



WOMEN AT THE TABLE

We Shape Our Tools, Thereafter Our Tools Shape Us.

Artificial Intelligence, Automated
Decision-Making & Gender





WOMEN AT THE TABLE

Women At the Table is global civil society organization based in Geneva. It's the first organization to focus on systems change by helping feminists gain influence in sectors that have key structural impact: economy, democracy and governance, technology and sustainability.

Further information about Women At the Table can be found at www.womenatthetable.net

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Introduction

"Bias is inherent in human life, and therefore in the human data that informs the rule making of machine learning."¹

We can either seize this moment to correct bias in the digital realm, as we tackle bias in the analog world, or condemn ourselves to old bias hardwired into the future century of Automated Decision- Making (ADM) that is trained by machine learning on biased data sets².

1 Virginia Dignum, Professor of Social and Ethical Artificial Intelligence, University of Umeå, Sweden; Member Global AI Council at World Economic Forum.

2 This paper will use the definition of automated decision-making as defined by the UK Information Commissioner's Office. That is, automated decision-makings the process of making an online decision by automated means without any human involvement. These decisions can be based on factual data, as well as on digitally created profiles or inferred data. Examples of this include: an online decision to award a loan; an aptitude test used for recruitment which uses pre-programmed algorithms and criteria. Automated decision-making often involves profiling, but it does not have to. Profiling analyses aspects of an individual's personality, behaviour, interests and habits to make predictions or decisions about them. UK Information Commissioner's Office. (n.d.). What is automated individual decision-making and profiling? [online]. Available at: <https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/automated-decision-making-and-profiling/what-is-automated-individual-decision-making-and-profiling/> [Accessed 30 Jun. 2019].

Machine learning refers to the construction and study of computer algorithms — step-by-step procedures used for calculations and classification — that can 'learn' when exposed to new data. This enables better predictions and decisions to be made based on what was experienced in the past, as with filtering spam emails, for example. Data-Pop Alliance. (2019). Key Terms. [online] Available at: <https://datapopalliance.org/resources-and-methodologies/key-terms/#statistical-machine-learning> [Accessed 30 Jun. 2019].

We mean all intersections of women and girls when we speak of them in this paper – however women and girls can also serve as a proxy for all groups traditionally invisible and ‘other’ to the system – those traditionally left behind³. Because there has been systematic exclusion of women in standards making, in data collection, and defining the old rules of the system, and a continuing exclusion of women in defining the new rules –aggravated by the lack of women scientists creating ADM systems – newly strategic and innovative thinking to achieve gender equality, and to strengthen democracy is needed in the new systems we create⁴.

We are at a critical turning point. Particularly urgent given the scale at which ADM systems are being deployed, is that machine learning trains on and then extracts data’s deep and implicit inference⁵. This means that machine learning

3 The Global Research Council defines intersectionality as the interconnected nature of social categorisations such as race, class, and gender as they apply to a given individual or group, regarded as creating overlapping and interdependent systems of discrimination or disadvantage. Global Research Council (2019). *Supporting Women in Research. Policies, Programs and Initiatives Undertaken by Public Research Funding agencies*. [online] Available at: https://anr.fr/fileadmin/documents/2019/GRC_GWG_Case_studies_final.pdf [Accessed 1 Jul. 2019].

4 Women have historically and continuously been excluded from 20th century drug trials, international standards and global trading rules and now to 21st century algorithmic decision-making. Liu, K, and DiPietro Mager, N. (2016). *Women’s involvement in clinical trials: historical perspective and future implications*. Pharmacy Practice, 14(1), pp.708-708 and WTO. (2017); *Speeches - More work needed to tackle barriers women entrepreneurs face in trade says DG Azevêdo*. [online] Available at: https://www.wto.org/english/news_e/spra_e/spra275_e.htm [Accessed 1 Jun. 2019]; Gonzalez, A. (2017). *What’s challenging women as they seek to trade and compete in the global economy*. [Blog] Available at: <https://blogs.worldbank.org/trade/what-s-challenging-women-they-seek-trade-and-compete-global-economy> [Accessed 1 Jun. 2019]. Perez, C. (2019). *Invisible Women: Exposing Data Bias in a world designed for Men*. London: Chatto & Windus. The deadly truth about a world built for men – from stab vests to car crashes. The Guardian. [online] Available at: <https://www.theguardian.com/lifeandstyle/2019/feb/23/truth-world-built-for-men-car-crashes> [Accessed 1 Jun. 2019]

5 Artificial intelligence has the potential to incrementally add 16% or around \$13 trillion by 2030 to current global economic output- an annual average contribution to productivity growth of about 1.2 percent between now and 2030. Impact of AI on the World Economy. [online] Available at: https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Artificial%20Intelligence/Notes%20from%20the%20frontier%20Modeling%20the%20impact%20of%20AI%20on%20the%20world%20economy/MGI-Notes-from-the-AI-frontier-Modeling-the-impact-of-AI-on-the-world-economy-September-2018.ashx?mod=article_inline [Accessed 2 Jul. 2019].

makes the implicit information in the data, explicit in the code, and the machine learning ‘intelligently mirrors’ the information it has been given from the analog world. In addition, machine learning improves on the historic bias in the data, and crafts it into an embedded, exacerbated digital form. Thus, making the bias being slowly stripped from the analog world, a new digital, and potentially permanent reality.

This position paper advocates for Affirmative Action for Algorithms (<A+>) in order to correct real life bias and barriers that prevent women from achieving full participation and rights in the present, and in the future we invent. We must ensure that machine learning does not embed an already biased system into all our futures.

We begin by outlining the landscape of the problem of gender bias in ADM and then continue in three sections: Accountability; Inclusion; and Cooperation. We end with a set of practical recommendations that offer a real opportunity to rescript bias and create a proactive agenda. We must seize the moment to advance the values of equality we have long embraced, and correct for the visibility, quality and influence of women proportionate to the population.

The landscape

Gender Bias in the Algorithm & Automated Decision-Making⁶

< 2.1 > Inherent bias in hiring

To optimize human resources Amazon created an algorithm derived from 10 years of resumes submitted to Amazon. It used data benchmarked against Amazon's high performing predominately male engineering department. The algorithm was taught to recognise word patterns, rather than relevant skills sets in the resumes, and seeing that males historically had been hired and promoted, the algorithm taught itself to penalise any resumes that included the word "women's", such as "women's chess club captain" in the text, and downgraded resumes of women who attended two "women's colleges"⁷. This is because training data that contains human bias or historical discrimination, creates a self-fulfilling prophecy loop where machine learning absorbs human bias and replicates it, incorporates it into future decisions, and makes implicit bias an explicit reality⁸.

Despite multiple and unsuccessful attempts to correct the algorithm and strip out the bias which was assumed would be a simple technical fix, Amazon eventually scrapped the algorithmic recruitment tool because the bias was

⁶ Algorithm: computer – designed to define how to sequentially solve a recurrent problem through calculations and data processing. Data-Pop Alliance. (2019). *Key Terms*. [online] Available at: <https://datapopalliance.org/resources-and-methodologies/key-terms/#algorithm> [Accessed 1 Jul. 2019].

⁷ Dastin, J. (2018). *Amazon scraps secret AI recruiting tool that showed bias against women*. Reuters. [online] Available at: <https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK08G> [Accessed 20 Jun. 2019].

⁸ World Wide Web Foundation (2017). *Algorithmic Accountability. Applying the concept to different country contexts*. [online] World Wide Web Foundation. Available at: https://web-foundation.org/docs/2017/07/Algorithms_Report_WF.pdf [Accessed 30 Jun. 2019].

built too deeply within Amazon's past hiring practices. The bias was deeply implicit in the data that the algorithm was trained on, and the machine learning ADM system could not unlearn the bias⁹. In 2017, Amazon abandoned the project and their experience shared with the public via Reuters. Reuters also mentions the growing list of global companies, including Hilton Worldwide Holdings and Goldman Sachs Group, also looking to automate portions of their hiring process¹⁰.

< 2.2 > Selection bias and stereotypes

A recent study of Facebook's ad delivery service found that ads for jobs in the lumber industry were disproportionately shown to white male users, while ads for cashier positions at supermarkets were shown to female users¹¹. Allowing job advertisers to target only men advertisers, without necessarily intending or being aware, delivered ads in a manner aligning with gender stereotypes¹².

When an algorithm learns a pattern that more men than women are interested in lumber industry jobs (even if it doesn't know their gender and learns this by correlating other information about a person's likes and habits), then the system winds up deciding not to show those job ads to other women, solely because they are women¹³. This exacerbates the existing stereotypes and societal barriers that have excluded women long before ADM. After Facebook was sued for these targeting practices and as part of its settlement early in

⁹ Dastin, J. (2018).

¹⁰ Ibid.

¹¹ Ali, M., Sapiezynski, P., Korolova, A., Mislove, A. and Riek, A. (2019). *Discrimination through optimization: How Facebook's ad delivery can lead to skewed outcomes*. [online] Available at: <https://arxiv.org/pdf/1904.02095.pdf> [Accessed 8 Jul. 2019].

¹² Scheiber, N. (2018). *Facebook Accused of Allowing Bias Against Women in Job Ads*. The New York Times. [online] Available at: <https://www.nytimes.com/2018/09/18/business/economy/facebook-job-ads.html> [Accessed 10 Jun. 2019].

¹³ Merrill, J. (2019). *Facebook's algorithm makes some ads discriminatory—all on its own*. Quartz. [online] Available at: <https://qz.com/1588428/new-research-suggests-facebooks-algorithm-may-be-discriminatory/> [Accessed 10 Jun. 2019].

2019, Facebook agreed to stop allowing advertisers in key categories to target messages only to people of a certain gender, race or age group¹⁴.

Often ads seem to deliberately target in accordance with stereotypes. A ProPublica survey found that the Pennsylvania State Police, for example, boosted a post targeted exclusively to men with text saying: Pennsylvania State Troopers earn a starting salary of \$59,567 per year. Apply now.¹⁵ Targeting by sex is just one way Facebook and other platforms let advertisers focus on certain users — and exclude others, inadvertently denying opportunities to apply for potentially higher paying, higher status jobs.

< 2.3 > **Implicit stereotype and unconscious bias translated into explicit misogyny**

Researchers at a major U.S. technology company claimed an accuracy rate of more than 97% for a face- recognition system they'd designed - however the data set was more than 77% male and more than 83% white¹⁶. Researchers from MIT and Stanford in the US recently tested three facial-analysis programmes, by IBM, Microsoft, Megvii (Face ++), and found the software was good at recognising white males but not females, especially if they had a darker skin tone¹⁷. Another example of geo-diverse paucity in algorithm development is

¹⁴ Facebook had taken some steps to try to address this issue through self-certification. For more than a year, it required anyone running ads for jobs to check a box saying their ads stay within all legal boundaries. Schreiber, N. and Isaac, M. (2019) *Facebook Halts Ad Targeting Cited in Bias Complaints*. The New York Times. [online] Available at: <https://www.nytimes.com/2019/03/19/technology/facebook-discrimination-ads.html> [Accessed 10 Jun. 2019].

¹⁵ Tobin, A. and Merrill, J. (2019). *Facebook Is Letting Job Advertisers Target Only Men*. ProPublica. [online] Available at: <https://www.propublica.org/article/facebook-is-letting-job-advertisers-target-only-men> [Accessed 10 Jun. 2019].

¹⁶ Raji, I. and Buolamwini, J. (2019). *Actionable Auditing: Investigating the Impact of Publicly Naming Biased Performance Results of Commercial AI Products*. [online] Available at: http://www.aies-conference.com/wp-content/uploads/2019/01/AIES-19_paper_223.pdf [Accessed 12 Jun. 2019].

¹⁷ Office, L. (2019). *Study finds gender and skin-type bias in commercial artificial-intelligence systems*. [online] MIT News. Available at: <http://news.mit.edu/2018/study-finds-gender-skin-type-bias-artificial-intelligence-systems-0212> [Accessed 7 Jun. 2019].

that algorithms currently label a photograph of a traditional US bride dressed in white as "**bride**", "**dress**", "**woman**", "**wedding**", whereas a photograph of a **North Indian bride is tagged as "performance art" and "costume"**. The selection bias from data used to train the algorithm over-represents one population, while under-representing another¹⁸.

In 2017 a group of researchers found that two prominent research-image collections, including one supported by Microsoft and Facebook, display a predictable gender bias in their depiction of activities such as cooking and sports¹⁹. For example, images of shopping and washing are linked to women, while coaching and shooting are linked to men. Similarly, **kitchen objects such as spoons and forks are strongly associated with women, while outdoor sporting equipment such as snowboards and tennis rackets are strongly associated with men.**

Machine-learning software trained on these datasets didn't just mirror these biases, it amplified them. If a photo set generally associated women with cooking, the software trained by studying those photos and their labels created an even stronger association. In the researchers' tests, people pictured in kitchens became even more likely than reflected in the training data to be labelled woman: **in a photo of a man at a stove he is labelled "woman"**²⁰. Similarly, Researchers from the Universities of Washington and Maryland found that for some search terms, like Chief Executive Officer (CEO), Google presented percentages worse than the already imbalanced figures in real life. **The study**

¹⁸ More than 45% of ImageNet data (an image database) comes from the United States, home to only 4% of the world's population. By contrast, China and India, who together represent 36% of the world's population together contribute just 3% of ImageNet data. Zou, J. and Schiebinger, L. (2018). *AI can be sexist and racist — it's time to make it fair*. Stanford. [online] Available at: <https://history.stanford.edu/news/ai-can-be-sexist-and-racist-%E2%80%94-it%E2%80%99s-time-make-it-fair> [Accessed 7 Jun. 2019].

¹⁹ The researchers looked at ImSitu, created by the University of Washington, and COCO, initially coordinated by Microsoft, and now also co-sponsored by Facebook and startup MightyAI. Each collection contains more than 100,000 images of complex scenes drawn from the web, labeled with descriptions. Zhao, J., Wang, T., Ordonez, V. and Chang, K. (2017). *Men also like shopping: Reducing Gender Bias Amplification using Corpus-level Constraints*. In: Proceedings of the 2017 Conference on Empirical Methods in Natural Language Processing. [online] Available at: <http://markyatskar.com/publications/bias.pdf> [Accessed 7 Jun. 2019].

²⁰ Ibid.

found that 11% of the people shown in a CEO image search were women, while the data indicates that 27% of women in the US were CEOs²¹.

Likewise, word embeddings trained on Google News articles demonstrate gender stereotypes propagated on a daily basis. For example, extreme she occupations include homemaker, librarian and nanny, while extreme he occupations include maestro, philosopher and financier²². Researchers from Boston University and Microsoft show that software trained on text collected from Google News reproduced gender biases well documented in humans. When they asked the software to complete the statement "**Man is to computer programmer, as woman is to X**", it replied, "**homemaker**"²³.

Similarly, when Google Translate converted news articles written in Spanish into English, phrases referring to women professionals such as professors often became he said or he wrote²⁴. In the Turkish language where there is no he or she, Google Translate created gender pairings where the Turkish language has none, and the results are unsurprisingly shocking – she is a cook, he is an engineer, he is a doctor, she is a nurse, "**he is hard working**", "**she is lazy**"²⁵.

²¹ Researchers looked at the top 100 image search results for 45 different jobs. They then compared the gender breakdown of those results to actual gender data from the Bureau of Labor Statistics for each job. Kay, M., Matuszek, C. and Munson, S. (2015). *Unequal Representation and Gender Stereotypes in Image Search Results for Occupations*. In: Proceedings of the 33rd Annual. pp.3819-3828.

²² Bolukbasi, T., Chang, K., Zou, J., Saligrama, V. and Kalai, A. (2016). *Man is to Computer Programmer as Woman is to Homemaker? Debiasing Word Embeddings*. In: 30th International Conference on Neural Information Processing Systems (NIPS'16). [online] Available at: <https://papers.nips.cc/paper/6228-man-is-to-computer-programmer-as-woman-is-to-homemaker-debiasing-word-embeddings.pdf> [Accessed 6 Jun. 2019].

²³ Ibid.

²⁴ Zou, J. and Schiebinger, L. (2018).

²⁵ Olson, P. (2018). *The Algorithm That Helped Google Translate Become Sexist*. Forbes. [online] Available at: <https://www.forbes.com/sites/parmyolson/2018/02/15/the-algorithm-that-helped-google-translate-become-sexist/#3fcd757f7daa> [Accessed 8 Jun. 2019].

Other examples of unconscious gender bias include the prevalence of feminised machines, such as **Alexa, Google Home and Siri** – all of which have female voices by default (although Google Home and Siri can be switched to a male voice). However, the speech-recognition software that understands commands is trained on recordings of male voices. Therefore, Google’s version is 70% more likely to understand males, and therefore **male commands of the female ‘assistant’**²⁶.

A storied ad campaign developed for UN Women in 2013, reveals widespread discrimination against women and sexism through the use of Google search autocomplete algorithm. The campaign features close-ups of women’s faces with real life autocomplete results for searches such as "Women shouldn’t..." and "Women need to...". Examples of the search autocompleted to **"Women shouldn’t.... have rights and Women need to...be disciplined"**²⁷.

< 2.4 > “We shape our tools, and thereafter our tools shape us”²⁸

We have been slow to react to the mounting evidence, and gender bias and sexism continue to be pervasive online. Deep fakes, real people, real faces, close to photorealistic footage, and entirely unreal events continue to exist²⁹. At the time of writing this position paper, **DeepNude, an app that undresses women with a single click** was launched (and subsequently removed after

²⁶ United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2019). *I’d blush if I could: closing gender divides in digital skills through education*. [online] Available at: <https://unesdoc.unesco.org/ark:/48223/pf0000367416.page=1> [Accessed 1 Jul. 2019].

²⁷ UN Women. (2019). *UN Women ad series reveals widespread sexism*. [online] Available at: <http://www.unwomen.org/en/news/stories/2013/10/women-should-ads> [Accessed 21 Jun. 2019].

²⁸ McLuhan, M. (1964). *Understanding Media: The Extensions of Man*. 1st ed. New York: McGraw Hill.

²⁹ Chivers, T. (2019). *What do we do about deepfake video?* The Guardian. [online] Available at: <https://www.theguardian.com/technology/2019/jun/23/what-do-we-do-about-deepfake-video-ai-facebook> [Accessed 6 Jul. 2019]

public backlash following media attention)³⁰. Equally concerning, **Twitter** pushed sponsored tweets advertising a piece of spyware marketed to **monitor girlfriends** and wives with an ad reading "**What is she hiding from you? Find our (sic) with mSpy!**"³¹

As Marshall McLuhan is famously quoted, "We shape our tools, and thereafter our tools shape us."³² This is our immediate challenge. We must establish new tools, and new norms, for lasting institutional and cultural systems change now and for the century beyond. This concerns all corners of the world. It is crucial that we focus on gender equality and democracy for both women and men, now. Then everyone can thrive. We must leave no one behind and lift everyone up.

30 DeepNude, uses a photo of a clothed person and creates a new, naked image of that same person. It swaps clothes for naked breasts and a vulva, and only works on images of women. When Motherboard (multimedia publication news platform) tried using an image of a man, it replaced his pants with a vulva. Cole, S. (2019). *This Horrifying App Undresses a Photo of Any Woman With a Single Click*. [online] Motherboard Tech by Vice. Available at: https://www.vice.com/en_us/article/kzm59x/deepnude-app-creates-fake-nudes-of-any-woman [Accessed 4 Jul. 2019]. Mahdawi, A. (2019). *An app using AI to 'undress' women offers a terrifying glimpse into the future*. The Guardian. [online] Available at: <https://www.theguardian.com/commentisfree/2019/jun/29/deepnude-app-week-in-patriarchy-women> [Accessed 4 Jul. 2019].

31 Cox, J. (2019). *Twitter Pushed Adverts for Spyware to Monitor Girlfriends*. [online] Motherboard Tech by Vice. Available at: https://www.vice.com/en_us/article/3k3wx5/twitter-pushed-adverts-for-spyware-to-track-girlfriends?utm_campaign=the_download.unpaid.engagement&utm_source=hs_email&utm_medium=email&utm_content=74342438&_hsenc=p2anqtz-_mbch4wb6ipqsvrc2en4beugnoj7q3r9fklolshloqxxfg4r6x8fj1ccu-vz6ym6vwmsptwuu4c91fsno6q-t85gqblmq&_hsmi=74342438 [Accessed 4 Jul. 2019].

Accountability

Public institutions, public policy: accountability and transparency for automated decision- making in the public and private sector

< 3.1 > Lead and Pilot Affirmative Action for Algorithms

It is critical that public institutions take the lead. Public monies should be spent for the creation of accountability frameworks, and the creation of low cost targeted pilots for **Affirmative Action for Algorithms. These pilots must be designed to actively correct real world and digital bias**, and not only to check for bias.

Public institutions must broaden their frame of reference to work with a wider range of social scientists, philosophers, anthropologists, behavioural economists, academics from neuroscience, data science, systems biology, civil society organizations, and the citizens whose lives are affected, and whose insights into the lived realities of ADM systems will be invaluable³³.

Pilots for ADM should be conceived and deployed to embrace the principles of **Smart Cities 3.0** that focus on **the quality of the lives we want to lead**, and not merely optimizing for traffic efficiency or surveillance³⁴. Pilots must include citizens in the co-creation, design and deployment of the new programs and technologies, and specifically include a gender analysis in their design.

33 Whittaker, M., Crawford, K., Dobbe, R., Fried, G., Kaziunas, E., Mathur, V., Myers West, S., Richardson, R., Schultz, J. and Schwartz, O. (2018). *AI Now Report 2018*. [online] Available at: https://ainowinstitute.org/AI_Now_2018_Report.pdf [Accessed 1 Jun. 2019]

34 Smart Cities 3.0: Citizen co-creation a new model has started to appear. Instead of a tech-driven provider approach (Smart Cities 1.0), or a city driven, technology enabled model (Smart Cities 2.0), leading smart cities are beginning to embrace citizen co-creation models for helping to drive the next generation of smarter cities Smart Cities LibraryTM. (2019). *The 3 Generations of Smart Cities From 1.0 to 3.0*. [online] Available at: <https://www.smartcitieslibrary.com/the-3-generations-of-smart-cities/> [Accessed 1 Jul. 2019].

Initial pilots could hard target specific implicit and unconscious bias existing in the analog world, and should apply longstanding, as well as create new, social science and behavioural research. Academic research has long shown the benefits of allocating certain social incentives, subsidies, or scholarships where women have traditionally been left behind. Pilot programs optimally would have a core group of municipal data managers and innovators, academic data scientists, social scientists, community organizations, and private sector in their composition to allow for the most dynamic and useful construction of a pilot system³⁵.

< 3.2 > Impact Assessments

Impact assessments are well established practice. They have been successfully implemented in scientific and policy domains such as environmental protection, human rights³⁶, data protection³⁷, and privacy³⁸. For example, US' National Environmental Protection Act established in 1970, mandates that federal agencies evaluate a proposed action's impact on the "quality of the human environment" through an Environmental Impact Statement (EIS)³⁹.

35 Women At theTable's second Position Paper in the Triple A series, dealing with Affirmative Action on pilots will be released in the last quarter of 2019.

36 For example: United Nations, Guiding Principles on Business and Human Rights: OHCHR. (2011). *Guiding Principles on Business and Human Rights: Implementing the United Nations "Protect, Respect and Remedy" Framework*. [online] Available at: https://www.ohchr.org/documents/publications/GuidingprinciplesBusinesshr_eN.pdf [Accessed 1 Jun. 2019].

37 For example: Data Protection Impact Assessments. UK Information Commissioner's Office. (n.d.). *Data protection impact assessments*. [online] Available at: <https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/accountability-and-governance/data-protection-impact-assessments/> [Accessed 4 Jun. 2019].

38 A. Bamberge, K. and K. Mulligan, D. (2008) Review. *Privacy Decision making in Administrative Agencies* [online] Chicago Law Review. Available at: <https://pdfs.semanticscholar.org/840f/f9444b83adb2a26acbd4167de95ed0f83856.pdf> [Accessed 1 Jun. 2019].

39 The EIS process has been credited with institutionalising increased sensitivity to environmental values within federal agencies in the US and for informing the public, which must be celebrated given the complex scientific knowledge the EIS process can require.

A typical federal Environmental Impact Statement includes:⁴⁰

1. Introduces the proposed action, its purpose and need;
2. Describes the affected environment and provides a baseline for understanding the current environmental situation in relation to the proposed action/s;
3. Presents a range of alternatives to the proposed action (no action alternatives) – understanding how the environment would respond if no action were taken assists with evaluating the proposed action and alternatives; and
4. Analyses the environmental impact of each proposed action/s and range of alternatives –includes consideration of the social and economic impacts on the environment and individuals.

An EIS may also include financial plans, environmental mitigation plans and plans for complying with any additional required federal, state or local permits.

< 3.2.1 > **Algorithmic Impact Assessments (AIA)**

We urgently need to lay the foundations for accountable ADM. Currently, ADM and machine learning systems operate as opaque "black boxes" outside the scope of meaningful scrutiny and accountability. We must ensure that machine learning does not embed and make explicit an already implicitly biased system into our futures. AI Now, a NYC research institute, have proposed using Algorithmic Impact Assessment (AIA), a self- assessment framework designed to respect the public's rights to accountability and fairness.

⁴⁰ Middleton, T. (2018). *What is an Environmental Impact Statement?* [online] American Bar Association. Available at: https://www.americanbar.org/groups/public_education/publications/teaching-legal-docs/teaching-legal-docs--what-is-an-environmental-impact-statement-/ [Accessed 25 Jun. 2019].

AIAs are designed to:⁴¹

1. Respect the public's right to know which systems impact their lives by publicly listing and describing automated decision systems* that significantly affect individuals and communities;
2. Increase an organisation's internal expertise and capacity to evaluate the systems they build / procure and allow an organisation to anticipate issues that might raise concerns and mitigate associated risks;
3. Ensure greater accountability of automated decision systems by providing researchers an ongoing opportunity to review, audit and assess systems and identify and detect problems; and
4. Ensure the public has a meaningful opportunity to respond and, if necessary, dispute an organisations approach to algorithmic accountability.

Municipal Government:

New York City Automated Decision Systems Task Force

The first of its kind in the world, Local Law 49 established the New York City Automated Decision Systems Task Force (ADS Task Force), in August 2017 for deployment January 2018⁴². The ADS Task Force co- chaired by the Directors of the Mayor's Office, Deputy Commissioner of the NY Commission on Human Rights, and members from non-profit, advocacy and research groups is tasked with recommending a process for reviewing New York City's use of algorithms⁴³.

⁴¹ AI Now reference to Automated Decision Systems generally refer to technical systems that aim to aid or replace human decision- making. AI Now (2018). Reisman, D., Schultz, J., Crawford, K. and Whittaker, M. (2018). Algorithmic Impact Assessments: A practical framework for public agency accountability. [online] AI Now. Available at: <https://ainowinstitute.org/aiareport2018.pdf> [Accessed 1 Jun. 2019].

⁴² Local Law 49 of 2018 defines Automated decision system (ADS) as computerized implementations of algorithms, including those derived from machine learning or other data processing or artificial intelligence techniques, which are used to assist in making decisions. City of NY. (2019). NYC Automated Decisions Systems Task Force. [online] Available at: <https://www1.nyc.gov/site/adstaskforce/index.page> [Accessed 25 Jun. 2019].

⁴³ Ibid.

New York City's Automated Decision Systems Task Force:⁴⁴

New York City's Automated Decision Systems Task Force to develop:

- 1.** A procedure for impacted individuals to request information on decisions involving Automated Decision Systems (ADS);
- 2.** A procedure for cities to determine any disproportionate impact/s on protected categories of people (including women);
- 3.** If an ADS disproportionately impacts protected categories of persons (including women) – a procedure for addressing any individual instances of "harm";
- 4.** A feasibility analysis of archiving information about agency systems;
- 5.** A process for publicly disclosing information about agency systems; and
- 6.** Criteria for identifying which ADS should be subject to one or more of the above.

The Task Force is multidisciplinary and public forums and consultations should inform the Task Force's work.

National Government:

Canada's Algorithmic Impact Assessment Questionnaire

On 1 April 2019, the Government of Canada became the first country in the world to develop an Algorithmic Impact Assessment (AIA), a tool in the form of a questionnaire. Federal Government departments are directed to complete a mandatory AIA prior to the production of any system, tool, or statistical model used to recommend or make an administrative decision about a client⁴⁵.

> **Peer review:** by a qualified expert e.g. government institution; member of post-secondary institution; NGO researcher; or a data and automated advisory board.

> **Notice:** Plain language notice on the program service website for all Automated Decision Systems (ADS).

⁴⁴ Ibid.

⁴⁵ Government of Canada. (2019). Directive on Automated Decision-Making. [online] Available at: <https://tbs-sct.gc.ca/pol/doc-eng.aspx?id=32592> [Accessed 25 Jun. 2019].

- > **Human-in-the-loop for decisions:** specific human intervention at various points during the decision-making process for ADS that impact individuals / the community.
- > **Explanation requirement:** meaningful explanation is provided for all ADS systems including those that are considered to not impact individuals or a community e.g. through a FAQ.
- > **Testing:** training data for unintended biases and other factors that may unfairly impact ADS outcomes before an ADS system is produced. Ensure the data that is being used by the ADS is routinely tested to ensure it is still relevant, accurate and up to date.
- > **Monitoring:** outcomes of ADS must be monitored on an ongoing basis to safeguard against unintentional outcomes.
- > **Training:** courses to be completed where an ADS has high impacts on an individual / community, in addition to documentation on the design and functionality of the system.

Canadian Algorithmic Impact Assessment requirements⁴⁶

Once the AIA questionnaire is completed, Government departments receive an impact level which determines which requirements will apply to the automated decision system (impact levels 1-4: no impact; moderate impact; high impact; and very high impact). Requirements scale according to the risk level; i.e. peer review requirement for level 1 initiatives will be much less than those required for level 4⁴⁷.

46 The Government of Canada define Automated Decision System as any technology that either assists or replaces the judgement of human decision-makers. These systems draw from fields like statistics, linguistics, and computer science, and use techniques such as rules-based systems, regression, predictive analytics, machine learning, deep learning, and neural nets.

Questions in the Canadian Algorithmic Impact Assessment questionnaire*:

- > **Business driver/positive impacts:** e.g. motivations and intentions;
- > **About the system:** e.g. focus;
- > **About the decision:** does the decision relate to health, economic interests and social assistance;
- > **Impact assessment:** describe the impacts resulting from the decision on the rights and freedoms, health and well-being and economic interests of individuals as well as on the sustainability of an environmental ecosystem;
- > **About the data:** will the system use personal information as input data; and who controls the data;
- > **De-risking and mitigation measures relating to data quality:** are processes in place to test datasets against biases; is there a process to document how data quality issues were resolved during the design process; has a Gender Based Analysis of the data occurred; and has accountability been assigned in the institution for the system.
- > **De-risking and mitigation measures relating to procedural fairness:** does the system provide an audit trail; is there a mechanism to capture feedback by users of the system; is there recourse process for clients that wish to challenge the decision; and does the system enable human override of system decisions.

**Note – This is not the full list of questions within the Canadian AIA questionnaire – it provides a snap shot of the questionnaire. The full text can be found on the Government of Canada’s website⁴⁸.*

⁴⁸ Government of Canada. (2019). *Algorithmic Impact Assessment* – Open Government Portal. [online] Available at: <https://open.canada.ca/data/en/dataset/748a97fb-6714-41ef-9fb8-637a0b8e0da1> [Accessed 25 Jun. 2019].

< 3.3 > **Rigorous testing across the lifecycle of Artificial Intelligence systems**

All parts of the ADM system and the supply chain on which it relies on must be better understood and tracked to ensure meaningful accountability and responsible auditing⁴⁹. This must include the "full stack supply chain", i.e. the entire value chain, which includes accounting for the origins and use of training data, models, Application Program Interfaces (APIs), and other infrastructural components over a product life cycle⁵⁰.

< 3.4 > **Strong legal frameworks to promote accountability**

ADM has expanded at an unprecedented rate while mechanisms for governance, oversight and accountability have clearly failed to keep pace. Most ADM systems designers and developers are not experts in fairness, explainability and security, nor should they be expected to be⁵¹. But someone must be accountable for: the fairness, explainability and security of the algorithms and ADM unleashed into the public space and our data ecosystem⁵². Accountability tools and frameworks must be developed to assist designers, developers, and policymakers to ensure women and those traditionally excluded are not left behind⁵³.

⁴⁹ Whittaker, M., et al. (2018). AI Now Report 2018.

⁵⁰ Ibid.

⁵¹ For example, ADM systems designers and developers are not experts in: ensuring the ADM does not create discriminatory / bias / harmful outcomes; providing a meaningful explanation about what specifically about the ADM impacts on individuals and their rights; and ensuring safeguards are in place when dealing with sensitive data and dealing with personal information.

⁵² Data ecosystems: Complex adaptive systems that include data infrastructure, tools, media, producers, consumers, curators, and sharers. They are complex organizations of dynamic social relationships through which data/information moves and transforms in flows. Data-Pop Alliance. (2019). Key Terms. [online] Available at: <https://datapopalliance.org/resources-and-methodologies/key-terms/#data-ecosystems> [Accessed 1 Jul. 2019].

⁵³ European Parliamentary Research Service (2019). A governance framework for algorithmic accountability and transparency. Study - Panel for the Future of Science and Technology. [online] Available at: [http://www.europarl.europa.eu/RegData/etudes/STUD/2019/624262/EPRS_STU\(2019\)624262_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2019/624262/EPRS_STU(2019)624262_EN.pdf) [Accessed 1 Jun. 2019]

< 3.4.1 > European Parliamentary Research Service

The European Parliamentary Research Service (EPRS) in their 2019 report ‘A Governance Framework for Algorithmic Accountability’, urge that frameworks composed of metrics, methodologies and ability tools be developed. Their report provides an overview of the different potential avenues to regulation and Governance⁵⁴:

- > **Consumer protection rules:** algorithmic governance should be considered from the perspective of consumer protection rules and the role of Consumer Protection authorities⁵⁵. In order to increase accountability for operators, some argue for a broader application of consumer protection regulation to user agreements⁵⁶. Responsible supervisory authorities would then apply consumer protection legislation⁵⁷.
- > **Centralised regulatory body:** a singular new and centralised regulatory body – like the US Food and Drug Administration (FDA)⁵⁸ given that ADM systems are based on complexity, opacity and dangerousness⁵⁹.
- > **Agency tasked with certifying the safety (includes societal and discriminatory harms) of ADM systems in combination with**

⁵⁴ This EPRS Report was written request of the Panel for the Future of Science and Technology (STOA) and is prepared for, and addressed to, the Members and staff of the European Parliament as background material to assist them in their parliamentary work. Ibid.

⁵⁵ Larsson, S. (2018). *Algorithmic governance and the need for consumer empowerment in data-driven markets*. Internet Policy Review Journal on Internet Regulation, 7(2) and de Streel, A. and Sibony, A. (2017). *Towards Smarter Consumer Protection Rules for Digital Services*. [online] Available at: https://www.cerre.eu/sites/cerre/files/171005_CERRE_Digital-ConsumerProtection_FinalReport.pdf [Accessed 14 Jul. 2019].

⁵⁶ Rhoen, M. (2016). *Beyond consent: improving data protection through consumer protection law*. Internet Policy Review. Internet

⁵⁷ King, N. and Forder, J. (2016). *Data analytics and consumer profiling: Finding appropriate privacy principles for discovered data*. Computer Law & Security Review, 32(5), pp.696-714.

⁵⁸ Tutt, A. (2016). *An FDA for Algorithms*. SSRN Electronic Journal.

⁵⁹ European Parliamentary Research Service (2019). *A governance framework for algorithmic accountability and transparency*.

a legal liability framework: designers, manufacturers and sellers of agency-certified systems would be subject to limited tort liability. Uncertified systems that are offered for commercial sale or use would be subject to strict joint and several liability. This strong tort-based system would compel designers and manufacturers to internalise the costs associated with harm caused by algorithmic decisions⁶⁰.

Others have suggested certifications and labels as a way to enhance trust in ADM and to verify that organisations comply with certain rules, such as absence of bias or discrimination. The needs and risk vary greatly between sectors, therefore certification requirements, obligations and potential expansion of powers, or new terms of reference, could and should be sector specific⁶¹.

National Government / Private Corporations: US Algorithmic Accountability Act 2019

The *Algorithmic Accountability Act* of 2019 filed in the US Senate in April proposes that the Federal Trade Commission (FTC) expand its regulatory mandate and require the private sector to conduct impact assessments of highly sensitive automated decision systems⁶². This requirement would apply both to new and existing systems and requires companies that make over \$50 million per year, hold information on at least one million people or devices, or primarily act as data brokers that buy and sell consumer data to regularly evaluate their tools for accuracy, fairness, bias, and discrimination⁶³.

⁶⁰ Scherer, M. (2015). *Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies*. SSRN Electronic Journal.

⁶¹ European Parliamentary Research Service (2019). *STOA Options Brief. Understanding algorithmic decision-making: Opportunities and challenges*. [online] Available at: [http://www.europarl.europa.eu/RegData/etudes/STUD/2019/624261/EPRS_STU\(2019\)624261\(ANN1\)_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2019/624261/EPRS_STU(2019)624261(ANN1)_EN.pdf) [Accessed 1 Jun. 2019].

⁶² This Bill was introduced by Senators Ron Wyden and Cory Booker on 10 April 2019. The Bill states that ‘automated decision system’ means a computational process, including one derived from machine learning, statistics, or other data processing or artificial intelligence techniques, that makes a decision or facilitates human decision-making, that impacts consumers. *S.1108 – 116th Congress: Algorithmic Accountability Act of 2019*. <https://epic.org/privacy/policy/Algorithmic-Accountability-Act-2019.pdf> [Accessed 25 Jun 2019].

While the Bill may sit in the US Senate indefinitely, it provides a useful guide on the elements that should be considered before and when ADM systems are deployed. The Bill requires companies to study the algorithms they use, identify bias in the systems, and fix any discrimination or bias they find. A Bill such as this one is a key step toward ensuring more accountability from the private sector organisations that use machine learning and which make decisions that can change lives⁶⁴.

In the European context, the EPRS suggests the establishment of a European ethical committee to address ethical, legal, social and political issues relating to ADM⁶⁵. However, one region working alone cannot address all these issues on its own. International cooperation complemented by a multi-stakeholder approach must occur⁶⁶. The position paper considers this issue in section 5.

Although the most effective way to implement accountability that will protect the public is still in discussion, there is clear agreement that strong legal frameworks and regulatory oversight are needed to oversee, audit and monitor ADM. Whatever governance arrangement is ultimately agreed, women and men need to be equally represented in leadership positions that make these critical decisions⁶⁷.

64 Cory Booker US Senator for New Jersey (2019). *Booker, Wyden, Clarke Introduce Bill Requiring Companies To Target Bias In Corporate Algorithms*. [online] Available at: https://www.booker.senate.gov/?p=press_release&id=903 [Accessed 25 Jun. 2019].

65 European Parliamentary Research Service (2019). *STOA Options Brief*.

66 UN Secretary-General's High-level Panel on Digital Cooperation (2019). *The Age of Digital Interdependence*. [online] Available at: <https://www.un.org/en/pdfs/DigitalCooperation-report-for%20web.pdf> [Accessed 21 Jun. 2019].

67 The need to ensure equal men and women in leadership positions in all governance bodies was affirmed on the occasion of the 40th anniversary of the Convention on the Elimination of Discrimination against Women, the CEDAW and Inter-Parliamentary Union recommended states ensure an equal number of women and men in leadership positions in all governance bodies, through transparent and fair processes, such as dual leadership and gender rotation in leadership positions. OHCHR. (2019). *40th Anniversary of the Convention on the Elimination of Discrimination against Women*. [online] Available at: <https://www.ohchr.org/EN/NewsEvents/Pages/DisplayNews.aspx?NewsID=24279&LangID=E> [Accessed 22 Jun. 2019].

< 3.5 > Gender-responsive procurement

Public procurement accounts for over 30% of GDP in developing countries, and between 10-15% in developed countries. Of this, it is estimated that only 1% of the market is catered to by women entrepreneurs⁶⁸. The 2016 UN High-Level Panel on Women's Economic Empowerment confirmed that gender responsive procurement is one important way to advance gender equality and women's rights in local, national, and international economies⁶⁹. While the main goal of public procurement is to buy high quality goods and services that governments need, public procurement can also be used to promote socioeconomic objectives, build capacity and create wealth⁷⁰. Gender responsive procurement is smart economics⁷¹.

The private sector has acknowledged the great value of gender responsive procurement. In September 2017, EY announced a commitment to direct US\$100 million of global purchasing spend to women-owned businesses around the

68 International Trade Centre. (2017). *Public Procurement, a Tool to Boost Women's Economic Empowerment: Speech delivered by ITC Executive Director Arancha González at Scuola di Politiche, Milano 10 November 2017*. [online] Available at: <http://www.intracen.org/news/Public-Procurement-a-Tool-to-Boost-Womens-Economic-Empowerment/> [Accessed 22 Jun. 2019].

69 UN Secretary General's High Level Panel on Women's Economic Empowerment (2016). *Leave No One Behind - A Call to Action for Gender Equality and Women's Economic Empowerment*. [online] Available at: <https://www.empowerwomen.org/-/media/files/un%20women/empowerwomen/resources/hlp%20briefs/unhlp%20full%20report.pdf?la=enhttps://www.empowerwomen.org/-/media/files/un%20women/empowerwomen/resources/hlp%20briefs/unhlp%20full%20report.pdf?la=en> [Accessed 22 Jun. 2019].

70 Research shows that there is a positive correlation between gender equality and a country's gross domestic product (GDP) per capita. When women are excluded from the marketplace, the economy suffers. ITC (2014). *Empowering Women through Public Procurement*. [online] Available at: <http://www.intracen.org/uploadedFiles/intracenorg/Content/Publications/Women%20procurement%20guide-final-web.pdf> [Accessed 22 Jun. 2019].

71 When women are excluded from the marketplace, the economy suffers. Promoting gender equality is, in the words of former World Bank President Robert Zoellick, 'smart economics'. The same applies to using public procurement policy to stimulate entrepreneurial activity by women-owned businesses. Ibid.

world over the next three years’, as part of its ‘Women. Fast Forward’ campaign⁷². Preferential public procurement targets to boost women owned enterprises have been adopted by several governments – including Kenya, South Africa, Botswana, India, Israel, Namibia, Zambia, and the United States⁷³.

Establishing mandatory goals or targets for procuring entities is an important use of a targeted assistance strategy. For example, in the United States, the statutory target for small businesses ‘owned and controlled’ by women is not less than 5% of the total value of all federal contracts⁷⁴. These concepts can be important drivers in incentivising women owned and driven Artificial Intelligence (AI) businesses which then in turn could address one part of the problem regarding lack of women as decision-makers in AI. Organisations should undertake gender responsive procurement⁷⁵ and adopt guidelines that include hard targets to boost women owned enterprises and outline roles and responsibilities of those organisations required to apply the Guidelines.

72 EY (2017). EY commits to spend US\$100 million with women-owned businesses around the world by 2020. [online] Available at: <https://www.ey.com/gl/en/newsroom/news-releases/news-ey-commits-to-spend-100-million-with-women-owned-businesses-around-the-world-by-2020> [Accessed 22 Jun. 2019].

73 Chatham House The Royal Institute of International Affairs (2017). *Research paper Gender-smart Procurement Policies for Driving Change*. [online] Available at: <https://www.chathamhouse.org/sites/default/files/publications/research/Gender-smart%20Procurement%20-%202020.12.2017.pdf> [Accessed 24 Jun. 2019].

74 Ibid.

75 UN Women defines gender responsive procurement as the selection of goods, civil works or services that take into account their impact on gender equality and women’s empowerment. UN Women. (n.d.). *Gender-responsive procurement*. [online] Available at: <http://www.unwomen.org/en/about-us/procurement/gender-responsive-procurement> [Accessed 24 Jun. 2019].

< 3.6 > Improve datasets – Open gender disaggregated data, data collection and inclusive quality datasets

Several recent studies have focused on algorithmic fairness with respect to a specific metric. Despite this, there still remain important metrics for which we do not have fair classifiers⁷⁶. Open and gender disaggregated datasets better enable an understanding of the sources of bias in ADM. Open data is “disaggregated by gender and is easily accessible, machine-readable, accessible for free or at negligible cost, and with minimal limitations on its use, transformation and distribution (open data)”⁷⁷. Open data will ultimately improve the performance of machine learning systems. Organisations can also reduce the risks of gender bias in ADM by investing in controls to oversee data collection processes and human-in-the-loop verification (e.g. involving human operators within ADM), so that data is not collected at the expense of women and other traditionally excluded groups. We must ensure that no one is left behind⁷⁸. Barcelona provides a good practice example with 435 open datasets, which can be accessed through a dedicated website, Open Data BCN.⁷⁹

Engaging in more inclusive data collection processes to focus not only on quantity but on the quality of datasets can also improve datasets and ADM learning systems⁸⁰.

⁷⁶ Celis, E., Huang, L., Keswani, V. and Vishnoi, N. (2018). *Classification with fairness constraints: A meta-algorithm with provable guarantees*. arXiv preprint arXiv:1806.06055.

⁷⁷ Data-Pop Alliance. (2019). *Key Terms*. [online] Available at: <https://datapopalliance.org/resources-and-methodologies/key-terms/#open-data> [Accessed 1 Jul. 2019].

⁷⁸ World Wide Web Foundation (2017).

⁷⁹ Open Data BCN is now part of the Barcelona Ciutat Digital strategy which aims to foster a pluralistic digital economy and develop a new model of urban innovation based on the transformation and digital innovation of the public sector and the implication among companies, administrations, the academic world, organizations, communities and people, with a clear public and citizen leadership. Opendata-ajuntament.barcelona.cat. (2019). *Open Data BCN*. [online] Available at: <https://opendata-ajuntament.barcelona.cat/en/open-data-bcn> [Accessed 4 Jun. 2019].

Inclusion

Intersectional variety and equal numbers of women and girls in the creation, design and coding of ADM.

< 4.1 > Gender balance in AI decision-making

Although there has been a steady upward general trend of women filling the general ranks of employment at greater speed than men from 2002, particularly in Asia and the Pacific, Latin America and the Caribbean, Europe and Central Asia, with Africa and the Middle East having markedly smaller increases, any gains have yet to lead to a major shift in the gender composition of senior leadership and decision-making positions within companies⁸¹.

The World Economic Forum has found there is a significant gender gap among AI professionals. Only 22% of AI professionals globally are female, compared to 78% who are male. This accounts for a gender gap of 72% yet to close⁸². A recent estimate produced by WIRED and Element AI found that only 12% of researchers who contributed to the three leading machine learning conferences in 2017 were women⁸³. This gender gap is replicated at large technology firms like Facebook and Google – where according to their websites only 15% and 10% respectively of their AI research staff are women⁸⁴. The fact that women have remained largely under-represented and / or excluded in ADM has meant

81 International Labour Organisation (2019). *Women in Business and Management: the business case for change*. [online] Available at: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_700953.pdf [Accessed 24 Jun. 2019].

82 AI talent gender gaps are imperfectly correlated with the overall gender gaps in industries. The Software and IT Services industry has a gender gap of 42%. World Economic Forum (2018). *The Global Gender Gap Report 2018*. [online] Available at: http://www3.weforum.org/docs/WEF_GGGR_2018.pdf. [Accessed 1 Jul. 2019].

83 Simonite, T. (2018). *AI Is the Future—But Where Are the Women?* [online] WIRED. Available at: <https://www.wired.com/story/artificial-intelligence-researchers-gender-imbalance/> [Accessed 24 Jun. 2019].

that sometimes the ADM system is simply unfit or even dangerous for half of the world's population⁸⁵. An urgent and profound shift is needed. And one solution is straightforward: include the women who have been consciously or unconsciously excluded throughout the ADM product lifecycle of funding, design, adoption.

The ILO's report, *Women in Business and Management: the business case for change*, surveyed almost 13,000 enterprises in 70 countries. More than 57% of respondents agreed that gender diversity initiatives improved business outcomes. Almost three-quarters of those companies that tracked gender diversity in their management reported profit increases of between 5-20%, with the majority seeing increases between 10-15%⁸⁶. According to McKinsey, gender diversity on executive teams is strongly correlated with both profitability and value creation⁸⁷. Similarly, significant studies by Credit Suisse, Deloitte, and the Peterson Institute for International Economics in the past decade have all shown that the higher the proportion of women in senior management, the greater the return to shareholders – referred to by Deloitte as the gender dividend⁸⁸. There longstanding research shows that gender inequality has usually been associated with lower GDP growth in developing countries during the last few

85 The exclusion of women is not new. Women have historically and continuously been excluded from 20th century drug trials, international standards and global trading rules and now to 21st century algorithmic decision-making. Perez, C. (2019).

86 Additionally, in 60% of companies, fewer than 30% of senior managers and top executives are women. ILO, 2019.

87 Hunt, V., Prince, S., Dixon-Fyle, S. and Yee, L. (2018). *Delivering through Diversity*. [online] *McKinsey&Company*. Available at: https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Organization/Our%20Insights/Delivering%20through%20diversity/Delivering-through-diversity_full-report.ashx [Accessed 1 Jul. 2019].

88 Credit Suisse (2016). *The CS Gender 3000: The Reward for Change*. [online] Available at: <https://www.credit-suisse.com/corporate/en/research/research-institute/publications.html> [Accessed 1 Jul. 2019]. Noland, M., Moran, T. and Kotschwar, B. (2016). *Is Gender Diversity Profitable? Evidence from a Global Survey*. Peterson Institute for International Economics Working Paper No WP 16-3. [online] Peterson Institute for International Economics. Available at: <https://www.piie.com/publications/working-papers/gender-diversity-profitable-evidence-global-survey> [Accessed 1 Jul. 2019].

decades⁸⁹. Similarly, the World Economic Forum has found there is a positive correlation between gender equality and a country's level of competitiveness, GDP per capita and its rank in the Human Development Index⁹⁰.

The Committee on the Elimination of Discrimination against Women (CEDAW) affirms the importance of empowering all women through education and training in government, public policy, economics, information technology and science to ensure that they develop the knowledge and skills needed to make full contributions in all spheres of public life in its General recommendation No. 36 (2017) on the right of girls and women to education⁹¹. Additionally, there is mounting evidence that there are efficiency gains from removing gender gaps and promoting gender equality in decision-making positions. Amongst efficiency gains is that women in decision-making positions contribute to the definition of a new agenda for the organisation⁹². A 2018 study by Boston Consulting Group found that that increasing the diversity of leadership teams leads to more and better innovation and improved financial performance⁹³.

The inclusion of intersectional feminists will assist and trigger greater innovation and creativity. IBM in its report 'The Business Case for Gender

89 Klasen, S. and Lamanna, F. (2009). *The Impact of Gender Inequality in Education and Employment on Economic Growth: New Evidence for a Panel of Countries*. *Feminist Economics*, 15(3), pp.91-132. Gruen, C. and Klasen, S. (2007). *Growth, inequality, and welfare: comparisons across space and time*. *Oxford Economic Papers*, 60(2), pp.212-236.

90 World Economic Forum (2018).

91 Committee on the Elimination of Discrimination against Women (2017). *General recommendation No. 36 (2017) on the right of girls and women to education*. [online] Available at: https://tbinternet.ohchr.org/Treaties/CEDAW/Shared%20Documents/1_Global/CEDAW_C_GC_36_8422_E.pdf [Accessed 22 Jun. 2019].

92 Profeta, P. (2017). Gender Equality in Decision-Making Positions: The Efficiency Gains. *Intereconomics*, 52(1), pp.34-37.

93 Boston Consulting Group surveyed employees at more than 1,700 companies in eight countries (Austria, Brazil, China, France, Germany, India, Switzerland and the US) across a variety of industries and company sizes. To gauge a company's level of innovation the survey looked at the percentage of total revenue from new products and services launched over the past three years. Companies that reported above-average diversity on their management teams also reported innovation revenue that was 19 percentage points higher than that of companies with below-average leadership diversity—45% of total revenue versus just 26%.

Balance’, presents IBM research on growth and innovation that shows the level of organizational innovation in a strong diversity climate is four times higher (71%) than in companies with a weak diversity and inclusion climate (16%); additionally, organisations with strong innovation levels tend to be linked to significantly increased levels of organisational performance⁹⁴; and why organizations should encourage and support women’s career progression and address gender imbalance in senior management. The inclusion of more intersectional women will also help detect and mitigate bias and potential harmful effects on women and those who have been traditionally excluded⁹⁵.

< 4.2 > Gender balance in design teams

The digital tools that will increasingly make up our new reality are also being designed without the input of women (e.g. currently some 83% of ICT professionals in the EU are men)⁹⁶. However, a review of decades of scientific articles and patent applications reveal that our most important scientific innovations are increasingly produced by collaborating teams⁹⁷. Evidence strongly suggests that team collaboration is greatly improved by the presence of women in the group⁹⁸. Together these findings imply that promoting the role of women in AI design teams could have positive consequences for productivity (and therefore innovation) by enhancing the quality of collaboration taking

94 Lorenzo, R., Tsusaka, M., Krentz, M., Abouzahr, K. and Voigt, N. (2018). *How Diverse Leadership Teams Boost Innovation*. [online] Boston Consulting Group. Available at: <https://www.bcg.com/publications/2018/how-diverse-leadership-teams-boost-innovation.aspx> [Accessed 24 Jul. 2019].

95 Turner Lee, N., Resnick, P. and Barton, G. (2019). *Algorithmic bias detection and mitigation: Best practices and policies to reduce consumer harms*. [online] Brookings. Available at: <https://www.brookings.edu/research/algorithmic-bias-detection-and-mitigation-best-practices-and-policies-to-reduce-consumer-harms/> [Accessed 1 Jun. 2019].

96 European Institute for Gender Equality. (2019). *Women in decision-making: why it matters*. [online] Available at: <https://eige.europa.eu/news/women-decision-making-why-it-matters> [Accessed 24 Jun. 2019].

97 Wuchty, S., Jones, B. and Uzzi, B. (2007). *The Increasing Dominance of Teams in Production of Knowledge*. *Science*, 316(5827), pp.1036-1039.

98 Woolley, A., Chabris, C., Pentland, A., Hashmi, N. and Malone, T. (2010). *Evidence for a Collective Intelligence Factor in the Performance of Human Groups*. *Science*, 330(6004), pp.686-688.

place in teams⁹⁹. Another study of group performance in a business simulation by Fenwick and Neal (2001) found that groups with equal numbers of men and women, and/or groups with a greater number of women than men, performed better than homogeneous groups on a management simulation task¹⁰⁰. Similarly, a 2018 study published by Deloitte found that gender diversity in technology teams had a number of benefits including better problem-solving, increased innovation, better group performance and improved operational financial benefits (amongst a number of other benefits)¹⁰¹.

< 4.3 > **Require companies to proactively disclose and report on gender balance targets in design teams**

To promote gender equality in research and innovation the European Commission and the Helsinki Group on Gender in Research and Innovation guidance recommends that targets and/or quotas are an element of an overall strategy of cultural and institutional changes at national level¹⁰².

Over a dozen countries have established targets for female representation on publicly traded corporate and/or state-owned enterprise boards of directors, ranging from 33-50%, with various sanctions¹⁰³. Other countries have introduced

99 Bear, J. and Woolley, A. (2011). The role of gender in team collaboration and performance. *Interdisciplinary Science Reviews*, 36(2), pp.146-153. Likewise, a study by Jehn and Bezrukova found that gender diversity increased constructive group processes. Jehn, K., Northcraft, G. and Neale, M. (1999). *Why Differences Make a Difference: A Field Study of Diversity, Conflict, and Performance in Workgroups*. *Administrative Science Quarterly*, 44(4), p.741.

100 Fenwick, G. and Neal, D. (2001). *Effect of Gender Composition on Group Performance*. *Gender, Work & Organization*, 8(2), pp.205-225.

101 Prabhakar, K., Lamar, K., Shaikh, A. and Brown, C. (2018). *Smashing IT's glass ceiling - Perspectives from leading women CIOs*. [online]

102 European Commission (2018). *Guidance to facilitate the implementation of targets to promote gender equality in research and innovation*. [online] Available at: https://ec.europa.eu/research/swafs/pdf/pub_gender_equality/KI-07-17-199-EN-N.pdf [Accessed 24 Jun. 2019].

103 In Belgium, France and Italy firms that fail to comply can be fined, dissolved or banned from paying directors. Germany, Spain and the Netherlands prefer quotas without sanctions. C, S. (2019). Are gender quotas good for business? *The Economist*. [online] Available at: <https://www.economist.com/the-economist-explains/2018/09/03/are-gender-quotas-good-for-business> [Accessed 24 Jun. 2019].

non-binding gender targets in their corporate governance codes enforcing a “comply or explain” principle¹⁰⁴. Adoption of temporary special measures aimed at accelerating de facto equality is also a measure the private sector or a country can take in order to hit hard targets of representation in a timely fashion¹⁰⁵. For example, to increase the number of women in academic roles to 25% over a period of five years, Australia’s University of Melbourne School of Engineering, advertised 20 academic roles within its engineering school. Taking into account the low representation of women in the school’s academic workforce, the slow increase in the number of women and the modest aim of increasing that representation to 25%, this was permitted under Australia’s laws relating to special measures. Similarly, a number of other companies in Australia have been permitted to target woman only candidates for positions and shortlisting for leadership, management, executive or board level roles¹⁰⁶. Proactive disclosure and reporting on gender balance targets in design teams will contribute to public accountability of gender equality throughout the ADM product lifecycle.

104 Britain opted for guidelines, and names and shames companies that fall short. Ibid.

105 UN. (n.d.). CEDAW 29th Session 30 June to 25 July 2003. [online] Available at: <https://www.un.org/womenwatch/daw/cedaw/text/econvention.htm> [Accessed 1 Jul. 2019]. The importance of special measures has been long recognised by CEDAW – General Recommendation No. 5: Temporary Special Measures 1988 and General recommendation No. 25. Refworld. (1988). *CEDAW General Recommendation No. 5: Temporary Special Measures*. [online] Available at: <https://www.refworld.org/docid/52dcfeb84.html> [Accessed 1 Jul. 2019].

106 *Australia’s Sex Discrimination Act 1984* (Cth) allows special measures that improve equality of opportunity for people based on their sex, sexual orientation, gender identity, intersex status, relationship status, pregnancy or potential pregnancy status or family responsibility. Australia’s A-status National Human Rights Institution, the Australian Human Rights Commission has developed Guidelines intended to assist organisations and individuals to understand and use the special measures provisions in the *Sex Discrimination Act* (Cth). Australian Human Rights Commission (2018). *Guidelines: Special measures under the Sex Discrimination Act 1984* (Cth). [online] Australian Human Rights Commission. Available at: https://www.humanrights.gov.au/sites/default/files/document/publication/AHRC_SDA_Special_Measures_Guidelines%202018.pdf [Accessed 1 Jul. 2019]. Legislation.gov.au. (2017). *Sex Discrimination Act 1984*. [online] Available at: <https://www.legislation.gov.au/Details/C2014C00002> [Accessed 10 Mar. 2017]. Victorian Equal Opportunity and Human Rights Commission. (n.d.). *Examples of special measures*. [online] Available at: <https://www.humanrightscommission.vic.gov.au/discrimination/exceptions-exemptions-and-special-measures/special-measures/examples-of-special-measures> [Accessed 1 Jul. 2019].

< 4.4 > **Require universities and start-ups to proactively disclose and report on gender balance targets in research and design teams, including upstream when applying for grants**

There is a unique opportunity through the provision of funding to influence, advocate for and create change that addresses gender and diversity in research and innovation. This was affirmed in 2016 when the Global Research Council (GRC) endorsed the *Statement of Principles and Actions: Promoting the Equality and Status of Women in Research*, with the aims of increasing the participation and promotion of women in the research workforce and considering the integration of the gender dimension in research design and in the analysis of research outcomes¹⁰⁷. The imperative to include women in research workforces was further affirmed in 2017 through the GRC's creation of the Gender Working Group (GWG) to champion the implementation of the 2016 Statement of Principles and Actions¹⁰⁸.

There is evidence that suggests that targets work and public reporting and accountability work hand in hand. In Austria, national legislation was introduced to require university bodies to meet a quota of 40% of female members. By 2016, all but one of the university body had filled this quota and in 2015 the quota was raised to 50%.¹⁰⁹

We must incentivize teams that are balanced and multi-disciplinary. Prizes and awards incentives provide competition between institutions and are now considered a basic requirement for results-oriented actions towards encouraging gender equality. The EU and European Commission have adopted measures including funding schemes, prizes and awards to increase women's

107 The Global Research Council is a virtual organisation, comprised of the heads of science and engineering funding agencies from around the world, dedicated to promoting the sharing of data and best practices for high-quality collaboration among funding agencies worldwide. Global Research Council (2019).

108 The Gender Working Group is constituted by representatives of all GRG regions who are nominated and supported by their GRC Heads of Research Council. Ibid.

109 European Institute for Gender Equality. (n.d.). Austria. [online] Available at: <https://eige.europa.eu/gender-mainstreaming/toolkits/gear/legislative-policy-backgrounds/austria> [Accessed 24 Jun. 2019]. Pyke, J. and White, K. (2018). *Gender quotas and targets would speed up progress on gender equity in academia*. [online] Phys.org. Available at: <https://phys.org/news/2018-08-gender-quotas-equity-academia.html> [Accessed 24 Jun. 2019]

participation in STEM labour force and research and innovation¹¹⁰.

For example, the EU Prize for Women Innovators is awarded every year to European women who founded a successful company and bring innovation to market, and the European Commission Call for Tech StartUps awards prizes to women who co-own a tech startup¹¹¹. Likewise, the Athena-SWAN Charter promotes practices to eliminate gender bias and foster an inclusive culture that values female staff, through the establishment of prizes and awards. In 2016, the European Institute for Gender Equality identified that the Athena-SWAN Charter was one of the most impactful strategies to support gender mainstreaming in EU member states – in the United Kingdom (UK), 136 out of 168 research institutions have adopted strategies as part of the Athena SWAN Charter scheme¹¹².

< 4.5 > Research fund

The AI research community and those producing AI products must go beyond focusing on mathematical definitions in efforts to adjust ADM systems to produce “fair” outcomes¹¹³. Experts in ethics as well as social scientists, lawyers, anthropologists, philosophers, civil society organisations, private sector and

110 Fatourou, P., Papageorgiou, Y. and Petousi, V. (2019). *Women are needed in STEM*. *Communications of the ACM*, 62(4), pp.52-52).

111 European Commission. (2019). *EU prize for women innovators*. [online] Available at: https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/prizes/eu-prize-women-innovators_en [Accessed 25 Jun. 2019]. European Commission. (2018). *Call for tech-startups that are led by women - Digital Single Market - European Commission*. [online] Available at: <https://ec.europa.eu/digital-single-market/en/news/call-tech-startups-are-led-women> [Accessed 25 Jun. 2019]).

112 Kalpazidou Schmidt, E., Bühner, S., Schraudner, M., Reidl, S., Jörg, M., Palmen, R., Haase, S., Graversen, E., Holzinger, F., Striebing, C., Groó, D., Klein, S., Dorottya, R. and Høg Utoft, E. (2017). *A Conceptual Evaluation Framework for Promoting Gender Equality in Research and Innovation Toolbox I - A synthesis report*. [online] Available at: <https://efforti.eu/sites/default/files/2018-03/EFFORTI%20D3.3%20FINAL%2027032018.pdf> [Accessed 25 Jun. 2019]).

113 Narayanan, A. (2018). *21 fairness definitions and their politics*. *ACM Conference on Fairness, Accountability and Transparency*. [image] Available at: <https://www.youtube.com/watch?v=-jIXluYdnyk> [Accessed 4 Jul. 2019].

data scientists should work together with affected communities¹¹⁴. Research shows that multidisciplinary research enables a project team to capitalize on a broader range of insight, when drawing from several disciplines¹¹⁵. A multi-agency, multi-disciplinary team collaborating on a US Army research project involving a dynamic military command and control simulation, found that a multidisciplinary approach allowed the team to draw upon individuals unique yet complementary areas of expertise in order to address the numerous challenges during planning and execution of the experiment and, thereby, achieve a greater return on investment¹¹⁶.

Funds must be prioritised and directed to this holistic and multi-disciplinary research approach that seeks to understand: how ADM are shaped by the environments in which they are built; the people that build them and; the economic, political and social effects ADM have on the lives of women and girls and those who are traditionally excluded from rules-making and decision-taking¹¹⁷.

114 European Parliamentary Research Service (2019). *A governance framework for algorithmic accountability and transparency*.

115 M. Cuevas, H., A. Bolstad, C., Oberbreckling, R., LaVoie, N. and Kuhl Mitchell, D. (2012). *Benefits and Challenges of Multidisciplinary Project Teams: “Lessons Learned” for Researchers and Practitioners*. The ITEA Journal (International Test and Evaluation Association), 33(1).

116 Ibid.

117 Avila, R., Brandusescu, A., Ortiz Freuler, J. and Thakur, D. (2018). *Policy Brief W20 Argentina Artificial Intelligence: open questions about gender inclusion*. [online] World Wide Web Foundation. Available at: <http://webfoundation.org/docs/2018/06/AI-Gender.pdf> [Accessed 1 Jun. 2019].

Cooperation

International cooperation and an approach to automated decision-making grounded in human rights.

< 5.1 > UN agencies-wide review of the application of existing international human rights law and standards for ADM and gender

< 5.1.1 > Artificial Intelligence National Strategies¹¹⁸

The race to become the global leader in AI has accelerated in the last two and a half years. Over this time, Canada¹¹⁹, China¹²⁰, Denmark¹²¹, the EU Commission¹²²,

118 Infographic from years 2017 and 2018 – Dutton, T. (2018). *An Overview of National AI Strategies*. [online] Medium Politics + AI. Available at: <https://medium.com/politics-ai/an-overview-of-national-ai-strategies-2a70ec6edfd> [Accessed 24 Jun. 2019].

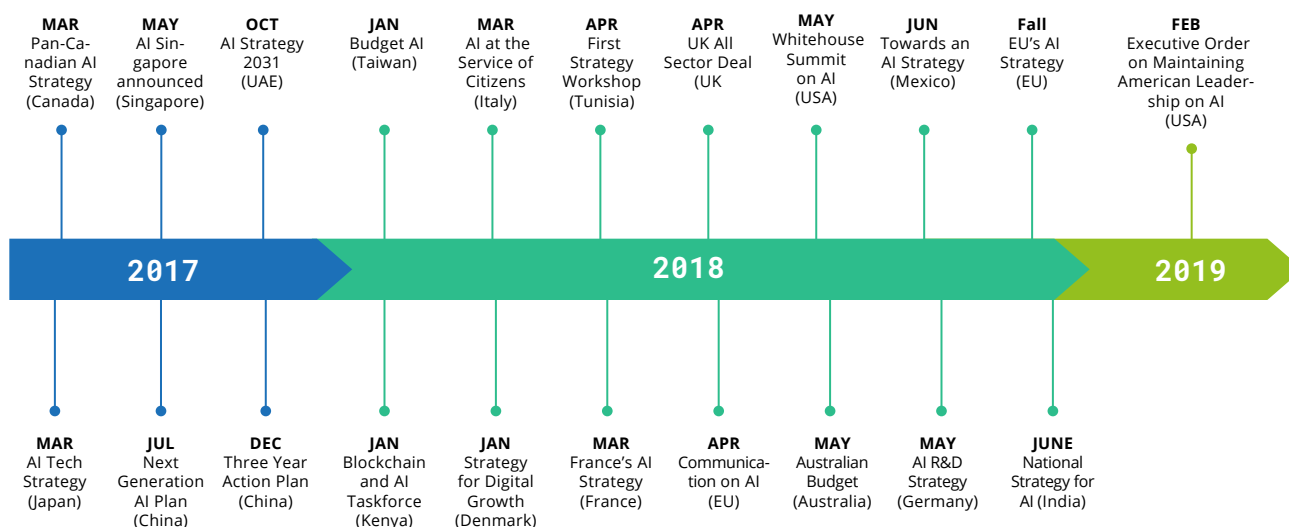
119 Canada was the first country in the world to release a National AI strategy, the Pan-Canadian Artificial Intelligence Strategy in March 2017. Ibid.

120 In July 2017, China publicly released its national AI strategy, A Next Generation Artificial Intelligence Development Plan The plan includes strategies and goals for research and development, industrialisation policy, talent development, education and skills attainment, standard setting and regulations, ethical norms and security. Ibid.

121 Denmark's Strategy for Denmark's Digital Growth, released January 2018, aims to make Denmark a leader in the digital revolution and to create growth and wealth for all Danish people. Rather than focusing exclusively on advances in AI, the strategy concentrates on AI, big data, and the Internet of Things. Ibid.

122 In April 2018, the EU Commission adopted the Communication on Artificial Intelligence and then in December 2018, the EU Commission released the Coordinated plan on Artificial Intelligence.

Finland, France, India, Italy, Japan¹²³, Germany¹²⁴, Mexico, the Nordic region, Singapore¹²⁵, South Korea, Sweden, Taiwan, the UAE, and the UK¹²⁶ have released strategies to promote the use and development of AI¹²⁷. Each strategy focuses on different aspects of AI policy – scientific research, talent development, skills and education, public and private sector adoption, ethics and inclusion, standards and regulations and data and digital infrastructure. No two countries’ strategies are alike¹²⁸.



123 In March 2019, Japan released its Artificial Intelligence Technology Strategy. Japan has long recognised a need for coordinated International Standards for AI. In April 2016 at the G-7 tech meeting in Shikoku, Japan, the Japanese Government proposed the establishment of a set of basic rules for developing AI. Ibid.

124 This comprehensive strategy includes the promotion and development of transparent and ethical AI, integrating AI into government services, encouraging greater accessibility to data and policies to attract AI talent to Germany. Ibid.

125 Singapore realised its AI strategy, AI Singapore, in May 2017. This strategy is a government-wide partnership involving six different public organizations and cooperation of private industry and academia. It is a five-year \$150 million national strategic plan to enhance Singapore’s capabilities in AI. Ibid.

126 In April 2018, the UK Government released an AI Sector Deal. This plan is part of the UK government’s larger industrial strategy and aims to position the UK as a global leader in AI. Ibid.

127 Ibid.

128 Ibid.

< 5.1.2 > Artificial Intelligence - International efforts

International efforts to address issues arising from ADM are highly dispersed across multiple sector initiatives within the human rights and disarmament spaces and under the umbrella of UNESCO¹²⁹. Most recently, the High-level Panel on Digital Cooperation released its report *The Age of Digital Interdependence* to the United Nations Secretary-General on 10 June 2019¹³⁰.

The Organisation for Economic Co-operation and Development (OECD) recently released the *OECD AI Principles*¹³¹. Standardisation in the area of AI, through the International Organisation for Standardization (ISO) and International Electrotechnical Commission (IEC), are still in the early stages of development. Many of the world's leading technology companies and other standards setting bodies such as the International Telecommunication Union (ITU) and the Institute of Electrical and Electronic Engineers (IEEE) are also developing ADM technologies and frameworks¹³².

It is abundantly clear that many organizations are wrestling with these issues

129 This includes UN led efforts to: Encourage the development of 'AI for Good' to address the UN Sustainable Development Goals (SDGs), managed by ITU; Ban Lethal Autonomous Weapon Systems, primarily discussed under the banner of the UN Convention on certain Conventional Weapons (UNCCW); and a multi-stakeholder dialog on ethics and governance of AI/algorithmic systems, in the frame of the Internet Governance Forum (IGF) under the umbrella of UNESCO. Panel for the Future of Science and Technology. European Parliamentary Research Service (2019). *A governance framework for algorithmic accountability and transparency*.

130 This report was mandated by the United Nations Secretary-General (SG) and makes five sets of recommendations: build an inclusive digital economy and society; develop human and institutional capacity; protect human rights and human agency; protect digital trust, security and stability; and foster global cooperation. UN Secretary-General's High-level Panel on Digital Cooperation (2019).

131 OECD. (2019). *OECD Principles on Artificial Intelligence - Organisation for Economic Co-operation and Development*. [online] Available at: <https://www.oecd.org/going-digital/ai/principles/> [Accessed 1 Jul. 2019].

132 OECD. (2019). *OECD Principles on Artificial Intelligence - Organisation for Economic Co-operation and Development*. [online] Available at: <https://www.oecd.org/going-digital/ai/principles/> [Accessed 1 Jul. 2019].

and the global landscape is littered with new initiatives¹³³. Critical thinking on the issues is siloed and uncoordinated. International cooperation and multi-stakeholder cooperation of governments, civil society, academics, technologists and the private sector is needed. Diverse voices are needed at the table – women and those traditionally left behind¹³⁴.

Technology presents challenges that were not foreseen when the foundational human rights instruments were created¹³⁵. There is a critical need for guidance on the application of existing international human rights law and standards for ADM. Mass scale correction of skewed data systems will require multilateral and international cooperation to ensure that no one is left behind. The UN is positioned well to lead on this, for example through an initial UN agencies-wide review and engagement with states and other stakeholders, to consider the development of a set of metrics for digital inclusiveness. It is envisaged that this action would guide and provoke creative thinking for an approach grounded in human rights that is fit for purpose in the fast-changing digital age¹³⁶.

133 E-commerce proposals being discussed at the WTO as well as regional trade negotiations (such as the Regional Comprehensive Economic Partnership (RCEP) and others) include proposals to protect Intellectual Property by restricting access to information regarding proprietary algorithms. European Parliamentary Research Service (2019). *A governance framework for algorithmic accountability and transparency*.

134 UN Secretary-General's High-level Panel on Digital Cooperation (2019).

135 International human rights law guarantees States obligations and duties under international law to respect, to protect and to fulfil human rights. The 2011 UN Guiding Principles on Business and Human Rights affirms that states have the duty to protect rights and provide remedies, and businesses also have a responsibility to respect human rights, evaluate risk and assess the human rights impact of their actions. Ibid.

Recommendations

“The best way to predict the future is to invent it”¹³⁷

We call on Governments, Private Sector and Civil Society Organizations to undertake Algorithmic equitable actions to correct real life biases and barriers that prevent women and girls from achieving full participation and equal enjoyment of rights:

- < 6.1> Advocate for and adopt guidelines that establish accountability and transparency for algorithmic decision-making (adm) in both the public and private sector.**

We must ensure machine learning does not embed an already biased system into all our futures.

Recommendations:

- > Public institutions to Pilot and Lead:** Affirmative Action for Algorithms deployed when public institutions pilot ADM. Base pilots on longstanding and new social science research that allocate social incentives, subsidies, or scholarships where women have traditionally been left behind by prior systems. This is a positive agenda to advance values of equality we have long embraced, to correct for the visibility, quality and influence of women proportionate to the population.

137 Alan Kay, at a 1971 meeting of XeroxPARC where he worked on world-changing inventions like the graphical interface, object-oriented programming, and the personal computer itself. Later, at Apple, Atari, HP, Disney, Kay helped refine the tools he anticipated long before they were realized. As the industry blossomed, however, Kay grappled with the deeper purpose of computing, struggling to create the machine that wouldn't only recapitulate patterns in the world as we know it. Barnes, S. (2007). Alan Kay: Transforming the Computer into a Communication Medium. *IEEE Annals of the History of Computing*, 29(2), pp.18-30.

- > **Public and Private sector uptake of Algorithmic Impact Assessments (AIA):** A self-assessment framework designed to respect the public's right to know the AI systems that impact their lives in terms of principles of accountability and fairness.

- > **Rigorous testing across the lifecycle of AI systems:** Testing should account for the origins and use of training data, test data, models, Application Program Interfaces (APIs) and other components over a product life cycle. Testing should cover pre-release trials, independent auditing, certification and ongoing monitoring to test for bias and other harms. ADM should improve the quality of, not control the human experience.

- > **Strong legal frameworks to promote accountability:** Including potential expansion of powers for sector specific agencies, or creation of new terms of reference to oversee, audit and monitor ADM systems for regulatory oversight and legal liability on the private and public sector.

- > **Gender-responsive procurement guidelines:** Organizations and all levels of Government, to develop ADM gender equality procurement guidelines with hard targets; and outline roles and responsibilities of those organisations required to apply these principles.

- > **Improve datasets – Open gender disaggregated data, data collection and inclusive quality datasets:** Actively produce open gender disaggregated datasets; this better enables an understanding of the sources of bias in AI, to ultimately improve the performance of machine learning systems. Invest in controls to oversee data collection processes and human-in-the-loop verification, so that data is not collected at the expense of women and other traditionally excluded groups. Engage in more inclusive data collection processes that focus not only on quantity but also on the quality of datasets.

< 6.2 > Take clear proactive steps to include an intersectional variety and equal numbers of women and girls in the creation, design and coding of ADM.

New technologies offer new opportunities including the creation of genuinely new structures that require new ideas and new teams. Gender roles being removed from the real world are being baked into new ADM with the old and stereotypical conceptions and associations of gender, race and class. Innovative and inclusive thinking are necessary. This imagination and skill can be provided by the largest untapped intellectual resource on the planet – women and girls.

Recommendations:

- > Gender balance in AI decision-making:** Gender balance in decision-making should be put on the official agenda of all involved with the funding, design, adoption and evaluation of ADM.
- > Gender balance in design teams:** Employment of a robust range of intersectional feminists in the design of ADM systems will trigger and assist greater innovation and creativity, as well detection and mitigation of bias and harmful effects on women, girls and the traditionally excluded.
- > Require companies to proactively disclose and report on gender balance targets in design teams.** Incentivize companies with balanced teams.
- > Require universities and start-ups to proactively disclose and report on gender balance targets in research and design teams, including upstream when applying for grants.** Incentivize teams that are balanced and multi-disciplinary.
- > Research fund:** Create a research fund to explore the impacts of gender and AI, machine learning, bias and fairness, with a multi-disciplinary approach beyond the computer science and engineering lens to include new ways of embedding digital literacy, and study the economic, political and social effects of ADM on the lives of women and those traditionally excluded from rules making and decision-taking.

< 6.3 > International cooperation and an approach to ADM and machine learning grounded in human rights

Mass scale correction of skewed data systems will require multilateral and international cooperation to ensure we leave no one behind.

Recomendations:

- > A UN agencies-wide review of the application of existing international human rights law and standards for ADM and gender:** This can guide and provoke the creative thinking for an approach grounded in human rights that is fit for purpose in the fast-changing digital age.

- > Development of a set of metrics for digital inclusiveness:** To be urgently agreed, measured worldwide and detailed with sex disaggregated data in the annual reports of institutions such as the UN, the International Monetary Fund, the International Telecommunication Union, the World Bank, other multilateral development banks and the OECD.

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