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The Gendered Impacts of AI: Policies and Safeguards to Regulate New Technologies, Mitigate Risks and Protect Rights

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* 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

Recent advances in artificial intelligence (AI) have brought under the spotlight the need for a profound ethical reflection on it. Questions arise in relation to AI development, deployment and use, and how these (re)shape people's lives and their social interactions; economic, political and cultural relationships; and societies' ability to address current and future challenges. [i] [ii]

The multiple opportunities that AI technologies offer are no longer in doubt. Similarly, though, nobody can question that AI can generate risks, including those derived from a malicious use of the technology, and exacerbate societal biases, inequalities and divides.

The gender biases that people carry in their everyday lives can be reflected and even amplified in the development and use of AI systems and advanced analytics. As a recent UNESCO report explains "*these biases are rooted in stark gender imbalances in digital skills education and are exacerbated by the gender imbalances of the technical teams developing frontier technologies, (and) by companies with significant gender disparities*" [iii]. If AI and automation are not developed and applied with a gender perspective, they are likely to reproduce and reinforce gender stereotypes, as well as existing discriminatory social norms[iv], with the challenge that it may be even more difficult to identify the biases, given the lack of transparency and accountability in the development of these technologies. As a result, the benefits offered by AI technologies may not be fully realised by society.

In 2019 the Social and Human Sciences Sector of UNESCO published a seminal report[v] by the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) where these risks were defined. It informed the elaboration of the *Recommendation on the Ethics of AI* (henceforth UNESCO AI Recommendation).

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Adopted on 24 November 2021 by standing ovation by the General Conference at its 41st session, the UNESCO AI Recommendation establishes a comprehensive framework, based on human-centred principles and values. These include the full respect for human rights, fundamental freedoms and human dignity; environmental sustainability; and inclusive and fair outcomes.

The UNESCO AI Recommendation aims to guide Member States in the formulation of a wide array of actions, including legislation and regulation, aimed at making AI inclusive by design and at making AI development, use and deployment rely on clear ethical principles that can be translated into implementable and effective policies. It calls for AI that is accountable and transparent, and is in compliance with human rights and the rule of law. It further calls for concrete actions in a wide array of relevant policy fields, with a particular focus on gender, under Policy Area 6.

In this paper we discuss how this normative instrument, and its implementation can help steer policy to ensure that digital technologies and AI contribute to gender equality for all individuals - whether women, girls, non-binary, trans or gender-diverse people. The term Artificial Intelligence (AI) is used here to refer to computer technologies that resemble processes associated with human intelligence, such as reasoning, learning and adaptation, sensory understanding, and interaction.[vi]

This short paper provides first, a brief overview of how bias in AI is generated and may impact gender equality. It then proceeds to examine the broader digital gender divide and the combined effects on the labour market that it may have, especially from gender lenses. The last section provides an overview of the relevant provisions of the UNESCO AI Recommendation.

1. Gender stereotypes and biases in artificial intelligence

As AI is playing an important role in all aspects of our daily lives already today, and will likely do so even more in the near future, it is important to examine how biases in AI may affect or exacerbate gender inequality.[vii]

AI-generated patterns, predictions and recommended actions are reflections of the accuracy, universality and reliability (or lack thereof) of the datasets used, as well as the inherent assumptions and biases that developers may have, and that translate into the algorithms developed and employed.[viii] Bias in AI can be generated by simple statistical error or through conscious and unconscious assumptions that programmers make about race, gender, or other ideological concepts and social stereotypes.

The complex statistical challenges relating to bias in algorithms are not new. In machine learning, algorithms rely on data sets, or training data, that specify what the correct outputs are for some people or objects. Statistical and computational bias arises when errors result from samples which are not representative of the population. If the training data is misrepresentative of the population, AI becomes prone to reinforcing bias.

Data on several population groups have a long history of being absent or misrepresented in existing datasets. To date, there have been numerous reports of algorithms that discriminate against vulnerable groups in the same fields in which AI has shown promising results. As an illustration drawn from healthcare, prediction models for cardiovascular disease, which claim to predict heart attacks five years before they happen, are trained using predominantly male datasets. As cardiovascular diseases have different patterns of expression in men versus women, an algorithm trained predominantly on data samples made of men is unlikely to be as accurate in diagnosing women. Past research

has also shown that while big data associated with advanced analytics can make gender discrimination more visible and quantify women's situation in the political, economic, social and health spheres, there is also a risk that it will not capture information on the full range of women's experiences, due to insufficient representation or exclusion of certain groups, and lack of information.[ix]

Scarce representativeness or imbalanced data are not the only source of bias. Algorithmic bias may emerge from the implementation of data collection systems influenced by human subjectivity; lack of proper regulation in the design process; and replication of human prejudices that cause algorithms to mirror historical inequalities.[x] It can result from procedures and practices of institutions that operate in ways which result in certain social groups being advantaged or favoured and others being disadvantaged or devalued. Institutional racism and sexism are the most common examples. Gender biases are also known to result from stereotyped representations deeply rooted in our societies. Just "like previous technologies, AI will reflect the values of its creators."[xi] Developers are known to carry their own significant cognitive biases into the development and operation of AI systems.

Current attempts to address the harmful effects of AI bias remain, however, largely focused on computational factors such as the statistical representativeness of the datasets. Despite growing recognition of their significance as sources of AI bias, human and systemic institutional and societal factors are still being overlooked". [xii]

Statistical remedies are vital for mitigating bias, but more work remains to be done to promote the systematic disaggregation of data by gender/sex and to check the extent to which datasets can provide the required information. The most complex and challenging task, however, remains how to prevent, identify and manage "social" bias. Possible solutions can emerge from AI technologies themselves, but more profoundly from the fundamental cultural changes that become needed and that will inevitably have an impact on the technology. Without prioritizing diversity, equity and inclusion in the teams involved in training and deploying AI systems it is difficult to move beyond a focus on statistical optimization. Moreover, while law also has a role in addressing discrimination and fairness applicable throughout the system's lifetime, compliance with law has proven insufficient. [xiii]

In this context, AI ethics can, and must contribute to encouraging the development and implementation of gender-inclusive strategies. In this respect, the UNESCO AI Recommendation aims to set global standards which address these challenges, in particular by calling for the collection of gender-disaggregated data (Policy Area 3. 76; pg. 30) and greater women's leadership in AI decision-making beyond participation, backed by capacity development (Policy Area 8. 105; pg. 34). The overall rationale behind the measures proposed in this normative instrument is one whereby the problem is not women themselves. It is rather education, the world of work, families, societies, and economies at large that currently fail to offer women the same opportunities and support that are offered to men. This is often the result of biased social norms and stereotypes, which constitute the root of the problem.

2. The digital gender divide in figures

Tackling gender stereotypes and bias in AI requires coordinated policy action including narrowing the existing global digital gender divide. As reported by the OECD (2018), hurdles to access, affordability, lack of education - as well as inherent biases and socio-

cultural norms - still curtail women's and girls' ability to benefit from the opportunities offered by the digital transformation.[xiv]

While mobile phone ownership is on the rise, figures show staggering gaps in Internet access for women in many regions of the world. Worldwide, about 327 million fewer women than men have a smartphone and access to the Internet from a mobile device.[xv] This is particularly severe for older, less educated, poor women or for those living in rural areas and developing countries.[xvi] Today, women and girls are 25 percent less likely than men to know how to harness digital technology for basic purposes, and four times less likely to know how to programme computers.[xvii]

Digital gender gaps also extend to digital literacy, and are often grounded in the relative low frequency of women in STEM (Science, Technology, Engineering and Mathematics) or ICT-related studies and occupations.[xviii]

Gender stereotypes and lack of role models affect girls' interest in STEM from an early age and are compounded by girls' lower self-confidence in their STEM abilities.[xix]

UNESCO estimates that men are four times more likely than women to have advanced Information and Communication Technologies (ICT) skills, such as the ability to programme computers. Currently, 90% of jobs require basic digital skills.[xx]

As recent research by the World Economic Forum shows, the percentage of male graduates in ICT is 400% higher than women graduates (8.2% versus 1.7%).[xxi]

Although in recent times female participation in patenting activities in the ICT sector has increased, the low starting point, coupled with the relatively slow progress, means that, at the current pace, it will be 2080 before women are involved in half of all patented inventions within the five largest IP office.[xxii]

Stanford University's Institute for Human-Centred Artificial Intelligence (HAI) shows that women have accounted for less than 19 percent, on average, of all AI and computer science PhD graduates in North America over the past ten years.[xxiii]

Globally, only 22% of AI professionals worldwide are women, only 13.83% of AI authors are women, and only 18% of key speakers in the AI field are women. Globally, only 12% of engineering students are women. [xxiv]

Looking at some of the figures in the Alan Touring Institute's report "Where Are the Women?" one sees that only 10–15 percent of machine-learning researchers are women in leading technology companies and that, on average, only 12 percent of authors who contributed work to the leading three machine-learning conferences in 2017 were women.[xxv]

Recruiters from tech companies in Silicon Valley estimate that the pool of applicants for technical jobs in AI and data science typically have less than 1% women.[xxvi]

Socio-cultural reasons play an important role in explaining this divide, which holds true even in countries with a higher gender equality index.[xxvii] In the European Union, for example, more than half of men earning degrees in IT end up working in digital jobs, compared to a quarter of women.[xxviii]

In addition to horizontal segregation into specific occupations, women also face glass ceilings that result in vertical gender segregation. Women in STEM fields and the digital sector are less likely to hold high-level positions. According to UNESCO (2019), only one in every four leadership positions in tech industries (including non-technical positions in marketing, human-resource management and the like) is occupied by a woman.

The COVID-19 pandemic has deepened these differences in all areas of knowledge[xxix], given that women tend to play leading roles in unpaid care work.[xxx]

These data highlight the disadvantaged situations in which women find themselves in the digital economy, and suggest that women still face significant barriers, including those raised by social expectations and cultural norms when facing the transformations of what is known as the Fourth Industrial Revolution.[xxxi]

On the other hand, women face higher aggressions on the net, and girls have mounting mental health issues due to their toxic interaction with social networks.

3. Why a gender perspective on AI-driven transformation of jobs is necessary

As the previous section highlights, one of the measurable consequences of the digital gender divide is the under-representation of women in ICT jobs, leading to a widening gap of women participation in the digital economy.

With AI-driven automation, even greater challenges are emerging.[xxxii] While automation promises to eliminate hazardous manual occupations and replace repetitive tasks, research by the IMF[xxxiii] and the Women's Policy Research Institute[xxxiv] found that women have a significantly higher risk of job displacement due to automation than men. One study in the US, found women to be overrepresented in administrative jobs, whose automation potential through AI has been estimated to stand at 60% in the country. [xxxv] In fact, most workers who have jobs that face a high risk of automation - such as office workers, administrative positions, book-keepers and cashiers - are women.

As more low-skilled jobs are automated, a higher level of education and skills will increasingly be demanded on the labour market. A 2019 study of employment trends in England between 2011 and 2017 found that sectors that rely on highly skilled occupations were less likely to be automated. Women accounted for 70% of employees in jobs with high risk of automation, and only 43% of women held jobs with low risk of automation. For example, the widespread installation of automatic cashiers in English retail establishments between 2011 and 2017, resulted in the loss of one in four cashier jobs, most of them women.[xxxvi]

Going forward, it is therefore critical to set up new education and training strategies that are gender-inclusive to mitigate the impact of the shifts in labour markets triggered by AI development and deployment, both in terms of the numbers and profiles of jobs in industries, and in terms of skills requirements.[xxxvii]

Women's exposure to the risks of automation are, however, not the same around the world; nor are the ways to mitigate them. The IDB report, The Future of Work in Latin America and the Caribbean (LAC), analyses data from four countries in Latin America to show how the risk of automation, including AI-based automation, differs across countries. This is consistent with evidence provided in other studies based on OECD countries.[xxxviii]

Fresh insights and evidence are, therefore, needed on how AI is changing the content and nature of jobs and the skills needed to perform them, to enable governments to identify challenges and to contain them and empower all individuals. In support of this effort, and particularly to address gender inequalities in AI, the UNESCO AI Recommendation calls on UNESCO Member States to "assess and address the impact of AI systems on labour

markets and its implications for education requirements, in all countries and with special emphasis on countries where the economy is labor-intensive." (Policy Area 10. 116)

4. The way forward: making AI ethical and inclusive by design

The UNESCO AI Recommendation has an entire policy area dedicated to gender: Policy Area 6. This area asks Member States to ensure that digital technologies and AI contribute to the achievement of gender equality. It goes on to underline the need for governments to ensure that human rights and fundamental freedoms - especially the safety and integrity of girls and women - are not violated at any stage of the AI system life-cycle (paragraph 87).

AI and automation must be designed to overcome gender discrimination and patriarchal social norms. In other words, these technologies must be used to respond to the challenges women face - such as unpaid care work; the gender pay gap; cyberbullying; gender-based violence and sexual harassment; trafficking; and under-representation in leadership positions. Similarly, the power of AI and automation must be leveraged to improve women's access to finance, higher education and flexible work opportunities.

Having set these general principles, the UNESCO AI Recommendation goes much deeper and asks Members States to "walk the talk", by putting in place positive actions aimed at ensuring the full inclusion of girls and women in AI, in all spheres of life, including education and employment.

The UNESCO AI Recommendation encourages Member States to have dedicated funds from their public budgets linked to financing gender-responsive schemes. Specially, it seeks to ensure that national digital policies include a gender action plan, and develop relevant policies - for example, on labour education, targeted at supporting girls and women to make sure they are not left out of the digital economy powered by AI. It also asks for special investment in providing targeted programmes and gender-specific language, to increase the opportunities for girls' and women's participation in STEM, including ICT disciplines, preparedness, employability, equal career development and professional growth of girls and women, should be considered and implemented.

The UNESCO AI Recommendation further stresses the need for Member States to ensure that AI does not exacerbate existing (and often wide) gender gaps. It also mandates that they put in place policies to reduce the gender wage gap and the unequal representation in certain professions and activities; to address the lack of representation, especially at top management positions, boards of directors, or research teams in the AI field; and to reduce the education gap, the gap in digital and AI access, adoption, usage and affordability, and the unequal distribution of unpaid work and caring responsibilities (Paragraph 89). These prescriptions aim not only to ensure that AI technologies do not create new divides but that the opportunities offered by AI are leveraged to help address existing ones.

Furthermore, it calls on Member States to ensure that gender stereotyping and discriminatory biases are not translated into AI systems and to "put in place mechanisms to fight gender stereotyping" within the AI research community (Paragraph 92). Policies and programmes that are "removing gender" from technology and helping women and girls develop their digital skills and gain confidence in gender-sensitive learning environments must be upscaled and replicated.

One of the most important principles contained in this normative instrument and that aims at ensuring its effectiveness is redressal. The Recommendation posits that Member States need to identify and proactively redress any problems caused by AI technologies and systems and ensure that this is the case for all stakeholders involved, included the private sector. For gender-related problems caused by AI, the UNESCO AI Recommendation asks Member States to avoid "the compounding negative effect of technological divides in achieving gender equality and avoiding violence such as harassment, bullying, or trafficking of girls and women and other underrepresented groups, including in the online domain" (paragraph 90). It further calls for policies that ensure harassment-free environments and concrete actions aimed at promoting diversity throughout the AI system life cycle.

Finally, paragraphs 91 and 92 of the UNESCO AI Recommendation state the need for Member States to encourage female entrepreneurship, participation and engagement in all stages of an AI system life cycle by offering and promoting economic, regulatory incentives, among other incentives and support schemes, as well as policies that aim at balanced gender participation in AI research in academia, gender representation on digital and AI companies' top management positions, boards of directors and research teams. Member States should ensure that public funds (for innovation, research and technologies) are channelled to inclusive programmes and companies, with clear gender representation, and that private funds are similarly encouraged through affirmative action principles.

UNESCO recognizes that Member States will be at different stages of readiness to implement the UNESCO AI Recommendation from the scientific, technological, economic, educational, legal, regulatory, infrastructural, social and cultural points of view, among others (paragraph 49). It should be noted that "readiness " is considered a dynamic state. Therefore, to enable the effective implementation of the UNESCO AI Recommendation, UNESCO is:

(1) developing a readiness assessment methodology to assist Member States in identifying their situation at specific points in their readiness trajectory along a continuum of dimensions; and

(2) supporting Member States in developing a globally accepted methodology for Ethical Impact Assessment (EIA) of AI technologies and in sharing of best practices, assessment guidelines and other mechanisms and analytical work.

Both methodologies are being carried out with a gender perspective.

5. Conclusions

This paper highlights how the lack of a gender perspective in AI risks aggravating existing inequalities in society, and creating new one. Given the pervasiveness of this general-purpose technology, if we do not act now, trying to fix problems *ex post* may simply become impossible, given the speed, scale and scope of the digital transformation.

In the absence of policy action, the development, deployment and use of AI in any sphere of economies and societies is likely to affect different groups unevenly. A more substantial impact is likely to be observed in relation to groups at risk of exclusion, such as women, girls, non-binary, trans and gender-diverse people, thus exacerbating existing gender, inter-regional, generational and income inequalities.

AI systems are neither objective nor gender-neutral, they are "opinions embedded in code". AI products and services lacking a gender perspective could even threaten women's physical and mental wellbeing, for example where AI systems supporting health diagnoses and predictive tools based on health data do not represent gender appropriately.[xxxix]

The societal and market transformations triggered by AI raise fundamental ethical issues of social and economic justice that need to be addressed. While skills and education are amongst the most critical determinants, a sustainable and effective strategy against gender discrimination must be streamlined, and measures taken to address the transversal impacts of AI across all sectors of the economy and all parts of society.

To that end, the UNESCO AI Recommendation provides guiding principles for Member States, as well as standards for a gender-responsive approach to AI. It lays out a roadmap of system-wide concrete actions to manage the ethical impacts of AI and ensure that AI developments do not leave behind the marginalized and the most vulnerable, but, rather, help shape a more inclusive, equal and just world.

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