Certificate I: Understanding AI and Machine Learning in Africa

Course AIML02: AI and Machine Learning in Africa

Module 4: Deployment of AI and Machine Learning in Africa

Lecture 2: Artificial Intelligence Deployment in Africa

Carnegie Mellon University
Africa

Learning Objectives

1. Summarize the benefits of AI in African settings
2. Identify the challenges that need to be addressed to ensure socio-economic inclusion in African settings
3. Explain why these challenges are different to those in developed countries
4. Explain why policies are necessary to address these challenges

Lecture Contents

1. What's special about the deployment of AI in Africa
2. Key policy challenges and potential risks
    a) AI and gender equity in African settings
    b) AI and cultural and linguistic diversity in African settings
    c) Labor market shifts
3. Policies at national, regional, continental, and global levels
4. Lecture summary
5. Recommended reading & references

What's Special about the Deployment of AI in Africa

AI is ...

"An area of computer science devoted to developing systems that can be taught or learn to make decisions and predictions within specific contexts"

(Smith and Neupane, 2018)

"Systems that display intelligent behaviour by analysing their environment and taking actions—with some degree of autonomy—to achieve specific goals"

(European Commission, 2018)

"A machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. AI systems are designed to operate with varying levels of autonomy"

(OECD, 2019)

What's Special about the Deployment of AI in Africa

Core elements of AI:

Also known as decision-support systems
These are socio-technological frameworks
that use models to make decisions

- Algorithmically controlled automated decision-making (ADM) systems
- Algorithms that translate the models into computable code

What's Special about the Deployment of AI in Africa

ADM systems are increasingly used as part of the decision-making processes in the public and private sector

- They make material decisions that have a direct effect on the finances, health, and liberty of African citizens
- Far-reaching impact on the weakest members of society
- Potentially significant negative consequences for individuals, organizations, and society as a whole

What's Special about the Deployment of AI in Africa

AI technologies and applications have the potential to address many of humanity's most pressing problems

Sickness
Hunger
Productivity
Education
Climate change

https://en.wikipedia.org/wiki/Yin_and_yang

What's Special about the Deployment of AI in Africa

AI technologies and applications have the potential to address many of humanity's most pressing problems

Sickness
Hunger
Productivity
Education
Climate change

https://en.wikipedia.org/wiki/Yin_and_yang

AI technologies and applications risk reinforcing and amplifying social inequality

AI grounded in non-representative or biased data reproduces the representation gaps and biases of the training data sets

What's Special about the Deployment of AI in Africa

AI technologies and applications have the potential to address many of humanity's most pressing problems

Sickness
Hunger
Productivity
Education
Climate change

https://en.wikipedia.org/wiki/Yin_and_yang

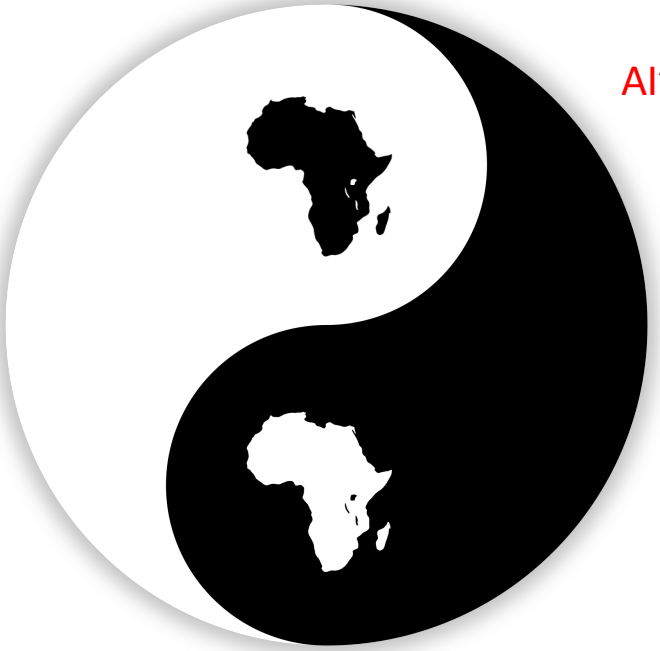
Technology firms that are already dominant can further increase their economic and social power

Governments can violate the privacy and other human rights of citizens

What's Special about the Deployment of AI in Africa

AI technologies and applications have the potential to address many of humanity's most pressing problems

Sickness
Hunger
Productivity
Education
Climate change



AI's potential risks are particularly acute in the developing world

Risk entrenchment of inequalities **within** developing countries

between developing countries and more developed regions

What's Special about the Deployment of AI in Africa

AI technologies and applications have the potential to address many of humanity's most pressing problems

Sickness
Hunger
Productivity
Education
Climate change

A study of startups in East Africa found that 90% of funding had gone to the startups' foreign founders (Pilling, 2019)

What's Special about the Deployment of AI in Africa

AI technologies and applications have the potential to address many of humanity's most pressing problems

Sickness
Hunger
Productivity
Education
Climate change

A recurring theme in this course

Applications of AI deployed in Africa tend to originate from outside the continent and thus **lack contextual relevance**, particularly in respect of **cultural** and **infrastructural** factors (Oxford Insights & IDRC, 2019)

What's Special about the Deployment of AI in Africa

AI technologies and applications have the potential to address many of humanity's most pressing problems

Sickness
Hunger
Productivity
Education
Climate change

Instances of foreign-controlled or foreign-designed AI tools in African settings are increasingly being seen in neo-colonial terms:

"algorithmic colonization" (Birhane, 2019)

"data colonialism" (Couldry & Mejias, 2019)

"digital colonialism" (Coleman, 2019)

What's Special about the Deployment of AI in Africa

AI technologies and applications have the potential to address many of humanity's most pressing problems

Sickness
Hunger
Productivity
Education
Climate change

If African nations are to build inclusive AI ecosystems, enlightened policymaking is essential

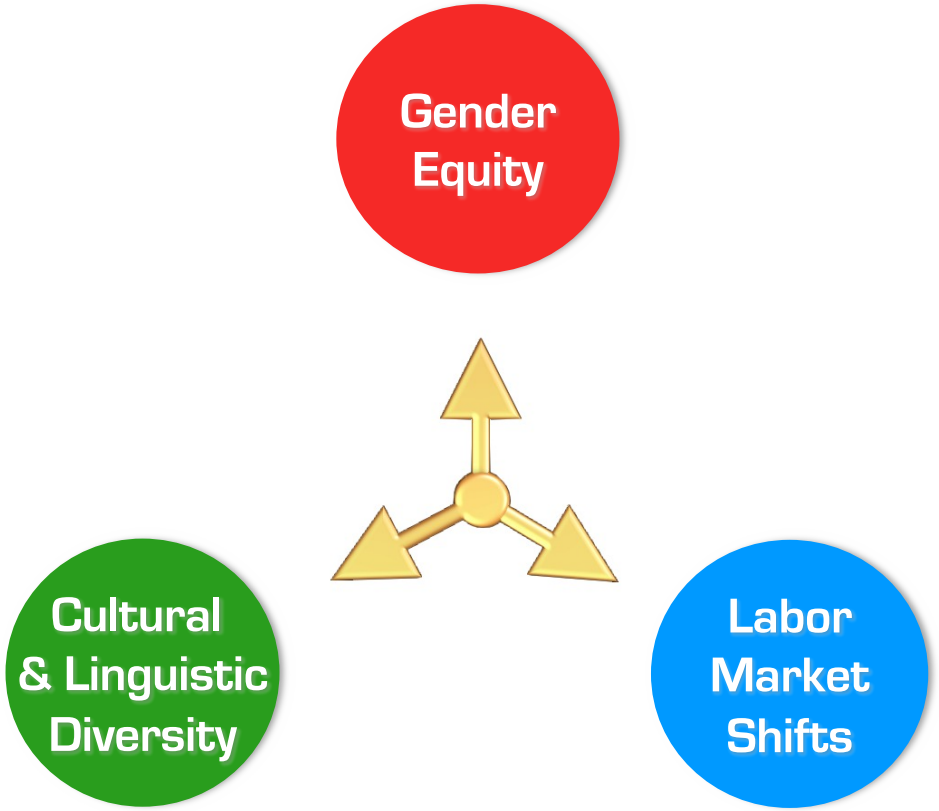
Key Policy Challenges and Potential Risks

Developed-world focus

Research agenda for the ethical and equitable application of AI in the Global South

Calo (2017): Key policy challenges		Smith and Neupane (2018): Potential risks
justice and equity	⟷	fairness, bias, and accountability
privacy and power	⟷	surveillance and loss of privacy
taxation and displacement of labour	⟷	job and tax revenue loss through automation

Key Policy Challenges and Potential Risks



Key Policy Challenges and Potential Risks

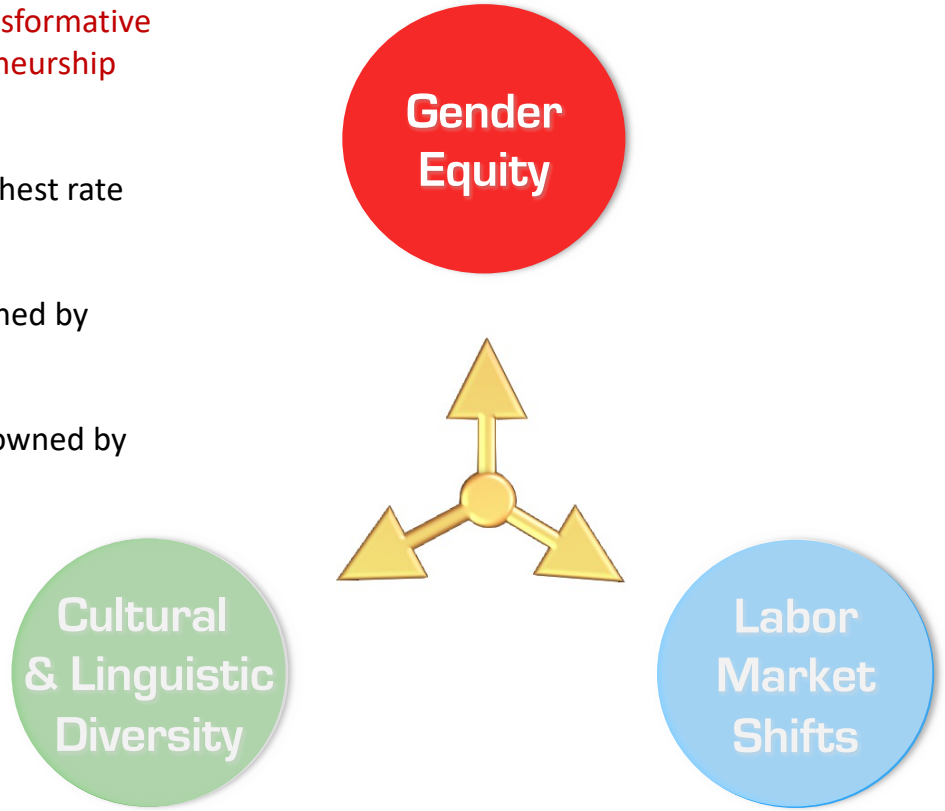
African nations are experiencing a transformative "feminization" of technology entrepreneurship (Monehin, 2017)

Sub-Saharan Africa had the world's highest rate of female entrepreneurs (27%)

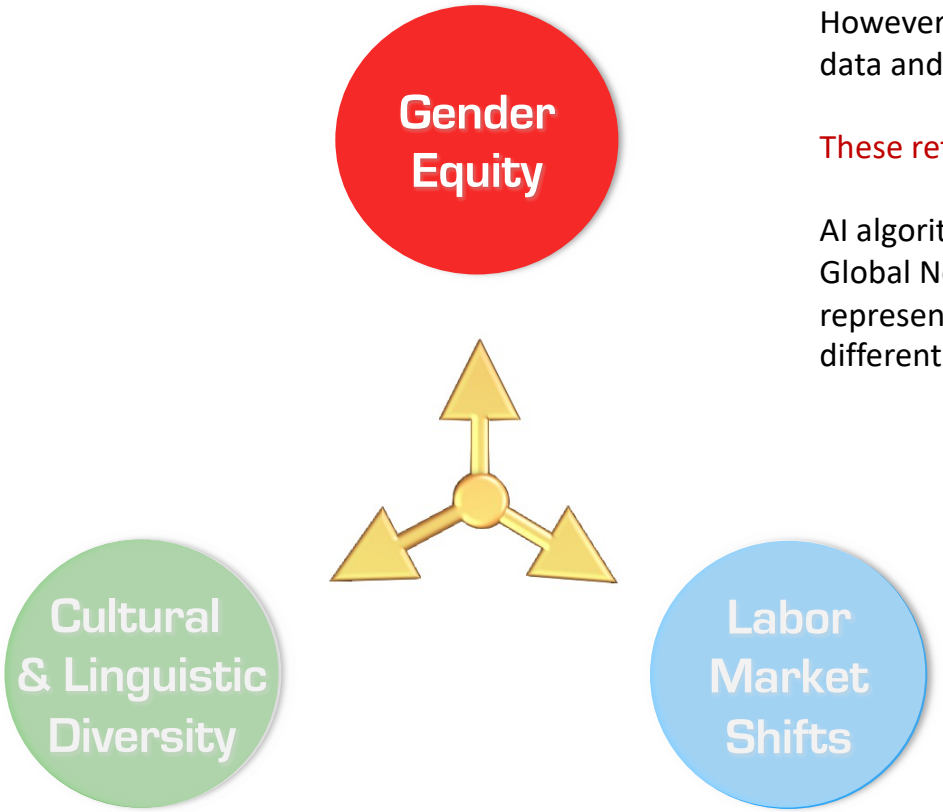
34.8% of businesses in Uganda are owned by women

34.6% of businesses in Botswana are owned by women

In Egypt, AI is empowering women to become drivers in ride-sharing platform services (Rizk et al., 2018).



Key Policy Challenges and Potential Risks

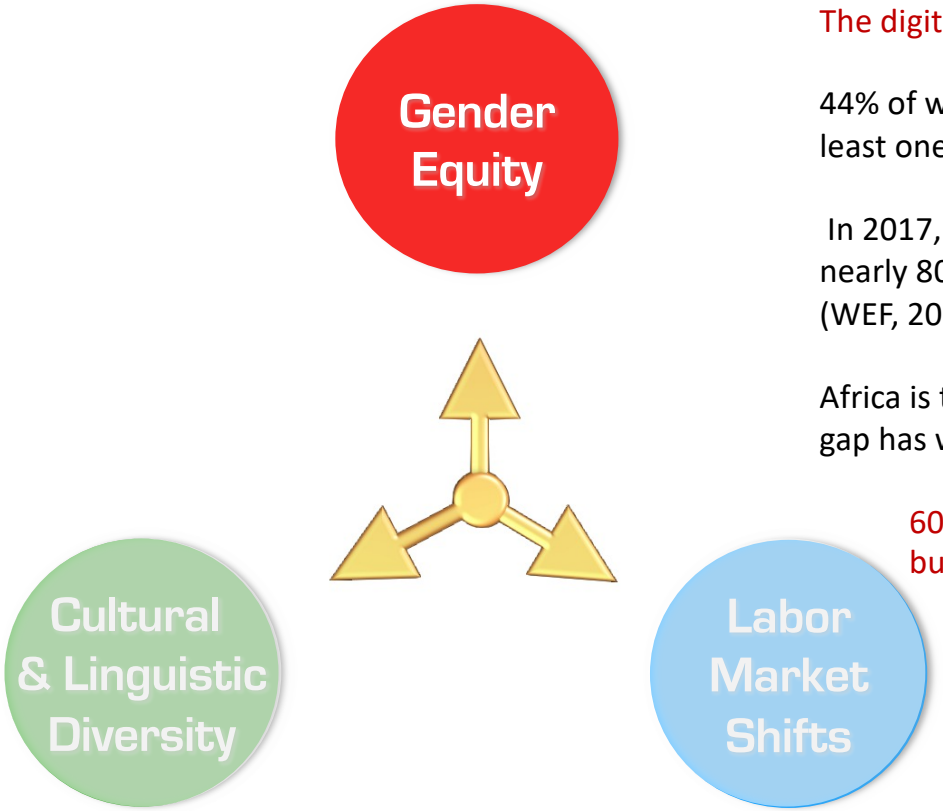


However, women are typically disadvantaged by data and algorithm biases ☹

These reflect and amplify existing inequities

AI algorithms are typically developed in the Global North, and trained on datasets representing circumstances that are significantly different from the realities of African contexts

Key Policy Challenges and Potential Risks



The digital divide is gendered

44% of women in Kenya were poor in terms of at least one dimension (Patel, 2018)

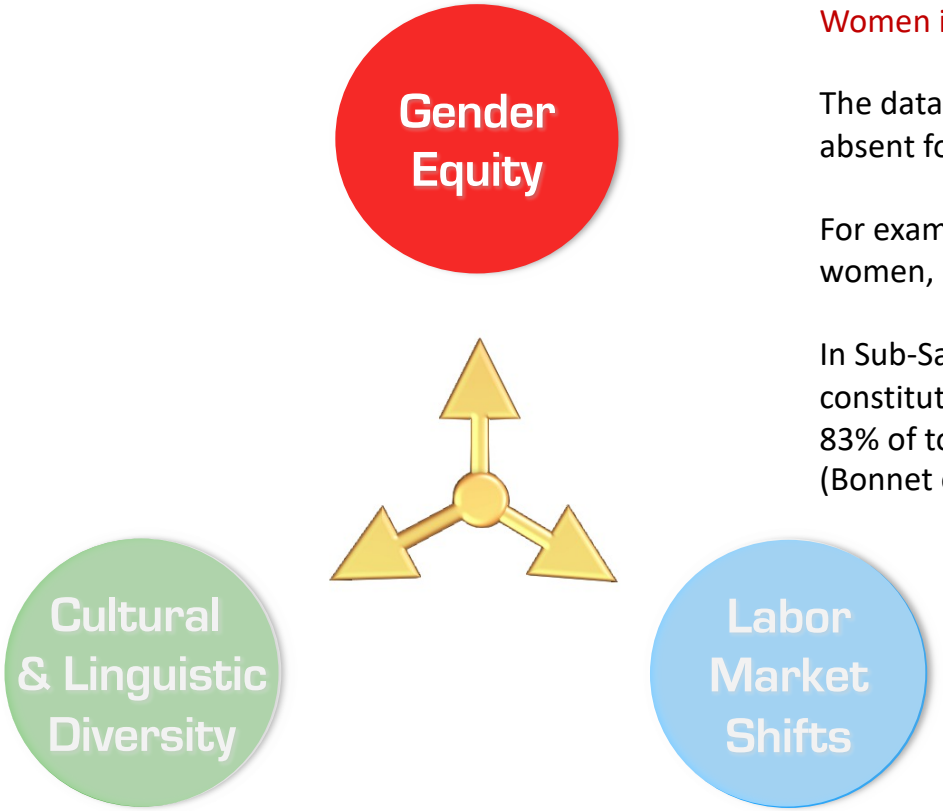
In 2017, the employment gender gap reached nearly 80% in Algeria and 69% in Egypt (WEF, 2017).

Africa is the only continent whose digital gender gap has widened since 2013

60% of African women own a mobile phone, but only 18% have internet access

(Majama, 2019)

Key Policy Challenges and Potential Risks



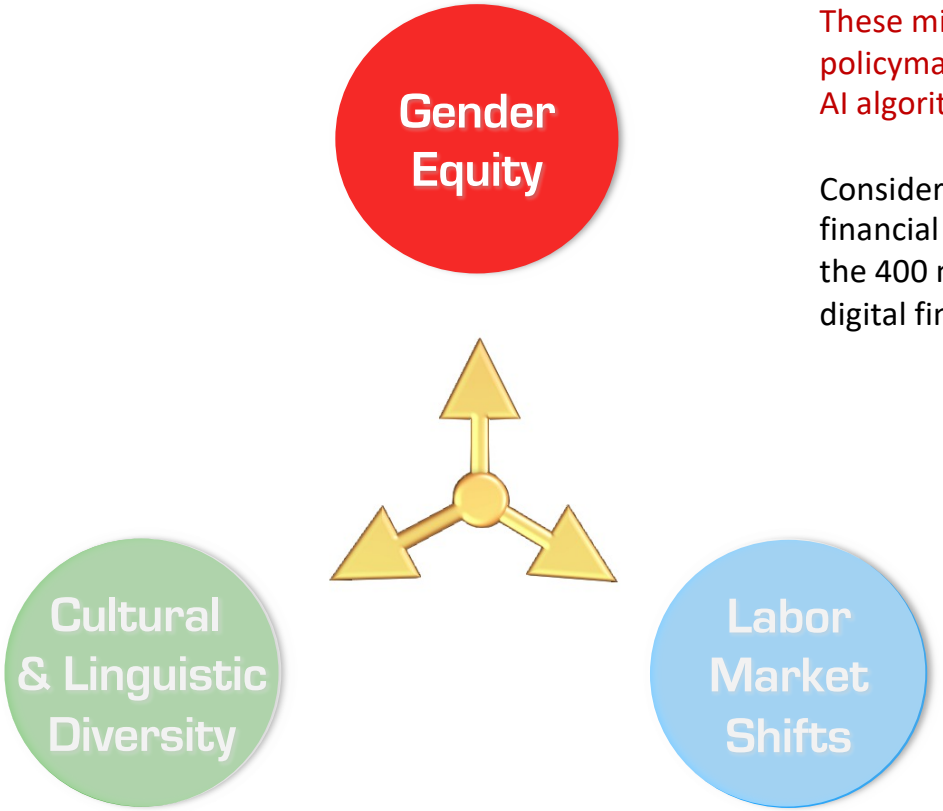
Women in Africa are likely to be marginalised by AI

The data can be inaccurate, with women being absent for a variety of reasons

For example, informal workers, many of whom are women, are not represented

In Sub-Saharan Africa, informal employment constitutes 92% of total female employment and 83% of total female non-agricultural employment (Bonnet et al., 2019).

Key Policy Challenges and Potential Risks



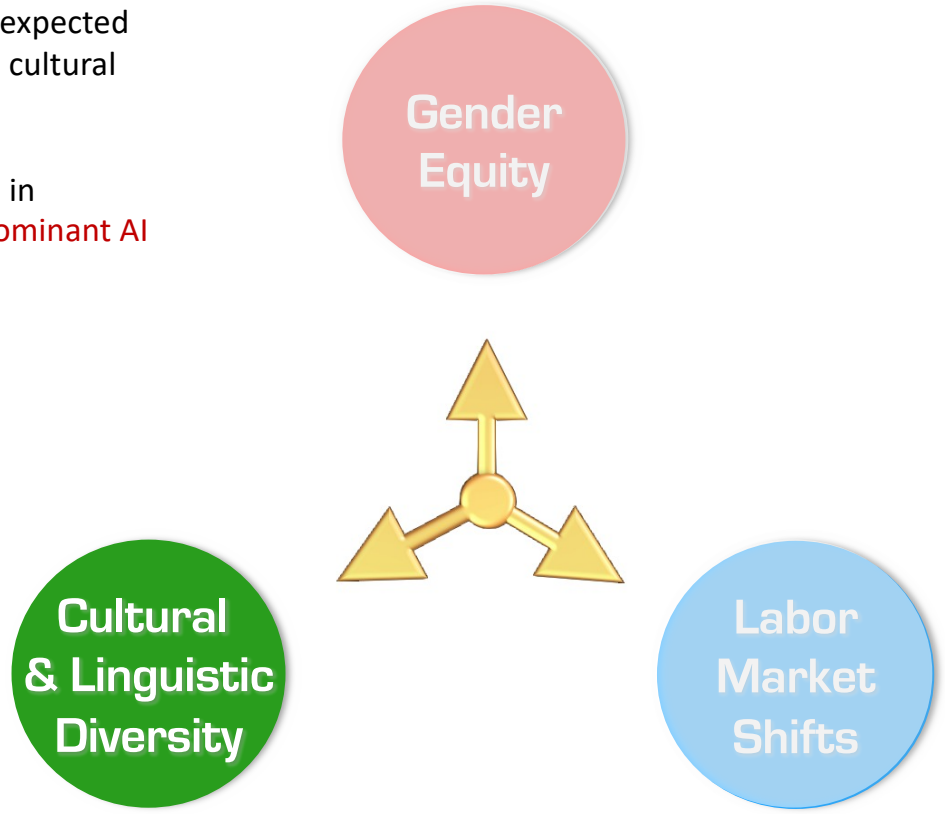
These missing data points feed into biases in policymaking and other decision-making based on AI algorithms

Consider algorithm-based decision-making in the financial sector, where women constitute 60% of the 400 million people in Africa who lack access to digital financial services across the continent

Key Policy Challenges and Potential Risks

☹️ Without policy intervention, AI can be expected to have a profound negative impact on cultural and linguistic diversity

This affects the world's poor countries, in particular, who are not home to the dominant AI and digital content companies.

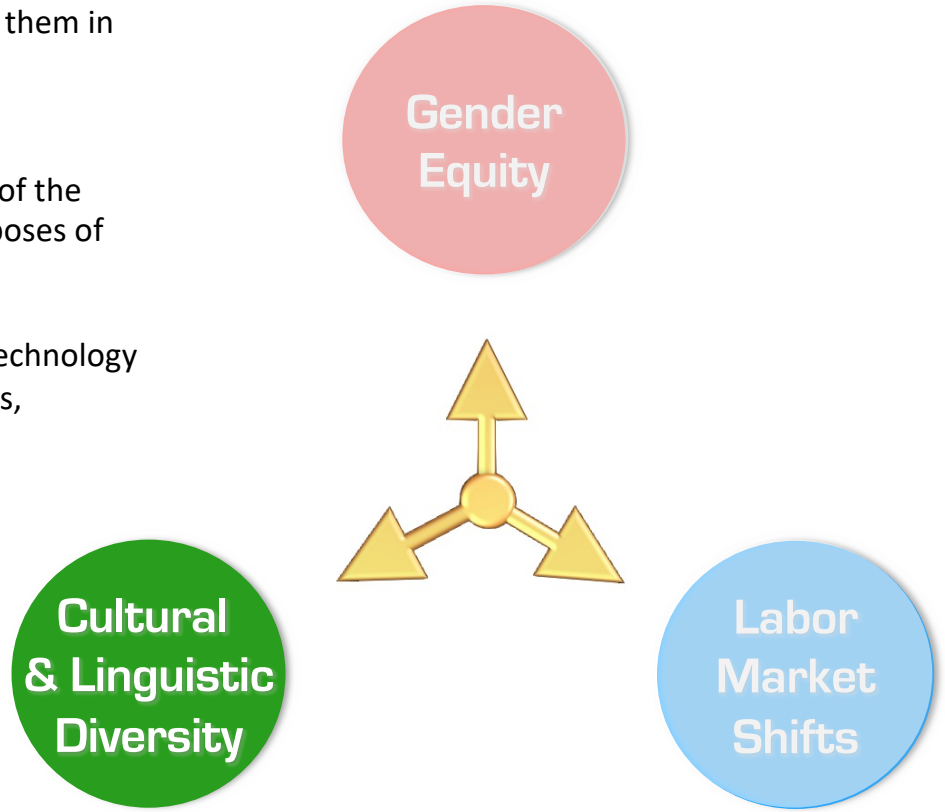


Key Policy Challenges and Potential Risks

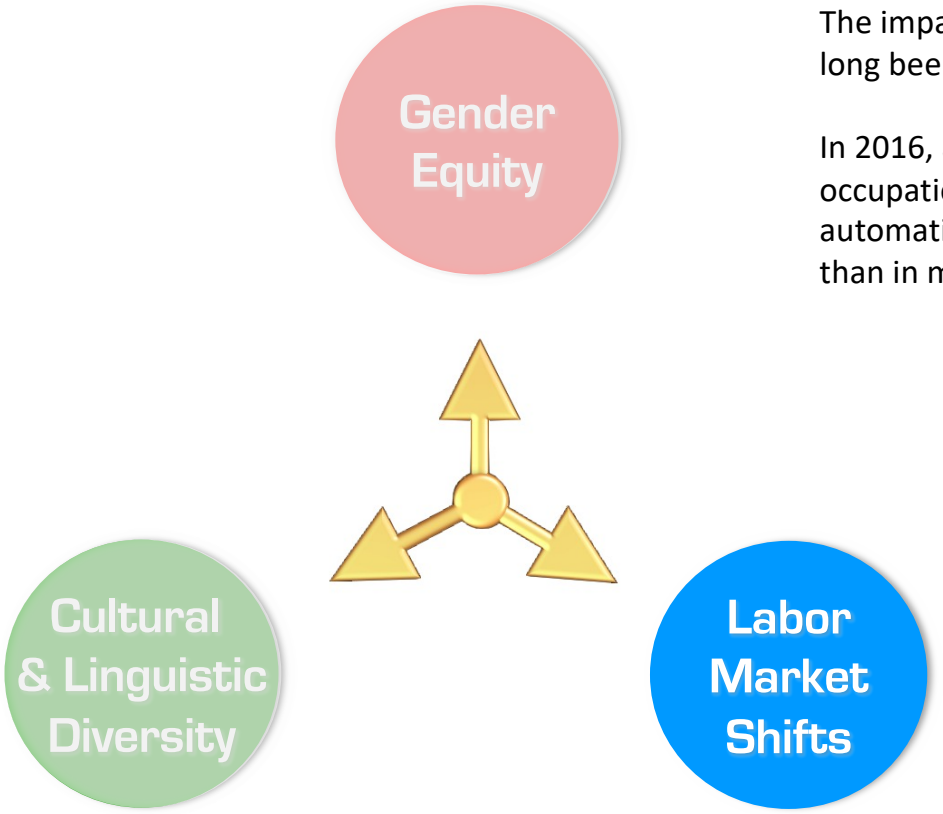
☹️ 17% of the world's languages, many of them in Africa, are low resource languages (Marivate et al., 2020)

There are insufficient examples of use of the languages available online for the purposes of training NLP applications

These languages are marginalised by technology deployments, including AI deployments, developed in the Global North



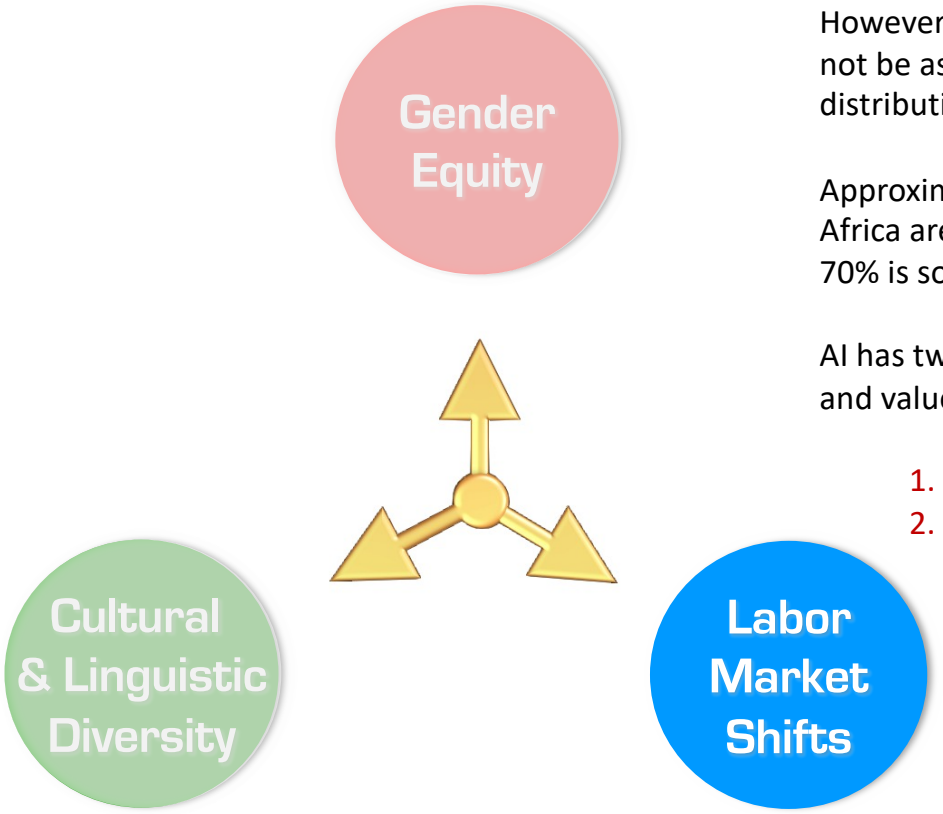
Key Policy Challenges and Potential Risks



The impact of AI and machine learning on jobs has long been a source of concern

In 2016, a World Bank report predicted "share of occupations that could experience significant automation is actually higher in developing countries than in more advanced ones" (World Bank, 2016)

Key Policy Challenges and Potential Risks



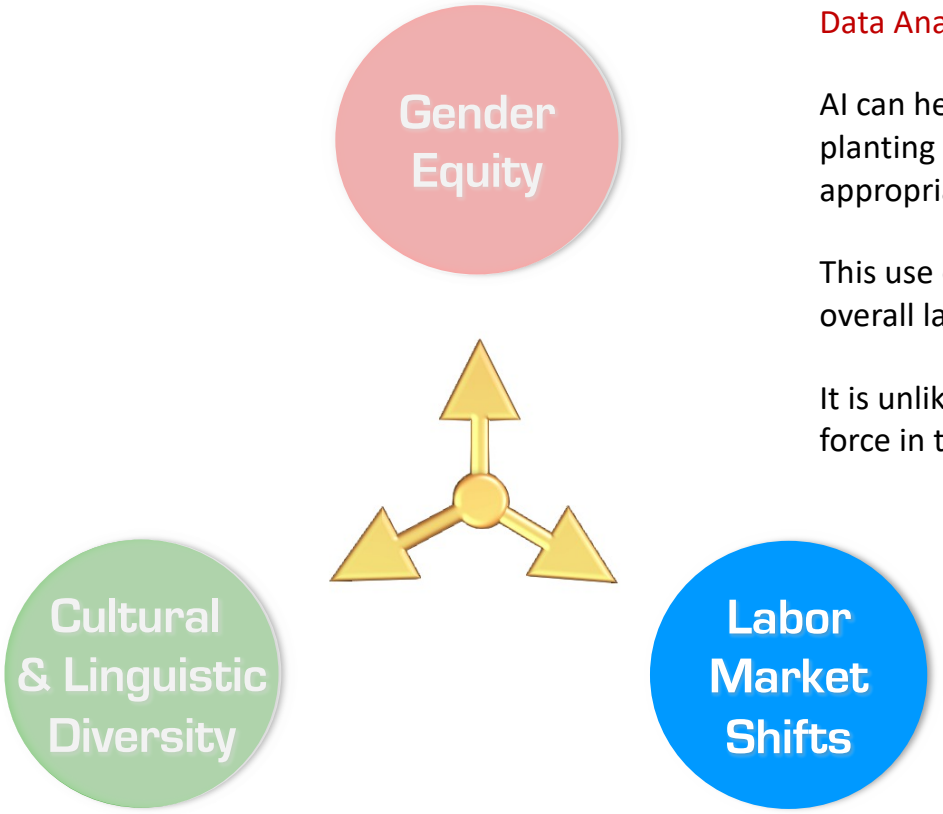
However, the impact of AI and machine learning may not be as bad as it seems if one considers the distribution of the labor force in Africa

Approximately 54% of all workers in sub-Saharan Africa are in the agricultural sector, and more than 70% is some countries (Fuglie et al., 2019)

AI has two primary uses that have significant impact and value in the agricultural sector:

1. Data analysis
2. Agricultural robots

Key Policy Challenges and Potential Risks



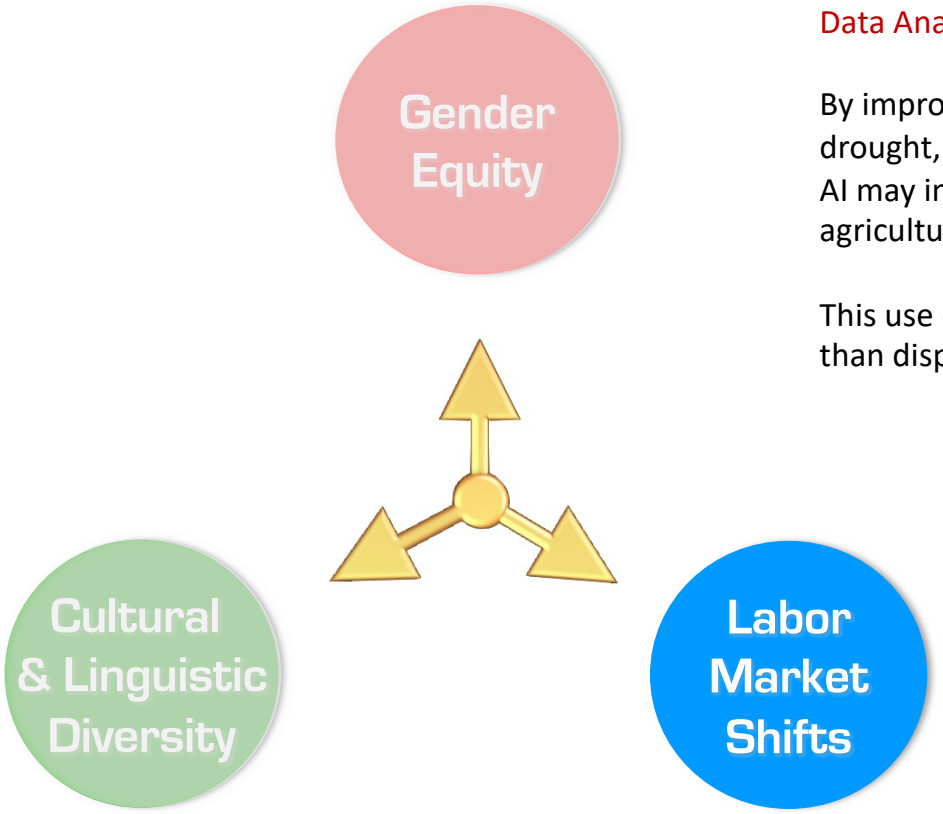
Data Analysis

AI can help predict weather patterns, optimize planting and harvesting schedules, and determine appropriate fertiliser needs

This use of AI has the potential to increase yields and overall land productivity or efficiency

It is unlikely to negatively affect the African labor force in the agricultural sector.

Key Policy Challenges and Potential Risks

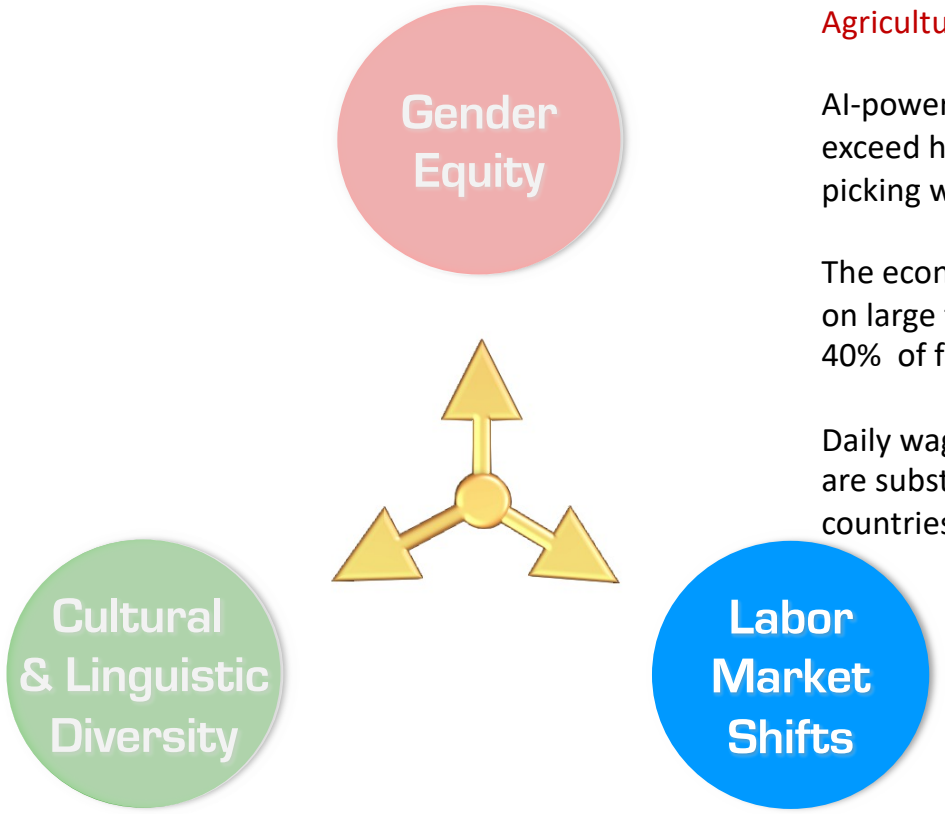


Data Analysis

By improving the ability to predict floods and drought, optimize land usage, and increase yields, AI may increase the need for workers in the agricultural sector

This use of AI complements human labor, rather than displacing it.

Key Policy Challenges and Potential Risks



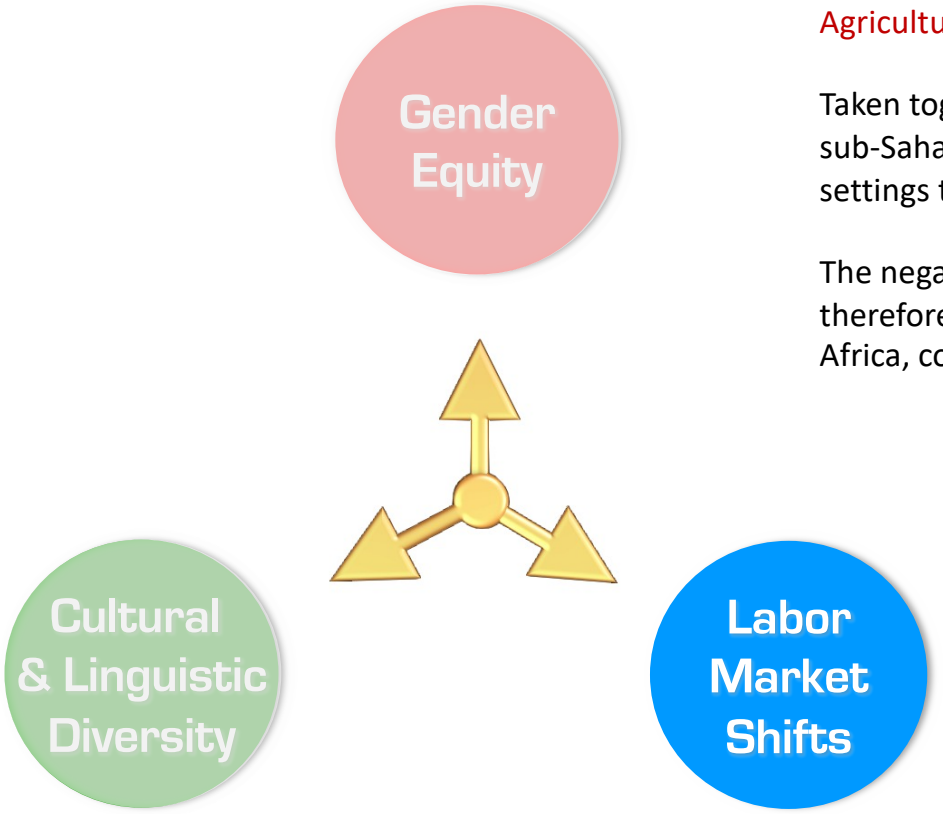
Agricultural Robots

AI-powered agricultural robots are expected to exceed human abilities for harvesting crops and picking weeds

The economic advantage of using robots is greater on large farms but smallholder farms account for 40% of farmland in sub-Saharan Africa

Daily wages for farm laborers in sub-Saharan Africa are substantially below those in highly developed countries

Key Policy Challenges and Potential Risks



Agricultural Robots

Taken together, there is less economic incentive in sub-Saharan Africa than in developed-world settings to invest in agricultural robots

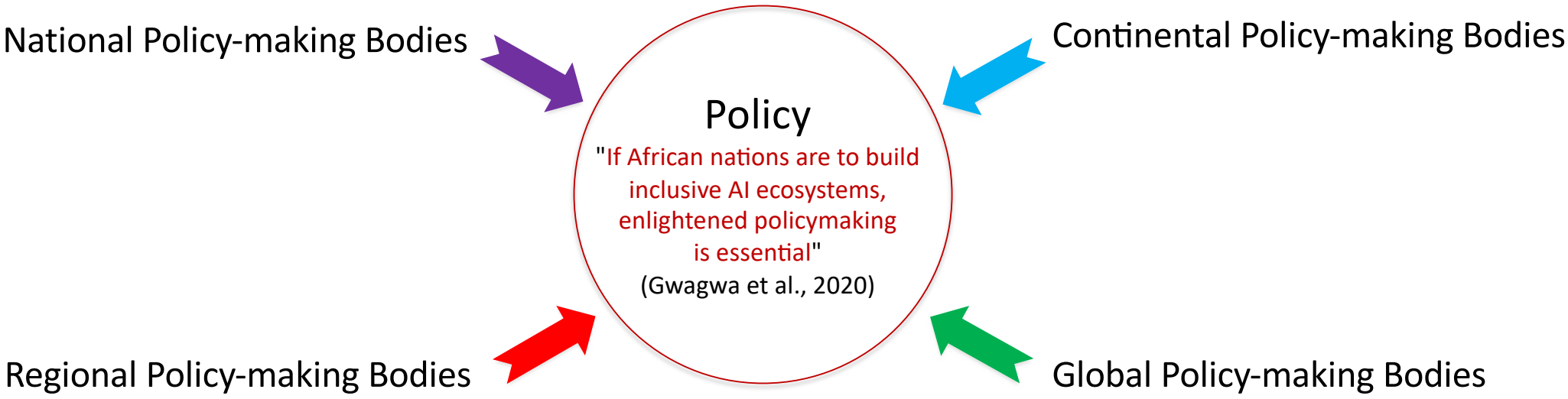
The negative impact of AI on farm labor could, therefore, be substantially less in sub-Saharan Africa, compared with developed countries

Policies at National, Regional, Continental, and Global Levels

Policy

"If African nations are to build inclusive AI ecosystems, enlightened policymaking is essential"
(Gwagwa et al., 2020)

Policies at National, Regional, Continental, and Global Levels



Conclusion

"Sound policy ... will be needed to enable African nations to build ecosystems that are inclusive, socially beneficial, and adequately integrated with on-the-ground realities."

(Gwagwa et al., 2020)

Conclusion

"African AI stakeholders will ultimately chart a course that is substantially dictated by the unique characteristics of the continent."

(Gwagwa et al., 2020)

Lecture Summary

1. AI offers many potential benefits and significant challenges for African nations
2. Africa presents different challenges to those in developed countries
3. These include gender equity, cultural and linguistic diversity, and labor market shifts
4. The appropriate policies must be in place to realize the benefits and mitigate the risks

Recommended Reading

Gwagwa, A., Kraemer-Mbula, E., Rizk, N., Rutenberg, I., & De Beer, J. (2020). Artificial Intelligence (AI) Deployments in Africa: Benefits, Challenges and Policy Dimensions. The African Journal of Information and Communication (AJIC), 26, 1-28.
https://doi.org/10.23962/10539/30361

References

Birhane, A. (2019, July 18). The algorithmic colonization of Africa. Real Life.
https://realli- femag.com/the-algorithmic-colonization-of-africa/

Bonnet, F., Vanek, J., & Chen, M. (2019). Women and men in the informal economy: A statistical brief. Women in Informal Employment: Globalizing and Organizing (WIEGO).
https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/ documents/publication/wcms_711798.pdf

Calo, R. (2017). Artificial intelligence policy: A primer and roadmap. UC Davis Law Review, 51(2), 339–435.
https://lawreview.law.ucdavis.edu/issues/51/2/Symposium/51-2_ Calo.pdf

Coleman, D. (2019). Digital colonialism: The 21st century scramble for Africa through the extraction and control of user data and the limitations of data protection laws. Mich- igan Journal of Race and Law, 24(2), 417–439.
https://repository.law.umich.edu/ mjrl/vol24/iss2/6

Couldry, N., & Mejias, U. (2019). Data colonialism: Rethinking big data's relation to the contemporary subject. Television and New Media, 20(4), 336–349.
https://doi.org/10.1177/1527476418796632

European Commission (EC). (2018). Artificial Intelligence for Europe.
https://www.european- sources.info/record/communication-artificial-intelligence-for-europe/

References

Fuglie, K., Gautam, M., Goyal, A., & Maloney, W. F. (2019). Harvesting prosperity: Technology and productivity growth in agriculture. World Bank. https://doi.org/10.1596/978-1-4648-1393-1

Majama, K. (2019). African women face widening technology gap. African School on Internet Governance (AfriSIG). https://afrisig.org/2019/04/01/african-wom- en-face-widening-technology-gap

Marivate, V., Sefara, T., Chabalala, V., Makhaya, K., Mokgonyane, T., Mokoena, R., & Modupe, A. (2020). Investigating an approach for low resource language data- set creation, curation and classification: Setswana and Sepedi. https://arxiv.org/ abs/2003.04986

Monehin, D. (2017). How youth and women are driving entrepreneurship in Africa. [Press release]. Mastercard. https://newsroom.mastercard.com/mea/press-releases/ how-youth-and-women-are-driving-entrepreneurship-in-africa/

OECD. (2019). Recommendation of the council on artif icial intelligence. OECD Legal Instruments. https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449

References

Oxford Insights, & International Development Research Centre (IDRC). (2019). Government artificial intelligence readiness index 2019.
https://www.oxfordinsights.com/ ai-readiness2019

Patel, N. (2018). Figure of the week: Understanding poverty in Africa. [Blog post]. Brookings.
https://www.brookings.edu/blog/africa-in-focus/2018/11/21/fig- ure-of-the-week-understanding-poverty-in-africa/

Pilling, D. (2019). Are tech companies Africa's new colonialists? Financial Times.
https://www.ft.com/content/4625d9b8-9c16-11e9-b8ce-8b459ed04726

Rizk, N., Salem, N., & Weheba, N. (2018). A gendered analysis of ridesharing: Perspectives from Cairo, Egypt. In F. Bercovich (Ed.), Urban transport in the sharing economy era: Collaborative cities. Center for the Implementation of Public Policies Promoting Equity and Growth (CIPPEC).
https://www.cippec.org/wp-content/ uploads/2018/09/UrbanTransport-completo-web_CIPPEC.pdf

Smith, M. L., & Neupane, S. (2018). Artif icial intelligence and human development: Toward a research agenda. White Paper. International Development Research Centre (IDRC).
https://idl-bnc-idrc.dspacedirect.org/handle/10625/56949

References

World Economic Forum (WEF). (2017). The future of jobs and skills in the Middle East and North Africa: Preparing the region for the fourth industrial revolution. Executive Briefing.
https://www3.weforum.org/docs/WEF_EGW_FOJ_MENA.pdf

World Bank (2016a). World development report 2016: Digital dividends.
https://www.world- bank.org/en/publication/wdr2016