


# Encoded Biases & Future Imaginaries



# POLLICY



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# executive summary

This paper is the second in a series of three papers that explore the relationship between women in Africa today and Artificial Intelligence. Our Engendering AI report provided a broad overview of the state of AI in Africa and on women in Africa today, including an overview of the foundations and barriers impacting the development and integration of Artificial Intelligence on the continent. With the aid of these technologies which mark the Fourth Industrial Revolution (4IR), Africa has an opportunity to propel development across various spheres of the economy and improve the lives of people living on the continent. However, there are risks of uneven growth and development which risk leaving out or worsening the situation of African women today.

In this paper, we explore the threats and benefits Artificial Intelligence brings to African women in different sectors. We explore what it means to be an African woman today from a pre-colonial, colonial, and postcolonial lens and how the intersection of various forces of production and society give insight into the ways African women's lives are currently being and will continue to be impacted by this technology.

Our report concludes with recommendations for various stakeholders with the power to shape the adoption and development of AI on the continent, among them the academia, the government, and tech companies and developers.

Through this report, we aim to contribute to gendered analysis on the continent about the impact of Artificial Intelligence on the continent by providing some context into the lived experiences of women in Africa.

# acronyms

**4IR** - Fourth Industrial Revolution

**ADM** - Automated Decision Making

**AI** - Artificial Intelligence

**CAD** - Computer-Aided Design

**CEDAW** - Convention on the Elimination of All Forms of Discrimination Against Women

**ICT** - Information and Communication Technologies

**IOT** - Internet of Things

**LMICs** - Low and Middle-Income Countries

**OECD** - Organisation for Economic Co-operation and Development

**RSIF** - Regional Scholarship and Innovation Fund

**SDK** - Software Development Kit

**STEM** - Science, Technology, Engineering and Mathematics

**WEF** - World Economic Forum

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# Introduction



The digital landscape in Africa is undergoing a radical transformation and has become a driving force for innovative, inclusive and sustainable growth. Innovations and digitalisation stimulate job creation and contribute to addressing poverty, reducing inequality, facilitating the delivery of goods and services, and the achievement of development across the African continent (African Union, 2020). Today's technologies indicate the scale and speed at which technology is transforming traditional socio-economic sectors. However, for African women, this transformation has come with many challenges related to living fully productive lives, and poses social and gender inequality challenges. Research has revealed disparities in earning capacity, internet access, access to education and health, and many others, which have denied women all over Africa the right to self-sufficiency and autonomy (McKinsey, 2019).

According to a 2019 report on the mobile gender gap by GSMA, 250 million more men use the internet than women (GSMA, 2019). Another piece of research by the Organisation for Economic Co-operation and Development (OECD), focused on bridging the digital gender divide revealed that women are under-represented in ICT jobs, top management and academic careers. Men were also four times more likely than women to be ICT specialists (OECD, 2018).

Moreover, hurdles to access, affordability, lack of education, and inherent biases and socio-cultural norms curtail women's ability to benefit from the opportunities offered by the digital transformation. In comparison with men, women face relatively lower educational enrolment in disciplines that would allow them to perform well in a digital world, such as science, technology, engineering and mathematics (STEM), and information and communication technologies (ICT) (World

Economic Forum, 2018). Coupled with women's more limited use of digital tools, this could lead to widening gaps and greater inequality.

Amidst this state of affairs, Artificial Intelligence (AI) has been consistently described as a fulcrum for the future of the industrial revolution. Advances in technology are already seeing the coupling of AI with sectors such as agriculture, education, finance and health to improve productivity and desired output and goods and services. However, conversations surrounding the impact of AI on the future of African women often ignore the potentially disruptive realities of its effects on women, dispensing with gendered analysis of the subject. As far back as the 1980s, researchers already were concerned about the development of computers, and by extension, technology, as a conservative force used to entrench existing power structures (Birhane, 2020). As the adoption of AI continues to grow throughout Africa, it is vital to take note of the existing and potential ways AI iterations and their use cases impact the lives of African women.

In our *Engendering AI* report, we provided a broad overview of the state of AI in Africa and on women in Africa today. The report included an overview of the foundations and barriers impacting the development and integration of Artificial Intelligence on the continent. This paper, which is the second in our series, will explore the impact of Artificial Intelligence on African end-users and consumers who identify as women and potential threats to women in different sectors.

The consensus view on each of the topics discussed in this paper is followed by a discussion on current practices, challenges and relevant examples of AI applied by drawing the considerable and existing body of literature on AI.

# Current Impact of AI on African Women





Today, through the integration of Artificial Intelligence (AI) in many sectors, many gaps in service delivery are being met, enhancing productivity. With AI's ability to utilise data to make decisions, many women in Africa can access previously unavailable services and products. In addition, African women are taking their place at the forefront of development across various fields and sectors to empower themselves and rewrite and change narratives about themselves and Africa.

### **Online Content Moderation**

The automation of online user-generated content moderation came about as a response to the moderation challenges involved with monitoring the content produced by the massive number of people interacting on online platforms today (Gillespie, 2020). With the aid of AI, social media platforms, for instance, are better able to identify harmful, abusive content in the form of hate speech, graphic violence or child abuse.

AI algorithms perform content moderation in various ways, such as nudging user actions,

demonetisation, or promoting positive interactions. Organisations using machine learning for content moderation often deploy it at multiple points in content creation and publication: at the pre-moderation stage, before publication and at the post-moderation stage, after publication (Cambridge Consultants, 2019).

However, it is essential to note that the use of automation and AI for content moderation is relatively new. AI algorithms have been rightly criticised for their inability to distinguish between hate speech and satire and to properly moderate content written in African indigenous languages (Bacchi, 2021). These deficiencies make it hard to keep these spaces safe for African women on the internet who face online abuse in their own languages.

However, with developments in Natural Language Processing, it might be possible to train content moderation algorithms to identify patterns and similarities in the textual content on these platforms in order to make digital spaces safer, as illustrated in the case study below.

**Masakhane (Masakhane, n.d) is a grassroots organisation whose mission is to strengthen and spur NLP research in African languages, for Africans, by Africans. Beyond content moderation, the group hopes to solve problems related to education, climate change, agriculture, and others by making research and content available in African languages so they are more accessible to Africans today (Johnson, 2019).**

**The group employed several recruitment strategies, beginning with local demand at a machine learning school, Deep Learning Indaba, meetups and universities. Distant connections were made through Twitter, conference workshops, and eventually press coverage and research publications.**

**The language dataset creation process is ongoing, with new initiatives still emerging. A few initiatives to demonstrate the Machine Translation process include:**

- 1 A team of Nigerian participants, driven by the internal demand to ensure that accessible and representative data of their culture is used to train models, are translating their own writings, including personal religious stories and undergraduate theses, into Yoruba and Igbo.**
- 2 A Namibian participant, driven by a passion for preserving the culture of the Damara, is hosting collaborative sessions with Damara speakers to collect and translate phrases that reflect Damara culture around traditional clothing, songs, and prayers.**
- 3 A connection between a translator in South Africa's parliament and a language technologist has enabled the curation and easy navigation of data from the parliament in South Africa's languages (which are public but not publicly accessible).**

## **Health**

In the health sector, medical and health practitioners use AI in various ways ranging from human resource planning, resource allocation, health diagnoses and even detecting fake drugs (Owoyemi et al., 2020). AI was also deployed in a number of clinical ways during the COVID-19 pandemic, including complex risk assessment, surge prediction, and evaluation of response efforts (The Future Society, 2020). However, the deployment of AI in the health sector, like many sectors in Africa, is plagued by resource barriers, especially data availability. In Africa, data is often siloed within private organisations or in

non-machine readable formats. Unfortunately, this data access problem is compounded by the very sensitive nature of health data required to run these AI systems. Therefore, innovation in this field requires the accountability and regulatory frameworks to protect the interests of private citizens and their personal data from data brokers.

A large number of initiatives focus on developing diagnostics services that help health professionals and patients identify ailments. One such organisation is minoHealth AI Labs, a Ghanaian data science start-up that offers diagnostics, forecasts and prognostics services for conditions

such as cancer detection, pneumonia, fibrosis, hernia, oedema, cardiomegaly, emphysema (minoHealth AI Labs, n.d.).

Already, women in Africa are beginning to use digital tools to combat medical misogyny at the hands of overstretched and sexist medical professionals (Ugwuede, 2020). Apps developed

to track headaches, urination and menstrual cycles help women better describe their symptoms at hospitals and get better care. With AI-powered smart accessories and wearables, it is even more possible to improve the quality of data collected and better analyse individual health needs.

**CHIL AI is a Ugandan femtech company founded by Shamim Nabuuma Kaliisa. As part of their health services, the organisation offers drug delivery, referral, and electronic medical records (EMR) and auto radiology reports with the aid of their chatbot.**

**CHIL (Community Healthcare Innovation Lab) AI offers services ranging from AI-guided consultation, Automated Referral, Automated Radiology Reports, Interpretation laboratory, and Automated Drug Ordering. All of these can be accessed through a conversational chatbot accessible through various mediums. As an Africa-focused firm, CHIL AI's services focuses on rural Uganda and provides services to more than 700,000 women in over ten countries in Africa, including South Sudan and the Democratic Republic of the Congo during the pandemic.**

**Nabuuma is among the first people on the continent to bring AI in offering tele-oncology services**

## **Agriculture**

In sub-Saharan Africa, where as much as 80 per cent of household foodstuff consumed and sold, including rice and maize, is cultivated by women, Artificial Intelligence is transforming this gendered space (Ben-Ari, 2014). In Tanzania, which has more women in agriculture than any other sub-Saharan African country with 81 per cent of the female population working in agriculture, compared to 55 per cent in the rest of sub-Saharan Africa, according to a 2011 survey (Anderson & Gugerty, 2011), 70 per cent of employed women work in agriculture (Partridge-Hicks, 2020).

African women face numerous challenges caused by cultural and colonial norms in the agricultural sector, which impacts their outputs and influence. A policy brief commissioned by United Nations (UN) Women notes "...that gender gaps in agricultural productivity do not arise because women are less efficient farmers but because they experience inequitable access to agricultural inputs, including family labour, high-yield crops, pesticides, and fertiliser" (Rodgers & Akram-Lodhi, 2019). Women also have less access to finance and face difficulties cultivating due to restrictive land ownership laws, which are often relics of colonialism

(Meinzen-Dick, 2019).

With the aid of technological innovations such as AI, women farmers gain a competitive edge as analysts use AI to analyse crop yield and soil suitability to boost harvests. AI assistants are

also helping women farmers identify crop diseases in their farms (Self Help Africa, 2019). Precision farming and data analytics are used to pool data and measure soil characteristics to improve yield.

**In Senegal, with the aid of AI, Fatoumata Thiam is assessing energy efficiency within irrigation networks and clean energy within solar-powered systems. She is also researching ways to automate irrigation systems to release the correct amount of water for crops (Economic Commission for Africa, 2021).**

**She commenced her PhD studies through the Regional Scholarship and Innovation Fund (RSIF), enrolled at the University Gaston Berger in Senegal with a research focus on the applications of Internet of Things (IoT) and Artificial Intelligence (AI) in agriculture and farming.**

**The goal of her research is to propose a solution that will optimise and automate the irrigation paradigm in the Niayes area in north-western Senegal. Niayes has an exceptionally favourable climate for farming and represents a natural base of agricultural production in Senegal. However, the region is experiencing increasing salt intrusion and destruction of its Casuarina trees that help prevent erosion, caused by speculation and irregular sale of land.**

**Her work has a cross-cutting impact on several Sustainable Development Goals (SDGs). The need to regulate and optimise water resources and the move to more sustainable farming systems is a shared concern in many developing countries and across the globe.**

**Overall, this study provides strong evidence of the transformative potential of the Fourth Industrial Revolution (4IR) in Africa and the need for the continent to invest heavily in the necessary infrastructure, capacity and policies.**

## **Creativity and expression**

There are immense opportunities available through AI-assisted and generated media. In this sense, Artificial Intelligence creates a lot of room for new content creation and entertainment methods and widens opportunities for expression. The widespread adoption and use of synthetic media for content creation can revolutionise content creation and remuneration by opening up new avenues for displaying creativity.

African women breathe new life into online platforms by sharing fresh, original stories about their lives and redefining what it means to be female and African. In the past, limited knowledge and access to editing tools posed a problem to the reach of many creatives. Today, apps such as TikTok have democratised and "banalised", i.e. demystify (Pollicy, 2021) access making video editing, videography and special effects more accessible. Taking advantage of these opportunities will better equip African women to tell their stories through "own voices," thereby redefining and taking back control of the use of synthetic media associated with abuse.

Synthetic media uses are also noteworthy and potentially beneficial to women. Applications in the entertainment industry could see entertainers and ordinary people offering their likeness and personas to create media with their consent, opening avenues for financial income. In health and mental wellbeing, synthetic audios have found some use in diagnosing and treating certain conditions such as Alzheimer's and dementia (Harwood et al., 2019). Synthetic media may also be valuable and helpful for dealing with the loss of a loved one or for preserving or synthesising memories for the future.

In the fashion and art space, artists are already creating AI-generated art, challenging conventional ideas about the borders and frameworks of creativity. African art and fashion reflect the diversity and creativity on the continent, and the rise in the deployment of computer vision means tasks such as image synthesis, detection, analysis, and recommendation are increasingly accessible (Oyewusi et al., 2021).

**In 2020, Anifa Mvuemba, who hails from the Democratic Republic of Congo (DRC), founder of Hanifa, a women's fashion brand, launched her Pink Label Brand at the height of the COVID-19 using CAD (Computer-Aided Design) 3D models in a virtual, digital fashion show.**

**The show, which has been described as sexy-yet-sophisticated, sensual and surreal (Bey, 2021; Mau, 2020; Tingle, 2020), brought attention to the environmental and resource "extractivism" prevalent in the DRC, a country responsible for sixty to seventy per cent of the world's supply of coltan.**

**The collection was inspired by the gentleness, beauty, history, poise, majesty, strength, power, and hope of the Congolese spirit. Riddled with a painful past, the beauty of Congo is often overlooked. When Anifa created each piece, she was reminded of her mother's stories of the women she knew back home in Congo. Women who suffered great loss, but still mustered every ounce of strength every day to show up. She hoped that this collection would inspire all women to stand tall in their power and, like the Democratic Republic of Congo, use their history, whether pretty or painful – to redesign their future.**

## **Better Control of Data through Alternative Data Stewardship Models**

Africa's growing industrialisation and digitalisation needs, which require access to vast amounts of data, have spurred efforts aimed at the "datafication" of entities, individuals and communities. Datafication is a process through which subjects, objects, and practices are transformed into digital data (Southerton, 2020). According to Gurumurthy & Bharthur (2018), while datafication can provide value, the process of datafication in the developing world is problematic due to several factors including the overwhelming privatisation and silo-ing of the data in crucial sectors and the growth of so-called data-led development solutions by private and public bodies.

Datafication is often driven by "tech-chauvinism" (Gibson, 2021). It inequitably distributes the

benefits of digitalisation between corporations and corporate interests and may be ably countered by reimagining and restructuring power imbalances in how data is shared. However, this reimagining and restructuring must involve the empowering of African women through alternative data stewardship models such as indigenous data governance mechanisms (Mozilla Insights et al., 2020). Indigenous data governance mechanisms comprise methods through which indigenous groups retain control of data pertaining to their communities, resources, landmarks, rather than surrendering them to external interests. One such framework is the CARE (Collective benefit, Authority to control, Responsibility, Ethics) framework, which was initially developed at a workshop on Indigenous data sovereignty in Botswana as part of International Data Week in 2018 (Carroll et al., 2020).

**Indigenous stewardship frameworks have been successfully utilised by certain groups around the world. Using advocacy similar to the CARE framework, the Maori people of New Zealand Aotearoa successfully advocated to have the Whanganui River recognised as a legal person in line with the Whanganui iwi belief that the river is an ancestor (Roy, 2017). This legal action was in response to the pollution of the river by European settlers and industrialists which was destroying local livelihoods and the natural ecosystem of the river. Following their action, the court appointed two guardians for the river, one from the Crown, and one from the Whanganui iwi. The decision set precedent for similar actions around the world and since then, two rivers in India and all the rivers in Bangladesh have been granted legal personhood (Hollingsworth, 2020).**

## **Modern Slavery and Human Trafficking**

According to the 2018 Global Slavery Index (Global Slavery Index, 2018), twenty-three per cent of the world's human trafficking takes place in Africa. Globally, women and girls make up seventy-one per cent of the victims of modern slavery (International Labour Office & Walk Free Foundation, 2017). Artificial Intelligence and Big Data are also being used to fight modern slavery and human trafficking. While controversial due to its culpability in human rights abuses against

black people, facial recognition is used to track child victims of trafficking and arrest traffickers. According to Emily Kennedy, President and Co-Founder of Marinus Analytics, a woman-owned and -led AI company in the US focused on protecting the vulnerable and ending systemic exploitation, "...computer vision can identify the same pattern in many different photos, like the pattern in a hotel bedspread. This helps law enforcement identify multiple victims advertised and sold from the same hotel room" (Wu, 2020).

**In Tanzania, the N/LAB at the University of Nottingham led by its Deputy Director, James Goulding and his team, tease out what they refer to as "ground truths", about vulnerabilities, and combine them with data on mobile money transactions, cell tower activity or transport usage.**

**For the project, the team uses AI and machine learning to predict patterns and also discover complex non-linear relationships. It also helps to unpack new explanations and use those insights for further innovation.**

**Using AI to interpret communication patterns, they have been able to build models to determine what areas are prone to urban slavery, for instance, areas where mobile money is more in use.**

# Potential threats from AI applications





In Africa, the effects of the European Industrial Revolution led to a scramble for colonies and resources. However, the exploitation of these resources due to the monopoly of control and access imposed by Western colonial powers greatly impoverished many African societies and weakened traditional powers and customs (Fagunwa, 2020). This state of affairs also weakened women's traditional roles and positions in pre- and post-colonial Africa as economic, social and political leaders (Alapo, 2014).

Mirroring then-prevalent European values and norms regarding the function of women and through racist, capitalist exploitation, colonisation systematically disenfranchised and stripped African women of economic agency, mobility, and social standing further complicating traditional gender roles and inequality. The effects of the systematic and systemic disenfranchisement of African women can be seen all over the continent today as women continue to occupy fewer positions of authority (Anunobi, 2002).

African women are also discriminated against based on their age. Phrases such as "women age like milk, and men age like wine" have been used to prescribe and project social, economic and cultural beliefs and expectations upon women's bodies. The effect of age discrimination in majority youth populations has been explored in the light of their impact of sexual and health implications (Chepngeno-Langat & Hosegood, 2013).

The elderly, of whom women are the majority, are the last to be resettled in periods of natural disasters (Centre for Human Rights, 2021) and are vulnerable to online scams and security breaches due to their lack of familiarity with technology. Due to their age, they sometimes are unfairly stigmatised and excluded due to socio-cultural beliefs that they are witches and thus blamed when bad things happen (Ngalomba & Harpur, 2016).

The over-policing of women's bodies through surveillance systems is another pervasive issue for African women. While surveillance systems can sometimes help prevent crime, their use could lead to severe privacy and personal data protection breaches. For instance, many women have recently complained about stalkers attaching Apple AirTags to their vehicles or persons without their knowledge (Gopani, 2022). The dangers of the misuse of surveillance technology against vulnerable women who are migrants or victims of abusive partners are therefore worth examining. Globally, with the aid of such software as Pegasus, the surveillance app developed by the Israeli company NSO, governments can monitor the activities of civil rights activists, journalists and even political opponents. These tools are also used to monitor women, often without their knowledge. As a result, surveillance systems and devices do not necessarily make the spaces women inhabit safer.

Women human rights defenders across the Middle East and North Africa have been subjected to physical and sexual violence and abuse following privacy breaches through Pegasus (Fatafta & Front Line Defenders, 2022). Hajar Raissouni, a Moroccan journalist, along with her husband, Sudanese human rights activist Rifaat Al-Amin, was arrested and interrogated in 2019. In her words: "When I was arrested in 2019 and interrogated by people of whom I still don't know who they represent, they told me things about me that no one could know unless they read my diary moment by moment" (Raissouni, 2021). The defamatory publication of private conversations in newspapers led to the couple's isolation from loved ones who were unwilling to be caught in the crosshairs and, afterwards, their decision to leave the country. According to Alia Ibrahim, co-founder of Daraj, an independent digital media platform in the region that partnered with Amnesty on the Pegasus Project, a third of potential targets in the region were women. This

included human rights defenders and journalists, and women linked to powerful men or men who were themselves targeted ("Women at risk of blackmail as a result of the use of Israel spyware", 2021). In Rwanda, Carine Kanimba, the daughter of Paul Rusesabagina, who inspired the Hotel Rwanda film and who has since been detained by the Rwandan government, was one of the individuals whose phone was infiltrated by the software (Kirchgaessner, 2021). Similarly, in West Africa, the Gnassingbé family of Togo have maintained political power by relying on digital surveillance to repress journalists and activists (Nabourema, 2020).

The development of Artificial Intelligence as part of the HR was seemingly assumed to imply the eradication of economic inequalities. This may not be as true as previously thought as AI applications threaten to deepen gender stereotypes and confine women in more restrictive roles.

## Women's Employment

The future of work is today being shaped by emerging technologies and heated contests between and amongst the factors of production: land, labour, capital and entrepreneurship. The generally precarious nature of women's labour is an essential focus of feminist economic analysis as women are generally underpaid even while working long hours (Balakrishnan & Brosio, 2019). Recent statistics from the World Economic Forum (WEF) in 2021 reveal gender gaps in many sectors. Gender gaps are more likely to increase and widen in the digital technology sectors as women remain underrepresented. For example, in Cloud Computing, women make up 14 per cent of the workforce, a figure which has only improved overall by 0.2 per cent from 2018; in Engineering, 20 per cent; and in Data and AI, 32 per cent, which had instead declined by 0.1 per cent since 2018 (World Economic Forum, 2021).

A significant focus of conversations surrounding the future of work is the risk of unemployment caused by automation. Responses to this issue have pushed for the digital upskilling of women to prepare them for future employment. However, the inherent technological determinism in imagining the deployment of AI in the workplace as an inevitability which workers need to prepare against, downplays the intrinsic

causes underpinning current and unresolved labour inequalities. Already, the existing digital gender divide in access and use of mobile devices, 13 per cent in mobile ownership (Carboni et al., 2021) and the internet means that fewer women than men can take advantage of these opportunities. Madzwamuse & Kouakou (2018) note that the concerns about the future of women's work in Africa are timely.

This is especially so given that the dominant analysis of the implications of the 4IR has thus far been biased towards the formal sector. This completely ignores the realities of the structure of economies in Africa, where most economic activity takes place in the informal sector, and for which the formal sector has shown very little absorption capacity. The very same industrial revolution that we extol for its ability to improve lives and make our work more effective and efficient is simultaneously the vehicle for constant exclusion of women from the workforce as well as social division, suppression and or even violence in the workplace (Besaw & Filtz, 2019).

Moreover, in sub-Saharan Africa, women are the most dominant actors in the informal economy, making up at least seventy per cent of informal cross-border traders in Southern Africa (Mayisela, 2015) thus, AI may exacerbate the gender gap in labour, especially in corporate leadership positions (Gallego & et al., 2019). For instance, the International Monetary Fund (IMF) projects that eleven per cent of jobs currently held by women are at risk of elimination due to AI and other digital technologies. It is thought that women are more vulnerable to losing jobs from automation than their male counterparts. A look at financial services reveals that women predominantly occupy clerical and administrative positions that are at a high risk of elimination. Women are underrepresented in jobs that require science, technology, engineering, and math training—including jobs in AI itself. For example, globally women hold 56 per cent of university degrees, but just 23 per cent of STEM degrees, and makeup only 25 per cent of the STEM workforce. In a study conducted by the WEF in 2018, only 22 per cent of AI professionals were found to be women, and in machine learning, only 12 per cent (World Economic Forum, 2018). Therefore in the coming years, AI may disrupt employment patterns on a massive scale. Companies, governments, and individual women must therefore be prepared to invest in reskilling for the new generation of jobs. Most of the additional job growth from the 4IR will come in areas that require human-technology collaboration, such as managing data, working effectively with technology tools and applications, and identifying efficiency improvements. Many women are already unskilled in these areas. Reskilling and upskilling, then, can change the odds and offer significant opportunities for women.

## Education and Skills Acquisition for Women

AI has broad implications for the whole of humanity, including the education sector and training institutions that equip learners with lifelong skills to navigate both work and society. Education and skills are crucial for effectively integrating AI into all sectors. Society recognises the need for education and skills that will enable people to participate in life and work in the era of AI. Thus, this requires the development and use of tools to identify shifts in the skills and update curricula accordingly, and also reveals the need for AI literacy skills across all levels of society. Both public and private sectors, including academic institutions worldwide, are involved in a number of programmes to boost interest and engagement in STEM subjects. Opportunities include events such as Africa Code Week, longer initiatives such as community-based or mentorship programmes like those offered by Technovation, internships or apprenticeships, and massive open online courses (MOOCs) such as those offered by Lynda (UNESCO, 2021).

However, across the African region, there are differing rates of admission and graduation from different education levels for women and girls compared to men and boys. According to UNESCO (n.d. a), Sub-Saharan Africa has the highest rates of education exclusion in all the regions for women and girls. For instance, 9 million girls between the ages of 6 and 11 are reported to have never had the opportunity to go to school at all, compared to 6 million boys. The data goes on to state that while 23% of girls are out of primary school compared to 19% of boys, by the period of adolescence, the exclusion rate for girls is 36% compared to 32% for boys (Patel & Jesse, 2019). The varying levels of educational disadvantage across Africa are caused by heterogeneous factors such as local conditions and policy decisions, and there is a perception that these may be exacerbated by the introduction of AI in learning and skilling institutions (Baten et al., 2021). Closing the gender gap for women and girls in all spheres of life is urgent globally, particularly in Africa. Eliminating AI bottlenecks in education and acquisition of skills allows women to participate in all sectors, thus transforming families and communities.

## Freedom of Expression

In today's digital world, access to internet platforms is a major way to exercise freedom of speech as AI forms an integral part of the new media world. However, access to the internet has further compounded some of the barriers to free speech that women already face offline by (re)introducing them to digital spaces. Women also contend with fresh challenges regarding access to the internet and digital devices, with the effect that women are not visibly involved in the shaping and design of these spaces. According to the GSMA 2021 report, in 2020, the gender gap in mobile ownership and the gender gap in mobile internet use in Sub-Saharan Africa was 13 per cent and 37 per cent, respectively, the second-highest rates in the world. In addition, while mobile devices were the primary way people in low and middle-income countries (LMICs) access the internet, women were less likely than men to access the internet through any device. Women were also fifteen per cent less likely than men to own or use smartphones among the

same group. More worrying, the increasing significance of technology to the economy, politics, and governance means that the absence of women online prevents their full participation and representation (Iyer et al., 2020).

Artificial intelligence is likely to exacerbate these situations. For example, if content moderation is incorrectly done, for instance where video evidence or text-based reporting of crimes and injustices and crimes over social media is incorrectly flagged as inappropriate content (Asher-Schapiro & Barkawi, 2020) there is a risk of silencing legitimate freedom of speech and impacting freedom of expression. This could also lead to the flourishing of hateful content and the spread of fake news, both of which affect women significantly and impact their right to freedom of expression. A glance at content curation reveals another way automated decision-making (ADM) controls what information citizens see. As the information people come across informs their world view, beliefs and how they participate in different sectors in society, relevant stakeholders must prevent AI from being the sole curator of biased content and from creating so-called "filter-bubbles" where citizens do not get exposed to alternative views.

Algorithms used to enforce shadowbanning pose essentially the same risks, this time to content creators. Shadowbanning is a content and user moderation tool used to restrict the visibility of certain content without the awareness of their creators (Brown, 2021). The use of shadowbanning to police content deemed inappropriate or less desirable or unwanted on social media platforms, without the awareness of their creators is a way through which creators are disconnected from themselves and their communities. Specific hashtags that have been banned or flagged Not Safe For Work (NSFW), include #lesbian for instance (Iyer et al., 2021). Because content moderating algorithms operate in a black box, it is difficult to determine why some of these decisions are taken, or indeed, that a person or their content has been shadowbanned. In the meantime, while these platforms continue to profit from the presence of these users on their platforms, they remain undiscoverable and non-visible to other people.

In addition, data governance on the continent needs to be strengthened to adequately secure collected data, as malicious agents could use them to facilitate targeted manipulation against women, infringing on their right to receive information and facilitate online harassment, which women are incredibly prone to (Brink, 2021).

## Surveillance and Colourism

In Africa today, the deployment of facial recognition surveillance systems is on the rise (Allen, 2020) and African governments have begun partnerships with Chinese firms such as CloudWalk and Huawei to develop facial recognition and mass surveillance systems (Donkor, 2020) in the interests of national security.

While their effects on national security remain the subject of debate, the resultant effect of the prevalence of these systems in patriarchal societies on women is already visible. For instance, in India, government plans to use affect recognition to determine whether women are in distress based on their appearance (Shanti, 2021) were followed with criticism focused on the patriarchal and paternalistic use of technology to monitor women. For women, who have to contend with harassment and judgemental comments about their physical appearance, the impact of emotion-policing software is not new. Feminists have, in the past, criticised the unending social pressure on women to exhibit happiness and smile (Coulter, 2021). However, affect recognition software may be the latest (digital) iteration of conventional pressure to enforce superficial smiles on women's faces, with little regard for the dismantling of structural inequalities that harm and dissatisfy women.

The use of AI for facial recognition is also controversial due to its associations with racist phrenology and physiognomy (Colaner, 2020). Research by Buolamwini et al. (2018) reveals that biases in facial recognition datasets disproportionately affected women and persons with dark skin. In Buolamwini's words, "...as we tested women with darker and darker skin tones, the chances of being correctly gendered came close to a coin toss" (Buolamwini et al., 2018). Training facial recognition technology algorithms on African facial features would appear to be a great way to resolve challenges around wrongful arrests and detentions prevalent in places where they have been previously deployed. However, their accuracy could wield a sharp edge, leading to the more effective weaponisation of the technology against individuals of African descent, thus leading to them being targeted more accurately and more effectively policed by security apparatuses (Hagerty & Albert, 2021). In parts of Africa where police and military brutality is prominent, state agencies accurately utilising facial recognition could better surveil vulnerable groups of people.

In light of the history and impact of colourism globally and on the African continent, the drop in accuracy of facial recognition systems when it comes to identifying women with darker skin tones could be regarded as digitally-enabled colourism. In 1983, the Pulitzer-winning American author, Alice Walker, coined the term "colourism", which she defined to mean "prejudicial or preferential treatment of same-race people based solely on their color" (Walker, 1983). Notable examples of AI-facilitated colourism include Twitter's infamous image-cropping algorithm, which in 2020 was found to crop out the faces of dark-skinned people automatically in favour of white people (Hern, 2020). The history of colourism globally and in Africa is very tangled, with roots steeped in beauty practices that identified and associated paler and white-skinned individuals with luxury and means. A documentary by Nollywood actress Beverly Naya on colourism, *Skin*, revealed disparities in the media representation and economic access of actresses and persons with darker skin (Salaudeen, 2020). Also, a 2016 report on the prevalence of skin lightening amongst Sudanese female undergraduate students in Sudanese higher institutions found that over half of the respondents used lightening products for acne and dark spots, while one-third of the undergraduate

females reported using them to attract a man (Ahmed & Hamid, 2016). In addition, a 2011 World Health Organisation (WHO) report found that 77% of Nigerian women use skin lightening products regularly - the highest on the continent - 59% in Togo, 35% in South Africa, and 27% in Senegal ("Nigeria's Skin-Bleaching Epidemic", 2018). Reacting to the trend, a number of African countries have banned skin lightening products (Odutayo, 2019). However, these efforts may remain ineffective in today's digital age if Artificial Intelligence-enabled colourism remains rampant.

The use of Facial Recognition Technology for surveillance is also highly concerning for women who are members of minority groups. In Kenya, for instance, Muslims make up only eleven per cent of the population and are routinely targeted by the government and victims of extrajudicial killings (Office of International Religious Freedom, 2021). As religious and sometimes ethnic minorities in a patriarchal state, Muslim women in Kenya grapple with bias and discrimination based on the tripartite intersections of religion, ethnicity and gender, with the hijab stigmatised as a symbol of terror (Ali & Mwambari, 2021). The country's androcentric approach to counterterrorism has exacerbated the discrimination faced by Muslim women. It is also culpable in the redirection of funding from peacebuilding and development-focused projects and increased insecurity experienced by local communities (Aroussi, 2020). Describing the "Somalinisation of terrorism and counterterrorism in Kenya," Mwangi (2018) describes how the Kenyan state's approach to terrorism characterises Somali refugees in Kenya as radicalised terrorist sympathisers. As a result, Somali women in Kenya have their bodies securitised due to their relationships with male family members characterised as terrorists by the state.

## **Virtual Assistants and Chatbots**

The implications of the growing use of chatbots and other conversational agents are also very worrying. The decision of many corporate institutions to develop female-gendered bots or virtual assistants gendered female by default, engenders bias and discrimination. These bots perpetuate gender stereotypes about women and the kinds of roles women can perform. Chatbots and virtual assistants such as Siri and Alexa are designed to be constantly polite, even in the face of abuse, solicitous and always on standby.

However, the feminisation of conversational agents could define societal opinions about how women are expected to react in the face of such abuse or form technologically-cast moulds of how women are generally expected to behave and what roles they are expected to perform. This is particularly troubling since the attribution

of the female gender to chatbots appears to be a predominant one in sectors such as customer service, sales, and brand representation, as one study analysing the design of 1,375 chatbots (Feine et al., 2020) showed.

Introducing these conversational agents to less technologically advanced environments could entrench foreign sexist values about women's roles in new societies (UNESCO, 2019). The dissonance in the decision to dehumanise a female-gendered bot is an exciting and challenging one worth ethical consideration.

While conversational agents themselves are merely computer programmes that cannot be said to feel pain, human interactions with them could be said to be significant reflections of societal biases. Significantly, violence against female-gendered chatbots could contribute to cultural harm and create unsafe environments for women whom they are designed to model.

## Migration and Movement

African women also grapple with many barriers related to experiential opportunities, limiting their ability to learn, observe and interact with different environments, cultures and people.

Intra- and cross-continental female travel and migration trends vary greatly amongst regions in the continent. According to the World Bank's Women, Business and Law Mobility Chart (2019), which depicts the evolution of regional scores for the mobility indicator over the past 51 years, as well as the legal constraints on women's freedom of movement, sub-Saharan Africa scored 83.3 out of 100, while the Middle East and North Africa scored 57 out of 100, the lowest of all the regions surveyed. In 2019, women constituted forty-seven per cent of international migration in Africa (Mitchell, 2021).

The migration struggles of women are further compounded by current and past policies locally and internationally enacted to limit the ability of women to travel deliberately. These policies are in contravention of instruments such as Paragraph 4 of Article 15 under the Convention on the Elimination of all Forms of Discrimination against Women (CEDAW), which legally binds states party to it against the use of sex-specific bans and discriminatory restrictions on women's migration. A notorious example of state policy that restricted the right of women to travel was the administrative policy of the Nigeria Immigration Service (NIS), which compelled married Nigerian women to produce letters of consent from their husbands as a condition for issuance of the international passport. This policy was declared unconstitutional following the decision of the Federal High Court in 2009 in the case of *Dr. Priye Iyalla-Amadi v. Comptroller-General, Nigerian Immigration Services and Anor*, which sought a declaration that the policy was a breach of the fundamental human right based on sex. The defence claimed that the government classified Nigerian married women alongside minors as persons who require consent from the head of the family. They furthermore claimed that the administration put the requirement in place to perpetuate the authority of a man over his wife, no matter the status she had attained in society. In addition, the defence put forward that the requirement was set as a measure to avoid unnecessary breakdown of the marriage institution in the country ("*Court Voids Immigration Condition for Issuing Passports to Married Women*", 2009). Furthermore, the social and political visibility of single-sex male labour migration has tended to obscure the historical migration of female migrants whose labour often fell outside what was conventionally considered work. This has further occluded some examples of movement-restricting policies globally (Andall, 2018).

The use of AI in international travel for flow management could severely impact the rights of African women to exercise their right to movement. The impact of the inaccuracy of these systems is already being felt around the world in more AI-ready climes where they are deployed at borders and airports to scan the faces of travellers. The struggles of these systems to distinguish between Black women and the differences in the length of time taken to process non-White faces (Israel, 2020; Simonite, 2019) could cause discomfort, distress and indignity.



In pre-boarding applications of AI, it was found that the United Kingdom's Home Office had been using an algorithm to assess visa applications since 2015 (Warrell, 2020). The algorithm reportedly used a traffic light system to stream visa applications green, amber, or red according to their level of risk. An All-Party Parliamentary Group Report (APPG) (Bailey et al., 2019) released by the APPG for Africa, the APPG for Diaspora, Development & Migration and the APPG for Malawi found that visa processing was marred by inconsistencies and highly discriminatory against Africans. In the report, the Independent Chief Inspector for Borders and Immigration (ICIBI) was quoted saying, "Since 2015, UKVI has been developing and rolling out a "streaming tool" that assesses the perceived risks attached to an application. The streaming tool is regularly updated with data of known immigration abuses... It streams applications 'Green' (low risk), 'Amber' (medium risk) or 'Red' (high risk). There is a risk that the streaming tool becomes a de facto decision-making tool." The ICIBI told the inquiry he was concerned that overreliance on the algorithmic "streaming" tool could mean that decisions were not being made on the merits of the individual case but on a set of generalised and detached indicators. The Home Office has since then announced that it would stop using the algorithm.

However, the incident suggests that such algorithms may be in place in other parts of the world at various stages of the (im)migration and movement process. The black-box nature of these algorithms due to latent design and the securitised nature of work they are expected to perform could mean that African women eager to travel the world may be hindered and never know why.

## Privacy and Data Breaches in Education and Financial Inclusion

In education and finance, leveraging user-generated data previously inaccessible to service providers like banks, schools and public institutions, AI solutions are bridging the gap and making these services more accessible to the excluded.

In the fintech space, AI algorithms are already being used to bring funding closer to the unbanked. According to the 2017 Global Findex Database report on financial inclusion, globally men are more likely than women to own bank accounts with there being a 9 per cent gender gap in access (Demirgüç-Kunt et al., 2017).

In sub-Saharan Africa however, the gap widens to 37 per cent and in North Africa, where two-thirds of the population is said to be “unbankable”, the gap is even wider (Morsy et al., 2019). However, this disparity is significantly mitigated in sub-Saharan Africa with the aid of mobile money, where a reduction in the account ownership gender gap can be attributed to mobile money accounts, especially in “mature mobile money markets” (Delaporte & Naghavi, 2019). While data silos and paper trails have greatly limited the willingness and ability of traditional financial institutions to grant credit facilities to persons in need of financial aid, fintechs today are leveraging Artificial Intelligence to provide these services for those in need. Reductions in the digital gender divide mean that financial institutions can now grant loans to female customers who are typically less likely to own bank accounts but more likely to own mobile money apps and therefore more able to download and install fintech apps.

By leveraging data available through access to mobile devices, it is possible to evaluate the creditworthiness of African women who are often “thin-file customers — people who would not be likely to have a traditional credit score” (Kelly & Mirpourian, 2021). With the aid of AI, financial institutions can verify the identity of loan-seekers and the authenticity of presented documents while spotting irregularities in documentation, thereby eliminating fraud.

However, because of the heavy reliance of these services on personal data, they pose a huge risk to the rights of customers to data protection, privacy and dignity. Lendtechs, fintech apps which specialise in loaning money, in particular have been noted to be particularly invasive in the choice of data they collect. A report on the lending app scene in Nigeria (Ikigai Innovation Initiative et al., 2021) found “...32 % of the LendTechs using machine learning and/or artificial intelligence for their proprietary creditscoring and credit risk assessment algorithm, which decides on a User’s suitability for a loan or otherwise. However, only one (1) provided information in its privacy notice about its existence contrary to the requirement of the law.”

Service providers collect and deploy a number of questionable data and methods for analysis, some of which include the number of selfies on a customer’s phone, the number of games installed, videos created per month, contact information and digital personality tests to determine credit-worthiness (Nieburg, 2021). The black-box processes in this analysis also mean that it is impossible to determine how these systems determine creditworthiness. Essentially, fintechs could be contributing to financial exclusion and discrimination through a reliance on unexplainable AI.

Moreover, the loan repayment tactics deployed by these apps are often brutal and aggressive, showing a disregard for the rights of borrowers. Exploiting personal information of the users, friends and family are often contacted regarding loan defaults. In Kenya, digital lending apps have been held responsible for suicides, divorce and family breakups (Manyibe, 2020).

In education, AI is employed by proctoring apps to monitor and supervise students during tests and lessons. Its use in classrooms assists parents and teachers in identifying fatigue, concentration, frustration, and even learning dysfunction (Ojewale, 2020). In some countries, robots have been introduced into classrooms to assist teachers and engage students in learning by making learning more fun and engaging (Gottsegen, 2019). According to research conducted by Alcorn et al. (2019), humanoid robot-aided learning could be beneficial for neurodivergent students who might feel more comfortable interacting with the bots due to their level of predictability compared to human teachers and classmates.

Personalised learning, which could be used to assess specific needs of students, available through AI could be helpful in understaffed and low-resourced environments. AI could also be applied to reaching out to children living in remote, unreachable climes to evaluate learning gaps and promote targeted learning. AI use cases in education could also prove beneficial to

teachers, especially when integrated as administrative assistants to teachers themselves, not administrators or supervisors. This way, the needs of teachers themselves are centred, and a human remains in the loop. However, there are use cases for AI in education that prioritise students' and teachers' needs. AI algorithms may be able to create custom lesson plans targeted to individual students.

However, the use of AI in education is similarly concerning because of the exclusion risks the use of proctoring apps pose to people of African descent whose facial features are misidentified due to training biases and deficits. The use of proctoring apps to track “abnormal” eye movements and keystroke patterns is also described as ableist and on the whole, anxiety-inducing to students (Feathers & Rose, 2020). In addition, the use of robots to aid overworked teachers raises questions regarding the refusal of administrative bodies to simply employ more teachers or teacher assistants and is intricately tied to fears that the integration of AI systems into our lives could mean severe job loss across various sectors of the economy.

The uses of AI in education and finance while offering solutions to some of the most marginalised and excluded groups also raises significant questions and concerns about misuse which could cause further exclusion. In both sectors, their use points to how tech-solutionism could be responsible for worsening social injustice.

# Recommendations and Conclusion

## To Academia

There has been a significant increase in ICT jobs in Africa have significantly increased. In South Africa, for instance, ICT jobs have increased by twenty-six per cent over the last decade. ICT jobs constitute 6.7% of all formal sector employment in Ghana and 18.4% of all formal sector employment in Kenya (WEF, 2021). Based on these trends, curriculum developers must pay attention to the skills of the future and align education and skills training with the requirements of the Fourth Industrial Revolution. In building the AI futures we want for African women and everyone on the continent, we need to develop enabling institutions locally. An African vision for Artificial Intelligence that is inclusive and intersectional and seeks to promote justice and equality must be built and spearheaded by Africans themselves.

Therefore, the foundations of this vision must begin with developing local talent at institutions of learning. There is a considerable burden on these institutions to encourage the growth and development of female students into the STEM fields, and rightfully so, as we cannot achieve a genuinely African internet without fifty per cent of our population. The localisation of our curriculum should lead to the development of solutions to our challenges and avoid the blind imitation of Western solutions to social challenges. More resources need to be channelled into digital upskilling and training of students at all levels of education to prepare them for the future of work.

However, it is not merely enough to develop STEM talent; the development of ethical and responsible Artificial Intelligence for responsible and beneficial innovation cannot be carried out in a vacuum. Only through the involvement of knowledge from the arts and social sciences will it be possible to truly build inclusive tech. As such, the growing interest in technology development and innovation should be encouraged and nurtured alongside interest in the arts and social sciences.

Furthermore, academic institutions should leverage AI to promote quality research and innovation and promote media and AI literacy, which contribute to developing critical thinking and acquiring skills necessary to understand and use AI responsibly.

## **To Tech Companies**

In the design of digital platforms, gender-by-design frameworks that prioritize African women's needs not merely as an add-on but as a fundamental feature need to be included.

Gender-by-design frameworks use design strategies to reduce gender inequality. Using these frameworks, it is possible to build products that subvert the assumptions and design policies that de-centre women, girls and sexual and gender minorities. This would necessarily involve the inclusion of safety and privacy features that give users autonomy over the content they would prefer to view and interact with.

These features would include the ability to mute, for instance, in cases where outrightly blocking certain persons could be unsafe. As online safety laws in Africa are generally poorly enforced, female victims of online harassment and abuse would benefit from improved reporting of perpetrators to digital platforms whenever they encounter abuse while using these platforms.

In developing AI products, tools and services, there is the need to question and examine the nature and amount of data such tools require and the data protection and privacy safeguards in place to ensure that personal data is not misused and mismanaged.

## **To Governments**

Governments need to prioritise AI, ensure that citizens are knowledgeable about it and its role in society, allow individuals to make informed decisions about AI and create avenues of redress for AI-related harm, should they be necessary. Further, governments need to draft policies that address issues of safety, bias, and ethics and enable and encourage the integration of AI into their economies and in the national strategy.

More policies related to labour and employment, privacy and, of course, curriculum and educational outcomes and policies to take account of the influence of AI and robotics should be developed. Additionally, governments need to prioritise affordable connectivity for all in both policies and domestic spending. In line with growing calls for internet access to be considered a basic human right, governments and institutions alike must prioritise the infrastructure and human capital required to ensure robust national ICT infrastructure. This includes the prioritisation of digital skills in schools. There is also an implicit awareness that economies, institutions and labour markets may not necessarily benefit equally from AI.

There is also a need for transparency and accountability before, during and after the procurement process of AI systems. The potential significance of the impact of these systems on human rights, justice and equality on huge populations, some of which have been described above, as well as the opaque ways they are designed to operate, reveals the need for guidelines which would involve public commentary and consultation. Transparency and accountability would strengthen and improve the commitments of governments to fair procurement practices generally and set the tone for the development of technology overall in Africa.

Therefore, governments must strive to ensure that the benefits are fairly distributed across these sectors and with a particular focus on urban-rural and gender divides.

### **To Tech Founders**

Foreign and indigenous tech companies and other organisations who use data in their service and product creation and delivery need to be accountable, transparent and ethical in their use of data and while developing algorithms.

While African governments grow more aware of the technology regulatory needs on the continent, these organisations need to proactively take the lead on developing industry-wide standards, in line with global standards, at the very least. There is also the need to be compliant with the existing data protection and regulatory standards while collecting and processing personal data.

Founders need to be aware of the discussions about the misuse of certain products and ensure that their products do not replicate these biases.

### **Artificial Intelligence Developers**

Finally, the various stakeholders involved in the process of developing and regulating AI and data need to work together with grassroots organisations to identify and resolve the unique needs of different groups in society. To truly understand and address the needs of African women, individuals in this development need to speak to women and civil society groups working with women to design technology around their needs. Developers related to AI and automation should adopt a gender-response approach across all principles to overcome inherent gender bias. They should, for example, embed a gender perspective in assessing which new technologies are “socially beneficial” or how AI systems are “built and tested for safety.”

## Conclusion

Artificial intelligence presents an important opportunity for the continent of Africa.

If governments can successfully navigate these challenges, AI can be a driver of growth, development, and democratisation. It has the potential to enhance productivity growth by expanding opportunities in key sectors for Africa's development, including agriculture, healthcare, financial services, and government services. By empowering them with access to high-quality digital tools, AI will equip workers, entrepreneurs, and businesses to compete globally and be at the forefront of economic transformation.

However, the obstacles require serious policy responses. AI will mean substantial adjustments for workers and businesses. Its use also opens

new ethical questions that require thoughtful responses. Labour and ethical questions are compounded by higher hurdles specific to Africa, stemming from gaps in connectivity, the readiness of education systems, and the availability of digital data. Africa needs to take decisive steps to overcome its unique challenges, but if it can, it has the opportunity to catch up to those countries that have already taken steps to advance AI.

These efforts will not be easy, but the path forward is clear. Success will depend on the ability of governments to foster collaboration among all stakeholders — state and civil society, academia, industry, and national and international stakeholders. If these groups jointly embrace the challenges and opportunities of AI, Africa will reap the benefits of a vibrant AI ecosystem.

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