TAIFA
The AI Forward Alliance

Women in AI:
A Global Overview of a $200 Billion Innovation Opportunity

Contents

Women in AI: A Global Overview of a $200 Billion Innovation Opportunity

Executive Summary

The "Women in AI: A Global Overview of a $200 Billion Innovation Opportunity" report analyzes the current landscape and future projections for women in technology across 91 countries. This report highlights the potential of women as "Builders of Better AI," emphasizing their role in driving global economic growth and innovation.

Key Findings:

Empowering women through future-proof AI-skilling is essential for gender equality and is a powerful catalyst for global economic growth and innovation. This report looks to the future of an AI-driven society—one where citizens are not only critical and responsible users of AI, but also co-creators of new AI systems.

1

Currently, less than a third of all technology professionals in the world are women (~3.9 million women compared to ~14 million men). Individual, institutional, and societal barriers contribute to this disparity and rapidly accelerating technologies threaten to exponentially widen this gap. However, with accelerated efforts, there is potential to double the number of women tech professionals to ~8 million by 2038.

2

AI-skilling for women and girls is a path to sustainable development that adds ~$212 billion to the global economy and increases economic resilience.

3

This report examines longitudinal occupation data from 91 countries, successful case studies, and necessary programmatic elements that ensure long-term success. Leveraging existing nonprofit programs, engaging mentors, involving communities, and investing in sustained data monitoring are proven strategies that result in girls actually following through with successful tech and AI careers.

4

The potential to meet accelerated growth targets by 2038 varies by country, but every country in the world can use the prediction model and program checklist in this report to set national targets and financing strategies for AI-skilling programs.

Introduction

Sabrina's Story

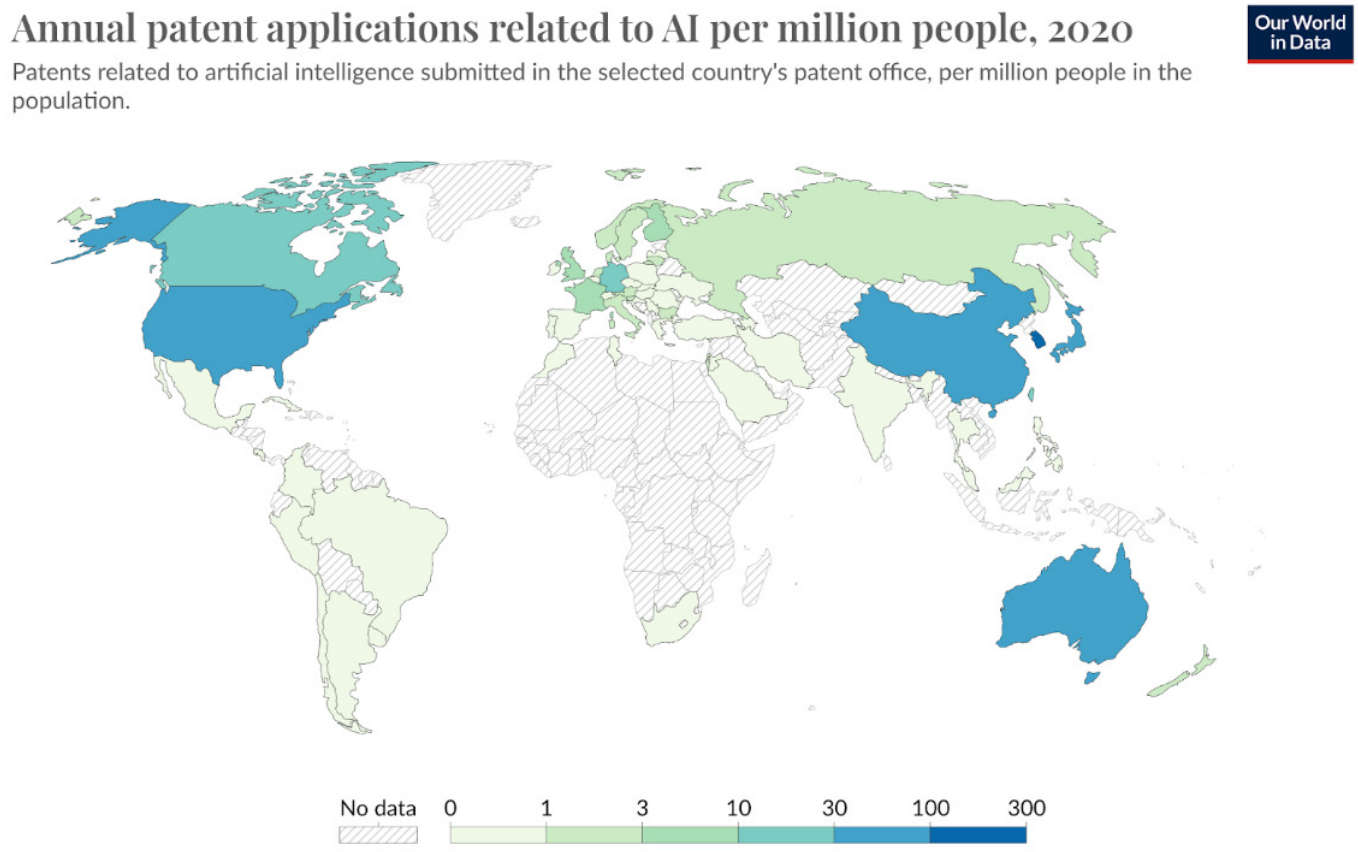
Sabrina grew up in a remote area in Uganda, one of the poorest areas in the world, without electricity, sanitation or enough nutritious food to eat. The only way she was able to further her education was by winning scholarships and competitions. When she heard her school was offering a technology entrepreneurship competition, she wasn't sure she could even participate without access to a computer. Thankfully, she was granted access to a university computer lab once every few weeks. Through sheer determination, ingenuity, and the support of mentors, she learned to code and developed a business plan to launch a mobile telehealth app for her community. Now, at just 25, she's developing a platform that tracks how well schools prepare students for the workforce—filling a data gap in educational accountability in her native Uganda. She has even advised heads of state on Innovation at the United Nations High Level Political Forum Panel.

The AI revolution is here.
Sabrina's story reminds us that the future of technology is not just about algorithms and data, but about harnessing dreams and resilience around the world.

Sabrina Atwiine
Founder and CEO, Nimarungi
UN Speaker and Technovation Alumna

1 Revolutionizing AI: The Talent Gap

[1] The AI revolution is being driven by a small fraction of the global workforce. Less than half a percent of the workforce (0.49%) is responsible for developing disruptive technologies that are reshaping our world and work (ILO, 2024). There are only 4 million women technology professionals and ~14 million men technology professionals unevenly distributed across countries—with the majority of them in the United States and China. This is evident in the AI innovations emerging from these countries and the high number of related patent applications filed.



Source: https://ourworldindata.org/grapher/artificial-intelligence-patents-submitted-per-million

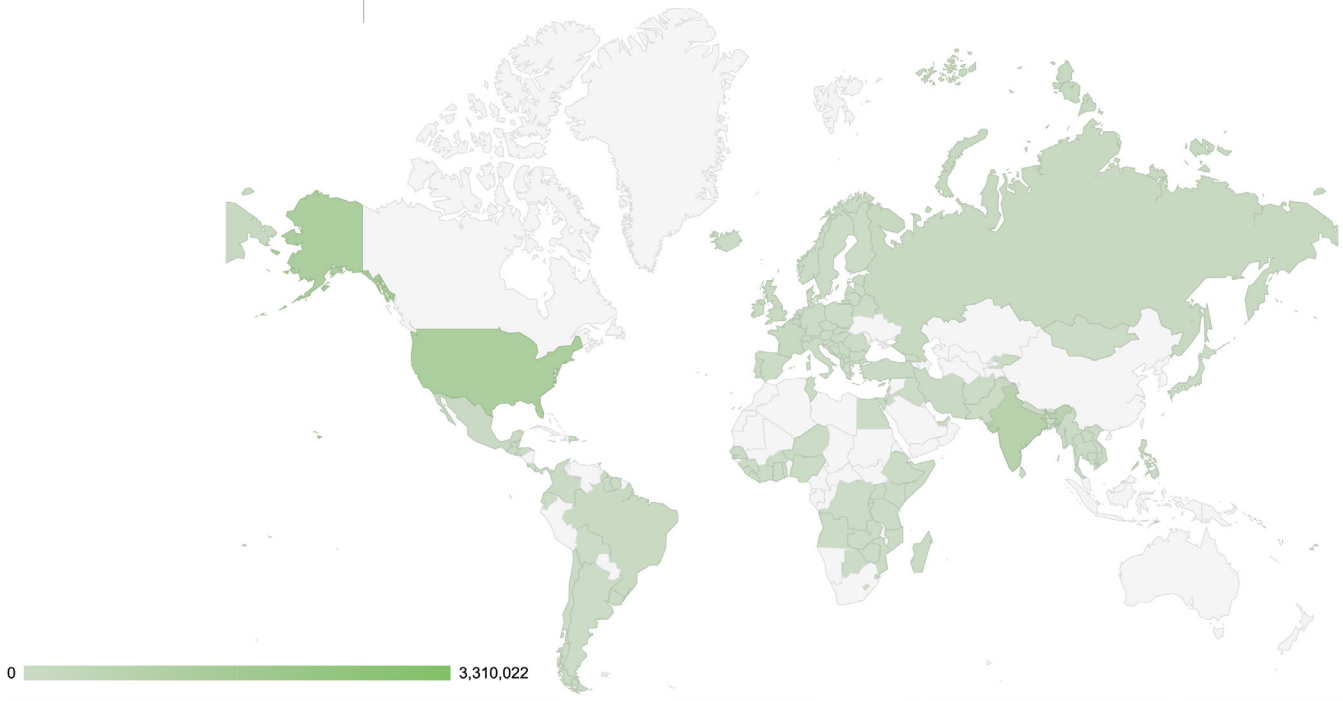
[1] Information and communications technology (ICT) professionals defined as those who conduct research, plan, design, write, test, provide advice and improve information technology systems, hardware, software and related concepts for specific applications; develop associated documentation including principles, policies and procedures; and design, develop, control, maintain and support databases and other information systems to ensure optimal performance and data integrity and security (ILO).

This concentration of expertise highlights the global struggle for talent development to keep pace with rapid technological advancements. One strategic and rapid way to address this talent gap is by bringing a highly underrepresented group—women—into the AI field. The map below shows the current distribution of women technology professionals.

By focusing on AI-skilling girls and women, countries can jump-start national innovation and growth (World Economic Forum, 2023).

An additional benefit to economic growth would be the integration of diverse perspectives into the design process of AI systems, models and applications. Currently 70% of the developers of AI systems worldwide are male (World Economic Forum, 2023). In the U.S., (the world leader in filing AI patents) the proportion of patents where a woman is the first inventor is just 10.4% , underscoring the specific and significant gender gap in technological innovation (Nayyar S., Bostrom, A. 2023). Diverse builders of AI can accelerate innovation while also reducing the risk of embedding systemic biases that reinforce existing inequalities (Page S., 2008).

A powerful example of this is Trial Unity, an AI-powered application developed by four young women from Ontario, Canada. Recognizing the bias in clinical trials, which often exclude racial minorities and women, they developed an AI-powered web application that generates an Equitable Selection Rating (ESR) score for trials. Trial Unity helps researchers make sure diverse populations are fairly represented in clinical trials, eventually democratizing access to life-saving treatments.



Current distribution of women technology professionals by country. Data source: ILO STAT

1.1

Projected Economic Impact of AI-skilling Women Across 91 Countries—565x Return on Investment

$212 billion

being added to the global economy, with the return on investment being approximately 560 times the cost of training.

The adoption of research-based AI-entrepreneurship programs for girls and young women could double the number of women technology professionals to 8 million within 14 years.

A salary analysis shows that women who transition from service sector roles to AI-driven careers could increase their earnings by 4-6x[2]. This shift would result in an estimated $212 billion being added to the global economy, with the return on investment being approximately 560 times the cost of training.

Forecasting Methodology & Assumptions Behind the Projections

The above predictions are based on the following considerations and assumptions[2]:

14-Year Time Frame: A 14 year time period was chosen to account for long-term support programs that would engage girls from ages 8 and up and sustain support until they enter the workforce.

Forecasting Methodology: Future projections for the number of women tech professionals are based on linear regression analysis of past data taken from ILOSTAT.

Forecasting Categories:

Steady Gains: No adjustments were made in forecasting for 28 countries where the current trends indicate steady gains in the number of women tech professionals, leading to a doubling by 2038.

Accelerated Efforts: In 63 countries current trends are insufficient to achieve the doubling by 2038 and accelerated efforts and interventions are needed to meet targets.

Negative Trends: Nine countries: Jordan, Bolivia, Iceland, Ecuador, Argentina, Costa Rica, Kiribati, Guyana and Myanmar, are experiencing negative trends, which could lead to a significant decline in the number of women technology professionals if no action is taken.

Data Gaps and Limitations:

Limited Data: 14 countries - Bangladesh, Barbados, Burundi, Chile, Eswatini, Georgia, Guinea, Honduras, India, Lebanon, Maldives, Palau, Tonga and Vanuatu have only one year of relevant data, making precise forecasts more challenging.

Data Gaps: The ILO dataset does not have data from most countries on the number of women technology professionals. This includes countries such as China, Canada, Japan, Kenya, Nigeria and South Africa.

[2] This analysis was conducted by Technovation and included a review of 2024 salary data for service and tech industry roles from Indeed, Levels.fyi, and Glassdoor.

[3] Data for this analysis comes from ILO data on occupations. This dataset, while robust, is not uniform across countries. Data gaps are noted in the Forecasting Methodology section.

Program Impact & Cost Projections

Engagement Projections: Projections about the number of engaged girls needed in each country are based on longitudinal data from a research-based technology program. Statistics show that when girls aged 8-18 are engaged in community-based, mentor-supported tech programs, 60% go into technology careers. (Cheuoua A., Liu J., 2020)

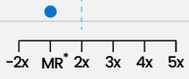
Program Costs: The cost of implementing evidence-based, deep impact (3 month long) programs at national scale is estimated at $48/student. These costs take into account efficiencies due to centralized curriculum development, monitoring and evaluation and leveraging online technologies and platforms for providing training. Technology can also be leveraged to localize content and support.

Return on Investment: Despite the substantial costs, the return on investment is clear, as the earning potential of AI-skilled women significantly exceeds the cost of their training—by approximately 565 times. This is because on average software engineers or AI-entrepreneurs will earn $26,660.

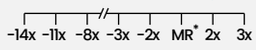
1.2 **Data Review:** The Current Landscape and Future Projections for Women in Technology Across 91 Countries

Future Projections and Costs to Double the Amount of Women in ICT, in thousands

Country	Proj. Women in ICT[1]	No. girls[2]	Ann. Cost[3]
Countries on track to double the number of women in ICT			
Bhutan		1.393	$66,853
Panama		29.677	$1,424,512
Botswana		13.988	$671,400
Slovak Republic		19.226	$922,828
United Arab Emirates		110.816	$5,319,168
Angola		14.865	$713,536
Seychelles		0.222	$10,640
Kosovo		6.779	$325,376
Pakistan		95.405	$4,579,440
Brunei Darussalam		2.156	$103,476
Albania		7.840	$376,312
Serbia		52.887	$2,538,570
Vietnam		63.907	$3,067,552
Egypt, Arab Rep.		28.552	$1,370,480
Lithuania		25.045	$1,202,173
Bulgaria		57.742	$2,771,638
Philippines		201.933	$9,692,768
Dominican Republic		10.853	$520,921
Montenegro		0.970	$46,537
Palestine, State of		5.029	$241,412
Portugal		86.442	$4,149,240
Iran, Islamic Rep.		80.079	$3,843,792
Romania		87.652	$4,207,318
Italy		147.986	$7,103,332
Mexico		227.903	$10,939,363
Sweden		179.565	$8,619,142
Norway		48.401	$2,323,261
Kyrgyz Republic		5.213	$250,240
Countries with slower growth to double the number of women in ICT			
Turkiye		31.28	$1,501,286
Netherlands		68.31	$3,279,110
Slovenia		3.81	$183,053
Belgium		25.89	$1,242,950
Sri Lanka		4.64	$222,854
El Salvador		1.81	$87,034
Austria		23.38	$1,122,163
Israel		67.49	$3,239,712
Switzerland		28.72	$1,378,771
Denmark		20.64	$990,605
North Macedonia		4.36	$209,203
Mongolia		1.18	$56,563
Luxembourg		2.59	$124,128
Poland		56.39	$2,706,797
Ethiopia		8.85	$424,627
United Kingdom		208.43	$10,004,602
Estonia		4.76	$228,499
Belarus		15.86	$761,357
Czechia		16.14	$774,490
Germany		166.42	$7,988,256
Hungary		15.36	$737,050
Cyprus		1.90	$91,296
Brazil		160.87	$7,721,856
Finland		33.34	$1,600,243
Russian Federation		199.95	$9,597,715
Uruguay		4.61	$221,242
Malta		0.60	$29,030
Rwanda		1.01	$48,672
United States		1549.53	$74,377,267
Croatia		8.11	$389,376
Bosnia and Herzegovina		3.76	$180,691
Thailand		26.22	$1,258,445
Mauritius		1.31	$62,669
Colombia		139.79	$6,710,080
France		186.18	$8,936,640
Iraq		6.64	$318,874
Greece		9.17	$440,179
Latvia		5.02	$241,171
Spain		55.49	$2,663,539
Ireland		18.06	$866,765



Country	Proj. Women in ICT[1]	No. girls[2]	Ann. Cost[3]
Countries with insufficient data[4]			
Bangladesh	*insufficient data*	9.63	$462,400
Barbados	*insufficient data*	0.32	$15,520
Burundi	*insufficient data*	4.09	$196,480
Chile	*insufficient data*	37.78	$1,813,440
Eswatini	*insufficient data*	1.56	$74,720
Georgia	*insufficient data*	4.76	$228,320
Guinea	*insufficient data*	8.17	$392,160
Honduras	*insufficient data*	7.11	$341,440
India	*insufficient data*	2844.95	$136,557,440
Lebanon	*insufficient data*	6.46	$309,920
Maldives	*insufficient data*	0.05	$2,400
Palau	*insufficient data*	0.04	$1,760
Tonga	*insufficient data*	0.16	$7,520
Vanuatu	*insufficient data*	0.15	$7,360
Countries with declining trends of women in ICT			
Jordan		8.10	$388,640
Bolivia		7.01	$336,480
Iceland		2.68	$128,800
Ecuador		13.92	$668,160
Argentina		32.01	$1,536,480
Costa Rica		4.09	$196,480
Kiribati		0.02	$1,120
Guyana		0.50	$24,000
Myanmar		9.37	$449,760



- High-Income
- Upper-Middle-Income
- Lower-Middle-Income
- Low-Income
- Women in ICT (most recent year)
- Projected Women in ICT by 2038
- 2x Women in ICT Target

[1] Projected Women in ICT by 2038 compared to most recent data
[2] No. of 8-18 y.o. girls that would need to be engaged annually in AI-entrepreneurship programs to meet 2038 targets (in thousands)
[3] Annual cost of implementing AI-skilling programs for girls
[4] Countries with only one year of data were given a target calculated off of that one data point
* Women in ICT Most Recent Year (data from ILOSTAT)

To gain a deeper understanding of the report's overview and the data behind it, we encourage you to watch this video and explore the interactive data tables.

1.3 Trends and Findings

57% of the countries that are on track to double the number of women tech professionals are low to upper-middle income countries[5]. 65% of the countries that have slower growth rates are high-income countries[6] This finding is consistent with research showing that as countries become more affluent, the number of women entering technology professions decreases (Charles M, 2017). Thus, as countries become more wealthy, they will continually need to assess their AI-skilling strategies to ensure they are not slowing down in efforts to support women innovators.

1.4 Structural Barriers Faced by Women in Technology

To better understand different growth and decline rates in the number of women technology professionals around the world, it is important to identify the individual, institutional, and societal barriers that women and girls face.

Lack of Role Models and Mentors

There are very few women in technology, innovation, and leadership roles (SDG 5.5.1 and SDG 5.5.2, Our World in Data). This lack of role models creates a barrier for girls considering careers in this field (Klinger U., Svensson J. (2023), González-Pérez S., et al 2020). Studies have shown that if girls were exposed to female inventors during childhood at the same rate that boys are to male inventors, the gender gap in innovation would fall by half (Bell A., et al, 2017).

Diverse role models provide tangible examples of success, showing that it is possible to thrive in an industry traditionally dominated by men (Breda T., et al, 2023). Role models can also serve as mentors, offering guidance, advice, and support to help navigate the challenges of entering and advancing in tech careers.

Mentorship is especially vital for women entrepreneurs, who often face additional challenges such as limited access to capital, resources, networks, and tools (Shopify, 2024). For these women, mentors can provide the guidance, networking opportunities, and market access necessary to overcome these barriers.

[5] Economic classifications in this report and analysis are aligned to the World Bank classifications, which use gross national income (GNI) per capita data in U.S. dollars, converted from local currency using the World Bank Atlas method. There are four categories: low-income, low-middle income, upper-middle-income, and high income. More information can be found here: https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html

[6] SDG indicators 5.5.1 and 5.5.2 are part of the United Nations Sustainable Development Goal 5, which aims to achieve gender equality and empower all women and girls.

- **SDG Indicator 5.5.1** measures the proportion of seats held by women in national parliaments and local governments. It reflects women's representation in decision-making positions at both the national and local levels, which is crucial for ensuring that women's voices are heard and considered in policymaking processes.
- **SDG Indicator 5.5.2** assesses the proportion of women in managerial positions. This indicator highlights the representation of women in leadership roles within the workforce, which is key to promoting gender equality in the workplace and ensuring that women have equal opportunities to influence and lead in their fields.

Both indicators are essential for tracking progress towards achieving gender equality in leadership and decision-making roles across different sectors.

> By elevating and supporting women in both tech and entrepreneurship, we can build a more inclusive and diverse community, inspiring countless girls to pursue and excel in technology.

Lilia's journey exemplifies the power of mentorship. Lilia was a high school student in Mexico who wanted to be a writer. She learned about a technology entrepreneurship competition where she would be mentored to build an app that solved a real-world problem. She registered and was partnered with a mentor who was a woman technology professional working at Intel. With the mentor's guidance, Lilia won the competition, building an app to help volunteers work more effectively. Over the years, she continued to be mentored by the Intel employee and Lilia's passion for technology ignited, leading her to an internship at Intel and eventually a career as a software engineer at Microsoft. Today, Lilia herself mentors girls, and shares her story widely, inspiring hundreds of thousands of young women around the world.

Without role models like Lilia, the cycle of underrepresentation persists. By elevating and supporting women in both tech and entrepreneurship, we can build a more inclusive and diverse community, inspiring countless girls to pursue and excel in technology.

Lack of Access to Financing for Women Entrepreneurs

Women entrepreneurs around the world are confronted with a staggering $1.7 trillion credit gap (World Bank Group, 2017). This gap is indicative of the deep-rooted inequalities that permeate financial systems globally. In many societies, systemic barriers prevent women from accessing capital to start or scale businesses. Women are less likely to own property (a key form of collateral for loans due to discriminatory property rights and inheritance laws that limit their ability to leverage assets for business purposes. Women are legally discriminated against in 150 countries (World Bank).

In regions such as sub-Saharan Africa, only 37% of women have access to formal financial services compared to 48% of men (International Monetary Fund, 2020). This is part of a larger structural pattern of financial exclusion of women, including limited access to banking infrastructure, restrictive cultural norms about work, and a lack of tailored financial products that meet the unique needs of women entrepreneurs.

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1.5 Institutional Barriers

"Is this for me?"

Need to Move towards Computational Action and "Computing in Context"

There is much research showing that for students who may be new to computer science, which includes many girls, it is important to not just focus on learning how to code or even AI literacy, but to show the different contexts in which computer science skills can be used. When learning activities are aligned with real world scenarios and topics are aligned with students' own interests, they are more effective. (Fisher A., Margolis J., 2003), (Guzdial, M., & Tew, A. E., 2006), (Childs, K., 2021).

The Computational Action model provides a valuable perspective by integrating these recommendations (Tissenbaum M., et al 2019). Computational Action emphasizes the importance of students not just learning about computing but actively using it to create solutions that address real-world issues they care about. This approach helps students find their sense of purpose, see themselves as capable creators, and strengthen their sense of self-efficacy to enact meaningful change in the world. This purpose-driven approach also provides a rich substrate for the development of future-proof skills such as cognitive abilities, self-efficacy, leadership, technology development, and collaboration (Future of Jobs, WEF, 2023).

1.6 Societal Barriers

Deeply Rooted Social Norms for Women Entrepreneurs

Deeply ingrained societal expectations often pressure women towards domestic roles, discouraging them from pursuing entrepreneurial ventures seen as risky or unconventional. This gender bias influences not only individual choices, but also institutional practices, making it harder for women to access funding and support for their businesses (UN Women).

When women do start businesses, they face additional challenges at home, where they carry a heavier burden of family responsibilities, such as housework, eldercare, and childcare (World Health Organization). Globally, women spend an average of 4.5 hours per day on unpaid care work, compared to just 1.5 hours for men (UN Women & Frederick S. Pardee Center for International Futures). Although there are cultural and regional differences in gender roles and expectations, there are common threads. For instance, in Latin America, women's disproportionate share of unpaid domestic and care work—on which women typically spend two to five times more hours than men—significantly reduces the time they can dedicate to entrepreneurial activities (ILO, 2024). Similarly, in Japan, societal expectations often pressure women to leave their jobs after having children, becoming full-time caregivers, which leads to a significant drop in female labor force participation and entrepreneurship rates (National Institute of Health, USA). Additionally, in some South Asian countries, restrictive societal norms limit women's mobility, hindering their ability to attend business meetings, access markets, or engage in networking opportunities that are essential for business growth (World Economic Forum, 2024b).

As a result of these constraints, most women start small businesses in highly competitive, low-tech, low-margin industries like retail or personal services, where the cost of entry is low but so is the potential for growth. A recent World Economic Forum report found that only 25% of women-led social enterprises use AI, compared to 50% of all social enterprises worldwide (WEF, 2024b). The disparity is particularly evident in the technology sector— only 2.3% of women entrepreneurs are launching tech businesses, compared to 5.3% of men. (GEM, 2024).

25%
of women-led social enterprises use AI, compared to

50%
of all social enterprises worldwide

2

Recommendations for Closing the Gender Tech Talent Gap

Building on Success: Real Stories of Impact addressing Structural Barriers

As global demand for AI talent grows, we must leverage existing initiatives that have already proven successful in empowering women and girls to pursue tech careers to meet that rising demand and also diversify the field. The following examples offer practical, real-world insights into addressing the structural barriers discussed earlier. By focusing on proven strategies such as holistic training, mentorship, and AI upskilling, these programs provide valuable models for cultivating the next generation of "Builders of Better AI."

Carnegie Mellon University (CMU) is an example of successfully addressing the gender gap in their undergraduate computer science class by implementing research-based recommendations. In 1995, only seven of the 95 students entering their undergraduate computer science program were women (7%). The CMU administration was alarmed and supported a study to determine what needed to be done to bring more women into the computer science program. Alan Fisher and Jane Margolis led the study and published their recommendations in a book —*Unlocking the Clubhouse* in 2003 (Fisher A., Margolis J., 2003). CMU then implemented their recommendations over two decades, and in 2021 welcomed an undergraduate CS program that was more than 51% women.

Scaling and Efficiency

Cost-effective, large-scale educational initiatives require synergistic partnerships and selective approaches.

A prime example is the collaboration between UNICEF and Africa Teen Geeks in South Africa. By joining forces with the South African Democratic Teachers Union (SADTU), they provided free coding and robotics training to 1.2 million pupils and 2,000 teachers. This initiative succeeded for two main reasons: First, it concentrated efforts in densely populated areas, enabling a larger impact by reaching more students compared to a scattered approach across a wide geographic region. Second, it leveraged the extensive reach and influence of SADTU, which played a crucial role in promoting the program through training its teachers. By partnering with SADTU, the initiative not only gained credibility and trust but also enhanced SADTU's reputation by showcasing their commitment to bringing future-facing, cutting-edge programs to their students. This partnership reflected positively on SADTU, as they received recognition for being at the forefront of educational innovation in South Africa. The result was a rapidly scalable and sustainable program that delivered long-term, mutually beneficial impact.

> Her journey was not just about learning to code or mastering AI tools; it was about applying technology in a way that honored her heritage and kept it alive for future generations.

Four-Pronged Model of Self-Efficacy

Self-efficacy research has shown that successful programs provide a four-pronged support system that guides participants through the critical phases of development—from initial interest to the durable formation of an innovator's identity (Bandura, 1997).

1. First, **exposure to role models** who share their strategies for success is crucial in inspiring girls to envision themselves in technology careers. These role models demonstrate that success is attainable and provide concrete examples of how to navigate the challenges of the field.

2. Second, the "**Computing in Context**" approach is essential. This tailored learning experience helps bridge the gap between abstract concepts and real-world applications, making the learning process more relevant and motivating. By engaging with topics and skills that resonate with their personal experiences and aspirations, girls are more likely to persist and succeed in their studies.

a. A powerful example of this approach in action is NrityaTracker, an AI application developed by a young girl in Haryana, India. Deeply connected to her cultural roots, she set out to preserve the traditional dance form of Kathak using AI. She employed computer vision to analyze and measure key body angles during dance movements, ensuring the accuracy and authenticity of the poses. Her journey was not just about learning to code or mastering AI tools; it was about applying technology in a way that honored her heritage and kept it alive for future generations.

3. Third, **access to mentors** who provide a continuum of support, encouragement, and access to new social capital is vital. These mentors not only guide women through their educational journey but also open doors to networks and opportunities that might otherwise be out of reach. This mentorship is not a one-time interaction but a sustained relationship that evolves as the mentee grows, ensuring continuous support through various stages of their career (Rights and Resilience, Technovation 2020).

4. Finally, **high-energy events and community experiences** play a critical role in solidifying commitment to a tech career. These experiences, which often evoke strong physiological responses, create lasting memories that reinforce a sense of belonging and excitement about the field. This has been seen over centuries in the sports arena and leveraged effectively by FIRST Robotics.

Each of the above four elements need to be part of the intervention for durable impact.

This initiative resulted in **19 alumnae** hired in Shopify's Early Talent programs

and over

200 alumnae receiving various forms of professional development.

Mentorship and Workforce Skill Development

Mentorship is a critical factor in the success of technology education programs for young women.

Shopify, a leading Canadian e-commerce company, has demonstrated this through its partnership with Technovation, a global technology education nonprofit. Over ten years, Shopify expanded its initial national partnership in four Canadian cities to a global initiative that empowered over 18,000 girls worldwide (Shopify, 2021). Shopify's commitment included mobilizing 674 volunteers who provided 10,908 mentorship and coaching hours, leading to a 90% program completion rate among teams supported by mentors. Additionally, Shopify offered Technovation alumnae access to its Dev Degree program, where students could earn a computer science degree while gaining real-world work experience through paid internships. This initiative resulted in 19 alumnae hired in Shopify's Early Talent programs and over 200 alumnae receiving various forms of professional development.

Holistic Training and Multi-Year Support

Holistic, multi-year support models effectively empower women in underserved areas by integrating technology with financial literacy and business management.

The Grameen Foundation's "train-the-trainer" model equips women and girls with the skills needed to drive change in their communities. In Uganda, Women And Youth (WAY) Agents were trained as mobile money agents, improving access to financial services for 8,575 refugees over five years (GSMA, 2023). In Ghana, Grameen trained 90 mobile money agents, offering coaching in digital literacy, gender-based violence, health access, and microinsurance. These efforts not only empowered the agents but also enhanced their standing and income within their communities (Grameen Foundation, 2024).

2.1 Era of AI: Policy Recommendations for AI Upskilling

The development of AI represents a profound societal shift, potentially as significant as the advent of the Internet. However, history teaches us that even the most powerful new technologies take time to fully transform economies. This gap between innovation and economic impact is often due to the need for fine-tuning and the accumulation of intangible capital, like the expertise needed to make effective use of new technologies (Economist, 2023).

Governments must recognize the magnitude of AI's impact and ensure citizens understand how AI-based systems work. Governments can play a pivotal role in creating responsive, large-scale opportunities for AI upskilling by partnering with nonprofit organizations and industry.

Successful AI upskilling hinges on three key factors:

***1. Appropriate Prioritization*:** Governments indicate importance by where they allocate time and money. By directing resources and attention to AI-skilling programs and opportunities, governments will be conveying the urgent need for these programs. AI will continue to, have a transformative impact on the way we work. While AI won't completely replace technical workers, those fluent in AI will have a distinct advantage, delivering higher-quality outcomes faster and increasing their value in the marketplace. This inflection point in skills development will create a clear divide between those with long-term career viability and those facing diminishing opportunities. Drawing parallels from previous industrial shifts, it is crucial that governments act swiftly to prevent the lag in skilling that historically followed the introduction of general-purpose technologies like steam engines and computers.

***2. Incentivization*:** To increase speed and efficiency, governments can incentivize nonprofit organizations and industry partners to provide cutting-edge, student-centric learning experiences. An example is the CHIPS and Science Act passed by the United States Congress in 2022 to boost semiconductor manufacturing. It directly provides funding for STEM education and teacher training to be deployed by various institutions. Leveraging local government delivery resources, such as libraries and schools, can further enhance accessibility and scale. Examples of such collaborative strategies include AI Singapore, launched in 2017, and Elements of AI, launched in 2018 and supported by the Finnish government.

***3. Adaptive Trainings*:** Successfully launching AI upskilling programs will also require ensuring access to both structured and unstructured AI training. Unstructured learning leverages the vast amount of free, high-quality AI content available online, such as on platforms like YouTube. These resources offer a flexible and scalable way to build AI skills, particularly for those who may not have access to formal education. Conversely, structured university courses in AI and data science provide valuable, in-depth learning but may not scale quickly enough to meet global demand or keep pace with rapidly evolving technology. In this era of democratized learning, an adaptive, guerrilla approach to AI upskilling can empower a broader population (outside of traditional universities) to seize opportunities in the rapidly evolving tech landscape.

A useful set of frameworks to guide governments is UNESCO's AI competency frameworks for students and teachers. The frameworks outline a progression in knowledge, moving from understanding to applying, and ultimately to creating new AI systems. The frameworks also emphasize the need for a unique kind of citizenship in an AI-driven society—one where citizens are not only critical and responsible users of AI, but also co-creators of new AI tools. Governments can use these frameworks to set up calls for collaborative proposals for diverse AI skilling programs across nations.

2.2 Doubling the Number of Women in AI: Program Recommendations for AI Upskilling

To make significant progress towards doubling the number of women in AI and achieving the Sustainable Development Goals of Innovation (SDG 9) and Gender Equality (SDG 5), it is crucial to avoid three common pitfalls:

1) relying too heavily on technology for program delivery to the exclusion of mentors and educators; 2) focusing on coding and AI literacy without real-world context; 3) funding and tracking program impact only for the duration of one year.

Avoiding Common Pitfalls

Integrate mentorship & peer learning in addition to online courses

Online courses are appealing interventions because of the promise of reaching millions of learners at low cost. However, these courses fall short of making a lasting impact because over 90% of online learners struggle with self-discipline and motivation, leading to low completion rates (Badali, Hataami, Banihashem et al, 2022). Mentorship and opportunities to learn alongside peers can increase student motivation and deepen the impact of online courses (Bandura, 1997)(Fisher A., Margolis J., 2003).

Focus on Future-Proof Skills in addition to AI literacy

In the rapidly evolving technological landscape, it is crucial for educational organizations to prioritize future-proof skills such as cognitive abilities, self-efficacy, and leadership, rather than focusing solely on teaching specific skills like coding or AI literacy (Future of Jobs, WEF, 2023). While these technical skills are important, the pace of technological advancement means that by the time curricula are developed, educators are trained, and programs are evaluated and refined, the technologies they are based on may have already advanced significantly. Future-proof skills, on the other hand, equip learners with the ability to adapt, learn continuously, and apply critical thinking to a range of problems and challenges, even those we might not yet imagine.

Extend Impact Assessment Beyond a Single Year

Many education programs include only one year of impact data due to funding constraints. However, it is hard to gather data beyond initial changes in learner interest within this short period of time.

Hidi and Renninger's work on interest identifies four stages of interest development:

- ***Triggered Situational Interest:*** This is the initial spark of interest, often caused by something in the environment that catches attention, like a surprising fact or engaging activity. It's usually short-lived unless it receives further support.
- ***Maintained Situational Interest:*** If the initial interest is supported, it can develop into a more sustained interest, where attention and engagement continue over time, typically through meaningful and personally relevant activities.
- ***Emerging Individual Interest:*** At this stage, the interest becomes more personal and self-driven. The individual starts to seek out opportunities to re-engage with the topic, building knowledge and

developing a more consistent desire to learn.

- ***Well-Developed Individual Interest*:** This is a deep, enduring interest where the individual consistently seeks to learn more, often going beyond what is required. It is characterized by a high level of knowledge, motivation, and self-regulation (Hidi S. and Renninger K. A. 2010).

Organizations need to plan for and invest in long-term data tracking to determine what it takes to create durable interest in learners. Only with this type of longitudinal data is it possible to iterate and refine interventions leading to sustained impact.

Participants should be evaluated using a multi-year capability-based framework, looking for gains in

- ***Resources*:** Access to material, human, and social resources
- ***Agency*:** Abilities, participation, voice, and influence in the family, workplace, school, community
- ***Achievements*:** Improvements in well-being and life outcomes that result from increasing agency and cognitive skills (Kabeer, 2002).

In addition, organizations need to research, adapt and develop metrics of measuring the impact of the program on the community itself. Research shows that communities will be more resilient to external changes and shocks if its members (especially women) develop an identity as lifelong learners and if the community itself is more open to girls and women becoming technology innovators and entrepreneurs (Rights and Resilience, Technovation 2020).

2.3 The Builders of Better AI Checklist: Strategies for Lasting Impact

To make meaningful progress toward Sustainable Development Goals 5 and 9, it is essential to not only equip women with the necessary technical skills but also foster a sense of purpose, leadership, and resilience. The following strategies outline how to create sustainable impact.

Aim high: Teach for Purpose & Computational Action

When students go through the process of finding a real problem in their community, and actually developing a solution to help someone else, it builds their sense of confidence and courage that they can be problem solvers (Fisher A., Margolis J., 2003), (Guzdial, M., & Tew, A. E., 2006), (Childs, K., 2021) (Tissenbaum M., et al 2019). Each step of the entrepreneurial journey challenges students to take risks and keep learning. These skills of self-regulated learning, self-awareness and resilience remain with them long after the program has ended, and prepare them to tackle these challenges as adults.

I think any young girl who has participated in Technovation will attest to this - how important it is to be able to be in a space where your ideas are not only celebrated, but also supported with resources. That's one of the key aspects that Technovation focuses on, understanding that technology itself really does not necessarily help us solve problems. It is a tool, and we need to have creative leaders who have strong leadership skills and a strong sense of emotional intelligence and empathy to be able to identify those issues within their community. ***—Winnie Msamba, Technovation alumna and founder of Morogoro Cocopeat, an initiative to help small farmers switch to the more environmentally-friendly cocopeat.***

Picking programs that address structural barriers

Today, we possess all the knowledge necessary to identify and scale the right programs at national and global levels to double the number of women in tech. One successful example of a program taking this approach is Technovation, a global nonprofit running an AI-entrepreneurship program for girls.

Technovation has a program model based on Bandura's four-pronged self-efficacy theory:

1
providing girls with exposure to role models and mentors;

2
supporting the development of computing skills in real-world contexts;

3
educating mentors and parents to have high expectations of the girls;

4
providing high-energy, supportive community experiences. This comprehensive approach has engaged tens of thousands of girls worldwide across different socio-economic backgrounds, ethnicities and cultures, empowering them to become confident AI innovators and leaders. 76% of its alumnae pursue STEM degrees, and 60% attribute their career choices to Technovation (Cheuoua A., Liu J., 2020).

Take Sidney, for example. As a Technovation participant, she worked with local scientists to develop an AI-based app to help Californian farmers recognize weeds. This hands-on experience honed her technical skills while also deepening her understanding of AI's real-world applications. Sidney later launched Chord, a research tool using large language models to summarize reviews and recommend top experiences. This, as well as her project Meander, a discovery platform that uses AI-driven web crawls to offer hyper-personalized activity recommendations based on user biographies, was acquired by Newsweek in August 2024. Now, she's working on a solar geoengineering initiative with climate economist Gernot Wagner. Sidney's journey highlights the transformative impact of programs like Technovation, which empower young women to develop technical skills, connect with mentors, and lead innovative AI projects.

Patrick Fole, theCUBE, SiliconANGLE Media, Inc.
https://www.thecube.net/guest/atPqytWDckoSKAveX

Innovating Financing: Unlocking Resources, Increasing Jobs

Two key challenges to scaling AI skilling programs are: 1) unlocking the resources needed to execute large scale, high quality education programs; 2) ensuring there are jobs available for the new graduating learners.

Key strategies to address these challenges include:

- ***Dual-benefit training models:*** Governments can incentivize and encourage tech industry and academia to offer innovative AI upskilling programs to employees and university students. One example of such a program could be where employees and university students learn about AI models and then draw on that knowledge to support K-12 students working to solve real-world problems. This model not only trains employees and university students to have relevant skills, but also alleviates the burden on teachers to provide student-centric, project-based learning experiences to students.
- ***Climate AI:*** 85 million additional green jobs are expected to be created by 2030 (IRENA, 2022). One way to fill these jobs would be to implement programs at the intersection of AI, entrepreneurship, climate, and gender. Women and girls in low-income countries are

responsible for food production and resource management (FAO). Increasing their education levels and technology skills increases productivity as well as sustainability, since education is key to addressing food waste, consumer behavior, and sustainable agriculture practices (Le Loarne-Lemaire et al, 2021, Dixson-Declève et al, 2022).

- ***AI powered small businesses:*** AI training has the potential to dramatically enhance the success of women business owners, who currently account for one-third of the world's 400 million small businesses (IFC, 2014, World Bank, 2019). Given that small businesses are responsible for 70% of global employment (ILO, 2019), empowering women entrepreneurs to leverage AI could have a substantial impact on both economic growth and societal well-being. Many women-owned businesses are in low-growth sectors, where traditional entrepreneurship programs have already proven effective in improving business performance, earnings, and employment (Kluve et al. 2017). By integrating AI into these training programs, women can gain the skills needed to leverage technology for things like expanding their market reach, automating operations, improving productivity and creating more jobs. This not only helps them move out of low-growth sectors, but also enhances their overall business performance. The resulting increase in business success can lead to higher standards of living, better mental health, and increased well-being, creating a ripple effect that benefits their communities as well (ILO, 2017).

2.4 Recommendations for Leaders and Policy Makers

As AI transforms job roles and operations, it introduces significant challenges that require careful consideration by both organizational leaders and policymakers. The fears and uncertainties that accompany these changes, often rooted in a lack of technological understanding, can be particularly pronounced at the leadership level (WEF, 2024c).

Leaders and policymakers must adopt a proactive, hands-on approach to AI. This means not only gaining a theoretical understanding of AI technologies but also actively engaging with them to solve real-world problems. Such experiential learning fosters a deeper comprehension that goes beyond traditional methods like lectures and expert talks. Leaders must exemplify lifelong learning, curiosity, and courage, moving past the fear of failure to build and implement AI-driven solutions. Policymakers, in particular, have a pivotal role in creating frameworks that support this mindset shift. This includes promoting practical AI training for leaders, and providing incentives for organizations to adopt AI-first strategies.

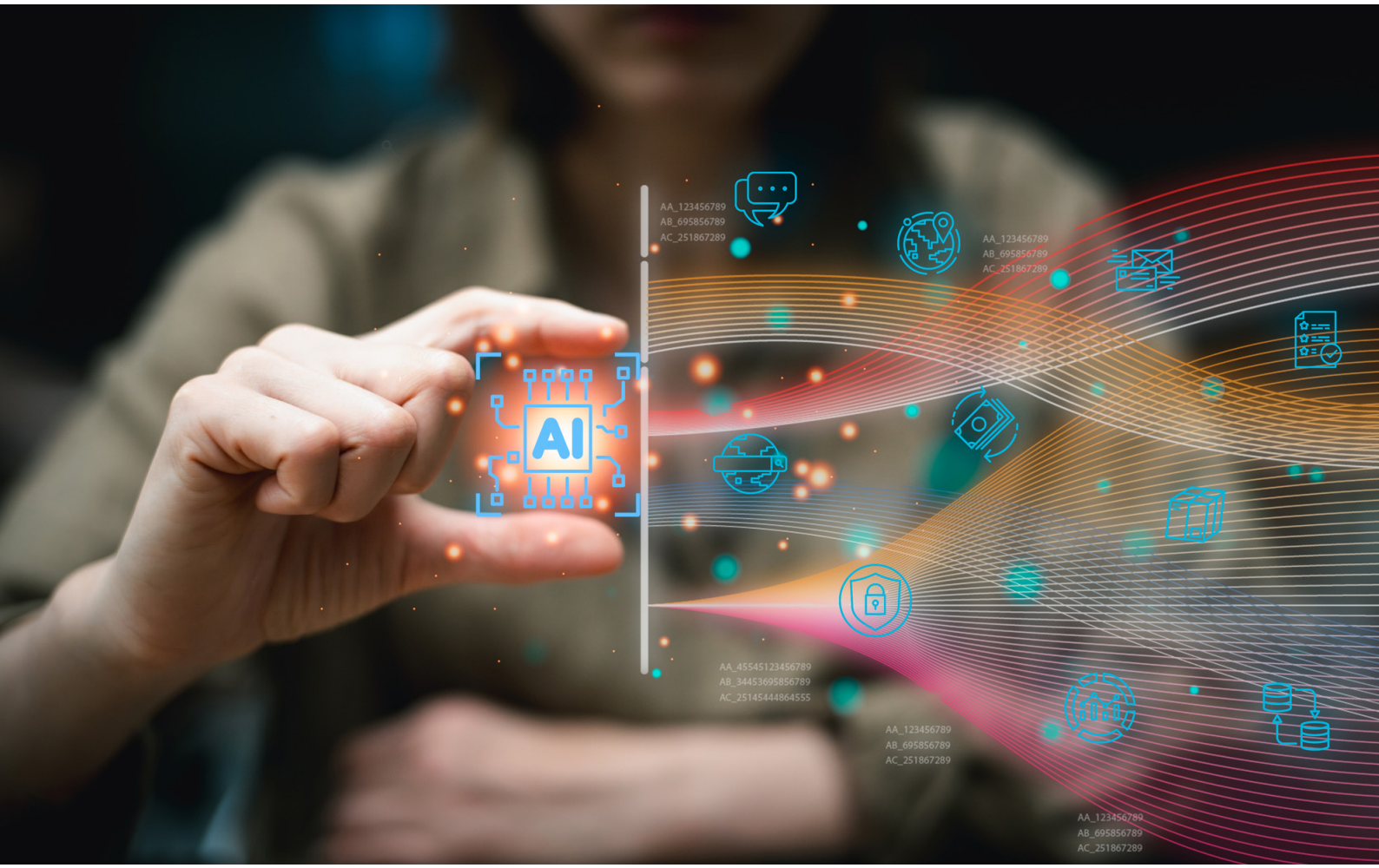
In addition to developing technical competency at all levels, it is crucial to cultivate a mindset that embraces continuous learning and a willingness to take calculated risks. Leaders and policymakers must be willing to take big bets, go the extra mile, and see opportunity where others see nothing but extreme danger (Economist, 2024). This mindset will be critical in ensuring that AI integration leads to sustainable growth and innovation.

Conclusion: Empowering Women as Builders of a Better AI Future - ROI 565x

As global demand for AI talent continues to rise, women and girls are poised to play a transformative role in driving economic growth and innovation. By 2038, with accelerated efforts, the number of women technology professionals could grow to 8 million, contributing an estimated $212 billion to the global economy—a staggering 565x return on investment.

Each country in the world can use the prediction model and program checklist in this report to set national targets and financing strategies for bringing research-based AI-skilling programs to their girls and women. By bringing together nonprofits and industry partners, and learning from best practices, it will be possible for each country to rapidly deploy programs that will boost the nation's ICT workforce within a few years. This approach will foster significant growth by increasing both the technical workforce and the creation of new AI-based businesses.

The longitudinal data is clear and the way forward will require intentional, intersectional collaboration. The economic potential for countries that proactively future-proof their workforce by investing in AI upskilling young women cannot be overstated. We have the opportunity to create a new kind of global citizenship in the AI-ecosystem of the future. One where all citizens regardless of nationality or gender are not only conscientious users of AI but also innovative co-creators. Let's begin together.



Contributors and Acknowledgements

Project team

Authors

Tara Chklovski
CEO and Founder,
Technovation

Wycliffe Ottieno
Senior Advisor, Education,
UNICEF

Amanda Gethin
EY Global Consulting Talent Leader

Sarah Henderson Rosenberg (Hendo)
Senior Program Manager,
Tech Education, Google.org,
Google

Maggie Cacioppo
Program Manager,
Education for Social Impact,
Google

Josh Caldwell
CS Curriculum Program Manager,
Google

Philip Gilchrist
Chief Transformation Leader for
AI and Sustainability,
TE Connectivity

Gigi Gatti
Sr. Director, Program
Strategy & Learning,
Grameen Foundation

Natalie Lao
Executive Director,
App Inventor Foundation

Sydney Piggott
Senior Social Impact Manager,
Shopify

Data Analysis

Tara Chklovski
CEO and Founder,
Technovation

Nick Luu
Program Specialist,
Technovation

Advisor

Vilas Dhar
President,
Patrick J. McGovern Foundation

Editors

Maggie Jaris
Director of Content Strategy,
Technovation

Jenna Boles
Content Strategist,
Technovation

Berenice Thomassiny
Chief Brand Officer,
Technovation

Yolanda Botti-Lodovico,
Storytelling and Advocacy Lead,
Patrick J. McGovern Foundation

Michelle Pomerantz
Board Liaison,
Patrick J. McGovern Foundation

Graphic Design

Anne Campbell Black (A.C.)
Graphic Designer,
Technovation

Audra Darbyshire
Creative Manager,
Technovation

App Inventor
Foundation

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