State of AI in Climate Action in Sub-Saharan Africa



State of AI in Africa
Report Series

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Responsible AI for Africa

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About CEIMIA

In an era of rapid development in artificial intelligence (AI), including the arrival of generative AI, governments are faced with the crucial task of effectively navigating the complexities surrounding the deployment of AI and its impact on society. It is in this context that the International Centre of Expertise in Montreal on Artificial Intelligence (CEIMIA) supports the work of the Global Partnership on Artificial Intelligence (GPAI), a multi-stakeholder initiative aiming to bridge the gap between theory and practice on delivering responsible AI. GPAI does this by supporting cutting-edge research and applied activities on AI-related priorities. Built around a shared commitment to the OECD Recommendation on AI, GPAI brings together engaged minds and expertise from science, industry, civil society, governments, international organizations and academia to foster international cooperation.

With its unique position supporting GPAI, CEIMIA mobilizes international experts and resources (from the academic, private, and civil society sectors) to promote the responsible development and use of AI for the benefit of humanity. CEIMIA is therefore acting as a key player in the responsible development of AI based on human rights, inclusion, diversity, innovation, economic growth and the well-being of society, while seeking to achieve the United Nations' sustainable development goals.

In this shared effort to develop responsible AI, CEIMIA, with the support of the International Development Research Centre (IDRC), has launched a Researcher-in-Residence Program to facilitate the development of links with AI ecosystems in Global South, particularly in Africa, and to identify opportunities for collaboration with GPAI expert groups and the Canadian AI ecosystem. Such a mission would not be possible without knowing the current state of AI in Africa. It is for this reason that CEIMIA, with the support of the researcher in residence, has decided to produce a series of reports on the state of AI in Africa, which will enable us to target priority areas based on the needs of Africa and Africans, when it comes to developing responsible AI.

Acknowledgements

This report was developed in the context of the Researcher-in-Residence Program at (CEIMIA), with the support of the International Development Research Centre (IDRC).

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CEIMIA recognizes the meaningful contribution of experts who reviewed the report: **Jean-Louis Fendji,** Afroleadership, **Howard Lakougna**, Bill & Melinda Gates Foundation, and **Winston Ojenge,** African Centre for Technology Studies (ACTS). CEIMIA also recognizes the contribution of **Ngombi Oum Samuel**, **Ateh Christabella**, **David Alex Eto Mengom** and **Talla Wamba Ulrich**, former Master students at the Advanced School of Mass Communication at the University of Yaounde II.

Supported by:
Gwenaëlle Le Peuch, Communications Manager, CEIMIA;
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Stefan Janusz, Senior Project Manager, CEIMIA;
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Disclaimer

This report was developed in the context of the Researcher-in-Residence Program at the International Centre of Expertise in Montreal on Artificial Intelligence (CEIMIA), with the support of the International Development Research Centre (IDRC). The report reflects the personal opinions of the Researcher and does not necessarily reflect the views of CEIMIA, IDRC, or reviewers' organizations.

Citation

Cite as:
International Centre of Expertise in Montreal on Artificial Intelligence (CEIMIA). (2025). State of AI in Climate Action in Sub-Saharan Africa.
https://doi.org/10.5281/zenodo.14963128

DOI: 10.5281/zenodo.14963128

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Acronyms

ACCF	Africa Climate Change Fund
AfDB	African Development Bank
AFD	Agence Française de Développement
AfDB	African Development Bank
AI	Artificial Intelligence
AIIKS	African Institute in Indigenous Knowledge Systems
AI4D	Artificial Intelligence for Development in Africa
BCP	BioCarbon Partners
BMGF	Bill and Melinda Gates Foundation
CAD	Canadian Dollar
CBIT	Capacity-building Initiative for Transparency Trust Fund
CSO	Civil Society Organizations
CEIMIA	International Center of Expertise in Montreal on Artificial Intelligence
FCDO	Commonwealth and Development Office
GBFF	Global Biodiversity Framework Fund
GCF	Green Climate Fund
GEF	The Global Environment Facility
GPAI	Global Partnership on Artificial Intelligence
IDRC	International Development Research Centre of Canada
ICPAC	IGAD Climate Prediction and Applications Centre
IGAD	Institution of the Intergovernmental Authority on Development
IoT	Internet of Things
ITIKI	Information Technology and Indigenous Knowledge with Intelligence
LDCF	Least Developed Countries Fund
ML	Machine Learning
NGO	Non-Governmental Organisation
NPIF	Nagoya Protocol Implementation Fund
RAN	Resilient Africa Network
R&D	Research and Development

SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
SAWS	South African Weather Service
SCCF	Special Climate Change Fund
SDM	Service Delivery Manager
SIDA	Sweden's government agency for development cooperation
SMS	Short Message Service
SMART	Spatial Monitoring and Reporting Tool
TAHMO	Trans-African Hydro-Meteorological Observatory
TEK	Traditional Environmental Knowledge
TDIF	Trustworthy Data Institutions Framework
UAVs	Unmanned Aerial Vehicles
UKZN	University of Kwazulu-Natal
UNDP	United Nations Development Programme
UQAM	Université du Québec à Montréal
USAID	United States Agency for International Development
WASCAL	West African Science Service Centre on Climate and Adapted Land Use

List of Figures

Figure 1: The Research Approach

Figure 2: Areas of Climate Action in which AI is Widely Applied in Sub-Saharan Africa

Figure 3: The Hot Spot Countries for AI in Climate Action

Figure 4: Types of Organisations Leading the Development of AI in Climate Action in Sub-Saharan Africa

Figure 5: Challenges and Recommendations

List of Tables

Table 1: AI-Techniques and Technologies Used in Climate Change

Table 2: Non-Exhaustive List of Climate adaptation and Early Warning Systems Initiatives

Table 3: Non-Exhaustive List of Modelling and Forecasting Initiatives

Table 4: Non-Exhaustive List of Biodiversity Monitoring Initiatives

Table 5: Non-Exhaustive List of Energy Optimization Initiatives

Table 6: Non-Exhaustive List of Carbon Footprint Tracking Initiatives

Table of Contents

Executive Summary **11**
1. Introduction **15**
2. Methodology **17**
3. Applications of AI in Climate Action **20**
3.1. AI Technologies and Techniques 20
3.2. Climate adaptation and Early Warning Systems 23
3.3. Modelling and Forecasting 24
3.4. Biodiversity Monitoring 26
3.5. Energy Optimisation 27
3.6. Forest Monitoring and Carbon Footprint Tracking 28
4. Additional Observations **31**
5. Main Funding Agencies **35**
5.1. The International Development Research Centre (IDRC) 35
5.2. The Bill & Melinda Gates Foundation 36
5.3. The African Development Bank (AfDB) 36
5.4. The Agence Française de Développement (AFD) 37
5.5. The Global Environment Facility (GEF) 37
5.6. The UN Organisations 38
5.7. The Rockefeller Foundation 38
5.8. European Commission 38
5.9. The United States Agency for International Development (USAID) 39
5.10. Big Tech Companies 39
6. Pathways to Responsible Uptake of AI in Climate Action **41**
7. Conclusion **47**
8. Bibliography **49**
Annex: List of AI Initiatives in Climate Change **61**

Executive Summary

The "State of AI in Climate Action" report explores the pivotal role of artificial intelligence (AI) in addressing the multifaceted challenges of climate change across Africa. As the continent contends with increasing threats such as extreme weather events, food insecurity, and biodiversity loss, the integration of AI offers transformative potential to enhance resilience, promote sustainable development, and protect vulnerable ecosystems and communities.

This third report of the "State of AI in Africa" series, developed under the Researcher-in-Residence Program at the International Centre of Expertise in Montreal on Artificial Intelligence (CEIMIA), with the support of the International Development Research Centre (IDRC), provides an in-depth analysis of the current state of AI in climate action across sub-Saharan Africa. This report will enable policymakers, developers, researchers, entrepreneurs, and citizens to develop AI-enabled solutions that are both contextually relevant and culturally appropriate to address climate change.

Takeaways

1. **AI Technologies and Techniques**
   - **Data Gathering:** AI-enabled climate solutions rely on a data-driven approach, gathering vast amounts of information from various sources such as sensor data, satellite imagery, weather records, historical climate data, and land use maps. This data is collected through advanced technologies like Internet of Things (IoT), high-resolution cameras, drones, and satellite systems, and is often processed on cloud platforms such as Google Earth Engine;
   - **Analysis and Decision-Making:** AI techniques such as machine learning and computer vision are pivotal. These techniques analyze data to provide real-time information on environmental conditions, predict future climate patterns, monitor land use changes, and assess public perceptions of climate change. More advanced techniques like deep learning and large language models further enhance the ability to process complex datasets, detect

changes in land use and vegetation, and analyze vast amounts of textual and visual data.

2. Applications of AI in Climate Action

- **Climate Adaptation and Early Warning Systems:** Early warning systems predict and provide timely alerts for natural disasters, thereby reducing risks for vulnerable communities;
- **Climate Modeling and Forecasting:** AI-driven models are significantly improving the accuracy of climate predictions, enabling better preparedness and mitigation of extreme weather events;
- **Biodiversity Monitoring:** AI-powered tools are facilitating greater monitoring of wildlife and ecosystems, crucial for protecting biodiversity;
- **Optimized Energy Systems:** AI is optimizing the use of renewable energy resources, contributing to the creation of more sustainable and efficient energy systems across the continent;
- **Carbon Footprint Tracking:** AI is enabling more effective tracking and management of carbon emissions, supporting efforts to reduce greenhouse gas emissions and combat climate change.

3. Main Funding Agencies

- **Big Tech involvement:** Companies like Google, IBM and Microsoft have established AI research labs and tech hubs in Africa;
- **Funding initiatives:** Programs like AI4D Africa support AI research and applications to address development challenges.

Recommendations for the Uptake of Responsible AI

1. Implement a data governance model based on the Trustworthy Data Institutions Framework (TDIF[1])

- Encourage shared access to digital resources amongst stakeholders;
- Share the benefits of data-driven innovations amongst communities;
- Ensure Data Privacy and Security; and

[1] Trustworthy Data Institutional Framework - A practical tool to improve trustworthiness in data ecosystems

- Improve inclusiveness and ownership within data steward organizations in order to foster greater representation of marginalized groups.

2. Strengthen Responsible AI literacy of local experts and communities

- Build data literacy and increase participation of local communities;
- Develop local expertise in AI and climate science; and
- Focus on Transparency and Explainability[2].

3. Integrate Traditional Environmental Knowledge (TEK) in AI-enabled solutions for climate change

- Encourage Inclusive and Participatory Approaches;
- Develop Inclusive AI Models; and
- Build datasets for underrepresented languages focusing on climate terms and issues.

4. Promote sustainable and scalable solutions

- Facilitate access to open data and AI Tools
- Engage with and contribute to continental AI initiatives

[2] The technical terms (transparency, explainability, participatory approaches, AI models) used in this executive summary will be discussed more in later sections.

Introduction

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1. Introduction

Climate change represents one of the most significant challenges of the 21st century, with its impacts being especially felt across the African continent[3]. From extreme weather events and shifting agricultural patterns to rising sea levels and a reduction in biodiversity, the consequences of a changing climate are profound and far-reaching. As African nations grapple with these challenges, there is an increasing recognition of the need for innovative solutions that can enhance resilience, promote sustainability, and mitigate the impacts of climate change. In this context, artificial intelligence (AI) has emerged as a transformative tool with the potential to revolutionize climate action.

> *Artificial intelligence (AI) has been proposed as one such tool, with significant opportunities to accelerate climate action via applications such as forecasting solar power production, optimizing building heating and cooling systems, pinpointing deforestation from satellite imagery, and analyzing corporate financial disclosures for climate-relevant information.*
>
> - **Global Partnership for Artificial Intelligence (GPAI, 2021)**

In this research report, we aim to provide the current state of AI in climate action in sub-Saharan Africa. Based on the analysis of existing online resources, this report shows how dynamic the African AI ecosystem is, with local talents and experts who are proactive in applying AI to enhance climate resilience, mitigate environmental impacts, and support sustainable development.

We conclude the report by discussing the opportunities and challenges related to the adoption of AI in the climate sector, providing a set of recommendations for policymakers, researchers, and practitioners on how best to leverage this technology to address one of the most urgent issues of our time.

[3] CLIMATE CHANGE AND AI

Methodology

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2. Methodology

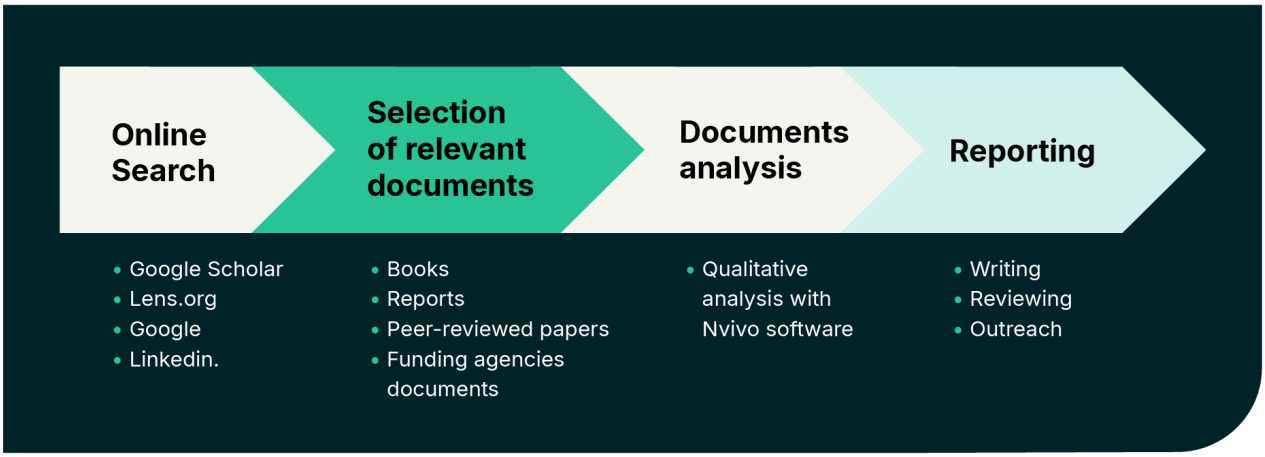
Research Approach

This report is the result of an analysis of data gathered through four main platforms: Google Scholar, Lens.org, Google search, and LinkedIn. We did our research in French and English, using a variety of means:

- **Keywords:** we used a different combination of keywords such as AI and ML application in: Climate Change, Renewable Energy, Global Warming, Greenhouse Gases, Carbon Emissions, Climate Mitigation, Climate Adaptation, Extreme Weather Events, Biodiversity, and Climate Resilience. Among the results obtained, we restricted our selection to the date range from 2018 to 2024.
- **Relevant documents** including books, reports, peer-reviewed papers, and documents from funding agencies were selected. The bibliographic references are available in this Zotero group: CEIMIA - AI in Climate Change in Africa (Note: please feel free to join the group and contribute).
- **A sample of 22 active AI initiatives** in climate action in Africa (see the annex). We are aware that our research did not cover all existing initiatives of AI in climate action in Africa. We encourage the reader to complete this form so we can collectively uphold a dynamic repository of AI initiatives in climate action.

These resources were then processed and analyzed using Nvivo, a qualitative analysis software programme. The information we present in this report has emerged from this analysis.

Figure 1: The Research Approach



Limitations

- The lack of linguistic diversity in the various sources of information used to write this report is a limitation. Indeed, in sub-Saharan Africa, there are French, English, Portuguese, and Spanish speaking countries. However, we only used French and English keywords to gather information for this report.
- The report focuses on local initiatives. The information gathered about AI climate action in Africa mainly comes from Western countries that work in Africa as a research field, either through African diasporas or collaborations with local researchers. In this report, we aimed to highlight initiatives originating from the continent. Therefore, some globally recognised initiatives based in the West may not be included in this report.
- Our figures are indicative only. The representations and breakdowns shown in this report only reflect an assessment based on the numbers of initiatives we found.

Applications of AI in Climate Action

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3. Applications of AI in Climate Action

Climate change poses complex challenges that require innovative strategies for effective mitigation, in order to protect communities, infrastructure, and businesses from their effects. In this sense, Artificial Intelligence (AI), offers powerful capabilities for processing large datasets, identifying patterns, and making predictions, which are essential for effective climate modeling, disaster preparedness, and resource management.

> *AI has the potential to advance and scale up transformative climate solutions, for example regarding mitigation and adaptation action. For instance, AI can be used to predict climate patterns and extreme weather events, improve crop yields, reduce water usage or optimize renewable energy systems.*
>
> - **United Nations University, Institute for Environment and Human Security (2024)**

Across Africa, a growing number of initiatives and startups are harnessing AI to address climate-related challenges, from optimizing renewable energy systems and monitoring biodiversity to tracking carbon emissions and integrating indigenous knowledge with modern technology. The following sections list, respectively, the different AI techniques and technologies that can be used to better understand climate change, and then examples of specific AI solutions applied in the African context[4].

3.1. AI Technologies and Techniques

Collecting Climate Data

AI-enabled climate solutions are a data-driven approach done by analyzing large amounts of data from various sources (sensor data, satellite data, weather data,

[4] Note: The initiatives highlighted here are indicative and geographically representative. Their presence and ordering is not intended to promote any one initiative or to demonstrate its superiority over others.

historical climate data, land use maps), gathered through network infrastructure of the Internet-of-Things (IoT), advanced technology (high resolution camera, satellite technology, sensors, drones, mobile phones, unmanned aerial vehicles (UAVs)), and openly available cloud platforms (e.g., Google Earth Engine).

Sensor Data

Sensor data refers to information collected from ground-based or in-situ sensors that measure environmental variables such as rainfall, river levels, temperature, humidity, and more. These sensors provide real-time data that is crucial for monitoring and managing natural resources and environmental conditions. Sensor data is used in early warning systems for floods, droughts, and other natural disasters, water resource management, and hydrological modeling to predict and mitigate the impacts of climate variability.

Satellite Data

Satellite data - often called 'Earth Observation Data' - encompasses imagery and other forms of data captured by satellites orbiting the Earth. This includes visible light images, infrared data, and radar data that provide detailed views of the Earth's surface, atmosphere, and oceans. Satellite imagery is widely used for land use monitoring, tracking deforestation and urbanization, agricultural monitoring, and disaster management.

Weather Data

Weather data includes measurements of atmospheric conditions such as temperature, humidity, wind speed, and precipitation. This data is collected by weather stations, satellites, and other meteorological instruments to understand and predict weather patterns. Weather data is essential for short-term weather forecasting, long-term climate studies, agricultural planning, and disaster preparedness.

Historical Climate Data

Historical climate data refers to long-term records of climate variables such as temperature, precipitation, and wind patterns, typically spanning decades or centuries. This data is crucial for understanding past climate conditions and trends.

Historical climate data is used to study climate change, model future climate scenarios, and assess the potential impacts of climate variability on ecosystems, economies, and human societies.

Land Use Maps

Land use maps are visual representations of how different areas of land are utilized, such as for agriculture, urban development, forestry, or conservation. These maps are created using data from satellite imagery, surveys, and other sources. Land use maps are essential tools for urban planning, environmental management, and conservation efforts.

Analysis and Decision Making

The basic premise of ML is to build algorithms that can receive input data and use statistical analysis to predict an output while updating outputs as new data become available. More specifically, computer vision algorithms analyze visual data such as images and videos captured by satellites, drones or smartphones. In the climate change context, the analysis of these data provides real-time information on soil moisture, allowing farmers to make data-driven decisions to predict future climate patterns and changes (Machine Learning), map and monitor land use changes and urban development (Computer Vision), analyze social media data to assess public perceptions of climate change (Natural Language Processing), analyse satellite imagery to detect changes in land use and vegetation (Deep Learning), process vast amounts of textual and contextual data (Large Language Models). This is promising for climate action, as it can help policymakers, Governments and communities to anticipate the impacts of climate change and design effective mitigation and adaptation strategies.

Table 1: AI Techniques and Technologies Used in Climate Change

Functions	Technologies	Techniques
Climate data collection	• Internet; • Cloud computing; • Desktops, Laptops, tablets, smartphones and mobile apps; • Drones; • Satellite imagery.	• SMS; • Sensors and IoT devices; • Chatbots.
Analysis and decision-making	• Artificial intelligence • Automation • Blockchain	• Machine Learning; • Deep Learning; • Computer vision; • Natural Language Processing; • Large Language Models; • Image Processing Technique • AI modeling; • Predictive analytics.

3.2. Climate adaptation and Early Warning Systems

Artificial intelligence (AI) has emerged as a viable tool for climate change adaptation. By analyzing large amounts of data, such as climate models, satellite images and weather patterns, AI can assist in planning climate change adaptation actions. Moreover, given that indigenous knowledge is based on relative and local experience, integrating them in AI applications may also upscale climate engagement of the public and strengthen AI-Powered Early warning systems.

ICPAC, Kenya	**www.icpac.net**
The IGAD Climate Prediction and Applications Centre (ICPAC) is a specialized institution of the Intergovernmental Authority on Development (IGAD), aiming at creating resilience in a region deeply affected by climate change and extreme weather. ICPAC provides climate services and early warnings to support disaster risk reduction in the Greater Horn of Africa. ICPAC utilizes AI and machine learning to process and analyze climate data, improving the accuracy of their seasonal forecasts and early warning systems.	

ITIKI, South Africa	www.urida.co.za/who-we-are
ITIKI (Information Technology and Indigenous Knowledge with Intelligence) is a drought forecasting service whose uniqueness is in the integration of indigenous knowledge in drought forecasting techniques. ITIKI addresses the challenge that the lack of an appropriate drought-forecasting tool for smallholder farmers makes them continue to rely on their indigenous knowledge to reach critical cropping decisions. By using ITIKI, farmers in Kenya, Mozambique and South Africa, can now reach cropping decisions that lead to improved crop yields.	

Table 2: Non-Exhaustive List of Climate adaptation and Early Warning Systems Initiatives

AI Initiatives	Organizations		
	Name	Type	Country
AfriClimate AI	AfriClimate AI	CSO	Ghana
Weather Net	SASSCAL	Government	Namibia
Climate Monitoring	ICPAC	Government	Kenya
WASCAL	WASCAL	Government	Ghana
African Risk Capacity	African Risk Capacity	Government	South Africa
ITIKI	Central University of Technology, Free State	Academia	South Africa
AIIKS	University of KwaZulu-Natal (UKZN)	Academia	South Africa

3.3. Modelling and Forecasting

AI-enabled climate modeling is a data-driven approach done by analyzing large amounts of data from various sources, including satellite imagery, weather patterns; to predict future climatic conditions and to identify patterns and trends that may not be apparent through traditional methods. This can help policymakers, African

Governments and stakeholders anticipate the impacts of climate change and design effective mitigation and adaptation strategies.

Ignitia Smart, Ghana	**www.ignitia.se/en/**
Ignitia is a tropical weather forecasting company that provides accurate, location-specific weather forecasts for small-scale farmers in West Africa. Ignitia uses AI to improve the accuracy and reliability of its forecasts. AI-driven models are used to generate hyper-local weather forecasts, which are delivered via SMS to farmers, enabling better preparedness for extreme weather.	

SAWS, South Africa	**www.weathersa.co.za**
The South African Weather Service (SAWS) is a leader in climate modeling and forecasting in Southern Africa, providing a wide range of climate services, including seasonal and long-term climate predictions. SAWS uses AI for various applications, including improving weather prediction models, real-time data assimilation, and climate risk assessment. Machine learning algorithms enhance the accuracy of short-term and seasonal forecasts.	

Table 3: Non-Exhaustive List of Modelling and Forecasting Initiatives

AI Initiatives	**Organizations**		
	Name	**Type**	**Country**
Digital Earth Africa	DE Africa Analysis Tools	CSO	South Africa
AfriGIS Weather	SAWS	Government	South Africa
TAHMO	TAHMO	CSO	Kenya
Ignitia Smart	Ignitia	CSO	Ghana
Cape Analytics	Cape Analytics	Company	South Africa

3.4. Biodiversity Monitoring

Biodiversity plays a crucial role in the sustenance and life cycle of organisms on the planet; it is also an essential component of climate action, economic growth, and cultural identity. Healthy ecosystems, rich in biodiversity, act as natural carbon sinks, absorbing greenhouse gases and mitigating climate change impacts. Conversely, biodiversity loss exacerbates climate instability by reducing the planet's capacity to regulate atmospheric carbon (Brooks et al., 2002). According to the United Nations (2022), nature-based solutions—such as forest conservation, wetland restoration, and sustainable land management—are vital for addressing climate change while safeguarding ecological balance and human well-being. In addition, AI technologies are offering hope for the continued protection and thriving of Africa's unique biodiversity.

Smart, Mozambique	**www.smartconservationtools.org**
SMART (Spatial Monitoring and Reporting Tool) SMART in Niassa Reserve, Mozambique, is a system used to combat poaching and monitor wildlife populations. The system processes data from camera traps, allowing rangers to identify and track animals, assess population trends, and respond to potential threats in real time. Through the system, authorities can carry out law enforcement monitoring, biodiversity monitoring, and intelligent data collection.	

Savannah Tracking, Kenya	**www.savannahtracking.com**
Savannah Tracking is a Kenyan-based startup with the aim to create affordable customized systems for animal tracking and identification. Savannah uses AI and IoT solutions to monitor wildlife and enhance biodiversity conservation efforts. AI-driven algorithms analyze data from GPS collars and other tracking devices to monitor the movements and health of wildlife, supporting conservation strategies. Savannah uses real time solutions for information dissemination via their bespoke Data and Hardware management software (SDM), Phone Applications (MiSavannah) as well as automatically updated links in Google Earth.	

Table 4: Non-Exhaustive List of Biodiversity Monitoring Initiatives

AI Initiatives	Organizations		
	Name	Type	Country
Smart	Wildlife Conservation Society (WCS)	CSO	Mozambique
Mara Elephant Project	Mara Elephant Project	CSO	Kenya
Wildlife Tracking Solutions	Savannah Tracking	Company	Kenya
African Parks	African Parks	CSO	South Africa
Endangered Wildlife Trust	Endangered Wildlife Trust	CSO	South Africa

3.5. Energy Optimisation

AI, with its capacity to process vast amounts of data and learn from patterns, has revolutionized energy management practices in buildings, industries, and transportation systems. AI has the potential to cut energy waste, lower energy costs, and accelerate the use of clean renewable energy sources in power grids worldwide.

SunCulture, Kenya	www.sunculture.io
SunCulture provides solar-powered irrigation systems for farmers in Africa, integrating AI to optimize energy and water use. AI-driven systems monitor energy consumption, optimize irrigation schedules based on weather predictions, and improve the overall efficiency of solar-powered farming solutions. SunCulture sells affordable IoT-enabled solar irrigation equipment bundled with tailored advice and generates unique intelligence around usage/needs. Its IoT connected energy management system brings precision farming (e.g. hyperlocal highly accurate weather forecasts) to smallholder farmers for the first time, and it is rolling out soil sensors/weather stations to further improve the information available to its customers.	

Oolu, Nigeria	www.oolusolar.com
Oolu is a solar energy provider operating in West Africa, with the vision is to build a future in which West and Central African citizens have access to clean and affordable energy. Oolu Solar employs AI to optimize the energy output and distribution of their solar systems. AI-driven analytics help in predicting energy consumption patterns, optimizing battery storage, and ensuring efficient energy distribution in off-grid areas.	

Table 5: Non-Exhaustive List of Energy Optimization Initiatives

AI Initiatives	Organizations		
	Name	Type	Country
GreenCape	GreenCape	Company	South Africa
Oolu Solar	Oolu Solar	Company	Nigeria
SunCulture	SunCulture	Company	Kenya

3.6. Forest Monitoring and Carbon Footprint Tracking

In climate change mitigation, innovations and technological developments play a pivotal role in supporting sustainable practices. AI-powered technology is used in forestry and carbon emission tracking, to tackle a wide range of climate problems.

BioCarbon Partners, Zambia	www.bcp.earth/our-story
BioCarbon Partners (BCP) is a Zambian-based social enterprise focusing on reducing deforestation and enhancing carbon sequestration. BCP uses AI to track and manage carbon emissions in forestry, and provide accurate reporting on carbon credits generated from forest conservation projects.	

GeoTerraImage, South Africa	www.geoterraimage.com
GeoTerraImage is a South African company that specializes in geospatial data analysis and environmental monitoring. They specialize in using advanced technologies, including artificial intelligence (AI), to deliver insights and solutions across various sectors such as agriculture, forestry, urban planning, and natural resource management.	

Table 6: Non-Exhaustive List of Carbon Footprint Tracking Initiatives

AI Initiatives	Organizations		
	Name	Type	Country
REDD+ project	BioCarbon Partners (BCP)	CSO	Zambia
Geo TerraImage	Geo TerraImage	Company	South Africa

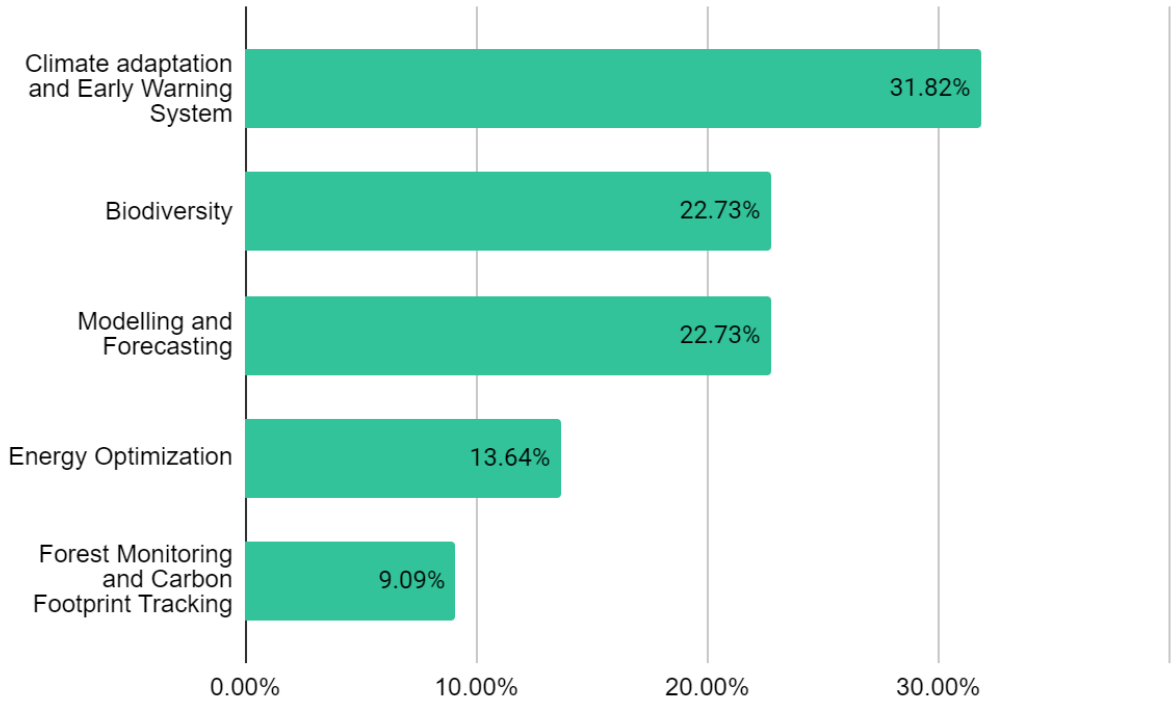
Additional Observations

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4. Additional Observations

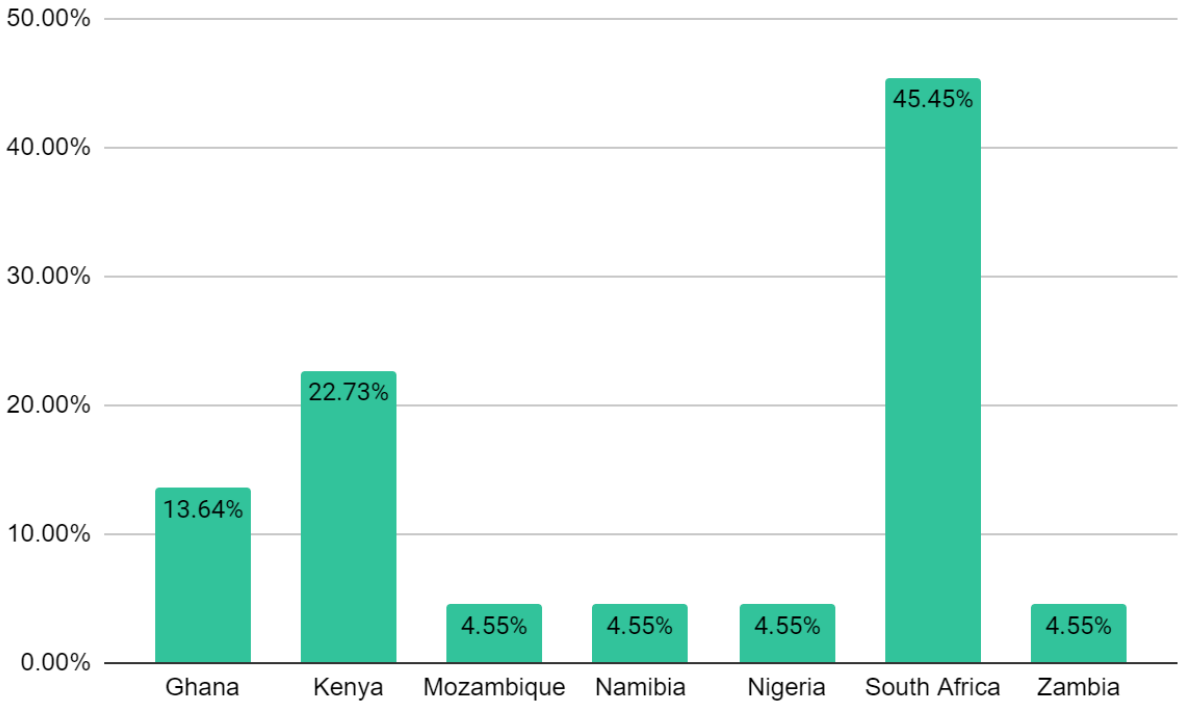
An analysis of our various non-exhaustive lists of AI initiatives in sub-Saharan Africa has enabled us to provide an indicative breakdown of the adoption of AI in different fields of climate action (Figure 2); the most active countries in developing AI solutions in climate action (Figure 3) and the most active type of organizations (Figure 4).

Figure 2: Areas of Climate Action in which AI is Widely Applied in Sub-Saharan Africa



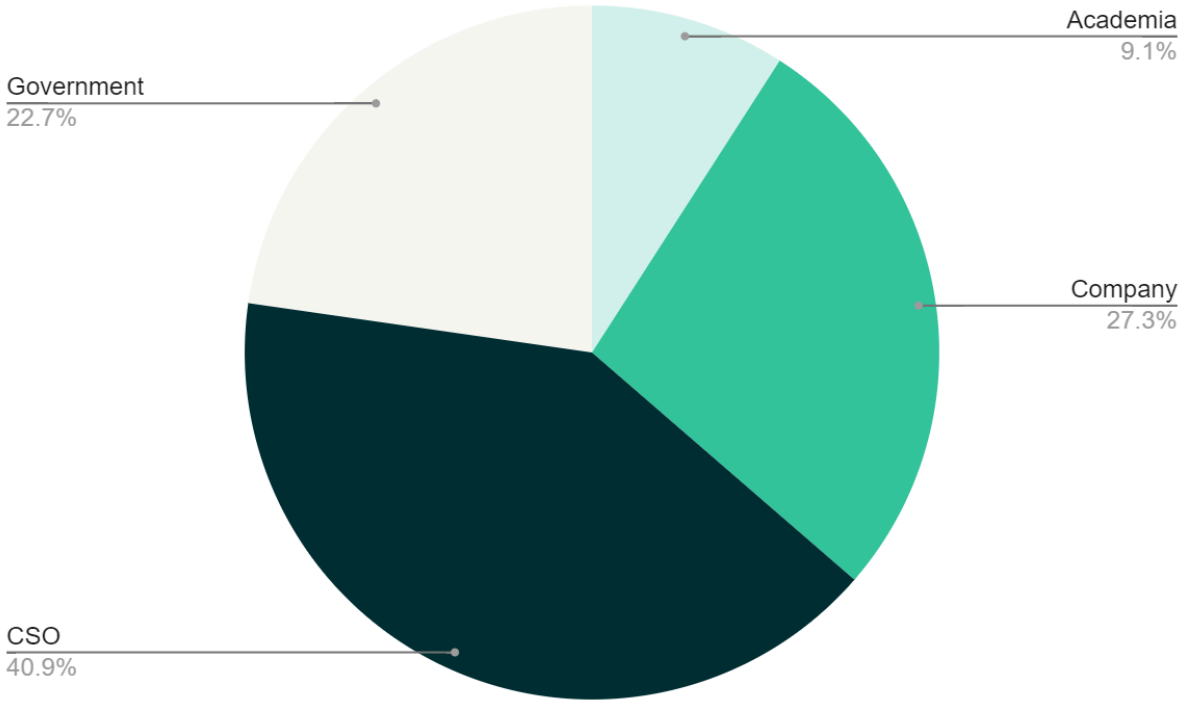
This figure shows an indicative rate of the adoption of AI solutions in the field of Climate adaptation and Early warning System (31.82%), Biodiversity (22.73%), Modelling and Forecasting (22.73%), Energy Optimization (13.64%) and Forest Monitoring and Carbon Tracking (9.09%).

Figure 3: The Hot Spot Countries for AI in Climate Action



Based on the results we found, this figure shows that South Africa, Kenya and Ghana are the most active countries in developing AI solutions in Agriculture. However, it is important to note that French-speaking countries appear to be underrepresented in this field. This disparity could be attributed to various factors, including the lack of targeted funding calls for these regions, potential language barriers in writing successful project proposals, and limited access to training programs focused on grant writing and competitive research.

Figure 4: Types of Organisations Leading the Development of AI in Climate Action in Sub-Saharan Africa



Finally, our indicative results show Civil Society Organisations including international NGO (40.29%) are much more involved in the development of AI solutions applied to agriculture, followed by private companies (27.3%); government (22.7%), then academia (9.1%)[5].

[5] In the era of globalization, it is essential to recognize that the complexity of international relations makes it difficult to distinguish between purely endogenous solutions and those arising from international collaborations. Indeed, entities such as NGOs, companies, and universities forge transnational partnerships that influence and shape responses and solutions to local challenges in Africa.

Main Funding Agencies

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5. Main Funding Agencies

Several key funding agencies are actively supporting AI initiatives in climate change across sub-Saharan Africa. These agencies play a crucial role in developing AI applications for climate action, including climate modelling and forecasting, sustainable energy and improving emission control in sectors such as transportation, agriculture and the industry. Here are some of the main funding agencies:

5.1. The International Development Research Centre (IDRC)

In 2020, Canada's International Development Research Centre (IDRC) and Sweden's government agency for development cooperation (Sida) launched the Artificial Intelligence for Development in Africa (AI4D Africa) program. This partnership, spanning four years and valued at CAD 20 million, is dedicated to a future where Africans across all regions create and use artificial intelligence (AI) to lead healthier, happier and greener lives. The program promotes excellence in applied research and applying AI technologies in the service of solving development challenges and improving livelihoods for those living in poverty. The Artificial Intelligence for Agriculture and Food Systems Innovation Research Network[6] is an example of the initiatives funded under this programme. The AI4D program has now grown with combined investments from the United Kingdom's Foreign, Commonwealth and Development Office (FCDO), the Bill and Melinda Gates Foundation (BMGF), United States Agency for International Development (USAID) and IDRC[7]. Through the AI for Climate Action Innovation Research Network, the AI4D Program supports AI-driven climate action initiatives that aim to enhance resilience and reduce vulnerability to climate change.

[6] Artificial intelligence for agriculture and food systems innovation research network
[7] Combining forces for a new phase of AI for development: Africa and beyond | IDRC

5.2. The Bill & Melinda Gates Foundation

While primarily focused on health and development, the Gates Foundation funds projects that use AI to address climate-related challenges in agriculture and food security in Africa. Its agricultural innovation program integrates AI for climate-smart agriculture and resilience building. The Gates Foundation Agricultural Development program invests in innovations that enhance the productivity and sustainability of smallholder farms in sub-Saharan Africa. By supporting the development and deployment of AI technologies, such as climate-smart crop varieties and digital soil maps, the foundation aims to improve crop yields, resilience to climate change, and overall food security. Their efforts include partnerships with local organizations and governments to ensure these technologies reach the farmers who need them most. Their initiatives are focused on:

- Digital Tools and Platforms: Supporting the creation of digital platforms that provide farmers with real-time data on weather, soil health, and market prices.
- Innovative Crop Varieties: Funding research and development of crop varieties that are resilient to pests, diseases, and climate change.
- Capacity Building: Training programs for farmers to adopt new technologies and farming practices.

5.3. The African Development Bank (AfDB)

The African Development Bank (AfDB) funds a variety of climate action projects across Africa. The Africa Climate Change Fund (ACCF or Fund) is one of their programs through which they fund initiatives that integrate AI for improved outcomes in areas such as climate resilience, renewable energy, and sustainable agriculture. The Africa Climate Change Fund (ACCF or Fund) is a multi-donor trust fund well positioned to contribute to the achievement of the African Development Bank (AfDB)'s goal to triple its climate financing efforts and foster its drive for a climate-resilient Africa.

The AfDB established the ACCF in April 2014 with an initial contribution of € 4.725 million from the Government of Germany to support African countries build their resilience to the negative impacts of climate change and transition to sustainable

low-carbon growth. ACCF was converted to a Multi-donor Trust fund in 2017 with contributions from the Governments of Flanders, Belgium and Italy. The Global Affairs Canada and the Government of Quebec joined the Fund in 2020 and the Global Center on Adaptation in 2022. The current trust size is USD $25.71 million.

5.4. The Agence Française de Développement (AFD)

The Agence Française de Développement (AFD) is a public international financial institution established several decades ago. The mandate of AFD is to contribute to social and economic development through sustainable and inclusive growth, enhancing livelihoods and natural resource management. With operations in more than 90 developing countries across all regions, including least developed countries and small developing island states, AFD is actively engaged in climate change mitigation and adaptation actions across all sectors. AFD sought accreditation with the Green Climate Fund (GCF) to utilize its experience in project delivery by offering support to national priorities in climate resilient development pathways, leveraging AI for climate action, sustainable development, and environmental protection.

5.5. The Global Environment Facility (GEF)

The Global Environment Facility (GEF) is a multilateral family of funds dedicated to confronting biodiversity loss, climate change, and pollution, and supporting land and ocean health. Its financing enables developing countries to address complex challenges and work towards international environmental goals. The partnership includes 186 member governments as well as civil society, Indigenous Peoples, women, and youth, with a focus on integration and inclusivity. Over the past three decades, the GEF has provided more than $25 billion in financing and mobilized $145 billion for country-driven priority projects; including funding grassroots AI projects in climate action and biodiversity conservation. The family of funds includes the Global Environment Facility Trust Fund, Global Biodiversity Framework Fund (GBFF), Least Developed Countries Fund (LDCF), Special Climate Change Fund (SCCF), Nagoya Protocol Implementation Fund (NPIF), and Capacity-building Initiative for Transparency Trust Fund (CBIT).

5.6. The UN Organisations

The United Nations Development Programme (UNDP) provides funding and technical assistance for climate action projects in Africa, including those like the UNDP Accelerator Labs which leverage AI applications for climate resilience and adaptation in Africa. The UNDP Accelerator Labs Network has been actively mainstreaming data innovation inside and outside UNDP, with the explicit goal of diversifying the ways in which we understand sustainable development problems and identify solutions to those problems.

5.7. The Rockefeller Foundation

The Rockefeller Foundation is a pioneering philanthropy built on collaborative partnerships at the frontiers of science, technology, and innovation to enable individuals, families, and communities to flourish. The Foundation funds AI-driven initiatives aimed at building resilience to climate change, particularly in vulnerable communities in Africa. Atlas AI is part of these climate resilient infrastructure investments, leveraging satellite data and machine learning technologies across sub-Saharan Africa. Atlas AI is a predictive analytics platform that enables organizations to optimize performance and expand reach by investing in underserved communities around the world.

5.8. European Commission

The European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program provides significant funding for climate action projects in Africa, many of which incorporate AI to enhance their impact. The EU supports projects focused on sustainable energy, climate resilience, and environmental protection.

5.9. The United States Agency for International Development (USAID)

The United States Agency for International Development (USAID) funds projects that address climate change in Africa, with a focus on integrating AI to improve resilience, food security, and disaster response. This is the case of the Resilient Africa Network (RAN), which integrates AI into climate adaptation and resilience-building efforts.

5.10. Big Tech Companies

In the last few years, a growing and thriving AI ecosystem has emerged in Africa. Within this ecosystem, there are local tech spaces as well as a number of internationally driven technology hubs and AI research labs established by big tech companies such as Twitter, Google, Facebook, Alibaba Group, Huawei, Amazon, and Microsoft.

For climate action, initiatives like Microsoft's AI for Earth Program or computational resources from Google Cloud are crucial in overcoming the resource constraints faced by many forecasting African experts and initiatives.

Recommendations

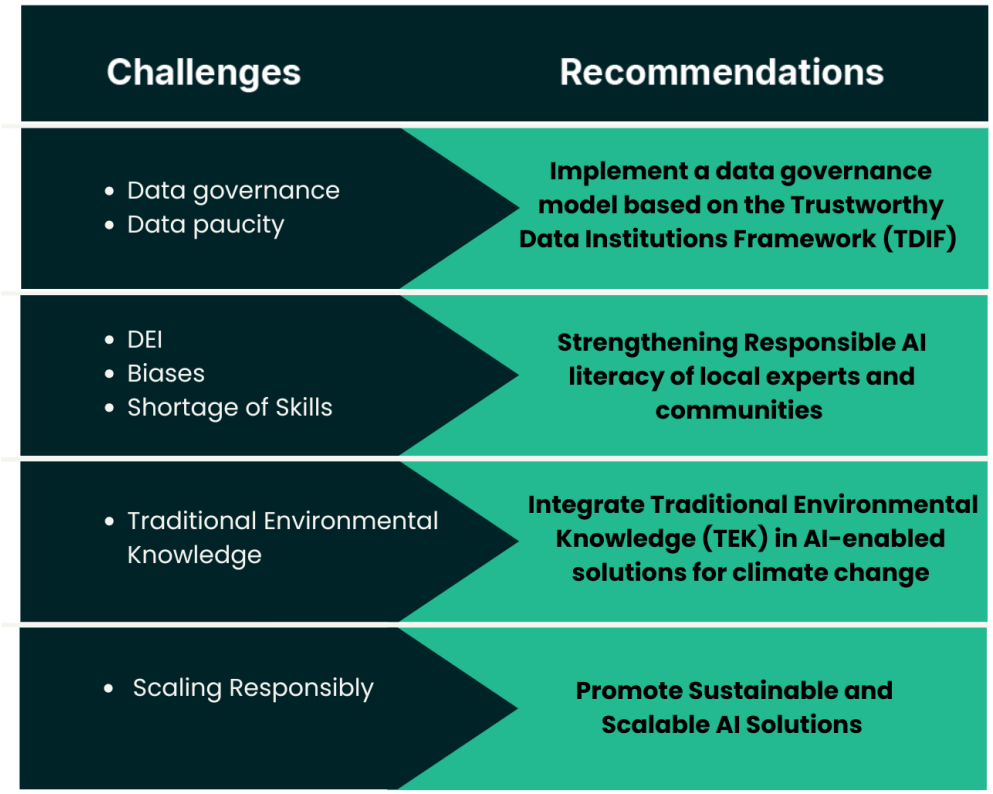
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6. Pathways to Responsible Uptake of AI in Climate Action

The deployment of artificial intelligence in Africa faces challenges related to infrastructure disparities, ethical concerns, a lack of data, and a lack of digital skills and literacy, which have stymied progress in different parts of the continent. Despite these challenges, AI remains a transformative tool with the potential to revolutionize climate action; demonstrated by the wide range of initiatives we have been able to identify in this report. However, for this potential to be fully realized, certain conditions will have to be met. Echoing the Global Partnership for AI (GPAI, 2021), we would like to make the following recommendations to relevant stakeholders, such as governments, funding bodies, farmers, communities, researchers, developers, farmers, etc.

> *While AI has great potential to enable climate mitigation and adaptation strategies, it also comes with many pitfalls and risks that are inextricably connected with the opportunities. This leads to the need for the responsible development, deployment, and governance of AI in the context of climate change.*
>
> - **Global Partnership for Artificial Intelligence (GPAI, 2021)**

Figure 5: Challenges and Recommendations



Recommendation 1: Implement a data governance model based on the Trustworthy Data Institutions Framework (TDIF)

Developed by GPAI (2023), the Trustworthy Data Institutional Framework (TDIF) is a practical tool enabling organisations that manage data to understand where they currently stand with regards to their data governance, while providing a path to improve trustworthiness. Trustworthiness in data institutions enables the development of safe, fair, and equitable sharing of data while empowering individuals and communities to assert their data rights. To achieve this, there is a need to:

- **Encourage a shared access to digital resources amongst stakeholders**
  - Ensure equitable access to skills development and digital infrastructure;
  - Improve stakeholders' usability of digital resources
  - Encourage the participation of communities affected by climate changes in all stages of the data lifecycle;

- **Share the benefits of data-driven innovations amongst the communities**
  - Strengthen data transparency by making information publicly available about what climate data is collected and how it is used;
  - Develop national data sovereignty policies;
- **Ensure Data Privacy and Security**
  - Establish clear guidelines for collecting, storing, and using data, particularly sensitive environmental and personal information.
  - Implement strong data protection measures to safeguard against misuse.
- **Improving inclusiveness and ownership within data steward organizations in order to foster greater representation of marginalized groups**
  - Support local organizations involved in the data ecosystem (statistical offices, meteorological agencies, ministries, etc) in standardized data collection to facilitate timely exchanges;
  - Consider the large penetration of mobile devices as new opportunities for real-time data collection and sharing and allowing for the inclusion of perspectives from marginalized communities;

Recommendation 2: Strengthening Responsible AI literacy of local experts and communities

Addressing climate with AI-enabled solutions in Africa, requires developing robust, practical and contextually-relevant AI methods, building local expertise and empowering affected communities to lead AI-driven climate action initiatives. Therefore, it is essential to:

- **Build data literacy and participation of local communities**
  - Enhance data literacy and the co-production of data to support informed decisions on how to adapt on climate change;
  - Empower women with climate information and skills to ensure that their voices and knowledge are considered during decision processes on climate adaptation;
  - Democratize AI use in climate action, allowing more stakeholders to contribute to and benefit from AI solutions.

- **Develop local expertise in AI and climate science**
    - Invest in training programs including AI ethics and climate resilience in educational curricula;
    - Invest in collecting localized data to train AI models on accurate and relevant data that reflects African environmental and socio-economic conditions;
    - Involve local experts and stakeholders in international research efforts through data collection, model development and scenario-building;
    - Encourage national conversation between local actors working on climate migration and international organizations.
- **Focus on Transparency and Explainability**
    - Develop AI models and algorithms that are transparent and explainable, enabling stakeholders to understand how decisions are made.
    - Ensure that AI systems are auditable and accountable.

Recommendation 3: integrate Traditional Environmental Knowledge (TEK) in AI-enabled solutions for climate change.

Given that indigenous knowledge is based on relative and local experience, their clear understanding and careful integration with AI offers opportunities to develop AI-enabled climate change solutions which are culturally appropriate and locally relevant. Integrating indigenous knowledge with AI will enhance the effectiveness and sustainability of climate solutions, ensuring that they address the real challenges faced by African communities. To this end, it is important to:

- **Encourage Inclusive and Participatory Approaches**
    - Involve local communities, indigenous groups, and stakeholders in the design, implementation, and monitoring of AI-driven climate action projects, ensuring they address real needs;
    - Combine AI with indigenous knowledge systems to create contextually relevant and culturally appropriate climate action strategies. Ensure that AI models respect and preserve indigenous practices.

- Use a Human-centric approach in data collection by taking into consideration native languages, storytelling, indigenous knowledge, comics, etc.

- **Develop Inclusive AI Models**
  - Ensure that AI models are designed to be inclusive and do not marginalize vulnerable communities or neglect TEK;
  - Integrate traditional knowledge and practices into AI-driven climate solutions to enhance their relevance and effectiveness in local contexts;
  - Implement mechanisms to ensure that the benefits of AI-driven climate solutions are equitably shared among all stakeholders, particularly marginalized communities.

Recommendation 4: Promote Sustainable and Scalable AI Solutions

Maximising the impact of AI in climate action in Africa is possible by designing AI solutions that are sustainable and can be replicated across different countries in the continent. This ensures that AI technologies address the real needs of the people they are intended to serve. For this purpose, it is important to:

- **Facilitate Access to Open Data and AI Tools**
  - Promote open access to climate-related data, AI tools, and resources to enable broader participation in AI-driven climate action.
  - Support initiatives that provide open-source AI platforms and datasets to ensure access to high-quality, climate-related data;
  - Establish innovation hubs and incubators supporting the development of AI solutions for climate action, particularly those addressing local challenges and led by African innovators.
- **Join the Pan-African efforts**
  - Engage with and contribute to pan-African initiatives and collaborations focusing on AI and climate action;
  - Foster collaboration between African institutions and international partners to share knowledge, resources, and best practices in AI and climate action.

Conclusion

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7. Conclusion

The convergence of artificial intelligence (AI) and climate action presents a unique opportunity for Africa to address the pressing challenges posed by climate change. As the continent faces increasing threats from rising temperatures, extreme weather events, and environmental degradation, the integration of AI into climate strategies offers promising solutions for enhancing resilience, promoting sustainable development, and protecting vulnerable communities and ecosystems.

This report highlights the various ways AI is being utilized across Africa, from climate modeling and early warning systems to biodiversity monitoring and energy optimization. The examples provided demonstrate the innovative spirit of African startups, initiatives, and researchers who are leveraging AI to develop contextually relevant and impactful solutions. By combining modern technology with indigenous knowledge, these efforts are creating holistic approaches that are both effective and culturally appropriate.

However, the responsible uptake of AI in climate action is essential to ensure that the benefits of this technology are equitably distributed and that potential risks are mitigated. Ethical considerations, transparency, and inclusivity must be at the forefront of AI-driven climate initiatives. It is also crucial to build local capacity, foster collaboration among stakeholders, and promote open access to data and tools.

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Annex

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Annex: List of AI Initiatives in Climate Change

Country	Domain	AI Initiatives	Type
Ghana	Climate resilience, capacity building, climate action	AfriClimate AI	CSO
	Weather forecasts, mapping, decision making	Ignitia Smart	CSO
	Governance, capacity building,	WASCAL	Government
Kenya	Climate data, forecasting, Weather	TAHMO	CSO
	Analyze climate data, improving the accuracy of their seasonal forecasts and early warning systems.	Climate Monitoring	Government
	Biodiversity conservation	Wildlife Tracking Solutions	Company
	Energy Optimization	SunCulture	Company
	Wildlife conservation	Smart	CSO
	Biodiversity Protection	Mara Elephant Project	CSO
	Governance, Drought Monitoring	ICPAC	Government
Namibia	Capacity building, decision making, climate change	Weather Net	Government
Nigeria	Energy Optimization	Oolu Solar	Company
South Africa	Forecasting, climate action, Weather Services	AfriGIS Weather	Government
	analyze satellite, aerial imagery, predict the impacts of climate change	Cape Analytics	Company

	water management, optimize energy consumption, and improve agricultural practices.	GreenCape	Company
	Environmental monitoring, deforestation, land degradation	Geo TerraImage	Company
	Biodiversity Conservation	African Parks	CSO
	Biodiversity Conservation	Endangered Wildlife Trust	CSO
	Indigenous Knowledge	ITIKI	Academia
	Indigenous Knowledge	AIIKS	Academia
	Governance	African Risk Capacity	Government
Zambia	Monitor forest conditions, assess carbon stock changes	REDD+ project	CSO

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