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**What Mechanisms Can Ensure Digital Technologies
Favor Inclusion and Close Gender Gaps?**

Expert paper prepared by:

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¹ The views expressed in this paper are those of the author and do not necessarily represent those of the United Nations.

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Introduction

The digital ecosystem is increasingly extending its reach, brought together by the centrality of internet: from telephony to artificial intelligence, digital platforms, the internet of things, big data and social networks, with practical applications that are deeply transforming our lives, like remote work.

All these innovations have the capacity to accelerate the advancement of women, making it easier to exercise their rights and linking them with opportunities to improve their income, have better jobs, continue their education, access health services and justice, participate politically and insert themselves socially.

However, despite the general progress of digital uptake for persons, organizations and governments, gender gaps persist, and each new technology is accompanied by new dimensions of the gender digital divide.

Where are we in terms of digital gender gaps?

GSMA² estimates a 16% internet use gender gap in 2021, up from a 15% gap in 2020. This association has been measuring mobile gender gaps since 2017 and this is the first time it has widened.

Mobile internet adoption in general continues to expand, though 2021 was a difficult year especially for women. While in 2020 there were 110 million women who adopted mobile internet, in 2021 this figure fell to 59 million. In the case of men, the same did not happen, which explains why the gap has grown.³

² GSMA. The Mobile Gender Gap Report 2022.
https://www.gsma.com/r/wp-content/uploads/2022/06/The-Mobile-Gender-Gap-Report-2022.pdf?utm_source=website&utm_medium=download-button&utm_campaign=gender-gap-2022

³ GSMA (2022).

A similar phenomenon occurred in the smartphone ownership gender gap, which increased from 16% in 2020 to 18% in 2021 (it had been improving since 2021, when it was 21%). This setback is worrying, as device ownership and availability is an important driver of internet use. Not having a device is one of the main barriers to digital inclusion.

Other studies confirm the gendered nature of digital gender gaps. Caroline Butler⁴ found that women are 5 and 4 percentage points less likely to own a mobile phone or a smartphone, respectively, than men, and 6 percentage points less likely to use mobile internet, even when controlling for other relevant factors to isolate the gender effect.

She also found that the negative gender effect is enhanced for women that live in rural areas, have low levels of literacy and are not employed, and that the marginal effect for having a disability decreases probability of owning a mobile phone by 7 percentage points (9 percentage points for a smartphone).

One of the aspects in which the digital gender divide reveals itself is that women use a narrower range of online activities than men, which means that there is still a great margin for women to take better advantage of technologies and make significant use of the internet, that is, one that positively impacts their quality of life and translates into opportunities for social and economic advance.

Also, women tend to be less confident in using the internet, which can be explained by a combination of causes: real and perceived disadvantages in digital abilities⁵, higher risks to privacy and security, and also cultural norms. But as GSMA confirms, “Once women own a smartphone, their awareness and use of mobile internet is almost on par with men”⁶.

We are still learning about the specific causes that sustain digital gender divides. Gender perspective, is not usually applied on the policy-making process, and we still lack gender data to support diagnosis, analysis, problem-solving and public policy evaluation.

It wasn't until very recently, that data on device ownership began to be collected. For example, in Mexico the official statistics that are used as indicators of mobile phone ownership actually refer to the availability of a device that might have to be shared or is subject to the priorities of other people, but not women's.

⁴ Butler, Caroline (2020). Disaggregating the Drivers of Mobile Technology Adoption: The Threat of Unobservable Gender Biases. TPRC48: The 48th Research Conference on Communication, Information and Internet Policy, <http://dx.doi.org/10.2139/ssrn.3748717>

⁵ As there are still not enough official statistics to measure the different dimensions of the digital gender divide, particularly digital proficiency, self-reporting, and surveys are commonly used, but the effect of gender biases in respondents are rarely considered, and it is the case that women tend to underestimate their technical skills, while men overestimate them, so skills gaps might not be as broad as surveys reflect or might relate to factors that remain unstudied. This is a topic that deserves more research, in order to tailor policies for the actual nature, location and size of skills gaps.

⁶ GSMA (2022).

According to GSMA, women were less likely than men to have chosen their model of mobile phone, even when they paid for it themselves.

Women need agency to use digital technologies in the way that generates the greatest benefit for them, according to their interests, needs and circumstances. Therefore, the ownership of devices (mainly mobile, for its widespread role as the main gateway to the internet), as well as combating cultural norms and gender violence, is essential to promote a *significant* use of the internet.

The internet ecosystem has been expanding to incorporate exponential technologies (artificial intelligence, big data, blockchain, internet of things, robotics), which coexist and are part of the new business models fostered by digital platforms, data analytics, social networks and countless applications for all aspects of our lives. But it happens that very few women participate in these new technological specialties.

According to UNESCO⁷, only 20 % of employees in technical roles in major machine learning companies are women, 12 % of artificial intelligence researchers are women and as little as 6% of professional software developers are women.

Artificial intelligence that is developed by teams that lack diversity -mainly made up of heterosexual, white, young males- generate applications and systems that replicate and extend human discriminatory behaviors, biases and stereotypes, so AI that is not gender-conscious (and neither conscious of other types of structural discrimination), instead of helping bridge gender divides, can replicate and amplify current digital, economic, social, and political divides.

The gender gap in leadership and decision-making also keeps women's interests and experiences underrepresented in technological developments. OECD⁸ points out that, across its countries, men are three times more likely than women to own a business with employees; and 90% of innovative start-ups seeking venture capital investments have been founded by men. Also, that women-owned start-ups receive 23% less funding and are 30% less likely to be acquired or to issue an initial public offering.⁹

Gender gaps in the development of AI and other technologies is related to the fact that women are underrepresented in STEM fields, and the gender gap is most prevalent in ICT and engineering.

The World Economic Forum (WEF) data show that considering graduates from all fields, ICT represents only 1.7 % of fields chosen by women graduates, compared to 8.2% in the case of

⁷ UNESCO: <https://www.unesco.org/en/artificial-intelligence>

⁸ OECD (2018). Bridging the Digital Gender Divide, <https://www.oecd.org/digital/bridging-the-digital-gender-divide.pdf>.

⁹ Source: OECD (2018). Bridging the Digital Gender Divide, <https://www.oecd.org/digital/bridging-the-digital-gender-divide.pdf>

men. The gap for Engineering and Manufacturing is also very wide, with 24.6% for men and 6.6% for women.¹⁰

Between 2013 and 2019, these gender gaps remained mostly unchanged, which shows how persistent are differences rooted in cultural norms and stereotypes.

Online learning has become an important tool for education and upskilling, and gender biases are showing there too.

Considering Coursera's Global Skills Taxonomy, the WEF report shows that women represent 70% of enrolments in Resilience, Stress Tolerance, and Flexibility, while men show that same level of preference for Technology Use, Technology Design, and Mathematical Thinking.

What keeps digital gender gaps from closing?

There are complementary answers to this question:

- we have practically not modified the underlying system that produces a world that discriminates against women;
- we have focused efforts in the consequences and not so much on the causes of discrimination;
- a permanent solution implies a cultural transformation.

The digital ecosystem has many components that interact in non-linear ways.

It is a complex system that feeds not only on technological and economic dynamics, but on historically rooted social and cultural structures.

Therefore, it is necessary to design strategies that are also complex in the sense that they focus on the root causes and on the direct and indirect relationships that feedback on historical gaps that are now reflected in the technological world.

Many of the barriers that prevent closing gender gaps are well-known:

- Affordability of services and internet enabled handsets and other devices.
- Ownership and agency on internet and devices use.
- Lack of literacy and digital skills.
- Privacy, safety and security risks.
- Insufficient relevancy of content, services and applications.
- Particular access-related barriers.

All of these barriers are consequences of structural discrimination against women and affect them in specific ways, so actions to surmount them have to be designed through a gender lens.

¹⁰ World Economic Forum (2022). Global Gender Gap Report.

Access-related barriers are numerous, usually related to individual circumstances, communities and cultures in which women live, as well as their affiliation to different groups that are doubly discriminated against, based on their race, age, sexual preferences, disability, language, educational level, migration status, ethnicity or living in a rural area.

For example, lack of family approval is a major barrier for many women in certain countries, like Pakistan. Girls and teenagers refrain from going to hotspots located in dangerous places or where they are subject to harassment. Speech recognition sometimes is less accurate for women's voices, which decreases the likelihood that women will use them.

Privacy, safety and security is a top barrier world-wide, ranking as the third barrier in importance in GSMA report, and the first for Mexico, encompassing information security concerns, fear of receiving unwanted contact from strangers and being exposed to harmful content.

Some experts have also pointed at the technology-facilitated gender-based violence phenomenon, which affects women specifically because it has a role in facilitating, exacerbating, and obfuscating the harms of sexual violence, so it discourages digital inclusion of women and girls.¹¹

Using digital technologies, mainly applications and mobile phones, to monitor and control women are new forms of violence that must be addressed to assure that women do not refrain from using the internet because of these risks.

An important category of barriers that isn't frequently discussed is the low participation of women as creators, promoters and decision makers in the fields of digital technologies. Women's direct participation is needed to lead investments, research, public policy, and business efforts. We need more women deciding on which technologies to produce, and how to shape them. Creating and designing technology by women is vital to produce technology that responds to women needs, aspirations, circumstances, preferences and priorities.

These are important barriers that have to be addressed but are sometimes ignored because of their systemic nature.

- Low participation of women in leadership positions and decision-making.
- Low participation of women in STEM, ICT and digital-technological industries.

¹¹ Jane Bailey & Carissima Mathen (2017). "Technology-Facilitated Violence against Women and Girls: If Criminal Law Can Respond, Should it?". Ottawa Faculty of Law Working Paper No 2017-44. Amanda Turnbull, "Onlife Harms: Uber and Sexual Violence" (2022) 19:2 CJLT 277. Turnbull focuses on the ecosystemic nature of this type of violence, so she recommends solutions that include education, workplace policies, transparency, accountability and responsible AI.

- Low participation of women as technology creators, inventors, designers and entrepreneurs.
- Influence of gender biases and cultural norms on individual, social and organizational choices.

Also, to sustainably bridge gender divides, technology must be used in an ethical, responsible and inclusive way.

Policy recommendations

In order to design and implement successful mechanisms to ensure digital technologies favor inclusion and close gender gaps, it's paramount to apply two cross-cutting methodologies: **gender perspective and a systemic approach**, both of them supported by **gender data**.

These should be applied to all policy-making, not only to programs aimed explicitly to promote equality. We have to break with the cycle where public policy on spectrum, coverage, international cooperation, national security, and also housing, public transport, wages, etc., is generally done without a gender perspective and without considering how such policies reinforce the complex systems that produce gender gaps. As this dynamic does not solve the root causes, specific policies to close gender digital gaps end up being remedial actions intended to correct the side-effects (which are in fact systemic effects) of policy-making infused with cultural biases.

For this reason, when some digital gender gaps seem to be finally closing –for example the access gap in some countries–, new dimensions of the digital gender divide emerge in the more recent technological developments, as is currently the case in big data and artificial intelligence, which present not only gender gaps in terms of the use and exploitation of technology, but additionally, they are also amplifying pre-existing gender gaps. We can foresee the same with the metaverse that is being developed in general without a gender lens and will undoubtedly produce a new dimension of the digital gender divide if it remains unchecked. We need to make all technologies and policies work for women.

The first element of the recommendation is to apply gender perspective horizontally to the policy-making process. Gender perspective allows us to understand the implications for women and men of any policy aimed at closing the digital gender divide, so women's concerns and experiences become an integral dimension of the design, implementation, monitoring and evaluation of policies and programs.

This means that it is not enough to include women in the process of policy making, technology design, etc., but that every person involved in these responsibilities needs to be acknowledgeable in gender perspective methodologies.

Gender perspective can be facilitated through guidelines, methodologies and questionnaires, but also training to stakeholders (specially regulators and authorities) is key to increase awareness on how digital technologies (their use, access or lack of) shape women's rights and opportunities as well as their long-term interests.

Specific gender perspective guidelines should be developed to direct data, algorithm and technology design, starting with reflecting on whether it's advisable to produce it in the first place: the specific data, algorithm, system or technology will be more beneficial than detrimental? Who will control the project through its lifecycle? Is the project the most effective, riskless way to achieve its purpose? Which are the worst-case scenarios?

In order to apply gender perspective methodologies, we need to have gender data. This encompasses not only to collect and present data by sex, but also to reflect gender issues; to be based on concepts and definitions that adequately reflect the diversity of women and men and capture all aspects of their lives; and to be developed through collection methods that take into account stereotypes and social and cultural factors that may induce gender biases in the data.¹²

The second fundamental element to bridge the digital gender divide is to apply a systemic approach, that is, to identify the different factors that affect and feed the state of things that we want to change, understanding the direct and indirect relationships between them. It implies generating multifactorial strategies and getting stakeholders to work together to provoke permanent changes for the long term, where new systemic relationships are those that will sustain equality.

This means a substantial modification of the vicious cycles that exist to this day where the root causes of gender discrimination remain mostly untouched, in order to disrupt power imbalances between women and men.

For example, increasing the number of girls and women studying STEM will not close gender gaps—at least not permanently or at a swifter pace— if there are no strategies to address gender violence in universities or biases in workplaces.

General barriers to digital inclusion must be addressed in a systemic way: affordability, privacy, safety and security, knowledge and skills, relevant content, services and products; cultural norms and female participation in leadership, creation and decision-making.

This doesn't mean that strategies cannot be applied to influence specific aspects, but rather that these have to be accompanied and conceived in an integral way with actions that address all the relevant elements needed to achieve permanent structural changes.

Some of the actions needed to bring about systemic change are:

¹² This is the definition of gender statistics used by the United Nations Statistics Division.

- To include diverse women and feminist points of view in internet governance, content moderation, algorithmic programming, research and innovation, policy-making and evaluation, and data processes.
- To debias datasets used for public policy and AI.
- To develop systemic strategies that take into account the specific circumstances of groups of excluded women. There are no general application recipes, neither on the use side of technology, nor in its production. What an indigenous girl requires is not what a women engineer in AI needs, nor a woman with a disability in an urban environment.
- To include the target population of women in the design and evaluation of solutions, as well as to visualize and target women as users of all types of technologies, services and applications.
- To develop relevant services and applications for diverse groups of women.
- To identify and address specific access barriers.
- To convene and collaborate with different stakeholders.
- To direct resources to women-led ventures, inventions, research and projects.
- To address gender biases in language and media.
- To detect and correct biases in instances where women access and opportunities are at stake. For example, in evaluation (of teachers by students, of employees by clients, of workers by colleagues and managers) since they translate in gender gaps in employment, tenure, scholarships, promotions, salary, etc.¹³
- To promote labor flexibility through digitalization in a way that doesn't result in women losing security, salary and long-term career potential.
- To foster a care economy that redistributes social, private and public responsibilities, so that women have better prospects in digital labour markets.
- To highlight the contributions of women in every corner of the world, as scientific champions, technologists, social activists, educators, who have promoted ICT and technological advances, so that girls have close role models with whom to identify and also so that gender roles and stereotypes disappear.
- To promote disruptive changes within ICT organizations, so that they erase discrimination, correct pay gender gaps, become safe spaces for women, promote inclusion and thrive because of diversity.
- To apply affirmative actions to bring visible and immediate changes in face of women participation, as well as direct subsidies and assistance for women inclusion.
- To eliminate all forms of gender digital violence, including those that make women refrain from using the internet or affect the image, careers and public participation of women.

Cultural change is at the core of bridging the gender digital divide and strengthening gender equality. It is not an easy task and is a long-term objective, but it is the only way to achieve fundamental and lasting transformation.

¹³ See Cunningham-Parmeter, Keith (2022). Discrimination by Algorithm: Employer Accountability for Biased Customer Reviews. *UCLA Law Review*, Forthcoming, <http://dx.doi.org/10.2139/ssrn.4044072>.