

Climate Justice in the Digital Era: Incorporating African Languages, Culture and Ecological Knowledge into Artificial Intelligence for Sustainability

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Kariuki Muigua*

Abstract

This paper explores how AI can be appropriately utilised to promote climate justice in the digital era. The paper observes that the emergence of AI provides effective and innovative solutions that can strengthen climate action and promote climate justice for people and planet. It discusses some of the specific applications of AI in the climate justice discourse. Despite its appropriateness, the paper notes that if not effectively harnessed, AI can undermine inclusive climate action thus affecting the pursuit of climate justice. In particular, the notes that since most AI models are designed in the Global North, these models fail to incorporate languages, culture and ecological knowledge systems in Africa and the Global South thus hindering appropriate, inclusive, just and equitable climate action that is necessary in the pursuit of climate justice. In light of these concerns, the paper suggest how African languages, culture and ecological knowledge can be incorporated into AI towards promoting climate justice in the digital era for sustainability.

1.0 Introduction

With climate change having devastating and disproportionate impacts on nations, communities and individuals all over the world, climate justice has emerged as an effective tool towards protecting people and planet while ensuring equity, inclusivity and fairness in climate action. It has been observed that human-induced climate change has led to widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere, leading to many weather and climate extremes in every region across the world¹. Consequently, regions, nations, communities and people all over the world are experiencing the adverse impacts of climate change, which include changing weather patterns, rising sea level, and more extreme weather events such as intense droughts, catastrophic storms and flooding². The adverse impacts of climate change are causing dangerous and widespread disruption, depletion and degradation of nature while also affecting the lives, health, livelihoods and well-being of billions of people all over the world³.

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¹ World Meteorological Organization., 'Climate Change' Available at <https://wmo.int/topics/climate-change> (Accessed on 29/07/2026)

² United Nations., 'Climate Action.' Available at <https://www.un.org/sustainabledevelopment/climate-action/> (Accessed on 29/07/2026)

³ Intergovernmental Panel on Climate Change., 'Climate change: a threat to human wellbeing and health of the planet. Taking action now can secure our future' Available at https://www.ipcc.ch/report/ar6/wg2/downloads/press/IPCC_AR6_WGII_PressRelease-English.pdf (Accessed on 29/07/2026)

Climate change is therefore a major impediment in the pursuit of Sustainable Development. The 2030 Agenda for Sustainable Development describes climate change as one of the greatest challenges of our time whose adverse impacts undermine the ability of all countries to achieve Sustainable Development⁴. However, despite being a global problem, the impacts of climate change are felt unevenly. For example, it has been observed that climate change has disproportionate impacts on vulnerable individuals, groups and communities including indigenous peoples and local communities, women, the youth, the elderly, people of colour, persons with disabilities and people and communities in developing countries⁵. Consequently, effective climate action involves addressing the disproportionate impacts of climate change on vulnerable individuals, communities and regions for justice, equity, fairness and human rights⁶.

Fostering climate justice is therefore an effective approach in the global effort to confront climate change since this concept acknowledges that although climate change is a global crisis, its effects are not evenly felt around the world⁷. Climate justice focuses on protecting human rights of the most vulnerable including the poor, women and girls, the youth, indigenous peoples and local communities in the face of climate change⁸. It has been observed that by recognising the disproportionate impacts of climate change, climate justice seeks solutions that address the root causes of climate change and in doing so, simultaneously address a broad range of social, racial, and environmental injustices caused by the climate crisis⁹. The pursuit of climate justice has been bolstered in the digital era with modern technologies such as Artificial Intelligence (AI) providing effective and innovative solutions that can strengthen the global response to climate change

⁴ United Nations General Assembly., 'Transforming Our World: the 2030 Agenda for Sustainable Development.' 21 October 2015, A/RES/70/1., Available at <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf> (Accessed on 29/07/2026)

⁵ Center for Climate Justice., 'What is Climate Justice?' Available at <https://centerclimatejustice.universityofcalifornia.edu/what-is-climate-justice/> (Accessed on 29/07/2026)

⁶ Mary Robinson Foundation Climate Justice., 'Incorporating Human Rights into Climate Action' Available at <https://www.mrfcj.org/wp-content/uploads/2016/05/Incorporating-Human-Rights-into-Climate-Action-Version-2-May-2016.pdf> (Accessed on 29/07/2026)

⁷ What is Climate Justice?., Available at https://globalwitness.org/en/campaigns/land-and-environmental-defenders/what-climate-justice/?gad_source=1&gad_campaignid=13050085427&gbraid=0AAAAADm6LOBCAWyvG1rV8P9t7a-3ITtgC&gclid=Cj0KCQiAo4TKBhDRARIsAGW29beo0CN5gLtHcdqr42LaywMKxO5VVBWiMDiQOaj-Bj3eLN4oXC55Ah0aAkN1EALw_wcB (Accessed on 29/07/2026)

⁸ Aliozi. Z., 'Climate Justice and Human Rights, in a World in Climate Emergency' Available at <https://repository.gchumanrights.org/server/api/core/bitstreams/2eba3de1-1427-481b-a2d6-07818e00a53b/content> (Accessed on 29/07/2026)

⁹ Center for Climate Justice., 'What is Climate Justice?' Available at <https://centerclimatejustice.universityofcalifornia.edu/what-is-climate-justice/> (Accessed on 29/07/2026)

towards justice, equity, fairness and inclusivity¹⁰. Consequently, by effectively and appropriately harnessing AI, it is possible to promote climate justice in the digital era towards safeguarding people and planet for Sustainable Development.

This paper explores how AI can be appropriately utilised to promote climate justice in the digital era. The paper observes that the emergence of AI provides effective and innovative solutions that can strengthen climate action and promote climate justice for people and planet. It discusses some of the specific applications of AI in the climate justice discourse. Despite its appropriateness, the paper notes that if not effectively harnessed, AI can undermine inclusive climate action thus affecting the pursuit of climate justice. In particular, the notes that since most AI models are designed in the Global North, these models fail to incorporate languages, culture and ecological knowledge systems in Africa and the Global South thus hindering appropriate, inclusive, just and equitable climate action that is necessary in the pursuit of climate justice. In light of these concerns, the paper suggest how African languages, culture and ecological knowledge can be incorporated into AI towards promoting climate justice in the digital era for sustainability.

2.0 Artificial Intelligence and Climate Justice: Opportunities and Challenges

AI is being widely applied across many sectors to bolster climate action in the digital era. It has been observed that AI is being integrated in a wide range of sectors that are integral in climate action¹¹. These sectors include energy systems, transportation, agriculture, buildings and cities, biodiversity conservation, climate finance and societal resilience¹². For example, in the energy sector, AI tools can be used to reduce the energy needed to heat and cool a building thus fostering energy efficiency¹³. In addition, it has been observed that AI tools and systems can optimize the deployment of renewable energy sources such as solar and wind thus supporting global energy transition which is a crucial agenda towards confronting climate change¹⁴. In addition, it has been observed that AI is a powerful enabler of greener transport systems, helping cities and operators reduce emissions and energy consumption from the transport sector through smarter planning and real-time optimization¹⁵. AI can be applied to vehicle routing, fleet deployment, and traffic signal control towards achieving sustainable transport which is key for effective climate action¹⁶.

¹⁰ United Nations Climate Change., 'AI and Climate Action: Opportunities, Risks and Challenges for Developing Countries' Available at <https://unfccc.int/news/ai-and-climate-action-opportunities-risks-and-challenges-for-developing-countries> (Accessed on 29/07/2026)

¹¹ United Nations Educational, Scientific and Cultural Organization., 'How AI Policy can Accelerate Climate Action' Available at <https://www.unesco.org/ethics-ai/en/articles/how-ai-policy-can-accelerate-climate-action> (Accessed on 29/07/2026)

¹² Ibid

¹³ Ibid

¹⁴ United Nations Climate Change., 'AI and Climate Action: Opportunities, Risks and Challenges for Developing Countries' Available at <https://unfccc.int/news/ai-and-climate-action-opportunities-risks-and-challenges-for-developing-countries> (Accessed on 29/07/2026)

¹⁵ AI in Transportation: How Artificial Intelligence Transforms Mobility., Available at <https://www.ptvgroup.com/en/application-areas/ai-in-transportation> (Accessed on 29/07/2026)

¹⁶ Ibid

In addition, it has been observed that advances in AI are supporting precision agriculture by analyzing local soil and weather patterns to optimize the use of inputs such as water, fertilizer and pesticides, minimize environmental impacts and boost agricultural productivity and food security¹⁷. Through this, AI is supporting the resilience of agriculture and food production systems towards fostering food security in the midst of climate change¹⁸. Further, it has been observed that AI provides tools that can monitor and identify emission hotspots in industrial processes thus providing a basis for sound climate action¹⁹. The integration of AI into biodiversity conservation also provides an effective solution towards protecting vital carbon sinks including forests and wetlands towards effective climate action²⁰.

AI also provides solutions that can enhance the resilience of people and planet to climate change. For example, AI tools can analyze huge volumes of climate data thus tailoring and translating warnings to specific contexts and enhancing access to climate information on the basis of geography, gender, or vulnerability²¹. AI can strengthen early warning systems by predicting extreme weather events such as hurricanes, floods and droughts, thus enabling proactive disaster risk management for sound climate action towards protecting people and planet from the adverse impacts of climate change²².

From the foregoing, it is evident that AI is a powerful weapon in the global effort to confront climate change. Its data analysis, optimization, monitoring and predictive capabilities can support sound decision-making processes towards confronting climate change²³. However, in the quest towards climate justice, AI is associated with several challenges that can undermine this ideal. For example, it has been observed that most AI models are trained on the English language, leading to bias and, in some cases, errors with serious consequences due to exclusion of most of the world's 7,000 languages²⁴. In particular, some of the world's most linguistically diverse

¹⁷ United Nations Development Programme., 'Precision Agriculture for Smallholder Farmers' Available at <https://www.undp.org/publications/precision-agriculture-smallholder-farmers> (Accessed on 29/07/2026)

¹⁸ Ibid

¹⁹ United Nations Climate Change., 'AI and Climate Action: Opportunities, Risks and Challenges for Developing Countries' Op Cit

²⁰ United Nations Development Programme., 'People-Centric AI for Conserving Biodiversity' Available at <https://www.undp.org/sites/g/files/zskgke326/files/2025-12/people-centric-ai-for-conserving-biodiversity.pdf> (Accessed on 29/07/2026)

²¹ Artificial Intelligence and Early Warning Systems: Promise, Peril, and the Path Forward., Available at <https://www.early-action-reap.org/blog/artificial-intelligence-and-early-warning-systems-promise-peril-and-path-forward> (Accessed on 29/07/2026)

²² United Nations Climate Change., 'AI and Climate Action: Opportunities, Risks and Challenges for Developing Countries' Op Cit

²³ United Nations Educational, Scientific and Cultural Organization., 'How AI Policy can Accelerate Climate Action' Op Cit

²⁴ World Economic Forum., 'Generative AI is trained on just a few of the world's 7,000 languages. Here's why that's a problem - and what's being done about it' Available at <https://www.weforum.org/stories/2025/10/generative-ai-languages-llm/> (Accessed on 29/07/2026)

regions including Africa, Asia and Latin America, are systematically under-represented in AI research and development undermining inclusivity²⁵. Further, it has been observed that AI models often fuel biases, discrimination and prejudices against indigenous cultures and ecological knowledge in Africa and the Global South²⁶. Most AI models deployed in Africa and the Global South reflect foreign norms, values and knowledge systems thus undermining indigenous cultures and knowledge systems including Traditional Ecological Knowledge (TEK)²⁷.

The foregoing challenges can undermine climate justice since they hinder the ability of Africa and the Global South to confront climate change through local, context-specific and culturally-appropriate solutions. It is therefore necessary to incorporate African languages, culture and ecological knowledge into AI in order to promote climate justice in the digital era towards sustainability.

3.0 Incorporating African Languages, Culture and Ecological Knowledge into Artificial Intelligence for Sustainability

Promoting climate justice is a key agenda for Africa. For example, it has been observed that despite having the least greenhouse gas emissions, Africa stands out disproportionately as the most vulnerable region in the world to climate change and its impacts²⁸. Africa is already facing climate change and is amongst the regions that will experience the most devastating consequences of projected climate trends in the future²⁹. In particular, it has been observe that many parts of Africa are warming at a faster rate than the global average and facing an above-average sea-level rise³⁰. Climate change is profoundly impacting African countries in numerous

²⁵ United Nations Development Programme., 'Harnessing Multilingual AI for Industrial Development Growth and Powering Local Communities' Available at <https://www.undp.org/digital/blog/harnessing-multilingual-ai-industrial-development-growth-and-powering-local-communities> (Accessed on 29/07/2026)

²⁶ How to Break Digital Colonialism in African Software Development., Available at <https://www.ictworks.org/digital-colonialism-african-software-development/#:~:text=Defining%20Digital%20Colonialism%20in%20Software,serve%20its%20communities'%20best%20interests> (Accessed on 29/07/2026)

²⁷ Perera. M et al., 'Indigenous peoples and artificial intelligence: A systematic review and future directions' Available at <https://journals.sagepub.com/doi/10.1177/20539517251349170#:~:text=Abstract, discuss%20literature%20under%20each%20category> (Accessed on 29/07/2026)

²⁸ United Nations Environment Programme., 'Responding to Climate Change' Available at <https://www.unep.org/regions/africa/regional-initiatives/responding-climate-change> (Accessed on 29/07/2026)

²⁹ African Development Bank Group., 'Africa and Climate Change' Available at <https://www.afdb.org/en/topics-and-sectors/sectors/climate-change/our-strategy> (Accessed on 29/07/2026)

³⁰ Ibid

ways by fuelling water scarcity, damaging agricultural harvests, affecting lifestyles, and amplifying gender and other dimensions of inequality³¹.

Due to the adverse and uneven impacts that the continent faces from the climate crisis, securing climate justice is key towards protecting people and planet in Africa for Sustainable Development. It has been observed that the continent is responsible for only a fraction of global greenhouse gas emissions but is suffering disproportionately from climate change and its impacts when compared to other regions³². The emergence of AI therefore provides opportunities towards bolstering Africa's response to climate change towards climate justice. It has been observed that AI has the capacity to bolster climate action in Africa strengthening early warning systems, supporting precision agriculture towards food security, improving biodiversity conservation and environmental monitoring, and supporting efforts towards greening African economies³³.

Incorporating African languages, culture and ecological knowledge into AI provides a useful approach towards promoting climate justice in the digital era. For example, it has been observed that communities all over Africa have developed deep and sophisticated indigenous knowledge systems, based on their observations and interactions with the environment over generations that have enabled them to harness ecosystem services to support their livelihoods, ensure harmony with nature and survive socioecological changes including climate change³⁴. Indigenous knowledge system, cultures and practices have enabled communities in Africa to live in harmony with nature for many centuries since they hold a prevailing view that nature is sacred³⁵. For example, pursuant to their cultures, communities in Africa view themselves as an integral part of the environment and its ecosystems, thus living in balance and harmony with nature³⁶.

In particular, it has been observed that Traditional Ecological Knowledge (TEK) passed down from generation to generation in Africa is key towards confronting climate change and fostering

³¹ Fonjong. L., Matose. F., & Sonnenfeld. D., 'Climate change in Africa: Impacts, adaptation, and policy responses' *Global Environmental Change*., Volume 89, December 2024

³² World Meteorological Organization., 'Africa suffers disproportionately from climate change' Available at <https://wmo.int/media/news/africa-suffers-disproportionately-from-climate-change> (Accessed on 29/07/2026)

³³ Responsible Artificial Intelligence for Climate Action in Africa., Available at <https://rain-ca.org/> (Accessed on 29/07/2026)

³⁴ Zougmore. R., Segnon. A., & Thornton. P., 'Harnessing Indigenous Knowledge and Practices for Effective Adaptation in the Sahel' Available at <https://doi.org/10.1016/j.cosust.2023.101389> (Accessed on 29/07/2026)

³⁵ Naamwintome. B.A., & Millar. D., 'Indigenous Knowledge and the African Way Forward: Challenges and Opportunities' Available at <https://www.scirp.org/journal/paperinformation?paperid=68164> (Accessed on 29/07/2026)

³⁶ Traditional Ecological Knowledge and Global Climate Change; A Global South Perspective on Climate Solutions., Available at <https://afo.or.tz/traditional-ecological-knowledge-and-global-climate-change-a-global-south-perspective-on-climate-solutions/> (Accessed on 29/07/2026)

sustainability³⁷. Africa's TEK has enabled long-term environmental observations, thus helping communities in the continent to develop valuable data and insights on climate patterns and changes specific to Africa³⁸. Through TEK, communities in Africa have developed flexible and resilient practices to cope with environmental variability unique to the continent including sustainable agricultural practices, sustainable hunting and fishing, and sustainable conservation and practices tailored to local ecosystems³⁹.

Incorporating African cultures and ecological knowledge including TEK into AI is therefore necessary towards developing local, appropriate and context-specific solutions to the climate crisis towards climate justice. Further, since cultural values and knowledge systems including TEK are usually preserved in indigenous and local languages, incorporating African languages into AI can ensure that culture and ecological knowledge is preserved and made available in an understandable manner⁴⁰. It is therefore necessary to prioritise local AI models that incorporate African languages, culture and ecological knowledge towards fostering climate justice in the digital era. In particular, collaborating with indigenous peoples, local communities and developers in Africa and the Global South in the development and deployment of AI can ensure that indigenous languages, culture and ecological knowledge are effectively harnessed for sustainability⁴¹.

4.0 Conclusion

With Africa being disproportionately impacted by climate change, promoting climate justice is key towards protecting people and planet for Sustainable Development. In particular, AI provides tools and solutions that can strengthen climate action and accelerate progress towards climate justice in the digital era especially in Africa and the Global South⁴². By incorporating African languages, culture and ecological knowledge into AI, it is possible to effectively harness and utilise local, context-specific and culturally-relevant solutions towards confronting climate change and realising climate justice in the digital era.

³⁷ Ibid

³⁸ Ibid

³⁹ Ibid

⁴⁰ Kilungu. N., 'Pluriversal AI: Bridging African Epistemologies and Peace Innovation' Available at <https://www.linkedin.com/pulse/pluriversal-ai-bridging-african-epistemologies-peace-mwelu-kilungu-g-acl1f/> (Accessed on 29/07/2026)

⁴¹ African-language Large Language Models (LLMs) present major opportunities for the continent., Available at <https://medium.com/code-for-africa/african-language-large-language-models-llms-present-major-opportunities-for-the-continent-8a92a69518b3> (Accessed on 29/07/2026)

⁴² Responsible Artificial Intelligence for Climate Action in Africa., Op Cit

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