  - **Regulatory barriers affecting trade in digitally delivered services**

1. Introduction

This section discusses several aspects of women's employment in digitally delivered services. The shift towards greater participation of women in the services sector over the past two decades, both worldwide and within APEC is illustrated. However, the negative impact of the COVID-19 pandemic has slowed down this trend and left numerous impacts on women's employment, negatively affecting their ability to engage in work in the services sector in multiple ways, Limitations on data availability preclude the examination of women's employment on a sectoral basis, but an alternative approach to examining the employment of women by occupation in higher skilled services categories in APEC is adopted, with a discussion of existing barriers and how they are impacting women's ability to engage in these more digitally advanced areas.

2. Evolution and status of women's employment in the world economy and in APEC

Globally, the labor force participation rate for women on average (i.e. across all sectors in the economy) is just over 50 percent compared to 80 percent for men, highlighting a significant gender gap in workforce participation which drives the gap in women's ability to access economic

opportunities, discussed in Section I.[28] The World Bank points out in its Gender Data Portal that women's labor force participation in the world economy has remained fairly flat over the last three decades, and that women are less likely to work in formal employment and have fewer opportunities for starting a business or progressing to leadership roles in their career.[29] It also underscores that women's engagement in work brings in less remuneration than does that of men and creates a gender wage gap, as was shown in Section I and will be further discussed in Section IV. The COVID-19 pandemic years accentuated these differences and set women's participation in the work force back considerably.[30] It also pushed back the projected timeline for achievement of gender parity.[31]

There are, however, considerable differences between regions in the current situation of women's employment and how it has evolved as well as between economies in different income levels.

The World Bank notes that the gender employment gap is the largest in the lower middle-income economies but decreases with an increase in levels of development and per capita income.[32] For the upper middle-income and high-income economies (which encompass all but three APEC economies), the rate of women's labor force participation in these two groupings reached 61.4 percent and 67.6 percent in 2020.[33] However, within the region the picture is more nuanced.

The APEC Women and the Economy Dashboard (2023) report highlights the positive fact that APEC economies have progressively removed restrictions to encourage more women to participate in the labor market. Despite this, the report indicates that women's labor force participation in APEC has done the opposite and shown a steady decline over the past 15 years, from 59.8 percent in 2008 to 57.9 percent in 2022. Much of this decline was due to a significant drop in women's employment at the height of the COVID-19 pandemic. Since that time women's workforce engagement in the region has remained below pre-pandemic levels.[34]

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[28] UN Women, *Facts and figures: Economic empowerment*, https://www.unwomen.org/en/what-we-do/economic-empowerment/facts-and-figures#:~:text=Globally%2C%20the%20gender%20gap%20in,90.6%20per%20cent%20for%20men. Globally, the gender gap in labor force participation has hovered at 30 per cent since 1990.

[29] World Bank Group, Gender Data Portal, January 2022, https://genderdata.worldbank.org/en/data-stories/flfp-data-story .

[30] Sofia Sprechmann, *Covid-19 is the biggest setback to gender equality in a decade*, World Economic Forum blog, July 2020, https://www.weforum.org/stories/2020/07/gender-equality-women-employment-covid19/ The author notes that the overwhelming burden of unpaid work which increased during Covid-19 fell on women.

[31] As reported in Section I, based on current data, it will take 134 years to reach full parity – roughly five generations beyond the 2030 Sustainable Development Goal (SDG) target.

[32] See World Bank Group Gender Data Portal, op.cit. Note that this gender wage gap is part of the Global Gender Gap discussed in Section 1.

[33] The only APEC economies that do not fall into the upper middle- or high-income categories as of 2024 are the Philippines, PNG and Viet Nam. See World Bank country classifications by income level for 2024-2025 at https://blogs.worldbank.org/en/opendata/world-bank-country-classifications-by-income-level-for-2024-2025

[34] The APEC Women and the Economy Dashboard, Report by the APEC Policy Support Unit, Executive Summary, August 2023, https://www.apec.org/docs/default-source/publications/2023/8/223_psu_apec-women-and-the-economy-dashboard.pdf?sfvrsn=bf5084d_2

Figure III.1. APEC Women's Labor Force Participation Rate, 2008-2022

Source: Figure Page v, in the APEC Women and the Economy Dashboard 2023, APEC Policy Support Unit, August 2023

A study by the APEC PSU provides more details of the various ways that the COVID-19 pandemic has affected women in the recent period, with detrimental impacts on their ability to improve their economic situation and thus constituting a major setback to their economic empowerment.[35] The pandemic increased demands for unpaid care work that drew women out of the work force (formal or informal) and obliged them to take up caretaking responsibilities instead. It adversely affected women-led MSMEs which tend to be smaller and are more likely to be informal and often could not obtain the capital required to keep afloat. These small women-led businesses are also less likely to engage in international trade.[36]

Importantly for the focus of this study, the pandemic accelerated the adoption of new digital technologies which led to job displacement for women who were not educated in the STEM areas (science, technology, engineering and mathematics) or unable to find or pursue digital training or reskilling opportunities. In APEC, women continue to be underrepresented in the STEM fields which have become increasingly in demand in the workforce, as discussed in Section IV of this study. The APEC PSU study cautions as well that data from some APEC economies suggest that women are more likely than men to be employed in an occupation that is at high risk of automation, affecting women's future of work.[37]

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[35] APEC Policy Support Unit, Women, COVID-19, and the Future of Work in APEC, Policy Brief No. 38, December 2020, https://sea-vet.net/images/seb/e-library/doc_file/841/220psuwomen-covid-19-and-the-future-of-work-pdf.pdf. The study underlined that sectors hardest hit during the COVID-19 pandemic were those that employed the largest proportion of women workers, particularly the informal sectors.

[36] OECD blog, Women are less engaged in trade: why and what to do about it, at https://oecdstatistics.blog/2023/10/18/women-are-less-engaged-in-trade-why-and-what-to-do-about-it/

[37] APEC Policy Support Unit, Women, COVID-19, and the Future of Work in APEC, Ibid.

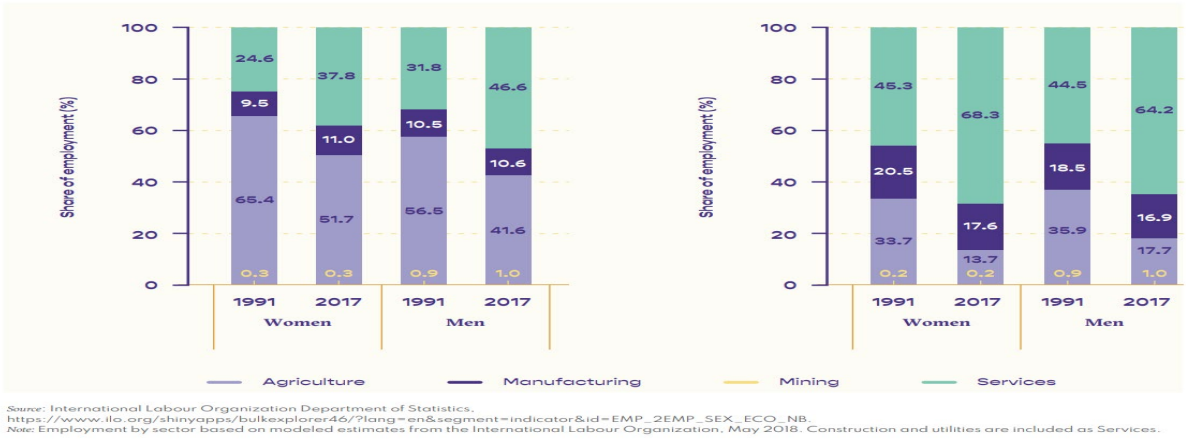
3. Women's employment in services worldwide is growing

The services sector is well known for being the largest area of the economy to employ women. A World Bank-WTO report indicates that in 2021, 59 percent of employed women globally worked in the sector, up from 44 percent in 2000.[38] The report emphasizes the beneficial impact for women's economic well-being of this evolution, stating that "*services have a positive gender dimension and play an important role in women's empowerment*".

Figure III.2 shows that this shift for women into services has been experienced across all economies but has been more pronounced in the upper middle- and high-income economies as contrasted with the low- and lower-middle-income economies. More than two-thirds of women in the former were working in services in 2017, up from 45 percent in 1991, while the proportion of women in the services sector in the latter group of economies increased to 38 percent from 25 percent over this period. Male workers followed a similar but less pronounced trend in both cases. This trend is expected to continue, as several World Bank and other studies have shown a strong correlation between increased employment in the service sector and rising per capita income.

Figure III.2. Women's Employment has Shifted into Services

2017 compared with 1991



Source: International Labour Organization Department of Statistics.
https://www.ilo.org/shinyapps/bulkexplorer46/?lang=en&segment=indicator&id=EMP_2EMP_SEX_ECO_NB.
Note: Employment by sector based on modeled estimates from the International Labour Organization, May 2018. Construction and utilities are included as Services.

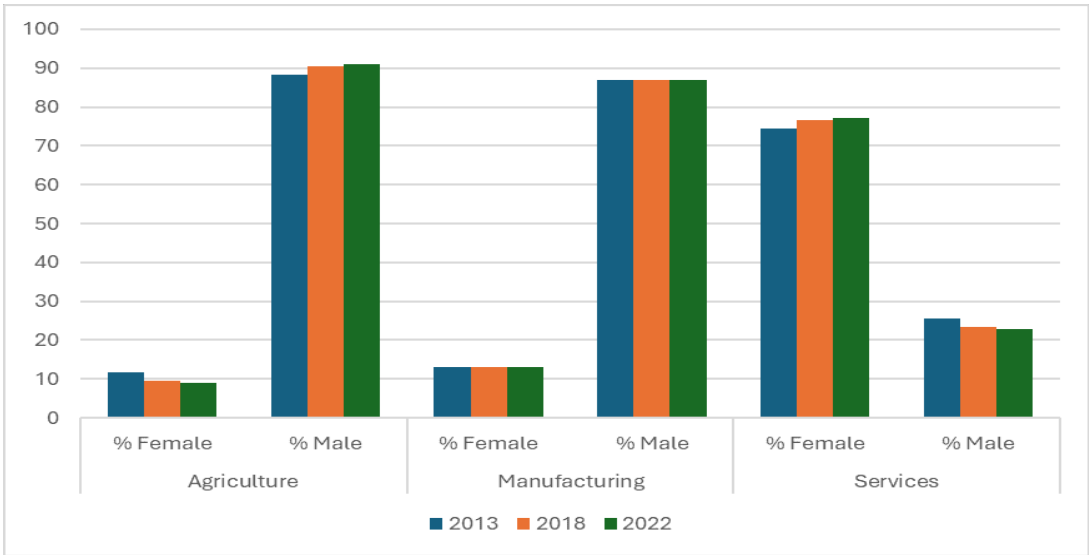
Source: Figure 0.5, page 8, in the report Women and Trade: The Role of Trade in Promoting Gender Equality, a joint report by the World Bank and the World Trade Organization (WTO).

[38] World Bank-WTO, Women and Trade: The Role of Trade in Promoting Gender Equality, 2020, https://www.wto.org/english/res_e/booksp_e/women_trade_pub2807_e.pdf In contrast, services accounted for 45 percent of total male employment in 2021.

4. Women's employment in services in the APEC region

In the Asia Pacific region, there are fewer women working than men in all APEC economies as discussed in Section I. The ratio of women's to men's labor force participation ranged from a high of 87 to a low of 57 for APEC economies over the period 2013-2023. In the services sector, however, the situation is reversed. Proportionally, more women work in services in the APEC region than in manufacturing and agriculture combined. Figure III.3 (based on ILOSTAT data) shows how the proportion of women employed in the services sector in APEC more than tripled that of men for the three years 2013, 2018 and 2022, and has been on the increase.

Figure III.3. Percentage of Women's Compared with Men's Employment in the Services, Manufacturing and Agricultural Sectors in APEC, 2013, 2018 and 2022



Source: ILO, Statistics on women - ILOSTAT – (modelled ILO estimate

5. Women's employment in higher skilled occupations in APEC

Ideally for this study and project, we would like to be able to show the share and evolution of women's employment in the high skilled service sectors of focus identified in Section II, namely computer and information services, financial services, and professional services. Unfortunately, for reasons of data limitations, it is not possible to do this for all APEC economies over the period in question, as employment data are not collected on a sectoral basis by the ILO and are likewise not available in any OECD or World Bank statistical publication. The ILO publishes employment data (broken down between women and men) by list of occupations rather than by sectoral categories. Selected occupations are shown in Table III.1.

Table III.1. List of Occupations Available in the ILO dataset

Occupation (Detailed): Total
Occupation (Detailed): 1. Managers
Occupation (Detailed): 2. Professionals
Occupation (Detailed): 3. Technicians and associate professionals
Occupation (Detailed): 4. Clerical support workers
Occupation (Detailed): 5. Service and sales workers
Occupation (Detailed): 7. Craft and related trades workers
Occupation (Detailed): 8. Plant and machine operators, and assemblers

Source: ILO, Statistics on women - ILOSTAT

The occupations that are the most relevant for this study are those that require higher skills and a large digital content to provide. Fortunately, it is possible to align the above list of occupations with the skills they require by using the International Standard Classification of Occupations (ISCO-08 Framework) used by the ILO.[39] Table III.2 below provides information on the ILO description of skills for each of these occupational categories.

Table III.2. Skills Required for the Occupations Listed in the ILO Dataset

Occupation	Skills Required
1. **Managers** (ISCO-08 Group 1)	Leadership, strategic planning, decision-making, project management, financial management, organizational skills, problem-solving, communication, and team coordination.
2. **Professionals** (ISCO-08 Group 2)	Analytical thinking, subject-matter expertise (e.g., legal, medical, IT, engineering), research skills, critical thinking, writing and reporting, creativity, innovation, and advanced technical skills related to their discipline.
3. **Technicians and Associate Professionals** (ISCO-08 Group 3)	Technical knowledge, practical problem-solving, data analysis, software use (for IT-related positions), field-specific technical expertise (e.g., engineering, healthcare), operational monitoring.
4. **Clerical Support Workers** (ISCO-08 Group 4)	Office administration, data entry, computer proficiency (e.g., spreadsheets, word processing), customer service, record-keeping, organizational skills, communication; attention to detail.
5. **Service and Sales Workers** (ISCO-08 Group 5)	Customer service, sales techniques, persuasion, interpersonal skills, problem-solving, hospitality management (if relevant), adaptability, cash handling, and product knowledge.

[39] ILO, International Standard Classification of Occupations, https://webapps.ilo.org/ilostat-files/ISCO/newdocs-08-2021/ISCO-08/ISCO-08%20EN%20Vol%201.pdf [39] Note that ILOSTAT data are available for all 21 APEC economies on employment by sex and the occupations shown in Table 1 and Table 2 for the period 2013 through 2023. Source: ILOSTAT Data Explorer
https://rshiny.ilo.org/dataexplorer12/?lang=en&id=EMP_2EMP_SEX_OCU_NB_A

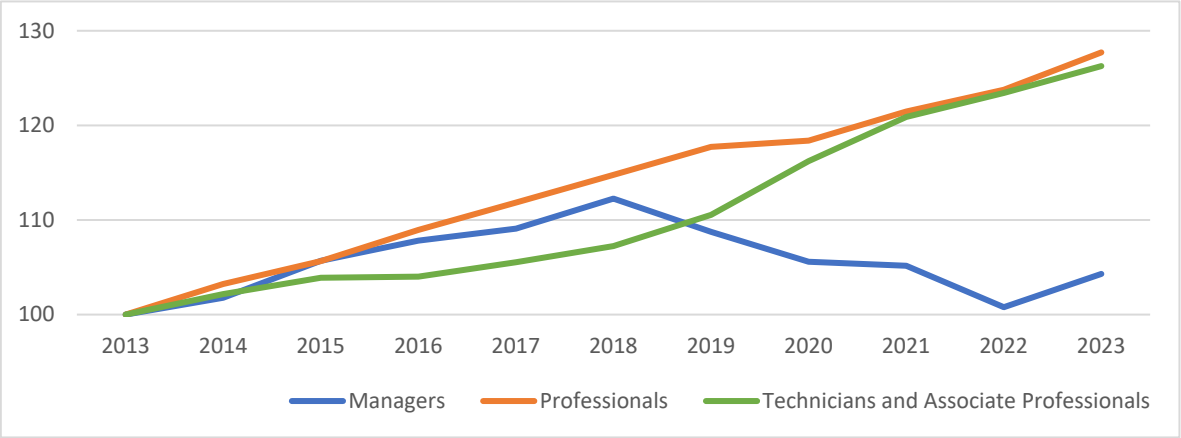
7. **Craft and Related Trades Workers** (ISCO-08 Group 7)	Manual dexterity, craftsmanship, trade-specific skills (e.g., construction, welding, carpentry), tool operation, blueprint reading, mechanical problem-solving, and safety compliance.
8. **Plant and Machine Operators and Assemblers** (ISCO-08 Group 8)	Machine operation, production process understanding, maintenance, troubleshooting, assembly techniques, mechanical knowledge, and safety awareness.

It is evident that the first three occupational categories require higher skills than the other occupations. Of relevance to digitized service activities, the 'professional' category requires workers to have subject-matter expertise, which includes IT skills, along with research, critical thinking, innovation, and advanced technical skills. "Technicians and associate professionals' are required to have several skills for IT-related positions, including data analysis and software use. 'Managers' are expected to have leadership, strategic planning, and decision-making skills, and to understand the use of IT in problem solving and communication. The IT skills required in the other occupational categories are much less advanced. The skills required for women to work in digitally delivered high skill services are discussed in detail in Section IV of this part of the study.

In the absence of three-dimensional data on women's employment in APEC in the digitally delivered service sectors of focus, we have opted to show what is available according to the ILO occupational categories above for the three occupations that require more highly skilled service workers, namely: Managers; Professionals; and Technicians and Associate Professionals (ISCO-08 Groups 1, 2 and 3). **These are the categories likely to encompass the high skill, digitally delivered services of focus in this study**. The figures that follow in this discussion have been developed using employment data for these three categories for the APEC economies.

Figure III.4 shows how women's employment in the three higher-skilled occupational categories above has evolved in the APEC region during the decade 2013-2023. It is interesting to note that only the category of 'professionals' shows a marked increase in number of women employed in APEC. The number of women 'technicians and associated professionals' employed increased slightly in the region, while the number of women managers employed actually declined.

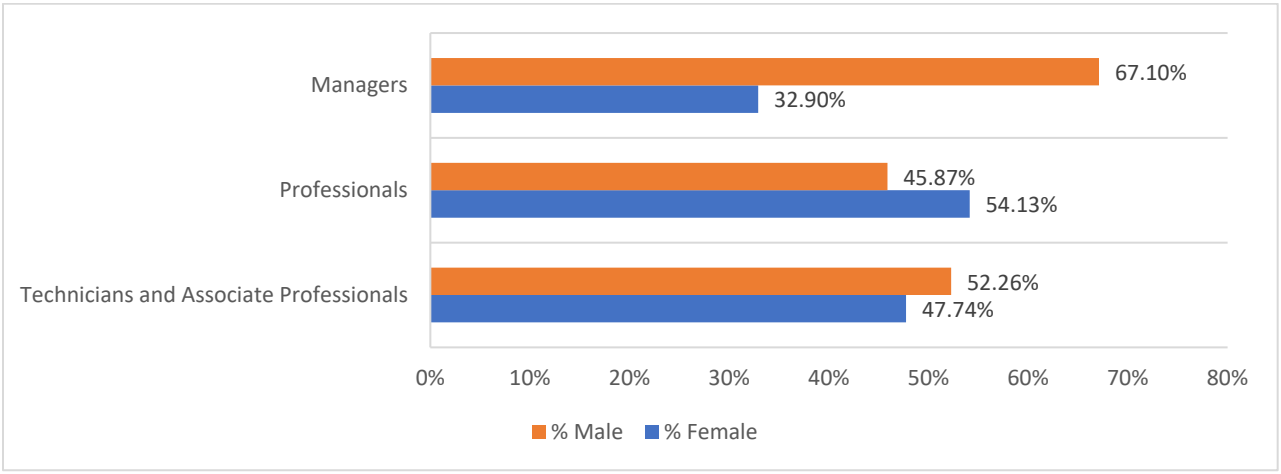
Figure III.4. Employment Trends in the Higher Skilled Occupations in APEC (2013 = index 100)



Source: Statistics on women - ILOSTAT.

Figure III.5 provides a snapshot of the share of female vs. male employment for the three higher skilled occupations in 2023 for the APEC region. While women professionals constituted more than half of the work force, women managers constituted less than one-third, a stark difference between the two.

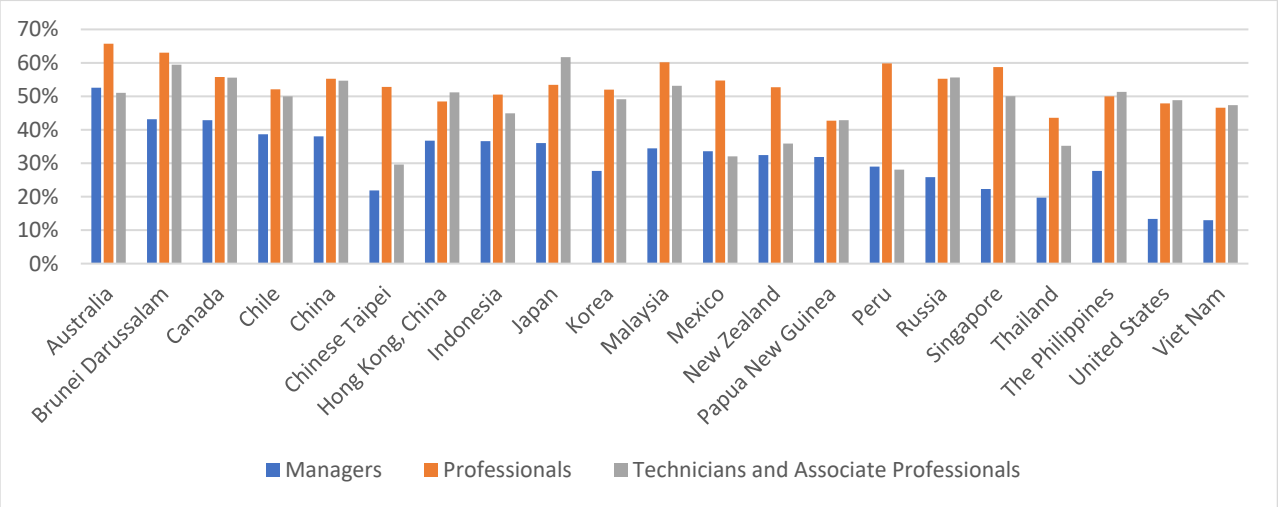
Figure III.5: Share of Women's vs. Men's Employment in the Higher Skilled Occupations in the APEC Region, 2023



Source: Statistics on women - ILOSTAT.

Figure III.6 provides more detail on the breakdown for women's employment in the three higher skilled occupations in each of the 21 APEC economies. While women constitute the highest percentage of professionals in more than half of the APEC region, in only two APEC economies are women managers slightly more prominent than technicians/associate professionals.

Figure III.6: Women's Employment in APEC in the Higher Skilled Occupations, (percentages, 2013 – 2023, modeled ILO estimates)



Source: ILO, Statistics on women - ILOSTAT

Note: The data for this chart represent the average number of women employed in the three high skill occupational categories in each APEC economy between 2013 and 2023.

6. Barriers to increasing women's employment in high skilled digitally delivered services in APEC

The earlier study carried out for the APEC Group on Services that examined *Knowledge Intensive Business Services (KIBS), Digital Services (DS) and Barriers Faced by Women in International Trade in Services* examined some of the reasons why women's participation in the more highly skilled occupational categories above has not increased at all or only shown a moderate increase (in the case of professionals) over the previous decade.[40] The services examined by this study overlap with two service sectors that are being examined in this study.[41] However, as previously noted, the approach and focus are different, as the KIBS study approached the issue from the perspective of women-owned services businesses and challenges they face related to their ability to export digital services as women-led MSMEs. But many of the same findings reached from the survey administered to firms in the APEC region can be inferred to apply to women's employment and advancement in digitally intensive sectors, whether it be in home markets or in trade with other APEC economies.

[40] Knowledge Intensive Business Services (KIBS), Digital Services (DS) and Barriers Faced by Women in International Trade in Services, GOS 02 2022, finalized report circulated in January 2025.

[41] The services included in knowledge-intensive business services (KIBS) study cited above do not appear to be clearly defined in the study, which mentions that the KIBS sectors include professional, scientific, and technological services, content development, telecommunications, information and communications technologies, along with other knowledge-intensive business services (page 15). These categories encompass two of the three digitally intensive service sectors identified as the focus of this paper, namely computer and information services, financial services, and professional services, they do not include financial services and do include other services that are broader than these three sectors.

The KIBS study conducted a survey among firms and associations or institutions representing business in APEC containing questions to identify what barriers are considered by the private sector to hold back the ability of women-led firms to participate in digital services trade. The relevant responses are summarized below as falling into four areas, under the assumption that these barriers also stifle women's employment in higher skilled services occupations in general.

a) Skills barriers (access to IT and STEM education and training)

The firms surveyed reported significant challenge in finding technologically trained workers to meet their needs. The survey findings show that factors such as technological skills and digital marketing capabilities are frequently rated as very important. For instance, 47 percent of respondents rate technological skills as very important, and 48 percent consider digital marketing capabilities as very important.[42] This mismatch between women who are available to work in digitally intensive sectors and the demand for these workers underscores the finding in this study that women are less educated in the STEM and related fields than men (as shown in Section IV). To the extent that women lack education and training in these technological and digital skills, this will act as a barrier to their employment in these sectors.

b) Cultural and attitude barriers

The firms surveyed also reported cultural and social factors that contribute to the underrepresentation of women in digitally intensive services. Such cultural and social barriers that prevent gender equality in the workplace preclude greater employment and advancement of women in DDS. A significant percentage of respondents reported that legal frameworks promoting gender equality in business are still insufficient or inadequately implemented in APEC economies.

c) Finance barriers (lack of women's access to capital)

Respondents to the survey also cited unequal access to financial resources as a primary concern affecting women's ability to be engaged in high skill digital services, both through assisting with access to educational and training opportunities and to help women entrepreneurs set up firms in the digitally intensive, high skill services sectors.

d) Regulatory barriers affecting trade in digitally delivered services

Barriers that block the expansion of international trade in high skilled digitally delivered services also serve to hold back women's ability to pursue work in these sectors. The KIBS study highlighted the main regulatory barriers that affect trade in digitally delivered services, which are shown in Figure III.7. These regulations, although often legitimate and

[42] Ibid, page 19. The survey responses provide a view of the main challenges women face and of the factors that need to be addressed to expand their opportunities to engage in exporting digital services.

necessary (such as online consumer protection, privacy, and data protection, among others) can negatively impact cross-border trade in DDS in APEC, depending upon how they are written and implemented.

Figure III.7. Regulatory Barriers to Digital Trade in APEC Economies

Source: Digital Trade Restrictiveness Index, DTRI. European Centre for International Political Economy. https://ecipe.org/wp-content/uploads/2018/05/DTRI_FINAL.pdf

The content of the 2023 edition of the APEC PSU Women and the Economy Dashboard Report supports and confirms several of the results of the survey carried out for the KIBS study.[43] The Dashboard Report provides the following insights on four key areas.

a) On the benefits of upgraded digital skills for women's employment

The PSU Dashboard report underscores the important of upgraded digital skills, particularly STEM education and skills, to help bridge the digital gender divide and open up more opportunities for women to participate in *"high-growth and high-paying sectors such as information technology, artificial intelligence and robotics, among others"*.[44] These areas are critical ones for employment in digitally delivered services sectors. Women still represent a minority in the areas of STEM and research and innovation in many APEC economies, as is discussed in Section VI of this part of the study.

[43] *The APEC Women and the Economy Dashboard*, Report by the APEC Policy Support Unit, Executive Summary, August 2023, op.cit.

[44] Ibid, page xiii.

b) On protection against sexual harassment in the workforce

While the PSU Dashboard report applauded the fact that the majority of APEC economies have established laws against domestic violence and sexual harassment together with dedicated courts to respond to such cases. However, it advocated for all 21 APEC economies to put in place laws that protect women from all forms of violence and in all settings: private, public and online. This protection would also improve women's ability to enter the workforce at all levels.

c) On women's access to digital finance

The PSU Dashboard report emphasized how access to digital platforms, mobile money and financial services could open a whole new array of opportunities for women to earn more income with better-paying digital work, entrepreneurship or financial investments. The PPWE added an indicator on women's access to digital finance to strengthen the Dashboard in its 2023 Report. However, it also underlined a crucial policy gap in this area, pointing out that most APEC economies do not have laws in place mandating non-discrimination in credit access based on sex.

d) On the importance of innovation and technology in advancing women's empowerment

While the PSU Dashboard does not focus on women's participation in trade *per se* as part of its 90 indicators, the 2023 Report does highlight the importance of innovation and technology for women's empowerment. These are areas that need open markets with unencumbered cross-border data flows to the greatest extent possible so that ideas and skills can flourish in the most productive way possible in the APEC region.

Section IV. Skills and Education for Enhancing Women's Participation in Digitally Delivered Services

KEY TAKEAWAYS

- **Skills Mismatch and Gender Gaps** – Women often lack the digital, financial, and managerial skills required for high-paying DDS jobs due to unequal access to training.
- **STEM Education and Employment Deficit** – Less than one-third of STEM graduates in APEC are women, impacting their access to tech-driven and innovation-led careers.
- **Digital Divide** – Women's lower access to digital tools and infrastructure limits their participation in education and skill acquisition.
- **Growing Importance of Digital Skills** – By 2030, 39 percent of core job skills will shift towards AI, big data, and digital literacy, areas where women are currently underrepresented.

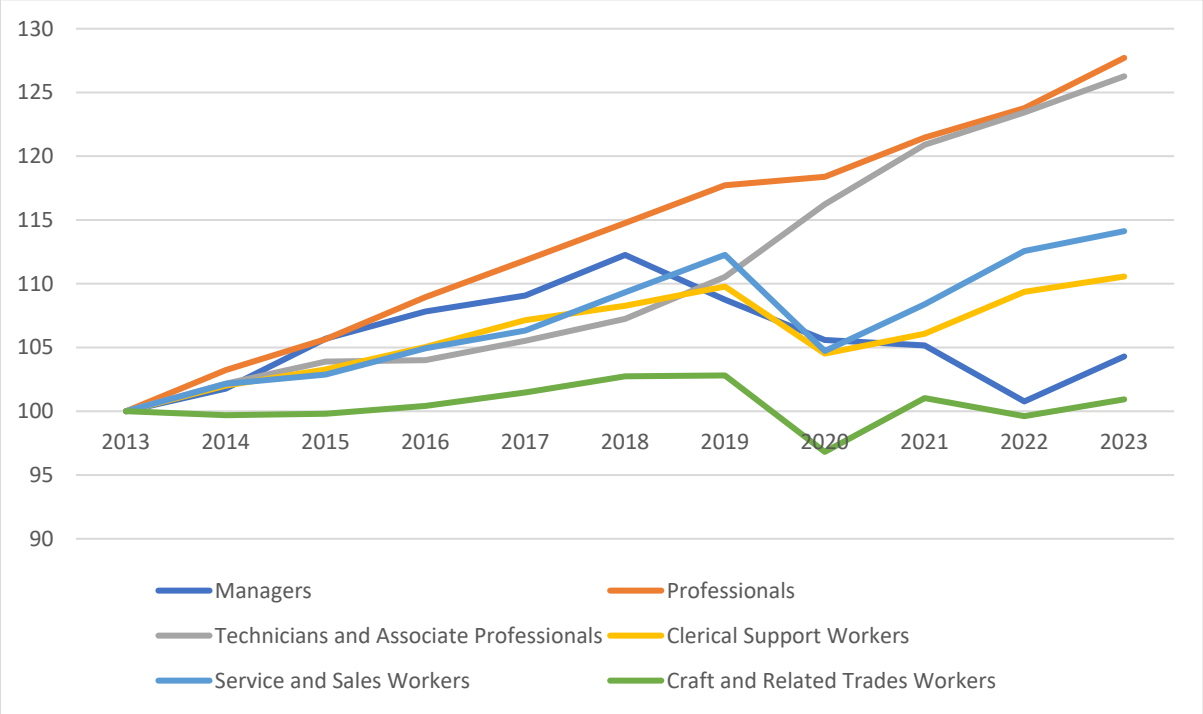
1. Introduction

Digitally delivered services (DDS) encompass services that are supplied from one economy to another via digital means, without the supplier and consumer being in the same location (so-called, mode 1 of service supply). As demonstrated in Section II, these services have expanded significantly with technological advancements in the last two decades. Trade in the three digitally intensive sectors which are the focus of this study (financial services, professional services, and telecommunication/ICT services) have on average grown faster than the rest of trade in most APEC economies as well as globally (cf. Section II, Part I).

This section explores the skills required to participate (i.e. be employed) in these sectors and the gender disparities in possessing / acquiring these skills. Furthermore, it examines how education and training can enhance women's access to such skills and thus potentially boost their participation, quality of employment, and career progression in these services.

The section builds upon the statistics and material presented in the previous sections, especially in Section II on the growth of DDS' trade and in Section III on the employment of women in DDS based on the occupational categories that are linked to the DDS of focus. Section III in particular reports on gender disparity in employment in the three occupations most closely linked to digitally delivered services. Figure IV.1 below shows that employment trends in other, less skilled and less digitally intensive occupations, are lagging behind those of professionals and technicians/ associate professionals in APEC. Nevertheless, women still fall behind men with respect to managerial jobs. Other relevant studies also point to the same conclusions: while women's employment in services in general has increased over time, this growth has been concentrated in occupations which are associated with lower skills and lower responsibility/seniority (and thus usually lesser income).

Figure IV.1. Employment Trends in Higher-skill and Other Selected Occupations in APEC
(2013=100)



Source: Source: Statistics on women - ILOSTAT.

If APEC economies are to design policies and measures to enhance women's employment in the DDS of focus, better insights are needed on how women can be equipped with skills required for work in these digitally intensive sectors. It is also important to understand what barriers impede women from moving upward once they land a job. While competency and capability are related to knowledge and the skills associated with a particular job/occupation, career advancement is often related more to social and cultural norms.

2. Skills for today's and future jobs

Skills are the capabilities needed to complete a task and therefore execute a job. They are different from 'knowledge' which refers to the body of facts, principles, and theories related to a field of work acquired through education or experience. Skills are the practical abilities to apply knowledge effectively in real-world scenarios. They are developed through practice and involve the proficient use of tools, techniques, and methods. With respect to the financial sector, for

example, knowledge would be the understanding of financial regulation while a skill would be the ability to analyse financial statements.[45]

While knowledge provides the foundation, skills enable the practical application of that knowledge. The two are interdependent; possessing knowledge without corresponding skills can limit effectiveness, just as having skills without a solid knowledge base can lead to errors.

Existing literature typically measures the skills of an economy's workforce through years of schooling. This does not, however, accurately capture the level of digital skills in the workforce as digital skills are not always adequately taught in schools and the full acquisition of such skills typically happens in formal work or training settings. Therefore, it is not straightforward to understand what type of educational path women should follow to increase their level of skills for future of work in services relying on digital technologies (more on education later in this section).

The recent World Economic Forum 2025 *Future of Jobs Report*[46] usefully informs our thinking about the state of skills in the present workforce and the impact of technological changes on the evolution of skills for the future. The Report provides an in-depth analysis of the global labor market, highlighting key trends expected to shape employment by 2030. Drawing insights from over 1,000 leading global employers across 22 industry clusters and 55 economies (14 of which are from APEC), the report identifies several macro trends influencing job creation and displacement. These include technological advancements, green transition, demographic shifts, geoeconomic fragmentation and economic uncertainty. The estimated impact of these trends will result in a net increase of 78 million jobs by 2030, with 170 million new roles created and 92 million displaced.

The skills necessary to either keep a current job or to get a new one in 2030 are shown in Figure 4.2 below which illustrates the anticipated shifts in skill requirements by 2030. Employers expect that 39 percent of core skills will change, especially due to the growing importance of technological proficiency, particularly in AI and big data. Additionally, human-centric skills such as creative thinking, resilience, flexibility, and agility will be increasingly valued alongside and to accompany the technological skills. This underscores the necessity for continuous learning and upskilling to adapt to the evolving job market. These issues are discussed below.

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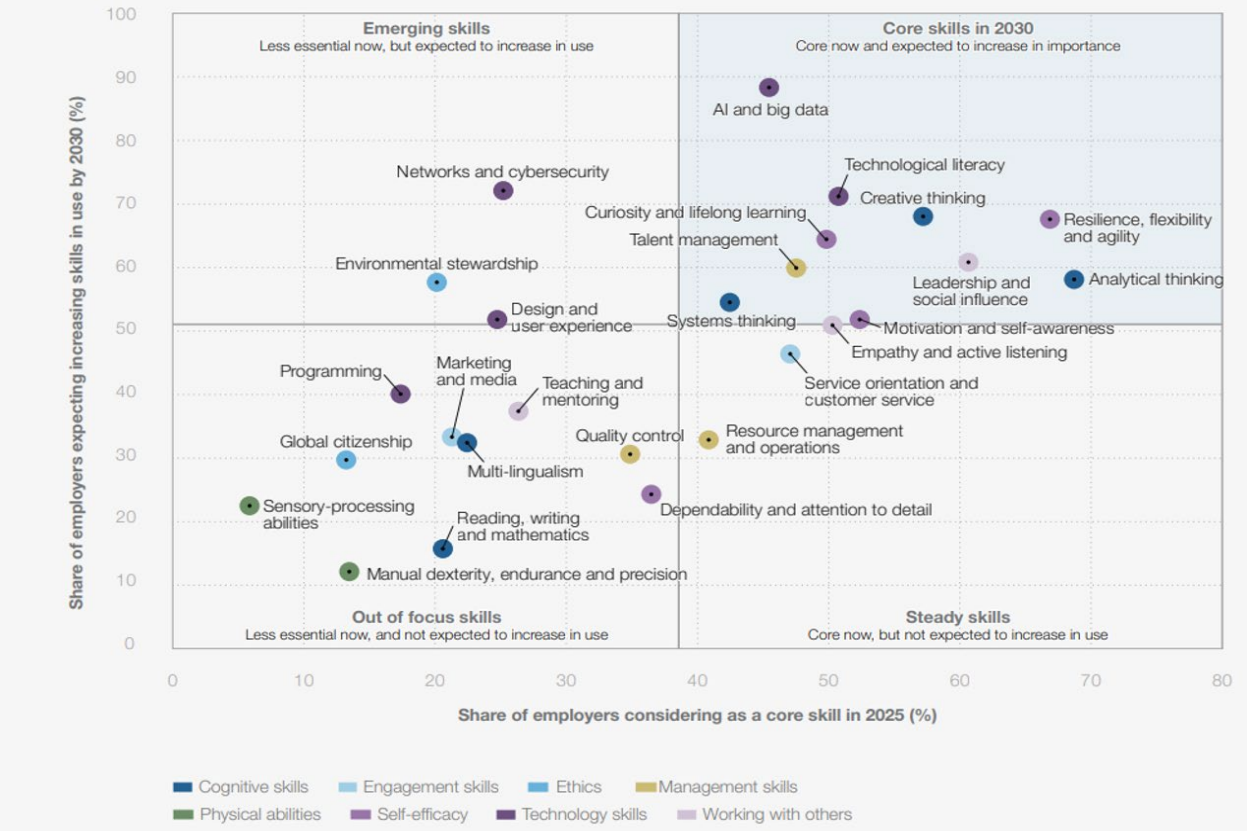
[45] In addition to knowledge and skills, to get a job one also needs to display a positive attitude and possess necessary abilities. Attitudes are learned behaviors, emotional intelligence traits and beliefs that individuals exhibit that influence their approach to ideas, persons and situations. Abilities are possession of the physical, psychomotor, cognitive and sensory means to perform a job. See more in WEF 2025 Future of Jobs Report.

[46] World Economic Forum (2025) Future of Jobs 2025 Report https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf?_gl=1*iq8rq8*_up*MQ..*_gs*MQ..&gclid=CjwKCAiA2cu9BhBhEiwAft6IxEO4rZyOG6x-YaL5iUbeIopUeY7JUtmHNX2HYCUMBGUE3XkEZSqlfRoCV0cQAvD_BwE

Figure IV.2 Core Skills Required for Employment in 2030

Share of employers considering skill to be a core skill in 2025 and share of employers expecting skill to increase in importance by 2030



Source: WEF 2025 Future of Jobs Report, Figure 3.6.

The skills currently identified as core and expected to grow in importance by 2030 show significant—though not complete—overlap with those associated with high-skill occupations in digitally delivered services (DDS).[47] Many of the key competencies listed in the ILO ISCO-08 classification, such as technological literacy, subject matter expertise, leadership, strategic planning, resource management, and creativity, align with those highlighted in the WEF Future of Jobs 2025 report. However, several critical skills emphasized in the WEF report—such as resilience, agility, flexibility, empathy, social influence, networking and environmental stewardship—are notably absent from the ILO classification. This omission likely reflects the fact

[47] These occupations were set out in the Section III on Employment and drawn from the ILO ISCO-08 list of occupations, as follows: Group 1: Managers required skills: leadership, business strategy, financial acumen, digital transformation management; Group 2: Professionals required skills: advanced ICT skills, financial analysis, programming, cybersecurity, legal expertise; Group 3: Technicians and associate professionals: IT support, data analysis, digital marketing, compliance and customer service.

that ILO ISCO-08 was developed in 2008, before the widespread acceleration of automation and AI integration in the workforce.

The skills missing from the ILO framework are precisely those that enhance adaptability and human-centered capabilities, which are increasingly essential to be combined with technological literacy, STEM skills, or big data for navigating the evolving nature of work in an AI-driven economy. These are also the skills that are part of so-called emotional intelligence. Women are often perceived as having higher emotional intelligence than men. However, it turns out while women and men are about equal in overall emotional intelligence, they possess different strengths or competencies that are considered gender specific. In general, women tend to score higher than men in areas of empathy, interpersonal relationships and social responsibility. Men tend to score higher in areas of assertiveness, stress tolerance and self-regard (or confidence). Recent work on emotional intelligence suggests these differences may play a role in the leadership gender gap.[48] These differences often advantage men and disadvantage women at work which is also valid when looking at DDS.

Findings of the World Bank's 2021 report *"At Your Service- The Promise of Service-led Development"*[49] provide additional insights. The report categorizes services into different groups mostly based on underlying skills, one of which is Global Innovator Services—a high-skill, knowledge-intensive set of industries that includes **IT services, financial services, professional services (legal, consulting, engineering, R&D, etc.), and creative industries**. These industries require a workforce that also possesses strong digital, cognitive, and socio-emotional skills, particularly as automation and digitalization transform job roles.

BOX IV.1 Skills required for women to participate in digitally intensive, high skill service sectors

Group of skills	Related work /job with sample of skills needed
1. Advanced digital and technical skills	Programming & software development (especially for IT and digital finance roles) Data analytics & AI literacy (ability to interpret and work with AI-driven tools) Cybersecurity awareness (particularly relevant in financial and IT services) Cloud computing & digital infrastructure management

[48] See for example UNSSC (2021) "Emotional Intelligence and Leadership Development: A Gender perspective", Blog 21 February, https://www.unssc.org/news-and-insights/blog/emotional-intelligence-and-leadership-development-gender-perspective?utm

[49] World Bank (2021) *At Your Service- The Promise of Service-led development*, https://openknowledge.worldbank.org/entities/publication/b5f153be-e867-5746-ad02-e12a0774e2d1

	Tech-enabled problem-solving (applying technology to enhance service delivery)
2. High-level cognitive skills	Complex problem-solving & critical thinking (necessary for consulting, legal, and R&D work) Strategic planning & decision-making (especially for leadership roles in professional services) Numeracy & financial literacy (critical for financial services and business consulting) Research and innovation management (vital for R&D, engineering, and high-value knowledge services)
3. Socio-emotional and leadership skills	Emotional intelligence & empathy (important for client-facing roles, team collaboration) Negotiation and persuasion (especially for women in leadership or consulting) Social influence and networking (crucial for career advancement in male-dominated industries) Resilience and adaptability (to navigate technological disruptions and career transitions) Cross-cultural communication and teamwork (important for global service firms)
4. Entrepreneurship and business development skills	Digital marketing and branding (important for independent consultants, creative industries) Project management and agile work methods (widely used in IT, consulting, and finance) Regulatory and compliance knowledge (particularly in law, finance, and consulting)
Additionally, women would need to have industry-specific skills and subject-matter expertise.	

Source: Adapted from World Bank (2021) At Your Service- The Promise of Service-led Development

3. Men and women are not equally equipped with skills for DDS

Women face significant barriers in acquiring the necessary skills that allow them to participate in the dynamic digitally delivered services sectors of focus. Research shows that:

Women are underrepresented in ICT-intensive roles that are often indispensable for participation in high-skill digitally delivered services, particularly in programming, cybersecurity, and fintech.

Women face barriers to acquiring such skills for various reasons, including limited access to STEM education or digital training (formal or informal training; on-the-job or otherwise).[50]

The OECD 2023 *Survey of Adult Skills*[51] highlights that women score lower in digital problem-solving and numeracy skills, which are essential for many financial and professional services.

ILO 2023 research[52] reports gender gaps in AI and data-related professions, with men occupying the majority of high-paying digital jobs.

The OECD's 2023 *Survey of Adult Skills* offers a comprehensive assessment of adults' proficiency in literacy, numeracy, and adaptive problem-solving across 31 economies (seven of which are from APEC). The OECD survey provides a detailed examination of gender disparities in skills, education, and labor market outcomes.

The report reveals a mixed global picture of proficiency in key information-processing skills (referring to literacy, numeracy and adaptive problem-solving skills all of which have an essential role in achieving positive economic and social outcomes). While some economies have made progress, others show stagnation or decline (with Japan performing well across all three skill domains). Eleven APEC economies (including Chile and Republic of Korea) consistently perform below the OECD average in all skill domains. Literacy proficiency has declined more strongly among men than women, resulting in gender gaps narrowing in some economies and women displaying higher literacy skills on average than men at present. On the other hand, men continue to outperform women in numeracy, as well as in adaptive problem solving (albeit by much less).[53]

These persistent skill gaps translate into labor market and wage disparities. Although skills proficiency is a key determinant of wages, the OECD survey hints that “on average, years of education explain a larger share of variation in wages for women than for men, whereas numeracy and literacy proficiency accounts for a greater share of variation for men than for women. This is consistent with research that finds that women’s wages are more closely linked to formal education, as they are often concentrated in sectors where qualifications are crucial for advancement (notably the public sector), and they may face greater barriers to being rewarded for skills acquisition alone.” (pp.159-160).[54] This distinction highlights the structural and social factors influencing women's economic opportunities and remuneration.

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[50] World Bank (2021), Op.cit.

[51] OECD (2023) Do Adults Have the Skills They Need to Thrive in a Changing World?, Survey of Adult Skills, https://www.oecd.org/en/publications/do-adults-have-the-skills-they-need-to-thrive-in-a-changing-world_b263dc5d-en.html

[52] ILO (2023) Generative AI and Jobs: A global analysis of potential effects on job quantity and quality, ILO Working Paper 96, https://www.ilo.org/publications/generative-ai-and-jobs-global-analysis-potential-effects-job-quantity-and

[53] For more details check OECD (2023), Op. cit.

[54] However, these gender differences are relatively small across economies. “The OECD averages for men and women differ by 2 percentage points in favor of men for skills proficiency and 4 percentage points in favor of women for years of education. Differences are much more pronounced in e.g. Canada where the gender gap in the share of variation explained by years of education is greater than 8 percentage points.“ Ibid, page 160.

3.1. Contributing factors to gender skill disparities

The disparities highlighted above can be attributed to several interrelated factors: educational achievement and specialization, access to technology, access to training, workplace dynamics, social norms, personal attitudes / confidence, and so on. More detail on Other contributing factors to gender skill disparities are discussed below. Below we only provide more comments on access to education, and technology but that does not render other factors irrelevant.

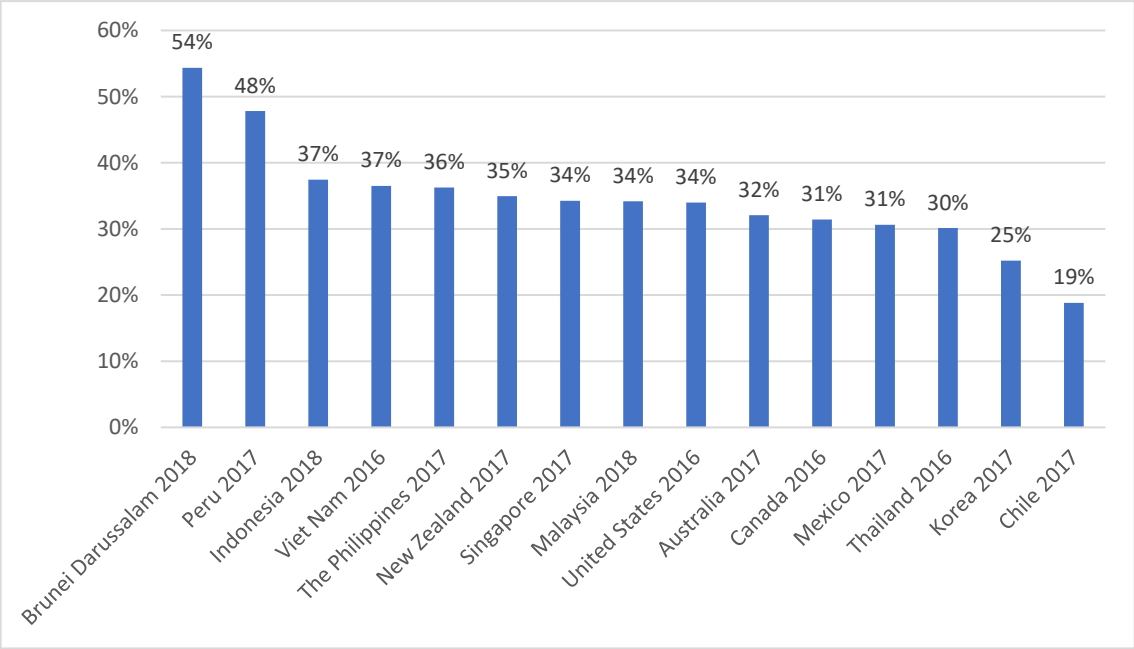
- Educational pathways

The underrepresentation of women in STEM fields remains a critical concern, with significant implications for gender wage disparities and economic participation. On average, less than one-third of STEM graduates in APEC economies are women, though this varies widely; for example, in Brunei Darussalam, women account for over 50 percent of STEM graduates (Figure IV.3), whereas in some economies, including Japan, the share remains below 20 percent. In contrast, women are heavily overrepresented in non-STEM fields, making up about 65 percent of graduates. This trend suggests that while access to higher education has improved for women, their participation in STEM disciplines—key drivers of technological innovation and economic growth—continues to lag.

Societal norms and stereotypes play a crucial role in shaping these educational disparities. From an early age, gendered expectations and confidence gaps in mathematics contribute to fewer women pursuing STEM education. Although the relative share of women STEM graduates in APEC economies is above 30 percent, there is significant attrition when it comes to actual employment in STEM-related jobs. As shown in Figure IV.4, a relatively low proportion of female STEM graduates transition into STEM occupations and into high-paying sectors such as IT and professional services. This "leakage" in the education-to-employment pipeline further exacerbates the persistent gender wage gap.

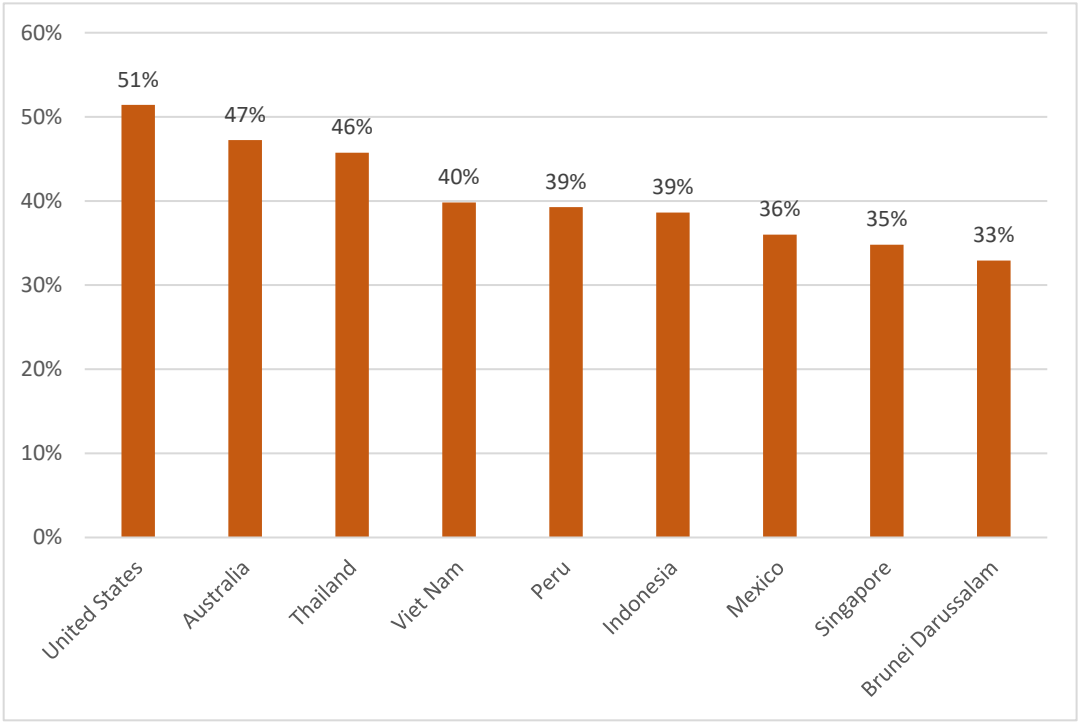
Women’s underrepresentation in high-paying STEM occupations (see also Figure IV.5 below) is not merely a reflection of individual career choices but is shaped by systemic barriers, including workplace biases and limited access to leadership roles (as discussed in Section III). Addressing these disparities requires targeted interventions to challenge societal norms, support confidence-building in STEM skills from an early age, and create inclusive policies that ensure women's full participation in the digital and technological workforce.

Figure IV.3. Share of Women Graduates in STEM Programmes, Tertiary (%) in APEC economies (2016-2019)



Source: ILOSTAT, Figure sourced from Workers in STEM occupations | Download Dataset

Figure IV.4 Share of Women Employment in STEM Occupations in APEC Economies, 2023



Source: ILOSTAT, Figure sourced from Workers in STEM occupations | Download Dataset

Access to Technology

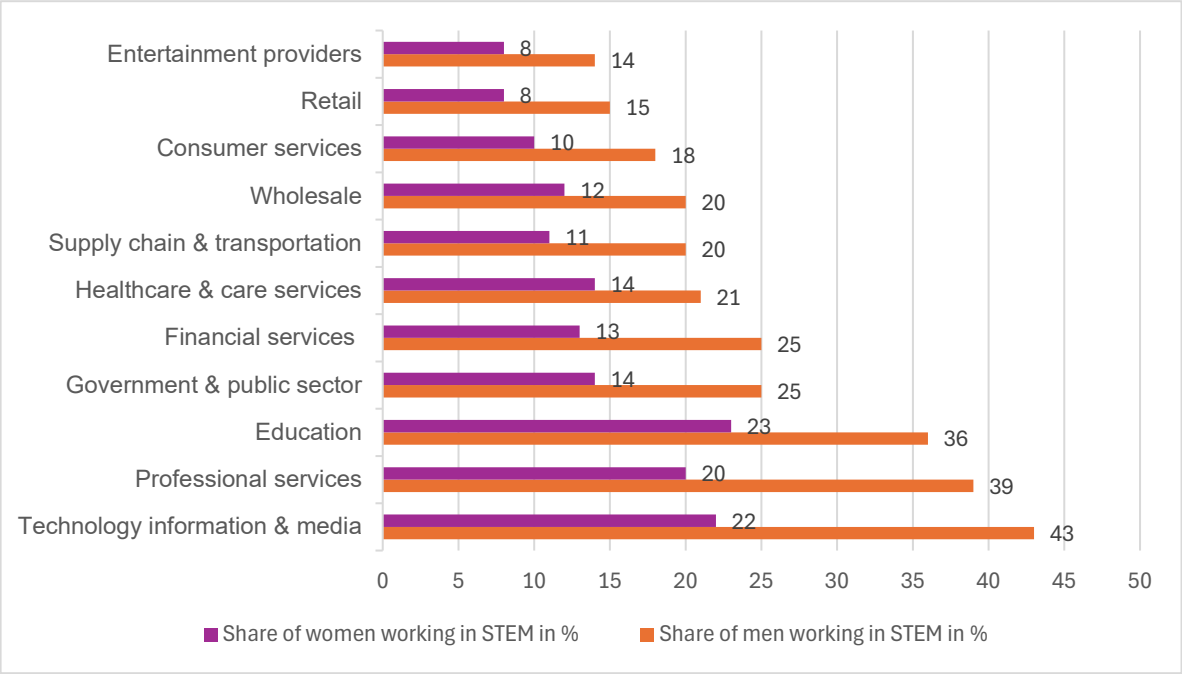
In many APEC economies, women face substantial barriers to accessing digital devices and the internet, which are essential for participation in high-skill occupations.[55] Data from 2020 indicates that approximately 55 percent of men were internet users compared to 48 percent of women globally. Within the APEC region, women use the internet to a lesser extent than men in almost every economy in APEC (exceptions in 2020 are China, the United States, Chinese Taipei, and The Philippines) with the widest gaps observed in Peru, Japan, and Viet Nam.[56] This digital divide is further exacerbated by disparities in mobile phone ownership; since 2017, women have been approximately 10 percent less likely than men to own a mobile phone, limiting their access to mobile internet services. These technological access gaps hinder women's ability to acquire digital skills, engage in online professional development, and compete for high-skill positions that increasingly rely on technological proficiency.

The factors above that contribute to gender disparities have resulted in a very skewed and disproportionate share of women working in the most dynamic high skill digitally delivered service sectors at present, as shown in Figure 4.5 which highlights a significant gender disparity between men and women working in STEM-related fields across various occupations. The DDS sectors which are the focus of this study perform rather badly with two associated with the largest gap: Technology, Information & Media (43 percent men vs. 22 percent women); and Professional Services (39 percent vs.20 percent). The representation of both men and women in STEM is lower overall in financial services, but men still hold a much larger share (25 percent vs. 13 percent). These disparities suggest that structural barriers, societal expectations, and unequal access to STEM education and career opportunities discussed above continue to limit women's participation in high skill, high-paying STEM fields. Addressing these gaps will require targeted policies that promote career advancement opportunities for women in STEM professions.

[55] Access to AI as one of the crucial digital 4.0 technologies is discussed in the next Section of this paper.

[56] See more details in https://www.apec.org/publications/2022/09/the-untapped-economic-potential-of-including-women-in-the-digital-economy-in-the-apec-region#:~:text=This%20study%20aimed%20to%20perform%20an%20economic%20estimate,of%20access%20to%20the%20internet%20and%20STEM%20careers .

Figure IV.5 Shares of Women and Men in STEM Occupations, by Industry



Source: Extracted and redrawn from Figure 2.16 in World Economic Forum, Global Gender Gap Report 2024, p. 51

Acquiring digital education for women to participate in DDS

In the context of APEC economies, acquiring knowledge and skills is essential for fostering economic growth and competitiveness. Here are the key channels:

- **Formal education**: Academic programs offer structured learning, providing foundational knowledge and, in some cases, practical skills through labs and projects. There should be more encouragement to pursue degrees in computer science, data analytics, and digital finance in all APEC economies and particularly in those which are relatively lacking in these STEM and ICT competencies.

- **Vocational training**: Focuses on hands-on experience, allowing individuals to develop specific skills pertinent to their field. Programs targeting cybersecurity, fintech, and cloud computing.
- **On-the-Job training (informal education)**: Real-world experience where individuals learn and refine skills under actual working conditions. The World Bank emphasizes that digital channels now open more possibilities, improving the matching of job seekers' skills and experience with job vacancies, thereby enhancing on-the-job learning opportunities.

- **Continuous professional development**: Engagement in workshops, seminars, and online courses enables professionals to stay abreast of industry trends and enhance their

competencies. Continuous professional development is vital for career advancement in high-skill digitally intensive occupations. However, women in APEC economies often encounter obstacles in accessing such training due to caregiving and other unpaid responsibilities and the limited availability of flexible training programs.

- **Leadership training programs:** Equipping leaders and leader-to-be with the skills needed to navigate and drive digital transformation within their organizations. These courses cover topics like digital disruption, AI applications in business, and managing digital economies, preparing women for executive roles in the digital age.

APEC economies are prioritizing the development of soft skills and business acumen, including leadership, digital communication, and negotiation training. Furthermore, the APEC Women in STEM initiative aims to address gaps and promote best practices in the region, focusing on the advancement of women in science, technology, engineering, and mathematics fields. Active engagement and deliberate practice are crucial in transitioning from knowledge acquisition to skill proficiency.[57]

The APEC Gender Equality Structural Reform Voluntary Principles and Recommendations emphasize the need to support women's education, training, and skills development, particularly in STEM fields and emerging industries. Despite these initiatives, the 2023 APEC Women and the Economy Dashboard reports that women's participation in STEM, research, and R&D remains below 35 percent in many APEC economies. This underrepresentation is partly attributed to the lack of accessible training opportunities that accommodate women's schedules and responsibilities. Moreover, the COVID-19 pandemic has intensified these challenges, as increased caretaking duties have further limited women's capacity to engage in professional development. Addressing these issues requires implementing policies that promote flexible, inclusive training programs and support systems to balance professional and personal responsibilities.

4.1. Capacity Building Network Roadmap (2022-2025)[58]

APEC has in place the *Capacity Building Network (CBN) Roadmap 2022-2025* which was put in place to address the impact of the COVID-19 pandemic on APEC economies. However, it also refers to the impacts of the Fourth Industrial Revolution (4IR) which makes it relevant for the purposes of this study. The *Roadmap* emphasizes the need for capacity building to adapt to technological transformations, digitization, and new work practices. The mission of the *CBN Roadmap* is to facilitate knowledge sharing, skills development, human resource management,

[57] Key models of success: Finland and Estonia: Strong emphasis on digital skills for women through early STEM education, and Singapore and Canada: Targeted programs to increase women's representation in fintech and AI.

[58] See https://www.apec.org/docs/default-source/groups/hrd/2024/capacitybuildingnetwork_cbn_roadmap2022-2025.pdf

and vocational training to support post-pandemic recovery and build a resilient and inclusive Asia-Pacific community.

The *Roadmap* outlines four strategic directions:

- Foster an Environment for Capacity Building:
- Promote sharing of best practices and benchmarking activities.
- Conduct regional studies and research on digitalization and skills development.
- Improve labor market information systems.

Strengthen Digital Capacity:

- Advocate the use of 4IR and emerging technologies in capacity-building programs.
- Promote digitalization of skills assessment and certification.
- Share best practices for effective online training, particularly for underserved populations, including women.

Reskill and Upskill Workers:

- Integrate 21st-century skills and digital skills in training curricula.
- Improve digital competencies of trainers.
- Facilitate lifelong vocational skills training.
- Foster green skills development.

Restyle Capacity Building Initiatives:

- Support flexible and responsive TVET systems, including micro-credentialing.
- Improve access to vocational training programs for vulnerable populations, including women.
- Pursue greater industry involvement and alignment in capacity-building initiatives.
- Promote mutual recognition of skills among economies.

The *Roadmap* highlights the importance of skilling and training for women. First, it emphasizes the importance of strengthening digital skills through formal and informal means, particularly for women. This includes advocating for the use of emerging technologies and sharing best practices for online training. Secondly, it highlights the need to create gender-sensitive training programs and improve access to vocational training for women, especially in digital and green skills. Lastly, it encourages women to take executive courses in digital business transformation and participate in regional policy dialogues to enhance cooperation and collaboration among stakeholders.

Section V. Issues of Concern Around Women's Participation in Digitally Delivered Services

1. The Distinction Between Formality and Informality in Services: Implications for Women in APEC Economies

KEY TAKEAWAYS

- **Informality is Prevalent in Low-Skill Service Roles.** While services account for over 60 percent of GDP and employment in many APEC economies, informality is widespread in low-skill roles like caregiving, retail, and hospitality. In contrast, high skill digitally delivered services have lower levels of informality, reflecting different barriers and opportunities.
- **Women Face Unique Challenges in Informal Service Work.** Women in informal service roles earn lower wages, face job insecurity, and lack social protections, limiting their economic mobility. However, women with secondary or tertiary education are less exposed to informality than similarly educated men, particularly in middle-income economies.
- **Barriers to Transitioning into Formal, High-Skill Services Persist.** Limited access to digital and professional skills, gender disparities in STEM education, and caregiving responsibilities restrict women from advancing into formal, high-skill service roles. Addressing these barriers is essential for women to move from informal to formal employment.
- **Digital Platforms Create Both Opportunities and Risks.** Online freelancing and digital nomadism provide new work opportunities, but many roles lack formal contracts, labour protections, and income stability. Women are more likely to be concentrated in lower-paid digital roles, while men dominate higher-paying fields like software development and digital marketing.

The distinction between formality and informality is crucial across all economic sectors, including services.[59] However, in services because of the nature of service work itself, informality often revolves around employment status, regulatory compliance, pay, and access to labor protections rather than the production and sale of physical goods. The digital economy has further blurred the boundaries, making informality more complex and less visible. In APEC, where services account for a significant portion of GDP and employment, understanding how this distinction impacts women is essential. This subsection explores the prevalence of informality in services, its

[59] Informality and formality here are inked to informal and formal economic concepts. The informal economy refers to all economic activities, excluding illicit activities, by workers and economic units that are, in law or in practice, not covered or insufficiently covered by formal arrangements. ILO (2023) *Women and men in the informal economy: A statistical update* available at https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40ed_protect/%40protrav/%40travail/documents/publication/wcms_869188.pdf

gendered impacts, barriers to transitioning into formal, high-skill services, the role of digitalization and digital nomadism, and policy implications, with a focus on APEC economies.

1.1. Prevalence of Informality in Services

Services contribute over 60 percent of GDP and employment in many APEC economies, yet a significant portion of this workforce operates informally. Informality is prevalent in activities such as domestic work, caregiving, retail, hospitality, and personal services. Informality in the services sector is relatively high in low-income economies, and much lower in high-income economies where the administrative capacity to capture earnings is more developed. However, in both income categories informality is less prevalent for the high skill DDS that are the focus of this study, as shown in Table Vi.1.

Table V.i.1 The Sectoral Dimension of Informality, by Economy Income Group (%), 2019

Sector/ activities	World	Low-income economies	High-income economies
Services (average)	**47.0**	**57.5**	**14.9**
Professional, scientific and technical activities	31.3	31.3	--
Information and communication	22.0	32.5	8.6
Financial and insurance activities	17.8	24.0	7.3

Source: Extracted from Figure 10 in ILO (2023) *Women and men in the informal economy: A statistical update,* https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40ed_protect/%40protrav/%40travail/documents/publication/wcms_869188.pdf

This informality in services contrasts with both the agricultural and industrial sectors. In the former, informal work is often seasonal or family-based, while in the latter, formal labor regulations are more common. Informality persists in services due to the sector's fragmented nature, reliance on low-skilled labor, and regulatory gaps.

1.2. Gendered Impact of Informality

The gendered impact of informality in services is evident in wage disparities, job insecurity, and limited career advancement. Women in informal service roles typically earn less than their male counterparts, reflecting both occupational segregation and gender discrimination. For example, in Thailand and Viet Nam, women in informal services earn significantly lower wages than men with similar qualifications.[60]

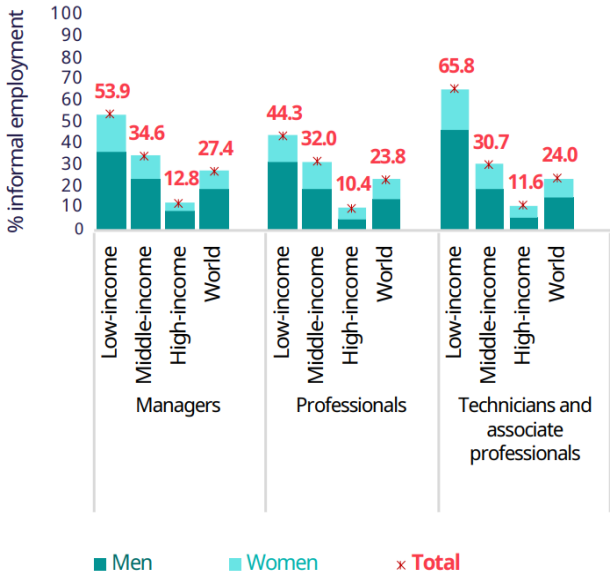
[60] See more in World Bank (n.d.) Gender and informal work in Thailand available at https://openknowledge.worldbank.org/server/api/core/bitstreams/5ae590ef-4e5d-43fa-90af-2fbfb447853d/content and ILO et al (2021) Country Gender Equality Profile -Viet Nam (2021) available at https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40asia/%40ro-bangkok/%40ilo-hanoi/documents/publication/wcms_825087.pdf?utm_source=chatgpt.com

Job insecurity is another critical issue. Informal workers often lack contracts, social insurance, and legal protections, making them vulnerable to job loss and exploitation. This insecurity is exacerbated for women, who face additional barriers such as unpaid care responsibilities and limited access to skills development. Furthermore, the absence of formal career pathways restricts women's upward mobility, confining them to low-wage, precarious jobs.

Whether in low-, middle- or high-income countries, women with a low level of education (primary education or less) are more exposed to informality than men with a similar level of education. In contrast, when they reach secondary and tertiary levels of education, women are less exposed to the risk of informality than men with a similar level of education. This holds true especially for middle-income countries as observed in Figure V.i.1.

Women in informal employment, both globally and in low- and middle-income countries, are over-represented at lower levels of education compared to men. By contrast, women in formal employment, both globally and in high-income countries, have a higher share than men of tertiary-level education (ILO, 2023, ibid, figure 13, panel B).

Figure V.i.1 Share of Informal Employment, by Occupation and Sex



Source: Extracted from ILO (2023) Ibid, Women and men in the informal economy: A statistical update, Figure 14, page 33

1.3. Barriers to Transitioning into Formal, High-Skill Services

Several barriers prevent women from transitioning into formal, high-skill service roles, including skills gaps, social norms, and structural inequalities. Digitalization has created new opportunities in financial services, ICT services, and professional services, but as pointed out in Sections III and IV, women often lack the digital and professional skills required to access these roles.

As shown in Section IV, according to the ILO's ISCO-08 classification, high-skill service occupations (managers, professionals, and technicians) require advanced cognitive, technical, and digital skills. However, women in many APEC economies still face gender disparities in access to education (especially in STEM fields), digital technology and training, limiting their ability to acquire these skills.

Social norms also play a role in limiting women's participation in formal services. In some APEC economies, cultural expectations regarding women's caregiving responsibilities (refer also to child penalty in Section I) restrict their availability for full-time, formal employment. Additionally, gender biases in hiring and promotion processes further limit women's career advancement in high-skill services.

1.4. Impact of Digitalization and Digital Nomadism on Informality

Digitalization is reshaping the services sector, offering both opportunities and challenges for women. Digital platforms have created new work opportunities in areas such as online freelancing, virtual assistance, and e-commerce. However, many of these opportunities are characterized by informal working conditions, with limited labor protections and income stability.

The growing trend of digital nomadism is often linked to informality due to the freelance nature of most digital nomad work, which typically lacks formal contracts, social protections, and stable income. Like other informal workers, digital nomads face income volatility and limited access to benefits such as health insurance and pensions. This instability disproportionately affects women, who may also encounter gender biases on digital freelancing platforms (see Box Vi.1) – resulting in men accounting for roughly six in ten digital nomads worldwide (March 2024).[61]

Box V.i..1. Digital Nomadism and Informality in Services Sectors

Digital nomadism illustrates the growing overlap between formal and informal economies in the digital age. While some digital nomads work for established companies with formal contracts, many rely on gig platforms (e.g., Upwork, Fiverr) that offer little job security or legal protection normally linked to formal employment contracts. Many digital nomads work as freelancers or independent contractors, which mirrors the characteristics of **informal work**, where individuals lack job security, legal protections, and benefits like health insurance, pensions, and paid leave. For example, a freelance software developer or online

[61] According to Barry Elad (2024) Digital Nomad Statistics 2024 By Demographics, Gender, Background, Salary, Education Level, Nationality And Preferred Activities

consultant working remotely across APEC economies might not be eligible for social security or labor protections in their host or home economy.

Digital nomadism often exists in a legal grey area. Many economies, including some in APEC, lack clear regulations regarding the taxation, visa status, and labor rights of digital nomads. This can result in informal working arrangements, where individuals operate outside traditional tax and labor systems. Even with dedicated digital nomad visas (e.g., Thailand's Smart Visa program), labor protections typically apply only to locally employed workers, not remote freelancers.

Like informal workers, digital nomads often face income volatility due to short-term contracts, fluctuating client demand, and lack of guaranteed work. Without employer-provided benefits, digital nomads must rely on personal savings or private insurance to bridge periods without contracts, increasing their financial vulnerability. This instability can be especially challenging for women, with economic and social implications for women digital nomads.

Women digital nomads may face greater barriers to securing well-paid, stable work due to gender biases in digital freelancing platforms. They are more likely to take on lower-paid remote jobs like virtual assistance or online tutoring, while men dominate higher-paying digital services such as software development or digital marketing.

Care responsibilities can also limit women's ability to travel freely, reducing their access to digital nomad opportunities compared to men. In 2023, men comprised 56 percent of digital nomads, women 43 percent, and nonbinary individuals one percent.

While "platformization" of work appears to offer a degree of formality, it often replicates informal conditions, with individuals bearing the risks of unstable income and lacking access to collective bargaining or social security. Women have a disadvantage in such situations.

The rise of digital nomadism presents policy challenges for governments, particularly in regulating cross-border remote work. Clearer regulations on taxation, labor rights, and social protections are needed to prevent digital nomadism from perpetuating informality.

For APEC economies, balancing the benefits of attracting digital nomads (e.g., economic growth and knowledge exchange) with the need to ensure fair labor conditions is crucial. For example, offering social security options for self-employed digital workers could help reduce informality.

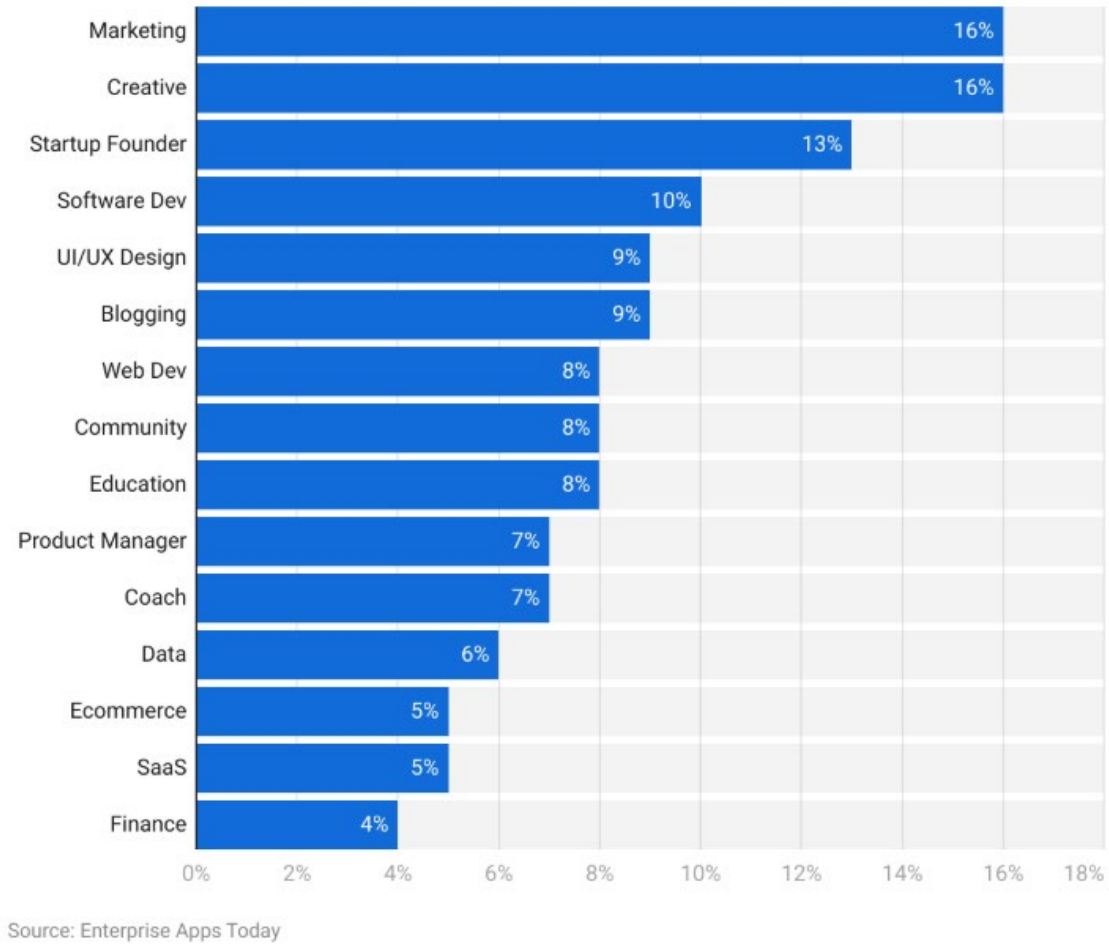
As of March 2023, Information technology was the leading profession of most of the digital nomads resulting in 19 percent. Creative services and education and training were other commonly seen professions contributing 14 percent and 9 percent respectively. The areas of work involved were primarily finance and accounting, sales, marketing and public relations, and research, coaching, and consulting.[62]

Figure Vi.2 illustrates the most populous occupations by women digital nomads (as of March 2023). The leading occupations were marketing (16 percent), creative industry (16 percent) and startups founder (13

[62] Source: Enterprise Apps Today available at https://www.enterpriseappstoday.com/stats/digital-nomad-statistics.html

percent). In contrast, for men the leading occupations are software developer (34 percent), web developer (29 percent), and startup founder (28 percent).

Figure V.i..2. Leading Occupations for Women Digital Nomads Worldwide as of March 2023



Source: Enterprise Apps Today available at https://www.enterpriseappstoday.com/stats/digital-nomad-statistics.html.

The digital gig economy often replicates informal conditions, with women concentrated in lower-paid roles such as virtual assistance or online tutoring, while men dominate higher-paying digital services like software development or digital marketing. Regulatory gaps in cross-border remote work further contribute to informality, as many digital nomads operate outside traditional tax and labor systems.

Despite these challenges, digitalization can also offer pathways for women to transition into formal, high-skill services. Online learning platforms and digital skills training programs can help women acquire the competencies needed for work in financial services, ICT services, and professional services. Initiatives such as APEC's Women in STEM program aim to increase women's participation in digital and high-skill sectors, promoting greater economic empowerment.

2. Artificial Intelligence, Women and Digitally Delivered Services

KEY TAKEAWAYS

- **Artificial intelligence (AI) can be viewed as a technology that is delivered by a service so that it may be applied by individuals and companies.**
- **AI is being adopted faster than PCs or the Internet were in the previous technological revolutions.**
- It is unclear at present what type of impact AI technologies will have on women; however, occupations involving creative and professional skills should be enhanced rather than displaced by AI, whereas the 'person to person', less digitally intensive jobs risk being negatively affected.
- Ingrained attitudes and biases exist in AI development and application at present that work against women.
- **Digital Skills are of the essence for women to be able to participate in digitally intensive services that require AI applications; large gaps that exist between men and women in STEM occupations at present must therefore be reduced through education and skill acquisition.**

Our world is increasingly permeated by artificial intelligence (AI) where our production, consumption and scientific research are being shaped by the application of AI and other new technologies. AI is viewed as potentially one of the most controversial and disruptive technologies in this decade. It is also not well understood.

Generative AI (or GenAI) can be thought of as a process or technology where large language model (LLM) computer systems learn to perform human-like tasks by extrapolating from past experiences, learning in an iterative fashion, and solving problems at speeds which are tremendously fast. They do this through being provided huge amounts of data that enables them to then recognize and repeat patterns and synthesize information in order to generate high-quality text, images, and other content based on the data they were provided.[63] Broadly, disparate technologies such as AI, machine learning (ML), natural language processing (NLP), computer vision, and robotics all come under the roof of digital frontier technologies.[64].

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[63] One of the controversies at present around Generative AI (of several) is the compensation and attribution of the intellectual property rights over the data and information fed into the large language model computers for the process of generating synthesized output. This controversy over intellectual property rights involved in the development of Generative AI is ongoing and has not yet been resolved. For a comprehensive overview of the issues involved in this debate see Robyn Chatwood, *AI and Intellectual Property Rights,* Dentons, January 28, 2025, https://www.dentons.com/en/insights/articles/2025/january/28/ai-and-intellectual-property-rights and Matt Blaszczyk, Geoffrey McGovern, and Karlyn D. Stanley, *Artificial Intelligence Impacts on Copyright Law,* Expert Insights, Rand Corporation, November 20, 2024, https://www.rand.org/pubs/perspectives/PEA3243-1.html

[64] See WIPO, Fact Sheet on Frontier Technologies, https://www.wipo.int/export/sites/www/about-ip/en/frontier_technologies/pdf/frontier-tech-6th-factsheet.pdf

The importance of AI in business and investment decisions is already economically large, as witnessed by the extremely high valuations of the 'tech' companies that are putting millions of dollars into AI research and development.[65] It is also a volatile and rapidly moving field and one which is now perceived to create not only economic dislocations but domestic security threats. Significant shake-ups in the AI marketplace are occurring at present, with the appearance of new firms (such as DeepSeek) which are challenging the competitive advantage of the long-standing incumbents.[66]

2.1. Potential economic impact of AI

The real economic impact of AI application seems likely yet to come, but it could be significant. A report by Price Waterhouse Cooper estimates that AI could increase global GDP by up to 14 percent as of 2030, contributing $15.7 trillion to the global economy.[67] This would be more than the current output of China and India combined. Of this amount the report estimates that $6.6 trillion will come from increased productivity and $9.1 trillion from consumption side effects.

Economic gains from the adoption and application of AI technology are expected to come from three areas.[68] These include:

i) Productivity gains from businesses automating processes (including use of robots and autonomous vehicles).
ii) Productivity gains from businesses augmenting their existing labor force with AI technologies (assisted and augmented intelligence).
iii) Increased consumer demand resulting from the availability of personalized and/or higher-quality AI-enhanced products and services.

While some markets, sectors, and individual businesses have more familiarity and are more advanced than others, Generative AI is still felt by many to be at an early stage of development

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[65] The major tech companies have been spending billions over the past two years since the introduction of ChatGPT in November 2022, to further develop AI capacities and applications. It is reported that Amazon, Alphabet, Meta, and Microsoft intend to spend as much as $320 billion combined on AI technologies and datacenter buildouts in 2025. Amazon has outlined the most ambitious spending plan, at around $100 billion. These numbers are up from $230 billion in total capital expenditures for AI development in 2024. Samantha Subin, *Tech megacaps plan to spend more than $300 billion in 2025 as AI race intensifies,* CNBC, 8 February 2025, https://www.cnbc.com/2025/02/08/tech-megacaps-to-spend-more-than-300-billion-in 2025-to-win-in-ai.html

[66] Kelly Ng, Brandon Drenon, Tom Gerken and Marc Cieslak, *DeepSeek: The Chinese AI app that has the world talking*, BBC news, 4 February 2025. Deep Seek is an AI-powered chatbot that operates very much like ChatGPT but requires a fraction of the cost and computing power to function. For the consumer, DeepSeek is currently free to use while ChatGPT requires a subscription, with the basic access plan costing around $20 per month. https://www.bbc.com/news/articles/c5yv5976z9po In response, ChatGPT launched the DeepResearch tool on February 2, 2025, a new agentic capability that conducts multi-step research on the internet for complex tasks and which can accomplish in tens of minutes what would take a human many hours. See https://openai.com/index/introducing-deep-research/

[67] Price Waterhouse Cooper report, Sizing the prize What's the real value of AI for your business and how can you capitalize? At https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf. See figure on page 5 which shows that labor productivity improvements are expected to account for over 55 percent of all GDP gains from AI over the period 2017 – 2030.

[68] Ibid, page 4.

and economic application overall. The impact it will have on different regions is predicted to be uneven and will depend largely upon the speed with which it is adopted and put into application in the workplace. The major economic gains are predicted to accrue in the U.S., China, Europe and developed Asian economies, at least in the short term.[69] An OECD report indicates that its real impact may in fact be felt in innovation, though this remains to be seen.70

2.2. Relationship of AI to services

There is no general agreement on whether AI falls into the goods or services area. However, artificial intelligence is most often viewed as a service transmitting technology. From this perspective it can be defined as "***a service that outsources AI to enable individuals and companies to explore and scale AI techniques at minimal cost***". [71] Under this definition, AI would be considered a service delivering Generative AI technology, or the application of iterative learning, by companies to potential end users. In terms of AI use and application, this would be realized primarily through digitally delivered services. To date there has been no move to incorporate AI technology into any of the existing services classification systems for digital trade.

AI is expected to lead to the development of new services and to the upgrading of traditional services, both of which could potentially result in higher welfare and productivity.72, 73

2.3. Speed of adoption of GenAI

It is becoming a bit clearer as to the expected speed at which the adoption of GenAI will occur. According to a recent NBER research paper, its adoption is happening at a faster pace than was the case for the take-up of personal computers or the Internet.[74] Figure 1 shows this comparison, with the dot in the figure (at 39 percent) representing the adoption rate for GenAI (in the United States) at two years since the first mass-market product of ChatGPT was introduced (November 2022). If the depiction in Figure 1 is accurate, the uptake on the new AI technology in the coming decade could be very significant. The NBER paper indicates that generative AI and PCs demonstrate very similar early adoption patterns by education, occupation, and other

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[69] Ibid, page 7. The report details the determinants of these GDP gains in several economies, including the U.S. and China, and develops an AI Impact Index, to help firms target their investment opportunities.

[70] OECD Artificial Intelligence and International Trade, OECD Trade Policy Papers, 2022. https://doi.org/10.1787/13212d3e-en.

[71] *What is artificial intelligence as a service? Definition, architecture and trends*, Spiceworks, 10 February 2022, https://www.spiceworks.com/tech/cloud/articles/artificial-intelligence-as-a-service/

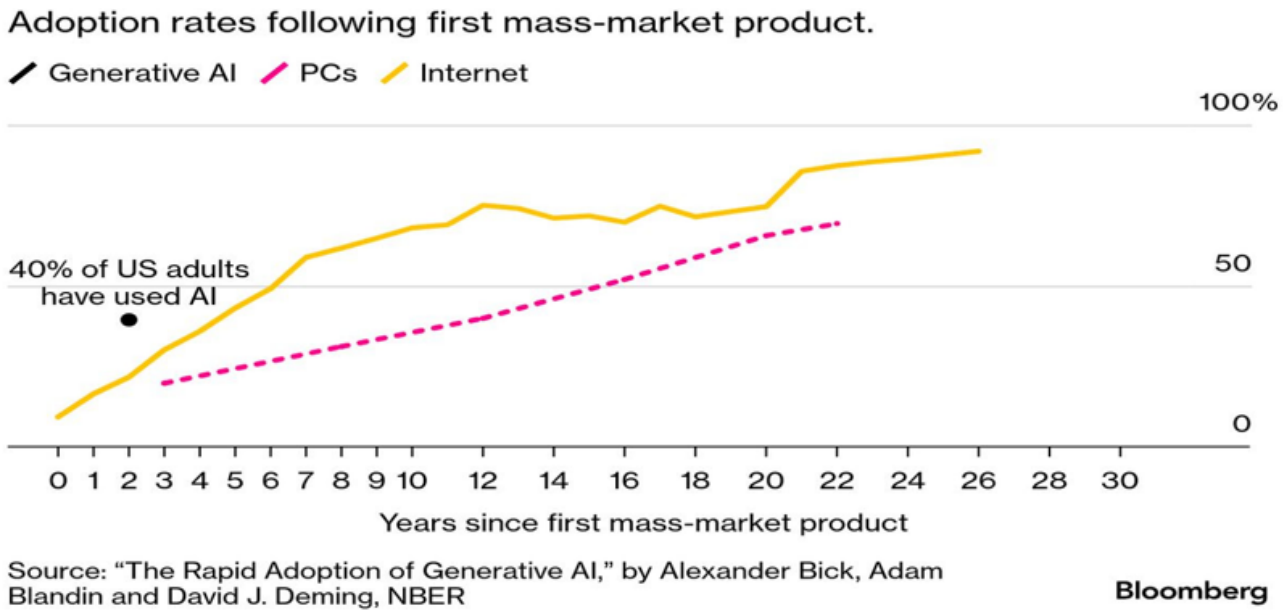
[72] Trefler, Daniel, and Ruiqi Sun, *AI, Trade and Creative Destruction: A first look*, NBER working paper 29980, National Bureau of Economic Research, 2022. https://doi.org/10.3386/w29980.

[73] Furman, Jason, and Robert Seamans, *AI and the Economy*, NBER working paper 24689, National Bureau of Economic Research, 2018. https://doi.org/10.3386/w24689.

[74] Alexander Bick Adam Blandin David J. Deming, *The Rapid Adoption of Generative AI*, National Bureau of Economic Research, Working Paper 32966, February 2025, page 13. https://www.nber.org/system/files/working_papers/w32966/w32966.pdf

characteristics.[75] In particular, the lower cost of GenAI applications as compared with PCs or the Internet should prove to be a major boost to its use both by individuals and by firms.

Figure V.ii.1: AI is Being Adopted Faster Than PCs Or the Internet



Source: Figure from "Do Marketers Need to Be Writing for AI?" Bloomberg, 9 Feb. 2025.

2.4. Impact of AI on women's employment in high skill DDS

Given the period of transition in which we are currently living, it is unclear at present what type of impact that GenAI and new AI technologies will have on women. To try and answer this question, it would be necessary to explore what impact AI might have on different types of economic activities or occupations. A report by the McKinsey Global Institute put forward the view that the biggest impact of automation would be felt on those occupations involving repetitive tasks, particularly customer-facing jobs), such as office support, customer service, health services, etc.) where employment could well decline in favor of robots or online AI applications.[76] This view has also been put forward by several other studies. An OECD study emphasized the risk of AI adoption for female workers (as well as older workers and those without tertiary education) as

[75] The NBER working paper cited in footnote 5 points out that the choice of whether to adopt a given technology is a function of both its benefits and its cost. Many genAI products are currently free or inexpensive and user-friendly. These lower adoption costs relative to PCs and the internet (which require equipment purchase to use and access) may allow GenAI to diffuse more rapidly. *Ibid,* page 14.

[76] McKinsey Global Institute, *Generative AI and the Future of Work in America*, July 26, 2023 https://www.mckinsey.com/mgi/our-research/generative-ai-and-the-future-of-work-in-america . For the case of the United States, the report estimates that activities that account for up to 30 percent of hours currently worked across the US economy could be automated by 2030 —a trend accelerated by Generative AI. However, this trend would not significantly affect high skill services activities.

they are expected to lose out given their more limited access to AI-related employment opportunities and to productivity enhancing AI tools in the workplace. [77]

In contrast the McKinsey study indicates that those occupations involving creative and professional skills should be enhanced rather than displaced by AI applications. Following this line of reasoning, the high skill, DDS services occupations that are the focus of this study should experience few occupational shifts by 2030. Therefore, the more women are able to acquire the requisite education, skills, and training to be able to shift into these digitally intensive service activities dependent upon AI applications, the better off they will be to insulate themselves from the employment impacts of AI.

The relative strengths that women possess as some of the necessary skills for participating in the jobs of the future have been emphasized by Sue Duke, the Head of Global Public Policy and Economic Graph Team at LinkedIn. The data at Linked-In found that women had a 28 percent larger share than men of essential soft skills for jobs of the future, including strategic leadership and collaboration, allowing Duke to emphasize that "…..*the growing number of female AI talent and the advent of GenAI presents an opportunity to help close the gender gap*".[78] However, this will very much depend upon the qualifications and skill levels of the women in the labor force who will be expected to understand how to use the hard skills required by GenAI applications and to apply them to their fields of work. And it will also depend upon how the soft skills will be translated into positions of decision-making and leadership in data-driven and AI intensive industries.

Drawbacks to this possible positive impact include current gender differences in skilling profiles between men and women – which skew how they are engaging in the technological transition. An examination of the current situation does not look promising. Coursera data shows gender parity remains low in AI and big data (30 percent), programming (31 percent), and networks and cybersecurity (31 percent).[79] This reinforces the findings in this study in Section IV that a lack of skilling and technological access gaps (to computers and Internet use) has hindered women's ability to acquire digital skills, engage in online professional development, and compete for high-skill positions that increasingly rely on technological proficiency in the digital area.

These limitations to access have thus created a situation of large gaps between women and men in STEM occupations by industry (see Figure IV.4 in Section IV). It would appear easy to conclude

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[77] Lane,M. (2024), "Who will be the workers most affected by AI?: A closer look at the impact of AI on women, low-skilled workers and other groups",OECD Artificial Intelligence Papers, No.26, OECD Publishing, Paris, https://doi.org/10.1787/14dc6f89-en

[78] *Quote from Sue Duke, the Head of Global Public Policy and Economic Graph Team at LinkedIn.* Cited in the WEF blog on *Gender Gap: This is the state of work for women in 2024,*June 27, 2024 https://www.weforum.org/stories/2024/06/women-work-gender-gap-2024/#:~:text=Women%20make%20up%2042%25%20of,cited%20in%20the%20Forum's%20report.

[79] World Economic Forum, 2024 Global Gender Gap Report, Geneva, https://www.weforum.org/stories/2024/06/women-work-gender-gap-2024/#:~:text=Coursera%20data%20shows%20gender%20parity,the%20closure%20of%20workforce%20gaps.

from this that any widening gaps in education and training on AI applications for women would only serve to widen this existing gap even further. Therefore, how women are educated and trained for future employment in high skill DDS industries that require AI use and application will be critical to access these opportunities.

2.5. Ingrained attitudes and biases in development and application of artificial intelligence that work against women

Much of the challenge around women's ability to take advantage of the AI 'revolution' in the workplace revolves around the existence of ingrained attitudes and biases in AI development and application. This aspect of AI is not well appreciated but has important implications and consequences both in practical terms and in the extra challenges it poses for women in the digital fields. The presence of ingrained attitudes and biases comes from the information and materials that are fed into the LLMs for the creation of GenAI applications, most of which are created by and for the large technology corporations, which are led and staffed mainly by men. The gender bias inherent in their actions, guidelines and decisions is then translated into GenAI responses and applications. As long as women (employees) are not present in greater numbers and especially in decision-making roles of seniority in the digitally intensive services firms that are developing GenAI applications, these ingrained biases will continue to be propagated.[80]

Simon Johnson, author of Progress and Prosperity, and 2024 recipient of the Nobel Prize in Economic Sciences, made the very pertinent remarks that are included in Box V.ii.1 during a recent IMF podcast (February 2025) which illustrate these points. In his remarks he emphasizes the reality around the vision and the decisions which lie behind the making and exploiting of AI and other technologies.

Other consequences of this ingrained bias in the development and application of GenAI which are not mentioned by Johnson in the podcast include those of an economic nature which result in lower incomes for women in their employment. This often translates into lower social status and less ability to have a voice in household and enterprise decisions, as well as political consequences which deny women the voice they would otherwise be able to exercise.

[80] The 2023 APEC Women and the Economy Dashboard cites the 2022 report from Equileap on gender equality in the corporate sector covering Asia-Pacific economies which points to uneven progress in gender equality in the workplace, with women making up only 4 percent of chief executive officers (CEOs), 10 percent of chief financial officers (CFOs) and 5 percent of board chairs in the Asia Pacific. Globally, women make up 31 percent of business leaders, with varying shares per industry, according to high-frequency data from LinkedIn. However, the 2023 OECD-Social Institutions and Gender Index (SIGI) shows that of these business leaders, globally women hold only around 25 percent of management positions. And the WEF Global Gender Gap Report underlines that the "drop to the top" from entry-level to C-suite positions is more pronounced in STEM occupations than in non-STEM roles. See APEC Policy Support Unit, Women and the Economy Dashboard, August 2023, page x. https://www.apec.org/publications/2023/08/the-apec-women-and-the-economy-dashboard-2023

Box V.ii.1: Ingrained Attitudes and Biases in AI Development and Application

"Well, this is obviously the age of AI and artificial intelligence, and there are great claims being made for the improvements that will permeate all of human societies as a result of making computers and algorithms more potent and more able to do thinking for us. And we think that is possible; it could happen.

But also,.,.,,, based on our reading of history and our thinking about the theory of economics as well, that it is not necessarily the case. Improving technology, making technology more productive, expanding the capabilities of some people may not necessarily translate into an improved standard of living for everyone. It can….it should…. we want it to…. that's what we work on…. trying to push it.

But if you look at the vision of a lot of big tech, it is currently more intensely focused on improving the capabilities of people like themselves (i.e. the creators and users of this new AI technology)

So these are highly educated people. They're mostly white people. They're mostly men. They have a certain view of the world. They have a certain view of what they want technology to do for them. And they have a view of where the market is. Where's the money? What are people willing to adopt? It is quite natural that they would be pulled towards inventing things that favor that vision."

Simon Johnson, recipient of the 2024 Nobel Prize in Economic Sciences, former IMF chief economist and currently professor at MIT in the Sloan School of Management

Remarks made in a podcast produced for the IMF on Technology, Institutions and Prosperity, 14 February 2025, at https://www.imf.org/en/News/Podcasts/All-Podcasts/2025/02/14/simon-johnson?utm_medium=email&utm_source=govdelivery .

PART II: PRIVATE SECTOR PERSPECTIVES ON THE PARTICIPATION OF WOMEN IN HIGH SKILL, DIGITALLY DELIVERED SERVICE SECTORS

Section I. Background on enquiry into private sector perspectives

To incorporate the perspectives of the private sector into the examination of the topic researched in this study, a questionnaire was developed with questions relevant to the content of Part I. It was felt particularly important to solicit and consider private sector views and experience, in order to have a more in-depth and accurate understanding of the current situation, as well as the challenges and opportunities for enhancing the participation of women in high skill, digitally delivered services in APEC.

The questionnaire was sent out to all the firms (21 in total) with a representative member in ABAC that were identified as carrying out activities in the services sectors of focus for this study, namely professional services, ICT services, and financial services. The aim of the questionnaire was to identify structural and institutional factors that enable or hinder women's participation and advancement in high skill, digitally delivered service sectors in APEC economies. Specifically, it focused on gathering qualitative and quantitative insights from firms in the following key areas: Equal Opportunity Practices; Composition and Nature of High-Skill Jobs; Women's Participation in High Skill Digitized Roles; Impact of Digitalization on Skill Requirements; Workplace Support for Women's Advancement; Gender Equity in Pay and Promotion; and Institutional Gender Policies and Transparency. Seven responses were received from ABAC firms for a response rate of 33 percent. These responses have been compiled and serve as the basis for the information presented below.

Additionally, Part II of the study benefited from the rich discussion that took place in the APEC Group on Services (GOS) Private Public Dialogue (PPD) held on 6 May 2025 as part of the annual stocktaking of the APEC Services Competitiveness Roadmap at SOM2 in Jeju, Republic of Korea. A summary of the main insights from the private sector experts in the PPD has been included in the discussion below to complement and further expand upon the responses provided to the questionnaire. The agenda for the PPD is set out in Part II – Appendix 1, and the Summary Report of the full presentations given by the ten experts who provided a private sector perspective on these questions in Part II – Appendix 2.

Section II. Responses to the questionnaire sent to selected ABAC firms

1. On equal access to employment opportunities

The firms that responded to the questionnaire in the three focus sectors of professional services, IT/ telecom services and financial services indicated that they were all equal opportunity employees, half of them by choice and the other half both by legal obligation and by choice. Thus,

the opportunity for women to be considered for professional positions in these digitally intensive firms on an equal footing with men seemed to be both guaranteed and respected. Additionally, and importantly, all firms that responded from these three sectors stated that they provided equal pay to both women and men for the same positions and skills. So, there seemed to be no discrimination in either the hiring practices or in the remuneration offered in these high skill, digitally intensive services

2. On the skills required for women for high skilled jobs

There was also a similarity of responses regarding the skills required to work in these service sectors. All but one of the firms that replied indicated that either a STEM education or STEM certificate, or competency in digital / computer skills was required for hiring in high skilled jobs. This would seem to indicate that rather than the lack of equal employment opportunity, it is possibly the lack of a sufficient number of women with appropriate skills that accounts for the lower percentage of women working in these digitally intensive sectors, as will be evidenced in the discussion below.

3. On the gender gap in high skill digital jobs

Most striking in the replies to those questions which showed a variety of responses was the differences in the percentage gap of women working in high skilled digital jobs in these firms. This percentage varied from 10 percent to 100 percent. The highest percentage of women in these jobs was in the professional service companies (60 to 100 percent), and the lowest in the IT/ telecom companies (less than 20 percent), with financial service companies falling somewhere in between (around 30 percent). It is notable that not less than 60 percent of highly skilled digital jobs are filled by women in the professional services sector. The occupations considered highly skilled as indicated by the respondent firms are legal services, engineering, accounting, programming services, investment advice and decisions, portfolio management and compliance. These responses confirm the information and statistical data that are contained in Sections III and IV of Part I of this study.

It is, however, most interesting to observe that many of the respondent firms stated that digital skills, though essential, had no impact on their baseline operations. Two firms did provide a more positive reply, stating that digital skills enhanced the impact of their activity and that employees with digital skills increased the demand for the application of artificial intelligence.

4. On women working in top positions

Responses to the question on the percentage of women in top positions (according to a five-year trend) showed a picture which also confirmed the information and statistical data contained in Sections III and IV of Part I. In no firm are women at parity to hold an equal number of top positions. The percentage of women in senior roles varies considerably from 10 to 41 percent, but this is lower than 25 percent in all but two firms. One firm replied that these positions were not comparable at the top as between men and women, while the other respondent firms indicated

that the percentage increase in women in top or senior positions over the past five years had been very slight. The largest increase was given as 10 percent, but this was an outlier.

5. On training programmes and/or mentorship for women

Often women can be helped to advance through training programmes or mentorship. All firms but two replied that internal training was either offered or required. And the same number replied that a mentorship programme was available and/or encouraged. Thus, it seems that the opportunity to undergo training to assist with career advancement is available to women in these digitally intensive firms. An internal grievance mechanism was also made available by all but two firms, although details are not made public. In these cases, women have the right and opportunity to express concerns over any aspect of potentially unequal treatment.

Lastly, the questionnaire asked if a report by the firm on gender equality and women's economic empowerment is carried out and made publicly available. Three of the respondent firms stated that such a report is prepared and is publicly available for consultation, while the other firms either did not conduct such a report or did not make it publicly available. Based on these responses, it is possible to provide some further details, as set out in the table below

Table 1: Summary of information from company reports on gender equality issues

Area	**Firm 1** **ITC**	**Firm 2** **Banking**	**Firm 3** **Financial**
Gender equality policy	No discrimination; equal opportunity; zero tolerance for harassment	DEI as core strategy; Talent Policy emphasizes diversity; zero tolerance for discrimination	Diversity, inclusion, and belonging as strategic priorities; zero tolerance for discrimination
Leadership diversity	Board reflects gender diversity; sexual equality on board	23.1% women on board (2024); targets for 30%; initiatives for female managers1	42.9% women on board (FY25); 44% of employees are women; 63% of leadership team (CEO and direct reports) are women
Workforce diversity	Mandatory human rights/gender equality training; inclusive recruitment	48% female employees; diversity KPIs for gender, mid-career, and foreign economy-wide 1	44% women overall; 46.2% of new starters women (FY25)
Pay equity/ Gender pay gap	Not explicitly reported on English website	Paris branch gender pay score: 82 (target: 85); UK: women earn 76p for every £1 men earn (median)	UK: median hourly pay gap 13.2% (women lower); Australia: see WGEA; global median pay gap 7.4% (FY25)
Work-life balance	Not detailed in English materials	Childcare leave: 100% male take-up goal;	Flexible working; strong parental leave policies;

Area	Firm 1 ITC	Firm 2 Banking	Firm 3 Financial
		average 11.5 days paternity leave (2023)	supports work-life integration
Training & development	100% of employees attend human rights/gender equality training	Group-wide training for female managers; eCampus for self-directed learning	Career development programs; annual pay equity reviews; leadership development for women
Reporting & transparency	Human rights policy and training data disclosed	Annual DEI reporting: gender pay gap reports for major regions1	Annual sustainability and pay gap reports; transparency in diversity data
Recognition	Recognized for corporate governance and board diversity	Included in Bloomberg Gender-Equality Index	Included in Equileap Top 100 for gender equality; US offices in Built In's 100 Best Places

Key insights obtained by analyzing the public reports and websites of the three companies indicate that the common strengths include strong non-discrimination and strategies for diversity, equity, and inclusion (DEI), mandatory training and development, and transparent reporting. On the other hand, gaps are identified in still-persisting gender pay gaps.

Section III. Insights from experts in the APEC GOS Private Public Dialogue

Several representatives from the high skill, digitally intensive service sectors of focus for this project spoke in the APEC Group on Services Private Public Dialogue held on 6 May 2025. As practitioners, they provided additional, complimentary insights to the issues examined in the questionnaire. A selection of their insights is highlighted below. More detail can be accessed in the full presentations of the speakers which are contained in the Summary Report of the Dialogue in Part II - Appendix 2.

1. On access to digital employment opportunities

Providing the possibility for women to pursue education in STEM and obtain digital skills was emphasized by several speakers as potentially transformative, not just for individuals, but for families and their communities at large. Encouraging women to follow entrepreneurship opportunities by providing digitally delivered services can allow those from small developing economies or underserved communities to participate in regional and global markets. Digital entrepreneurship can represent a survival path in economies where formal jobs are limited.

2. On the skills required for women for high skilled jobs

Speakers highlighted how obtaining digital skills can help women move from education and training into employment, leadership or digital entrepreneurship. Such digital skills can not only be transformational for individuals but can build talent pipelines across generations. Several speakers emphasized the importance of facing and removing the sometimes-persistent barriers that women face in being able to acquire these digital skills and be prepared to access these opportunities.

Women are behind on digital skills, with one speaker stating that only around 35 percent of STEM degrees are currently earned by women compared to 65 percent by men. It is critically important for women to obtain digital skills, as the private sector representatives underscored the acceleration of digital disruption in the workplace, pointing out that nearly 40 percent of core job skills will involve AI and data skills by 2030.

One speaker emphasized that it may be necessary to rethink the skills framework and to focus as well on mid-career women to ensure that they can access digital upskilling and reskilling opportunities. This is especially important as women are represented at every layer in the ecosystem for digitally delivered services in both large and small firms, and their support roles in occupations using digital skills are overlooked but are in fact foundational. So, skills should be viewed in a more comprehensive manner, as women in these support roles act as digital enablers with ripple effects across the economy

3. On the gender gap in high skill digital services employment

Responses to the questionnaire highlighted the large differences in the percentage gap of women working in high skilled digital jobs between those firms surveyed. Speakers emphasized this gap, pointing out that women remain underrepresented in the high tech, digitally intensive sectors, with fewer than 35 percent of tech roles held by women across the APEC region and female representation in digital professions generally below 30 percent. One speaker presented LinkedIn data indicating that women constitute just 27 percent of AI engineering talent globally, representing only one-fourth of the engineering work force and only 22 percent when this is broadened to include foundational skills like ChatGPT and Claude image generation.

Women account for over 60 percent of the total services workforce yet hold less than 30 percent of STEM roles critical for digital services. One speaker mentioned the finding of an ILO/ADB recent study for the Asia Pacific region finding that in the digital services sectors with the most dynamic growth—IT and other information services—only one in four jobs (25 percent) went to women. The most dynamic sectors for job growth over the past three decades in the region have seen significantly more job gains for men than women. Speakers underlined that marginalizing women's digital contribution results in a significant economic loss of billions of dollars annually to the APEC region.

It was pointed out in the PPD that one critical challenge for boosting women's participation in these high skill digital jobs is found in the large drop off that occurs in the women qualified in STEM degrees who then choose not to be engaged in STEM employment after graduation. This phenomenon is shown to be consistent across APEC economies and across cohorts over the past eight years and represents the largest drop off of women between those educated and those who enter the labour force than in any of the other degree areas. This lower entry by women into STEM occupations is one of the explanatory factors behind the gender gap observed in high skill digitally intensive service jobs and is a key problem to be addressed.

4. On the lower number of women working in top positions

Private sector experts pointed out that leakage from the STEM pipeline contributes to a lower representation of women in top positions, as this participation continues to drop as women start climbing the career ladder. LinkedIn global data show that women hold 24 percent of STEM managerial positions that number drops to 12 percent at the C-suite level, while in comparison women in non-STEM fields hold about 40 percent of managerial roles. Private sector analysts pointed out in the PPD that women continue to face barriers to advancement after they enter the STEM workforce as well. The lack of women in top positions comes at a cost: one speaker cited the estimated $17 trillion of losses to APEC region's GDP as a result of the under representation of women in leadership roles.

5. On the barriers confronting women working in digitally intensive services

Several speakers coincided in highlighting barriers they had observed or experienced in their professional careers that women face in trying to participate in high skill, digitally intensive services. Such barriers included limited market employment opportunities and differences in access to venture capital for startups with women led tech startups securing 50 percent less capital than male startups. Also cited were rigid policies with respect to flexible hours, biased promotions, and hiring through male networks. Lack of access to digital infrastructure for women in rural areas was also cited as an insurmountable structural barrier.

Additionally, many experts identified "attitude" barriers in the form of gender norms and cultural expectations as one of the main reasons keeping women in more traditional occupations, expected to prioritize family over professional ambitions. A lack of mentors and role models was deemed influential in determining women's career choices.

All the barriers cited above contribute to the current significant gender gap in employment in high skill digitally intensive services. Speakers advocated public-private initiatives to tackle regulatory and structural barriers along with education on gender equality so that women could choose freely to study STEM subjects and work in occupations requiring STEM and digital skills.

The lack of role models and mentorship for women constitutes another area of disadvantage for women trying to break through into digitally intensive services sectors. The lack of role models in

leadership positions make it difficult for aspiring female entrepreneurs to see a clear, viable path to long term success in the sector. The absence of female role models thus remains a significant barrier, making it harder to attract women in the sector.

One speaker advocated more effective employment policies to tackle these barriers. The first would be a shift from education and qualifications hiring approach to a skills-based approach to hiring and training. The second would be to place greater emphasis on adopting measures to address actual barriers that are in place, or designing programs around the disadvantage, and not the disadvantaged, to be more specific and targeted. Other speakers advocated a focus on skill acquisition and reskilling as the means to close the gender participation gap faster, with targeted interventions as appropriate.

6. On the impact of artificial intelligence on women in the services area

One topic addressed by the PPD which was not covered in the questionnaire was that of the application of artificial intelligence technologies and their impact on women's participation in these high skill, digitally intensive services sectors. AI technology is reshaping the world of work and what skills are needed to perform various jobs. It offers significant potential benefits to firms and workers, but speakers pointed out that realizing these will require focused and targeted reskilling along with behavioural change.

Private sector representatives in the PPD emphasized that AI is being adopted faster than the computer or the internet was at similar points in time after being introduced, but that only around 50 percent of women trust and use AI tools at work compared with 70 percent of men. Women also display a "technology trust gap" with respect to AI which could inhibit their regular use of the technology and full participation in new genAI applications.

Speakers emphasized that the impact of AI will vary by profession, but data indicate that women are more likely to work in jobs at high risk of AI disruption. Thus, AI presents social risks and threats that may impact women more than men. This is of significant concern because AI-augmented roles are those expected to grow faster and pay more in the future. Speakers pointed out that the participation gap between women and men in using AI technologies is closing only slowly, which has economic implications. Non-diverse teams of digital workers lose 20 percent of innovation potential, delivering weaker AI FinTech and consulting.

Those engaging with AI acknowledge it can and does channel inherent gender biases. Private sector experts in the PPD explained that AI is trained on raw data—linguistic, audio, or image-based—drawn from societies which are, on the whole, still gender-biased. This bias will continue to be perpetuated as long as women do not participate more fully in developing and applying AI. Presently women constitute less than one-third of the AI workforce. Increasing this percentage will not only help reduce gender bias in AI technologies but also give women a greater role in steering the future of the technology.

Removing the structural barriers standing in women's way to obtain and employ critical AI skills was felt by the private sector representatives to be key, in part because of the incorporated gender bias at present in genAI technologies, examples of which were given in the PPD. Just as important for women-led startups is the impetus for knowing how to use AI technology and deploy it in innovative and monetizable ways.

7. On the impact of trade policy on women working in services

One speaker pointed out that trade policies are not gender neutral, and that trade policy and its implementation impact women and men differently. Trade policies can help promote gender equality and increase women's economic empowerment—especially when they facilitate access to digital markets. The adoption by WTO Members of the E-commerce Moratorium (or the Moratorium on Imposing Customs Duties on Electronic Transmissions) has been instrumental in this regard. By preventing customs duties on digital transmissions, the moratorium has allowed digital platforms and services to expand and become more accessible. This expansion has, in turn, enabled women-led and women-owned businesses to advertise, sell, and export their products online at lower costs, creating a more level playing field and opening up new opportunities to participate in international markets. Ultimately, the moratorium has played a key role in supporting women's economic empowerment by fostering an environment where digital platforms can thrive and reach a global audience.

Section IV. Broader evidence from the literature on these issues

Given the relatively small sample size of the ABAC firm questionnaire, it is important to place its findings within the broader context of global and regional evidence on women's participation in digitally delivered services. Several recent reports offer data-driven insights in relevant areas based on large-scale employer surveys and corporate performance metrics.

Recent publications by the World Economic Forum (2023), McKinsey & Co/ Leanin.org .(2024),[81] McKinsey & Co., (2025),[82] Altrata (2025),[83] Deloitte (2024),[84] Equielap (2024),[85] the International

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[81] McKinsey & Co., and LeanIn Org (2024) Women in the Workplace 2024 available at https://womenintheworkplace.com/#:~:text=Women%20in%20the%20Workplace%20is%20the%20most%20comprehensive,the%20key%20findings%20from%20the%202024%20report%20now.

[82] McKinsey & Co. (2025) How women can steer toward growing industries and companies available at https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/how-women-can-steer-toward-growing-industries-and-companies

[83] Altrata (2024) The Global Gender Diversity 2024 available at https://altrata.com/reports/global-gender-diversity-2024#:~:text=Altrata%27s%20latest%20report%2C%20Global%20Gender%20Diversity%202024%2C%20provides,20%29%20as%20of%20the%20first%20quarter%20of%202024.

[84] Deloitte (2024) Women in the boardroom available at https://www2.deloitte.com/us/en/insights/topics/leadership/women-in-the-boardroom.html

[85] Equielap (2024) Gender Equality Report & Ranking available at https://equileap.com/wp-content/uploads/2024/02/Equileap_2024_Gender_Equality_Report_Developed_Markets.pdf#:~:text=Navigating%20unfinished%20business%20In%20the%20corporate%20landscape%2C%20the,a%20slow%20and%20unfinished%20journey%20towards%20gender%20balance.

Labour Organization (2023), and APEC Policy Support Unit (2024). Together, they provide comparative benchmarks that both reinforce and extend the findings of the ABAC survey, particularly regarding the persistent gender gap in high-skill digital service sectors such as IT, finance, and professional services.

1. Participation gaps

Recent studies consistently confirm that women remain significantly underrepresented in roles central to digital transformation. According to the World Economic Forum (2023), women account for only 29 percent of the global tech workforce and just 26 percent in emerging digital fields such as artificial intelligence and cloud computing. These trends are echoed in the Asia-Pacific region, where the ILO (2023) reports that only one in four STEM-qualified professionals are women—a pattern also reflected in low female representation across ICT and high-skill professional services. The Altrata Global Gender Diversity 2024 report, based on data from publicly listed companies in major economies, finds that while women hold 32 percent of board seats and 22 percent of executive leadership roles, only 6.5 percent of CEOs are female. In the technology and financial sectors, women's participation in senior roles remains below 30 percent, closely aligning with the ABAC companies survey data (presented in section A).

In addition to participation gaps, broader literature highlights a consistent set of structural, cultural, and institutional barriers that hinder women's advancement in digital and high-skill service sectors. Cultural and attitudinal biases, particularly in promotion and evaluation processes, remain widespread. The Women in the Workplace 2024 report by McKinsey and LeanIn.org emphasizes that women, especially those in technical roles, continue to be under-mentored and under-sponsored, which limits their progression into leadership. Deloitte's Women in the Boardroom study similarly underscores how workplace cultures often fail to adapt to women's needs, with unconscious bias frequently unaddressed. These findings are especially relevant as the findings from the private sector reflected in sections A and B acknowledge challenges in fostering inclusive advancement pathways.

2. Structural barriers

Structural barriers also play a key role. Limited access to STEM education and targeted upskilling opportunities constrains the pipeline of qualified women entering digital roles. While many companies acknowledge the importance of digital skills, few have gender-specific training or development programs. The APEC PSU (2024) highlights that only a minority of firms in the region assess the gender implications of adopting digital technologies or track disaggregated workforce outcomes. Similarly, Equileap's 2024 report reveals that just 33 percent of companies globally disclose gender pay gap data, and only 65 percent have a formal anti-sexual harassment policy. The resistance to collecting and publishing diversity, equity, and inclusion (DEI) data is particularly acute in sectors where male dominance is entrenched.

3. Emergence of positive trends

Despite these ongoing challenges, several positive trends have emerged. Some leading firms are implementing targeted strategies to promote gender equality in high-skill, digitally delivered roles. Companies such as Cisco and Telstra have developed leadership programs specifically tailored to women in digital fields, often tied to measurable inclusion outcomes. Increasingly, gender-related key performance indicators (KPIs) are being incorporated into environmental, social, and governance (ESG) reporting frameworks, with some firms linking these KPIs to executive remuneration—a move designed to embed accountability for inclusion at the highest levels. Legislative reforms in countries like France, Spain, and the United Kingdom have also made an impact. France, for example, mandates a minimum of 40 percent women on corporate boards and is extending quotas to executive teams, while the UK enforces mandatory gender pay gap reporting.

Equileap's ranking of the top 100 companies for gender equality in their workforce provides further evidence that institutional change is possible. The top-performing companies tend to have strong policies on pay equity, parental leave, leadership diversity, and harassment prevention. They are also more likely to have women in CEO roles and other senior leadership positions, suggesting that intentional and sustained efforts can lead to meaningful results. Importantly, these practices are not only improving gender outcomes but also strengthening organizational performance. Evidence increasingly shows that diverse teams drive innovation, enhance decision-making, and improve employee retention—critical advantages in a fast-evolving digital economy.

In this broader context, the findings from the questionnaire carried out for this project reflect larger global patterns, especially in sectors where digitalization is advancing rapidly. While progress remains uneven, the growing body of good practices and performance-linked gender initiatives offers a roadmap for firms seeking to harness the full potential of their female workforce. Strengthening institutional support for women in high-skill, digitally delivered services is not only a matter of equity—it is also a business imperative.

PART III: WOMEN'S ENTREPRENEURSHIP IN DIGITALLY DELIVERED SERVICES-ORIENTED START-UPS: CASE STUDIES OF SUCCESS IN APEC

Introduction

Part III is designed to complement the two prior components of this study on ***Enhancing Women's Economic Empowerment in APEC through Greater Participation in High Skill Digitally Delivered Services*** carried out for the APEC Group on Services in 2024 and 2025. Part I analyzes the status of women's participation in the most dynamic and fastest growing digital services sectors of APEC economies and explores why women are not reaching gender parity in economic opportunity and participation in these sectors. Part II presents a private sector perspective on the issues that may be holding women back in realizing this objective, both in acceding to high skill employment in digital service activities and in advancing to more senior levels along their career path.

Part III narrows in more specifically on the experience of women-led firms in digitally delivered and AI-linked sectors. Its objective is to explore the unique pathways, challenges, enablers, and outcomes for women-led start-ups in these key service sectors in APEC economies, given the importance of the digital economy and of AI development and application as part of the delivery of these digitally delivered, high-skill services.

In particular, women-led start-ups in high-skill service sectors are increasingly engaging with digital tools to build scalable, innovative, and responsive business models. While not all are developing AI applications themselves, many are integrating off-the-shelf AI tools and other digital enablers into their operations, products, or service delivery strategies.

Highlighting these experiences will allow for a better understanding of how the barriers and challenges set out and analysed in Part I and discussed in Part II have been addressed by women entrepreneurs who have been able to succeed as producers and often as exporters in the regional and international market. This understanding also contributes to the relevance and applicability of the recommendations that are put forward to APEC economies as part of this project to facilitate progress towards achievement of greater equality of economic opportunity and enhanced women's empowerment in line with the objectives of the *La Serena Roadmap*.

Section I. Methodology and case selection

Part III focuses on women entrepreneurs in digitally delivered or AI-linked service sectors. As explained earlier in the study, these sectors are those which are growing most rapidly, require high levels of skill and innovation, and increasingly serve as engines of economic transformation in the APEC region. These services are not only among the most dynamic in terms of trade and employment but also offer some of the highest wages and most scalable business models. They

offer a greater opportunity to women to enhance their economic advancement and empowerment in a more sustainable and rapidly growing context over time.

The methodology followed in Part III consists of a set of 15 case studies on women-led start-ups from 11 APEC economies, selected to reflect geographic and sectoral diversity:

- North Asia (China, Chinese Taipei, Japan)
- Southeast Asia (Indonesia, Singapore, the Philippines, Thailand)
- Pacific (Australia, New Zealand)
- Latin America (Chile, Peru)

Profiles of these companies are contained in Part III – Appendix 1. Each case study is informed by structured interviews guided by a common questionnaire (Part III – Appendix 2), which covers founder motivation and background, business model and digital enablers, financing and support networks, gendered perceptions and constraints, as well as market orientation and measurable outcomes.

A cross-case thematic synthesis compares the experiences of these women start-up entrepreneurs to identify common enablers, recurring challenges, and critical inflection points. These findings provide evidence for actionable policy recommendations and offer insights for further research on how to foster a more inclusive and dynamic digital entrepreneurship ecosystem in APEC.

Section II. Digital and AI tools as enablers in service-oriented start-ups in APEC

Digital tools and AI are proving especially valuable for services-oriented start-ups by lowering entry costs, expanding market access, and improving service quality. For women entrepreneurs, they may also help navigate constraints related to time, mobility, and access to traditional networks.

Common applications include:

- *Customer-facing automation*: AI chatbots, voice assistants, and customer relations management tools streamline client engagement and scale communication.
- *Process efficiency*: Cloud computing, Enterprise Resource Planning systems, and AI-driven analytics help small teams manage inventory, logistics, and workflows.
- *Personalization and predictive capabilities*: In sectors like edtech and fintech, algorithms tailor offerings based on user behaviour and data analysis.
- *New content creation and services*: Generative AI and digital design tools are lowering production costs in marketing, media, and creative sectors.

- *Remote service provision*: Platforms and apps allow for the delivery of services across borders without the need for physical presence.

Access to these tools—often offered as "software-as-a-service" (SaaS)—means that even micro-enterprises can adopt sophisticated technologies without in-house development capacity.

Despite the democratizing potential of digital tools, women remain underrepresented in digital entrepreneurship, especially in AI-intensive ventures. A recent OECD study examining start-ups acknowledges that women-led start-ups are underrepresented compared to men in global start-up ecosystems with a persistent gender gap in entrepreneurship and the need for targeted support.[86] This is attributed to several factors, including difficulties in obtaining financing; lack of networks; regulatory challenges; skills and training inadequacies; cultural and societal norms; balancing professional with domestic responsibilities; and limited government support.

Research by the APEC Policy Support Unit on women-led start-ups reinforced these more general conclusions in the Asia Pacific context, indicating that fewer than 10% of startups in APEC economies are founded or co-founded by women. And this gap or underrepresentation is especially evident in technology-driven sectors, where the share of women founders is very low.[87] The five major barriers highlighted in the APEC PSU study that contribute to this entrepreneurial gap dovetail those in the OECD study, namely: inadequate access to finance; limited mentorship and networks; low representation in STEM; societal perceptions and mindsets; and legal and institutional barriers present in some APEC economies.

Particularly striking is the fact that

- Women account for just 22 per cent of AI professionals globally and even less in technical leadership roles.
- In the startup ecosystem, less than 3 per cent of global venture capital goes to all-women founding teams, and only a fraction of that is directed to AI or deep-tech firms.
- Even among digital start-ups, women often operate in sectors considered low-tech or low-growth, reinforcing gendered segmentation in entrepreneurship.

These disparities are not due to lack of ambition or potential. Research shows that women-led start-ups are more likely to target underserved populations, apply inclusive design principles, and exhibit higher capital efficiency. In fact, the APEC PSU study states that women-led startups often

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[86] OECD, *Start-up Asia: Chasing the Innovation Frontier*, 2025, https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/05/start-up-asia_b5817d26/a9b71040-en.pdf

[87] APEC Policy Support Unit, *Empowering Tomorrow: APEC Women Entrepreneurs in Start-Ups*, January 2025, https://www.apec.org/docs/default-source/publications/2025/2/225_psu-apec-women-in-startups.pdf?sfvrsn=76412711_1

The study notes that while the APEC region has experienced rapid growth in start-ups, women founded or co-founded startups remain a small fraction of the total created each year.

outperform men-led counterparts in revenue growth and export diversification.[88] Nonetheless, systemic biases in financing, digital skill development, platform visibility, and access to innovation ecosystems persist, particularly in emerging APEC economies.

The services sectors most relevant to this study—financial services, professional and business services, ICT, logistics, and creative content—are all undergoing rapid AI-driven transformation. However, a similar story is true for other sectors as well.

- In **fintech**, AI enables real-time credit scoring, fraud detection, and personalised financial products.
- In **edtech**, adaptive learning engines and AI tutors personalize learning journeys based on learner behaviour.
- In **health** and **logistics**, start-ups are deploying AI for diagnostics, routing optimization, and supply chain visibility.
- In **creative sectors**, generative AI tools support content generation, translation, and targeted digital marketing.

Several APEC economies, including Canada, Chile, New Zealand, the Republic of Korea, and Singapore, have introduced domestic AI strategies or startup frameworks that explicitly aim to foster entrepreneurship and innovation. However, very few of these explicitly adopt gender-responsive innovation policy tools or track women's participation in AI and digital startup ecosystems.

Section III. Case studies of women-led startup firms: Overview of findings

The in-depth interviews conducted with fifteen women-led digital and AI-focused firms across eleven APEC economies provide rich insights into entrepreneurial journeys shaped by technology, innovation ecosystems, and gendered contexts. The Interviews were carried out along the five interlinked dimensions below (see more details on this in Part III – Appendix 2):

A. Firm Profiles and Market Orientation

Women-led start-ups in digitally delivered services are typically small, agile, and global from inception. Most have fewer than 15 employees yet export services to multiple APEC markets.

[88] Specifically, the PSU study cites an impressive statistic, namely that women-led startups in the APEC region generate about 10 per cent more cumulative revenue over five years and provide higher returns per dollar invested, with 78 cents in revenue per dollar versus 31 cents for male-led ventures. Ibid.

Their strength lies in rapid scalability enabled by cloud-based tools and digital networks rather than physical expansion. Many operate across borders virtually—delivering logistics optimization (TOPLOGIS), digital credentials (Accredify), or inclusive fintech solutions (xcube.co).

B. Founders' Background and Motivation

Interviewees commonly cited three motivational strands: (i) personal experience of exclusion from mainstream opportunities; (ii) desire to solve a social or economic problem; and (iii) passion for technology and innovation. Most founders possess tertiary degrees—many in STEM or business—but fewer have formal AI training. Instead, they upskilled through accelerators or online certifications.

C. Digital Enablers and AI Integration

Digital platforms—especially SaaS, APIs, and cloud services—were essential to all firms studied. AI adoption patterns vary: some firms integrate AI as a core product (MACSO, Theodora, Neurofrog), while others deploy AI for efficiency and content generation (Techsauce, ANGO Ventures). Access to accelerators and digital skills programs was often decisive for early survival and credibility.

D. Financing and Ecosystem Support

Access to finance remains the most persistent barrier. Fourteen of fifteen founders relied on self-funding, grants, or women-focused investor circles in early stages. Commercial bank loans were rare due to limited collateral and gender bias. Government grants and public–private accelerators filled critical gaps (e.g., Queensland co-investment, NIA Thailand).

E. Gender-Specific Experiences and Inclusion Policies

Interview evidence reaffirms that gendered barriers remain systemic. Women founders often face credibility questions, exclusion from male-dominated networks, and unequal investor treatment. Yet, their firms are also pioneers in creating inclusive workplaces. (See also Box 1).

Box 1. Gendered Barriers and Inclusion Strategies in Women-Led Digital Start-ups

Access and credibility bias in financing: Many women founders reported being challenged to prove their competence or questioned about family commitments during fundraising rounds. Examples include ***Beyond the Clinic*** and ***MACSO***. ***xcube.co*** and ***TOPLOGIS*** whose founders described the necessity to develop alternative investor circles and blended-finance routes to bypass systemic barriers.

Invisible exclusion from social capital and networks. Informal networks remain gatekeepers for funding and partnerships. Late-night meetings, golf outings, and male-dominated tech events exclude

many women entrepreneurs. Firms like ***Noburo*** and ***Mindset Global*** responded by establishing peer-based professional networks.

Symbolic versus substantive support: Numerous founders criticised token "women-in-tech" initiatives that provide visibility but no financing. ***Beyond the Clinic*** and ***QBO Innovation*** stressed that measurable funding and follow-up mechanisms are what distinguish impactful interventions.

Inclusive workplaces as innovation enablers: Inclusive firms display higher retention, creativity, and resilience. Companies like ***QBO***, ***Techsauce***, and ***TOPLOGIS*** show that flexible arrangements and equitable promotion policies strengthen productivity.

Emerging shifts: A new generation of women entrepreneurs in the APEC region is redefining "success" to include impact metrics, AI ethics, and social value.

Section IV. Comparative summary: Patterns emerging from the case studies

The four comparative tables collectively illustrate how women-led firms in APEC harness digitalization and artificial intelligence to expand markets, pursue social impact, and overcome financing and credibility barriers.

The four comparative tables present a synthesis of evidence on the fifteen women-led firms operating across eleven economies in the APEC region. The tables were developed from information obtained in interviews with these firms and cross-checked through desk research. The tables translate diverse qualitative insights into a structured analytical framework.

Each table captures a distinct dimension of women's digital entrepreneurship:

- **Table 1** profiles company characteristics and market reach, illustrating the structural diversity of the sample;
- **Table 2** examines motivations, revealing how profit and purpose often intersect in women-led service ventures;
- **Table 3** maps common challenges faced by these start-up firms to access finance, gain credibility, and obtain institutional support;
- **Table 4** explores the depth and breadth of AI and digital integration across the 15 firms and diverse sectors.

Taken together, the tables trace a consistent pattern: **digitalization and AI adoption are not peripheral but central to how women entrepreneurs build competitive advantage, social impact, and resilience**. They also demonstrate that inclusive innovation depends very much as well on access to finance and networks,

1. Companies' profiles and market reach

Method Note

Information for Table 1 was drawn from company interviews and verified against public data (company websites, LinkedIn, accelerator listings, press coverage). "**Years in operation**" were calculated as 2025 minus the founding year. "**Employment**" numbers include both full-time and contract staff; where only ranges were given, figures were rounded to the nearest five. "**Percentage of women**" covers total staff unless founders specified management ratios. "**Exports"** capture both cross-border sales of digital products and the international client base served remotely.

Table 1: Company Profiles and Market Reach

Company	Founded (Year)	Years in Operation	Employees (approx.)	Women Employees (%)	Export to Foreign Markets
Accredify (Singapore)	2018	7	≈30	n/a	Yes – APAC; UAE
ANGO Ventures (Indonesia)	2016	9	n/a (network of 85–87 investors)	Focus on women-led firms	Yes – Regional (ASEAN, EU, India, Japan)
Bespoke Inc. (Japan)	2015	10	≈49	55%	Yes – Europe & North America (services export)
Beyond the Clinic (Australia)	2021	4	12 (4 full time plus 8 contractors)	n/a	Yes – Australia & New Zealand; global partner
Laboratoria (Peru)	2014	11	≈40	n/a	Yes – Cross-border digital delivery across LATAM
MACSO (New Zealand)	2021	4	8	n/a	Yes – 11 overseas markets
Mindset Global Partner (Chile)	2020	5	n/a	n/a	Yes – LATAM-wide programs

Neurofrog (New Zealand)	2020	5	n/a	Female-majority	Planned ASEAN expansion
Noburo Platform (Thailand)	2018	7	20	Balanced mix; 70% female users	Potential regional expansion
QBO Innovation (Philippines)	2016	9	12	≈75%	≈5% of supported start-ups internationalize
Qiliang Digits (China)	2020	5	n/a	n/a	Yes – EU/NA/SEA/LATAM
Techsauce (Thailand)	2015	10	≈70	60–65%	Yes – Summit exports; events in VN & ID
Theodora (Chile)	2022	3	7	n/a	Yes – Multinational clients
TOPLOGIS (Chinese Taipei)	2004	21	≈50	≈70% (80% of managers)	Yes – Clients in US/CN/SG/JP (≈20%)
xcube.co (Singapore)	2023	2	10 core plus contractors	More women than men	Yes – SEA & GCC

Analysis

1. The 15 firms form a representative, although heterogeneous, slice of women-led and women-inclusive digital entrepreneurship across APEC. Size and maturity vary sharply between the firms —from early-stage ventures of fewer than 10 employees to established regional platforms exceeding 70 staff. Most firms, however, average around 6 to 10 employees. Roughly two-thirds have already accessed foreign markets and operate in fully digitalized service-exporting modes, illustrating the important point that even small start-ups can internationalize through digital delivery.

2. Sectoral diversity is striking. The sectors of health-tech, fintech, digital education, logistics, and AI consulting dominate, but each one demonstrates how women entrepreneurs leverage digital tools to reach global markets from small domestic bases. The overall profile confirms that digitalization has become both the entry point and equalizer for women-led firms in services.

2. Founders' motivation and mission orientation

Method Note

Motivations were classified into three non-exclusive categories based on self-descriptions and company missions as explained by the founders (see Table 2):

- ***Social enterprise***: combines market activity with explicit social or environmental goals.
- ***Non-profit***: registered or operating as a non-profit or trust entity.
- ***Profit-making***: commercial venture with market-rate returns as its main goal. Hybrid cases (e.g., profit-making firms with impact missions) were ticked in multiple columns. Qualitative notes capture the specific balance between financial and social objectives.

Table 2: Motivation and Mission Orientation

Company	Social Enterprise	Non-profit	Profit-making	Notes
Accredify (Singapore)			✓	Mission-driven trust infra; VC-backed
ANGO Ventures (Indonesia)	✓		✓	Women-focused investment fund; profit + impact hybrid
Bespoke Inc. (Japan)	✓		✓	Social mission (crisis info; migrant worker training) with commercial model
Beyond the Clinic (Australia)	✓		✓	Health impact + commercial growth
Laboratoria (Peru)	✓	✓		Non-profit, impact-first; diversified revenue
MACSO (New Zealand)			✓	Deep tech venture; sustainability mission
Mindset Global Partner (Chile)	✓		✓ (B-type)	B-type company; inclusion & ethical AI
Neurofrog (New Zealand)	✓		✓	Science-driven parenting; commercial with mission
Noburo Platform (Thailand)	✓		✓	Hybrid social enterprise/startup

QBO Innovation (Philippines)	✓	✓		Public–private innovation hub (grant-funded)
Qiliang Digits (China)			✓	Profitable; cross-border SaaS/services
Techsauce (Thailand)			✓	Ecosystem enabler; profitable
Theodora (Chile)	✓		✓ (pre-profit)	Bias reduction tech; grant/clients funded
TOPLOGIS (Chinese Taipei)			✓	Logistics SaaS; profitable since 2014
xcube.co (Singapore)	✓ (DEFY inclusive finance)		✓	Venture studio; bootstrapped

Analysis

1. Across the sample, **profit and purpose coexist rather than being in conflict**. Roughly half the firms are structured as profit-making businesses but pursue clear inclusion or sustainability aims; one-third identify explicitly as social enterprises; and a smaller subset (Laboratoria, QBO) operate formally as non-profits, with only a couple of firms operating for profit only. For many firms, profit is viewed as the means to scale impact rather than its opposite.

2. A strong **mission orientation** cuts across categories. Founders commonly cite similar areas of difficulty they have experienced—financial exclusion, gender bias, lack of digital skills, or misinformation—as catalysts for innovation.

This **hybrid** motivation pattern is consistent with the new generation of "impact tech" entrepreneurship in APEC: ventures seek both market viability and measurable contribution to social or gender goals. The evidence also shows that women founders frequently embed inclusion values in business models from inception and define these as part of the firm's core mission rather than include such values retroactively to satisfy investors or CSR expectations.

3. Challenges and enablers

Method Note

Each challenge category was coded "✓" only when directly mentioned by the interviewee. Sub-categories follow a standardized interpretation (see Table 3):

- Seed capital = difficulty obtaining early-stage or angel investment.
- Commercial loans = bank or institutional credit barriers.
- Government grants = applications to public funding or co-investment programs.
- Private–public accelerator = participation in incubators, PPPs, or regulatory sandboxes.
- Discrimination = gender, age, or network bias affecting funding or market access.
- Convincing on novel idea = scepticism toward innovation, sector unfamiliarity, or need for proof-of-concept.

Table 3: Challenges and Enablers

Company	Access to Seed Capital	Access to Commercial Loans	Access to Government Grants	Private–Public Accelerator	Discrimination (gender/systemic)	Issues with Convincing on Novel Idea
Accredify (Singapore)	✓ (investors chase trends)		✓ (overseas expansion grants)		— (leader reports no gender bias)	✓ (market pivot/education)
ANGO Ventures (Indonesia)	✓ (initial capital own + women investors)			✓ (investor networks, community ecosystem)	✓ (credibility as woman fund manager; systemic bias)	✓ (convincing SMEs to digitalize reporting)
Bespoke Inc. (Japan)	✓ (woman founder in JP capital market)				✓ (gender/capital barriers in JP)	✓ (trust/adoption; multilingual nuance)
Beyond the Clinic (Australia)	✓ (sold home; angels)		✓ (Queensland co-investment)		✓ (bias in fundraising; client meetings)	✓ (healthcare validation)
Laboratoria (Peru)						✓ (corporate inclusion practices, recognition)
MACSO (New Zealand)	✓ (bias during fundraising)			✓ (deep tech incubator)	✓ (gender/age bias in AgTech)	✓ (new sensory AI in agriculture)
Mindset Global Partner (Chile)	✓ (self-financed; access to finance programs)			✓ (regional networks, challenges)	✓ (gender biases; unpaid care burdens regionally)	✓ (market positioning beyond 'for women')

Neurofrog (New Zealand)	✓ (underinvestment; conservative risk)		✓ (Callaghan R&D grant)	✓ (accelerators: NewChip, HealthTech Activator)	✓ (systemic undervaluation of care/parenting tech)	✓ (AI-native parenting; education of investors)
Noburo Platform (Thailand)	✓ (scaling vs resources)		✓ (NIA, DEPA, SET support)	✓ (DTAC, NIA, DEPA, SET)	✓ (exclusion from male networks)	✓ (behaviour-change model credibility)
QBO Innovation (Philippines)	✓ (nonprofit capacity underfunded)		✓ (donor-funded programs)	✓ (PPP hub)		✓ (ecosystem maturity; tracking outcomes)
Qiliang Digits (China)						✓ (educating investors on 'tech' vs 'services')
Techsauce (Thailand)			✓ (grants alongside VC)	✓ (accelerators/hackathons)	— (reports respectful treatment)	✓ (AI use acceptance; IP/copyright caution)
Theodora (Chile)	✓ (self-financed; grants/prizes)		✓ (public grants/prizes)	✓ (competitions/incubators)	✓ (structural gender bias; legal sector resistance)	✓ (pivot from legal to broader sectors)
TOPLOGIS (Chinese Taipei)	✓ (rejections from banks)	✓ (bank financing rejections)		✓ (investor networks; later stage)	✓ (gender bias from investors)	✓ (cloud logistics before mainstream)
xcube.co (Singapore)	✓ (bootstrapped; fundraising barriers)			✓ (regulatory sandbox PPP)	✓ (male-dominated networking; panel bias)	✓ (alt risk scoring; inclusion tech)

Analysis

1. **Financing hurdles dominate**. Fourteen of fifteen firms faced obstacles securing seed capital; many relied on self-funding or women-only investor circles. Access to commercial loans was rare, while targeted **government grants and PPP accelerators** (e.g., Queensland Investment, DEPA Thailand, Callaghan Innovation NZ) played outsized roles in the early survival of several firms.

2. **Gender bias persists but is context-specific**. Roughly two-thirds of the women founders reported explicit or implicit discrimination—from investors questioning competence to exclusion from male-dominated networks. A small minority (Accredify, Techsauce) encountered little bias, reflecting supportive ecosystems in more mature digital markets.

3. A recurring theme is the **credibility gap for novel ideas**: deep-tech or social-impact start-ups often had to prove both technical feasibility and commercial logic to sceptical funders. Accelerators and public-private incubators mitigated these barriers by providing validation and networks.

4. Overall, the pattern underscores that **finance and recognition**, not technology capability, remain the main constraints for women-led start-up digital firms. Where institutional support exists, success rates rise sharply. This suggests high latent potential for such firms, and an area where the impact of government and other accelerators could be very significant.

4. Patterns of AI and digital adoption

Method Note

Table 4 classifies the 15 profiled companies according to how deeply artificial intelligence (AI) and other digital technologies are embedded in their business models and delivery systems. The classification developed draws on detailed interview responses, company documents, and desk research on each firm's technology stack and market orientation.

The "**coding principles**" adopted to classify entries are the following:

- **AI Intensity** distinguishes between three levels of integration:
  • *Core* – AI constitutes the firm's main product or differentiating capability (e.g., MACSO, TOPLOGIS, Theodora).
  • *Partial* – AI supports internal processes or customer engagement but is not central to the product (e.g., Techsauce, QBO, and Noburo as Partial/Core hybrid).
  • *Limited / Not stated or emphasized* – AI use mentioned only peripherally.

  Although the coding framework allowed for "core," "partial," and "limited" levels of AI or technology use, none of the 15 profiled firms were classified as "limited." All firms operate in digitally delivered environments where at least partial AI or advanced technology integration is present.

- **Digital Delivery Model** records how products and services reach clients: Virtual, Hybrid, or Physical + Digital.
- **Digital Technologies Used** lists the key platforms, infrastructure, or software categories identified by respondents.
- **AI Applications Used** describes the specific AI functions (e.g., risk scoring, bias detection, conversational agents).

Data treatment

Where companies cited proprietary or branded tools, the functions were described generically (e.g., "AI risk scoring" rather than a trademarked algorithm). References to the use of Cloud, API, and analytics references are consolidated under "digital technologies." Each entry was validated through at least one public source (website, press release, or investor brief).

Limitations

AI adoption levels are self-reported and may vary in technical depth. The distinction between "core" and "partial" integration is qualitative, based on interview evidence rather than formal R&D metrics. Some smaller firms did not disclose full technical architectures for confidentiality reasons.

Interpretation

Table 4 provides a comparative snapshot of AI depth and digital breadth across the sample. It reveals that AI integration is nearly universal among women-led and women-inclusive firms in digital services, but the nature of its use—product-embedded versus operational—varies by sector, maturity, and financing environment.

Table 4: Patterns of AI and Digital Adoption

Company	AI Intensity	Digital Delivery Model	Digital Technologies Used	AI Applications Used
Accredify (Singapore)	Core – AI integrated with blockchain credentialing	SaaS / cloud platform	Blockchain, cloud services, verification APIs	Automated credential verification, doc authentication
ANGO Ventures (Indonesia)	Partial – AI tools for investment ops	Virtual network platform	Cloud-based data systems; HR platforms	AI for proposal screening; HR analytics; content drafting
Bespoke Inc. (Japan)	Core – Conversational AI (NLP)	Fully digital / B2B service export	Chatbots, multilingual NLP, analytics dashboards	Real-time customer engagement; multilingual training data

Beyond the Clinic (Australia)	Core – AI in product	Fully virtual	Low-code platform, API integration, telehealth tools	Vision-based vitals detection; workflow automation; transcription
Laboratoria (Peru)	Partial – AI for operations /training	Fully online (LMS- based education)	Proprietary ed-tech platform, CRM, analytics	Admissions scoring; learner tracking; AI basics training
MACSO (New Zealand)	Core – Edge AI & Tiny ML	Hybrid (devices + SaaS)	IoT sensors, edge computing devices	On-device audio for disease detection; environmental AI
Mindset Global Partner (Chile)	Core – AI products & leadership	Virtual consulting & training	SaaS tools; collaboration platforms	ALIPA (SME trade); InspirIA (AI Leadership); Ethical AI diagnostic
Neurofrog (New Zealand)	Core – AI-native service	Fully digital app + cloud architecture	AWS cloud, MongoDB, micro-services	Conversational assistant; AI orchestration; synthetic media
Noburo Platform (Thailand)	Partial/Core – AI in finance education	Hybrid (offline + app)	Mobile app; gamified learning systems	AI-driven debt planning; behaviour scoring
QBO Innovation (Philippines)	Partial – AI for operations	Fully digital ecosystem hub	Video conferencing platforms, CRM, Slack	GenAI (ChatGPT/Gemini) for admin, content support
Qiliang Digits (China)	Core – AI application innovator	SaaS / global platform	Cross-border SaaS; cloud integration	Market monitoring; automated decision support; ad optimization
Techsauce (Thailand)	Partial/Core – AI for content/events	Hybrid (events + media)	Event management platform; LMS; Google Cloud	AI translation; video storyboarding; content generation
Theodora (Chile)	Core – Patented AI technology	Fully digital SaaS	Social listening tools; data collection app	Bias detection in text/image/video; reputational risk analysis
TOPLOGIS (Chinese Taipei)	Core – AI in supply chain	SaaS / cloud logistics	Cloud integration platform; data exchange API	Automated customs docs (~95%); predictive analytics

xcube.co (Singapore)	Core – AI for fintech innovation	Digital consulting + PPP platforms	Blockchain; APIs; data analytics stack	AI risk scoring; behavioural analysis; real-time KYC

Analysis

Fifteen women-led enterprises across eleven APEC economies demonstrate the rapid diffusion of artificial intelligence (AI) and digital technologies into service-sector entrepreneurship. Their experiences reveal four main patterns.

1. **AI roles diversify by business function**. Roughly two-thirds of the sample of 15 firms are AI-core firms—those whose products depend directly on machine learning, natural-language processing, or computer-vision technologies (e.g. MACSO, Neurofrog, TOPLOGIS, Theodora). Others are AI-enabled, using generative or analytic tools to enhance operations (e.g. Techsauce, QBO Innovation, ANGO Ventures). Even social enterprises now employ AI in fundraising, HR, and evaluation functions, showing that AI's utility is no longer confined to technology companies.

2. **Digital delivery is universal; AI intensity varies**. All firms operate on cloud or SaaS architectures. About half deliver entirely online, while others combine digital and face-to-face channels (hybrid learning, health services, or events). Some have moved from face-to-face delivery to primarily or entirely online delivery at present, increasing their use of digital and AI technology to do so. AI intensity correlates loosely with age: younger firms (post-2020) tend to be AI-native, whereas older digital platforms integrate AI incrementally to remain competitive.

3. **Gender inclusion and AI complement each other**. Women founders frequently position AI as a tool to correct bias—through fair-credit scoring, inclusive hiring algorithms, or bias-detection in media and law. (Example: Theodora; other?). Yet many still face gendered barriers in finance and credibility, forcing them to bootstrap or rely on peer networks. Firms such as TOPLOGIS and QBO show that internal gender parity combined with digital flexibility can yield strong retention and innovation outcomes.

4. **Sectoral convergence and policy relevance**. AI use cuts across health diagnostics, financial inclusion, logistics, and education. Despite different industries, similar needs emerge from these small, women-led firms: affordable cloud access, ethical-AI guidance, and female participation in STEM and digital-finance ecosystems. Targeted support—grants for women-led AI pilots, gender-responsive accelerators, and cross-border regulatory sandboxes—could significantly expand this cohort's contribution to inclusive digital trade.

In sum, AI is in evidence in these case studies as both a product as well as an enabler for women entrepreneurs in services. The challenge ahead as expressed in the interviews is to scale inclusion, trust, and transparency at the same pace as technological adoption, while providing adequate support for start-up financing.

Section V. Recommendations based on case studies

The case studies presented in this part highlight the progress and persistent gaps in women-led digital entrepreneurship across APEC. While all profiled firms operate in high-skill, digitally delivered services and most have achieved regional market reach, their experiences reveal consistent patterns: (i) dependence on self-funding and limited access to risk capital, (ii) under-representation in accelerator pipelines and AI-intensive innovation programs, (iii) uneven visibility in government startup frameworks, and (iv) the importance of peer networks and inclusive workplaces as enablers of success. Based on this evidence, the following recommendations aim to strengthen the enabling environment for women-led digital and AI-linked start-ups in APEC economies.

For APEC economies and policymakers

- Embed **gender-responsive innovation targets** within domestic AI, digital-economy, and startup policies—reflecting the finding that only a few APEC economies currently do so.
- Ensure **public grant and co-investment schemes** (such as DEPA Thailand, Callaghan NZ) include dedicated windows for women-led digital firms.
- Establish **cross-border accelerator and sandbox partnerships** under PPSTI–PPWE–GOS to help women-founded start-ups scale regionally.
- Support **digital-skills upskilling and re-skilling** programs for mid-career women entering AI-enabled services.
- Provide **scholarships and fellowships** for women in STEM and digital business disciplines aligned with AI-intensive services.

For financial institutions and ecosystem enablers

- Require **gender-disaggregated investment data** from VC funds, incubators, and accelerators operating in APEC economies.
- Expand **gender-lens investing and blended-finance mechanisms** proven to bridge early-stage capital gaps in the cases studied.
- Incentivize banks and impact-funds to **recognize digital assets and IP** as acceptable collateral for women-founded service firms.
- Foster **public–private partnerships** between mainstream accelerators and women-specific networks (e.g., replication of QBO Innovation's model).

For APEC fora and regional cooperation (GOS–PPWE–PPSTI)

- Launch an **APEC Inclusive Innovation Fellowship** for women founders focusing on AI-linked services.
- Develop an **APEC dashboard** tracking women's participation in digitally delivered and AI-intensive service start-ups, drawing on PSU methodology.

- Curate and disseminate a **Good-Practice Toolkit** showcasing accelerator models, financing solutions, and inclusive workplace strategies from the 15 case studies.

Convene periodic **policy-practice dialogues** between women entrepreneurs and regulators to monitor progress and emerging barriers.

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Appendices

Part I – Appendix 1: Overall Global Gender Gap Index for APEC Economies, 2006 – 2024

Economy	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022	2023	2024
Australia	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.74	0.74	0.73	0.72	0.73	0.73	0.73	0.73	0.74	0.778	0.78
Brunei Darussalam			0.64	0.65	0.67	0.68	0.68	0.67	0.67	0.68	0.67	0.67	0.69	0.69	0.68	0.68	0.693	0.68
Canada	0.72	0.72	0.71	0.72	0.74	0.74	0.74	0.74	0.75	0.74	0.73	0.77	0.77	0.77	0.77	0.69	0.77	0.76
Chile	0.65	0.65	0.68	0.69	0.7	0.7	0.67	0.67	0.7	0.7	0.7	0.7	0.72	0.72	0.72	0.74	0.777	0.78
China	0.66	0.66	0.69	0.69	0.69	0.69	0.69	0.69	0.68	0.68	0.68	0.67	0.67	0.68	0.68	0.68	0.678	0.68
Indonesia	0.65	0.66	0.65	0.66	0.66	0.66	0.66	0.66	0.67	0.68	0.68	0.69	0.69	0.7	0.69	0.7	0.697	0.69
Japan	0.64	0.65	0.64	0.64	0.65	0.65	0.65	0.65	0.66	0.67	0.66	0.66	0.66	0.65	0.66	0.65	0.647	0.66
Korea, Rep.	0.62	0.64	0.62	0.61	0.63	0.63	0.64	0.64	0.64	0.65	0.65	0.65	0.66	0.67	0.69	0.69	0.68	0.7
Malaysia	0.65	0.64	0.64	0.65	0.65	0.65	0.65	0.65	0.65	0.66	0.67	0.67	0.68	0.68	0.68	0.68	0.682	0.67
Mexico	0.65	0.64	0.64	0.65	0.66	0.66	0.67	0.69	0.69	0.7	0.7	0.69	0.72	0.75	0.76	0.76	0.765	0.77
New Zealand	0.75	0.76	0.79	0.79	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.79	0.8	0.8	0.84	0.84	0.856	0.84
Papua New Guinea														0.64	0.64			
Peru	0.66	0.66	0.7	0.7	0.69	0.68	0.67	0.68	0.72	0.68	0.69	0.72	0.72	0.71	0.72	0.75	0.764	0.76
Philippines	0.75	0.76	0.76	0.76	0.77	0.77	0.78	0.78	0.78	0.79	0.79	0.79	0.8	0.78	0.78	0.78	0.791	0.78
Russian Federation	0.68	0.69	0.7	0.7	0.7	0.7	0.7	0.7	0.69	0.69	0.69	0.7	0.7	0.71	0.71			
Singapore	0.66	0.66	0.66	0.67	0.69	0.69	0.7	0.7	0.7	0.71	0.71	0.7	0.71	0.72	0.73	0.73	0.739	0.74
Thailand		0.68	0.69	0.69	0.69	0.69	0.69	0.69	0.7	0.71	0.7	0.69	0.7	0.71	0.71	0.71	0.711	0.72
United States	0.7	0.7	0.72	0.72	0.74	0.74	0.74	0.74	0.75	0.74	0.72	0.72	0.72	0.72	0.76	0.77	0.748	0.74
Viet Nam		0.69	0.68	0.68	0.68	0.67	0.69	0.69	0.69	0.69	0.7	0.7	0.7	0.7	0.7	0.7	0.711	0.72

Note: 100%=gender parity, 0%=maximum gender disparity; no data for 2019

Source: Data extracted from WEF Global Gender Gap Report | Download Dataset (downloaded January 2025).

Part I – Appendix 2: Global Gender Gap, by Sub-indices, APEC, 2006 – 2024

Subindexes	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022	2023	2024
Overall Global Gender Gap Index	0.68	0.68	0.69	0.69	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.71	0.71	0.71	0.72	0.72	0.73	0.73
Global Gender Gap Economic Participation and Opportunity Subindex	0.63	0.65	0.65	0.66	0.67	0.67	0.68	0.68	0.69	0.70	0.68	0.68	0.69	0.70	0.70	0.70	0.71	0.70
Global Gender Gap Political Empowerment subindex	0.13	0.13	0.14	0.15	0.16	0.16	0.15	0.15	0.17	0.17	0.17	0.19	0.20	0.20	0.22	0.25	0.28	0.27
Global Gender Gap Health and Survival Subindex	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Global Gender Gap Educational Attainment Subindex	0.98	0.97	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.99	0.97

Note: 100%=gender parity, 0%=maximum gender disparity; no data for 2019

Source: Data extracted from WEF Global Gender Gap Report | Download Dataset (downloaded January 2025).

Part I – Appendix 3: Ratio of Female to Male Labor Force Participation Rate (%) (modelled ILO estimate) for APEC Economies, 2013–2023

Economy	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Australia	82.23	82.69	83.15	84.07	84.67	85.29	85.73	85.97	86.68	86.26	86.20
Brunei Darussalam	76.73	77.94	79.21	80.57	82.00	78.79	75.55	75.69	76.61	75.54	76.25
Canada	87.72	87.23	86.71	87.21	87.63	88.03	87.66	86.70	87.07	88.14	88.20
Chile	66.53	67.64	67.54	67.44	68.15	69.64	70.58	67.29	67.74	70.97	72.80
China	82.17	82.42	82.68	82.96	83.27	83.61	83.92	83.74	84.79	84.14	83.95
Hong Kong, China	78.74	79.25	79.53	79.88	80.69	80.50	81.51	81.92	82.42	81.77	81.81
Indonesia	61.17	61.23	61.56	62.31	63.71	64.60	65.31	65.15	65.30	64.46	65.03
Japan	69.24	69.91	70.38	71.35	72.44	73.67	74.65	74.40	75.09	75.91	76.67
Korea	69.09	69.92	70.57	71.02	71.67	72.16	73.16	73.10	73.82	74.72	76.05
Malaysia	62.95	64.46	64.87	65.37	65.89	66.07	66.09	65.96	66.60	66.14	66.18
Mexico	56.04	54.93	55.63	55.90	55.45	56.13	58.04	57.17	57.81	59.12	60.49
New Zealand	85.06	85.29	85.19	85.56	85.65	86.25	87.24	86.41	87.46	88.17	88.02
Papua New Guinea	97.24	96.92	96.83	96.76	96.74	96.78	96.72	96.72	97.56	96.55	96.52
Peru	81.98	81.58	80.26	81.42	81.88	82.52	82.56	76.57	81.88	83.62	82.87
Russia	78.68	78.39	77.92	77.85	77.73	78.10	78.23	78.54	78.47	79.08	78.86
Singapore	76.17	77.39	78.61	79.15	78.47	79.08	80.28	80.62	82.66	81.30	80.89
Thailand	78.61	78.19	78.40	78.28	77.96	77.94	78.16	78.47	78.74	78.80	78.30
The Philippines	64.56	65.02	65.38	64.02	61.27	62.62	64.15	63.62	64.05	64.12	64.59
United States	81.93	82.18	81.92	81.93	82.44	82.54	82.97	82.99	82.91	83.25	83.86
Viet Nam	88.97	89.01	88.18	88.34	88.13	86.93	86.98	85.97	87.66	88.05	88.03
APEC Average	76.29	76.58	76.73	77.07	77.29	77.56	77.98	77.35	78.27	78.51	78.78

ource: ILO, Statistics on women - ILOSTAT (downloaded October 2024)

Labor force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labour for the production of goods and services during a specified period. Ratio of female to male labour force participation rate is calculated by dividing female labour force participation rate by male labour force participation rate and multiplying by 100. Closer to 100=more equality, further away from 100= greater disparity

Part II – Appendix 1: APEC GOS Agenda at SOM2 2025

Agenda from the APEC Group on Services Private Public Dialogue on Challenges and Opportunities for Women's Participation in High-Skill, Digitally Delivered Services in APEC

GOS PRIVATE PUBLIC DIALOGUE ON CHALLENGES AND OPPORTUNITIES FOR WOMEN'S PARTICIPATION IN HIGH SKILL, DIGITALLY DELIVERED SERVICES IN APEC

09:00 – 9:10	**Welcome Remarks**
	Christine Schaeffer, Assistant Director, APEC Trade and Investment Section, Australian Department of Foreign Affairs and Trade (DFAT) *The Public Private Dialogue (PPD) will focus on advancing the economic empowerment of women in APEC through addressing the challenges and opportunities of their greater participation in the dynamic growth sectors of high skill, digitally delivered services. The PPD will also provide input into the formulation of recommendations for how APEC economies can best help to progress this objective in different areas through relevant supportive policies in both the public and private sector. This PPD and its outcome constitute steps towards carrying out the key areas of the Action Plan contained in La Serena Roadmap for Women and Inclusive Growth endorsed by APEC Senior officials in December 2019 in Chile. It also supports one of the Republic of Korea's three main policy priorities for APEC 2025, namely digital innovation and transformation essential for accelerating sustainable and inclusive growth*
09:10 – 10:00	**Session 1: Barriers holding women back in high skill, digitally delivered services**
	Moderator: Sherry Stephenson, Member, Pacific Economic Cooperation Council (PECC) Services Network *The digital revolution is reshaping the global services landscape, creating new avenues for trade and employment. Among these, digitally delivered services (DDS) have emerged as the fastest-growing and most dynamic component of the global economy, offering unprecedented opportunities for innovation and economic growth. However, despite the transformative potential of DDS, women across APEC economies continue to face significant barriers that limit their participation and potential as key contributors to this growth. This session discusses existing gaps in women's participation and the reasons behind these in the three high-skill service sectors of focus, from the perspective of executives from these sectors.* Speakers: **Silvia Lara,** Gender Research Lead, LinkedIn Economic Graph Research Institute, Singapore ➢ General overview of main barriers holding women back in the digitally intensive, high skill service sectors

Hanna Norberg, Founder and Principal, TradeEconomista; Initiator and President TradeExperettes, Co-founder TPRForum

- Perspective from professional (consulting) services sector

Grace Gown, Head of Global Public Policy, Xero, Australia

- Perspective from financial services sector

Winifred Kula, President of the PNG ICT Digital Cluster and Founder eNovaX solutions, Papua New Guinea

- Perspective from information technology services sector

Views will be sought on the following questions:

1. *How important is the area of digitally intensive services for women's greater participation in trade and their economic future?*
2. *The background paper discusses several reasons behind the current economic gender equality gaps in the APEC region in the area of high skill, digitally delivered services. What has contributed to these gaps, and how costly have they proven to your operations?*
3. *What might be the benefits of greater women's participation in the digitally intensive service sector of your focus? And how this might have a positive impact not only on women but on society and economic performance and trade.*
4. *What are the main actions or programmes of support that you would ask from governments to allow women to better realize their potential through playing a bigger role in the growth area of digitally intensive services?*

10:00 – 10:40	**Session 2: Women in high-skill digital services: Addressing skills, access, and inclusion challenges**

Moderator: Dr. Mia Mikic, Research Associate, Waikato University, New Zealand

While more women work in services in the APEC region than in manufacturing and agriculture, the proportion of women in the highly skilled services jobs that demand digital skills is much less than that of men, particularly for managers and technicians/ associate professionals. The study suggests that there is a "digital equality gap" that is in part responsible for this, characterized by a skills mismatch for digital, financial and managerial jobs created by fewer numbers of women STEM graduates (less than one-third in APEC), and women's unequal access to training and digital tools and infrastructure. This session discusses these issues, along with other barriers (access to capital, cultural and attitude, and regulatory barriers) and the challenge of informality that impede women's greater participation in these services

Speakers:

Joana Valente, Partner in Technology and Transformation, Deloitte, Australia

- Enhancement of digital skills for women in high tech professions

Samar Alrayyes, Co-Chair, TechWomen, New Zealand

- Tackling structural and institutional barriers

Steven Tobin, ILO, Bangkok

- Challenges in converting informality into the formal economy

Discussion with panel and participants

11:10 – 11:50	**Session 3: Artificial Intelligence and its impact on women in services**
	Moderators: Sherry Stephenson and Mia Mikic
	AI is being adopted faster than PCs or the Internet were in the previous technological revolutions. Data from many sources indicate that by the year 2030, there will be a seismic shift in job skill requirements as AI accelerates change in the workplace, and particularly in the services area. It is unclear at present what type of impact AI technologies will have on women. What is clear is that ingrained attitudes and biases exist in the development and application of AI tools, which may influence women's ability to apply these. This session will discuss these issues and offer insights not only into the rapidity of technological change but also into what types of education and professional skills will be needed by women to be able to participate and thrive in the future in high skill, digitally delivered service sectors. Speakers: **Peter Lovelock,** Head of Fair Tech Policy, Access Partnership, Singapore ➢ Inherent biases in the creation of AI tools **Gareth Tan,** Associate Director and Technology Lead, APCO, Singapore ➢ Role of AI in preparing women for next generation careers **Silvia Lara,** Gender Research Lead, LinkedIn Economic Graph Research Institute, Singapore ➢ General overview of main barriers holding women back in the digitally intensive, high skill service sectors
11:50 – 12:20	**Session 4: Roundtable discussion, Recommendations and Wrap-up (30 minutes)**
	Moderator: Bonnie Rivendell, Associate Director, International Development and Director of Australian APEC Centre at RMIT University

Part II – Appendix 2: Summary Report from the APEC Group on Services Private Public Dialogue

SUMMARY REPORT

GOS Public Private Dialogue on Challenges and Opportunities for Women's Participation in High-Skill, Digitally Delivered Services in APEC

Held at SOM2, Jeju Island, Republic of Korea, 6 May 2025

Introduction

The Group on Services (GOS) Public Private Dialogue (PPD) on Challenges and Opportunities for Women's Participation in High Skill, Digitally Delivered Services, held on Tuesday 6 May 2025 in Jeju Korea, focused on advancing women's economic empowerment in APEC through addressing the challenges and opportunities of their greater participation in the dynamic growth sectors of high skill digitally delivered services.

The PPD provided input into the formulation of recommendations of how APEC economies can best help advance this objective in different areas through relevant supportive policies in both the public and private sector. The PPD and its outcomes constitute a step towards carrying out the key areas of the action plan contained in the La Serena Roadmap for Women and Inclusive Growth, endorsed by APEC Senior Officials in December 2019 in Chile.

The PPD also supports one of the Republic of Korea's three main policy priorities for APEC 2025 namely, digital innovation and transformation essential for accelerating sustainable and inclusive growth.

This discussion was held as part of a project being carried forward for the GOS by Australia, the objective of which is threefold. First, the project analyzes how women's employment in high skill digitally delivered services has evolved in the region and what may be the impact of digitalization on women's economic prospects in trade in these services. Second, it aims to deepen understanding of the nature of barriers to women's engagement in these sectors. And third, it aims to inform evidence-based policy making in support of women's greater participation in digitally delivered services.

There are approximately 600 million women in the region's labour force, with only 60 percent of these women included in formal economic sectors. Their limited participation as a workforce in the formal sector across the Asia Pacific can cost the regional economy tens of billions of dollars every year. Furthermore, two thirds of women in the APEC region are engaged in services activities. Empirical evidence shows women are overrepresented in low-paid services jobs, and underrepresented in high-paid services jobs, and are rarely in decision making roles when engaging in services trade.

The project on enhancing women's economic empowerment in APEC through greater participation in high skilled, digitalized services sectors, aims to deeper understand how better policy can lift women's participation in selected services activities and how greater participation by women in higher skilled digitally delivered services can advance their economic empowerment (and thus serve as an impetus to growth in the region's economies).

Incorporating the private sector perspective and experience, the project will provide case study discussions of three selected digitally delivered service sectors in APEC to analyze how women's employment and advancement in these sectors have evolved. The experience of firms in these sectors will identify barriers to women's participation and illustrate how digitalization can impact women's formal participation in high skilled digital services sectors.

Background research

The project has developed a background study that explores four issues and employs a multi-dimensional approach to understand how these issues interact. These are:

- women's employment in digitally intensive services;
- the skills and education that are necessary for enabling women's employment in these services;
- the growing informality of work in these higher skill digital services; and
- the potential impact of artificial intelligence on work in digitally delivered services, especially as it impacts women.

The study which can be found here examines these issues based on three premises.

- First, there continues to be a big gap in economic opportunity between men and women in APEC, which is manifested in several areas, including in levels of pay, advancement, access to seniority, and especially participation in high skilled digital services. This economic equality gap has not closed in the region, while other gaps, such as those in education and health, have been brought to near parity. So why is this the case? It's important to understand the reasons behind this.
- Second, the underutilization of women in the workforce leads to a loss of multi-billion dollars of annual foregone GDP in APEC. The second premise is the most dynamic area in our economies today is that of digitally delivered services. Trade in digital services is the fastest growing segment of world trade growing fast, twice as fast as trade in goods or trade in other services. And those service sectors which show the greatest digital intensity and APEC are the information communication technology services, financial services and professional services. These are our sectors of focus for discussion. Together with computer services, information communication technology services, financial services, and professional services constituted over three-fourths of digital services exports in 2023, and they continue to expand at the most dynamic rate.
- Third, digitally intensive services are also those that require higher skill levels. Our third premise is the recognition that women are not participating at present, to their full extent or potential in the high skill, digitally delivered, intensive service sectors, which are a crucial avenue for narrowing the current economic opportunity equality gap in APEC. And the critical question is why. The three sessions of this PPD explore these issues in more depth.

The main messages of the study are contained in an Annex to this summary report. The PPD discussions provide a better understanding of the reasons behind the current reality, along with insights into what policies can be recommended to enhance women's economic empowerment. Once finalized, the study will be posted on the APEC GOS website.

Session 1: Barriers holding women back in high skill, digitally delivered services

The digital revolution is reshaping the global services landscape, creating new avenues for trade and employment. Among these, digitally delivered services (DDS) have emerged as the fastest-growing and most dynamic component of the global economy, offering unprecedented opportunities for innovation and economic growth. However, despite the transformative potential of digitally delivered services, women across APEC economies continue to face significant barriers that limit their participation and potential as key contributors to this growth. This session discusses existing gaps in women's participation and the reasons behind these in the three high-skill services sectors of focus, consulting, financial and information and communication technologies.

General overview of main barriers holding women back in the digitally intensive, high skill services sectors

Silvia Lara, Gender Research Lead, LinkedIn Economic Graph Research Institute, Singapore

At LinkedIn, we analyze real time labour market data across more than a billion members and tens of millions of job postings and companies. This allows us to track workforce trends as they emerge, what jobs are growing, which skills are in demand, and how workers are adapting, across all economies, across industries and, of course, across demographics.

Starting with the big picture, according to our data, the share of women in STEM in 2016 was 26 percent and last year (2024) that number grew to 28 percent. While there was some progress, we are a long way from parity.

Women remain underrepresented, not just in STEM overall, but especially in the most advanced, highest paid parts of the digital economy, like artificial intelligence (AI), software engineering, and data science. What's interesting is that we found one critical challenge in the pipeline for women in STEM, and that is a barrier that happens right between education and joining the workforce.

Across nine APEC economies where LinkedIn has sufficient and reliable data we see a consistent drop off between the number of women who graduate with STEM degrees and the number who go on to be engaged in STEM employment. For example, in the 2017 graduating class on average, across the world, women made up 37 percent of STEM graduates, but only 30 percent of STEM job entrants the year after. That's a seven percentage points drop in one year, and it's remarkably consistent across economies, but also across cohorts, from 2017 all the way until now.

This large drop off in STEM representation of women between graduation and entry into the labour market is bigger than in any of the other degree areas. While proportionally, more and more women are graduating with STEM degrees, which is the good news, around 70 percent of women STEM graduates do not enter STEM careers, compared to 60 percent of men.

Leakage from the STEM pipeline remains a serious concern that we must address. It's especially important to address this drop-off, because representation keeps dropping as careers progress and as women start climbing the career ladder. One of the issues is really representation and accessing leadership levels. From our data globally, women hold 24 percent of STEM managerial positions but when we go to the C suite level, that number drops to 12 percent.

In comparison women in non-STEM fields hold about 40 percent of managerial roles. But even there, when we go to C suite, it just one in four. About 24 percent of executive level roles are held by women. Women are not just facing barriers to enter the workforce and STEM workforce specifically, but they really face barriers to advancement and to become those role models that young graduates can then look up to when they graduate the workforce.

If we zoom in specifically on women in AI, which is a fast-growing, transformative part of the digital economy, we see something quite similar. Women make about 27 percent of AI engineering talent globally. That's three men to one for every woman AI engineer. If we broaden the view to include those that list on their LinkedIn profiles AI, foundational skills like ChatGPT, Claude image generation platform, that percentage drops to 22 percent.

Women aren't just underrepresented in building AI, they are also underrepresented in using it. However, there is cause for optimism. The optimism is that the numbers have been improving and women's participation in AI is growing. In fact, the global likelihood of a woman being an AI engineer has more than doubled between 2016 and 2023. More women are learning those skills that matter. What we need to do now is remove the structural barriers that still block their way.

To sum it all up, our data show that the gender gap in STEM is largest right at the point of transition from education to employment. With visibility and inclusive hiring, we can build a stronger and more representative digital economy by targeting that moment.

Perspective from professional (consulting) services sector

Hanna Norberg, Founder and Principal, TradeEconomista; Initiator and President TradeExperettes, Co-founder TPRForum

Much of my intervention will be based on the study that the TradeExperettes trade experts did for Australia's Department of Foreign Affairs and Trade, looking at the role of the WTO e-commerce moratorium on women entrepreneurs across the world and during COVID. As a reminder, the E-commerce Moratorium dates back to 1998. It prohibits the imposition of customs duties on electronic transmissions, which was agreed to and regularly renewed by the members of the World Trade Organization (WTO).

After introducing the importance of applying a gender lens to the E-commerce Moratorium debate in a publication presented to the WTO in 2022, the TradeExperettes proceeded to further explore its impacts on women – including women-led or owned businesses, women working in the digital economy, as well as the effect on their livelihoods – and the possible consequences of the discontinuation of this arrangement. This study is based on research and discussions with experts, women leaders and business owners, and association representatives from Latin America and the Caribbean, Africa, and Asia and the Pacific that were held through webinars and one-on-one interviews during the spring of 2023.

The exercise revealed that women have been using digitally delivered services to fuel their jobs and businesses, and that these services were key for their survival or re-invention during the COVID-19 pandemic. The discussions also showed that the E-commerce Moratorium is deeply embedded in how these women think about their business opportunities. It has been instrumental in the adoption of

digital services by women-led or owned businesses by keeping costs low, creating a level playing field for firms and workers in developing countries, and providing opportunities to participate in international markets. While the evidence collected is largely anecdotal and more research and gender-disaggregated data are needed to thoroughly understand the socio-economic impacts of the E-commerce Moratorium on women in the digital economy, it serves as an important reminder that trade policy has a direct impact on the lives of people. These stories can therefore help inform governments as they develop policies responsive to the practical needs of individuals participating in the global economy.

Why is gender lens needed? Recent studies, such as the 2020 joint report published by the World Bank and the WTO, and a 2021 OECD policy paper, have demonstrated that trade policies are not gender neutral. Looking at trade policy through a gender lens reveals that the policy itself and its implementation impact women and men differently. These studies have also shown how trade policy can promote gender equality and increase women's economic empowerment, which ultimately leads to a positive impact on general economic welfare.

Moreover, post pandemic research has shown that the negative economic consequences of the COVID-19 pandemic disproportionately impacted women, a phenomenon that has been termed the "Shesession." One of the main factors that explain this phenomenon is the fact that the sectors where women are employed, which differ from those in which men are employed, especially in developing countries, were greatly affected by the pandemic. For example, the results of a survey carried out by the World Bank in Latin America and the Caribbean found that most of the job losses in the region during the pandemic were concentrated in sectors where women are highly represented, such as personal services, education, and hospitality. Furthermore, the role that women play as primary caretakers also helps explain many of these job losses.

Previous studies that have analyzed the economic and social impacts of the E-commerce Moratorium suffer from an obvious gap – they do not address its gender impact, though they acknowledge that it is an area in need of further exploration. Indeed, a paper by the Organisation for Economic Co-operation and Development (OECD) expressly points to the fact that the evaluation of this trade arrangement has not focused on traditionally disadvantaged groups, such as women or indigenous peoples.

Perspective from financial services sector

Grace Gown, Head of Global Public Policy, Xero, Australia

Xero is a cloud-based accounting platform with 4.2 million global subscribers—small businesses and their accountants and bookkeepers. These users rely on Xero to manage payroll, issue invoices, pay bills, file taxes, and meet day-to-day compliance obligations. While technically not a financial services provider, Xero enables core financial activities, and the professionals who use it—accountants, bookkeepers, and small business owners—operate squarely within the financial services landscape.

Women are represented at every layer of this ecosystem, and their participation in digitally delivered services provides real-time evidence of both progress and persistent barriers. These support roles—often overlooked—are in fact foundational. Women are overrepresented in roles such as payroll professionals, solo bookkeeping practices, or micro advisory firms. At Xero, many of these women

form part of our partner network, and their impact extends beyond their own work: they are often the primary advisor to small business clients, helping them navigate and adopt digital tools. In this way, they act as digital enablers with ripple effects across the economy.

Yet these roles are rarely recognised as strategic or skilled, despite being central to the digitalisation of small business. We need to rethink our skills frameworks, particularly in the age of AI. It's not just about STEM or digital literacy at entry level. Policymakers must also focus on mid-career women and ensure they can access upskilling and reskilling opportunities especially given the disproportionate caring responsibilities many women carry and their limited access to leadership networks.

From a small business lens, this is urgent. In every APEC economy, small businesses make up around 98% of firms and employ over half the workforce. In financial services, the number one concern is cash flow—so carving out time and resources for training is a real trade-off. Supporting women in these roles means addressing these economic realities and creating incentives that work for their context.

To illustrate the scale, in March 2025, Xero processed 11.7 million pay runs—equating to USD $11.8 billion in salary payments. That’s just one month, on one platform. These digital transactions only happen because of the care, commitment, and accuracy of payroll professionals, the majority of whom are women. Their work powers financial stability for millions.

Finally, the enabling environment matters. Cross-border data flows, e-Invoicing, and eSignatures are crucial for digital trade—but they depend on behind-the-border reforms. What resonated clearly in this discussion was the friction that analogue or disconnected systems create for small businesses and the professionals who support them. Government-led digital transformation is essential to address these frictions and enable participation. This includes investment in modern services infrastructure—such as APIs for tax and payroll, open banking frameworks, and e-Invoicing standards—that make compliance easier, faster, and more reliable. These public systems lower the barriers for small businesses and unlock opportunity for the women who enable them. Digital transformation doesn’t happen without clear, coordinated, and sustained public policy leadership.

Women in support roles are not peripheral. They are strategic. They are essential to the delivery, uptake, and success of digital services. It’s time we recognise and invest in them accordingly.

Perspective from information technology services sector

Winnie Kula, President of the PNG ICT Digital Cluster and Founder eNovaX Solutions

Good morning, distinguished guests. APEC delegates, colleagues and friends. Let me begin by thanking the APEC Secretariat and the Australian APEC Study Center for this important dialogue, and especially Sherry and Mia for the research paper, I also want to acknowledge the inspiring spirit of Jeju Island, especially its legendary women divers, whose deep sea endurance and community resilience reminds me of the strength women carry across all cultures and also with these inspiring women panelists as well. It is an honor and blessing to be here today in Jeju, Korea to discuss the barriers that women face in participating in high skill digitally delivered services.

I will speak today as a woman in tech and mother, daughter and sister, I understand the transformative power of education and digital skills, not just for individuals, but for families and communities at large, and this leads me to acknowledge that entrepreneurship is no longer a choice. It is a survival path in economies where formal jobs are limited. As a digital transformation practitioner with over 25 years of experience in the corporate world and in government, and now with my family business in eNovaX, but also as the President and co-founder of the PNG digital ICD cluster, which is the top industry body that previously did not exist. Also, as a mother of three sons, including one studying in Japan on a scholarship at the Asia Pacific University, and a woman in a developing economy where culture, language and tradition deeply shape our identity and our approach to progress, having navigated the double or triple biases, infrastructure gaps and limited representations in boardrooms and tech forums.

I know what it's like to build digital pathways with few role models or none at all, and I also know the power of showing others that it can be done by providing digitally delivered services to businesses and communities in PNG, allowing women like me with a background in computer science and entrepreneurship to contribute to local and potentially to global markets from underserved communities or economies such as PNG. I'd also like to highlight my journey as an example of how education builds talent pipelines across generations.

My family's connection to Australian development scholarships started with my father in the late 1970s, a pioneer biodiversity policy specialist and conservationist who helped establish Conservation International in PNG in the Pacific Islands. Scholarships to Canberra laid the foundation for our early exposure to global education. With my brother, we both started our early childhood learning in Canberra. Years later, I received an Australian Award Scholarship to complete my master's in business entrepreneurship, which later launched my career in tech and innovation. This scholarship didn’t just support me, it created ripple effects. My younger brother, also an Australian Japanese scholarship recipient, is now a professor in software engineering at Osaka University in Japan.

These talent pipelines matter. They are transformative and generational. But not everyone can access such pipelines, structured pathways or systems that help women move from education and training into employment, long term skills, job creation, leadership or digital entrepreneurship. In PNG and across the Pacific, women face persistent barriers to achieve these goals.

These barriers can be broken down into six areas. The first is the slow and complex approach to progress in PNG. This can often involve infrastructure challenges, domestic regulatory hurdles and resistance to change that make it harder for women to advance in tech fields and ecommerce and digital payments. While the world embraces digital rapid digital transformation, we are sometimes left behind due to these deep-rooted barriers. The reality is that these systemic barriers slow progress, and limited resources prevent women from achieving the success and growth that is expected.

The second is gender norms and cultural expectations. In PNG, cultural expectations place the majority of women in traditional roles, expected to prioritize family and care responsibilities over professional ambitions. This makes it difficult for women to pursue tech careers as they are expected to take on the majority of household responsibilities. As a caregiver myself, I understand this role. However, these norms not only restrict time and opportunities for professional development, but also create a cycle where women are sometimes excluded from high-tech careers. The absence of remote work options, part time roles, or family friendly policies often forces women to choose between employment and caregiving duties.

The third is limited employment and market opportunities. Despite being highly educated at university level, and with access to local and international scholarships being offered to tech, women in PNG still struggle from a shortage of job opportunities and career options in ICT sector. This lack of market development pushes many tech women into entrepreneurship, but with limited resources and support, the businesses they start often struggle to thrive. Also, these tech women entrepreneurs frequently encounter pricing pressure and are often undervalued compared to their male counterparts, even when delivering digitally intensive services of equal or higher quality.

The fourth is limited access to funding and investment. Women in ICT still face challenges in attracting investment. There is a lack of venture capital and angel investors targeted at women in tech. Additionally, the gender biases in funding decisions continues to limit the growth of women led businesses without access to capital credit. Women-led businesses are often unable to scale, limiting their potential and contributing to the under representation of women in high-skill services, also without a social welfare system in place. The vulnerabilities are quite high in economies such as PNG.

Fifth is the lack of role models and mentorship. While women in tech may gain some visibility, the lack of sustainable, profitable opportunities and role models in leadership positions make it difficult for aspiring female entrepreneurs to see a clear, viable path to long term success in the sector. The absence of female role models remains a significant barrier, making it harder to attract women in the sector.

The sixth is the digital divide that is a major obstacle in many parts of PNG and the Pacific Island economies. Women, especially those in rural areas, lack access to technology and training that would enable them to thrive in high skill sectors. Without adequate resources, women are unable to upskill in areas like software engineering, cyber security, data science, digital marketing or AI development, all which are essential for success in the modern digital economy. Even in theurban areas, the skill mismatch remains a significant issue. Women are underrepresented in STEM education and often lack the specialized training necessary.

In closing, I want to note that women divers in Jeju Island did not wait for permission to drive. They simply held their breath and went deep. We too must create systems where women in tech can dive into digital futures, equipped, supported and celebrated.

Session 2: Women in high-skill digital services: Addressing skills, access, and inclusion challenges

While more women work in services in the APEC region than in manufacturing and agriculture, the proportion of women in the highly skilled services jobs that demand digital skills is much less than that of men, particularly for managers and technicians/associate professionals. The study suggests that there is a "digital equality gap" that is in part responsible for this, characterized by fewer numbers of women STEM graduates (less than one-third in APEC), and women's unequal access to training and digital tools and infrastructure. This session discusses these issues, along with other barriers (access to capital, cultural and attitude, and regulatory barriers) and the challenge of informality that impede women's greater participation in these services. It explores how targeted investments in digital skills, more inclusive training programs, and better access to tools and enabling policy environments can help women overcome the structural, financial, and institutional barriers holding them back in these

jobs. It also examines informality and the difficulties in moving from informal to formal jobs. This is often overlooked but is a critical issue that continues to limit women's engagement in these sectors.

Enhancement of digital skills for women in high tech professions

Joana Valente, Partner in Technology and Transformation, Deloitte

We have already reflected on why gender parity is important – the estimated $17 trillion of losses in the APEC region's GDP as a result of the under representation of women in leadership roles is a strong reminder. Since 2006 we have only reduced the gender gap in the region by just 5.7 percent. This means it will still take 84 years to reach parity even though we now have transformational improvements via generative AI. Digital disruption is accelerating so that by 2030, nearly 40 percent of core job skills will involve AI and data skills, and over 70 percent of all new economic value will be digitally enabled. Yet women remain underrepresented in the high tech, digitally intensive sectors. Fewer than 35 percent of tech roles are held by women across the APEC region. And female representation in digital professions is generally below 30 percent.

Globally, as we've heard from our previous panel, only around 35 percent of STEM degrees are earned by women compared to 65 percent by men. Deloitte has undertaken a recent study which uncovers what we're calling the gender trust gap in AI.

We know AI is being adopted faster than the computer or the internet was at similar points in time after being introduced. The adoption is phenomenal. The value is phenomenal. Yet only approximately 50 percent of women trust and use AI tools at work. Approximately 50 percent compared to approximately 70 percent of men. Despite accelerating their genAI adoption, women express less trust than men that genAI providers will keep their data secure. This "technology trust gap" could inhibit women's regular use of the technology and full participation in new genAI applications, as well as slow down their future purchasing of genAI products and services. To help overcome this trust gap, tech companies should enhance their data security, implement clearer data management practices, and provide greater data control.

AI model bias can also have a negative impact on trust. Women constitute less than one-third of the AI workforce, and most AI workers feel that AI will produce biased results as long as their field continues to be male dominated. Increasing women's presence in the field can help reduce gender bias in AI, as well as give women a greater role in steering the future of the technology.

These findings describe an iceberg. What is beneath the water line? We're seeing the tip of it, because what we're discussing here are symptoms of something deeper. And so I'd like to spend a bit of time talking about the most powerful and the least visible force below – culture. Culture is like the mass beneath the water line, it shapes what girls believe is possible, but importantly, it shapes what families support and what societies reward. Clearly, society isn't rewarding women pursuing and staying in STEM careers.

The question is therefore --- Why? If we raise boys and girls with different expectations, we shouldn't be surprised when they make different choices. We still overwhelmingly celebrate sons who choose the entrepreneurial path to build, innovate and focus on career.

This is a societal, cultural issue. We shouldn't be surprised with the above statistics, because we're shaping workforce choices before formal education begins. Some of us might say, well, is this not innate? Is this not because there is a biological difference? I disagree.

Let me share some personal reflections here. My mother was a mechanical engineer. When I had my first child I rang my grandparents to tell them that I had decided to extend my maternity leave from three months to a year. Now in Portugal, most women, take less than three months of leave. A few years ago, women took much less than three months. That is because, in my culture, a woman's independence was critical, as was financial independence. So she needed to return to the workplace.

We need public-private initiatives to tackle cultural barriers. For example, in Finland, an experiment led by the government, alongside the university sector, worked not just with students, but also with parents and teachers to reframe technology as a place where girls could thrive. In India, there is a program that built careers intentionality among underprivileged girls. But it didn't just focus on girls. It also worked with both school aged boys and girls. Girls were tasked with developing digital ideas, digital business pitches, and boys were responsible for designing campaigns to support the girls' ambitions.

So that would be my ask that we look at the deeper considerations here, so that we have more women choosing to study STEM and choosing to stay and work in STEM.

Tackling structural and institutional barriers

Samar Alrayyes, Co-chair, TechWomen New Zealand

Today, we confront a defining challenge, with structural and institutional barriers that suppress the extraordinary potential of women in high skill jobs like AI, FinTech and consulting. These barriers, from discriminatory regulations to entrenched cultural biases, are not mere obstacles. They are a betrayal of talent which cost the region billions and silence at least half of our visionaries.

At TechWomen New Zealand, we are part of a community of 12,000 members (in a small economy of five million people). We are a strong albeit small economy representing 10 percent of New Zealand's workforce and less than 29 percent of women in the digital tech workforce in New Zealand, and we have seen firsthand how these barriers stifle diversity. I will discuss some of the barriers we face and their impact on APAC's economic growth, and in the discussion, I will also present some recommendations on how to tackle them.

I would like for you to picture this: a lone woman coding in a corner, and at the same time cooking, because that's what we call 'remote work', and in the across the street, in contrast to picture a vibrant, male dominated tech conference with participants talking about new visions. This is the reality of APEC.

Women power over 60 percent of our services workforce yet hold less than 30 percent of STEM roles critical for digital services. What holds them back you ask? Some of the invisible chains are created by regulatory barriers, like restrictive licensing that lock women out. Think of rules demanding in person credentials for remote jobs or access to capital. Or the differences in access to venture capital for startups. I can tell you for a fact that women led tech startups secure 50 percent less capital than

male startups, 50 percent. I'm going to repeat it for the third time, 50 percent less than male founders. And women always struggle to have mentors. And most of the time that I've seen mentors trying to mentor women, they begin with the recommendation to have an imposter syndrome. Let's fix you. How many of the women heard the word imposter syndrome last year. You must have it. Let's help you. Let's help you look stronger and better.

Then there are structural gaps, like the absence of high-speed internet in rural areas. This cannot be something we're still talking about in 2025. It has to be mandated by policy makers that the internet is accessible for everyone, including every woman. For women, this means more and is essential. It means life, because they need to have the job.

And then women are expected, as everyone said, to take care of the family. Cultural narrative, branding STEM as a male area. It is discouraging for girls to try and see themselves in those pioneers jobs, and it's what we call in tech the “leaky pipeline”, which Sylvia has mentioned. This starts with a STEM degree. And we have a program called Shadow tech that we created in tech women, where we inspire students in the 9th to 11th school years to come and see how the tech industry works. It's not only coding in a dark room. I promise you, we do more than that. And almost always, I hear at the beginning of the session, we were here because my mates forced me. The school required me to come. I don't want to study Tech because it's not for me - it has to be for the boys. We hear that every time. But then when the girls leave the visit, what a change we observe, thinking “We might actually choose this. It's a great we love this. I want to work here”. This is something that we probably need to address and to make it part of the curriculum at many tech organizations,

I have also seen rigid policies with respect to flexible hours, biased promotions, what we call hiring mates. You probably would know what that means. Most of the hiring, which sometimes we call referral or networking with many names for it comes from mates. If we are in a male dominated industry, and most of the hiring happens, when this often takes place on the pub or in the golf course late at night. Who do you think will be hired? That's a problem, so maybe we need to question those referrals of hiring mates. How do we work on that?

The impact of these barriers is huge. APEC forfeits billions and billions of dollars annually by marginalizing women’s digital contribution. These chains do not just limit; they plunder our collective future. Non-diverse teams lose 20 percent of innovation potential, delivering weaker AI FinTech and consulting. Excluding women narrows our ability to design inclusive products. In talking about AI, we say that the data is non-inclusive. Of course, it is. Because women are not there. We have to be there for the data to be inclusive, and we have to work on fixing this. It also helps in having role models to help shape the next generation. In New Zealand initiatives like shadow tech, for example, have done this, namely raised the female tech leadership by 15 percent in the last five years.

Another important story is that women in high skill roles have seen to be reinvesting in education, health care, and communities, forging a more equitable and vibrant region and a better future. A few years back. I don't know if people remember, there was a Christchurch attack, and a certain community has lost around 50 men. We and other tech women created a program to empower the women left behind who were not the earners, and we created a partnership with tech companies to come and help.

The highlight of my career was a woman that called me after six months of mentorship, and she said, “I've just secured my first role ever in a government agency, and thanks to you, I can provide for my kids and I have a life”. This is what we're trying to create – identity - and it's very important for our culture and for the future of the world. Let's make 2025 the year APEC champions women building a prosperous, inclusive future.

Challenges in converting informality into the formal economy

Steven Tobin, ILO Regional Office for Asia and the Pacific

About a year ago, the ILO, in conjunction with the ADB, examined female and sectoral employment as well as the composition of jobs over a three-decade period. The study found that considerable gender gaps between male and female workers remain in Asia-Pacific labour markets, where women are not benefiting as much as men from employment opportunities in growing sectors offering higher pay and better conditions.

The report examined trends over the past three decades in the sectoral employment of men and women in the Asia Pacific region, discussing the broader implications for gender equality, inclusive growth, and social justice. It highlighted the gap in labour market participation rates between men and women, at close to 25 percentage points, which remains above the global average. This is largely due to the high and persistent gap of almost 50 percentage points in the South Asia subregion.

Women’s work continues to be concentrated in low value-added sectors such as agriculture and retail trade, where decent work deficits are among the highest. The most dynamic sectors for job growth over the past three decades in the Asia Pacific region have almost all seen significantly more job gains for men than women. In the sector with the most dynamic growth—IT and other information services—only one in four jobs (25 percent) went to women. Only in accommodation and food services did more than half of the job growth accrue to women.

Turning to the issue of informality, underlying these sectoral composition changes is the prevalence of informal employment within the broader Asia-Pacific region. Approximately 1.3 billion workers are informal, accounting for about two-thirds of the world's total, with men slightly overrepresented in informality in the region.

Due to cultural nuances and gender-segregated sectors, it is clear that women are overrepresented in lower-skilled and more vulnerable segments of informal employment. This means they are predominantly employed in domestic and home-based work, which, of course, reinforces some of the stereotypes we've been discussing.

This is particularly the case for women. Now, the challenging question is: what can we do to address issues related to access and inclusion, especially in the context of high-skilled digital services?

We need to look at this in the context of how poorly we've managed to support women, and particularly over the past three decades, which have been marked by significant sectoral transformation as people moved out of agriculture and into manufacturing and services.

However, we are now witnessing a complete transformation across all occupations and sectors through the application of generative AI. Digital skills will be at the crux of success in the future labour market. Our policies will need to reflect this shift. So, what does that mean concretely?

I would first reiterate the importance of addressing cultural norms that are really at the forefront and centre, especially as they relate to informal employment and domestic work, and consider how we can break these norms in lower-skilled occupations.

We will then need to focus on how to move women into higher-skilled occupations, such as digital services, recognizing that we will see a major transformation in skill requirements across occupations and sectors. Digital access must be expanded, and the digital divide addressed. Issues related to role models and mentorship are also important.

There are two overarching employment policies I consider worth mentioning.

The first is the shift from education and qualifications hiring to skills-based hiring. This has significant implications for how we design employment policies to help women shift from one occupation to another, or - if they are already in a STEM occupation - to acquire the skills needed to move to higher or parallel roles. We have been talking about the skills-based approach for at least five or ten years but have failed to institutionalize it in our policy and program thinking. As we know, women often apply only to jobs where they feel fully qualified. If we can move to a skills-based approach to hiring and training, this should help reduce some bias—though not all.

The second is that, when designing programs to support women entering difficult sectors, we need to place greater emphasis on designing programs around the disadvantage, not the disadvantaged. We should design measures to address the actual barriers that are in place, whether that is childcare, transportation or whatever. Moving away from the generic approach of designing policies for certain groups and really focusing on designing programs around addressing the barriers that we have been talking about in the previous panels is key.

My final point is that this is a complex issue. Any single program or support mechanism, in isolation is fine, but will only yield marginal benefits. What we should try to encourage is a more holistic approach, following a comprehensive strategy that tries to addresses multiple barriers women are facing, from cultural issues to skills, attitudes, and perceptions. Only a comprehensive response will be sufficient to address what is truly a complex and multi-tiered challenge.

Our policies will really need reflect that. So, what does that mean? Concretely?

I would reiterate the comments that have been made in terms of addressing the cultural norms that really are forefront and center, especially when I think about informal employment and domestic work, and how can we sort of break those norms into lower skilled occupations.

We need to consider how we can then move women into higher skilled occupations, such as digital services, obviously, with this notion that we will see a complete transformation of the need for skills across occupations and sectors. There needs to be digital access, and the digital divide needs to be addressed. There are issues related to role models and mentorships.

There are two overarching employment policies I consider worth mentioning.

- The first one is the shift from education and qualifications to skills-based hiring. This has significant implications for how we design employment policies to help women shift from one occupation to another, or if they are within an existing STEM occupation, what are sort of the skills that they may require to either shift to higher or parallel occupation? We've been talking a lot about the skills-based approach for at least five or ten years, but we failed to institutionalize it in our policy and program thinking. And as we know and have been highlighting that, you know, women often apply to jobs where they feel they are qualified for. And I think if we're able to move to sort of a skills-based approach to hiring and training, this should at least help to reduce some of the bias, although not all.
- The second policy shift I would like to highlight is to recommend placing a greater emphasis on designing programs around the disadvantage, not the disadvantaged when we think about designing programs to support women entering challenging service sectors. All too often, governments have designed measures to help address the actual barriers that are in place, whether that's childcare, transportation or whatnot. Moving away from this generic approach of designing policies for certain groups and instead focusing on designing programs around addressing the barriers that we've been talking about in the last two panels is key.

My final point would be that, clearly, this is a complex issue. And, you know, any one program or support mechanism in isolation, I think is fine, but we should only expect marginal benefits from that. And so I think what we would like to try to encourage is a more holistic approach, where we see a comprehensive strategy that at least tries to address some of these multiple, multiple barriers that are facing from cultural to skills to attitudes, perceptions and really something which is much more comprehensive is needed in order to address what is really a complex and multi-tiered challenge.

What can services companies' members of the Asia-Pacific Services Coalition do to contribute to promoting women's status in digitally delivered services

Devi Ariyani, Executive Director, Indonesia Services Dialogue Council

When discussing women and skills in the digital era, the key question is: what do corporations need today? What are the most critical skills required of the workforce?

In 2023, we conducted a study asking companies about the skills they need. We received responses from around seventy companies—large, medium, and small enterprises—across FinTech, EduTech, ICT, media, HealthTech, and manufacturing services. Our survey found that communication and teamwork are the most dominant skills needed across all sectors, with the top three being communication, teamwork and team management, and time management.

This is particularly interesting as we enter the post-pandemic era, where the business operating model is shifting from working in the office to working from home, and now even to working from anywhere. Companies are offering more flexible working arrangements, and time management is cited as a particularly important skill.

We also asked the firms canvassed for the study about the hard skills needed across sectors. These were cited as sales and marketing, information technology and data-related services, financial services, human resources, and research and development.

We further inquired about the soft skills needed. Here we found a changing landscape of critical skills: while in 2016, skills in STEM (science, technology, engineering, and math) accounted for about 42 percent of the need, these had dropped to the bottom of the list by 2025.

We also observed that the need for basic computer skills and software application skills is declining. These are now considered the least critical by corporations, while time management, the ability to work in a team environment, and communication have become the top three.

These findings are aligned with our own research, even though there was no direct communication between our study and the corporations —the results are profoundly aligned. While industry- and occupation-specific skills remain important to increasing women's representation in services sectors, especially digital-intensive sectors, having the required soft skills is critical to closing the advancement gap.

Session 3: Artificial Intelligence and its impact on women in services

AI is being adopted faster than PCs or the Internet were in the previous technological revolutions. Data from many sources indicate that by the year 2030, there will be a seismic shift in job skill requirements as AI accelerates change in the workplace, and particularly in the services areas. It is unclear at present what type of impact AI technologies will have on women. What is clear is that ingrained attitudes and biases exist in the development and application of AI tools, which may influence women's ability to apply these. This session discusses these issues and offers insights not only into the rapidity of technological change but also into what types of education and professional skills will be needed by women to be able to participate and thrive in the future high-skill, digitally delivered service sectors.

Inherent biases in the creation of AI tools

Peter Lovelock, Chief Consulting and Innovation Officer, Access Partnerships

I will discuss research my company has conducted on generative AI—specifically, its effects on economic participation and workforce dynamics. I will also address what these findings suggest about women's participation and economic contribution in the services sector.

Our research examined the potential impact of generative AI on economies across Asia, particularly regarding jobs in APEC. We found that generative AI presents significant potential economic opportunities for economies in the region. For example:

- $79.3 billion for the Philippines, equivalent to 20 percent of GDP
- $113.4 billion for Malaysia, equivalent to 25 percent of GDP
- $621 billion for India, equivalent to 18 percent of GDP
- $1.1 trillion for Japan, representing a 27 percent additional contribution to GDP

These benefits can be realised if economies are able to capture the opportunities that generative AI offers. Moreover, this growth is not stagnant; the economies would continue to grow annually if we could seize these opportunities.

We also found that only 1 percent of workers will have their jobs significantly impacted, while the vast majority will see an impact of less than 10 percent. The primary effect will be augmentation, not replacement. Improvements and gains are expected through unleashing creativity—especially in content and design—accelerating discovery in research and science and enhancing productivity and business opportunities. This is the positive side, and the research is robust.

I stand by these findings, which are well supported in the literature. The issue, however, is that realising these benefits requires coordinated government action, focused and targeted reskilling, and behavioural change.

In the meantime, there will be job losses and dislocation as progress unfolds. According to the ILO, 21 million jobs are at risk in high-income economies, and without intervention, this will disproportionately impact women. Of that 21 million, 11.2 percent of women in high-income economies are at high risk, compared to 9 percent of men.

According to the WEF, only 40 percent of women in vulnerable roles are receiving any form of reskilling. McKinsey research estimates that up to 85 million women globally may need to transition occupational categories due to AI by 2030, particularly in Southeast Asia. Moreover, ADB and LinkedIn estimate that 2.5 million women need digital or AI-related skills to remain competitive.

Much of this shift was already underway, but AI is accelerating and amplifying these trends, increasing the gaps in opportunities.

We see this in the US, Australia, Singapore, and other high-income economies, where roughly nine in ten employed women work in services. In Japan and the Republic of Korea, about 82 percent of female employment is in services. By contrast, in Thailand and Viet Nam, only about 55 percent and 40 percent of women, respectively, are concentrated in services, reflecting the fact that many women in these emerging economies still work in agriculture or industry.

So, we are seeing a transition. However, AI is having the greatest impact on clerical and administrative roles, customer service, sales, and routine jobs in food and hospitality—all areas where female employment is overrepresented in the APEC region.

Currently, our estimates suggest that closing gender gaps in the digital economy could unlock an estimated $94 billion in untapped economic capital—even before fully considering the impact of digitalization and AI. The gender gap is profound, and my suggestion is that AI risks accelerating and amplifying current divides unless we act quickly to get ahead of these changes.

Let me briefly discuss the financial sector and, for illustrative purposes, the adult content sector. Historically, over the last 30 years, these two sectors have led technological transitions and often foreshadow broader economic trends.

They are the canaries in the coal mine. For example, algorithmic bias in financial systems is a critical concern. AI is increasingly used in hiring, promotions, lending decisions, trading strategies, and

performance evaluations within the sector. If algorithms learn from historical data, they can perpetuate discriminatory patterns. A good example is Apple's credit card algorithm, issued by Goldman Sachs, which used an automated model to determine credit limits. Multiple cases emerged where women were given significantly lower credit limits than their husbands with similar or even weaker financial profiles. One tech entrepreneur reported receiving 20 times the credit limit of his wife, despite her higher credit score and joint assets.

Even Apple's co-founder, Steve Wozniak, was offered ten times his wife's credit line, despite sharing all finances. Goldman Sachs denied using gender as a factor, but this illustrates the key point: the algorithm did not see gender explicitly, yet produced biased outcomes.

This occurred because it learned from data where structural factors, income patterns, and credit histories reflected gender disparities, thus indirectly disadvantaging women. Similar AI-driven hiring algorithms in finance have screened resumes or predicted fit for roles using past hiring data from investment banks where men were preferred, resulting in lower rankings for female candidates.

There is evidence that women in algorithmic-intensive trading roles face biases as well. Performance metrics are skewed when an AI-driven evaluation values certain aggressive trading behaviours historically exhibited by men. These systems are intended to be gender-neutral, assessing individuals based on their performance and background. However, because of the way we are building algorithmic assessment systems, they are automatically skewing toward male profiles and behaviours.

These jobs are influential in the economy and perpetuate cycles of hiring based on existing biases.

APEC data show that women comprise anywhere from 19 to 50 percent of the gig workforce across member economies. This is an important statistic, especially as we transition from generative AI to agentic and transformative AI. We are likely to see a significant increase in gig economy work and greater flexibility in emerging opportunities.

If the gig activities are where we see profound opportunity, and if those opportunities are now being shaped by AI, they are also becoming less secure, less protected, and more transient. As job cycles accelerate, protections for gig workers shrink, potentially leading to more aggressive and problematic behaviours in the workforce.

Turning to the adult content industry, where women have traditionally been prominent and sometimes held an advantage, we see that income distribution remains highly unequal. What we are seeing now, with digitalisation accelerated by AI, is a winner-takes-all pattern emerging. For example, on the platform OnlyFans, the average creator earns $150 to $180 per month, while the top 1 percent of creators capture about one-third of all revenue.

Top earners can make five to six figures monthly, but the vast majority of women are seeing only modest, supplemental income increases. We begin to see the same patterns of inequality and bias, now exacerbated by AI-driven algorithmic bias and content moderation. Women in the online adult industry also contend with algorithmic biases in how their content is moderated, which has broader implications for the economy.

Major social platforms use AI content moderation systems that often penalize female bodies and sexual content more harshly. One study found that AI vision algorithms rate images of women as far

more suggestive or racy than similar images of men, leading to routine suppression of women's posts— even when these are not sexually explicit. AI models deployed by Google, Microsoft, and Amazon frequently flag even benign images of women in swimwear, fitness wear, or breastfeeding as explicit, whereas men's images are less likely to be flagged. The result is that countless photos of women's bodies are shadow-banned or hidden, hurting female-led businesses and content reach.

Of course, this bias has been devastating. Educational or promotional posts by women, especially women of colour and LGBTQ creators, are disproportionately removed or down-ranked by algorithms before they even know about it. Such moderation biases reinforce social stigma around female sexuality.

While I strongly advocate for digitalisation and the levelling of opportunities, AI currently risks reinforcing existing barriers and inequalities. Looking at these two sectors, we find clear parallels: both reinforce existing biases. AI systems tend to mirror and sometimes amplify society's preexisting gender biases.

We get power imbalances and exploitations, formal versus informal work dynamics, roles of representation and inclusion, and cross-border and policy harmonization challenges from AI systems at present. These challenges will likely increase due to both conservative pushback against regulation and the complexities of cross-border data linkages. The broader trend is recognition that AI cannot be value-neutral.

AI governance must actively safeguard against the exploitation of vulnerable groups, including women. A debate around that would be most interesting.

Role of AI in preparing women for next generation careers

Gareth Tan, Associate Direct and Technology Lead, APCO

Today, I am representing the Secretariat of the Digital Prosperity for Asia Coalition (DPA). The Coalition is an alliance of digital startups and small and medium enterprises from across the Asia-Pacific region. It aims to foster a stronger understanding of digital regulations coming online across the region, most recently the AI rules regional governments are exploring.

Half of the DPA's work is in education, where we do our best to keep small digital companies updated on developments in the policy space through regular explanatory sessions and monitoring briefs. The other half focuses on advocacy, where we represent members' perspectives at policy-oriented discussions like this one, or at the World Trade Organization (WTO), for example. We have worked with Singapore's Ministry of Trade and Industry (MTI) to provide training to the negotiators on WTO-related issues and have supported discussions on the JSI on e-commerce and the ongoing ASEAN Digital Economy Framework Agreement. I often say the DPA functions like a government affairs department for companies too small to afford their own—until they are large enough to build their own capabilities.

This is relevant because my work with the DPA brings me into contact with the region's startup space, including founders developing or deploying AI, as well as founders who are women or who support gender equality.

I won't pretend that the DPA membership base is a vision of egalitarianism. We are a good representation, I think, of the digital startup ecosystem across this region, which does tend to skew towards male dominance, but I am pleased to say that we do have a number of very active female founders and representatives with whom we often consult on matters concerning gender and technology, and more recently, gender and AI. It is to them, particularly Christa Sabatali of Indonesia-based online visa service provider Span Global and Mustang Yi of Singaporean trust tech firm Accreditor, that I owe a debt for informing many of my perspectives today.

Turning to the questions we face today: First, as already mentioned, most people engaging with AI acknowledge it can channel inherent gender biases. This is because AI is trained on raw data—linguistic, audio, or image-based—drawn from societies which are, on the whole, still gender-biased. However, from our discussions with startups, including those run by women, this is unfortunately not their primary consideration. As startups, their main imperative remains understanding how to better use the technology and deploy it in innovative and monetisable ways.

I want to clarify that many of my points come from a position of accepting that AI presents social risks and threats that may impact women more than men. However, given the context I just provided, I am primarily addressing AI as an economic factor—an enabler and mechanism that must be engaged with, regardless of the outcome, due to its economic impact.

This brings us to the question of education—specifically, what education or professional skills are necessary for women to adapt to a more AI-driven world. Fundamentally, this is part of the broader question of what skills anyone, regardless of gender, would need to adapt to that world.

Many of the key actions needed are incredibly basic. It is literally about educating people on what AI can and cannot do. This may seem elementary, but our AI startups have noted that this lack of understanding can seriously inhibit meaningful conversations about how to implement AI, both internally within teams and externally with investors or policymakers.

Just last year, we organised a panel at the WTO Public Forum and brought one of our AI startup founders, who ran a tutorial on what exactly generative AI could and could not do. This was very well received, and people were surprised at how little they knew about the technology’s limits and capabilities.

Understanding AI will also affect how women or men entering industries enhanced by AI can adapt and use AI tools effectively. I am encouraged to see that many policymakers are already recognising this and taking proactive steps.

In Singapore, for example, the Ministry of Education recognizes that "AI" is a catch-all term for a wide range of technologies with very different applications and outcomes. They plan to roll out a phased introduction to AI by education level: early education will provide a surface-level introduction, secondary education will outline what AI can and cannot do, and tertiary education will involve practical training on AI skills such as prompt engineering.

Demystifying AI is essential so that learners see beyond the surface and understand how answers are generated, rather than perceiving AI as a mysterious tool. This is a great pathway to introduce future users to AI, allowing for a deepening of understanding and culminating in students who have a realistic

and proportionate expectation of what AI can accomplish, as well as a strong foundation to innovate with it. Before pushing a technology further, we must first understand where its real boundaries lie.

An aspect strongly emphasized in the Singapore framework, which I think is very important, is a continual degree of guided exposure across a variety of ages. AI is ultimately evolving into a general-purpose technology that eases aspects of the human-machine interface. It is likely to be integrated into products, services, and tools that are not explicitly labelled as AI, in the same way that Internet of Things (IoT) services have been integrated into products that no longer carry that name.

In summary, as basic precepts to prepare workers to adapt to a more AI-driven society, I believe that awareness and engagement are very important: awareness of what the technology is and can do, and engagement to aid in the process of constant demystification and familiarization.

Women remain a clear minority in the AI sector. There are several ways to interpret this persistent gap. One perspective involves survivorship bias. However, by focusing on the visible success stories, we may overlook the structural barriers that have prevented many talented women from advancing or even entering the field.

I shall end with a slightly controversial note, perhaps by reflecting that if there has been one common theme in my discussions with DPA female entrepreneurs on AI and other topics, it is that they have always been quick to clarify that while they face challenges, they have not felt those challenges to have been significantly magnified because they are women.

They tell me that they have benefited from mentors of either gender and that they been afforded opportunities, which they won despite competing with men.

I have consistently found that, despite these obstacles, the female startup founders in the DPA network are acutely aware of the challenges they face and navigate them with determination. This awareness offers optimism—there are still pathways into AI and digital entrepreneurship for women, and opportunities for allies to actively support their participation alongside men.

Insights from LinkedIn latest research on AI's impact on women's work

Silvia Lara, Gender Research Lead, LinkedIn Economic Graph Research Institute

LinkedIn has an economic graph, a digital map of the global labour market. It tracks work across one billion LinkedIn members, tens of millions of companies, and jobs as it collects significant big data. This data, viewed through the lens of data science, helps us understand what jobs are growing, which skills are in demand or changing, and how workers adapt, region by region, and sector by sector.

The world of work is changing. Our team estimates that 25 percent of the skills needed for a job have changed. This means that even if you stay in the same job, the requirements for that job have changed. AI, especially generative AI, is accelerating that change.

In the fall of 2024, we asked LinkedIn members whether they agreed that AI would help them in their careers. This question was asked across occupations. Over half of the surveyed members agreed that AI would be helpful—an increase of 10 percentage points compared to one and a half years earlier. This demonstrates growing optimism, at least among LinkedIn members.

For example, in Australia, 61 percent of women agreed that AI would help them in their careers, compared to 55 percent of men. In this case, women seem to be more optimistic about how AI will influence their working future.

Different APEC economies show different gender dynamics in terms of who agrees more, but in general, the key takeaway point is that optimism is growing, and more than half of the surveyed members share that optimism.

It's clear that this new technology is reshaping how we work, what we do, and what skills are needed to perform our jobs. At the Economic Graph Research Institute, my colleagues and I examined thousands of occupations in our taxonomy to understand how AI affects them. We categorized the occupations into three main groups based on the key skills required for each:

- Disrupted occupations, where AI might automate core tasks;
- Augmented occupations, which would benefit from AI-enhanced productivity;
- Insulated occupations, which are unlikely to be affected.

For example, translators and paralegal associates might face high disruption, while veterinary nurses are mostly unaffected. My own job as a data scientist is likely to be augmented. AI probably won't replace me, at least for now, but it will definitely change the way I work. However, the impact of AI isn't the same for everybody, which brings us to gender.

In the ten APEC economies for which we had data to analyse, we found that women are more likely than men to work in jobs at high risk of disruption. Women are less likely to be in AI-augmented or AI-insulated roles. This pattern is visible not only in current job holders but also in job applications, indicating future labour force trends.

Men are 8 percent more likely than women to apply to AI-augmented roles. This is a concern because these roles are expected to be more stable, grow faster, and pay more. The gap is closing only slowly; over the past seven years, it has narrowed by two percentage points, so progress is very slow. This progress precedes the advent of generative AI.

The burning question at present is: How do we close this gap faster? The answer is skills, and the good news is that reskilling is happening. We have seen an increase in people learning AI-related skills, especially those foundational ones like prompt writing and using tools like ChatGPT, Claude, or Copilot. In fact, over the last year, the number of LinkedIn members adding AI literacy skills to their profiles has tripled. Of course, we started from a very low baseline, but again, there is a gender gap here, too. Men hold two-thirds of AI literacy skills globally on LinkedIn, outnumbering women two to one. There is momentum, however; women are catching up in many places, giving us hope.

It is important to put into place targeted interventions to keep that momentum going. Right now, AI is transforming the world of work, and women face both risks and opportunities. With the right policy investment and a commitment to inclusive reskilling, we can help ensure this transformation is equitable before these gaps become as entrenched as those in STEM fields. The moment to act is now.

Part III – Appendix 1: Profiles of Interviewed Women-Led Digital and AI-Linked Firms in APEC Economies

ACCREDIFY (Singapore)

“Our mission is to make authentication accessible to all.”
https://www.accredify.io/

Firm activity overview

Founded in 2018, Accredify is a Singapore-based startup that began as an Initial Coin Offering Platform firm but pivoted in 2019 toward secure digital credentialing. The founders (**Quah Zheng Wei (current CEO), Shaun John Cheetham, Derrick Lee, and Edmund Chew**) saw that blockchain technology—often applied in financial services like cryptocurrency—could also serve as an infrastructure of trust for verifying documents across a wide range of sectors. Accredify’s solutions allow organizations to issue digitally verifiable and immutable records such as educational credentials, healthcare documents, government records, business profiles, and product certifications. Accredify’s solution has far-reaching implications on cross-border data sharing, where government and business counterparts across countries can rely on Accredify-issued verifiable credentials to securely access and share data without compromising data security, compliance, and privacy.

The firm experienced rapid growth during the COVID-19 pandemic. Accredify co-developed a healthcare credentialing solution to issue discharge memos and COVID-19 test results with the Singapore Government, enabling digital verification at worksites and immigration checkpoints. This innovation not only solved a pressing public health need but also validated the company’s model for broader use cases. Today, Accredify employs around 30 staff and continues to expand internationally, including in the UAE, while maintaining its base in Singapore.

Digital and AI content of firm’s activities or products

Accredify’s core technology leverages blockchain to ensure the **integrity and verifiability of digital documents**. Each record is assigned a cryptographic hash (a digital fingerprint) that is stored immutably on a blockchain. Verification simply requires recalculating the hash and comparing it with the blockchain record; if altered, the hash no longer matches. Access is enabled via QR codes, making the process simple, tamper-resistant, and privacy-preserving, since original data or private keys are never exposed.

Applications are diverse:

- **Education**: Universities issue degrees and transcripts digitally, reducing reliance on notarization.
- **Healthcare**: Hospitals and clinics issue discharge memos, PCR tests, and vaccination records in secure digital formats.
- **Government & Business**: Accredify provides business profile verification for Singapore’s corporate registry and authentication solutions for physical products (e.g., maritime safety equipment).

While Accredify does not develop AI products for clients, the company incorporates AI into its product suite and encourages its use internally to enhance productivity. Currently, Accredify’s product offers an AI writing feature that enables users to generate relevant copy for their credential designs. Staff is encouraged to use tools such as ChatGPT to streamline research, writing, and coding tasks, increasing efficiency across teams.

Founder's motivation and challenges faced

Among Accredify's earliest employees is **Tan Jing Yi** who currently serves as a **senior leader in the company.** She has a STEM background (B.Sc. Business Analytics (Hons), School of Computing, NUS). She joined the startup because of its mission-driven approach: providing mobility and trust by digitizing credentials, particularly for individuals from less recognized institutions or backgrounds who would benefit from easier verification processes.

While barriers to gender equality persist in less supportive environments, Jing Yi has not encountered gender-based discrimination in her professional journey—attributing this to Singapore's equitable education system and policies supporting women in STEM. The right to equitable treatment, regardless of gender, is a core principle of Jing Yi, who reflects it in how Accredify is managed. At the company level, Accredify adopts a neutral hiring philosophy, focusing on merit while complying with Singapore's robust statutory benefits framework. Salaries are aligned with market standards, and the firm cultivates a workplace culture centered on empathy, inclusivity, and equity.

Challenges faced by the company have included:

- **Pivoting**: Moving from ICO to product-based solutions required significant restructuring.
- **Scaling internationally**: Competing in markets like Australia, where incumbents were already established, has proved difficult.
- **Financing**: While the company has raised multiple rounds (seed, Series A) with Singaporean and U.S. investors, investor interest is often directed toward trendier sectors. International expansion requires navigating cultural preferences—for example, partnering with local integrators in the UAE rather than contracting directly.

Successes achieved by the firm

- Successfully pivoted from **Initial Coin Offering** to verifiable credentials, becoming the leading provider in Singapore and across APAC.
- Collaborated with the **Singapore Government** during the COVID-19 pandemic to deliver healthcare credentialing solutions.
- Expanded internationally, securing a **major contract with a UAE government agency**, with revenues from non-Singaporean clients now accounting for 10–20% of total business.
- Benefited from **Singapore Government grants** for overseas expansion, covering participation in trade fairs, training, and subsidizing salaries for overseas staff.
- Secured **funding through seed and Series A rounds**, with investors including Okta Ventures and U.S.-based venture funds.
- Built strong internal capabilities through structured training programs, such as AWS certification for engineers and personal development allowances for all staff.

Lessons to impart

- **Pivoting with purpose**: Accredify's transition from ICO to digital credentialing illustrates how startups can seize opportunities by adapting quickly.

- **Trust infrastructure is universal**: Blockchain provides a flexible trust layer that can serve education, healthcare, government, and industry equally well.
- **Workplace neutrality supports inclusion**: Fair hiring and statutory benefits frameworks can underpin gender-inclusive cultures.
- **Talent investment pays off**: Structured training and study leave build skills and loyalty across teams.
- **Government support accelerates expansion**: Singapore's proactive grant system has significantly reduced the risks of entering new markets.

ANGO VENTURES (Indonesia)

“Investing in women-led innovation to build inclusive growth and social impact across Asia”
https://angoventures.id

Firm activity overview

ANGO Ventures was established in **2016** by **Mariko Asmara**, a Japanese–Indonesian entrepreneur, together with a group of women investors, with the goal of addressing the financing gap for women-led startups and SMEs in Indonesia and the wider Asian region. What began as a small angel investment fund pooling capital from women has grown into a cross-border network of **85–87 investors from seven countries** (including Japan, Chinese Taipei, India, and European investors based in Asia).

The firm’s investment philosophy combines **financial sustainability with social impact**. ANGO Ventures specifically targets businesses that are led by women, have women in key management positions, or employ a majority of women—particularly working mothers balancing family and career responsibilities. Beyond capital, the fund also provides mentorship, networks, and in many cases acts as a **client or vendor** for portfolio companies, embedding them into a supportive ecosystem.

Over its first seven years, ANGO Ventures has invested in nearly **100 companies**, with an exceptional **90% survival rate**, far above global startup averages. Its portfolio spans food, health, manufacturing, and technology, with notable export successes such as **Burgreens** (vegan food exported to Malaysia and the Philippines, and a supplier to Starbucks Indonesia), **Krakakoa Chocolate** (exporting to Europe and supplying IKEA), **Deeptek.Ai** (India-based AI-powered $1 X-ray diagnostics), and a **3D manufacturing company in Tokyo, Japan producing medical joint replacements**. This expansion beyond Indonesia reflects both opportunity and necessity, as Mariko has deliberately diversified into other markets given Indonesia’s political volatility.

Digital and AI content of firm’s activities or products

Although not all portfolio companies are in the digital industry, ANGO Ventures **requires all investees to operate with digital platforms** for financial reporting, due diligence, and auditing. This insistence on digitalization strengthens transparency and positions firms for scalable growth. Some portfolio companies have gone further, integrating **AI into HR management, recruitment, and operational processes**.

ANGO Ventures itself is a practitioner of digital transformation. The firm uses **AI tools** in multiple areas:

- **Screening and evaluation**: AI processes and summarizes hundreds of startup proposals, helping the investment team decide efficiently which opportunities merit further exploration.
- **Recruitment and HR**: Through its sister recruitment company, AI manages a database spanning 16 countries and serving over 1,200 employees.
- **Content production**: AI supports newsletters, translations, and article drafting for external communications.

Mariko emphasizes that these tools are purchased or accessed through investments, rather than developed in-house, reflecting a pragmatic approach of leveraging proven digital solutions rather than building proprietary AI.

Founder's motivation and challenges faced

Mariko's path to establishing ANGO Ventures reflects both entrepreneurial drive and social purpose. With a career spanning media, creative industries, and traditional businesses in Japan and Indonesia, she observed first-hand how few Indonesian women advanced to top leadership positions. Many women joined the workforce primarily to support household income but hesitated to pursue higher-level careers. At the same time, women-led startups consistently faced greater difficulty accessing external finance compared to their male counterparts.

These barriers inspired Mariko to create ANGO Ventures as a **platform for women's economic empowerment through finance, networks, and mentorship**. The initial capital came from her own exit from traditional businesses, combined with contributions from a group of women investors—including prominent figures such as a family member of Indonesia's **Blue Bird Taxi Group,** who is committed to supporting the growth of women-led companies.

Her journey has not been without challenges. Operating in Indonesia's business environment meant confronting limited transparency, entrenched practices of "double books" in accounting, and cultural skepticism toward governance and disclosure. Convincing SMEs to digitalize their accounting and reporting systems was, and remains, a hurdle. At the same time, building credibility as a woman fund manager in a male-dominated investment landscape required persistence, strong networks, and visible success stories.

Mariko herself does not come from a STEM background; she studied arts, culture, and business management, later learning finance and investment through experience. To compensate, she **intentionally built a diverse investor base** including women with PhDs in AI, stem cell research, medicine, and technical fields. This expertise allows ANGO Ventures to function not only as a financial backer but also as a **strategic partner ecosystem**, where investors may eventually become clients or vendors for the startups supported.

Successes achieved by the firm

- Built a cross-border investor base of **85–87 women investors from seven countries**.
- Invested in nearly **100 companies**, with a **90% survival rate**, well above industry norms. ANGO Ventures also actively invests in companies listed on the Indonesian Stock Exchange, which align with Ango Ventures' vision and mission of sustainability and profitability.
- Supported international success stories including:
    - **Burgreens** vegan food (exports to Malaysia and the Philippines; supplies Starbucks Indonesia).
    - **Krakakoa Chocolate** (exports to Europe; supplies IKEA).
    - **Deeptek.Ai (India)** offering $1 AI-based X-ray diagnostics.
    - A **3D medical manufacturing firm** in Tokyo, Japan, producing joint replacements.
- Helped diversify women's participation in leadership across SMEs and startups in Asia.

- Achieved profitability while maintaining a strong social impact focus.

Lessons to impart

- **Women-focused investment models matter**: Access to finance remains biased; targeted funds help level the playing field.
- **Digital adoption is essential**: Requiring digital reporting and operations enhances accountability and scalability.
- **Impact and profitability align**: High survival rates and export success show that inclusive models can outperform traditional ones.
- **Diversity strengthens ecosystems**: A mix of technical, business, and medical expertise among investors enhances startup support.
- **Leadership must be context-sensitive**: In Indonesia, interpersonal and community-based leadership can be more effective than purely data-driven models.

BE-SPOKE Inc. (Japan)

“Safety, security and clarity through the power of AI”
https://www.be-spoke.io/en/about

Firm activity overview

Bespoke Inc. is a Tokyo-based conversational AI company founded by **Akemi Tsunagawa**. Originally inspired by the founder’s experience of the 2011 Great East Japan Earthquake, when access to accurate and timely information was lacking, Bespoke was created to ensure that people receive information they can trust, in real time, and in a language they understand.

The company began with a focus on crisis communication and customer service but has since expanded its work to develop **BeTrained**, an AI-powered multilingual workplace training platform. The tool is designed to support companies in training diverse workforces, especially non-Japanese workers, by providing learning modules in multiple languages and formats.

Bespoke operates with an international team of engineers, developers, and designers. It has primarily served clients in Japan but has also exported services to Europe and North America. Currently, there are 49 employees, with 55 percent female.

Digital and AI content of firm’s activities or products

Bespoke’s activities are **highly digital and AI-intensive**:

- **Conversational AI & NLP**: The firm uses natural language processing (NLP) and generative AI to power chatbots and workplace training modules capable of multilingual communication.
- **Real-time training and support**: BeTrained delivers customized training through AI interfaces that adapt to workers’ backgrounds and language needs, making workplace learning accessible to foreign employees.
- **Crisis and information systems**: Earlier products leveraged AI to filter and disseminate accurate safety and crisis updates in real time, reducing misinformation.
- **Virtual operations**: The company runs digital collaboration platforms internally and builds flexible, interoperable systems for clients.

Founder’s motivation and challenges faced

Founder **Akemi Tsunagawa** was motivated by her personal experience during the Great East Japan Earthquake. The lack of accessible, reliable information highlighted the social costs of communication breakdowns. This inspired her to build a business that could prevent similar situations and, over time, to expand into workplace solutions that foster inclusion for foreign workers.

Key challenges have included:

- **Building trust and adoption**: Convincing companies to invest in AI-based workplace training, especially in industries slow to digitalize.

- **Balancing speed and accuracy**: Real-time information systems must be fast but also avoid misinformation.
- **Scaling multilingual solutions**: Designing content that accounts not just for translation but for cultural nuance and comprehension.
- **Entrepreneurial hurdles**: As a woman founder in Japan, Tsunagawa has faced barriers in accessing capital and recognition in a male-dominated startup environment.

Successes achieved by the firm

- Developed BeTrained, an AI-powered multilingual training tool that empowers foreign workers in Japan's manufacturing, construction, and service sectors by making workplace training accessible across languages and cultures
- Built and nurtured a diverse, international team of AI engineers and developers, enabling innovation across cultural and linguistic boundaries.
- Successfully expanded operations beyond Japan, delivering AI solutions to clients in Europe and North America.
- Earned credibility as a trusted provider of real-time crisis communication systems, deployed during emergencies to combat misinformation.
- Evolved strategically, pivoting from crisis communication to workplace inclusion and multilingual learning solutions, addressing Japan's urgent need to train and support non-Japanese workers.

Lessons to impart

- **Address real social pain points**: AI adoption is strongest when solving urgent, visible problems such as crisis information or workplace inclusion.
- **Multilingual doesn't just mean translation**: Effective digital training must reflect cultural nuance and ensure comprehension.
- **Balance accuracy with speed**: Trust in AI systems depends on getting both dimensions right.
- **Women founders need access to capital**: Symbolic support is not enough — funding gaps remain a barrier for scaling.
- **Global teams enrich solutions**: Diverse technical teams can design more culturally aware products.

BEYOND THE CLINIC (Australia)

“Redesigning musculoskeletal care through AI-driven virtual health models”
https://beyondtheclinic.io

Firm activity overview

Beyond the Clinic is an **Australian digital health startup** founded in **2021** by **Alison Stokes**, a health entrepreneur, together with an orthopaedic surgeon. The company was born out of direct observation of gaps in traditional post-surgical care where patients undergoing joint replacement surgery were often given only 15 minutes of consultation post-operation and photocopied instructions before being sent home. This experience motivated the founders to develop a digital platform that empowers patients to **self-manage musculoskeletal (MSK) conditions** while optimizing the time and capacity of clinicians.

The firm operates as a **virtual-first company** with no physical office. Its team of **12 members** includes four full-time staff and eight contractors such as physiotherapists, UI/UX specialists, and engineers. Beyond the Clinic currently operates in **Australia** and has expanded its services to **operate in New Zealand** as well. Recently it has signed a partnership with a **global medical device company** which could lead to large-scale international distribution.

While the company is **not yet profitable**, it has generated approximately **AUD 650,000 in revenue** to date, with funding from bootstrapping, angel investors, and a co-investment grant from the Queensland Government. Beyond the Clinic expects to reach profitability within two years and is targeting **success with** its technology platform.

Digital and AI content of firm’s activities or products

The core of Beyond the Clinic’s platform is its **vision-based technology** and **transdermal optical imaging**. Patients take a 30-second facial scan through a mobile phone or computer camera, and the system captures blood flow patterns to calculate data points such as **heart rate, blood pressure, and oxygen levels**. Combined with patient-reported measures (surveys, pain scores, functional tests), the technology creates a **holistic digital profile** for each patient.

The platform architecture is **API-first, low-code/no-code, and interoperable** with users’ external devices and clinics’ operating systems. While much of the technology is licensed from partners, Beyond the Clinic’s **proprietary intellectual property lies in its clinical workflows**. These workflows use AI to support decision-making and automate tasks like prompting patients for new measurements or transcribing and summarizing telehealth consultations. Importantly, the company maintains a principle of **“AI to augment, not replace” clinicians**, recognizing that sensitive healthcare decisions still require human oversight.

Beyond the Clinic is an entirely virtual company and leverages multiple **digital collaboration platforms** (Slack, Hubspot, transcription tools like Fireflies or Otter, etc.) to run its virtual-first operations efficiently. Its service delivery model combines automated prompts with **telehealth coaching sessions.**

Founder's motivation and challenges faced

Ali's journey to founding Beyond the Clinic was deeply personal and entrepreneurial. She observed how clinical bottlenecks left patients underserved and believed digital solutions could scale care delivery to thousands rather than dozens of patients a day. To finance the startup, she **sold her first home** and reinvested the proceeds into building the business. Since then, the firm has raised angel funding and secured government support.

As a woman founder, Ali has faced persistent **gender-related barriers**, particularly during fundraising efforts. In customer meetings, she often encountered bias, with potential partners directing questions to her male co-founder instead of her. She often relies on his presence with clients, reflecting the workaround of leveraging his presence to gain credibility in male-dominated negotiations. Ali is also critical of "female empowerment" programs that emphasize mentorship rather than actual capital, stressing that **what women founders need most is funding, not symbolic support**. Her leadership style blends pragmatism with advocacy, supporting flexible work arrangements, employee stock option plans (ESOPs), and even side hustles for team members to foster innovation and loyalty.

Successes achieved by the firm

- Generated **AUD 650,000 in revenue** since founding
- Built a **team of 12**, including engineers, physiotherapists, and designers, all of whom operate fully virtually
- Refined its product through **three major iterations**, now delivered as a scalable, API-first platform
- Signed an **international distribution agreement with** a global medical device company
- Expanded operations internationally beyond Australia to **New Zealand**
- Demonstrated measurable patient impact, including cases where patients on surgical waitlists avoided surgery after completing Beyond the Clinic programs

Lessons to impart

- ***Build lean and test fast***: Iteration and early failures provide critical learning.
- ***Technology isn't everything***: Clinical workflows are as important as deep tech; licensing and integrating external tech can be more effective than building from scratch.
- ***Automate cautiously in healthcare***: AI can increase efficiency, but sensitive decisions require human oversight.
- ***Female founders need financial, not symbolic, support***: Mentorship is useful, but capital access remains the real barrier.
- ***Adapt to systemic bias strategically***: Navigating male-dominated spaces may require unconventional workarounds, but maintaining leadership internally is key.

LABORATORIA (Peru)

“At Laboratoria, we want more women to take an active part in the digital economy, recognize their talent and access real opportunities that allow them to grow with autonomy, confidence and purpose.”
https://laboratoria.la/en

Firm activity overview

Laboratoria is a social impact non-profit organization founded in 2014 in Lima, Peru, with a mission to train women for careers in the technology sector. Originally launched as an in-person coding bootcamp, it transitioned to digital delivery during the pandemic and has now expanded significantly to cross-border delivery of its programs, operating fully remotely across Latin America. The firm serves learners in Peru, Chile, Colombia, Brazil, and Mexico. The organization has trained over 5,000 women and aims to significantly scale its impact in the coming years. It employs approximately 40 staff and is led by a woman CEO, with co-founder Mariana Costa currently serving as board president and head of new ventures. The choice to continue as a non-profit was driven by the desire for the firm to remain impact-focused and serve women in need.

Digital and AI content of firm's activities or products

Laboratoria delivers digitally intensive programs, with approximately 90% of its activities conducted online. The organization offers training for women in technical skills (such as coding and web development) as well as life skills and leadership. Its educational content is accessed through a proprietary tech platform. Laboratoria has incorporated artificial intelligence into several operations: automating admissions processes, tracking student engagement, and training students in AI fundamentals. The firm uses AI applications internally as well for its day-to-day operations and in assessing the numerous applications it receives. It is also building learner profiles with integrated metrics to follow graduates’ career paths.

Founder’s motivation and challenges faced

Mariana Costa, the co-founder, was motivated by the desire to train women to work in the growing digital economy sector. She noted a huge demand for roles in technology along with a huge need for more diversity, as very few women were working in the technology space. She believed in the core mission of the firm to prepare women to participate and thrive in Latin America's growing digital economy and set about to achieve this mission through applying new models of education and training. As CEO of a women-focused organization, Mariana Costa stated that she did not face strong gender-related barriers within the internal culture of Laboratoria. Because she worked primarily in mission-aligned, women-focused environments, she was shielded from many systemic challenges. However, Mariana noted that outside the firm, the broader tech ecosystem in Latin America remains male-dominated, and structural inequalities persist in corporate and entrepreneurial settings. Most of Laboratoria's early graduates were the first women to join their respective tech teams and faced multiple constraints to advance. Laboratoria since has worked with many companies to support inclusive cultures that give the same growth opportunities to diverse talent.

Successes achieved by the firm

Laboratoria has become a regional leader in digital inclusion for women and has achieved notable success since its founding, including notably the following:

- Trained over 5,000 graduates in five Latin American economies
- Received strong employer recognition for the usefulness of its training programs, with its graduates employed across Latin America in tech firms and startups
- Achieved recognition of the value of the firm's diplomas by companies in need of staff with technology and digital skills
- Formed successful partnerships with industry, providing custom training and talent placement upon the demand of the private sector.
- Diversified its funding base with philanthropic grants, revenue earned from training services, and a recently established endowment fund to ensure long-term sustainability.

Lessons to impart

- ***Mission-driven digital education works.*** Laboratoria's experience shows that high-quality, digitally delivered training can scale impact across borders when rooted in local needs.
- ***Adaptability is essential***. Transitioning from in-person to fully remote learning enabled Laboratoria to survive the pandemic and extend its reach.
- ***AI applications can strengthen non-profit operations***. Smart use of AI can improve student engagement, help to track outcomes, and personalize education, even in resource-constrained environments.
- ***A mixed funding model provides resilience***: Combining philanthropic support with earned income allows social enterprises to scale while maintaining mission integrity.
- ***Women-led ventures make a difference***: Having women in leadership fosters organizational cultures that reflect empathy, flexibility, and gender equity, which in turn support broader inclusion goals.

MACSO (New Zealand)

"Building sensory intelligence to detect risks early and create healthier, more sustainable farming systems"
https://www.macso.ai

Firm activity overview

MACSO is a New Zealand–founded startup established in April 2021 by computer scientist and AI ethicist **Saba Samiei**, with strong support from board chair **Samar Alrayyes** as part of the incubation program by **Bridgewest Ventures** funded by the Bridgewest Group, a US-based Private Equity Investor that invest in deep technology in partnership with the New Zealand Government. The company specializes in **sensory artificial intelligence** technology that enables machines to understand sound, vibration, temperature, and other environmental data. Its first commercial application is in agriculture technology (AgTech), focusing on early disease detection in farm animals. The firm's flagship product is a respiratory health monitoring solution for swine herds. It uses AI-enabled audio sensors to detect illness days earlier than trained human operators. This innovation not only reduces animal death rates but also minimizes antibiotic use, thereby improving animal welfare and supporting farmers in meeting stricter food safety and regulatory requirements.

Although headquartered in New Zealand, MACSO has a global footprint and is already engaged in exporting its services, with devices already deployed or under installation in **11 countries across Europe, Latin America, and Southeast Asia**, after earlier pilots were conducted in the United States and New Zealand. The company emerged from a **New Zealand government–backed deep tech incubator program** (Bridgewest Ventures / Callaghan Innovation) and has since raised **NZD 5.5 million**, achieving a pre-money valuation of **NZD 13.5 million**. It has now started its Series A fundraising round. The company has 8 employees, from a diverse cultural, talent and gender range of backgrounds.

Digital and AI content of firm's activities or products

MACSO's innovation lies in its application of **Edge AI and Tiny Machine Learning (Tiny ML)** technologies. Unlike large-scale AI models that require significant computational resources and cloud infrastructure, MACSO's algorithms are lightweight and decentralized, running directly on devices installed inside farms. This approach ensures that sensitive data remains on the farm, improves connectivity resilience in rural areas, and reduces the carbon footprint associated with AI processing.

The firm's AI models analyse coughs and breathing patterns of farm animals, together with barn environment factors such as humidity and air quality to provide continuous, objective monitoring of animal health. This enables veterinarians to make more precise, data-driven decisions about when interventions are required, reducing unnecessary antibiotic usage and improving herd management. Beyond swine respiratory health, MACSO is expanding its roadmap to include other animal species, aquaculture, pets, and eventually environmental monitoring and human health applications. Its sensory AI platform is protected by patents in the **U.S., EU, China, and Brazil**.

Founder's motivation and challenges faced

MACSO was founded by **Saba Samiei**, whose academic background in computer science and AI ethics shaped her conviction that technology must be used to solve pressing global challenges. The

devastating 2018 African swine fever outbreak in China, which killed over 43 million pigs and caused nearly USD 200 billion in losses, highlighted the potential of AI-enabled sensory monitoring to reduce risks in agriculture. From this starting point, Saba and her team developed MACSO's first application in swine respiratory health, building toward a broader vision of sustainability and food security.

Her entrepreneurial journey, however, has been marked by persistent barriers. During fundraising, she faced overt bias and inappropriate behaviour, including investors questioning her commitment to the company because of her gender, age, or potential family plans. Some dismissed her ideas with comparisons to failed female founders, while others openly doubted her leadership capacity. Entering the male-dominated AgTech space added additional challenges. Despite these obstacles, Saba's leadership style, shaped by her ethical perspective and inspired by her mother's example as a "boundary breaker", emphasizes compassion, sustainability, privacy, and inclusivity, which have become defining features of MACSO's culture and growth.

Successes achieved by the firm

- Developed the first AI-enabled respiratory health monitoring solution for swine herds, reducing mortality and antibiotic usage.
- Expanded internationally to 11 overseas markets in less than four years.
- Raised NZD 5.5 million, achieving a pre-money valuation of NZD 13.5 million.
- Secured patents in the U.S., EU, China, and Brazil.
- Built a diverse and inclusive team, with women engineers, young interns, and flexible workplace practices that support work–life integration.
- MACSO has the first female Board Chair across the Bridgewest Venture portfolio.

Lessons to impart

- ***Edge AI can be a game-changer***: MACSO demonstrates that decentralized, energy-efficient models can solve global problems while maintaining privacy and scalability.
- ***Incorporating ethical concerns can provide a competitive edge***: Embedding sustainability, compassion, and privacy into business models builds trust with customers, regulators, and investors.
- ***Diversity fuels resilience***: A blend of gender, age, and cultural backgrounds strengthens creativity and problem-solving.
- ***Women founders need resilience and networks***: Bias persists in financing and tech ecosystems; external allies and inner confidence are essential to overcome and flourish despite these biases. Samar has been an advisor and mentor to the Saba from the very beginning, supporting the founder and the company.
- ***Frame innovation as part of a bigger story***: Framing innovation as part of solving systemic challenges—food security, climate change, and sustainability—helps inspire investors, partners, and employees.

MINDSET GLOBAL PARTNER (Chile)

"We are a digital-native consultancy committed to advancing inclusive leadership, ethical AI, and digital transformation across Latin America."

https://mindset-global.com/

Firm activity overview

Founded in 2020 during the COVID-19 pandemic, Mindset Global Partners (MGP) is a Chilean consultancy specialized in digital transformation, responsible artificial intelligence (AI), and inclusive leadership. MGP operates across Latin America, delivering training programs, transformation strategies, diagnostic assessments, and consulting services tailored to public and private sector clients. Its approach combines strategic, technological, and human-centered dimensions to help organizations adapt to 21st-century challenges such as digitalization, sustainable growth, and ethical AI adoption. MGP operates as a for-profit **B-type company** (with collective interest). It has been primarily self-financed.

Its founder, Leslie Carol Olave Rojas, is an IVLP Fellow (USA, 2021), a WEAmericas Fellow (2021), and currently serves as Secretary General of State Alumni Chile (2025–2026). MGP is active in global networks including ConnectAmericas Women, WEConnect International, Women in AI, and Global STEM Women, and is a signatory of the Women's Empowerment Principles (WEPs). In 2025, it completed the first stage of the **Women ConnectAmericas Access to Finance Challenge (IDB)** and was selected for the Specialized Technical Assistance stage, focused on financial diagnosis, business case development, and strategic financing planning.

At the economy-wide level, MGP contributes to public-policy dialogues in Chile through Nodo CINVAL (gender & CTCI), the SENCE Employability Roundtables, Startup Day and Science sessions at the National Congress of Chile (2025), and STEM leadership initiatives of the Ministry of Science. MGP participated in Chile's 2025 domestic roundtables on women in STEM, employability, and inclusive leadership. Beyond Chile, it leads a community of over 600 companies in Latin America established during Outsource2LAC 2020.

Digital and AI content of firm's activities or products

MGP develops proprietary AI-based solutions and applies advanced digital technologies in its services. These include: **ALIPA,** an AI solution supporting women-led exporting SMEs; **InspirIA** – the first intensive AI leadership program in Chile, co-created with CENIA, combining technical AI skills with change management; and **Ethical AI Diagnostic MVP** (in development) which is innovating a SaaS tool to assess AI maturity and ethical risk in SMEs. AI capabilities within the firm include generative AI for content and training, automated analytics and visualization, AI-based video generation, and collaborative intelligence systems for project management. MGP avoids reliance on closed ecosystems, prioritizing flexible and interoperable technologies.

Founder's motivation and challenges faced

As a single mother of three, Leslie Carol Olave Rojas, is driven by the need to address structural barriers women face in Latin America which include the burden of unpaid care, limited access to opportunities, persistent glass ceilings, and the fact that many women are primary

household providers. She believes that technology, collaboration, and inclusive leadership can create sustainable livelihoods and empower women to lead digital and economic transformation in their lives and professions.

Among the challenges faced by women, Leslie cites in particular gender biases, which result in women often being sidelined in male-dominated industries; andmarket positioning. Rather than being branded “only for women,” MGP promotes inclusive and collaborative leadership that involves both women and men.

Successes achieved by the firm

- **InspirIA**: first AI leadership program for women in Chile
- **Development of innovative AI technologies, including ALIPA**: AI solution for women-led SMEs in trade and **Ethical AI Diagnostic MVP**: under development as scalable SaaS
- 3rd place in the first **Pacific Alliance Hackathon** (2023, Peru) with participation from Chile, Colombia, Mexico, and Peru
- **Champion of the Women Connect Americas Challenge** (IDB, 2024)
- **Participation in MIT Innovation Days** (USA, 2023) and **United Nations** (USA, 2023)
- **STEM and leadership initiatives in Argentina (2024)** and participation in the **STEM Symposium at Broward International University (BIU, USA, 2024)** on “AI as a driver of change for organizations and STEM”
- **Outsource2LAC** participation (Jamaica 2023, Argentina 2024)
- **UNESCO–CAF Ministerial Summits** on the Ethics of AI (Chile 2023, Uruguay 2024)
- Training in **AI risk and crisis management** for the White Box Project Institute (Mexico, 2024)
- **VIP delegate** to GBM: Global Banking Digital Infrastructure & Project Finance Summit (USA, 2026); applicant to **eMerge Americas** (USA, 2026)

Lessons to impart

- ***Resilience and adaptability are essential***: Building a digital-native consultancy during a global crisis demands agility, reinvestment of resources, and the ability to navigate uncertainty.
- ***Inclusive and collaborative leadership drives innovation***: Less hierarchical leadership styles—often championed by women—enable diverse voices to shape digital transitions.

- ***Networks are powerful levers***: Engagement in global and regional communities such as IVLP, WEAmericas, ConnectAmericas Women, WEConnect International, Women in AI, and Global STEM Women has been decisive in expanding visibility and opportunities.
- ***Structural barriers require systemic responses***: Gender biases, unpaid care burdens, glass ceilings, and the prevalence of women as household providers highlight the urgency of real inclusion.
- ***Technology must serve empowerment***: By focusing on ethical AI, data-driven decision-making, and interoperable SaaS solutions, technology can democratize opportunities for SMEs and women-led businesses.

NEUROFROG (New Zealand)

“Science-driven parenting support, combining neuroscience, developmental psychology, and AI to empower families during the first 1,000 days.”

https://neurofrog.com

Firm activity overview

Neurofrog is a New Zealand–based digital health startup providing evidence-based tools and content for pregnancy and early childhood development. Founded in 2020 by Dr. Bruce Allen (radiologist and entrepreneur) and Tim Haynes (social scientist), the company was a result of several earlier pivots in the parenting category. The platform gained a strong neuroscience foundation in 2024 when Dr. Wan-Ting Yeh, an expert in neuroscience, developmental psychology, and AI-behavioural modelling, joined to merge scientific research with the company's innovation and R&D initiatives.

The firm's mission is to deliver neuroscience-informed parenting guidance at scale. Neurofrog operates as both a data-forward platform and consumer app, offering daily and weekly support programs, simplified developmental screening tools, and culturally adaptable content that empowers families during the critical first 1,000 days. While headquartered in New Zealand, Neurofrog is designed for expansion into Asian and ASEAN markets.

Dr. Wan-Ting heads the women-led psychology/neuroscience team as the in-house expert, supported by two women contractors with psychology backgrounds (one PhD holder). This team serves as the core early childhood knowledge engine that powers Neurofrog’s product delivery through technology.

Digital and AI content of firm’s activities or products

AI is central to Neurofrog’s platform and business model. The company combines neuroscience and developmental psychology with advanced digital infrastructure to scale across diverse contexts.

Key elements include:

- **Cloud infrastructure** – AWS-based multi-tenant architecture supports scalable microservices delivery.
- **Data management** – MongoDB Atlas stores diverse data types with geospatial indexing for region-specific delivery.
- **Conversational AI** – empathic AI assistants delivering validated parenting guidance.
- **Knowledge and content management** – AI-driven curation systems supporting expert content creators.
- **Synthetic media** – AI-generated visuals tailored to cultural and developmental contexts.
- **AI agents and orchestration** – multi-agent systems balancing proprietary models and third-party APIs to avoid vendor lock-in.
- **AI-driven QA** – automated testing tools to uphold safety, reliability, and efficacy standards.

Neurofrog has also participated in global and regional accelerator programs, including **NewChip (Austin, Texas)**, the **Callaghan HealthTech Activator**, and the **Angel Association New Zealand**, while promoting continuous digital upskilling internally.

Founder's motivation and challenges faced

While originally founded by Dr. Allen and Haynes, who wanted to spread science-made-easy to parents, Dr. Wan-Ting Yeh joined this adventure because she shared their motivation. Drawing from her academic background and personal journey as a mother, she had been a scientific blogger for years, focusing on sharing scientific parenting knowledge and making neuroscience accessible to families. When she joined Neurofrog, she brought a dual mission: expanding her impact in science communication while pioneering a neuroscience-informed work ecosystem that balances wellbeing and work progress to create a calm workplace.

From Haynes' perspective, challenges lie not only in technology development but also in navigating structural barriers:

- **Limited investor diversity** – male-dominated networks create closed circles where familiarity is mistaken for competence.
- **Conservative risk perceptions** – deep tech ventures with long R&D cycles are measured against traditional B2C cycles, resulting in underinvestment.
- **Geographic bias** – NZ investors favour established EU/US markets, overlooking high-growth ASEAN opportunities that align with Neurofrog's strategy.
- **Cultural bias against parenting tech** – male investors often underestimate the value of care and parenting solutions.

Successes achieved by the firm

- Built and validated a neuroscience- and AI-driven parenting platform.
- Secured a **Callaghan Innovation R&D grant** to fund neuroscience, AI, and technical research.
- Participated in **accelerator programs** regionally and internationally (NewChip, Callaghan HealthTech Activator, Angel Association NZ).
- Established a women-led, multicultural management and research team with a female majority across FTE and wider team composition.
- Positioned for ASEAN expansion with culturally adaptable solutions.
- Advanced AI infrastructure through continuous Proof of Concepts, iterative updates, and agentic system design.

Lessons to impart

- **Bootstrapping builds resilience** – running lean with R&D grants reinforces discipline.
- **AI-native mindset** – scaling sensitive services requires designing beyond tools, toward AI-native systems.
- **Human + AI partnership** – expert validation ensures safety and trust in child health applications.

- **Bias remains systemic** – women-led ventures and caregiving tech face structural under-valuation in funding ecosystems.
- **Alternative markets matter** – ASEAN offers stronger fundamentals than New Zealand's small domestic market for growth.
- **Continuous upskilling sustains innovation** – combining accelerator participation with in-house learning strengthens long-term capacity.

NOBURO PLATFORM (Thailand)

"We empower workers to move from debt to wealth through financial literacy, behavior change, and access to fair credit."
https://www.noburo.co/

Firm activity overview

Founded in 2018, Noburo Platform (commercial name: *Noburo Wealth-Being*) is a Thai hybrid between a social enterprise and a startup. Its mission is to help low-income, blue-collar workers transform from being "in-debt" to "in-wealth," tackling Thailand's severe household debt crisis. Noburo provides a combination of financial health checks, debt planning, financial literacy programs, and access to affordable loans. The model is B2B2C: the firm works with employers to offer services to workers, and with financial institutions—particularly government-owned banks—for lending. Noburo itself does not provide loans; instead, it prepares workers through education and behavior scoring to qualify for sustainable credit. To date, it has assisted around 16,000 individuals and employs 20 staff full-time with a balanced gender mix.

Digital and AI content of firm's activities or products

Noburo integrates technology-driven financial education and AI tools into its platform in several ways:

- **Mobile application**: Uses positive psychology and gamification to encourage financial literacy, debt clearance, and savings.
- **AI for debt planning**: Automates debt analysis by reading credit history PDFs and generating repayment recommendations tailored to each user.
- **Blended learning model**: Combines offline workshops (which are important for onboarding and trust-building) with digital tools, though reliance on in-person sessions limits scalability.
- **Financial health checks and behavior score**: Users complete assessments and tasks via the app, producing a behavior score that is shared with partner banks. This has enabled almost 100% loan approval rates when referrals are made.
- **Human–AI mix**: While AI supports back-end processes, human facilitation remains central for sensitive interactions such as debt counseling phone calls and workshops.

This combination of digital tools and human support allows Noburo to deliver scalable, yet empathetic, financial health solutions to vulnerable populations.

Founder's motivation and challenges faced

Founder **Thisana Thitisakdiskul**, trained in computer engineering and was inspired by Muhammad Yunus's social business model while studying in Japan. Exposure to Thailand's debt crisis—including through her father's microfinance business—strengthened her conviction that financial literacy combined with access to credit could offer a sustainable alternative to charity. She co-founded Noburo with a tech partner as Chief Technology Officer (CTO) and an operations partner as Chief Operating Officer (COO), developing the platform and launching pilots with family and friends' companies. Entry

into accelerators such as DTAC Accelerator in 2018, and later programs by Thailand's National Innovation Agency, DEPA, and the Stock Exchange of Thailand, helped validate and grow the firm.

Her entrepreneurial path has faced several hurdles. Scaling the business remains difficult, as workshops and counseling are resource-intensive and limit speed of expansion. Balancing the dual identity of social enterprise and profit-driven startup also presents challenges in securing sustainable financing. As a woman in business in Thailand, she reports not experiencing discrimination from investors or government programs, but notes exclusion from informal, male-dominated networking spaces (such as late-night socializing) where deals are often made. She also recognizes that investors in Thailand tend to prioritize hype-driven sectors such as AI, making it harder for impact-oriented models like Noburo to attract funding.

Successes achieved by the firm

- Assisted **16,000 individuals** with debt management, financial literacy, and savings.
- Established strong **partnerships with employers** and government-owned banks to deliver services.
- Maintains a **70% female user base**, reflecting women's critical role in household financial management.
- Benefited from recognition and support through:
    - National Innovation Agency (social innovation grants)
    - DEPA (convertible notes)
    - Stock Exchange of Thailand's social enterprise program
    - International Catapult Program in Luxembourg, highlighting Noburo's potential for regional expansion.
- Built a reputation for impact, with media coverage and endorsement from the **Governor of the Bank of Thailand** boosting credibility and visibility.

Lessons to impart

- ***Behavior change + financial access = lasting impact***: Literacy alone is not enough; it must be paired with access to tools like credit and savings.
- ***Hybrid models can thrive***: Combining social enterprise purpose with startup agility creates sustainability while keeping mission central.
- ***Gender-aware design? (interest and applicability?) emerges naturally from relevant product offerings***: Even without targeting women specifically, Noburo's services attract women, underscoring their role in household financial stability.
- ***AI complements, but does not replace, human trust***: Automation increases efficiency, but sensitive counselling requires human contact.
- ***Scaling requires partnerships***: Regional expansion will depend on building reliable local partnerships with banks and employers in other countries.

QBO INNOVATION (Philippines)

“Enabling Filipino startups to thrive through mentorship, inclusivity, and community building”
https://www.qboinnovation.com

Firm activity overview

QBO Innovation is the Philippines’ first public–private partnership innovation hub, established in **2016** through a collaboration amongst JP Morgan, the **Department of Science and Technology (DOST)**, the **Department of Trade and Industry (DTI)**, and **IdeaSpace Foundation**, the corporate accelerator of the First Pacific Group led by Manny V. Pangilinan. The hub was created to broaden access to entrepreneurial support beyond corporate-linked initiatives and to serve as a domestic platform for fostering innovation.

As an **enabler of the Philippine startup ecosystem**, QBO provides structured programs, mentorship, consulting services, and strong linkages with government, corporate, and academic partners. Over the past nine years, it has **supported more than 300 startups** across sectors ranging from agritech to fintech, healthtech, and creative industries. About **5 percent of these startups have expanded internationally**, demonstrating the global potential of Filipino entrepreneurs.

The organization maintains a **lean team of 12 staff**, with a strong female majority (nine women and three men), reflecting its commitment to gender balance not only in programming but also internally. QBO has become a **recognized thought leader in the Philippines’ innovation ecosystem**, often partnering with the Government, multilateral agencies (such as the ITC), embassies, universities, and corporations to deliver accelerator programs and startup events—including the annual **Philippine Startup Week**, the economy’s largest innovation gathering.

Digital and AI content of firm’s activities or products

QBO relies heavily on **digital technologies** to deliver its programs and maintain networks. The hub uses platforms such as **Zoom, Teams, Google Meet, and Streamyard** for training and webinars**, Slack** for internal collaboration, and more accessible tools like **Facebook Messenger, Viber and WhatsApp** for outreach—reflecting local communication norms.

The organization also experiments with **AI tools** like ChatGPT and Gemini for administrative tasks, event support, and program delivery. However, as a nonprofit operating mainly on grants, **financial constraints limit advanced AI adoption**. As Executive Director **Alwyn Joy Rosel** noted, donor funding is usually earmarked for direct startup support rather than for strengthening enabler organizations themselves. Despite these limitations, QBO exemplifies **resourceful digital adoption**, leveraging available tools to increase team productivity and ecosystem reach.

Leadership motivation and challenges faced

QBO’s leadership team is deeply embedded in the Philippine startup ecosystem. Executive Director **Alwyn Joy Rosel**, who began her career in the BPO industry before moving into startup incubation at the University of the Philippines and the Asian Institute of Management, has worked in innovation for over **13 years**. Her professional journey reflects a shift from corporate to developmental work, with a focus on **building collaborative networks** rather than technical product creation.

Several challenges shape QBO's operations. First, as a **grant-funded nonprofit**, the hub struggles to invest in its own organizational capacity and advanced tools. Second, **tracking startup outcomes** remains resource-intensive, with limited response rates to annual surveys; social media monitoring often substitutes for formal reporting. Finally, while QBO emphasizes inclusivity, achieving greater international expansion for Filipino startups has been difficult, with only a small proportion reaching foreign markets. These obstacles highlight systemic gaps in financing, scaling support, and ecosystem maturity.

Successes achieved by the firm

- Supported **over 300 startups** since 2016, across diverse sectors.
- Enabled **5 per cent of startups** to expand into international markets.
- Established itself as the **Philippines' leading innovation hub**, bridging government, private sector, and development partners.
- Pioneered **Startup Pinai**, an initiative ensuring women's representation in panels, judging committees, mentorship, and program activities.
- Built a **gender-diverse team** (75 per cent women) and contributed to normalizing women's leadership in the innovation ecosystem.
- Partnered with global organizations (e.g., ITC, U.S. Embassy, EU) to deliver accelerators and capacity-building programs for young entrepreneurs.

Lessons to impart

- ***Inclusivity requires intentionality***: QBO demonstrates that policies like "no all-male panels" and gender-balanced mentorship pools can shift norms in startup ecosystems.
- ***Digital adoption can scale impact***: Even without proprietary AI, consistent use of available digital tools enhances reach, collaboration, and efficiency.
- ***Nonprofits need capacity-building too***: Sustainable ecosystem enablers require donor support not only for startups but also for their own digital and institutional strengthening.
- ***Collaboration drives ecosystems***: Public–private partnerships create legitimacy, funding, and networks that startups cannot access alone.
- ***Representation in external initiatives matters***: Highlighting women entrepreneurs through initiatives like *Startup Pinai* changes perceptions and builds aspirational role models for the next generation.

QILIANG DIGITS (China)

“We harness AI and digital trade innovation to help Chinese enterprises build sustainable success in global markets.”

https://qldigits.com/en/

Firm activity overview

Founded in 2020 by CEO Arylin Wu, Qiliang Digits (QL Digits) is a Shanghai-based cross-border trade technology company. Its mission is to help Chinese firms globalize through intelligent digital trade solutions. Guided by the vision to “make the world fall in love with Chinese enterprises,” QL Digits aims to build genuine brand value and cultural recognition for Chinese products and services in overseas markets.

The company has assembled a multidisciplinary “AI-native” team of experts from firms such as Shanda, Ernst & Young, and NetEase. This culture of bottom-up innovation allows every team member to experiment with AI tools and embed them across workflows.

QL Digits has built an ecosystem of 2,000+ media resources worldwide. Its proprietary Cross-border Digital Intelligence SaaS Platform integrates global data sources, providing real-time market monitoring, insights, and automated decision support. The firm serves clients in digital finance, gaming, Web3, AIGC, and cross-border e-commerce, helping them expand into markets across Europe, North America, Southeast Asia, and Latin America. Strategic partnerships with Google, TikTok, Facebook, and Amazon strengthen its role as both a service provider and a system integration innovator.

The company achieved profitability in its first year, showing strong commercial viability and resilience.

Digital and AI content of firm’s activities or products

QL Digits is fully digitalized, with AI embedded in all operations. Initially investing over 20% of profits in proprietary AI R&D, the company pivoted after the emergence of GPT-3.5 in 2022. Rather than compete with foundational AI developers, QL Digits chose to become an “AI application innovator,” rapidly integrating new tools into business practice.

By 2024, all workflows were re-engineered around AI. In business intelligence, AI analyzes client needs and generates personalized solution recommendations. In market monitoring, AI tracks global dynamics and adjusts strategies in real time, ensuring clients’ overseas campaigns remain aligned with market shifts. The company also applies AI to massive cross-border trade datasets, identifying new opportunities and risks, and generating automated response strategies to regulatory or policy changes within minutes.

The flagship Cross-border Digital Intelligence SaaS System integrates global platform data for automated advertising optimization, personalized recommendations, and cultural adaptability analysis. Its strength lies not in reinventing platforms but in consolidating and orchestrating them into a unified decision-making network. This allows QL Digits to provide clients with both global reach and localized insights.

Founder’s motivation and challenges faced

Arylin Wu's entrepreneurial drive comes from more than 15 years in marketing and advertising. She observed that many high-quality Chinese products lacked recognition overseas because traditional marketing was labor-intensive and outdated. She concluded that digital capability—not just product quality—was the key to gaining international respect. Inspired by the idea of promoting Chinese enterprises through value creation rather than low prices, she founded QL Digits to help firms build true brand value abroad.

The biggest challenge came with the GPT-3.5 breakthrough, which disrupted the company's costly AI development strategy. The team had to choose between persisting with in-house R&D or embracing general AI tools. This pivot triggered internal debate but ultimately reshaped QL Digits as an agile AI application leader.

Another challenge was investor perception. Many viewed cross-border digital trade as a traditional service sector rather than a technology-driven industry. Educating the market while maintaining growth demanded perseverance.

The COVID-19 pandemic created both risk and opportunity: accelerating digitalization worldwide but also forcing QL Digits to build organizational resilience under uncertain conditions.

Successes achieved by the firm

- **Profitability and strategic autonomy:** Achieved profitability in the first year, ensuring independence from investor pressures and enabling long-term strategic planning.
- **Integration with global platforms:** Secured partnerships with Google (Greater China Partner), TikTok, Facebook, and Amazon, enabling precise targeting and expansion into multiple global markets.
- **Flagship AI platform:** Developed the Cross-border Digital Intelligence SaaS System, delivering real-time market insights and adaptive strategies.
- **AI-native organizational culture:** Established a bottom-up culture where employees use AI tools daily, fostering continuous innovation.
- **Academia-industry links:** Built collaborations with Shanghai University and the University of Shanghai for Science and Technology; CEO serves as MBA mentor and advisor.
- **Policy and industry influence:** Participates in policy discussions through CATIS and CCF, contributes to digital trade standards, and holds "High-tech Enterprise" certification.
- **Knowledge sharing and philanthropy:** Regularly shares practical experience through seminars, contributing to the development of China's cross-border digital trade ecosystem.

Lessons to impart

- **Cognitive agility matters more than technology alone:** The GPT-3.5 shock highlighted that competitiveness comes from the ability to reframe strategies quickly, not from clinging to sunk investments.
- **Systems thinking over control:** In complex markets, synergy and adaptability matter more than controlling every variable. QL Digits positions itself as an open system that optimizes flows of information and value.

- **Redefining competition:** Shifting from price competition to value recognition elevates the role of cultural identity and brand influence in global markets.
- **Independent thinking as a scarce resource:** Early profitability allowed the firm to maintain intellectual independence and make judgments based on first principles rather than external pressures.
- **From company to standard-setter:** Contributing to industry standards and policy processes shows that leadership lies not in monopolizing knowledge but in shaping frameworks that benefit the broader ecosystem.
- **Capability-focused culture:** True equality stems from focusing on skills, mindset, and value creation rather than gender. Flexible work arrangements support balance and help attract top talent.

TECHSAUCE (Thailand)

“Empowering Southeast Asia’s tech ecosystem through events, media, and innovation programs”
https://techsauce.co/en

Firm activity overview

Techsauce is a **technology ecosystem enabler** founded in **2015** by **Oranuch (Mimee) Lerdsuwankij** and three co-founders. Within two to three years, Mimee bought out her co-founders’ shares and became the sole active founder, steering the company into one of Southeast Asia’s most influential innovation platforms.

The company operates across four main platforms: (1) the **Techsauce Global Summit**, one of the region’s largest technology conferences, attracting more than **18,000 participants from 60 countries**; (2) a **media portal** providing in-depth coverage of technology, digital transformation, and innovation trends; (3) an **accelerator program** that runs hackathons and growth-stage support initiatives, including collaborations with organizations such as the Digital Economy Promotion Agency (under the Ministry of Digital Economy and Society), and (4) the **Techsauce Academy**, which delivers upskilling and reskilling programs using AI and digital tools.

From its origins in Thailand, Techsauce has steadily expanded its footprint. It now exports services by attracting international participants to its Bangkok summit (Mode 2) and by organizing **physical events in Viet Nam and Indonesia** (Mode 4).

With a **team of around 70 employees**, of whom **60–65% are women**, Techsauce is notable for its internal diversity, which also includes LGBT staff. It has been **profitable since its first year**, supported by careful cash flow management, venture capital investment, and government grants.

Digital and AI content of firm’s activities or products

Techsauce is **digitally intensive**, relying on over **50 different cloud-based software tools** to run its operations, including Google Workspace, Google Cloud, and Slack. For its flagship Techsauce Global Summit, it has also co-developed a custom **event and speaker management platform** with a local Thai startup that Mimee co-founded separately.

The company uses **AI extensively but cautiously**. Its media and content team employs **Google Gemini** for research and drafting, always under human editorial oversight to ensure quality and originality. Internally, Techsauce also uses **AI video tools** for storyboarding and event preparation, though it avoids publishing AI-generated videos externally due to copyright concerns. At its Global Summit, the company deploys **real-time AI translation systems** to deliver multilingual content, including Thai, Chinese, Korean, and Japanese, thereby making events accessible to a diverse regional audience.

The Techsauce Academy integrates digital and AI-enabled training into its programs, using hackathons to encourage employees and participants alike to identify bottlenecks and embed AI in workflows. Staff are also given training budgets to pursue self-selected digital courses, reflecting a culture of continuous learning and adaptation.

Founder's motivation and challenges faced

Mimee's path to Techsauce reflects a strong entrepreneurial trajectory and a passion for technology. With a background in **telecommunication engineering** and over a decade of experience in corporate product management, she left the corporate world in 2012 to launch her own startups. Techsauce is her **fourth company**: her first e-venture failed, her second—a digital marketing media platform—was acquired by online agency, and her third—a social media monitoring platform—was acquired by a Korean unicorn.

By the time she raised funds for Techsauce, the company was already well established, which spared her some of the gender-related fundraising challenges often faced by women founders. She reports being treated with respect and equality by investors, though she acknowledges that many female peers in Thailand's startup ecosystem encounter scepticism when disclosing family plans. Mimee credits **mentorship networks like IMETMAX,** along with role models such as Jareeporn Jarukornsakul of the WHA Group, for guiding her in business and society.

Techsauce's internal policies reflect this ethos. With a majority female workforce, the company supports **mothers with flexible work arrangements**, extending work-from-home or reduced-scope roles after maternity leave. It also actively ensures inclusivity by providing opportunities for LGBT employees and by embedding gender considerations in accelerator and hackathon activities.

Successes achieved by the firm

- Built a reputation as one of **Southeast Asia's largest and most influential tech ecosystem platforms**, hosting annual summits with **18,000+ international participants**.
- Expanded Techsauce Global Summit to **Viet Nam and Indonesia**
- Created a **multi-platform model**: global summits, media portal, accelerators, and academy.
- Achieved **profitability from inception**, supported by venture capital and government grants.
- Established a **diverse workforce** (60–65% women, LGBT-inclusive).

Lessons to impart

- **Diversified platforms create resilience**: Techsauce combines events, media, accelerators, and training to build an end-to-end ecosystem model.
- **AI is a tool, not a replacement**: Treating AI as a "colleague" ensures quality while maximizing efficiency.
- **Ecosystem growth requires inclusivity**: Gender balance, flexible work arrangements, and LGBT inclusion strengthen innovation communities.
- **Profitability and impact can align**: Techsauce demonstrates that ecosystem enablers can be financially sustainable while delivering social and economic value.
- **Founders' persistence and adaptability matter**: Mimee's multiple entrepreneurial experiences illustrate that failure and exits both feed into long-term success.

THEODORA (Chile)

“Theodora AI is the golden standard for managing reputational risk and creating rapid innovation by removing bias in your organization”
https://www.theodora.ai/

Firm activity overview

Theodora is a Chilean-founded startup established in 2022 by lawyer **María José Martabit**, in partnership with AI worldwide expert **Ricardo Baeza-Yates**. The company develops artificial intelligence (AI) to detect, analyse, and correct **biases in communication**, defined as any unconscious, unfair affirmation or comment about a group of people. Working with linguists, neurologist, AI specialists, and lawyers globally, the firm’s main product is a "bias report" that provides organizations with an "x-ray" of how bias impacts their communications, both internal and external. Originally focused on legal tech, Theodora pivoted to a focus on banking, retail, and creative industries after it encountered resistance to its objective and product from legal professionals, and has been much more successful with this focus. The company currently operates in Chile and Mexico, and works with multinational companies that have a worldwide presence. It maintains a diverse team of seven specialists worldwide.

Digital and AI content of firm's activities or products

Theodora’s operations are focused nearly one hundred percent on the utilization of digital and AI technology. The firm’s innovation lies in its **patented AI technology**, which integrates social listening tools with proprietary algorithms. The system draws on a unique and proprietary dataset which was built from scratch through consolidating input from individuals in 20 countries around the world. Creation of the dataset was financed through global competitions sponsored by Microsoft. Theodora uses the information in this dataset to assess online communications and the reports of firms and organizations for **gender, ethnic, disability, and sexual orientation biases**, as well as the assessment of their readability and reputational risk. The firm also collects information through a mobile app system on its website where people can submit and label biases in content. Theodora’s technology can process **text, images, and videos**. Theodora´s technology to detect and mitigate biases in texts is under patent protection in the United States, and now protecting new developments in the United State and in the European Union, which has opened a company in the U.S.to manage its IP portfolio. The firm also operates a **brain lab component** to study how unconscious bias impacts human decision-making, and is currently expanding its IP portfolio in this direction. It has developed an online anti-bias world challenge with psychiatrists available to all to complete.

Founder’s motivation and challenges faced

The founder credits her role models first and foremost as the hardworking women in her own family. Her motivation stems from her personal experience of 15 years in Chile’s legal profession, where despite multiple qualifications she felt herself to be “invisible” in the traditional legal system structure. She describes this experience as a reflection of the **“architecture of society”** that prevents women from advancing professionally to leadership roles. She was also motivated by a sense of justice and equality that should be the basis for the treatment of all individuals. Establishing Theodora required significant personal sacrifice: María José and her husband financed the first year of the firm’s

operations with their savings and by selling an apartment. Currently Theodora is funding its operations through grants, prizes, and client revenue. Beyond the financial sacrifices, further challenges included the high cost of IP protection and the difficulty of finding specialized AI lawyers in Latam to patent the innovative technology locally (which was patented in the U.S. and the EU as a result).

Successes achieved by the firm

Despite the above challenges, Theodora can attest to several notable successes. These include the following achievements:

- Developed and patented a novel technology with applications across different types of industries (retail, finance, and creative industries)
- Developed complementary tools, such as an **anti-bias quiz** with psychiatrists to allow individuals to test themselves and reflect about the bias they might have.
- A mobile app "**The bias project"** to allow people around the world to contribute to label text and images in several bias categories, in summary is a mobile app for bias submission and labelling.
- Built a multidisciplinary and international team of seven (ages ranging from 28 to 60+), including linguists, lawyers, sociologist, neurologist, engineers, and AI experts.
- Secured funding and recognition from multiple sources, including **Microsoft**, **Manateech (Miami)**, the **Ministry of Science of Chile**, **Corfo**, **Inria,** and impact investors.
- Conducted projects with multinational firms in banking and retail, and a political analysis project for the Mexican Consultant Firm on Latino voting behaviour in the US (during the last presidential election).

Lessons to Impart

1. **Resilience and adaptation:** Theodora's experience demonstrates how resistance encountered to the firm's output in one industry (legal services) can be overcome by pivoting toward more open sectors (banking, retail and creative services).
2. **Women must create their own platforms:** Structural gender biases in society and the professional world mean that women may need to create their own platforms rather than wait for existing ones to open.
3. **A global mindset is an asset:** Working from the outset with a global mindset to build international networks, distributed teams, and cross-border IP protection patents can strengthen resilience and credibility for a start-up firm.
4. **Financing is a big challenge:** Women founders are often forced to rely on personal savings and family resources at the outset as other financing is not available commercially; external grants and accelerators become essential later for the firm's expansion.
5. **AI can act as an enabler in the right environment:** Artificial intelligence can empower small teams to be more efficient and productive but requires constant investment in innovation and the right skill set of employees.

6. **Networking can and should be used to advantage**: Engagement in networks established by engagements in Theodora (but not preexisting professional associations or similar networks) has proved very useful in creating channels of support and providing visibility to the firm’s operation and objectives.

TOPLOGIS Inc. (Chinese Taipei)

“Smarter Supply Chains, Seamless Logistics.”

https://www.toplogis.com/

Firm activity overview

Founded in 2004 by CEO Peng Li-Chen (Catherine), TOPLOGIS Inc. is a cloud-based logistics platform headquartered in Chinese Taipei. The company helps businesses, especially high-tech manufacturers, manage complex supply chains with greater efficiency. Today, it is recognized as the largest B2B logistics platform in Chinese Taipei. TOPLOGIS serves around 80% domestic clients—principally major electronics firms—while 20% of its customer base spans the United States, China, Singapore, and Japan. Its mission is to deliver intelligent, digitalized logistics solutions that allow manufacturers to outsource supply chain operations and focus on their core competencies.

The firm employs about 50 people, with women making up 70% of staff and 80% of managers. Family-friendly policies, such as work-from-home options and support for working mothers, underpin a high retention rate, especially among women employees.

Digital and AI content of firm’s activities or products

TOPLOGIS develops proprietary software that digitizes logistics and automates customs clearance. Its AI models, trained on large datasets and supported by ChatGPT technologies, can auto-generate clearance documents with roughly 95% accuracy. Human experts verify the final step, creating a human–AI hybrid process that continues to learn and improve.

The platform also integrates supply chain actors—shippers, freight forwarders, customs brokers, and trucking companies—into a unified cloud-based system. By processing information once and sharing it across the chain, TOPLOGIS reduces redundancy, minimizes errors, and accelerates shipment cycles. Through this digital backbone, the company transforms traditional paper-heavy logistics into a streamlined, near paperless process. Clients benefit from faster compliance, lower risks of penalties due to errors, and enhanced operational efficiency.

Founder’s motivation and challenges faced

Catherine studied applied mathematics and later completed a master’s degree in IT. Early in her career, she worked in Hsinchu Science Park, where she saw women in shipping departments performing tedious manual paperwork in high-tech companies that otherwise drove Chinese Taipei's GDP growth. This contradiction motivated her to build a digital platform to make logistics smarter, more efficient, and more rewarding for workers.

Inspired by Salesforce.com’s transformation of CRM, she envisioned a similar disruption for supply chain management. Her personal motto, “do something different,” reflects this ambition.

The journey was not easy. Catherine invested USD330,000 (NTD 10 million) of her own savings to start the firm and faced repeated rejections when seeking bank financing. Banks in Chinese Taipei did not understand her business model, and she believes gender bias may have played a role—investors even questioned whether her husband supported her entrepreneurial decision. A breakthrough came when Acer’s founder, Mr. Stan Shih, invested through ID Soft Tech Capital, attracting further investors such as ACORN Campus, CTC Capital, and Evergreen Marine. With several million USD raised, TOPLOGIS grew steadily, finally achieving profitability in 2014 after a

decade of losses. COVID-19 became a turning point for the logistics industry in 2020, accelerating global demand for digital logistics and significantly boosting the company's growth trajectory.

Successes achieved by the firm

- **Market leadership:** Now in position as largest B2B logistics platform in Chinese Taipei, trusted by leading electronics manufacturers.
- **Patented technology:** Developed proprietary AI-driven logistics software, with patents registered in Chinese Taipei.
- **Profitability after persistence:** Achieved profitability in 2014 after 10 years, demonstrating resilience and long-term commitment.
- **AI-enabled customs clearance:** Reached 95% accuracy in automated document generation, reducing compliance risks and improving efficiency.
- **Gender-inclusive workplace:** TOPLOGIS features a team that is 70% female, with women holding 80% of management roles, supported by family-friendly policies.
- **Mentorship and advocacy:** Women entrepreneurs are actively mentored. Catherine promotes STEM education for girls and advocates persistence in male-dominated sectors.

Lessons to impart

- ***Persistence pays off*:** Building profitability took a decade, but persistence, coupled with the right investors, sustained the firm.
- ***Innovation can come from lived experience*:** Observing inefficiencies in the shipping departments inspired a platform that transformed logistics practices.
- ***Gender bias in capital markets*:** Female entrepreneurs face additional scrutiny; overcoming it requires both persistence and strong proof of concept.
- ***AI can be used as a practical tool:*** Rather than replacing people, AI can complement human expertise, reduce errors, and enable staff to focus on higher-value tasks.
- ***Inclusive leadership is important*:** A focus on family-friendly policies and capability building fosters loyalty and talent retention, particularly among women.
- ***Doing things differently*:** Innovation often begins with challenging entrenched assumptions, as shown by applying cloud technology to logistics long before it became mainstream.

XCUBE.CO (Singapore)

“We bridge the gap between corporates and startups, turning ideas into market-ready solutions that deliver real impact.”

https://www.xcube.co

Firm activity overview

xcube.co is a Singapore-based venture studio and innovation partner established in 2023. Its mission is to help financial institutions, large corporations, and early-stage ventures transform concepts into viable, market-ready products. xcube.co focuses on the “zero to one” innovation phase, combining strategic advisory, venture building (“innovation as a service”), leadership development and Public-Private Partnership (PPP) to ensure innovation drives measurable business results.

A flagship portfolio is **DEFY (Defiant for Good®)**, dedicated to inclusive finance, which develops technology solutions aimed at improving economic empowerment and inclusive growth by addressing structural gaps in traditional financial systems. Within two years of launch, xcube.co expanded beyond Singapore; Hong Kong, China; and Malaysia into the Middle East, establishing a hub in Bahrain due to the Central Bank’s progressive regulatory sandbox and innovation-friendly environment. The firm has a core team of 10 people, and employs a network of contractual experts according to project needs. It has ensured a strong gender and cultural diversity within its team, with more women than men in the core group and a multinational workforce.

Digital and AI content of firm’s activities or products

xcube.co’s operations are digital by design. Its activities span digital strategy, prototyping, product development, Go-To-Market strategy and Public-Private Partnerships. It deploys advanced technologies in its operations, particularly AI and blockchain. Applications include:

- **AI-driven alternative risk scoring**: enabling approval of customers often excluded by traditional credit scoring, while predicting and managing default risks.
- **Behavioural analysis**: uncovering customer patterns for incumbent banks to expand into new segments.
- **Real-time KYC (Know Your Customer)**: lowering underwriting costs while maintaining compliance across diverse jurisdictions.
- **Continuous machine learning**: real-time updates to maintain trust and regulatory compliance.

Beyond client projects, xcube.co also runs innovation programs. A notable example is the **Global Challenger competition** with Ant International, which drew applications from over 30 countries across four continents and emphasized impact-focused solutions aligned with the UN SDGs, particularly education, gender, sustainability, and inclusion.

Founder’s motivation and challenges faced

xcube.co was founded by **Sebastien Picard**, a serial entrepreneur with a PhD in Strategic Management and experience spanning pharmaceuticals, corporate innovation, education technology, and fintech. He created xcube.co as his fourth business, motivated by the need to help corporations innovate beyond their core business and integrate frontier technologies. **Eelee Lua**, Executive Director

and Chief of Staff, joined as part of the founding team shortly after inception and co-leads the inclusive finance portfolio, DEFY.

Eelee, with a background in business and international management rather than STEM, highlights her personal journey as proof that non-technical leaders can thrive in tech if they act as translators between developers and clients. However, she also underscores the **gender-related challenges** faced in fintech: in some contexts, she is not taken seriously due to her young appearance, and often finds herself the only woman on panels or at industry events. Fundraising difficulties are compounded by reliance on male-dominated networking channels (golf, late-night drinks), which many women cannot access due to social roles or preferences. Her response has been to mentor younger women and encourage them to build **alternative networks**, such as morning coffee meetups for impact investors, which now thrive in Singapore.

Successes achieved by the firm

- Expanded geographically to **Bahrain as GCC hub** within two years of founding
- Ran the **Global Challenger program** with Ant International, attracting applicants from 30+ countries and providing winners international exposure at a major tech inclusion conference in Shanghai
- D4Good, a technology developed within DEFY, was selected as a finalist for the **Investment Tech of the Year** at the Asia FinTech Awards 2025
- Invited by Bahrain Ministry of Sustainable Development and UN Bahrain to contribute to the Fourth International Conference on Financing for Development (FfD4) workshop
- Established a workplace culture of **employee autonomy**, providing flexible hours, and financial support for professional development, conferences, and memberships. Interns are paid, and international placements are hosted. **Executive leadership development program** for board directors from Malaysian financial institutions via a strategic partnership with FIDE Forum
- Developed leadership roles in industry networks with active contribution to the **Singapore Fintech Association's Women in Fintech subcommittee** and the **Women in Alliances** network

Lessons to impart

- **Bootstrapping builds resilience**: Running lean on client revenue forces discipline and strong project delivery.
- **Inclusive finance creates both impact and opportunity**: Financial solutions designed with inclusion in mind can expand markets while addressing social needs.
- **Networking formats matter**: Alternative, women-led networking spaces can expand access and visibility beyond male-dominated channels.
- **Diversity strengthens innovation**: Gender-balanced and multicultural teams fuel adaptability and creative thinking.
- **Non-STEM leaders can thrive**: Business acumen, communication skills, and the ability to bridge clients with technical teams are critical in tech ventures.

- **Mentorship multiplies impact**: Building inclusive pipelines through mentoring supports long-term systemic change.
- **Regulatory partnership accelerates trust**: Sandbox engagement and consultation with regulators enable compliant, faster innovation.

Part III – Appendix 2: Project Brief and Interview Details for Case Study Participants

This note provides background, project objectives, and outlines what participation involves for participants invited to join the case study on Women entrepreneurs in digital firms or AI-driven startups. Interview questions are appended to the note.

1) Project background

The rapid digital transformation in APEC economies has fundamentally reshaped services trade and employment, making **digitally delivered services (DDS)** the region's most dynamic growth area. Despite these advances, **significant gender gaps persist**: women remain underrepresented in high-skill, high-wage, and decision-making roles—including critical sectors such as ICT, financial, and professional services—while being overrepresented in lower-paid service work. These disparities are not just social issues; they substantially inhibit regional economic performance, as the underutilization of women in the formal sector costs Asia-Pacific economies billions annually.

Guided by the La Serena Roadmap for Women and Inclusive Growth, this APEC project carried out for the APEC Group on Services seeks targeted action to close these gaps, focusing on improving women's access to capital, markets, skills, and leadership, especially in the context of digitalization and technological change.

The project's previous phases have:

- Analyzed the root causes of gender gaps in digitally intensive services (Part I).
- Presented private sector perspectives, using surveys and private-public dialogues to illustrate both progress and continuing barriers for women in ICT, financial, and professional services (Part II).

2) Objectives of this component of the project

The current and final phase (Part III) turns to the critical role of **women-led startups and entrepreneurial ventures** in digital and AI-linked activities.

- **Primary objective:** To systematically explore the unique pathways, enablers, challenges, and outcomes for **women-led startups** in digitally intensive or AI-driven sectors across APEC economies.
- Through a small number of **in-depth case studies** representing diverse geographic locations, this phase seeks to illuminate:
    - How women founders enter and navigate digital and AI-focused startups.
    - The business models, digital enablers, and support networks that shape their entrepreneurial journeys.
    - The main barriers, turning points, and gendered perceptions that influence success.
    - Impacts to date and market reach—locally, regionally, or globally.

- A cross-cutting analysis will then draw out common success factors and persistent obstacles, summarizing implications for policy or future research to accelerate inclusive innovation and gender equality region-wide.

3) Interview purpose and involvement of the interviewee
As part of this case study series, you or your organization are being invited to participate as a valued example of women-led innovation in your sector and economy.

- **Purpose:** The interview aims to understand your startup's journey and experiences as a woman-led firm in a digitally intensive or AI-driven sector. The findings will help illustrate opportunities and persistent barriers for women entrepreneurs across the APEC region, supporting evidence-led policy and ecosystem interventions.
- **Involvement:** Participation will require a modest time commitment. We ask for:
    - Agreement to an **online interview** based on the provided interview questions (60 min).
    - Sharing relevant, non-confidential information about your founder's or yours background, business model, enabling factors, challenges faced, and progress made.
    - Optionally, review and validate a draft case profile before inclusion in the final public report.
- All case studies will be credited as appropriate and with your consent. Findings will be shared with participants before public dissemination.

Thank you for considering this request to help advance impactful research on women's entrepreneurship in digital services in APEC. This research will contribute to a broader effort to enhance women's economic empowerment in the region's thriving digital services sector. If you have any questions or need further information, please let us know.

INTERVIEW QUESTIONS
for the study on Women entrepreneurs in digital firms or AI-driven startups

Section A: Profile of the firm

- What does your firm do and when it was established?
- What market niche did your firm set out to enter?
- How digitally intensive are your firm's activities?
- What type of AI does your firm use and when was it adopted as part of output?
- Does your firm export? If so, is this within the APEC region or beyond? How many different markets do you export to?

Section B: Background & motivation

- What gave you the idea to start this business?
- Do you have a STEM background?
- Did you have a role model to help you start a firm (or work) in a digitally-intensive industry?

Section C: Digital enablers

- Which digital platforms or tools have been essential in starting or growing your business?
- Did you participate in any incubator, accelerator, or digital skills program?
- Does your firm use AI applications and what are they?
- How much does AI contribute to making your firm competitive and profitable? How often do you have to upgrade AI applications?

Section D: Financing

- How did you finance your startup in the early days?
- What challenges did you face as a woman in accessing finance for your business venture?
- Were you offered financing on less favourable terms than men entrepreneurs?
- Have you raised capital since then? If so, was the experience easier?

Section E: Gender-relevant issues

- What type of gender-related challenges, other than access to finance, have you encountered in running a digital business?
- Are there any professional networks that have helped you in your career path?
- What is the policy of your firm in advancing professional women employees?
- Are there any non-monetary incentives your firm has put in place to attract, maintain and help advance the careers of women professional employees (for example, childcare, flexible work hours and/or flexible requirements for medical leave).

Part III – Appendix 3: Glossary of terms for Table 4

Acronym / Term	Definition
AI	Artificial Intelligence – computer systems performing tasks requiring human-like reasoning or perception.
ALIPA	Artificial Intelligence Leadership for Inclusive Public Administration – Mindset Global Partner's program promoting AI leadership among SMEs and public institutions.
API	Application Programming Interface – a software intermediary enabling different applications to communicate.
AWS	Amazon Web Services – cloud-computing platform widely used for hosting AI and data services.
CRM	Customer Relationship Management – systems that manage client data and interactions.
DEPA	Digital Economy Partnership Agreement – referenced by Thai start-ups participating in digital trade initiatives.
DTAC	Digital Telecom Asia Corp. – Thai telecom accelerator supporting digital-finance and AI ventures.
Edge AI / Tiny ML	AI computation performed locally on small or embedded devices rather than in the cloud.
GenAI	Generative AI – AI systems (e.g. ChatGPT, Gemini) that generate text, images, or other content.
IoT	Internet of Things – network of connected devices exchanging data.
KYC	Know Your Customer – due-diligence process in financial services, often automated using AI.
LMS	Learning Management System – digital platform for managing online education.
ML	Machine Learning – sub-field of AI where systems learn patterns from data.
NIA	National Innovation Agency (Thailand) – government body supporting innovation and AI entrepreneurship.
NLP	Natural Language Processing – AI technique for interpreting or generating human language.
PPP	Public–Private Partnership – collaboration between public and private sectors, often in digital-innovation policy.
R&D	Research and Development – systematic work to innovate or improve technologies.
SaaS	Software as a Service – cloud-based software delivery model.
SME	Small and Medium-Sized Enterprise.
STEM	Science, Technology, Engineering and Mathematics – education fields relevant to digital skills.
UX/UI	User Experience / User Interface – design aspects of digital products.
InspirIA	Mindset Global Partner's AI-leadership curriculum linking innovation and ethics.
DEFY	xcube.co's Defiant for Good® portfolio – inclusive-finance initiative using AI for alternative risk scoring.