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GENDER, DIGITAL TRANSFORMATION AND ARTIFICIAL INTELLIGENCE

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Gender, Digital Transformation and Artificial Intelligence

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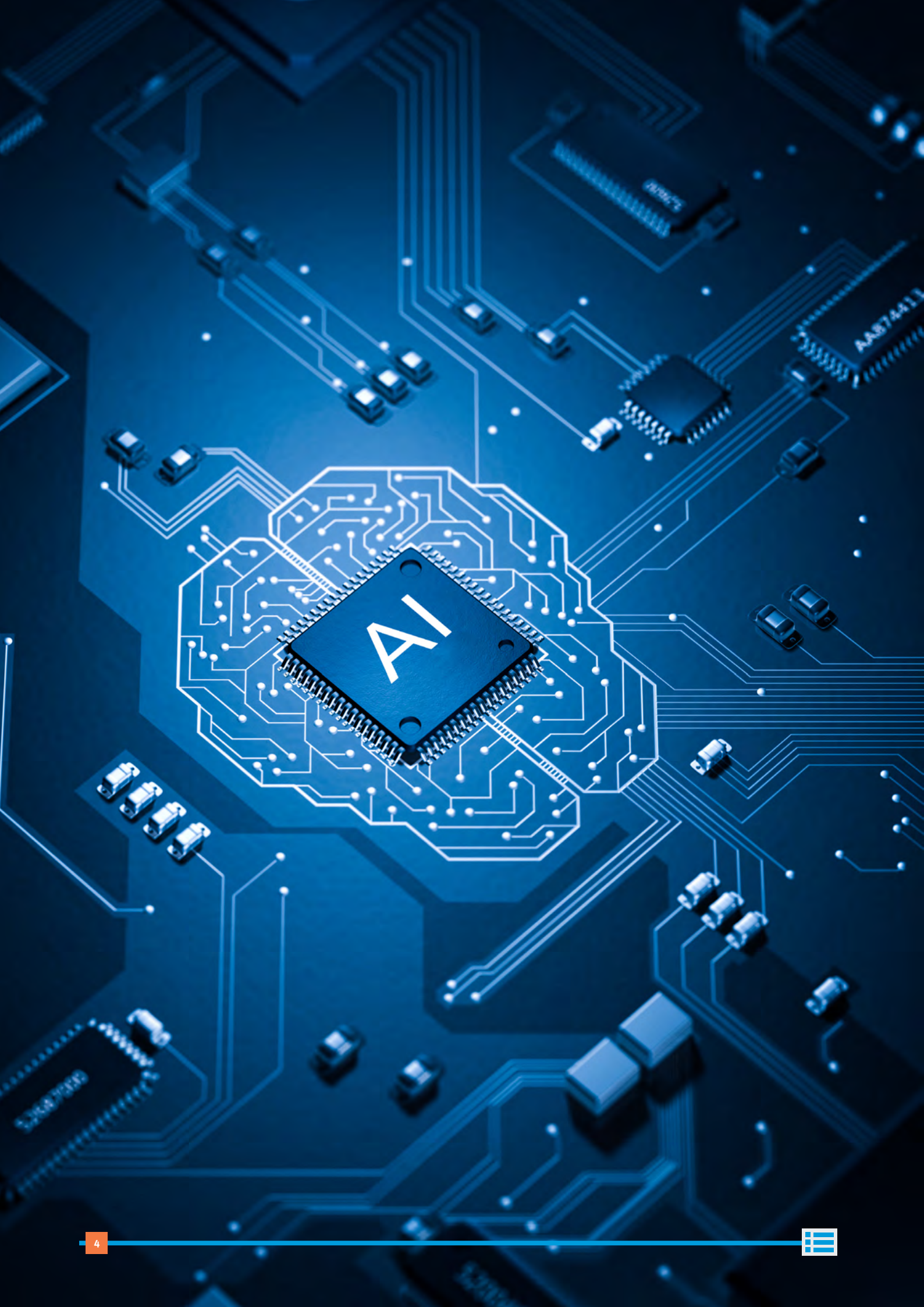
AI

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ABBREVIATIONS

4IR	Fourth Industrial Revolution
4YFN	Four Years From Now
ACWICT	African Centre for Women, Information and Communications Technology
AI	Artificial Intelligence
EBRD	European Bank for Reconstruction and Development
EIC	European Innovation Council
EU	European Union
GICC	Global Innovation Coalition for Change
GSMA	Global System for Mobile Communications Association
IBE-UNESCO	International Bureau of Education of the United Nations Educational, Scientific and Cultural Organization
ICT	Information and communications technology
ICT4D	ICT for Development
IDB	Inter-American Development Bank
IFC	International Finance Corporation
ILO	International Labour Organization
IoT	Internet of Things
ITC	International Trade Centre
ITU	International Telecommunication Union
LDC	Least Developed Country
ML	Machine learning
MSME	Micro-, small and medium-sized enterprise
OECD	Organisation for Economic Co-operation and Development
PPP	Public–private partnerships
SDGs	Sustainable Development Goals
STEM	Science, Technology, Engineering and Mathematics
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
WFX	Women's Finance Exchange
WIP	Women Innovators Programme
WITU	Women in Technology Uganda

Foreword by the Director General

GENDER, DIGITAL TRANSFORMATION AND ARTIFICIAL INTELLIGENCE

The digital transformation and Artificial Intelligence (AI) hold the promise for almost everything we can dream of. Yet, even today, we can see that technology development is strongly biased against women and disadvantaged groups. We must not accept that! The gender perspective must take center stage in our thinking, planning and implementation of digital transformation and AI.

Without conscious choices, AI will not magically eliminate biases. Much of the current data that forms the basis of even the best algorithms draws a picture we want to leave behind. At UNIDO, balancing and correcting gender bias is an integral part of our project portfolio. The fast-paced developments of technologies related to the digital transformation and AI must not be taken as an excuse to skimp on the gender question. I believe the opposite is the only fitting approach – taking the necessary precautions, but also preparations, for gender equality in AI and the digital transformation.

Building that future requires our efforts in all areas of development. We need to correct the inequality wherever we can, particularly in the digital field. How can we ensure gender balance and un-biased AI or digital transformation development, when the gender digital divide is gaping between countries, societies and even families?

However, there are developments we can influence. Raising awareness is a starting point to uncover the mechanisms that reduce women's participation as users, developers and learners of digital technologies. By design, the inclusive potential of the digital transformation must be pronounced. Capacity building for AI and digital technologies should primarily target women. This way, we not only increase participation, but, even more importantly, the skills needed to have not only gender balance in algorithms, but also in their development, adoption and further implementation.

In this background paper, UNIDO proposes actions we can take, and with this starting point, I hope we can raise the issues and start eliminating them. I firmly believe that through our attention and through our efforts, we can overcome this challenge and look into a brighter, balanced future.

Gerd Müller

Director General of the United Nations Industrial Development Organization

EXECUTIVE SUMMARY

Fast-changing technological developments across the digital, biological, and physical spheres are transforming work places, human relations, and trade networks. As the Fourth Industrial Revolution (4IR) unfolds, it is creating jobs and business opportunities but also making some roles and activities obsolete.

Gender bias and stereotypes hinder the participation of women as users, learners, and developers of digital technologies.

Digitalization has accelerated, particularly after the COVID-19 pandemic; however, not everyone is benefiting equally from the opportunities the 4IR is creating. Women and girls are less likely to have access to digital technologies, and they are underrepresented in technology fields, as students, academic staff, and entrepreneurs – a gap that is even more pronounced in the fields of artificial intelligence.

Digital technologies have the potential to create opportunities for women to lead, participate in, and benefit from technology developments. However, without the right policy enablers, digital technologies can reinforce gender stereotypes and deepen economic and social exclusion.

Based on a review of more than 150 initiatives across five geographical regions, this report offers recommendations on the priorities and entry points to further advance gender equality and women empowerment in the digital transformation.

Closing gender gaps is a human rights issue, but it also has economic and social benefits, from expanding markets and unlocking talent to addressing increasing skills shortages, improving financial performance, increasing innovation activity, and avoiding the reinforcement of disparities in status and power in societies.

The report reviews the current state of policies and initiatives related to the promotion and strengthening of global efforts toward gender-transformative strategies and initiatives in emerging digital technologies, with an emphasis on artificial intelligence. In addition to the field of AI, the paper focuses on the following technology areas: additive manufacturing, big data, cloud computing, cyber-security, the Internet of Things (IoT), distributed ledger technology, robotics, unmanned autonomous vehicle systems, and quantum computers.

More than 150 initiatives across Africa, Asia and the Pacific, Latin America and the Caribbean, Eastern Europe, and Western Europe and other states were reviewed within the scope of this report. The review involved desk research, the submission of input from international and civil society organizations, and interviews with key stakeholders that helped to develop case studies of good practices.

The report describes key areas of action and shared approaches and features case studies of initiatives, from international organizations funding research to understand gender gaps in technology fields, and development banks supporting women-led businesses, to academic institutions and the private sector collaborating in skills development, and civil society organizations supporting the digital inclusion of marginalized groups.

Eight key areas of action are identified, as listed below, to tackle the gaps between genders in the use, knowledge, and development of digital technologies.

KEY AREAS OF ACTION

1. Reducing gender skills gaps beyond coding

Efforts to develop skills with a gender perspective have overwhelmingly focused on coding abilities. However, initiatives run the risk of failing to address gender gaps in other related areas where disparities are wider, such as cloud computing, or in areas where gaps are actually widening, such as data analysis and artificial intelligence. Skills-development initiatives should therefore specialize their scope based on a sound understanding of the context-specific dynamics of the labour markets and the incremental nature of skills.

2. Gender-transformative lifelong learning approaches

Women face barriers to participation in digital technology fields throughout their lives. This puts women at risk of losing opportunities related to the digital transformation when facing the increasing need for digital competence, reskilling, and upskilling across disciplines, occupations, and sectors. Digital skills-development initiatives should therefore adopt a lifelong learning approach.

3. Gender-responsive approach in technology-driven research, design, and innovation

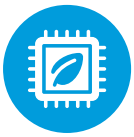
A gender-responsive approach is not only about fairness and justice but also about producing better knowledge, products, and services for a wider audience. Among the challenges identified, there is an increasing need to tackle digital technologies' discriminatory potential – in particular, in AI systems. Technology development and deployment, including the development and deployment of AI systems, should therefore strive for diversity in technical and leadership positions, and within teams, including cross-disciplinary competencies such as insights into mechanisms for gender discrimination.

4. Fostering multi-stakeholder partnerships

Gender bias and discrimination is manifesting in old and new ways through the digital transformation, and different stakeholders have a role to play to address these. The private sector and research organizations, for example, are key to addressing gender bias in technology-driven research, design, and innovation. Meanwhile, civil society organizations have been effective in raising concerns about the negative impacts of digital technologies on marginalized groups. Actions toward closing gender gaps in digital technology fields should therefore adopt a multi-stakeholder approach.

5. Mainstreaming gender considerations into industrial and innovation strategies

Differences in the participation of women and men in the digital transformation call for gender mainstreaming in industrial and innovation strategies, that is, assessing and addressing the implications for different gender groups of a planned action. In particular, the review of initiatives revealed a gap in measures with a gender perspective in several areas, such as support for technology adoption in business and funding for technology scale-up at the later stages of the innovation cycle.



6. Twin green and digital transitions

Digitalization can be a key enabler of the transition toward more circular and less carbon-intensive industries. Energy and infrastructure sectors, however, suffer from gender disparities similar to those observed in digital technology fields. The circular economy and climate-neutral industry sectors are equally male dominated, especially as regards technical and leadership positions. Failure to address these intertwined gender gaps risks amplifying existing inequalities.

7. Continuing to strengthen innovation ecosystems and infrastructure

Increasing opportunities for women also means that efforts to strengthen innovation ecosystems and infrastructure need to continue, particularly in developing countries. Governments can adopt a gender-responsive approach in the development of their innovation systems and infrastructure. This involves, for example, including gender equality conditionalities in the funding of research and innovation projects, and adopting gender-responsive public procurement strategies (gender-responsive procurement strategies).

8. Continuing to close information gaps

A lack of gender-disaggregated data in companies, and national and international statistics, is one of the main challenges that policy-makers face when addressing gender gaps in technology fields. Lessons from digital platforms, in partnership with the private sector, can be leveraged to gain a better understanding of the use of advanced digital technologies and the potential benefits. This review also revealed the need for a better understanding of gender equality initiatives within technology companies.

CHAPTER 1

Objective and Approach

Digital technologies have the potential to create opportunities for women to lead, participate in, and benefit from technology developments. However, without the right policy enablers, digital technologies can also reinforce gender stereotypes and deepen economic and social exclusion.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We are witnessing the development of the Fourth Industrial Revolution (4IR), the latest wave of technological breakthroughs, characterized by fast changing technological developments across the digital, biological and physical spheres.[1,2] Digital transformation is one of the manifestations of the 4IR: Organizations are digitalizing their operations, and thereby changing the modalities of work and value addition, and how people, technology, and the environment interact.[3]

As with previous industrial revolutions, although technological breakthroughs are at the center of the 4IR, they are transforming and being shaped by economic, social, and political realities. Digital technologies are becoming more accessible and digitalization has accelerated, particularly after the COVID-19 pandemic;[4] however, not everyone is benefiting equally from the opportunities the 4IR is creating.

In addition to factors such as an individual's socioeconomic background and the level of development of countries and regions, gender bias and stereotypes act as barriers to the participation of women as users, learners, and developers of digital technologies. Women and girls are less likely to have access to digital technologies, and they are underrepresented in technology fields as students, academic staff, and entrepreneurs. This gap is even more pronounced in sectors where artificial intelligence and other emerging technologies are prevalent.[5]

Digital technologies have the potential to create opportunities for women to lead, participate in, and benefit from technology developments. However, without the right policy enablers, digital technologies can also reinforce gender stereotypes and deepen economic and social exclusion.

1) United Nations Industrial Development Organization (2019). *Industrial Development Report 2020. Industrializing in the digital age*. Vienna.
2) United Nations Industrial Development Organization (2021). *Standards and digital transformation. Good governance in a digital age*. Vienna.
3) Ibid.
4) United Nations Industrial Development Organization (2021). *Industrial Development Report 2022. The Future of Industrialization in a Post-Pandemic World*. Vienna.
5) European Institute for Gender Equality (EIGE) (2022). *Artificial intelligence, platform work and gender equality*.

This paper reviews the current state of policies and initiatives related to the promotion and strengthening of global efforts toward gender-transformative strategies and initiatives in emerging digital technologies, with an emphasis on artificial intelligence (AI). In addition to the special focus on AI, the paper focuses on the following technology areas: additive manufacturing, big data, cloud computing, cybersecurity, the Internet of Things, distributed ledger technology, robotics, unmanned autonomous vehicle systems, and quantum computers.

To that aim, more than 150 initiatives across Africa, Asia and the Pacific, Latin America and the Caribbean, Eastern Europe, and Western Europe and other States were reviewed. The review involved desk research, the submission of input from international and civil society organizations, and interviews with key stakeholders that helped to develop case studies of good practices.

The paper is structured as follows:

- **Section 2** discusses how and why fewer women – compared to men – are taking advantage of digital technologies. It presents a framework of the barriers that women face in their relationship with technology as users, learners, and technology developers.
- **Section 3** presents the findings of the review of initiatives. It describes key areas of action and shared approaches and features examples of good practices. The main gaps in addressing gender inequalities are also discussed in this section.
- **Section 4** offers recommendations on priorities and entry points to further advance gender equality and women empowerment in the digital transformation, in the context of inclusive and sustainable industrial development.
- The **Appendices** present useful resources for private-, public-, and social-sector organizations to support their actions toward gender inclusion, as well as a list of initiatives reviewed in the preparation of this report.

CHAPTER 2

Gender Gaps in Tech: Barriers and Impacts

Technology is one of the fields where women are significantly underrepresented among academic staff, experts, and entrepreneurs, a gap that is even more pronounced in the fields of AI. Narrowing gender gaps is a human rights issue, but it also implies economic benefits for companies and countries.

As digital technologies become pervasive, they are changing numerous aspects of our lives, including how and what we produce and sell. These changes are transforming work places, labour relations, and trade networks. The digital transformation is creating new roles and business models, but not everyone is benefiting equally from these opportunities. Gender bias and stereotypes hinder the participation of women as users, learners, and developers of digital technologies.

Technology is one of the fields where women are significantly underrepresented[6] among academic staff, experts, and entrepreneurs, a gap that is even more pronounced in the fields of AI.[7] Narrowing gender gaps is a human rights issue, but it also implies economic benefits for companies and countries. For instance, estimates by the Global System for Mobile Communications Association (GSMA) indicate that closing the gender gap in mobile-phone ownership and usage in low- and middle-income countries could unlock an estimated $230 billion in additional revenue for the mobile industry by 2030.[8]

Regardless of the context, skills shortages represent the main barrier for companies to adopt digital technologies.[9] Closing gender gaps in digital skills would unlock the full potential of women and allow companies to deepen their digital transformation. Research has identified a positive and strong correlation between Internet penetration and female industrial labour productivity in upper-middle-income and high-income countries.[10] Similarly, the European Institute for Gender Equality found that closing the gender gap in Science, Technology, Engineering and Mathematics (STEM) in the European Union would contribute to an increase in gross domestic product per capita by 2.2% to 3.0% in 2050, equating to between €610 and €820 billion.[11]

For companies, growing evidence indicates that there is a business case for promoting gender diversity in leadership. Enterprises with diverse leadership tend to report better business outcomes and greater innovation activity.[12] A study by the International Labour Organization (ILO) found that enterprises that have implemented diversity and inclusion initiatives observed positive effects on their profits, productivity, talent attraction and retention, innovation, and consumer satisfaction.[13]

Beyond the economic benefits, more diverse leadership is associated with better corporate social responsibility.[14] Increasing the participation of women in the digital transformation also contributes to gender equality in other areas. Science, for instance, produces knowledge that is intertwined with social institutions, including the state, which affects billions of people.[15] Research has, however, highlighted that science is co-produced with gender relations. Gender inequalities in science not only reflect but also reinforce disparities in status and power in societies.[16]

In this section we discuss how and why fewer women – compared to men – are taking advantage of digital technologies, how they are less likely to develop the skills needed to enjoy the benefits of the digital transformation, and how female participation reduces even more in leadership and entrepreneurial roles.

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6) European Union (2021). *She Figures 2021*. Brussels.

7) European Institute for Gender Equality (EIGE) (2022). *Artificial intelligence, platform work and gender equality*.

8) GSMA (2023). *The Mobile Gender Gap Report 2023*.

9) Castañeda-Navarrete, J. (2021). *Don't fear the robots: How developing countries can prepare for Industry 4.0 and safeguard jobs*. Cambridge Industrial Innovation Policy.

10) Banga, K. and Feith, B. (2021). *For better or worse? How digitally restructured value chains are reshaping labor futures for women in the Global South*. IT for Change.

11) European Institute for Gender Equality (2017). *Economic benefits of gender equality in the EU. How gender equality in STEM education leads to economic growth*.

12) Khushk, A., Zengtian, Z. and Hui, Y. (2022). Role of female leadership in corporate innovation: a systematic literature review. International Journal of Gender and Entrepreneurship.

13) International Labour Organization (2019). *The business case for change*. Geneva: ILO.

14) Khidmat, W.B., Habib, M.D., Awan, S. and Raza, K. (2022). *Female directors on corporate boards and their impact on corporate social responsibility (CSR): evidence from China*. Management Research Review Vol. 45 No. 4, pp. 563-595.

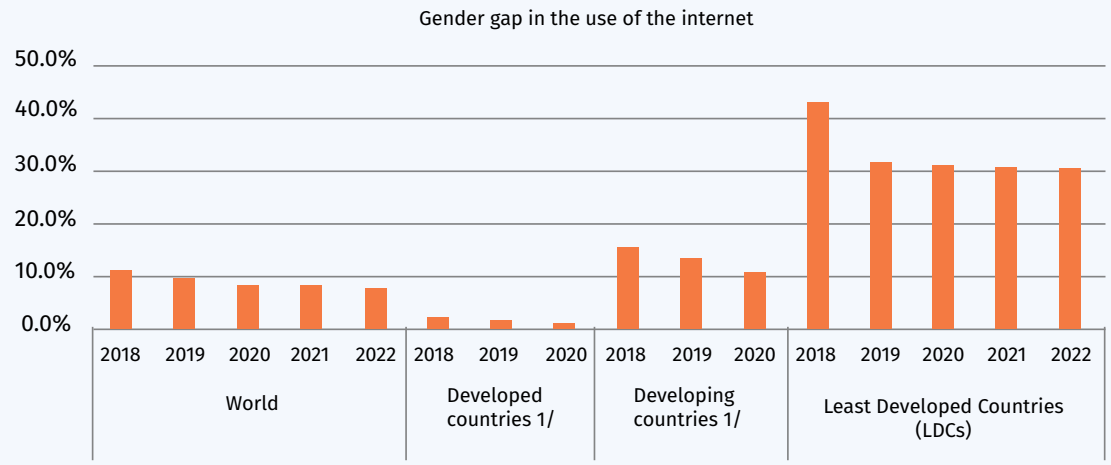
15) Jasanoff, S. (2004). *States of Knowledge. The Co-production of Science and the Social Order.* New York: Routledge.

16) Fox, M., Whittington, K. and Linkova, M. (2017). *Gender, (In)equity, and the Scientific Workforce*. In: Felt, U., Fouché, R., Miller, C.A. and Smith-Doerr, L. (eds). *The Handbook of Science and Technology Studies,* 701–731. Cambridge, MA: MIT Press.

2.1 The state of women's participation in the digital transformation

Digital technologies facilitate connectivity, while mobile devices enable users to access applications and solutions based on big data analytics, artificial intelligence, cloud computing and similar digital technologies. However, fewer women than men have access to the Internet. Worldwide, the gender gap in Internet use was 8.4% in 2022, and this gap is almost four times wider in Least Developed Countries[17] (see Figure 1).

FIGURE 1: WOMEN HAVE LESS ACCESS THAN MEN TO THE INTERNET

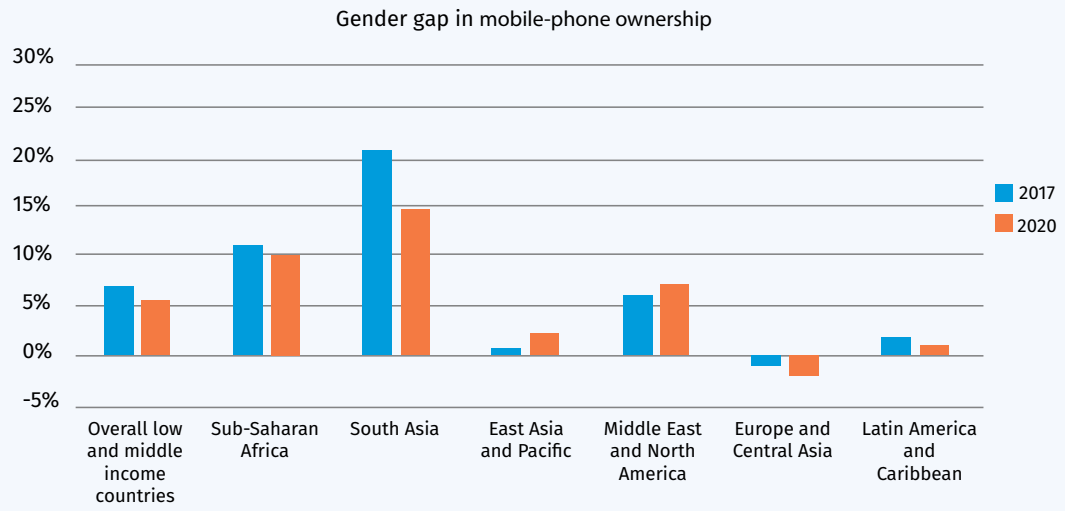


Note: 1/ Disaggregation of data for developed and developing countries is not yet available for 2021 and 2022.
Source: Authors, based on data from the ITU World Telecommunication/ICT Indicators database.

Women are also less likely than men to own a mobile phone. In low- and middle-income countries, there is a 7% gender gap in mobile-phone ownership.[18] Significant variations are found both across and within regions. Across regions, the widest gender gaps are observed in South Asia and Sub-Saharan Africa, although it is in South Asia where the gender gap has narrowed most since 2017, notably from 26% to 19% in 2020 (see Figure 2). Within South Asia, Pakistan shows the widest gender gap in mobile-phone ownership (33%), while India shows the smallest (14%).[19]

17) Regions are based on the ITU regions, see: http://www.itu.int/en/ITU-D/Statistics/Pages/definitions/regions.aspx
18) GSMA (2022). *The Mobile Gender Gap Report 2022*.
19) Ibid.

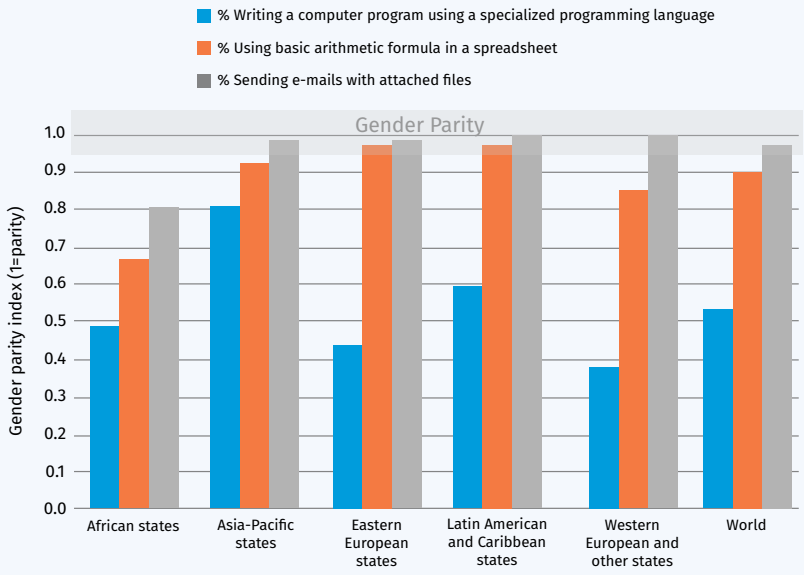
FIGURE 2: WOMEN HAVE LESS ACCESS THAN MEN TO MOBILE PHONES



Source: Authors, based on data from GSMA (2022). *The Mobile Gender Gap Report 2022.*

Women are also less likely to have the skills needed to enjoy the benefits of the digital transformation. Although, on average, women are nearly as proficient as men in the use of basic digital skills, such as sending emails or using spreadsheets, the gender gap widens in more advanced skills, such as programming (see Figure 3). On average, across economies where data is available, there is a difference of 40 percentage points between the proportion of men and women that have programming skills.[20] The gap is wider in select regions such as Western and Eastern Europe and Africa.

FIGURE 3: WOMEN ARE LESS LIKELY THAN MEN TO HAVE ADVANCED ICT SKILLS

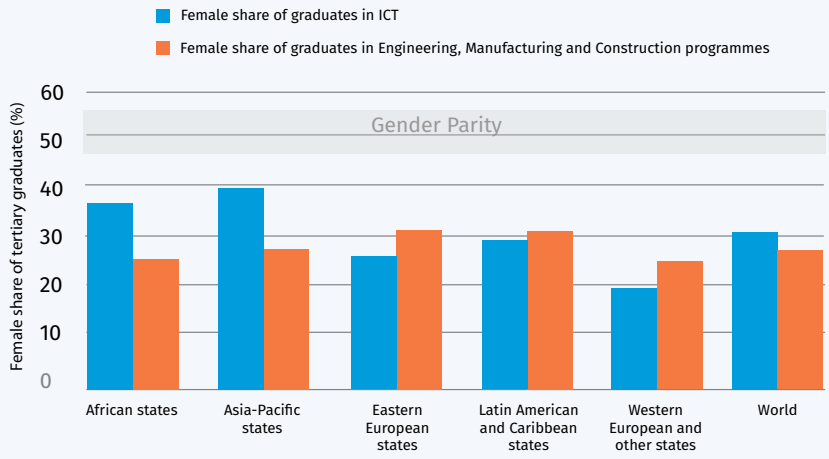


Source: Authors, based on data from the ITU ICT SDG Indicators database, sample of 67 economies.

20) ITU ICT SDG Indicators database.

Similarly, in tertiary education, from a sample of 122 economies, women represent only 30% of graduates from Information and Communication Technologies (ICT) programs, and 27.7% of the graduates in engineering, manufacturing and construction programs.[21] Variations are observed across regions. In ICT programs, African States and Asia-Pacific States show the largest women shares, greater than 30%. In comparison, Western European and other States have women shares that are below 20%. In engineering, manufacturing and construction programs, variation across regions is lower, with Eastern Europe and Latin America and the Caribbean showing the largest women shares, just above 30%, while Western Europe and other States and Africa show among the lowest women shares, around 25% (see Figure 4).

FIGURE 4: WOMEN ARE LESS LIKELY THAN MEN TO PARTICIPATE IN ICT AND ENGINEERING TERTIARY EDUCATION PROGRAMS



Note: Data refers to 2018 or latest year available.

Source: Authors, based on data from the World Bank, *Gender Data Portal*.

As Figure 4 shows, regions that are recognized for having achieved a high level of gender equality such as Western European States also have one of the lowest female shares in ICT and engineering programs. In comparison, regions with higher gender inequality, such as the Asia and Pacific region, have among the largest shares of female participation in ICT and engineering programs. This mismatch between high national gender equality scores and a persistently low level of women in technology-related fields has been discussed as the Gender Equality Paradox. While some researchers have suggested that this mismatch is a result of less economic hardship for women in some of the more affluent and gender-equal countries,[22] other researchers have criticized such assumptions for not recognizing social and cultural barriers, including gender stereotypes, that still prevail in countries commonly recognized as gender equal.[23] In the case of the Nordic countries, for example, which have been praised among the most egalitarian countries in the world, research has highlighted the role of social norms and stereotypes in gender segregation in the labour market and how welfare state services and labour market regulation are not enough to address this.[24]

Differences in the participation of women in ICT and engineering, manufacturing and construction programs are also observed within regions. Among Western Europe and other States, Greece and Turkey show among the largest women shares of graduates, around 30%; while Switzerland shows among the lowest shares, less than 10% in ICT programs and 16% in other engineering programs. In Asia and Pacific States, which show the largest women share of

21) World Bank. Gender Data Portal based on data from UNESCO Institute for Statistics.

22) Stoet, G. and Geary, D.C. (2018). *The Gender-Equality Paradox in Science, Technology, Engineering, and Mathematics Education*. Psychological Science, 29(4), 581–593.

23) Corneliussen, H.G. (2021). *Unpacking the Nordic Gender Equality Paradox in ICT Research and Innovation*. Feminist Encounters: A Journal of Critical Studies in Culture and Politics, 5(2), Article 25.

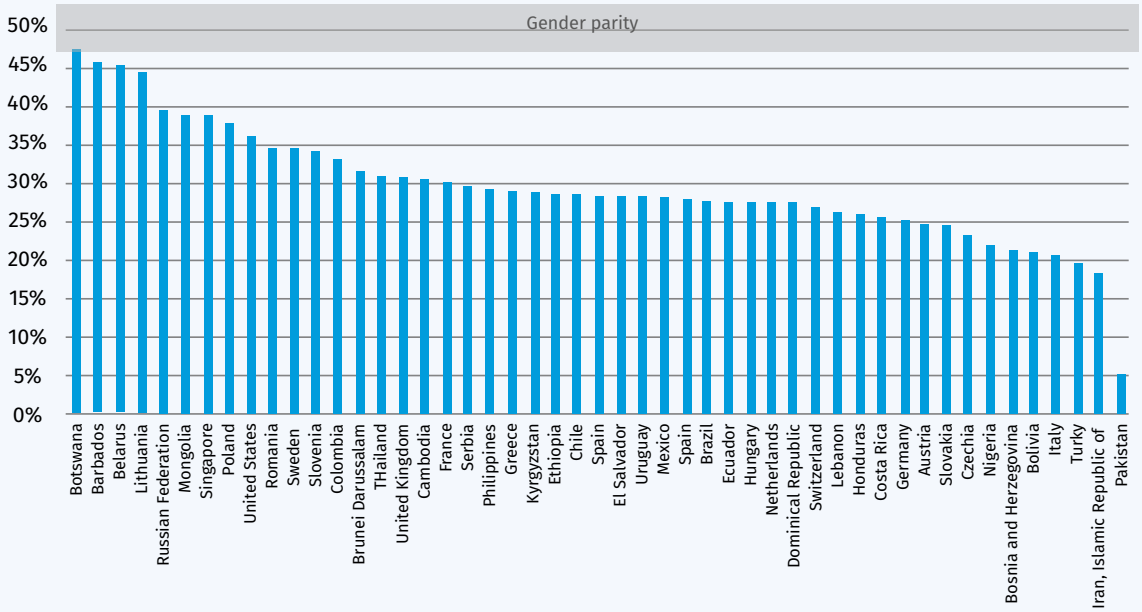
24) Mustosmäki, A., Reisel, L., Sihto, T., & Teigen, M. (2022). *Gendered Labor Market (dis)advantages in Nordic Welfare States. Introduction to the Theme of the Special Issue*. Nordic Journal of Working Life Studies, 11(S7).

graduates across regions, Oman shows the largest share (76%), while Cambodia shows the lowest share, less than 10%.

A comparison of countries' and regions' ratios of women graduates (Figure 4) and women's representation in the labour market (Figure 5), shows that these two parameters are not always correlated. This underpins the argument for the need to consider sociocultural gender norms and stereotypes. For example, although Turkey has one of the largest women shares of graduates in ICT and engineering, manufacturing and construction programs, this country also has one of the lowest female labour force participation ratios in these fields (19%). In comparison, Switzerland, for example, which has one of the lowest female shares of tertiary education graduates in relevant fields, shows women labour participation shares in relevant occupations of around 27%.

In addition to discriminatory gender norms and stereotypes, gender gaps in skills significantly contribute to the lower participation of women in occupations that are relevant to the digital transformation, such as science and engineering professionals and information and communications technicians. Globally, women represent about a third of the workforce in these occupations.[25] This rate, however, varies across and within regions, from around 5% in Pakistan, 19% in Turkey, and 22% in Bolivia, to 47% in Botswana and 45% in Barbados (see Figure 5).

FIGURE 5: FEWER WOMEN THAN MEN WORK IN OCCUPATIONS THAT ARE RELEVANT TO THE DIGITAL TRANSFORMATION



Note: Engineering, manufacturing, and ICT occupations defined as ISCO codes 12, 13, 21, 24, 25, 31, 35, and 74[25]. Data from 48 countries (2021 or the latest available). The sample includes data from 48 countries.

Source: Authors, based on data from *ILOSTAT*.

25) ILOSTAT, ISCO codes 12 Administrative and commercial managers; 13 Production and specialized services managers; 21 Science and engineering professionals; 24 Business and administration professionals; 25 Information and communications technology professionals; 31 Science and engineering associate professionals; 35 Information and communications technicians; and 74 Electrical and electronic trades workers.

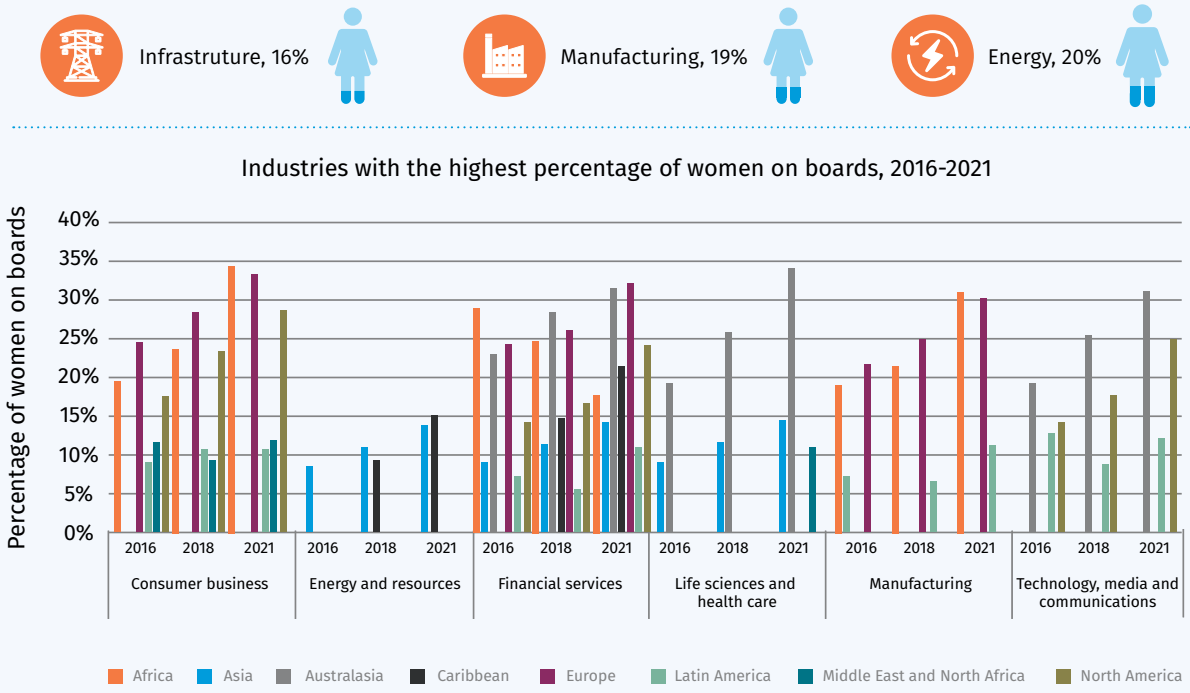
For women from ethnic minority and socially disadvantaged groups, gender gaps are compounded by discrimination. For example, in the US, Black, Hispanic, and Native American women account for only 4.3% of science and engineering occupations, although they represent 34% of tertiary education graduates.[26] Similarly, in India, students belonging to socially disadvantaged groups are seen to have lower participation in STEM fields (up to 20 percentage points), even from higher secondary level.[27]

Female representation is even lower in leadership positions, particularly in industrial sectors, such as manufacturing and energy, where women account for around two in every ten leadership roles.[28] In terms of participation in company boards, women represent 19.7% of boards and only 6.7% are chairs of these boards. Although progress was observed between 2016 and 2021 and women increased their participation in boards in this period by 4.7 percentage points, a wide gender gap still persists.[29]

Technology, media, and communications is one of the industries with the highest participation of women on boards in Australasia (31%), the Middle East and North Africa (13%), and North America (25%). In these regions, between 2016 and 2021, the participation of women on boards increased from 0.4 percentage points in the Middle East and North Africa, to 11.5 percentage points in Australasia.

In Africa (31%), Europe (30%), and Latin America and the Caribbean (11%), manufacturing is among the industries with the highest participation of women on boards. There, the participation of women increased between 3 percentage points in Latin America and 12 percentage points in Africa between 2016 and 2021 (see Figure 6).

FIGURE 6: FEWER WOMEN LEADERS THAN MEN IN SECTORS THAT ARE RELEVANT TO THE DIGITAL TRANSFORMATION



Note: Leadership roles included in the sample are director, VP, CXO, and partner. The sample includes data from 155 countries.
Source: Authors, based on data from the World Economic Forum (2022). *Global Gender Gap Report 2022*; Deloitte (2022). *Women in the Boardroom. Progress inches forward at a snail's pace.*

26) National Center for Science and Engineering Statistics, (2019). National Survey of College Graduates.

27) Kumar, A. and Sahoo, S. (2021). *Social Identity and STEM Choice: Evidence from Higher Secondary Schooling in India*. GLO Discussion Paper, No. 900, Global Labor Organization (GLO), Essen.

28) World Economic Forum (2022). *Global Gender Gap Report 2022*, Geneva.

29) Deloitte (2022). *Women in the Boardroom. Progress inches forward at a snail's pace.*

The pace of digitalization has accelerated and is changing the job landscape. New roles are emerging, but increasing evidence suggests that fewer women than men are taking advantage of these opportunities. The deepest gaps are observed in roles that support the development and deployment of digital technologies, such as cloud computing, engineering, data, and artificial intelligence.[30]

Artificial intelligence is one of the technology fields that has seen the fastest expansion during the last decade, creating demand for new skills. Although the share of women with AI skills has increased in recent years, women account for only 22% of global AI professionals. In the field of AI, gender segregation is observed in skills, roles, and sectors. Skills related to information retrieval, natural language processing, and data structures are prevalent among women, while women are less likely than men to have emerging skills, such as deep learning, neural networks, and computer vision.[31]

In terms of AI roles, women are more likely to be employed as data analysts, as well as in research, information management, and teaching positions. In comparison, male AI professionals are more likely to occupy roles such as software engineers and positions at a more senior level, which are also better paid.[32]

Furthermore, men are more likely than women to participate in the digital transformation as entrepreneurs. Globally, men are three times more likely than women to own a business.[33] Women-owned businesses tend to be smaller than those owned by men and are less likely to engage in international business-to-business transactions.[34]

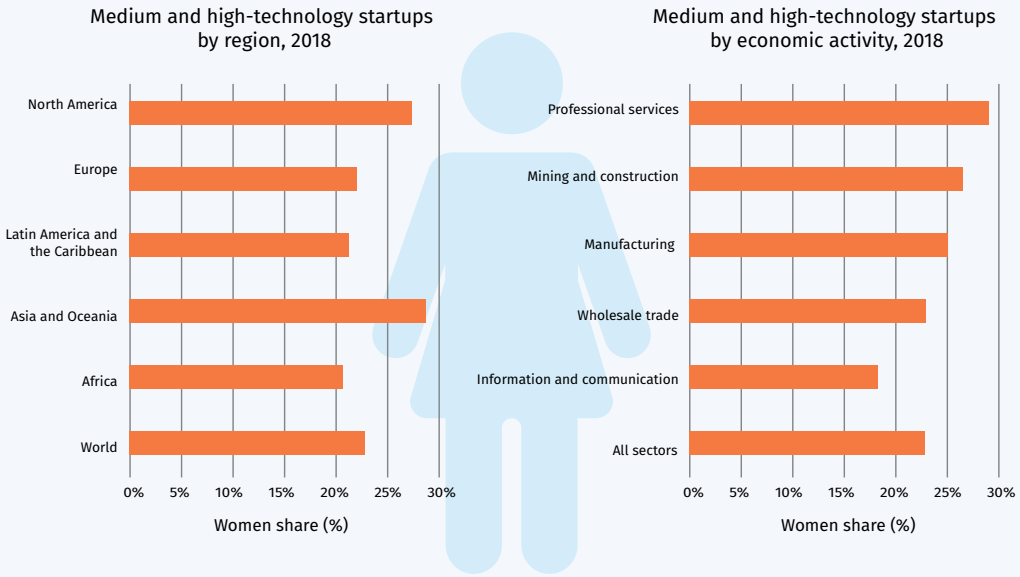
Among innovative startups looking for venture capital investments, the gender gap is even more striking. According to data from the Global Entrepreneurship Monitor, women represented only around 23% of the entrepreneurs in mid- and high-technology startups in 2018. The participation of women entrepreneurs in technology startups is larger in North America and Asia and Oceania (28%) and slightly lower in Africa (20%) and Latin America and the Caribbean (21%). By sector, a larger women participation rate is found in professional services (29%), while the lowest participation rate is observed in information and communication (19%) (Figure 7).[35]

Women are more likely to be employed as data analysts, as well as in research, information management and teaching positions. Male AI professionals are more likely to occupy roles such as software engineers and positions at a more senior level, which are also better paid.

The gap widens in terms of funding. Research from the International Finance Corporation indicates that only 7% of total private equity and venture capital funding in emerging markets goes to female-led businesses. The median funding received by female-led businesses is 65% of the median funding received by male-led businesses, and this is mainly explained by the lower representation of women beyond the accelerator or incubator stages.[36]

30) World Economic Forum (2021). *Global Gender Gap Report*. Geneva.
31) World Economic Forum (2018). *The Global Gender Gap Report*. Geneva.
32) Ibid
33) Halim, D. (2020). *Women entrepreneurs needed—stat!* World Bank Blogs.
34) Elam, A. et al. (2021). *Women's Entrepreneurship 2020/21*. Global Entrepreneurship Monitor; OECD (2018). *Bridging the digital gender divide.*
35) Global Entrepreneurship Monitor (2018). Entrepreneurial Behavior and Attitudes.
36) International Finance Corporation (2019). Moving toward in private equity and venture capital gender balance. Washington.

FIGURE 7: FEWER WOMEN THAN MEN PARTICIPATE IN TECHNOLOGY STARTUPS

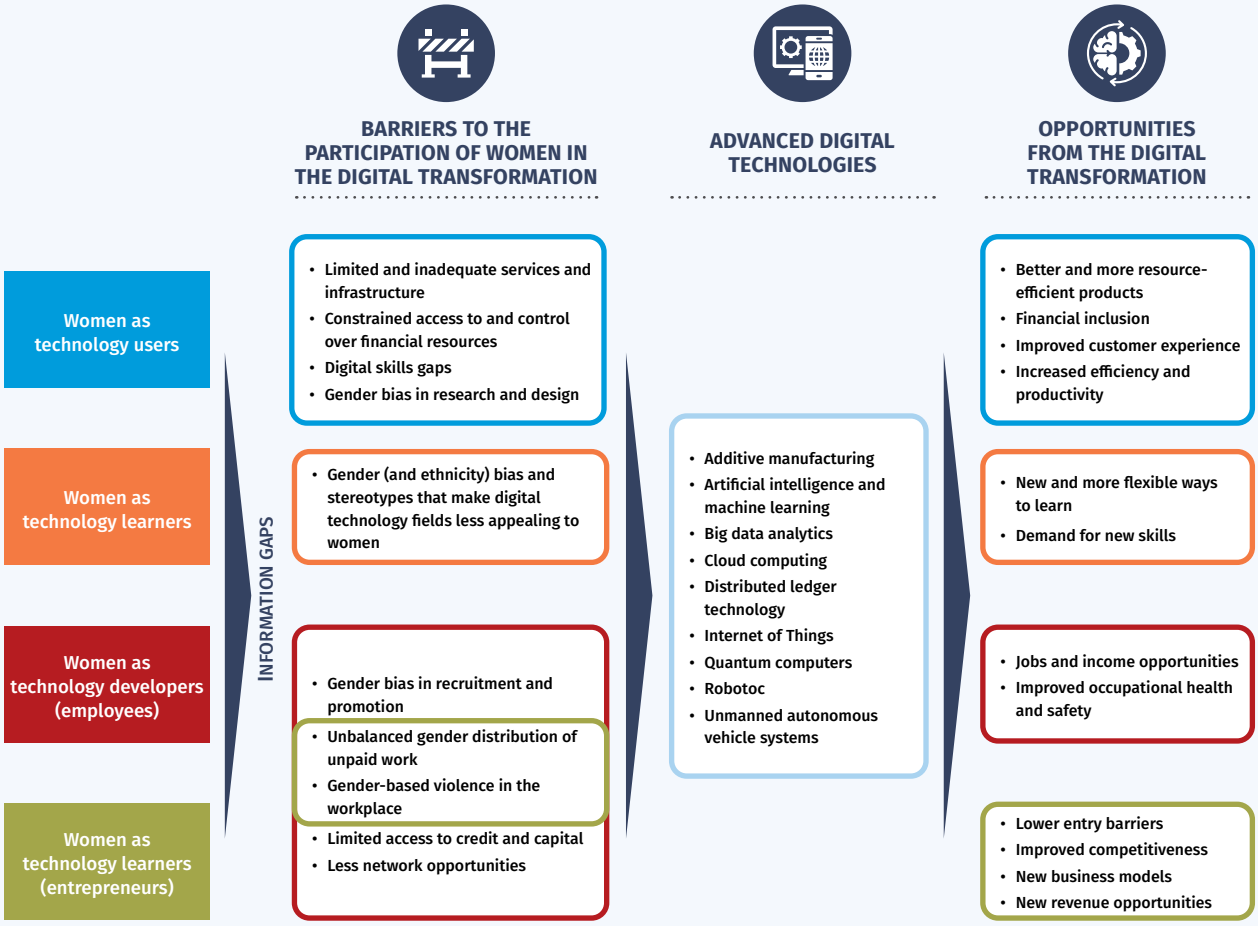


Note: Medium and high-technology startups represent 5.1% of a sample of 17,922 startups.
Source: Authors, based on data from the Global Entrepreneurship Monitor (2018). *Entrepreneurial Behavior and Attitudes*.

2.2 Barriers to the participation of women in the digital transformation

As digital technologies become pervasive, they are creating opportunities for consumers, students, employees, and entrepreneurs. However, as discussed above, women are being left behind in the digital transformation and the benefits that this entails. Barriers ranging from limited infrastructure and skills gaps, to gender bias and stereotypes and gender-based violence, prevent women from participating as technology users, technology learners, and technology developers (see Figure 8).

FIGURE 8: BARRIERS HINDERING WOMEN'S ABILITY TO BENEFIT FROM THE DIGITAL TRANSFORMATION



Source: Authors, based on Policy Links (2021). Making Industry 4.0 Work for Least Developed Countries and Small Island Developing States. An Implementation Blueprint. A report for the Commonwealth Secretariat; United Nations Industrial Development Organization (2019). Industrial Development Report 2020. Industrializing in the digital age. Vienna.

2.2.1 BARRIERS FOR TECHNOLOGY USERS

Women have less access to technology, and most of the time innovations do not account for gender differences. Limited and inadequate infrastructure and services act as a barrier for women wanting to take advantage of the digital transformation, particularly in developing countries and rural areas.[37] Women also tend to have more constrained access to, and control over, resources compared to men, and they are therefore less likely to be able to afford digital technologies.[38]

Gender gaps in access to digital technologies have narrowed over the past two decades, although progress seems to be stalling after the pandemic, and these gaps are much larger in developing countries.[39] However, digital skills gaps persist across geographies, and they also make women less likely to use digital technologies; in some contexts gender gaps in digital skills are even widening. A decline in women's enrolment in ICT-related fields has been documented in countries and regions including: Australia, Europe, Latin America and the Caribbean, New Zealand, and the Republic of Korea.[40]

Differences in the use of advanced digital technologies are even more pronounced. In Sub-Saharan Africa, while women represent more than 40% of smallholder farmers, they represent only 25% of the registered users of digital agricultural solutions.[41] This means that women farmers are more likely to show lower levels of productivity than men farmers.[42]

Gender bias in research also prevents women from benefiting fully from innovations. Traditionally, men have been seen as the norm in medical and engineering design fields. As a result, women are often mis- and under-diagnosed, protective work equipment tends to be less effective in safeguarding women, and safety risks in traditionally female-dominated industries are often overlooked.[43,44]

Despite an explosive market of health and fitness apps with the potential to empower individual users by increasing access to healthcare and health data, research has found that women's underrepresentation in app design disadvantages women in digital health.[45] These and other studies illustrate the negative impact of women's underrepresentation as technology developers on their roles as users and learners.

37) UNESCO, OECD, IDB (2022). *The Effects of AI on the Working Lives of Women*.

38) Sey, A. and Hafkin, N. (2019). *Taking stock: Data and evidence on gender equality in digital access, skills and leadership*. United Nations University, Tokyo.

39) Ibid.

40) Ibid.

41) Thompson, T. and Gyatso, T. (2020). *Technology adoption for improving agricultural productivity in Sub-Saharan Africa*. Global Agricultural Productivity Report.

42) Gill, K., Brooks, K., McDougall, J., Patel, P. and Kes, A. (2010). *Bridging the gender divide. How technology can advance women economically. International Center for Research on Women.*

43) Criado Perez, C. (20019). *Invisible Women: Exposing Data Bias in a World Designed for Men*. Chatto & Windus: London.

44) UN Women (2017). *Making innovation and technology work for women*. UN Women: New York.

45) Figueroa, C.A., Luo, T., Aguilera, A. and Lyles, C.R. (2021). *The need for feminist intersectionality in digital health*. The Lancet Digital Health, 3(8), e526–e533.

46) UNESCO, OECD, IDB (2022). *The Effects of AI on the Working Lives of Women*.

2.2.2 BARRIERS FOR TECHNOLOGY LEARNERS

The stereotype that technology and engineering are men's domains is pervasive and works as one of the main barriers for girls and women seeking to learn skills that are relevant for the digital transformation. This stereotype affects girls' perception of their proficiency in technical skills and constrains their career ambitions from an early age. For example, at 15 years of age, only 0.5% of girls, on average across OECD countries, are aiming to become ICT professionals, compared to 5% of boys. In STEM fields, boys are twice as likely to aspire to become engineers, scientists, or architects than girls.[47]

Gender stereotypes, however, evolve over time. For example, in the United States and the United Kingdom, women played a key role in the development of computer programming in the period following World War II,[48] but as this role became more sophisticated and better paid, computer science became a male-dominated field.[49, 50]

Discrimination in educational institutions also reinforces the underrepresentation of women and ethnic minorities. In Latin America, the negative impact of racial discrimination on the enrollment and retention of indigenous and Afro-descendant students in higher education has been widely documented, as well as the call for inter-cultural education.[51]

2.2.3 BARRIERS FOR TECHNOLOGY DEVELOPERS

Various barriers inhibit the participation of women as technology developers, ranging from an unbalanced gender distribution of unpaid care and domestic work to biases that affect recruiting and promotion processes, limited access to networks, finance and capital, and gender-based violence.

Across the world and without exception, women perform the majority of unpaid care work, notably 3.2 times more than men, on average.[52] This unbalanced distribution of unpaid work has repercussions for the participation of women in the labour market and their work conditions, from job level and remuneration to access to social security conditional upon work status. In every country around the world, female labour market participation is lower compared to their male counterparts.[53]

47) OECD (2018). *Bridging the digital gender divide. Include, upskill, innovate.*

48) Abbate, J. (2012). *Recoding Gender. Women's Changing Participation in Computing.* Cambridge, Massachusetts, London, England: MIT Press.

49) Ensmenger, N.L. (2012). *The computer boys take over: Computers, programmers, and the politics of technical expertise.* Cambridge, MA: MIT Press.

50) ESCAP (2021). *The Future is Equal: Gender Equality in the Technology Industry.* United Nations: Republic of Korea.

51) Mato, D. (ed.). (2019). *Educación Superior y Pueblos Indígenas y Afrodescendientes en América Latina. Colaboración intercultural: Experiencias y Aprendizajes.* Sáenz Peña, Buenos Aires, EDUNTREF.

52) ILO (2018). *Care work and care jobs for the future of decent work.* Geneva: ILO.

53) ILO (2020). *Empowering women at work. Company policies and practices for gender equality.* Geneva. ILO.

Having to fulfill more care responsibilities and a lack of real flexibility in full-time jobs push women to take part-time jobs and, in some cases, to engage in the informal economy, where earnings tend to be lower and work conditions more precarious.[54]

Globally, women earn on average 20% less than men.[55] Gender pay gaps, however, vary across countries and between different groups of women. Among low- and middle-income countries, India and Pakistan show the widest (unadjusted) mean hourly gender pay gap (34%), while the Philippines (-10.3%) and Costa Rica (-6.8%) show negative gender pay gaps, which means that women, on average, earn more than men.[56] Similarly, the (unadjusted hourly) gap between mothers and non-mothers ranges from 1% in countries such as South Africa and Canada to as much as 30% in Turkey.[57]

The COVID-19 pandemic has had a negative impact on female retention rates in the tech sector, with significant proportions of women planning to leave their roles, often because of work–life balance concerns.[58] Responsibilities at work also tend to "spill over" into private life for women more than for men.[59]

Recruitment and promotion processes that rely on informal networks, and which are affected by both a conscious and subconscious gender and ethnicity bias, also constitute an obstacle for diversity in technology sectors.[60,61] Gender stereotypes and the related bias not only affect perceptions of the digital expertise of men and women; they also contribute to a masculine culture in the workplace, which discourages the participation of women.

Masculinized workplaces result in micro-aggressions, subconscious biases, sexual harassment, and other forms of discrimination,[62] and more women than men experience gender discrimination at work.[63] A survey conducted among 1,000 tech employees, startup funders, and investors globally found that, among employees, 48% of women have experienced harassment compared to 11% of men.[64] Violence in the workplace leads to increased absenteeism and staff turnover and may prevent women from seeking leadership roles.[65] In the high-tech industry the quit rate among women is more than twice that observed among men.[66]

In the European Union, 8.7% of women with tertiary education working in the digital sector left their jobs and became inactive in 2015, while only around 1.2% of men workers made the same transition. It is estimated that this drop-out phenomenon among women causes an annual productivity loss of €16.1 billion for the European economy.[67]

The lower participation rate of women in digital-technology-related fields means that they struggle more to find mentors and to develop networks. This, together with their reduced access to finance, lowers their chances of becoming entrepreneurs. Gender-based violence also affects women's prospects of funding their business. The aforementioned study on harassment experiences found that, globally, 44% of female founders of tech startups have been harassed, and the proportion is larger among non-White women founders (47%) and LGBTQ founders (65%). Of these, four out of every ten had been harassed by an investor.[68]

Box 1 presents the case of the underrepresentation of women in the information and technology sector in Norway, a country that, despite having made significant achievements in gender equality, overall shows low participation of women in the digital technology sector.

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54) Ibid.

55) ILO (2018). *Global Wage Report 2018/19: What lies behind gender pay gaps*. Geneva: ILO.

56) Ibid.

57) Ibid.

58) Equileap (2022). *Gender equality global report & ranking*.

59) EIGE (2018). *Women and men in ICT: a chance for better work–life balance - Research note*. Luxembourg: EIGE: European Institute for Gender Equality, Publications Office of the European Union.

60) UN Women (2017). *Making innovation and technology work for women*. UN Women: New York.

61) ESCAP (2021). *The Future is Equal: Gender Equality in the Technology Industry*. United Nations: Republic of Korea.

62) Wajcman, J. et al. (2020). *The digital revolution: Implications for Gender Equality and Women's Rights 25 Years after Beijing*. Discussion Paper. UN Women.

63) Bailey, M. and Riley, S. (2018). *2018 Women in Tech: Unconscious Bias, Parity, and the Path Forward*.

64) Women Who Tech (2020). *Women who tech startup & tech culture survey*. Lincoln Park Strategies. Craig Newark Philanthropies.

65) ILO (2020). *Empowering women at work. Company policies and practices for gender equality*. Geneva. ILO.

66) UN Women (2017). *Making innovation and technology work for women*. UN Women: New York.

67) Quirós, C.T., Morales, E.G., Pastor, R.R., Carmona, A.F., Ibáñez, M.S. and Herrera, U.M. (2018). *Women in the digital age. European Union*.

68) Women Who Tech (2020). *Women who tech startup & tech culture survey*. Lincoln Park Strategies. Craig Newark Philanthropies.

BOX 1: IT ORGANIZATIONS' ATTITUDES TO GENDER EQUALITY IN NORWAY

Only about 20% of IT workers in Norway are women. NORDWIT, a Nordic Centre of Excellence for women in tech-driven careers (funded by Nordforsk 2017–22), invited IT organizations and employers from the private, public, and secondary IT sector to discuss the underrepresentation of women in IT, aiming to find answers to the following questions:

a. How do IT employers and organizations perceive the underrepresentation of women in IT?
b. Do they consider it a goal to increase women's participation in IT?
c. And, if so, which strategies or actions do the organizations have in place?

A total of 23 representatives (13 women and 10 men) from 12 organizations contributed to the interviews that took place in 2018–19.

The answer to the first question was unanimous: they had few or no women in tech positions, and they fully agreed with gender equality as a goal. However, from this point on, the answers began to diverge into four approaches to the companies' involvement:

1. Claiming that gender equality was not a challenge, because there was an overall gender balance in the company (often the public sector), there were women in other positions (e.g., HR), or referring to an assumption about the gender equality that was already in place: "Everybody is treated the same, we don't think much about it."
2. Gender equality was not a focus, either because other issues were prioritized or because of an assumption that focusing on gender would make it more difficult to recruit women to tech positions: "We don't believe in the typical 'women are encouraged to apply'."
3. Seeing men and women as different led to questioning women's interest and style in terms of developing tech competence compared to men, based on an assumption that men developed their tech competence from their teens in ways that made it difficult for women to compete. This led to further questioning about whether it was worth working toward the inclusion of women in tech work: "Do we need more women in IT?"
4. Indifference and passivity to the issue, assuming that it will eventually "gradually change by itself," and ignoring it, as there was no requirement to do anything about it: "[Gender equality in tech] is not an explicit part of our mission."

With this widely accepted gender equality regime, there was a gap between policy and practice. The Norwegian Equality and Anti-Discrimination Act requires employers to "make active, targeted and systematic efforts to promote equality, prevent discrimination" on the basis of gender and other differentiating factors.2 However, the guidelines are vague and there are no sanctions in place for not pursuing these goals. The study reveals that the gender equality norm was not easily translated into the context of technology work. Furthermore, it illustrates that gender stereotypes related to IT and IT workers made gender equality interventions appear less relevant in fields of IT. Consequently, this left the gender imbalance in tech jobs visible, as the organizations recognized women's underrepresentation; however, it remained invisible as a goal, when doing nothing appeared to be the right thing to do.

Source: Corneliussen, H.G. and Seddighi, G. (2020). The Challenge of Implementing the National Gender Equality Norm in IT Organizations. IADIS International Journal on Computer Science and Information Systems, 15(2), 1–14.

1/ Read more about research from NORDWIT: https://nordwit.com/
2/ https://lovdata.no/dokument/NLE/lov/2017-06-16-51

2.3 Digital transformation and gender equality: moving forwards or backwards?

Digital technologies have made work more flexible, creating opportunities for women to enter the labour market. As the digital transformation accelerates, it is likely to create further opportunities to perform roles that require a combination of disciplines and competencies. The need for multi- and cross-disciplinary competence is, for instance, highlighted in the Council of Europe's recent report on gender equality and AI, emphasizing that AI operates in a socio-technical environment.[69] However, digital technologies can also reinforce gender stereotypes and deepen economic and social exclusion.

Although digital technologies have increased flexibility in work,[70] without changes in gender norms this can mean more precarious working conditions and heavier burdens of unpaid care and domestic work, as the COVID-19 pandemic revealed.[71]

Automation, often enabled by a combination of digital technologies, such as sensors, robots, and AI, has the potential to improve working lives, reducing safety risks and the time spent on routine tasks.[72] However, the spread of automation also involves risks for those who are seeing their jobs disappear. While new jobs are also being created, as discussed above, women are underrepresented in these new roles.[73]

Various efforts have been made to predict the risks of automating jobs among women; however, such predictions should be considered with caution since they involve significant levels of uncertainty; they are sensitive to methodological approaches and assumptions; and the risks vary across countries and sectors. Nonetheless, most of the studies have found that, because women are disproportionately represented in low-skilled occupations and are more likely to perform routine tasks, their jobs are at higher risk of being automated. According to these estimates, women's jobs are between -5% and 25% more likely than men's jobs to be automated. Estimates of the risks of automation tend to be larger in developing countries (see Figure 9).

The expected impact of automation is complex regarding the unequal risks for men and women. The automation of jobs means that many women may need to transition between occupations, often into higher-skilled and more tech-skilled roles. However, women face a variety of barriers that make these transitions difficult, and without the right policy enablers in place, the digital transformation risks deepening gender segregation in the labour market.[74] In addition, women will also find increased barriers to accessing better-paid jobs in sectors that are traditionally dominated by men, which are also being automated.

69) Bartoletti, I. and Xenidis, R. (preliminary draft October 2022). *Preliminary draft Council of Europe study on the impact of artificial intelligence, its potential for promoting equality, including gender equality, and the risks to non-discrimination*. The Gender Equality Commission (GEC) and the Steering Committee on Anti-Discrimination, Diversity and Inclusion (CDADI), Council of Europe.

70) Barbieri, D., Lelleri, R., Maxwell, K., Mollard, B., Karu, M., Salanauskaitė, L. and Reingardė, J. (2018). *Women and men in ICT: a chance for better work–life balance - Research note*. Luxembourg: EIGE: European Institute for Gender Equality, Publications Office of the European Union.

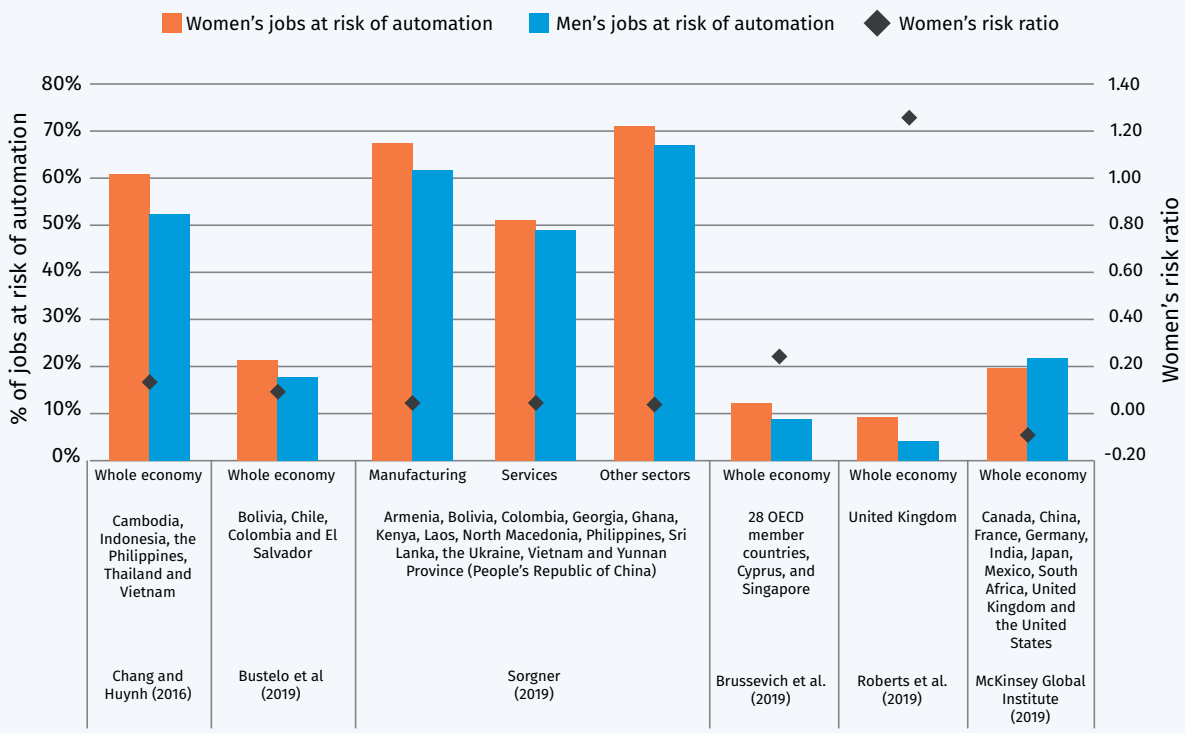
71) UN Women (2020). Whose time to care: Unpaid care and domestic work during COVID-19.

72) Madgavkar, A. et al. (2019). *The future of women at work. Transitions in the age of automation*. McKinsey Global Institute.

73) Barbieri, D. and Caisl, J. et al. (2022). *Artificial intelligence, platform work and gender equality*. European Institute for Gender Equality (EIGE).

74) OECD (2017). Going digital: The future of work for women. In: *The Pursuit of Gender Equality: An Uphill Battle*. OECD Publishing, Paris.

FIGURE 9: SELECTED STUDIES ON THE RISK OF AUTOMATION OF JOBS BY GENDER

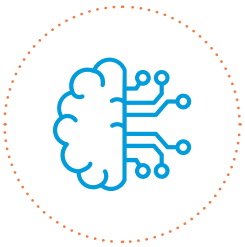


Note: Risk ratio calculated by dividing the percentage of women's jobs at risk of automation by the percentage of men's jobs at risk of automation.

Source: Authors, based on Bustelo et al. (2019), Brussevich et al. (2018), Chang and Huynh (2016), McKinsey Global Institute (2019), Roberts et al. (2019), and Sorgner (2019). See Appendix A for further details.

2.3.1 ARTIFICIAL INTELLIGENCE AND THE RISK OF REPRODUCING OR INTRODUCING NEW FORMS OF DISCRIMINATION

Artificial intelligence as a discipline was first developed in the 1950s and 1960s, with the aim of simulating human intelligence through computer systems. An AI system is often defined as a set of algorithms with the ability to analyze and interpret vast amounts of data to achieve certain goals. AI is increasingly used by industry and in the public sector, and across different fields such as transportation, education, healthcare, national security, social media, and more. AI systems that many of us encounter on an everyday basis include systems such as search engines, face-recognition systems, and voice assistants. AI can also be embedded in hardware devices, such as autonomous cars, robots, and IoT applications,[75] and there are constant news articles about new fields of use, as well as new benefits, but also new threats of AI.[76]



75) European Commission, High-Level Expert Group on Artificial Intelligence (2019). *A Definition of AI: Main Capabilities and Disciplines*.

76) One example is the chatbot that was recently released by Open AI, which has created worldwide headlines based on its ability to mimic authentic writing; see, for instance, Bloomberg's tech news: https://www.bloomberg.com/news/articles/2022-12-07/openai-chatbot-so-good-it-can-fool-humans-even-when-it-s-wrong

The risks of AI

AI includes efficient methods to analyze and interpret *connections between data*, which are then used by the AI algorithm to learn such connections. Data and algorithms are thus both vital parts of an AI system. An enormous amount of data is needed to train AI systems and for such systems to perform well. This raises many questions about the risk of producing unfair, biased, or discriminating results.[77] Data that is not representative of a wide set of users will introduce the risk of developing a bias in the AI system. Here, we focus on some of the risks of discrimination in relation to gender and race. However, bias can impact AI systems at different stages beyond data collection, including annotation, algorithm design, model training, mode testing and model deployment.

First, *a lack of geodiversity or demographic diversity in datasets* – that is, uneven representation of the world's population in the collections of data and datasets used for developing AI – has led to discriminating results in fields such as those listed below:

- **Natural language processing (NLP)**, where, for instance, translations of occupations are gendered according to English-speaking stereotypes. AlgorithmWatch identified that Google Translate suggests that a male nurse translates into a female nurse, applying the female noun: "She is a nurse." Such misrepresentations reflect historic data about men, women, and occupations, which makes it more likely for an AI system to interpret the category of nurse as connected to women.[78]

- **Computer vision** such as recognizing and labeling photos across cultures: A lack of diversity represented in datasets has resulted in AI systems misinterpreting terms and images across cultures, such as mislabeling a North Indian bride as "costume" and "performance art."[79]

- **Computer vision supported by linguistic datasets** is a means to improve visual recognition. However, research has shown that datasets supporting the development of AI models for image recognition also risk amplifying gender discrimination because of the high likelihood of associating activities with gender, for instance, cooking being more likely to include women than men.[80]

- **Biometrics** such as face-recognition technology: A lack of representation in demographic information has put AI-driven face-recognition technology at risk of discriminating against certain groups. A study of six different face-recognition algorithms found a consistently lower accuracy for recognizing women, Black people, and younger age groups.[81] A higher match for these groups can be achieved by more extensive training on datasets including these groups.

77) Suresh, H. and Guttag, J. (2021). *A framework for understanding sources of harm throughout the machine learning life cycle*, EAAMO '21: Equity and access in algorithms, mechanisms, and optimization (1–9). Srinivasan, R. and Chander, A. (2021). *Biases in AI systems*. Communications of the ACM, 64(8), 44–49; Xenidis, R. and Senden, L. (2020). *EU non-discrimination law in the era of artificial intelligence: Mapping the challenges of algorithmic discrimination*. In: Bernitz, U., Groussot, X., Paju, J. and de Vries, S.A. (eds.). *General Principles of EU law and the EU Digital Order* (151–182): Kluwer Law International.

78) AlgorithmWatch (2020). *Female historians and male nurses do not exist, Google Translate tells its European users*.

79) Shankar, S., Halpern, Y., Breck, E., Atwood, J., Wilson, J., & Sculley, D. (2017). *No classification without representation: Assessing geodiversity issues in open data sets for the developing world*. arXiv preprint arXiv:1711.08536.

80) Zhao, J., Wang, T., Yatskar, M., Ordonez, V. and Chang, K.-W. (2017). *Men also like shopping: Reducing gender bias amplification using corpus-level constraints*. arXiv preprint arXiv:1707.09457.

81) Klare, B.F., Burge, M.J., Klontz, J.C., Vorder Bruegge, R.W. and Jain, A.K. (2012). *Face Recognition Performance: Role of Demographic Information*. In: IEEE Transactions on Information Forensics and Security, 7(6): 1789–1801. doi: 10.1109/TIFS.2012.2214212.

Person data increases the risk of discrimination

A critical risk of AI producing discriminating results for social groups and individuals arises when person data is involved. This includes not only sensitive data but any kind of information about individuals, as there is always a possibility that such data reflect *patterns of institutionalized discrimination*.[82] The risk of discrimination *increases with bias in data*, such as historic bias in data reflecting differences in men and women's occupational profiles.[83] This has, for instance, resulted in specific types of occupation or position being linked to men or women (e.g., leaders associated with men, nurses associated with women).

A similar type of bias in AI systems that many of us encounter every day is reflected in adverts delivered with different content to men and women. Men are, more often than women, a target for high-paying jobs; and boys are targets for games, sports, and technology, while girls are targets for beauty and cosmetics. This way, the AI algorithms become normative and performative by reproducing gendered patterns. More critical harm may arise when such information is used to predict individuals' ability to, for instance, repay a loan or repeat a crime.[84]

A critical issue relating to using person data for AI systems is that, *even when everything is formally correct,* when datasets are controlled for bias and made as correct as possible,[85] the AI system trained on person data can still reflect *institutionalized gender (or other types of) discrimination*.[86] Measures against bias such as "cleaning" data, anonymization, and using "proxy" variables (e.g., exchanging sensitive information such as race with postcode), can reduce – but not erase – the risk of discrimination when using AI on person data, like the recruitment tool described in Box 2.

Furthermore, the risk of *discovering discrimination* increases with the *complexity of the AI algorithms*. Methods such as deep learning and black box algorithms pose the greatest challenge when identifying and explaining the results of an AI system.

Finally, AI can discriminate not only based on bias that *exists* in the dataset but also through data that is *excluded from*, or not made available to, the AI system for consideration. One such example is the norm of representing individuals' gender with an either/or categorization: either male or female. This leads to the risk of discriminating against individuals who identify with other gender identities that remain invisible in the system.

82) Connell, R.W. (2002). *Gender.* Cambridge: Polity.

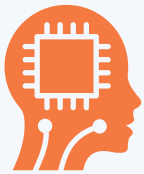
83) Broomfield, H. and Reutter, L.M. (2021). Towards a Data-Driven Public Administration: An Empirical Analysis of Nascent Phase Implementation. *Scandinavian Journal of Public Administration,* 25(2), 73–97.

84) Mancisidor, R.A., Kampffmeyer, M., Aas, K. and Jenssen, R. (2022), Generating customer's credit behavior with deep generative models. *Knowledge-Based Systems,* 245, 108568. doi: https://doi.org/10.1016/j.knosys.2022.108568

85) EU Regulatory Framework for AI https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai

86) ITU: Bridging the AI gender gap: Why we need better data for an equal world. https://www.itu.int/hub/2020/09/bridging-the-ai-gender-gap-why-we-need-better-data-for-an-equal-world/

BOX 2: REAL-WORLD DATA PRODUCES DISCRIMINATING RESULTS IN AI



In 2015, Amazon discontinued its AI recruiting tool after discovering that it discriminated against women. The unintended effect that surprised the developers was the systematically higher rating of men than women as candidates for technical posts. The result of the bias in the recruitment tool was the training data: 10 years of resumés submitted to job openings mainly from men, reflecting the lower participation of women in tech education and occupations.

The higher representation of men in the training dataset had produced a negative association with women, systematically devaluing resumés, including words that point to women. Simply excluding words such as "women" could, however, not guarantee unbiased results, since other types of information can also be connected to gender. The example illustrates that existing data integrates gender inequalities in ways that produce gender discriminating effects when this data is interpreted by AI.

Source: Koshiyama A. and Kazim E. et al. (2021). Towards algorithm auditing: a survey on managing legal, ethical and technological risks of AI, ML and associated algorithms. Soc. Sci. Res. Netw. https://doi.org/10.2139/ssrn.3778998 (SSRN Scholarly Paper ID 3778998); Dastin, J. (2018). Amazon scraps secret AI recruiting tool that showed bias against women, Reuters. https://www.reuters.com/article/us-amazon-com-jobs-automation-insight-idUSKCN1MK08G

Opportunities weighed against risks

Major opportunities of AI are recognized in many fields; however, as the examples illustrate, the risks of discrimination are also significant. While awareness of such challenges should be at the core of any AI development, these issues have also resulted in uncertainty, even slowing down the use of AI. One example of this ambivalence in the development is the use of AI-driven emotion analysis, which is used in AI-based healthcare innovations with the inclusive goal of making healthcare affordable and accessible to a wider group of users. The risks of discrimination, however, recently led to the Information Commissioner's Office in the UK issuing a warning against using biometrical technology for emotion analysis (such as gaze tracking, sentiment analysis, facial movements, gait, heartbeats, facial expression, and skin moisture) because it is immature and "could be discriminating against people."[87] Reflecting the complex challenges of AI is emphasized in a recent report from the Council of Europe, with the authors claiming that AI needs to be understood in light of "the broader socio-technical apparatus constituted by the interaction of social elements with algorithmic technologies."[88]

87) ICO (2022). 'Immature biometric technologies could be discriminating against people' says ICO in warning to organisations.

88) Bartoletti, I. and Xenidis, R. (preliminary draft October 2022). *Preliminary draft Council of Europe study on the impact of artificial intelligence, its potential for promoting equality, including gender equality, and the risks to non-discrimination*. The Gender Equality Commission (GEC) and the Steering Committee on Anti-Discrimination, Diversity and Inclusion (CDADI), Council of Europe.

CHAPTER 3

Bridging the Gender Gap in Tech

A number of initiatives promoting the participation of women in digital technology fields have been analysed, based on desk research, submission of inputs from international and civil society organizations, and interviews contributing to develop case studies of good practices.

Key Findings

Women as users of advanced digital technologies are receiving less attention from development stakeholders. Only 8% of the initiatives identified are addressing women as technology users. In comparison, one-third are targeted at women and girls as learners and another third at women as digital technology entrepreneurs.

Related to this, a gap was identified in the data and programs addressing gender differences in technology adoption. Lessons from partnerships with digital platforms can be leveraged to gain a better understanding of the use of advanced digital technologies and the benefits derived from this. The review also identified examples of how gender-transformative perspectives can be incorporated into technology-adoption programs.

Although a third of the initiatives address women as technology entrepreneurs, none of the initiatives that were identified focus on the later stages of technology and business development, where the gender finance gap is wider.

In terms of technology focus, initiatives are largely focused on programming and computing areas, which reveals opportunities for addressing gender inequalities in other fields equally relevant for the digital transformation. This is particularly apparent in skills development. We found that nearly half of the initiatives targeted at women as technology learners are focused on skills related to programming or computing.

Collaboration between different stakeholders is usually found across the initiatives analyzed. A common approach across government, international and civil society organizations is partnering with the private sector, but opportunities exist to increase collaboration with civil society and grassroots organizations, which may be able, more effectively, to reach underrepresented groups. A total of 5% of the initiatives analyzed include non-binary groups in their target population, and 13% target underrepresented women groups such as ethnic minorities, women from disadvantaged contexts, and women with disabilities.

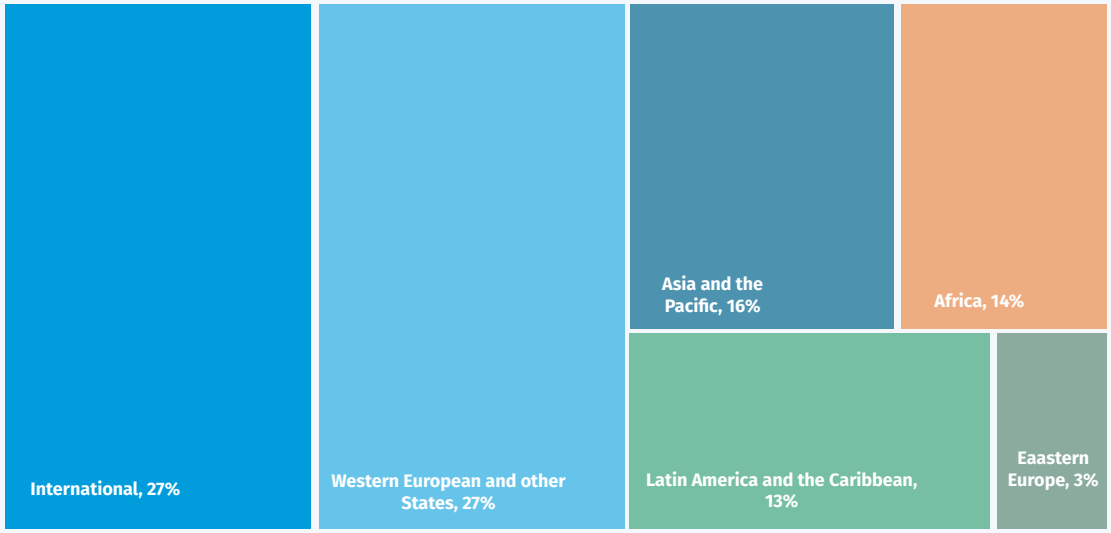
3.1 Landscape of initiatives

A number of initiatives promoting the participation of women in digital technology fields were documented. The analysis focused on initiatives led by international organizations and development banks, but efforts were also made to document initiatives from governments, civil society organizations, the private sector, and academia.

The objective of the mapping is to provide a global overview of initiatives tackling gender inequality in technology fields. For this reason, the mapping conducted does not provide an exhaustive list of global initiatives, but it aims to provide key insights on a sample of representative programs. Although initiatives led by the private sector within their organizations were documented, a better understanding of the variety of these programs would have required a separate study. Similarly, few initiatives led by education and government organizations were analyzed within the scope of this report.

Mapping of initiatives involved desk research, submission of inputs from international and civil society organizations, and interviews that helped to develop case studies of good practices. A total of 152 initiatives across five regions and with international coverage have been analyzed: International (27%), mainly led by international and civil society organizations; Western European and other States (27%), mainly led by civil society organizations and academic institutions; the Asia and the Pacific region (16%), mainly led by international organizations; Africa (14%), mainly led by civil society organizations; Latin America and the Caribbean (13%), mainly led by development banks and civil society organizations; and Eastern Europe (3%), mainly led by international organizations (see Figure 10).

FIGURE 10: INITIATIVES BY REGION

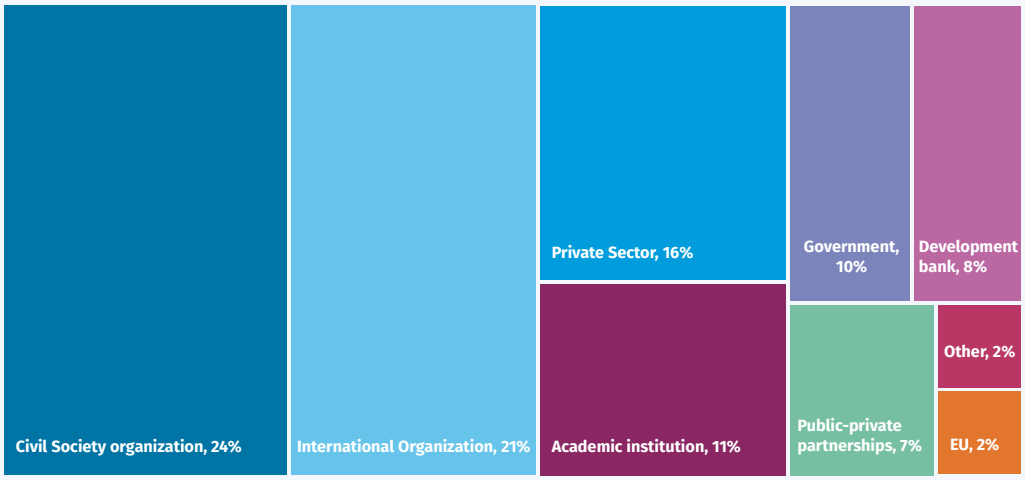


Note: 152 initiatives
Source: Authors' mapping of initiatives.

Nearly half of the initiatives identified are led by either civil society organizations or international organizations. While several of these programs involve different types of stakeholders, 7% are particularly identified as public–private partnerships (Figure 11). Public–private partnerships often involve cooperation between a governmental entity and business representatives. In Kenya, for example, the Ministry of Industry Trade and Enterprise Development, together with Microsoft and the African Center for Women Information and Communication Technology, launched the Emerging Markets Skills Initiative to accelerate the skilling of young people and to ensure an inclusive economic recovery in Kenya.[89]

Development banks are involved in a comparable number of initiatives (8%), mainly providing financial support and raising awareness through research projects and surveys. The major multilateral development banks covered in the mapping include: the Asian Development Bank (ADB), CAF (Development Bank of Latin America), the European Bank for Reconstruction and Development (EBRD), the Inter-American Development Bank (IDB), and the Islamic Development Bank (IsDB).

FIGURE 11: INITIATIVES BY TYPE OF ORGANIZATION



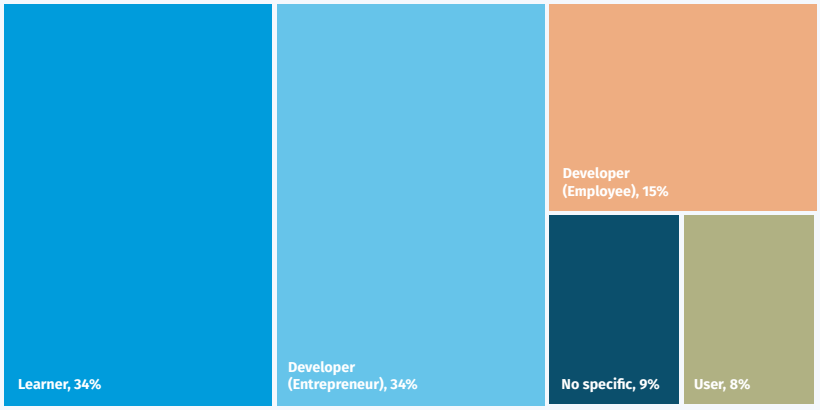
Note: 152 initiatives
Source: Authors' mapping of initiatives.

Following the classification of women and their relation to technology (user, learner, developer) presented in Chapter 2, we found that most of the initiatives analyzed are targeted at women and girls as learners (34%) and women as digital technology entrepreneurs (34%), followed by initiatives targeted at employees (15%) and users (8%). A total of 9% of the initiatives are not targeted at a specific women's group (see Figure 12). From those initiatives that are targeted at learners, 34% focus particularly on girls.

While facilitating access for women to basic digital technologies is at the core of a variety of development stakeholders' strategies, few programs support the adoption of advanced digital technologies by women, with only 8% of initiatives targeting women as technology users.

89) https://www.acwict.org/work/emerging-markets-skills-initiative/

FIGURE 12: INITIATIVES BY TYPE OF TARGET POPULATION



Note: 152 initiatives
Source: Authors' mapping of initiatives.

Although most of the initiatives mapped follow a gender-responsive or gender-transformative approach focused on women, 5% of these also address non-binary groups and 13% target underrepresented women's groups, such as ethnic minorities, women from disadvantaged contexts, and women with disabilities (see Figure 13).

FIGURE 13: INITIATIVES TARGETED AT SPECIFIC POPULATION GROUPS

34% of the initiatives targeted at learners focus on girls

5% of the initiatives include non-binary people

13% of the initiatives target under-represented woman
(ethnic minorities, women from disadvantaged contexts and women with disabilities)

Note: 152 initiatives
Source: Authors' mapping of initiatives.

Most of the initiatives follow an integrated approach, providing more than one type of support. For example, entrepreneurship programs usually involve the provision of finance, along with mentoring and networking opportunities. Similarly, hackathons, which are one of the most popular initiatives (13%), usually involve capacity building, networking opportunities, and some type of finance support.

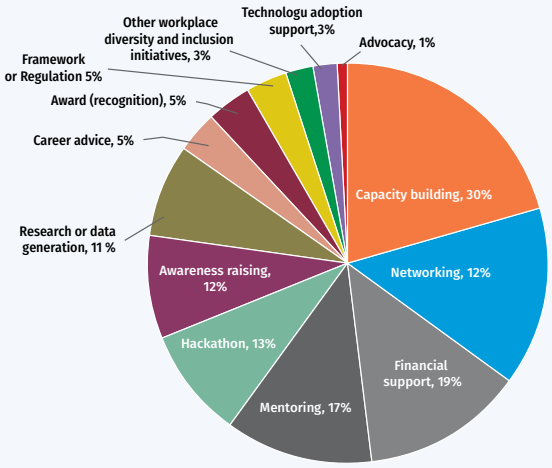
From the initiatives studied, the five most common elements involve: capacity building (30%), networking (21%), financial support (19%), and mentoring (17%). Other initiatives captured include awareness-raising campaigns, research or data-generation projects, career advice, awards for women or for gender-transformative approaches, gender-transformative frameworks and regulations, other initiatives promoting diversity and inclusion in the workplace (childcare facilities, gender pay gap reporting, etc.), technology adoption support, and advocacy (see Figure 14).

The main barriers and related issues addressed by the initiatives analyzed include: gender bias and stereotypes (20%), a lack of relevant skills (18%), limited access to finance (18%), limited networks (14%), underrepresentation of women in technology-related sectors (11%), and information gaps (7%). Other barriers addressed to a lesser extent include: gender bias in the workplace, gender bias in research, gender-based violence, and limited and inadequate infrastructure and services (1%) (Figure 15).

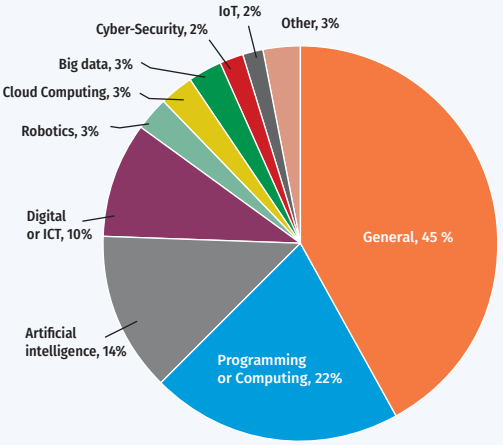
Many initiatives tackled more than one barrier. For example, initiatives addressing a lack of relevant skills often also tackled financial constraints, providing scholarships. Similarly, initiatives addressing the underrepresentation of women in technology-related sectors also seek to ameliorate the networks and services available to women.

FIGURES 14 AND 16: INITIATIVES BY MAIN TYPE OF INSTRUMENT AND TECHNOLOGY AREA, RESPECTIVELY

BY MAIN TYPE OF INSTRUMENT

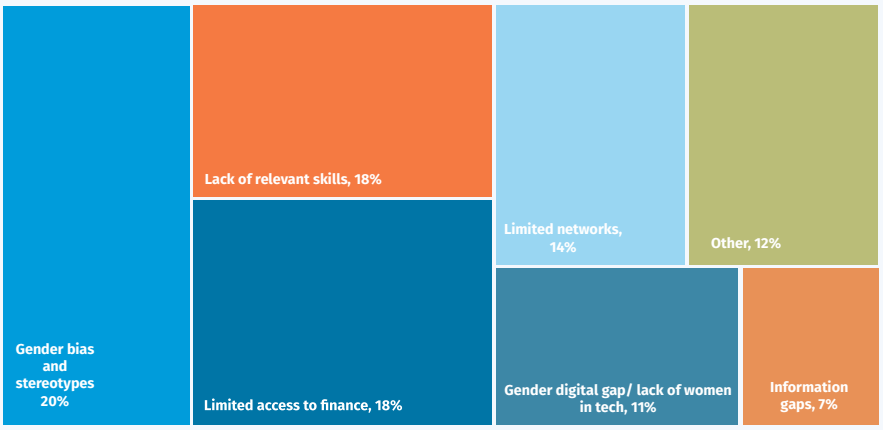


BY TECHNOLOGY AREA



Note: 152 initiatives. The total amounts to more than 100% because some initiatives involve more than one type of instrument
Source: Authors' mapping of initiatives.

FIGURE 15: INITIATIVES BY BARRIER OR ISSUE ADDRESSED AS PER THE DESCRIPTION OF THE INITIATIVE



Note: 152 initiatives
Source: Authors' mapping of initiatives.

The initiatives mapped rarely focus on specific technology areas, rather having a broader scope covering, for example, STEM, technology sectors, digital technologies, or ICT. However, from those initiatives where a specific technology focus can be identified, programming, computing and informatics tends to dominate (22%), followed by artificial intelligence (14%) (see Figure 16).

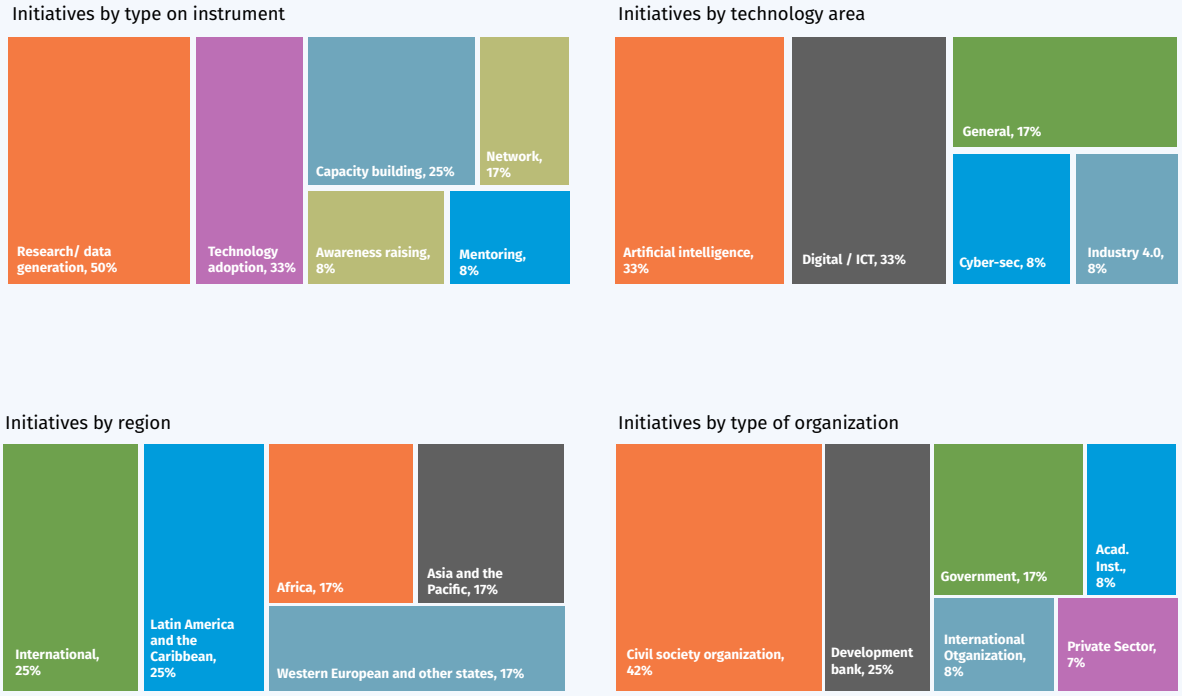
3.2 Facilitating women's and girl's access to technology

As discussed in Chapter 2, women use and benefit from digital technologies less than men. Barriers that hinder women's access to advanced digital technologies include: limited and inadequate digital infrastructure and services; lower access to, and control over, resources; digital skills gaps; and gender bias in research. In this and the following sub-chapters, we provide examples of how a wide range of stakeholders are addressing these barriers.

Among the initiatives analyzed, however, only 8% target women and girls as users of advanced digital technologies. Of this subset, half involve research projects addressing information gaps. Other common approaches include: technology adoption (33%), capacity building (25%), networking (17%), mentoring (8%), and awareness raising (8%). In terms of technology areas, there are significant differences between research projects to improve knowledge on challenges and entry points to increase women's and girls' access to technology, and initiatives supporting the adoption of technologies by women and girls: All of the research projects focus on AI, while initiatives supporting technology adoption cover broad digital, ICT, or Industry 4.0 solutions.

Geographically, a quarter of the initiatives analyzed in this subgroup have international coverage; another quarter cover Latin America and the Caribbean; 17% Africa; 17% Asia and the Pacific; and 17% Western European and other States. By type of organization, most of these initiatives are led by civil society organizations (42%) and development banks (21%) (see Figure 17).

FIGURE 17: DISTRIBUTION OF INITIATIVES TARGETING WOMEN AS TECHNOLOGY USERS



Note: 12 initiatives. Percentages by type of instrument and by type of technology may amount to more than 100% because some initiatives involve more than one type of instrument or technology area.

Source: Authors' mapping of initiatives.

3.2.1 MAKING ACCESS TO DIGITAL TECHNOLOGIES EASIER FOR WOMEN AND GIRLS

Leveraging affordable ways to provide digital infrastructure and services, in contexts where these services are limited, can make access to digital technologies easier for women and girls. Digital community centers designed with a gender-responsive perspective are examples of initiatives with this aim. A gender-responsive perspective would involve, for example, choosing a location that is safe and easily accessible for women and close to care facilities. Services generally provided by digital community centers include: free Internet connectivity, access to ICT devices, digital skills training, co-working spaces, and career advice.[90]

Financial support for the acquisition of technology solutions can also make access to digital technologies easier for women and girls. However, little is known about gender differences in the business adoption of digital technologies, and this information gap is reflected in a predominantly gender-blind design in the growing number of programs supporting the adoption of digital technologies in business.

Despite this gap, four initiatives are to be highlighted as examples for applying a gender perspective in providing support for technology adoption:

- The African Centre for Women, Information and Communications Technology (ACWICT) supports the adoption of digital technologies among under-served women farmers.[91]
- The European Bank for Reconstruction and Development (EBRD) provides financial and advisory support for the adoption of digital technologies in women-led micro-, small-, and medium-sized enterprises (MSMEs) in the West Bank and Gaza.[92]
- The Inter-American Development Bank (IDB) applies a gender perspective in two initiatives, aimed at supporting access to finance for the adoption of climate and digital technologies in MSMEs in the Eastern Caribbean and Sao Paulo, Brazil (see Box 3).

90) Women in Technology Uganda. WITU Digital Jobs Center; Digital Community Centre.

91) ACWICT (2021). Relevant and Development- Oriented Digital Content for Farmer Community in Laikipia County of Kenya; ACWICT (2021). Digital Agriculture for Accelerated and Inclusive Post COVID-19 Economic Recovery.

92) European Bank for Reconstruction and Development (2022). EBRD supports MSMEs and women-led businesses in West Bank and Gaza.

BOX 3: TECHNOLOGY ADOPTION SUPPORT WITH A GENDER PERSPECTIVE – THE CARIBBEAN

The Inter-American Development Bank (IDB) has granted a global credit loan to the Caribbean Development Bank to support environmental and digital innovation among MSMEs in the Eastern Caribbean. Unlike most of the programs in this area, IDB's initiative follows a gender perspective in its design and implementation.

Rationale

Digital technologies have the potential to boost productivity; however, MSMEs are lagging behind in the adoption of these technologies.

Target population

MSMEs in Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines, which are all eligible members of the Organization of Eastern Caribbean States.

Aim

To promote environmental and digital innovation in MSMEs.

Approach

The key characteristics of the program include the following:

- A minimum of 30% of the loans will be earmarked for buying equipment, software, consulting services, and other investments related to using technology to modernize and digitally transform the businesses, and to projects to mitigate and adapt to climate change.
- The program will finance campaigns that specifically target businesses that are run or owned by women.
- It will also finance the analysis and design of policy frameworks that promote or enhance gender diversity in the workplace.

Actors involved

IDB, business support organizations and financial intermediaries.

Expected impact

- It is expected that the program will directly benefit approximately 596 legally established MSMEs.
- At least 17% of these businesses will be owned by women

Source: IDB (2022). Caribbean Development Bank will promote Eastern Caribbean MSMEs with IDB support.

Lessons from digital platforms can be leveraged to gain a better understanding of the use of advanced digital technologies and the benefits derived from this. For example, the International Finance Corporation (IFC) has partnered with digital platform providers to gain access to data on how women leverage platforms and what barriers prevent their broader participation (Box 4).

BOX 4: LEVERAGING PRIVATE-SECTOR PARTNERSHIPS TO FILL KNOWLEDGE GAPS ON WOMEN'S PARTICIPATION IN DIGITAL PLATFORMS – IFC

The International Finance Corporation (IFC) has partnered with digital platform providers to gain access to data on how women leverage platforms and what barriers prevent their broader participation. In addition to insights on women's usage, the studies also develop a business case to motivate platforms to address these gaps and make recommendations to platforms and the public and private sector about how to boost women's participation in the respective sectors.

Rationale

Research on digital gender gaps and the inclusion of women in technology has largely focused on accessibility and affordability challenges, as well as digital skills. However, less is known about how women use digital tools to access better services and products or to increase their employment opportunities and incomes. The effects of greater digital inclusion, both on women's lives and on the revenue of companies operating in the digital space, are also not well understood.

Approach

The key characteristics of the program include the following:

- In partnership with Jumia and Lazada, two of the largest e-commerce platforms in Africa and Southeast Asia, respectively, IFC found that addressing the needs of women entrepreneurs and increasing their sales to reach parity with men's sales could grow the e-commerce markets in these regions by $300 billion between 2025 and 2030. The two studies found that while women were active participants in e-commerce, they require support to grow. For example, women-owned businesses in Africa were less likely to have received a loan from a financial institution, suggesting that targeted financing is an opportunity for e-commerce platforms to grow their seller base, while also closing gender gaps.
- Research conducted in Sri Lanka with ride-hailing platform PickMe showed that 64% of women riders perceive that they can access more or better jobs thanks to ride-hailing; and 88% perceive that ride-hailing gives them access to new places. Yet, women still make up a minority of riders. Getting ridership to parity with men would increase annual revenue by 24%, creating a clear business case for companies to serve women riders. To achieve this, companies need gender-smart design and enhanced safety features.
- Research with Coursera shows that women in emerging markets only represent about one-third of online learners. A total of 34% of women who access online learning report improvement in their employment and entrepreneurship opportunities, and some even report income increases. However, affordability and time constraints are among the main barriers preventing them from greater participation in online learning. If the gender gaps in adult online learning participation are closed, platforms in this sector stand to gain up to an additional $14 billion of revenue by 2026.
- Through the Digital2Equal Initiative, IFC brought together 17 companies to identify opportunities for women in emerging markets and boost their participation in the platform economy. Consequently, several platforms made commitments to close gender gaps. For example, Elo7, an online marketplace for creative handmade goods in Brazil, was supported by IFC to survey 1,000 women sellers on the platform to understand their needs and aspirations as entrepreneurs. The findings helped Elo7 to identify opportunities to grow its network of female sellers, many of whom are selling online for the first time, and the company developed a series of targeted training in areas such as marketing and pricing.

Source: Text provided by IFC based on 1IFC (2021). Women and E-commerce in Africa. (Washington DC: IFC, 2021); 2IFC (2021). Women and E-commerce in Southeast Asia (Washington DC: IFC, 2021); 3IFC (2020). Women and Ride-hailing in Sri Lanka. (Washington DC: IFC, 2020); 4IFC (2022). Women and Online Learning in Emerging Markets. (Washington DC: IFC, 2022); 5IFC (2020). Elo7 grows its e-commerce platform by helping women become digital entrepreneurs (Washington DC: IFC, 2020).

3.2.2 PROMOTING THE INCLUSION OF GENDER CONSIDERATIONS IN RESEARCH AND DIGITAL TECHNOLOGY DESIGN

A gender-sensitive approach in research and digital technology design includes awareness of the different situations, needs, and risks of men and women as participants in society and working life. A gender-sensitive approach is not only about fairness and justice, but also about producing better knowledge, products, and services for a wider audience. Gender balance within research and technology design teams and a gender perspective in research and innovation has increasingly been a requirement for research and innovation funding. An example of such an approach is *Horizon Europe*, the EU's key funding program for research and innovation with a budget of €95.5 billion.[93]

Gender balance in research and innovation teams ensures better representation of targeted users and thus strengthens the team's ability to understand and communicate with different user groups. It also has positive effects on creativity and innovative capacity. Gender-sensitive design includes asking questions about how a gender perspective can add value in relation to a topic, the relevant research questions, aim, target group, and expected results, by constantly questioning "Whom will this affect?" The *Gendered Innovations* project is an example of how this can be addressed (see Box 5).

Within the design of technology, we see increasing awareness of the need to tackle digital technologies' potential for discriminating results. This is particularly true for AI applications. International awareness around the challenges of AI having unfair and discriminating effects has led to a wave of policy initiatives to ensure that AI design is fair, accountable, and transparent.

The European Commission's proposition for a Regulatory Framework for AI (2021) is an example of regulation initiatives to address risk in AI applications.[94] The framework emphasizes a "risk-based approach," where the highest risk that involves "a clear threat to the safety, livelihoods and rights of people" is considered unacceptable and therefore (mainly) banned. The next level is the "high risks" category, including a wide range of AI that involves person data. It is suggested that such AI systems be "subject to strict obligations before they can be put on the market." The "limited risk" category emphasizes that AI systems such as chatbots need to be transparent, while most currently used AI systems (for instance, electricity, water, and other systems not based on person data) are found in the category of "minimal risk." While the EU framework puts risks of bias on the agenda, there are still unsolved questions regarding gender discrimination in this landscape when personal data is involved, and it remains to be seen how efficient such a framework will be for preventing gender-based discrimination.[95]

OECD.AI[96], a live repository of over 800 policy initiatives on artificial intelligence created by the Organisation for Economic Co-operation and Development (OECD) offers examples of laws, rules, directives, and other policies related to the development of new technologies. Despite the negative impacts on women of gender-blind AI design being well documented, only nine of the emerging AI-related regulation initiatives contained in OECD.AI at the time when the report was drafted identify women as one of their main beneficiaries.

93) https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

94) https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai

95) Corneliussen, H.G., Iqbal, A., Seddighi, A. and Andersen, R. (2022). *Bruk av kunstig intelligens i offentlig sektor og risiko for diskriminering*.

96) https://oecd.ai/en/dashboards/overview

BOX 5: GENDERED INNOVATIONS – A METHOD FOR GENDER-INCLUSIVE DESIGN

Rationale

Innovation with a focus on the diversity of users produces better and more inclusive innovations, and it adds value to research in terms of excellence, creativity, and business. Failing to recognize this can result in innovations that can be harmful for certain groups, such as designing seatbelts in cars that fail to reflect different body types, thereby posing a greater risk to women than men. A focus on gender and other social categories in the innovation process offers the opportunity to meet the diverse needs of a range of users.

Aim

To provide scientists and engineers with practical methods for sex and gender analysis.

Approach

The Gendered Innovations approach involves emphasizing the focus on gender in each phase of a research or innovation project, from setting priorities to making funding decisions, establishing project objectives, developing methodologies, gathering and analyzing data, evaluating results, developing patents, and transferring ideas to markets.

The project features a series of case studies with concrete examples of how sex, gender, and intersectional analysis leads to innovation; it offers practical methods of sex, gender, and intersectional analysis that can be used by scientists and engineers. The Gendered Innovations website and publications give examples of how questions regarding gender and other social categories can be raised across a diverse set of topics for research and innovation, from health to climate change, urban planning and transport, emerging technologies such as AI, finance, and more.

One of the challenges addressed by Gendered Innovations is the gender bias in chatbots and virtual assistants that are often feminized and designed in ways that reproduce gender stereotypes about women's role and work, as illustrated by this excerpt from Schiebinger and Klinge 2020 (p. 31):

> *Method: analyzing gender and intersectionality in social robots.*
>
> *When designing virtual assistants and chatbots, it is important to consider how they might perpetuate stereotypes and social inequalities. The designers of virtual assistants should be aware of how robots are gendered, e.g. by name or voice. Designers should adopt a participatory research approach to better understand how conversational AI agents can better fit a diverse group of users, based on intersecting traits such as gender, ethnicity, age and religion.*

Actors involved

Stanford University, the European Commission, and the US National Science Foundation.

Impact

Gendered Innovations has become an important framework for the funding of research and innovation by the European Commission.

Source: Gendered Innovations website: https://genderedinnovations.stanford.edu/; Schiebinger, L. and Klinge, I. (2020). Gendered Innovations 2: How Inclusive Analysis Contributes to Research and Innovation. Luxembourg: Publications Office of the European Union; Tannenbaum, C., Ellis, R.P., Eyssel, F., Zou, J. and Schiebinger, L. (2019). Sex and gender analysis improves science and engineering. Nature, 575(7783), 137–147. https://doi.org/10.1038/s41586-019-1657-6.

In addition to regulations, efforts have emerged to help governments, entrepreneurs, academics, and civil society to keep up with the fast pace at which technology transformations and the related frameworks are evolving. In Latin America and the Caribbean, in 2019, the Inter-American Development Bank launched fAIr LAC, a toolkit designed to help governments and entrepreneurs address risks in AI and data management. As described in Box 6, key elements of this initiative include: documenting and sharing good practice, regional hubs, pilot projects, and a set of handbooks, guides, and self-assessment tools.

BOX 6: FAIR LAC, A TOOLKIT FOR THE RESPONSIBLE AND ETHICAL USE OF AI

Rationale

Launched in 2019, fAIr LAC emerged to address bias identified in the use of artificial intelligence (AI) in social policy

Target population

Governments, entrepreneurs, civil society, and academia.

Aim

To influence public policy and the entrepreneurial ecosystem in promoting the responsible and ethical use of AI.

Approach

fAIr LAC provides practical tools to help governments and entrepreneurs address risks in AI and data management. Key elements of this initiative are:

- *Observatory*. The mapping of good practices in the ethical and responsible use of AI for social good.
- *Regional hubs*. Located in Mexico, Uruguay, Colombia, and Costa Rica, the hubs serve as local benchmarks for the responsible use of AI in North America, Central America, the Andean Region, and the Southern Cone.
- *Pilots*. Projects with AI components that have been developed by the IDB and its partners and implemented with the help of the hubs. They have a dual purpose: (i) to systematize the lessons learned from applications where AI helps to create greater social impact; and (ii) to create a cooperative environment so that projects may be scaled and emulated in the region.
- *fAIr LAC in a box*. Five tools for the application of the ethical principles of artificial intelligence in all phases of a project: (i) ethical self-assessment for the public sector; (ii) ethical self-assessment for the entrepreneurial ecosystem; (iii) project formulation handbook; (iv) data science handbook; and (v) algorithmic audit guide.

Actors involved

A diverse network of professionals and experts from academia, government, civil society, industry, and the entrepreneurial sector are involved in the initiative. Donors include Google, Microsoft, and Telefonica. Globalpolicy.AI is an online platform developed through ongoing cooperation between inter-governmental organizations, with complementary mandates on artificial intelligence.

Lessons learned

One of the main challenges faced in the project is raising awareness about the relevance of responsible and ethical use of AI, including data protection. This is true across different types of stakeholders, from the public to national governments.

Source: fAIr LAC Website and interview with Cristina Pombo, Inter-American Development Bank.

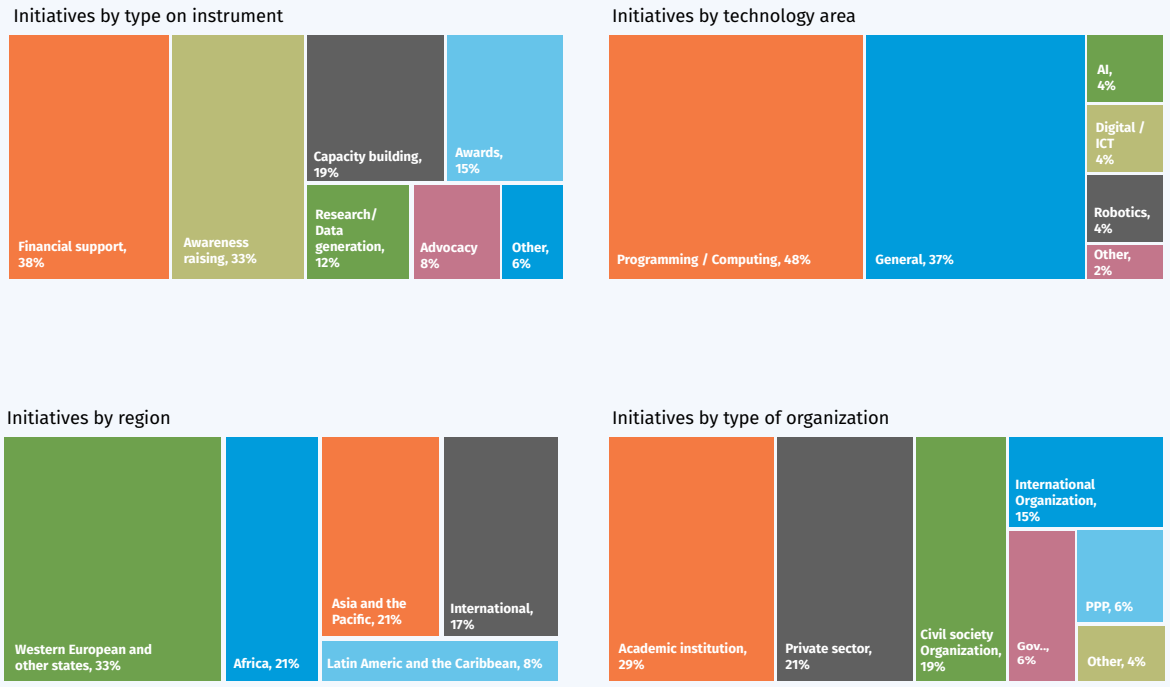
3.3 Closing the digital skills gender gap

As discussed in Chapter 2, women represent only a third of the graduates in tertiary ICT, engineering and other programmes that are relevant to the digital transformation.[97] There are two main challenges inherent in closing the digital skills gender gap: (i) recruiting girls and women to participate in digital technology-related fields, both in education and work spaces; and (ii) preventing women from leaking out of the talent pipeline including through policies aimed at women's retention, re-entry and promotion in relevant occupations.

From the initiatives analyzed, 34% are targeted at women as technology learners. The main approaches included in these initiatives are: financial support (38%), awareness-raising campaigns (33%), capacity building (19%), awards (15%), and research projects (12%).

Nearly half of these initiatives are focused on skills related to programming or computing (see Figure 18). This reveals other skills gaps that, although related, are receiving less attention and thus face the risk of broadening gender gaps in these areas. Job roles with increasing demand, according to the World Economic Forum[98] and LinkedIn Economic Graph,[99] that should receive more attention as regards efforts to increase the representation of women, based on this review of initiatives, include: cloud computing

FIGURE 18: DISTRIBUTION OF INITIATIVES TARGETING WOMEN AS TECHNOLOGY LEARNERS



Note: 52 initiatives. Percentages by type of instrument and by type of technology may amount to more than 100% because some initiatives involve more than one type of instrument or technology area.

Source: Authors' mapping of initiatives.

97) World Bank, Gender Data Portal

98) World Economic Forum (2020). *The Future of Jobs Report 2020*; World Economic Forum (2021). *Global Gender Gap Report 2021*.

99) LinkedIn Economic Graph (2022). *Future of Skills*; LinkedIn Economic Graph (2022). *Gender Equity in the Workplace*.

specialists; computer-aided design specialists; AI and data analysts; information security analysts; IoT specialists; mechanical engineers; mechanics and machinery repairers; network engineers; and process automation specialists.

Geographically, 33% of initiatives aimed at closing the digital skills gender gap analyzed cover Western European and other States, 21% target Africa, 21% target the Asia and Pacific region, 17% have international coverage, and 8% target Latin America and the Caribbean. By type of organization, most of these initiatives were led by academic institutions (29%), the private sector (21%), civil society organizations (19%), and international organizations (15%).

3.3.1 INSPIRING GIRLS AND WOMEN

Countering gender bias and stereotypes that inhibit women's participation in digital-technology-related fields may take decades; however, a variety of initiatives have been identified for supporting women's abilities and decisions to enter fields of digital technology, as well as initiatives aimed at retaining women by strengthening their sense of belonging.

Exposing girls to ICT skills from an early age contributes to breaking the stereotype of these being men's fields. Through Code Clubs, Women in Technology Uganda (WITU) has partnered with primary and secondary schools across the country to provide teachers and girls with a curriculum that introduces girls to computer science through coding and web design content. Their approach involves training teachers so that they can conduct the student training. WITU also established a maker space that connects women to mentors and role models.[100]

In India, VigyanShaala International, a civil society organization, inspires undergraduate students to participate in STEM fields through a mentoring program led by women leaders in STEM. While students from different backgrounds participate in VigyanShaala programs, their work has particularly impacted girls from rural areas, usually underrepresented in these fields. Partnerships with the private sector involving one-month internships in enterprises have proved to have a transformative effect in both the interns and the enterprises, encouraging interns to aspire to STEM jobs and incentivizing enterprises to reach talent beyond their traditional pools (see Box 7).[101]

Businesses can also play a key role in attracting girls and women into digital fields. In the United Kingdom, Cisco works with schools and colleges to introduce young women to careers in technology and to create awareness about the negative impacts of the lack of diversity in these fields. In collaboration with the University College of London, Cisco UK organized an online event with girls in years 12 and 13 discussing issues related to diversity, data, and ethics in machine learning and artificial intelligence. They also run girls-only work experience for 16–18-year-olds, as part of the Cisco Pathways program.[102]

100) Women in Technology Uganda (WITU). Tech Hub programme.

101) Interview with Darshana Joshi, VigyanShaala International.

102) Cisco UK & Ireland blog and interview with Cisco UK and Ireland Corporate Social Responsibility and People and Communities teams.

BOX 7: SHE FOR STEM (KALPANA): EMPOWERING WOMEN SCIENTISTS IN INDIA

In India, VigyanShaala International, a civil society organization, is creating opportunities for underrepresented young people in STEM fields through a comprehensive approach. Its work includes the She for STEM (Kaplana) program, a mentoring initiative targeted at young women.

Rationale

The Fourth Industrial Revolution is transforming the labour market landscape, changing roles and jobs, and demanding new skills. India has a young population of around 500 million; however, less than 5% of these have a formal education and less than 1% have the requisite STEM skills. An increase in skills gaps means that millions of young graduates risk losing opportunities for decent work.

Target popoulation

Underprivileged young girls.

Aim

To close the gaps in access, attainability, and quality in STEM education, particularly for the most marginalized.

Approach

Kalpana – She for STEM: a 7-week online immersive interpersonal development and mentoring program; the Kalpana Network, a community of women leaders in STEM and young aspiring female undergraduates in STEM; and the Kalpana Stories, interviews, and blogs of empowering stories of women leaders in STEM.

VigyanShaala STEM Fellowship: a 3-year comprehensive mentoring and STEM skilling program that nurtures local role models (STEM Fellows) with a 21st-century curriculum for critical thinking, promoting inquisitiveness, innovation, and interdisciplinarity.

Education Policy Research: leveraging a data-driven approach to identify key barriers and supporting government policy.

Actors involved

VigyanShaala International, in collaboration with other non-profit organizations, schools, corporates, research institutions, and policy-makers.

Impact

2,000 students have participated in She for STEM (Kalpana).

Source: Interview with Darshana Joshi and VigyanShaala International Website.

3.3.2 TRANSFORMING LEARNING SPACES

Transforming schools and universities into gender-inclusive spaces requires changes in teachers' and pupils' attitudes, as well as in recruitment and teaching practices. Initiatives in this direction include: gender-responsive codes of conduct, incentives to attract and upskill women ICT teachers, and teachers' awareness training to address gender bias and stereotypes in learning materials and teaching practices.[103]

For example, the International Bureau of Education of the United Nations Educational, Scientific and Cultural Organization (IBE-UNESCO) and the Ministry of Education of Malaysia developed the training tool *A Resource Pack for Gender-Responsive STEM Education*. This resource provides comprehensive guidance on the theory and practice of gender-responsive STEM education. It is designed for policy-makers, curriculum specialists and developers, teachers, teacher educators, school leaders, and district-level administrators. The key issues covered include:

- Gender and sociocultural practices in STEM education;
- Formulating policies for gender-responsive STEM education;
- Developing gender-sensitive STEM curricula;
- Creating gender-responsive STEM pedagogy, learning, and assessment;
- Teacher professional development; and
- Community awareness.[104]

103) West, M., Kraut, R. and Ei Chew, H. (2019). *I'd blush if I could. Closing the gender divides in digital skills through education*. EQUALS and UNESCO.

104) IBE-UNESCO (2017). *Training Tools for Curriculum Development: A Resource Pack for Gender-Responsive STEM Education*. Geneva. IBE-UNESCO.

3.3.3 ADOPTING GENDER-TRANSFORMATIVE LIFELONG LEARNING APPROACHES

Since discriminatory social norms and gender stereotypes inhibit the participation of girls and women in digital technology fields throughout their lifecourse, initiatives addressing these gender gaps should adopt a multifaceted, lifelong, and flexible approach that reflects this.[105] This involves, for example, enabling women and girls to acquire relevant skills through both formal and informal channels.[106]

Among the formal channels we find: workshops conducted by female role models or female entrepreneurs; and training, often connecting young women with mentors for post-training and mentorship support.

Alternative and flexible learning pathways are also very common. "Hackathons" is a term used to describe multiple-day/1-week-long events, usually hosted by academic institutions, which offer a variety of capacity-building activities and networking support, including: workshops, mentoring talks, conferences, social activities, and competitions.

In-person events and training are usually accompanied by digital e-learning tools that provide access to a variety of resources. In this way, the attendees have the opportunity to advance their knowledge and networking opportunities over time.

As discussed in Chapter 2, skills and roles are changing rapidly, and inevitably some women will see their jobs disappear as a result of automation. Gender-transformative reskilling and safety-net initiatives can facilitate transitions toward more gender-equal participation in the labour market. Two of the initiatives mapped, aiming to develop digital skills among unemployed women, provide examples of how to do this.

In Brazil, where only 13% of students of computer science are women, {*reprograma*}, a civil society organization, is working to develop programming and soft skills among unemployed women. Their work involves an 8-week free-of-charge boot camp comprising three components: (i) front-end development, (ii) professional capacity building and development of entrepreneurial skills, and (iii) mentorship and technology company visits. The boot camp is run by volunteer instructors and program coordinators and financially supported by crowdfunding and donations from companies.[107]

In Kenya, a similar program is run by the African Centre for Women, Information and Communications Technology (ACWICT), a Kenya-based ICT for Development (ICT4D) organization that promotes access to ICTs as tools for sustainable development. In response to the effects of the COVID-19 pandemic, ACWICT launched the "Covid 19 and Digital Employability Program," which supports unemployed and underemployed young women from informal settlements and rural

105) West, M., Kraut, R. and Ei Chew, H. (2019). *I'd blush if I could. Closing the gender divides in digital skills through education*. EQUALS and UNESCO.

106) Ibid.

107) https://reprograma.com.br/

Kenya, including those who lost their jobs and business opportunities as a result of the COVID-19 pandemic. Their approach, presented in Box 8, includes: (i) equipping women with digital skills, (ii) securing placement opportunities, and (iii) providing psycho-social and mental health support.

Exposing women to digital skills throughout their lives is important when seeking to attract women who may have left the talent pipeline earlier in their lives as a result of gender norms. For example, the city of Buenos Aires, Argentina, is developing digital skills among women graduates from social sciences degrees to broaden their job opportunities. In addition to training in skills including big data and statistics for decision-making, undergraduate students receive mentoring from women leaders working in companies in STEM-related sectors.[108]

108) ESTEMOS EN TECNOLOGÍA «Programa de formación en Herramientas STEM".

BOX 8: COVID-19 AND DIGITAL EMPLOYABILITY PROGRAM – AFRICA (KENYA)

The African Centre for Women, Information and Communications Technology (ACWICT), a Kenya-based ICT for Development (ICT4D) organization, promotes women's and young people's access to, and knowledge of, ICTs as tools for sustainable development. In response to the effects of the COVID-19 pandemic, ACWICT launched the "Covid 19 and Digital Employability Program" to support unemployed and underemployed young women.

Rationale

The outbreak of COVID-19, and the subsequent control protocols, resulted in lost employment and job and business opportunities globally. In Kenya the loss was disproportionately experienced among young women from urban informal settlements and rural areas, who were left vulnerable with no source of income. This exacerbated existing gender inequalities and vulnerabilities for women and girls, increasing the risk of abuse and gender-based violence arising from heightened anxiety and economic and other forms of tension at household level.

Target popoulation

Unemployed and underemployed young women aged 18–34 from informal settlements and rural Kenya, including those who lost their jobs/business opportunities as a result of the COVID-19 pandemic.

Aim

To equip unemployed and underemployed young women with market-driven online and digital work skills to enable them to become re-employed or secure new employment and business opportunities.

Approach

The key activities involved include:

- 1,000 disadvantaged young women equipped with skills/mentored to engage and succeed in the digital workspace;
- Securing placement opportunities for at least 70% of the young women participants of the program in the digital workspace, including digital entrepreneurship;
- Providing psycho-social and mental health support to young women participants affected by the COVID-19 pandemic; and
- Creating the partnerships and collaborations necessary for program sustainability.

Actors involved

The African Centre for Women, Information and Communications Technology (ACWICT). The main donor is UK AI.

Impact

- 1,864 young women were equipped with market-driven digital skills and participated in mentorships and mental health awareness; and
- 80% of these women were introduced to jobs or business opportunities.

Source: ACWICT (2020). Covid 19 & Digital Employability Program.

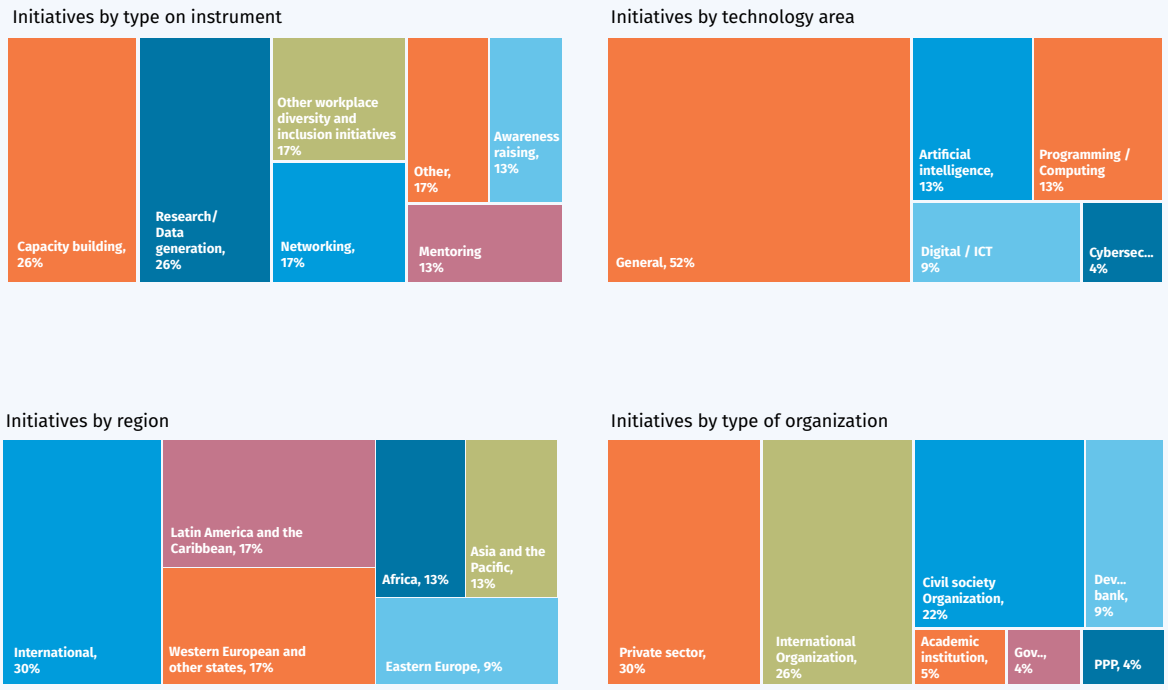
3.4 Creating gender-inclusive workplaces

As discussed in Chapter 2, the technology sector lags behind other sectors of the economy in terms of gender inclusion. According to Equileap's Gender Equality Global Report & Ranking, the gender equality score in the technology sector was 36% in 2022,[109] one of the lowest sectoral scores. In comparison, the average score of the top 100 companies in this ranking was 66%.[110]

A total of 15% of the initiatives analyzed are targeted at women working in digital technology sectors. The most common approaches involve: capacity building (26%), bridging information gaps through research (26%), networking (17%), other diversity and inclusion initiatives (onsite care facilities, diversity training, etc.) (17%), awareness-raising campaigns (13%), and mentoring (13%).

Half of these initiatives have a general technology focus. Geographically, 30% have international coverage, 17% focus on Latin America and the Caribbean, 17% on Western European and other States, 13% on Africa, 13% on the Asia and Pacific region, and 9% on Eastern Europe. By type of organization, most of these initiatives were led by either the private sector (30%) or international organizations (26%) (Figure 19).

FIGURE 19: DISTRIBUTION OF INITIATIVES TARGETING WOMEN EMPLOYEES



Note: 23 initiatives. Percentages by type of instrument and by type of technology may amount to more than 100% because some initiatives involve more than one type of instrument or technology area.

Source: Authors' mapping of initiatives.

109) The Equileap Gender Equality Scorecard™ is inspired by the UN Women's Empowerment Principles. It is based on the in-depth analysis of 3,895 publicly listed companies, representing 102 million employees globally. Companies are researched on 19 gender equality criteria, including gender balance, from the board to the workforce, as well as the pay gap and policies relating to parental leave and sexual harassment.

110) Equileap (2022). *Gender equality global report & ranking*.

3.4.1 PROMOTING WORK–LIFE BALANCE AND EQUAL SHARING OF UNPAID CARE AND DOMESTIC WORK

As discussed in Chapter 2, work–life balance concerns are a key factor explaining women leaving technology companies.[111] While a separate study would be required to gain a proper understanding of the initiatives led by the private sector to promote gender equality within their organizations, desk research and an interview with Cisco UK and Ireland showed that gender initiatives within companies can contribute to reverting this trend. Good practices in these areas are widely documented. For example, a recent ILO study identified nine key company policies and practices:

Providing maternity protection as part of a comprehensive care-leave policy, complying, at the minimum, with international labour standards.

Preventing discrimination against pregnant women and workers with care responsibilities. This ranges from awareness training to avoiding excessively long hours and unpredictable overtime or travel, which makes it difficult to plan for care of family members.

Providing paid paternity leave and encouraging uptake. Balancing unpaid care and domestic work requires companies to provide the conditions and incentives for men to assume their care responsibilities. This also contributes to reducing discrimination against women during recruitment and promotion.

Facilitating a smooth return to work after a parent's leave. Return-to-work policies may include: a gradual change from a part-time to a full-time schedule, flexible hours, working from home, coaching, and experience sharing. Box 9 presents the example of Cisco's Back to Business (B2B), a community that aims to connect those returning from extended leave with other Cisco colleagues and advisors from across the globe who share similar experiences.

Supporting breastfeeding in the workplace. This ranges from educating staff to decrease stigma, to providing appropriate lactation spaces, and providing paid nursing breaks.

Assisting with on- or near-site subsidized childcare. Although employer-supported childcare is not intended to replace public childcare, different levels of company support contribute to an easier return to work after parental leave. It also facilitates the involvement of fathers in care. Company support may include in-house childcare facilities, as well as economic support to cover childcare expenses.

Supporting care responsibilities beyond childcare. Employees may provide care to relatives who are not their children, such as partners, parents and siblings; therefore, leave policies should be sufficiently flexible to account for different care responsibilities. Box 9 presents examples of initiatives through which Cisco UK seeks to support its employees who are carers.

Providing flexible working arrangements, such as adjusting working hours or working from home. However, without company policies and a culture that encourages all employees to make use of such arrangements without detriment to their career, these arrangements risk reinforcing gender stereotypes.

Extending coverage of leave benefits to all workers and families, including part-time and hourly employees, since women are over-represented in these job categories. Coverage should also be inclusive of different family types, including single parents and same-sex couples.[112]

111) Ibid.

112) ILO (2020). *Empowering Women at Work Company Policies and Practices for Gender Equality*. Geneva. ILO.

BOX 9: CISCO: PROMOTING WORK–LIFE BALANCE

Cisco is a multinational company that develops, manufactures, and sells networking hardware, telecommunications equipment, and other technology services and products. It was founded in 1984 and its headquarters are located in San Francisco Bay Area, the United States. In 2022 Cisco was ranked third, among large US companies, in the Fortune Best Workplaces for Women™ list.

In the UK, women represent 28% of the overall Cisco workforce, a proportion that is almost three times larger than the percentage of women working as systems engineers (10%) in the London metropolitan area and twice the number working as network engineers (13%) in the same region.

Rationale

Care and domestic workloads are key contributing factors to employee attrition. Lockdown periods have exacerbated the impact on physical and mental well-being and have been reflected in career perspectives.

Approach

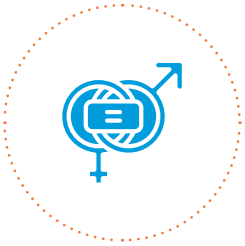
To address the impacts of the COVID-19 pandemic on carers, Cisco supports its employees who are carers with a range of benefits and policies including:

- Critical Time Off (up to 4 weeks paid leave to deal with a sudden, unexpected circumstance – without having to use vacation days);
- Flexible work offerings;
- Back-Up Care for children or adult dependents;
- The Employee and Family Assistance Program, which provides 24/7 access to counselling and is available to all employees and their families;
- Promoting employees while they are on paternity leave; and
- Cisco's Back to Business (B2B), a community that connects those returning from extended leave with other Cisco colleagues and advisors from across the globe who share similar experiences. Advisors provide individualized support and help to navigate the physical, emotional, and social challenges of returning to a fast-paced work environment following a life-changing transition.

Source: Cisco UK (2022). UK Gender Pay Gap Report 2021; Cisco profile in Crunchbase; Fortune Best Workplaces for Women™ 2022; and interview with Cisco UK and Ireland Corporate Social Responsibility and People and Communities teams.

3.4.2 ADDRESSING GENDER BIAS IN THE WORKPLACE

A gender-transformative approach in the workplace is needed to overcome the conscious and subconscious gender bias in the technology sectors. This includes: diversity training, codes of conduct, improving transparency on gender-gap data, the use of inclusive language in recruitment adverts, mentoring, skills development, and networking, among other initiatives.[113]



113) ILO (2017). *Women in business and management: gaining momentum in Latin America and the Caribbean*. International Labour Office, Bureau for Employers' Activities (ACT/EMP). - Geneva: ILO, 2017.

Equileap identified that only 14% of the technology companies in their sample publish gender-disaggregated pay information, while only 6% are signatories to the United Nations Women's Empowerment Principles.[114]

From the initiatives analyzed, we identified good practices in recruitment, promotion, and business culture from Cisco,[115] a US technology hardware and equipment company; Ricoh, a Japanese technology hardware and equipment company;[116] and ZenSar Technologies,[117] an Indian digital technology company. These include:

- Diverse interview panels. Including members who are gender diverse in interview panels and taking diversity training as a prerequisite for interview candidates;
- Experience sharing. Having safe and open spaces for the discussion of topics related to gender bias and discrimination;
- Leadership development. Training, mentoring, and networking opportunities to help women advance in their careers; and
- Addressing the "child penalty." Ensuring that paternal leave does not affect performance assessment and promotion.

As discussed in Chapter 2, women represent less than 20% of board members in energy, infrastructure and manufacturing sector companies.[118] From the analysis of initiatives, a concerted, multi-stakeholder approach should be highlighted as good practice that promotes the participation of women in leadership in Chile. Actions from the private, social, and public sectors are supporting the participation of women as leaders in digital-technology-related fields. These include: training for women working in research and public policy; a network of women directors and leaders of technology companies; and a bill involving a quota of 30% female participation on the boards of publicly traded companies (see Box 10).

While the private sector plays an essential role in promoting gender equality in the workplace, governments are also responsible for creating an enabling environment. Equileap, for example, has found improvements in gender equality in companies as a result of changes in legislation, such as gender pay gap reporting obligations, generous statutory parental leave, and enforcing female board quotas. Decisive involvement of the public sector in the provision of affordable and quality care services is also needed for gender equality.

Appendix B contains additional tools and resources for improving gender equality outcomes in technology companies.

114) The Equileap Gender Equality Scorecard™ is inspired by the UN Women's Empowerment Principles. It is based on the in-depth analysis of 3,895 publicly listed companies, representing 102 million employees globally. Companies are researched on 19 gender equality criteria, including gender balance, from the board to the workforce, as well as the pay gap and policies relating to parental leave and sexual harassment.

115) Cisco (2022). *UK Gender Pay Gap Report 2021*.

116) Ricoh (2022). *Diversity & Inclusion and Work-Life Management*.

117) ZenSar Technologies (2022). *Communication on Progress Annual Report with Diversity & Inclusion Highlights for FY22*.

118) Deloitte (2022). *Women in the Boardroom. Progress inches forward at a snail's pace*.

BOX 10: CHILE: A CONCERTED APPROACH FOR PROMOTING WOMEN LEADERSHIP

Rationale

There is a substantial gender gap in corporate leadership in Chile. In 2021 women held 10.5% of board seats, and 2.9% of board chairs were women.[1] However, concerted efforts from the private, social, and public sectors are levelling up the field in STEM-related sectors.

Approach

- *Women Board Up*. Founded in 2022, it is the first network in the country of women directors and leaders of technology companies. In addition to networking opportunities, it provides executive development programs and recruitment services for both employees and employers looking to hire women leaders. The executive programs are delivered in collaboration with national universities and consultancy firms, such as Deloitte[2].
- *Female leadership program in STEM* (Programa de Liderazgo Femenino en Ciencias). In collaboration with IDB, the Ministry of Science, Technology, Knowledge and Innovation developed a subsidized training course for developing the leadership skills of women working in science organizations. The program is targeted at women with at least five years' experience in research or technology organizations. It is delivered by the University of Chile.[3]
- *Women quotas on the boards of publicly traded companies. In 2022*, a bill was presented to the parliament involving a quota of 30% female participation on the boards of publicly traded companies.

Source: 1) Deloitte (2022). Women in the Boardroom. Progress inches forward at a snail's pace; 2) Women Board Up; 3) Programa de Liderazgo Femenino en Ciencias; 4Proyecto de Ley que Reforma Ley 18.046, Sobre S.A., para Incorporar Mujeres en los Gobiernos Corporativos; and interview with Jessica Ocampo.

3.5 Championing women entrepreneurs

A third of the initiatives analyzed address the gender gap in technology entrepreneurship: 43% of these involve financial support (grants, loans, or venture capital), while 18% involve financial incentives, in addition to other types of support, such as mentoring, capacity building, and networking. For example, Women TechEU provides support to EU women-led startups at the early stage of their company's growth. In addition to a €75,000 grant, participants receive mentoring in areas including: leadership, internationalization, business modelling, and fundraising, through the European Innovation Council's (EIC) Women Leadership Programme.[119]

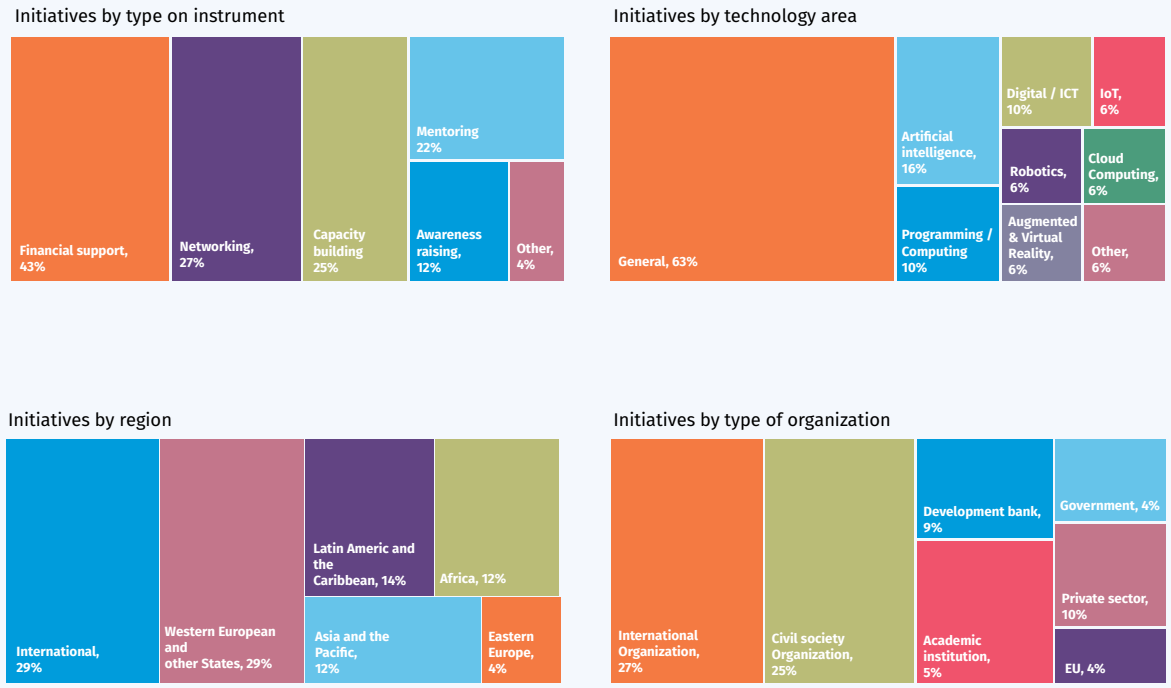
Instruments used by the initiatives analyzed that are targeting women entrepreneurs include networking (27%), capacity building (25%), or mentoring (22%) (Figure 20). For example, 4Good Programme South Africa, led by the UN Women Global Innovation Coalition for Change (GICC),[120] is a customized 12-month capacity development program supporting innovations that are developed by women and for women. The main topics covered by the program include: leadership, relationships with investors, and technology and digital markets.[121]

119) EU Funding (2022). Women TechEU Call.

120) GICC is a dynamic partnership between UN Women and key representatives from the private sector, academia, and non-profit institutions focused on developing the innovation market to work better for women and to accelerate the achievement of gender equality and women's empowerment.

121) UN Women. 4Good Programme South Africa.

FIGURE 20: DISTRIBUTION OF INITIATIVES TARGETING WOMEN ENTREPRENEURS



Note: 51 initiatives. Percentages by type of instrument and by type of technology may amount to more than 100% because some initiatives involve more than one type of instrument or technology area.

Source: Authors' mapping of initiatives.

Similarly, UNDP's Women Innovators Programme (WIP) provides mentorship and networking support to women-led, digital, social-impact-oriented startups in the Arab States. Mentorship takes place virtually over a period of approximately 2 months, covering areas such as: business strategy, marketing and communication, fundraising, management and operations, pitching and technology advice (see Box 11).

In terms of technology focus, most of the initiatives either have a general technology or STEM-field focus (64%) or they emphasize the field of digital or ICT technologies (10%). However, it is among the initiatives targeted at women entrepreneurs where a more specific technology focus is found that was difficult to identify in the initiatives presented in Chapters 3.2 to 3.4. The main technology areas covered include: AI (14%), programming and computing (10%), augmented and virtual reality (6%), cloud computing (6%), IoT (6%), and robotics (6%). Women TechEU, mentioned above, and the Women Innovators Programme are among the exceptions, where a specific focus on 4IR technologies is found (see Box 11).

Geographically, 29% of the initiatives analyzed had international coverage, 29% were from Western European and other States, 14% were from Latin America and the Caribbean, 12% were from Africa, 12% were from the Asia and Pacific region, and 4% were from Eastern Europe.

By type of organization, more than half of these initiatives were led by either civil society or international organizations, but usually in partnership with venture capital investors, companies, and academia. Other stakeholders leading initiatives were development banks (12%), governments (10%), entities established as public–private partnerships (12%), the private sector (10%), including venture capital companies, and regional organizations such as the EU (4%) (see Figure 20).

BOX 11: UNDP-4YFN WOMEN INNOVATORS PROGRAMME IN THE ARAB STATES

Mentorship can be a transformative experience for women entrepreneurs who face unique challenges that traditional entrepreneurship training often fails to address. To tackle this, UNDP created the Women Innovators Programme (WIP), in collaboration with GSMA's Four Years From Now (4YFN) program.

Rationale

Although innovative, women-led startups are becoming more common in the region, women still face many barriers to entrepreneurship, such as a lack of access to finance and discriminatory gender norms. WIP focuses, in particular, on the barriers related to the lack of business-relevant mentorship opportunities and social networks.

Target population

- Women who are founders, co-founders, or on the executive board of a startup;
- Startups that provide digital-based solutions, including, but not limited to: the Internet of Things (IoT), artificial intelligence, machine learning, robotics, augmented and virtual reality, 3D and 4D printing, cloud computing, big data, blockchain, drone technology and biometrics, and e-commerce;
- Startups in an early stage but already in the market (beyond ideation);
- Startup solutions that are contributing to one or more of the Sustainable Development Goals (SDGs); and
- Startups based in one of the following Arab States: Algeria, Bahrain, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, State of Palestine, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, and Yemen.

Aim

WIP provides mentorship and networking support to women-led, digital, social-impact-oriented startups in the Arab States.

Approach

- WIP expands networks and connects women-led, digital, social-impact-oriented startups in the Arab States to expert mentors, investors, and industry experts.
- Mentorship takes place virtually over a period of approximately 2 months, with 1–2 hours of mentorship per week (10 hours of mentorship in total). Mentorship support is available in the following areas, depending on the startups' needs:
- Business strategy: formulation and implementation of goals and objectives;
- Marketing and communication: development and evaluation of communication and marketing strategies;
- Fundraising: fundraising options and strategy, including crowdfunding;
- Management and operations: financial management, legal management, team management, business modeling, etc.;
- Pitching: creating and delivering a winning pitch for investment, partnerships or sales; and
- Technology: technical support related to the digital nature of the solutions.

Actors involved

A partnership between the United Nations Development Programme (UNDP) in the Arab States and 4YFN, the startup platform of the global mobile operators' association, GSMA.

Impact

With two rounds of implementation, the program has reached 52 women founders of digital startups from 15 countries with +500 hours of mentorship provided by close to 80 industry experts, investors, and tech leaders.

Source: United Nations Development Programme (2022). UNDP-4YFN Women Innovators Programme in the Arab States; and input provided by an interview with Diana Gutierrez, UNDP.

3.6 Leveraging digital technologies for gender equality and women's empowerment

Innovation challenges are a popular approach found in 23% of the initiatives analyzed tackling gender gaps in entrepreneurship. In these initiatives, women and other population groups are invited to participate in competitions to develop technological solutions to reduce gender inequalities. Awards are usually financial incentives, and participation in these challenges tends to involve mentoring and networking opportunities.

In China, U&AI – supported by UNDP and hosted by Tsinghua University – is calling for AI-based solutions to help advance the Sustainable Development Goals (SDGs). Registered participants are invited to join a 6-month learning journey through a series of online master classes. Then, they are teamed up (up to 10 young people) and develop a project proposal that receives guidance and mentorship from industry experts. Finally, the winners are selected through a competitive roadshow.[122]

The boot camp in 2021 had more than 1,300 young people from over 35 countries registered, and it provided more than 30 master classes and workshops to U&AI participants by the world's leading AI and SDG experts from academia, the private sector, venture capital, media, and UN agencies.[123]

A similar program, *Gender and Artificial Intelligence Challenge*, can be found in Latin America and the Caribbean. It is led by IDB through its innovation laboratory, IDB Lab, and is part of the fAIr LAC initiative discussed in Chapter 3.2.2. It is an open innovation challenge to identify, pilot, and accelerate technological solutions based on AI that contribute, through the concept of algorithmic justice, to reducing bias and discrimination based on sex and gender. The purpose of this challenge is to find solutions that contribute to the incorporation of women into the economy and society, especially for groups in poverty or vulnerable conditions.[124]

Awards of the Gender and Artificial Intelligence Challenge include: funding (US$150,000–750,000) to implement their proposed business models; and inclusion in IDB Lab's network of global innovators working in Latin America and the Caribbean.[125]

International organizations have recognized the potential of digital technologies to address complex societal issues, including gender equality. Examples of these applications, include: highlighting digital solutions for financial inclusion, as done by the Asian Development Bank; e-commerce training by the International Trade Centre; and a gender digital violence tracker, led by UNDP (see Box 12). A gender-responsive approach in the design and implementation of these initiatives is essential to avoid exacerbating pre-existing inequalities, as highlighted by Diana Gutierrez, UNDP Global Lead Gender & Digital, interviewed for this study:

"Even when digital solutions are aimed at closing the gender digital divide, it is the actual implementation that may exacerbate pre-existing inequalities and it poses ethical and safety risks for the women involved. Having a clear identification of risks and mitigation strategies is essential to ensure inequalities are not exacerbated by any intervention. In particular, a gender-based-violence and cyber-safety lens should be applied not only during the design phase, but especially during implementation and evaluation."

122) U&AI 2022 and inputs provided by UNDP.

123) Ibid.

124) IDB (2022). Gender and Artificial Intelligence Challenge.

125) Ibid.

BOX 12: LEVERAGING DIGITAL TECHNOLOGIES FOR GENDER EQUALITY AND WOMEN'S EMPOWERMENT

Women's Finance Exchange (WFX) – Asian Development Bank (ADB)

Geographical coverage: Developing ADB member countries in Asia and the Pacific.

Description: An interactive online platform providing digital solutions that can empower women. ADB partners with financial institutions in the region and leverages digital solutions to provide training in areas including: digital financial literacy, business planning, debt management, and e-commerce.

Target population: Financial institutions and women entrepreneurs.

Impact: A total of 22.1 million women and women's businesses have received finance to grow their business.

Source: Asian Development Bank, WFX.

ecomConnect – International Trade Centre (ITC)

Geographical coverage: Central America (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama).

Description: ITC's ecomConnect provided training on product design and export management for online sales. ITC also organized tailored e-labs for the most qualified businesses and launched an E-commerce Leadership Programme offering peer-to-peer e-commerce coaching.

Target population: Women business owners.

Lessons learned: Networking, mentoring, and peer-to-peer learning, especially between peers from different countries, contributed significantly to building and growing successful businesses and creating an international mindset.

Impact: From 2017 to 2021, businesses assisted by ITC generated more than $86,000 in revenue, 125 companies received more than 2,400 orders online from 21 markets, and they created and optimized 119 websites and stores on Etsy, eBay, and Novica.

Source: International Trade Centre, ecomConnect.

Gender digital violence tracker – United Nations Development Programme (UNDP)

Geographical coverage: Uruguay, Colombia, the Philippines and Uganda.

Description: An AI-based social media scanning tool that detects hate speech against women and girls and tracks discussions that are relevant to gender policy-making. This tool aims to: (i) capture public opinion, trends, and events regarding gender-based violence and hate speech; (ii) capture indications of gender policy backlashes around the world; and (iii) help UNDP Country Offices and partners turn these trends and signals on social media into actionable intelligence for decision-making.

Target population: Public institutions and policy-makers, civil society organizations and women's movements, journalists, development organizations, and academia.

Lessons learned: The pilot was designed building on the experience of Uruguay, tracking online violence against women with a focus on women in public spheres; Libya, tracking online hate speech against women in politics; and Sri Lanka, monitoring hate speech as one component of their Crisis Risk Dashboard (violence against women, religious violence, political protests, land disputes).

Impact: From March 2022 to October 2022, more than 900,000 tweets have been tracked in Uruguay, with the finding that 11% of them are violent.

Source: United Nations Development Programme, Violencia Digital Mujeres.

3.7 Understanding gender gaps

A lack of gender-disaggregated data in companies, and national and international statistics, is one of the main challenges that policy-makers face when addressing gender gaps in technology fields. Beyond data on access to the Internet and mobile devices, there is little information about the access and use of advanced digital technologies by women. Even in those cases where information is available, several limitations are found. Mobile-phone ownership, for example, is difficult to track in contexts where male relatives register devices used by women.[126]

Understanding how women are participating in the digital transformation is another key information gap. Research in this area is expanding rapidly. Between 2015 and 2021, academic publications[127] that included in their titles, abstract, or keywords the terms “gender” or “women” and “digital” increased from 421 in 2015 to 1,478 in 2021.[128] However, this is a dynamic phenomenon, and ongoing efforts are needed to better understand the opportunities and negative impacts that the digital transformation is creating for girls and women.

A total of 7% of the initiatives analyzed address information gaps. One of these initiatives involves the generation of gender-disaggregated data on speaking time in conferences. The International Telecommunication Union (ITU) created the ITU Gender Dashboard,[129] which uses machine learning to determine the speaking time of women in ITU conferences.

Similarly, following a feminist perspective, the f<a+i>r (feminist AI research) network is tackling gender bias in artificial intelligence and algorithmic decision-making. As part of their work, they are funding social science and algorithmic models that intersect with core public policy agendas in areas including data collection and community-driven data stewardship models.[130] f<a+i>r is a global network organized by Women at the Table, a civil society organization based in Geneva, Switzerland, and Laboratorio Experimental (LabExp), a research and extension group, located in the Technologic Institute of Costa Rica.

126) UN Women (2017). *Making innovation and technology work for women*. UN Women: New York.

127) In subject areas excluding those related to natural sciences.

128) Scopus.

129) ITU Gender Dashboard 2018.

130) A+ Alliance. Incubating Feminist AI*

Recommendations

The digital transformation is creating jobs and business opportunities; however, not everyone is benefiting equally. As discussed in Chapter 2, gender bias and stereotypes hinder the participation of women as users, learners, and developers of digital technologies. Women are less likely than men to use digital technologies, they are underrepresented in education programs that are relevant to the digital transformation, and the gender gap widens even more in leadership positions in technology companies and in entrepreneurship.

In Chapter 3 we featured the efforts of a variety of stakeholders who are working to close the gender gap in digital technologies, from international organizations funding research to understand gender gaps, and development banks supporting women-led businesses, to academic institutions and the private sector collaborating in skills development, and civil society organizations supporting the digital inclusion of marginalized groups.

Although awareness of these issues is increasing, we identified eight opportunity areas where action is needed to reduce, more effectively, the gender gaps in the use, knowledge, and development of digital technologies.

1. Expanding initiatives to reduce gender digital skills gaps beyond coding

Efforts to develop skills, with a gender perspective, have overwhelmingly focused on coding abilities, failing to address gender gaps in other related areas where disparities are actually widening. Areas where we identified opportunities for skills development include: artificial intelligence; cloud computing; computer-aided design; data analysis; information security; IoT; mechanical engineering; mechanics and machinery repairing; network engineering; and process automation.

ACTION POINTS:

- Skills development initiatives should specialize their scope beyond coding, based on a sound understanding of the context-specific dynamics of the labour markets and the incremental nature of skills.
- Governments and international organizations can collaborate with the private sector, unions, and professional bodies to produce gender-disaggregated timely data to understand how the demand for skills is changing and how different gender groups are participating in new jobs.
- Enterprises operating in areas such as: artificial intelligence; cloud computing; computer-aided design; data analysis; information security; IoT; mechanical engineering; mechanics and machinery repairing; network engineering; and process automation can collaborate with education institutions in raising awareness about opportunities in the industry and support the visibility of women and non-binary role models.

2. Apply gender-transformative lifelong learning approaches

Women face barriers to their participation in digital technology fields throughout their lives. This puts women at risk of losing opportunities of digital transformation when facing the increasing need for digital competence, reskilling, and upskilling across disciplines, occupations, and sectors. Digital skills-development initiatives should therefore adopt a lifelong learning approach.

Alternative learning platforms and lifelong learning approaches may present opportunities for women to join these fields following non-traditional pathways and at later stages of their lives. This can attract women who may have left the talent pipeline earlier in their lives as a result of gender norms. The development of digital skills can broaden job opportunities for women graduates, for instance, from social sciences degrees. Gender-transformative digital competence upskilling and reskilling initiatives can facilitate the transition toward a more gender-equal participation in the labour market.

ACTION POINTS:

- Policy-makers, educators, enterprises, NGOs, and labour unions can support gender-inclusive lifelong learning initiatives, including topics from basic ICT skills to advanced computing skills and other engineering and technical skills.
- Lifelong learning initiatives can benefit from collaboration between organizations such as NGOs or educators as organizers and tech companies providing digital competence.

3. Gender-sensitive approach in technology-driven research, design and innovation

Women are underrepresented among technology learners, users, and developers alike. A gender-sensitive approach in technology-driven research, design, and innovation includes awareness of the different situations, needs, and risks of men and women as participants in society and working life. This can more easily be achieved by focusing on gender balance and competence diversity in development teams, and by involving a gender perspective in technology-related research and innovation. Approximately equal participation of women and men in technical and leadership positions in the digital technology sector constitutes a prerequisite in this regard.

Gender equality in technical and leadership positions, and a gender-sensitive approach is not only about fairness and justice but also about producing better knowledge, products, and services for a wider audience. Among the challenges identified, there is an increasing need to tackle digital technologies' potential for discriminating results – in particular, in AI systems.

ACTION POINTS:

- The private sector, supported by regulatory measures from government, should strive for approximately equal representation of women in technical and leadership positions in the digital technology, AI and related sectors. This includes strengthening the recruitment, retention, re-entry and advancement of women at these levels.
- AI and other transformative technology development and deployment should strive for diversity in teams, including cross-disciplinary competencies such as insights into mechanisms for gender discrimination.
- Technology development and innovation projects should mainstream gender equality and the empowerment of women approaches in each phase of the project. Start by asking questions about how a gender perspective can add value to a technology development project.

Various sources of knowledge, guidelines, or networks can be used for support. Appendix B presents some of these resources.

4. Fostering multi-stakeholder partnerships

Gender bias and discrimination are manifesting in old and new ways through the digital transformation, and stakeholders across different sectors have a role to play in addressing this. The private sector and research organizations, for example, are key to addressing gender bias in technology-driven research, design, and innovation. Meanwhile, civil society organizations have been effective in raising concerns about the negative impacts of digital technologies on marginalized groups.

However, leverage varies across stakeholders, and governments and international organizations can play a key role in levelling up the field across stakeholders with divergent interests and different levels of economic and political power. Actions toward closing gender gaps in digital technology fields should therefore adopt a multi-stakeholder approach.

ACTION POINTS:

- Governments should set a shared vision, create an enabling environment for inclusive innovation, and develop and enforce regulation on ethical and transparent research and the design and deployment of digital technologies.
- Commitment from the private sector and academia is also needed to change the gender balance in research and design and to generate information about the participation of women, men, and non-binary groups in the digital transformation.
- Since marginalized groups are at higher risk, the participation of grassroots and other civil society organizations is needed in these partnerships to ensure that none are left behind. Thus, public, private, and international stakeholders can leverage collaborations with civil society organizations to reach underrepresented groups in their initiatives.

5. Mainstreaming gender considerations in industrial and innovation strategies

Differences in the participation of women and men in the digital transformation call for gender mainstreaming in industrial and innovation strategies, that is, assessing and addressing the implications for the different gender groups of a planned action.[131] In particular, the review of initiatives revealed a gap in measures with a gender perspective in areas including: support for technology adoption in business; and funding for technology scale-up at the later stages of the innovation cycle.

ACTION POINTS:

- Base industrial and innovation norms, policies and strategies on a gender analysis and set targets for reducing gender inequalities in the focus area of the norm, policy or strategy.
- While legal frameworks can include gender-responsive approaches as requirements for policy design, monitoring, and evaluation, it is equally important to strengthen awareness and capacities among government officials. Gender mainstreaming guides and gender equality training can contribute to this aim; and collaboration with academic, international, and civil society organizations can accelerate the process. Appendix B presents information on the tools and guides that may help this process.
- Civil society organizations can also play a key role in tracking the progress made by governments and make them accountable for gender equality commitments.

6. Twin green and digital transitions

Digitalization can be a key enabler of the transition toward more circular and less carbon-intensive industries.[132] Synergies exist between the green and digital transitions; for example, digital technologies enable monitoring and tracking of the use and waste of resources, as well as facilitating the optimization of energy systems. However, they can also hamper one another. The development of digital systems, for example, involves high quantities of energy and other resources.[133]

Energy and infrastructure sectors suffer from gender disparities similar to those observed in digital technology fields.[134] The circular economy and climate-neutral industry sectors are equally male dominated, especially as regards technical and leadership positions. For example, less than 3% of the measures contained in the OECD Green Recovery Database involve a gender perspective.[135] A failure to address these intertwined gender gaps risks amplifying existing inequalities.

ACTION POINT:

- Actors across different sectors should recognize the interdependency of the twin green and digital transformation and the need to engage gender-inclusive approaches in collaborations between digital and green sectors.

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131) United Nations Industrial Development Organization (2021). *UNIDO Guide to Gender Analysis and Gender Mainstreaming the Project Cycle.*

132) Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F. (2022). *Towards a green and digital future*. EUR 31075 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-52451-9.

133) Ibid.

134) World Economic Forum (2022). *Global Gender Gap Report 2022.*

135) OECD (2021). *Gender relevance of policies in the OECD Green Recovery Database.*

7. Continuing to strengthen innovation ecosystems and infrastructure

Increasing opportunities for women also means that efforts to strengthen innovation ecosystems and infrastructure need to continue, particularly in developing countries. As highlighted by UNIDO's Industrial Development Report 2020, just 10 economies account for 90% of patents and 70% of exports of advanced digital production technologies.[136] Thus, in order to benefit more from the digital transformation, developing countries need to further develop their innovation and production capabilities. This is also true for green transitions, where, for example, the participation of developing countries in the value chain of electric batteries beyond mining is limited.[137]

ACTION POINT:

- Governments can adopt a gender-responsive approach in the development of their innovation systems and infrastructure. This involves, for example, including gender equality conditionalities in the funding of research and innovation projects, and adopting gender-responsive public procurement strategies.

8. Continuing to close information gaps

A lack of gender-disaggregated data in companies, and national and international statistics, is one of the main challenges that policy-makers face when addressing gender gaps in technology fields. Beyond data on access to the Internet and mobile devices, there is little information about the access to, and use of, advanced digital technologies by women. This review also revealed the need for a better understanding of gender equality initiatives, particularly those implemented by technology companies.

ACTION POINTS:

- Lessons from digital platform projects can be leveraged for establishing partnerships with the private sector to gain a better understanding of the use of advanced digital technologies and the benefits derived from this.
- Governments and international organizations can play a key role in funding relevant research, as well as collecting gender-disaggregated data as part of firms' surveys, particularly those on innovation and technology adoption.

136) United Nations Industrial Development Organization (2019). *Industrial Development Report 2020. Industrializing in the digital age*. Vienna.

137) International Energy Agency (2022). *Global Supply Chains of EV Batteries*.

Appendices

APPENDIX A

Selected studies on the risk of automation of jobs by gender

TABLE A1: SELECTED STUDIES ON THE RISK OF AUTOMATION OF JOBS BY GENDER

Time frame	Scope	Women's jobs at risk of automation	Men's jobs at risk of automation	Methodology	Source
2010–13 data	**Five countries** (Cambodia, Indonesia, the Philippines, Thailand, and Viet Nam)	60.8% (employment at high risk of automation)	52.8% (employment at high risk of automation)	Estimates based on digitalization measures at occupation level.	Chang and Huynh (2016). *ASEAN in transformation: the future of jobs at risk of automation.* ILO.
2012 and 2013 data	**Four countries** (Bolivia, Chile, Colombia, and El Salvador)	21%	19%	Links occupation-based estimates of the probability of automation with the task composition and characteristics of individual workers. Estimates based on technical potential for automation.	Bustelo et al. (2019). *El futuro del trabajo en América Latina y el Caribe: ¿Cómo será el mercado laboral para las mujeres?* BID.
2013 data	**13 countries** (Armenia, Bolivia, Colombia, Georgia, Ghana, Kenya, Laos, North Macedonia, the Philippines, Sri Lanka, the Ukraine, Viet Nam and Yunnan Province, People's Republic of China)	64.9% in manufacturing; 51.3% in services; 71% in other sectors (risk of computerization)	61.9% in manufacturing; 49.4% services; 67.3% other sectors (risk of computerization)	Estimates based on digitalization measures at occupation level.	Sorgner (2019). *The impact of new digital technologies on gender equality in developing countries.* UNIDO.
1994–2016 data	**30 countries** (28 OECD member countries, Cyprus, and Singapore)	11% (26 million)	9% (28 million)	Links occupation-based estimates of the probability of automation with the task composition and characteristics of individual workers. Estimates based on the technical potential for automation.	Brussevich et al. (2018). *Gender, Technology, and the Future of Work.* IMF.
2018 data	**The United Kingdom**	9%	4%	Office for National Statistics estimates of automation assigning individual jobs within an occupation a likelihood of automation. Estimates based on the technical potential for automation.	Roberts et al. (2019). The future is ours: Women, automation and equality in the digital age. IPPR.
2014 data; 2017–30 projection	**10 countries** (Canada, China, France, Germany India, Japan, Mexico, South Africa, the United Kingdom, and the United States)	20% (107 million)	21% (163 million)	Estimates based on analysis of the component activities of each occupation and their technical and economic potential for automation. Midpoint scenario.	Madgavkar, A. et al (2019). *The future of women at work: Transitions in the age of automation.* McKinsey Global Institute.

APPENDIX B

Useful Tools and Resources

I. GENDER EQUALITY SELF-ASSESSMENTS AND CERTIFICATIONS

ACT | Gender Equality Audit and Monitoring (GEAM) Tool

An integrated environment for carrying out survey-based gender equality audits in academic organizations or organizational units. Its core instrument is a flexible questionnaire framework based upon the Athena Survey of Science, Engineering and Technology (ASSET) and on existing measurement scales in the scientific literature. It comprises a collection of questions that cover most aspects of gender equality in academic organizations, providing high-quality data for designing and implementing gender equality.

EDGE Certified Foundation | EDGE certification

Global assessment methodology and business certification standard for gender and intersectional equity. It measures where organizations stand in terms of representation, pay equity, effectiveness of policies and practices to ensure equitable career flows as well as inclusiveness of their culture

EW@W Empowering Women at Work | We-Test: A tool for companies self-assessment

What is the WE-TEST?
The online WE-TEST measures enterprises current capacity to promote gender equality and women's economic empowerment. It offers a self-diagnostic tool to improve business performance and competitiveness, with focus on SMEs, in an equitable and socially responsible manner. It is based on the ILO MIG-SCORE methodology and experience.

Reboot Representation | Tools and resources to drive solutions that close the gender gap

Tools and resources aimed to support technology companies closing the gender gap. These include: inclusion checklist, strategy diagnostic toolkit, tech action opportunities, and a metrics dashboard.

UN Women – United Nations Global Compact | Diagnosis tool for equal remuneration

The Diagnosis for Equal Remuneration (DIR) is a new self-evaluation tool developed by UN Women for companies and organizations committed to equality. It supports them in assessing whether they are applying the "Equal Pay for Equal Value Work" principle in line with the ILO Convention No. 100.

UN Women – United Nations Global Compact | Gender gap analysis

The Women's Empowerment Principles Gap Analysis Tool (WEPs Tool) helps companies identify strengths, gaps, and opportunities to improve their performance on gender equality. The WEPs Tool comprises 18 multiple choice questions that draw from good practices from around the world-covering gender equality in leadership, workplace, marketplace, and community.

UN Women – United Nations Global Compact | Women's Capitalize (Women's Empowerment Principles)

The Women's Empowerment Principles (WEPs) are a set of Principles offering guidance to business on how to promote gender equality and women's empowerment in the workplace, marketplace and community. WEPs are a primary vehicle for corporate delivery on gender equality dimensions of the 2030 agenda and the United Nations Sustainable Development Goals.

University College London | Equity in Informal STEM Learning: Using the Equity Compass

Training course about Equity Compass – a practical, evidence-based tool that supports equitable practice – and learn how and why you could use it.

Youth Equity + STEM | The Equity Compass: A tool for supporting socially just practice

The Equity Compass is a tool that can help funders to reflect on and develop their policy and practice, adopting a social justice mind set. The Equity Compass: A tool for supporting socially just practice. The Equity Compass was originally co-developed and iterated in partnership with informal science, technology, engineering and mathematics (STEM) learning settings, such as science centers, zoos and afterschool clubs. It has since been adapted and applied more widely, by teachers, senior leaders and funders in and beyond STEM.

II. GUIDES FOR MAINSTREAMING GENDER IN PROJECTS AND POLICY

European Institute for Gender Equality | Platform on Gender Mainstreaming

This online Platform helps to improve individual competences to mainstream gender throughout the different stages of the process of policy/program/project development and implementation.

United Nations Industrial Development Organization | UNIDO Guide to Gender Analysis and Gender Mainstreaming the Project Cycle.

Guidance, entry points and practical recommendations to facilitate the effective and efficient integration of gender considerations throughout the entire project or program cycle, with a particular focus on gender analysis tools.

III. GUIDES AND REVIEWS OF GOOD PRACTICES IN THE WORKPLACE

Empower Women – Resources database

Over 2,600 learning and research materials on gender equality.

European Commission | Diversity within small and medium sized enterprises – best practices and approaches for moving ahead

A guide for small and medium-sized enterprise (SMEs) managers wishing to improve the competitiveness and the social and economic performance of their business by building on the diversity of their workforce. The guide is divided into three parts: (i) key elements for SMEs to undertake diversity actions; (ii) best practices of SMEs successfully implementing diversity measures; and (iii) best practices of large corporate groups successfully supporting SMEs define and implement their diversity policy.

International Labour Organization | Empowering women at work – company policies and practices for gender equality

This document provides guiding frameworks and sets the business case to promote gender equality in the workplace. It focuses on five key areas where companies can contribute: (i) achievement of equal pay for work of equal value; (ii) prevention and elimination of violence and harassment; (iii) creating a harmonious work-life balance for both women and men; (iv) equal representation of women in business and management roles; and (v) investment in a future of work that works for women.

International Finance Corporation | Tackling childcare: a guide for employer-supported childcare

This document provides guiding frameworks and sets the business case to promote gender equality in the workplace. It focuses on five key areas where companies can contribute: (i) achievement of equal pay for work of equal value; (ii) prevention and elimination of violence and harassment; (iii) creating a harmonious work-life balance for both women and men; (iv) equal representation of women in business and management roles; and (v) investment in a future of work that works for women.

Organisation for Economic Cooperation and Development | Pay Transparency Tools to Close the Gender Wage Gap

This report presents the first stocktaking of pay transparency tools across OECD countries and explores how such policies can help level the playing field for women and men at work.

Workplace gender equality agency (Australia) | Gender equality tools

Tools, guides and blueprints to help organizations navigate areas such as flexible work, parental leave, pay equity and more.

IV. GUIDES AND TOOLS FOR LEVERAGING DIGITAL TECHNOLOGIES FOR GENDER EQUALITY

UN Capitalize (UN Women) | Innovation for gender equality

This brochure showcases some of UN Women's thoughts and practices around innovation that could accelerate gender equality and women's empowerment. The examples range from pilot programs with marginalized beneficiaries to partnerships with startups; from frontier technologies to non-tech interventions that challenge mindsets; and from procedural improvements to capacity-building.

The World Bank | Using Digital Solutions to Address Barriers to Female Entrepreneurship: A Toolkit

This toolkit provides practical guidance to help teams working on women's entrepreneurship projects apply digital solutions to project design and policy advice. Such solutions may include, for example, recommendations to further women's access to digital IDs or to implement online government services. It may also extend to specific community-level interventions, such as supporting women artisans in using e-commerce platforms and accessing online training.

World Economic Forum | Diversity, Equity and Inclusion 4.0: A toolkit for leaders to accelerate social progress in the future of work

The Diversity, Equity and Inclusion Toolkit explores the practical opportunities and risks that rapidly emerging technologies represent for diversity, equity and inclusion efforts. The toolkit outlines how technology can help reduce bias from recruitment processes, diversify talent pools, and benchmark diversity and inclusion across organizations.

V. GUIDES AND GOOD PRACTICES FOR GENDER DISAGGREGATED DATA

UN Women | Counted and Visible Toolkit

The Counted and Visible: Toolkit to Better Utilize Existing Data from Household Surveys to Generate Disaggregated Gender Statistics (Counted and Visible Toolkit) provides a compilation of tools and mechanisms used by several countries to produce evidence to inform gender-responsive policies and catalyze actions to leave no one behind.

VI. TOOLS TO ADDRESS GENDER-BASED VIOLENCE

CAF (Banco de Desarrollo de América Latina) | Guide to mitigate gender-based violence in public works projects (Spanish)

Guidance to prevent gender-based violence in public works. It is aimed at government and private sector entities. It defines gender-based violence, discusses risks and provides examples of how to prevent and address gender-based violence.

UN Women – International Labour Organization | Handbook: Addressing violence and harassment against women in the world of work

The UN Women-ILO Handbook presents promising practices – policies, strategies, campaigns, initiatives and other actions – that provide helpful insights and practical examples of how to tackle violence and harassment against women in the world of work.

VII. TOOLS TO ADDRESS RESEARCH AND DESIGN BIAS

Inter-American Development Bank | fAIrLac in a box

Five tools for the application of the ethical principles of artificial intelligence in all phases of a project. Part of fAIrLac, a diverse network of professionals and experts who want to promote an ethical application of AI in Latin America and the Caribbean from academia, government, civil society, industry, and the entrepreneurial sector.

Organisation for Economic Cooperation and Development | From principles to practice: tools for implementing trustworthy AI

A framework to evaluate approaches to trustworthy AI. It is a major step to help AI stakeholders move "from principles to practice" in the global effort to implement the OECD AI Principles.

Organisation for Economic Cooperation and Development | OECD.AI Policy Observatory

The OECD.AI Policy Observatory combines resources from across the OECD and its partners from all stakeholder groups. It facilitates dialogue and provides multidisciplinary, evidence-based policy analysis and data on AI's areas of impact.

Organisation for Economic Cooperation and Development | OECD Framework for the Classification of AI systems

To help policy makers, regulators, legislators and others characterize AI systems deployed in specific contexts, the OECD has developed a user-friendly tool to evaluate AI systems from a policy perspective.

Organisation for Economic Cooperation and Development | OECD-NIST Catalogue of AI Tools & Metrics

An interactive collection of the latest tools and metrics to help AI stakeholders be accountable and implement AI systems and applications that respect human rights and are fair, transparent, explainable, robust, secure and safe.

APPENDIX C
List of initiatives

REGION	COUNTRY	NAME OF THE INITIATIVE	WOMEN AS TECHNOLOGY...	BROAD TYPE OF INITIATIVE	MAIN TECHNOLOGY AREA	LEADING ORGANIZATION	SOURCE
Africa	Africa	eLearning Africa Workshop on #eSkills4Girls	Learner	Capacity-building	Digital / ICT skills	Government of Germany	https://www.eskills4girls.org/discover/activities/
Africa	Africa	SAP Africa Code Week 2018	Learner	Capacity-building	Programming / computing/ informatics	Government of Germany	https://www.eskills4girls.org/discover/activities/
Africa	Africa	African Girls Can Code Initiative	Learner	Capacity-building	Programming / computing/ informatics	UN Women	https://www.unwomen.org/en/news/stories/2021/10/feature-addressing-the-digital-gender-divide-in-africa
Africa	Burkina Faso	IsDB, ICD and the Government of Burkina Faso Join Hands to Support the BRAVE Women Project in Burkina Faso	Developer (Entrepreneur)	Capacity-building	General	Islamic Development Bank	https://www.isdb.org/news/isdb-icd-and-the-government-of-burkina-faso-join-hands-to-support-the-brave-women-project-in-burkina-faso
Africa	Cameroon, Ethiopia, Kenya, Mali, Nigeria, Rwanda, Senegal, South Africa, Togo, and Zambia	Energy2Equal initiative	Developer (Employee)	Research project	General	International Finance Corporation (IFC)	https://www.ifc.org/wps/wcm/connect/8ee0d5a9-8a6d-4bc8-b3ac-d795f998694f/FINAL+REPORT+2+-+E2E+Report_UPDATED+ONLINE.pdf?MOD=AJPERES&CVID=o7OxG0V
Africa	Kenya	Covid 19 & Digital Employability Program	Developer (Employee)	Capacity-building	Digital / ICT skills	ACWICT	https://www.acwict.org/work/covid19-and-digital-employability-program/
Africa	Kenya	Digital Skills & Computer Science Education	Learner	Capacity-building	Cloud Computing	ACWICT	https://www.acwict.org/work/digital-skills-and-computer-science-education/
Africa	Kenya	Emerging Markets Skills Initiative	Learner	Capacity-building	Digital / ICT skills	ACWICT	https://www.acwict.org/work/emerging-markets-skills-initiative/
Africa	Kenya	ICT4Agriculture	User	Capacity-building	General	ACWICT	https://www.acwict.org/work/ict4agriculture/
Africa	Kenya	Intel SHE WILL CONNECT	Developer (Employee)	Capacity-building	Digital / ICT skills	ACWICT	https://www.acwict.org/work/intel-she-will-connect/
Africa	Kenya	Maudhui Digiti End	User	Research project	General	ACWICT	https://www.acwict.org/work/maudhui-digiti-end/
Africa	Kenya	IBUKA STEM Mentorship Program	Learner	Mentoring	General	The Action Foundation	https://womenandgirlschallenge.economist.com/
Africa	Kenya, Uganda, and Tanzania	IIDEA	Learner	Capacity-building	Digital / ICT skills	ACWICT	https://www.acwict.org/work/idea/

Africa	Malawi	Gender Equality Seal career talks to inspire female students	Learner	Mentoring	General	United Nations Development Programme	https://www.undp.org/malawi/news/gender-equality-seal-career-talks-inspire-female-students
Africa	Morocco, Tunisia, Turkey	EQUALS Digital Skills Fund	Developer (Employee)	Capacity-building	Digital / ICT skills	World Wide Web Foundation	https://digital-skills-jobs.europa.eu/en/opportunities/funding/equals-digital-skills-fund
Africa	South Africa	4Good Programme South Africa	Developer (Employee)	Capacity-building	Digital / ICT skills	UN Women	https://www.unwomen.org/en/how-we-work/innovation-and-technology/un-women-global-innovation-coalition-for-change/4good-programme-south-africa
Africa	Uganda	Code Academy	Learner	Capacity-building	Programming / computing/ informatics	Women in Technology Uganda (WITU)	https://witu.org/programme/tech-hub
Africa	Uganda	CODE CLUBS (Skills For Their Future)	Learner	Capacity-building	Programming / computing/ informatics	Women in Technology Uganda (WITU)	https://witu.org/programme/tech-hub
Africa	Uganda	Women In Tech Network	Developer (Entrepreneur)	Networking	General	Women in Technology Uganda (WITU)	https://witu.org/programme/tech-hub
Africa	Uganda	Elevate Program	Developer (Entrepreneur)	Capacity-building	Digital / ICT skills	Women in Technology Uganda (WITU)	https://witu.org/programme/witu-hub
Africa	Uganda	WITU Digital Jobs Center (WITU DJC)	Developer (Entrepreneur)	Networking	General	Women in Technology Uganda (WITU)	https://witu.org/programme/digital-jobs-center
Africa	Uganda	Women in Fintech Hackathon	Learner	Capacity-building and networking	Programming / computing/ informatics	Devpost	https://women-in-fintech.devpost.com/?ref_feature=challenge&ref_medium=discover
Asia and the Pacific	Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, State of Palestine, Saudi Arabia, Somalia, Sudan, Syria, and Yemen	UNDP-4YFN Women Innovators Programme in the Arab States	Developer (Entrepreneur)	Mentoring	General	United Nations Development Programme	https://www.undp.org/arab-states/events/undp-4yfn-women-innovators-programme-arab-states
Asia and the Pacific	Armenia	Women ICT Frontier Initiative	Developer (Entrepreneur)	Awareness raising	Digital / ICT skills	UNESCAP	https://www.unescap.org/events/2022/virtual-training-trainers-women-ict-frontier-initiative-armenia
Asia and the Pacific	Azerbaijan	UNDP's STEM mentorship programme in Azerbaijan	Learner	Mentoring	General	United Nations Development Programme	https://www.undp.org/azerbaijan/blog/more-women-and-girls-azerbaijan-are-getting-involved-science

REGION	COUNTRY	NAME OF THE INITIATIVE	WOMEN AS TECHNOLOGY...	BROAD TYPE OF INITIATIVE	MAIN TECHNOLOGY AREA	LEADING ORGANIZATION	SOURCE
Asia and the Pacific	Cairo, Gaza	EBRD's Advice for Small Businesses programme	User	Financial support and mentoring	General	European Bank for Reconstruction and Development (EBRD)	https://www.ebrd.com/news/2022/ebrd-supports-msmes-and-womenled-businesses-in-west-bank-and-gaza-.html
Asia and the Pacific	Cambodia	Phnom Penh Impact Hub	Developer (Entrepreneur)	Financial support	General	WIPO	https://www.wipo.int/ipadvantage/en/details.jsp?id=12462
Asia and the Pacific	Cambodia	ADB to Strengthen Upper Secondary STEM Education Reforms in Cambodia	Learner	Financial support	STEM skills	Asian Development Bank (ADB)	https://www.adb.org/news/adb-strengthen-upper-secondary-stem-education-reforms-cambodia
Asia and the Pacific	China	Ladies Who Tech	No specific	Capacity-building	General	Ladies who tech	https://www.ladieswhotech.cn/
Asia and the Pacific	China	U&AI	Learner	Capacity-building and networking	Artificial Intelligence	UNDP	https://www.undp.org/china/news/uai-2022-call-proposals
Asia and the Pacific	China, Indonesia	Together Digital	Developer (Entrepreneur)	Capacity-building and networking	General	UN Women	https://asiapacific.unwomen.org/en/stories/press-release/2022/07/together-digital-to-empower-women-led-msmes
Asia and the Pacific	Dakar	YouthMobile initiative	Learner	Awareness raising	Programming / computing/ informatics	United Nations Educational, Scientific and Cultural Organization (UNESCO)	https://www.unesco.org/en/articles/international-girls-ict-day-importance-mobile-applications-female-leadership-and-female
Asia and the Pacific	India	The STEM Future is Female	Learner	Awareness raising	General	UNESCO New Delhi	https://www.unesco.org/en/articles/stem-future-female
Asia and the Pacific	India	Artificial intelligence and potential impacts on Human Rights in India Report	User	Research project	Artificial Intelligence	UNDP	https://www.undp.org/india/publications/artificial-intelligence-and-potential-impacts-human-rights-india
Asia and the Pacific	India	Kalpana She for STEM	Learner	Mentoring and networking	General	Vigyan Shaala	https://vigyanshaala.com/kalpana-2/
Asia and the Pacific	India	Approach document	No specific	Research project	Artificial Intelligence	OECD.AI	https://oecd.ai/en/dashboards/policy-initiatives/http:%2F%2Faipo.oecd.org%2F2021-data-policyInitiatives-27225
Asia and the Pacific	India	National Strategy on Artificial Intelligence	No specific	Financial support	Artificial Intelligence	OECD.AI	https://oecd.ai/en/dashboards/policy-initiatives/http:%2F%2Faipo.oecd.org%2F2021-data-policyInitiatives-24951

Asia and the Pacific	India	Diversity initiatives	Developer (Employee)	Awareness raising campaign, career advice, mentoring and awards	General	Zensar	https://www.unglobalcompact.org/participation/report/cop/create-and-submit/advanced/471315
Asia and the Pacific	India	STEM for girls	Learner	Awareness raising, capacity building, networking	General	IBM	https://www.ibm.com/impact/stem-for-girls?_ga=2.200634286.1444009420.1669794157-1052631058.1667982312
Asia and the Pacific	India	Script4HER	Developer (Entrepreneur)	Capacity-building and networking	Programming / computing/ informatics	Dhriiti (A leading NGO working in the Women Entrepreneurship) and Impact Hub Manila (pioneer in organizing international brands of hackathons) in collaboration with Project Her & Now of GIZ, Nasscom Foundation, Villigro and NuSocia announced the launch of the first edition of Scipt4HER Hackathon.	https://script4her.devpost.com/?ref_feature=challenge&ref_medium=discover
Asia and the Pacific	India	Hack Wizard	Learner	Capacity-building and networking	General	Superposition New Delhi	https://hack-wizard.devpost.com/?ref_feature=challenge&ref_medium=discover
Asia and the Pacific	India	WIEHack 3.0	Learner	Capacity-building and networking	General	Devpost	https://wiehack-3-0.devpost.com/?ref_feature=challenge&ref_medium=discover
Asia and the Pacific	Japan	Diversity initiatives	Developer (Entrepreneur)	Financial support	General	Fujitsu	https://www.ilo.org/empent/Projects/WCMS_770336/lang--en/index.htm
Asia and the Pacific	Japan	Young Women In Tech Leadership Program	Learner	Capacity-building	Programming / computing/ informatics	Waffle	https://waffle-waffle.org/?_ga=2.216280468.348970602.1666935049-914636238.1666935049
Asia and the Pacific	Japan	Diversity initiatives at Ricoh	Developer (Entrepreneur)	Awareness raising	General	RICOH	https://www.ricoh.com/sustainability/society/diversity/japan

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Asia and the Pacific	Malaysia, Singapore, Indonesia, Philippines, South Korea, Thailand, Sri Lanka, Bangladesh, Laos, Cambodia, Brunei or Vietnam.	Code; Without Barriers Hackathon	Developer (Entrepreneur)	Capacity-building and networking	Artificial Intelligence	Microsoft and iTrain Asia and Girls in Tech APAC	https://codewithoutbarriers.devpost.com/?ref_feature=challenge&ref_medium=discover
Asia and the Pacific	Several	Resource Pack for Gender-Responsive STEM Education	Learner	Framework	STEM skills	UNESCO	https://unesdoc.unesco.org/ark:/48223/pf0000250567
Eastern Europe	Romania	Women ICT leaders connect and unite at PP-22 networking breakfast	Developer (Employee)	Capacity-building	General	International Telecommunication Union	https://www.itu.int/hub/2022/09/women-ict-leaders-connect-pp22-networking-breakfast/
Eastern Europe	Romania	Promoting women in STEM in Romania	Developer (Entrepreneur)	Capacity-building	General	International Telecommunication Union	https://www.itu.int/hub/2022/07/women-tech-stem-romania-pp/
Eastern Europe	Serbia	EBRD loan	Developer (Entrepreneur)	Financial support	General	European Bank for Reconstruction and Development (EBRD)	https://www.ebrd.com/news/2022/ebrd-lends-25-million-to-mk-group-in-serbia.html
International	Australia, Japan, UK and US	Impact Fund	Developer (Entrepreneur)	Mentoring	Cloud Computing	Salesforce Venture	https://salesforceventures.com/about/
International	Global	Women Startup Challenge COVID-19 Tech Grant	Developer (Entrepreneur)	Financial support	General	Women Who Tech	https://womenwhotech.org/women-startup-challenge/covid-19-tech-grant
International	Global	WOMEN STARTUP CHALLENGE Emerging Tech Grants Program	Developer (Entrepreneur)	Financial support	General	Women Who Tech	https://womenwhotech.org/women-startup-challenge/emerging-tech-grants-program
International	Global	WOMEN STARTUP CHALLENGE FemTech + HealthTech Grants Program	Developer (Entrepreneur)	Financial support	Artificial Intelligence	Women Who Tech	https://womenwhotech.org/women-startup-challenge/femtech-healthtech-grants-program/finalists#wsc-section
International	Global	ACM-W Scholarships for Attendance at Research Computer Science Conferences	Learner	Financial support	Programming / computing/ informatics	Women Who Tech	https://women.acm.org/scholarships/

International	Global	Equals in Tech Awards	No specific	Award (recognition)	General	Government of Germany	https://www.eskills4girls.org/discover/activities/
International	Global	Champions for Innovation	No specific	Awareness raising and advocacy	General	UN Women	https://www.unwomen.org/en/how-we-work/innovation-and-technology/un-women-global-innovation-coalition-for-change/champions-for-innovation
International	Global	#FutureTechBoss – Empowering the Next Generation of Tech Leaders	Learner	Mentoring and networking	General	Black Girls Code	https://wearebgc.org/bgc-news/news-future-tech-boss/
International	Global	ICT SOLUTIONS FOR SDGs – WOMEN IN ICT:	Developer (Entrepreneur)	Capacity-building	General	International Telecommunication Union	https://www.itu.int/net4/wsis/forum/2018/Pages/Agenda/Session/206#intro
International	Global	Women's Empowerment Program	Developer (Employee)	Capacity-building and networking	General	Cisco	https://www.cisco.com/c/dam/en_us/training-events/netacad/success_stories/digitalDivide/docs/WEP.pdf
International	Global	Women Rock-IT	Developer (Employee)	Awareness raising campaign, career advice, mentoring and awards	General	Cisco	https://www.cisco.com/c/m/en_sg/partners/women-rock-it.html
International	Global	Women in AI	Developer (Entrepreneur)	Awareness raising campaign, career advice, mentoring and awards	Artificial Intelligence	Women in AI	https://www.womeninai.co/
International	Global	The Women in Data Science and AI project	User	Research project	Artificial Intelligence	The Alan Turing Institute	https://www.turing.ac.uk/research/research-projects/women-data-science-and-ai
International	Global	She Innovates Global Programme	Developer (Entrepreneur)	Networking and financial support	General	UN Women	https://www.unwomen.org/en/how-we-work/innovation-and-technology/un-women-global-innovation-coalition-for-change/she-innovates-global-programme
International	Global	She Innovates Campaign and Mentoring Programme	Developer (Entrepreneur)	Mentoring	General	UN Women	https://www.unwomen.org/en/how-we-work/innovation-and-technology/un-women-global-innovation-coalition-for-change/she-innovates-campaign-and-mentoring-programme
International	Global	HackHERS	Learner	Capacity-building and networking	General	Rutgers University	https://hackhers-2023.devpost.com/?ref_feature=challenge&ref_medium=discover

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International	Global	sheBUILDS 2.0	Learner	Capacity-building and networking	Programming / computing/ informatics	UC Berkeley	https://shebuilds2.devpost.com/?ref_feature=challenge&ref_medium=discover
International	Global	GirlHack	Learner	Capacity-building and networking	Programming / computing/ informatics	Devpost	https://girlhack.devpost.com/?ref_feature=challenge&ref_medium=discover
International	Global	DEEDhacks 2021	Learner	Capacity-building and networking	Programming / computing/ informatics	DEEDhacks Team	https://deedhacks-2021.devpost.com/?ref_feature=challenge&ref_medium=discover
International	Global	PitchTeen 2.0	Developer (Entrepreneur)	Capacity-building	Programming / computing/ informatics	Devpost	https://pitchteen2.devpost.com/?ref_feature=challenge&ref_medium=discover
International	Global	WomenTechies'21	Learner	Capacity-building and networking	Programming / computing/ informatics	Devpost	https://womentechies21.devpost.com/?ref_feature=challenge&ref_medium=discover
International	Global	Women's network puts gender equality at centre of development priorities	Developer (Employee)	Networking	General	International Telecommunication Union	https://www.itu.int/hub/2022/07/network-women-gender-equality-digital-development-wtdc/
International	Global	Women in Cyber (WiC) Mentorship Programme	Developer (Employee)	Mentoring	Cybersecurity	International Telecommunication Union	https://www.itu.int/hub/2021/08/my-women-in-cyber-mentorship-experience/
International	Global	Intellectual Property and Women Entrepreneurs	Developer (Entrepreneur)	Capacity-building	General	WIPO	https://www.wipo.int/meetings/en/details.jsp?meeting_id=73128
International	Global	EQUALS	No specific	Research project	General	equals	https://www.itu.int/en/action/gender-equality/PublishingImages/Pages/equalsGDImap/Gender%20Digital%20Divide%20Initiatives_ITU.pdf
International	Global	Girl Geek Dinners	Developer (Entrepreneur)	Networking	General	Girl Geek Dinners	https://girlgeekdinners.com/
International	Global	Grace Hopper Conference	No specific	Capacity-building	Programming / computing/ informatics	Grace Hopper Conference	https://ghc.anitab.org/
International	Global	coding black females	Developer (Entrepreneur)	Networking	Coding	Coding Black Females	https://codingblackfemales.com/about
International	Global	Equity Compass resources (YESTEM project)	Learner	Networking	General	Equity Compass resources (YESTEM project)	https://yestem.org/wp-content/uploads/2020/10/EQUITY-COMPASS-YESTEM-INSIGHT.pdf

International	Global	EY Women in Technology program	No specific	Networking	General	EY Women in Technology program	https://www.ey.com/en_gl/women-technology-program
International	Global	Feminist AI Research Network launch	User	Research project	Artificial Intelligence	A+ alliance	https://aplusalliance.org/en/articles/67
International	Global	Women@theTable and thoughtworks will present the G-app at the 2022 ECOSOC Partnership Forum 2 February 2022	User	Conferences	General	A+ alliance	https://aplusalliance.org/en/articles/66
International	Global	The Effects of AI on the Working Lives of Women	Developer (Employee)	Research project	Artificial Intelligence	Inter-American Development Bank	https://publications.iadb.org/en/effects-ai-working-lives-women
International	Global	Girl Powered	Learner	Capacity-building and networking	Robotics	Girl powered	https://www.roboticseducation.org/girlpowered/
International	Global	Women in Big Data	No specific	Capacity-building and networking	Big Data	Women in Big Data	https://www.womeninbigdata.org/about-us/
International	Global	AI for Good	Developer (Entrepreneur)	Networking	Artificial Intelligence	ITU	https://aiforgood.itu.int/gateway/?sdg=sdg5
International	Global	ITU Gender Dashboard	No specific	Disaggregation of data	Machine learning	ITU	https://www.itu.int/en/action/gender-equality/data/Pages/dashboard-2018.aspx
International	Global	Women Leaders in AI	Developer (Entrepreneur)	Role model campaign	Artificial Intelligence	IBM	https://www.ibm.com/watson/women-leaders-in-ai
International	Global	How Artificial Intelligence is impacting the working lives of women?	Developer (Employee)	Research project	Artificial Intelligence	UNESCO, IDB, OECD	https://www.unesco.org/en/articles/international-womens-day-unesco-will-discuss-impact-ai-womens-work-life-safety-women-journalists-and
International	Global	L'Oréal-UNESCO For Women in Science Awards	Developer (Employee)	Award (recognition)	General	L'Oréal Foundation and UNESCO	https://www.unesco.org/en/articles/22nd-loreal-unesco-women-science-awards-recognizes-five-exceptional-women-researchers-life-sciences
International	Oman, Pakistan, Uganda	Increasing the Role of Women in Innovation and Entrepreneurship: Workshop with Oman, Pakistan and Uganda	Developer (Entrepreneur)	Capacity-building	General	WIPO	https://www.wipo.int/sme/en/news/2021/news_0002.html

REGION	COUNTRY	NAME OF THE INITIATIVE	WOMEN AS TECHNOLOGY...	BROAD TYPE OF INITIATIVE	MAIN TECHNOLOGY AREA	LEADING ORGANIZATION	SOURCE
Latin America and the Caribbean	Argentina (Buenos Aires)	Estemos en Tecnología	Learner	Capacity-building	Big Data	Gender Equality Ministry OF Buenos Aires, Argentina	https://www.buenosaires.gob.ar/igualdaddegenero/noticias/estemos-en-tecnologia-programa-de-formacion-en-herramientas-stem
Latin America and the Caribbean	Argentina, Colombia, Ecuador, and Peru	Women in STEM Entrepreneurship (WISE)	Developer (Entrepreneur)	Capacity-building	General	IDB Lab	https://lavca.org/2018/11/12/women-in-stem-the-gender-dividend/
Latin America and the Caribbean	Argentina, Mexico	Data Género's Feminisms in Artificial Intelligence	User	Research project	Artificial Intelligence	A+ alliance	https://aplusalliance.org/en/articles/74
Latin America and the Caribbean	Bolivia, Brasil, Colombia, Ecuador and Mexico	Laboratorio CAF de Inclusión Financiera 2022	Developer (Entrepreneur)	Financial support	General	Banco de Desarrollo de América Latina (CAF)	https://www.caf.com/es/actualidad/convocatorias/2022/07/laboratorio-caf-de-inclusion-financiera-2022/
Latin America and the Caribbean	Brazil	{reprograma}	Learner	Capacity-building	Programming / computing/ informatics	{reprograma}	https://lavca.org/2017/11/15/ifc-vet-focuses-efforts-teaching-brazilian-women-code-reprograma/
Latin America and the Caribbean	Brazil	Mulher, Empresária Individual (with Nubank and SEBRAE)	Developer (Entrepreneur)	Research project	General	Inter-American Development Bank	https://blog.nubank.com.br/data-nubank-empreendedorismo-feminino-na-pandemia/
Latin America and the Caribbean	Brazil	Gender perspective in loan operation: New Innovation Financing Instruments for the State of São Paulo (BR-L1566)	User	Financial support	General	Inter-American Development Bank	https://www.iadb.org/en/project/BR-L1566
Latin America and the Caribbean	Chile	Programa de Liderazgo Femenino en Ciencias (LI*FE)	Developer (Employee)	Capacity-building	General	Ministry of Science, Technology, Knowledge and Innovation of Chile	https://www.minciencia.gob.cl/noticias/ministerio-de-ciencia-lanza-el-primer-programa-de-liderazgo-femenino-en-ciencias/
Latin America and the Caribbean	Chile	Executive Program Para Directoras de Empresas Innovadoras y Base Científico Tecnológica	Developer (Employee)	Capacity building, networking, career advice	General	Women Board Up Asociación de directoras de EBCT	https://www.womenboardup.org/
Latin America and the Caribbean	Chile, Argentina, Colombia, Peru and Mexico	Habilidades Tech: Potenciando Mujeres en la Nube – powered by AWS	Learner	Capacity-building	Cloud computing	Amazon Web Services	https://portales.inacap.cl/eventos/eventos-2021/habilidades-tech-potenciando-mujeres-en-la-nube-powered-by-aws

Latin America and the Caribbean	Chile, Mexico and Peru	Laboratoria	Learner	Capacity-building	Programming / computing/ informatics	Laboratoria	https://lavca.org/2017/11/15/perus-laboratoria-tackles-coding-gender-gap-latin-america-international-funding/
Latin America and the Caribbean	Colombia	Ethical framework for AI	No specific	Financial support	Artificial Intelligence	OECD.AI	https://oecd.ai/en/dashboards/policy-initiatives/http:%2F%2Faipo.oecd.org%2F2021-data-policyInitiatives-26728
Latin America and the Caribbean	Eastern Caribbean OECS Member Countries	Gender perspective in loan operation: Strengthening Private Sector Development Through Innovation in The Eastern Caribbean OECS Member Countries (RG-L1160)	User	Awareness raising campaign and financial support	General	Inter-American Development Bank	https://www.iadb.org/en/news/caribbean-development-bank-will-promote-eastern-caribbean-msmes-idb-support
Latin America and the Caribbean	Latin America and the Caribbean	Gender and Artificial Intelligence Challenge	Developer (Entrepreneur)	Financial support and mentoring	Artificial Intelligence	Inter-American Development Bank	https://convocatorias.iadb.org/en/bid-lab/gender-and-artificial-intelligence-challenge
Latin America and the Caribbean	Latin America and the Caribbean	WeXchange	Developer (Entrepreneur)	Networking	General	Inter-American Development Bank	https://wexchange.co/en/about-us/#what
Latin America and the Caribbean	Latin America and the Caribbean	Towards A Feminist Framework For Ai Development: From Principles To Practice	Developer (Employee)	Research project	Artificial Intelligence	A+ alliance	https://aplusalliance.org/en/articles/75
Latin America and the Caribbean	Latin America and the Caribbean	La dimensión de género en la transformación digital empresarial de América Latina y el Caribe	Developer (Entrepreneur)	Research project	General	Inter-American Development Bank	https://publications.iadb.org/es/la-dimension-de-genero-en-la-transformacion-digital-empresarial-de-america-latina-y-el-caribe
Latin America and the Caribbean	Latin America and the Caribbean	fAIr LAC	Developer (Entrepreneur)	Awareness raising	Artificial Intelligence	Inter-American Development Bank	https://fairlac.iadb.org/en
Latin America and the Caribbean	Latin America and the Caribbean	Women Champions in Digital Health	Developer (Employee)	Awareness raising	General	Inter-American Development Bank	https://blogs.iadb.org/salud/en/promoting-womens-development-in-digital-health/
Western European and other States	Canada	ElleHacks	Learner	Capacity-building and networking	Coding	ellehacks.com	https://ellehacks.devpost.com/?ref_feature=challenge&ref_medium=discover

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Western European and other States	Canada	WES Inclusive Women Venture Capital Initiative	Developer (Entrepreneur)	Financial support	General	Canadian Government	https://ised-isde.canada.ca/site/women-entrepreneurship-strategy/en/wes-inclusive-women-venture-capital-initiative
Western European and other States	Canada	Women Entrepreneurship Loan Fund	Developer (Entrepreneur)	Financial support	General	Canadian Government	https://ised-isde.canada.ca/site/women-entrepreneurship-strategy/en/women-entrepreneurship-loan-fund
Western European and other States	Canada	WES Ecosystem Fund	Developer (Entrepreneur)	Financial support	General	Canadian Government	https://ised-isde.canada.ca/site/wes-ecosystem-fund/en
Western European and other States	Canada	Women in Technology (WIT) Fund	Developer (Entrepreneur)	Financial support	General	Business Development Bank of Canada	https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---multi/documents/briefingnote/wcms_724855.pdf
Western European and other States	Europe	WOMEN STARTUP CHALLENGE 2018 Europe	Developer (Entrepreneur)	Financial support	General	Women Who Tech	https://womenwhotech.org/women-startup-challenge/2018-paris
Western European and other States	Europe	Women TechEU	Developer (Entrepreneur)	Financial support and mentoring	General	European Innovation Council	https://digital-skills-jobs.europa.eu/en/opportunities/funding/women-techeu-call
Western European and other States	Europe	EU Prize for Women Innovators	Developer (Entrepreneur)	Financial support and mentoring	General	European Innovation Council	https://eic.ec.europa.eu/eic-funding-opportunities/eic-prizes/eu-prize-women-innovators_en
Western European and other States	Europe	Female Edtech Fellowship	Developer (Entrepreneur)	Networking	General	The European Edtech Alliance	https://digital-skills-jobs.europa.eu/en/opportunities/funding/female-edtech-fellowship
Western European and other States	Europe	European Network for Gender Balance in Informatics (EUGAIN)	Learner	Networking	Programming / computing/ informatics	Informatics Europe	https://www.informatics-europe.org/society/women-in-icst-research-and-education.html
Western European and other States	Europe	ECWT	No specific	Networking	General	ECWT	https://ecwt.eu/about-us/

Western European and other States	Europe	Regulation laying down harmonised rules on artificial intelligence	No specific	Legal framework on AI	Artificial Intelligence	European Commission	https://digital-strategy.ec.europa.eu/en/library/proposal-regulation-laying-down-harmonised-rules-artificial-intelligence
Western European and other States	Europe and US	Women Startup Challenge 2019 Europe HealthTech	Developer (Entrepreneur)	Financial support	General	Women Who Tech	https://womenwhotech.org/women-startup-challenge/2019-paris-healthtech/sponsors#wsc-section
Western European and other States	Netherlands	Non-discrimination by design	No specific	Financial support	Artificial Intelligence	OECD.AI	https://oecd.ai/en/dashboards/policy-initiatives/http:%2F%2Faipo.oecd.org%2F2021-data-policyInitiatives-25502
Western European and other States	North America	Women Startup Challenge Tech Grant	Developer (Entrepreneur)	Financial support	General	Women Who Tech	https://womenwhotech.org/women-startup-challenge/grants
Western European and other States	North America	Women Startup Challenge 2019 NYC	Developer (Entrepreneur)	Financial support	General	Women Who Tech	https://womenwhotech.org/women-startup-challenge/2019-nyc
Western European and other States	North America	Women Startup Challenge 2018 Emerging Tech	Developer (Entrepreneur)	Financial support	General	Women Who Tech	https://womenwhotech.org/women-startup-challenge/2018-nyc
Western European and other States	Norway	ODA-network for women in tech	Developer (Entrepreneur)	Capacity-building and networking	General	ODA	https://odanettverk.no/about-oda/
Western European and other States	United States, Southern California	AIHacks	Learner	Capacity-building and networking		Devpost	https://devpost.com/hackathons?page=2&search=women
Western European and other States	Spain	STEM Talent Girl	Learner	Mentoring and awards	General	ASTI TALENT & TECH FOUNDATION	https://talent-girl.com/
Western European and other States	Spain	FP STEAM	Learner	Awareness raising campaign, career advice, mentoring and awards	General	ASTI TALENT & TECH FOUNDATION	https://fpsteam.es/

REGION	COUNTRY	NAME OF THE INITIATIVE	WOMEN AS TECHNOLOGY...	BROAD TYPE OF INITIATIVE	MAIN TECHNOLOGY AREA	LEADING ORGANIZATION	SOURCE
Western European and other States	Turkey	Koç Group launches catalytic new Generation Equality commitments to advance gender equality in technology and innovation	Developer (Employee)	Company commitments	General	UN Women	https://www.unwomen.org/en/news-stories/news/2022/03/koc-group-launches-catalytic-new-generation-equality-commitments-to-advance-gender-equality-in-technology-and-innovation
Western European and other States	United Kingdom	BCSWomen specialist group	Developer (Employee)	Capacity-building	Programming / computing/ informatics	BCS WOMEN	https://www.bcs.org/membership-and-registrations/member-communities/bcswomen-specialist-group/about-bcswomen/
Western European and other States	United Kingdom	Hack-HER-thon	Learner	Capacity-building and networking	General	Imperial College London Women in SET society	https://hack-her-thon.devpost.com/?ref_feature=challenge&ref_medium=discover
Western European and other States	United Kingdom	SeeMe	Learner	Awareness raising	General	Siemens	https://new.siemens.com/uk/en/company/education/see-me.html
Western European and other States	United Kingdom	Cisco Pathways programme	Learner	Capacity-building and networking	ICT	Cisco UK & Ireland	https://gblogs.cisco.com/uki/tag/diversity/
Western European and other States	United States	Launch with Goldman Sachs Initiative,	Developer (Entrepreneur)	Financial support	General	Goldman Sachs Group Inc.	https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---multi/documents/briefingnote/wcms_724860.pdf
Western European and other States	United States	Women@Energy Initiative	Developer (Entrepreneur)	Mentoring and networking	STEM skills	Department of Energy	https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---multi/documents/briefingnote/wcms_724860.pdf
Western European and other States	United States	STEM Rising	User	Capacity-building and networking	STEM skills	Department of Energy	https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---multi/documents/briefingnote/wcms_724860.pdf
Western European and other States	United States	Gendered innovations	Developer (Employee)	Framework	General	Stanford University	http://genderedinnovations.stanford.edu/what-is-gendered-innovations.html
Western European and other States	United States	Girl Security	User	Awareness raising	Cybersecurity	Girl Security	https://hewlett.org/grants/girl-security-for-strategic-planning/

Western European and other States	United States	ESA Commits to 1M to support Black Girls CODE	Learner	Financial support	Programming / computing/ informatics	Black Girls Code	https://wearebgc.org/bgc-news/esa-commits-to-1m-to-support-black-girls-code/
Western European and other States	United States	Simmons SharkHack 2022	Learner	Capacity-building and networking	Programming / computing/ informatics	Simmons University, Boston	https://sharkhack.simmons.edu/
Western European and other States	United States	WEHack 22	Learner	Capacity-building and networking	Programming / computing/ informatics	Texas college	https://wehack-22.devpost.com/?ref_feature=challenge&ref_medium=discover
Western European and other States	United States	AthenaHacks 2022	Learner	Capacity-building and networking	Programming / computing/ informatics	Southern California University	https://athenahacks-2022.devpost.com/?ref_feature=challenge&ref_medium=discover
Western European and other States	United States	FemmeHacks	Learner	Capacity-building and networking	Programming / computing/ informatics	University of Pennsylvania's Women in Computer Science (WiCS)	https://femmehacks-14664.devpost.com/?ref_feature=challenge&ref_medium=discover
Western European and other States	United States	ProjectCSGirls Fremont 2021 Hackathon	Learner	Capacity-building and networking	Programming / computing/ informatics	ProjectCSGirls Fremont's	https://projectcsgirls-fremont.devpost.com/?ref_feature=challenge&ref_medium=discover
Western European and other States	United States	Gracehacks: All-Female and Non-Binary Hackathon	Learner	Capacity-building and networking	Programming / computing/ informatics	UC Santa Cruz	https://gracehacks-ucsc.devpost.com/?ref_feature=challenge&ref_medium=discover
Western European and other States	United States	WOW! That's Engineering!	Learner	Conferences	General	The Society of Women Engineers of San Jose State University	https://wow-thats-engineering.devpost.com/?ref_feature=challenge&ref_medium=discover
Western European and other States	United States	Tech Truths	Developer (Employee)	Networking	General	DiscoTech	https://data.collectiveaction.tech/action/337
Western European and other States	United States	STEM education mentorship	Learner	Capacity-building	Robotics	Eva Longoria Foundation	https://evalongoriafoundation.org/our-programs/#education
Western European and other States	United States	TECHNOLOchicas	Developer (Employee)	Mentoring	General	TECHNOLOchicas	https://technolochicas.org/

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