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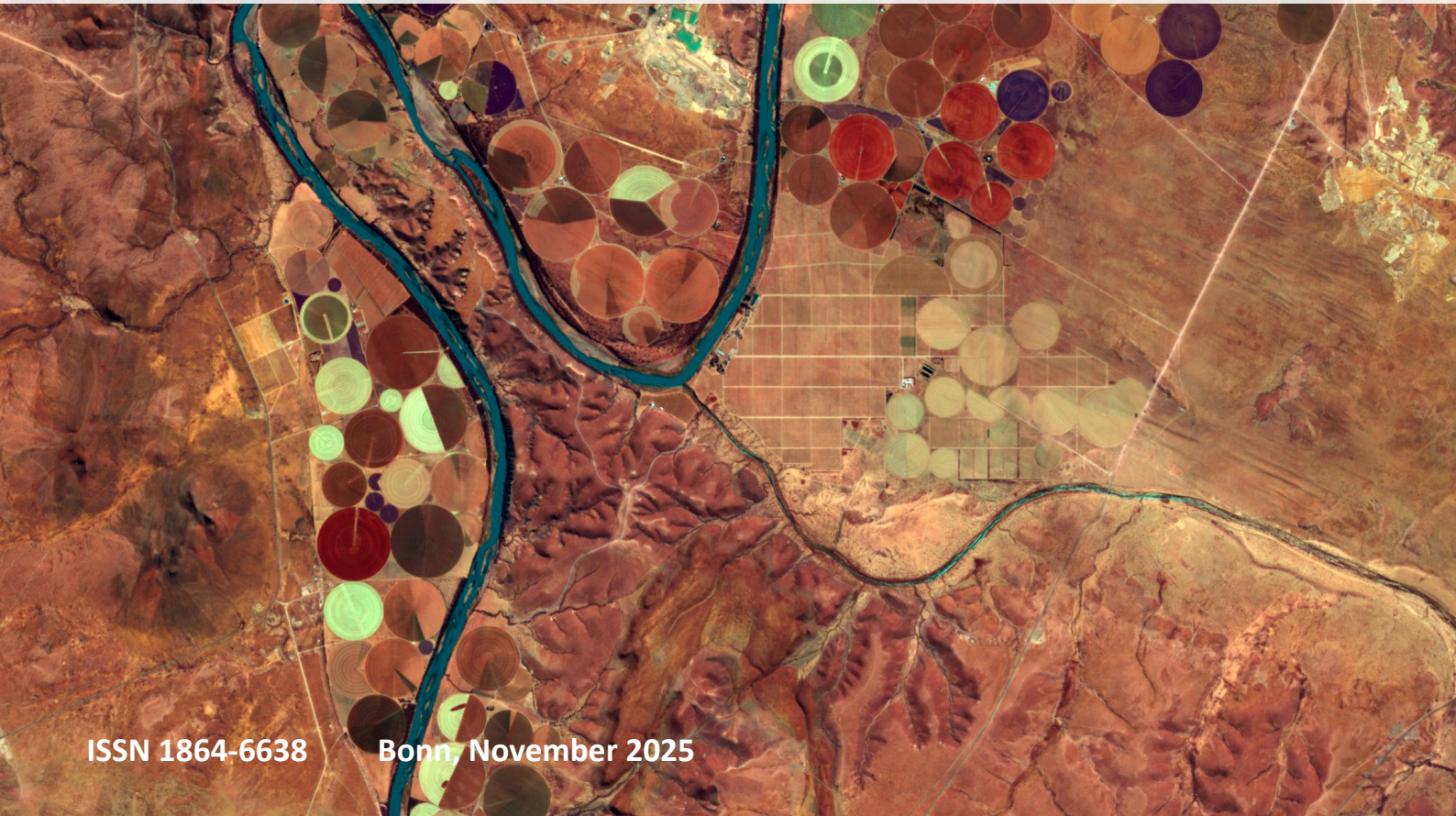
RACINE LY AND JEAN PAUL L. FAYE

From Climate to Development Intelligence: Building Africa's Data Governance Systems for Resilience and Economic Growth



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From Climate to Development Intelligence

Building Africa's Data Governance Systems for Resilience and Economic Growth

Racine Ly (Ph.D.) and Jean Paul L. Faye

Abstract

The adoption of the UN carbon-crediting mechanism at COP29 in Baku in 2024, and the growing emphasis on adaptation tracking leading up to COP30 in Belem, have marked a new phase in global climate governance. For African countries, the credibility of climate action—and access to finance—will increasingly depend on governments' capacities to generate, govern, and use reliable data.

This policy paper argues that Africa stands at a turning point: from fragmented digital systems toward an integrated data-intelligence and governance architecture that links geospatial and AI (GeoAI) analytics, harmonized measurement, reporting, and verification (MRV) systems, and transparent institutional frameworks. Drawing on insights from the Untapped Potential Index (UPI) on AI and geospatial readiness in African agri-food systems, the outcomes of the COP29 negotiations on Article 6, and the regional experience of ECOWAS in harmonizing climate-data systems, the paper outlines how Africa can consolidate its data foundations for both climate and development.

Developing such architecture serves three strategic goals: (i) strengthen Africa's credibility and participation in the global climate finance architecture through a reliable GHG tracking system; (ii) establish robust, evidence-based adaptation and resilience measurement; and (iii) build a foundation for multi-sectoral "development intelligence", linking climate, agriculture, energy, water, health, and trade.

Keywords: data governance, geospatial data, GeoAI, MRV systems, adaptation tracking, climate data

JEL codes: Q54, Q56, Q58, C55, O13, O21

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Table of Contents

1 Introduction

Since the adoption of the Paris Agreement at COP21 in 2015, the Enhanced Transparency Framework (ETF) has made credible and verifiable data a fundamental part of climate cooperation, ensuring that progress toward national targets can be measured and compared across countries. At COP29 in 2024, parties agreed on key standards to implement Article 6.4 of the Paris Agreement—laying the foundation for a UN-supervised carbon-crediting system—and advanced discussions on tracking adaptation efforts under the Global Goal on Adaptation, reaffirming the importance of robust monitoring and evaluation systems to gauge adaptation progress. These developments shift the climate regime from pledges to data-driven accountability.

For Africa, this new reality poses both challenge and opportunity. According to the African Development Bank (2024), Africa receives a mere 4.5 percent of global climate-finance flows despite its vast carbon-sink and renewable-energy potential, reflecting persistent data and verification gaps that limit participation in global carbon markets. In short, climate opportunity is now a function of data credibility.

Meanwhile, technological progress is accelerating. Earth-observation constellations (Sentinel, Landsat, and others) and AI-enabled analytics have revolutionized emissions monitoring, vegetation tracking, and early-warning systems (Wang et al., 2024). **The question is no longer where to find data, but how to transform it into trusted intelligence through sound governance structures.**

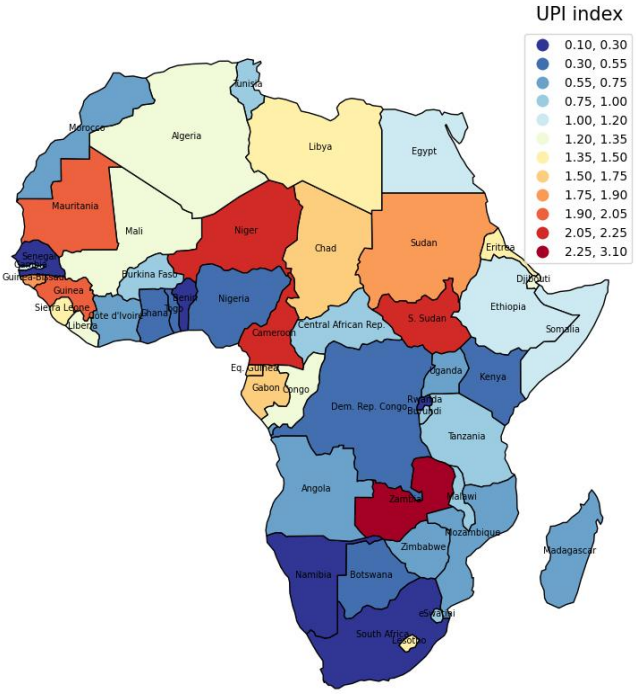
Africa is now producing unprecedented volumes of environmental and socio-economic data through satellites, sensors, mobile devices, and public administration systems. However, most of this data remains underutilized. The World Bank (2024) observes that Africa's expanding digital footprint has not yet translated into equivalent policy intelligence. Despite rapid growth in mobile connectivity, cloud services, and data generation, many African countries still face constraints in analytical capacity, institutional coordination, and cross-sectoral data integration. As Schroeder et al. (2021) highlight, data governance remains uneven across the continent, limiting the potential of digitalization to inform evidence-based policymaking and sustainable development. Similarly, the Centre for International Governance Innovation (Yusuf, B., 2024) notes a "data-abundance paradox," where rapid growth in data availability coexists with minimal transformation into actionable insights for decision-making.

The objective of this paper is to show that, despite increasing digital readiness, many African countries still lack a comprehensive data governance system that can support climate finance, track adaptation and resilience, and guide development actions.

2 Africa's digital readiness and untapped potential

Over the past decade, more than 35 African countries have adopted digital-economy or open-data strategies. However, as of October 2025, few countries have established comprehensive, cross-sectoral data governance frameworks aligned with the African Union's Data Policy Framework (2022) (D4D Hub & Smart Africa, 2024; Carnegie Endowment, 2025).

Figure 1: The Untapped Potential Index (UPI): The UPI indicates the gap between a country's potential —based on its readiness, transformation needs, infrastructure, and support systems —and its current level of AI and geospatial technology adoption. A higher UPI value indicates a greater untapped potential, meaning the country has strong foundational elements but has yet to fully implement or benefit from these technologies in its agri-food systems.



The Untapped Potential Index (UPI)[1] of AI developed by Faye et al. (2025) shows why such integration matters (Figure 1). Across 50 African countries, the UPI maps reveal that Africa is not data-poor but intelligence-limited: the infrastructure seems to exist (Figure 4) and the need for integrated data is expanding (Figure 3), yet governance mechanisms for data exchange, quality assurance, and cross-sector use remain fragmented (Figures 2 & 5). Closing that gap is the essence of building data intelligence. Closing the gap requires strengthening governance mechanisms to ensure secure, interoperable data exchange, uphold quality standards, and engage all stakeholders. Complementing this with expanded infrastructure, human capacity, and investment, along with innovative governance models, will foster trusted, cross-sector data systems for development and climate resilience.

[1] The UPI score reflects a country's potential to leverage AI and geospatial solutions in its agrifood system, based on its readiness and need, minus its current adoption of AI and geospatial solutions. A higher UPI indicates a stronger untapped opportunity, pointing to strong foundations and high need with low existing deployment.

Figure 2: Digital and AI readiness dimension indicator: Countries in red show low capacity to integrate AI and geospatial technologies into agri-food systems, reflecting gaps in infrastructure, governance, ethics, and technical expertise. Scores combine data on national strategies, connectivity, governance quality, and agri-food AI activity

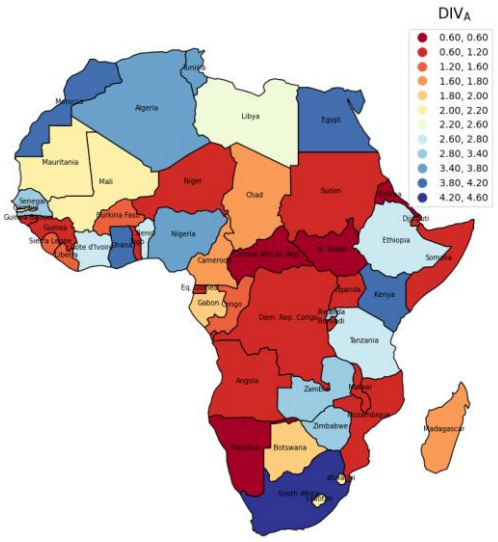


Figure 3: Agri-food system transformation needs a dimension indicator: Most African countries face significant pressure to modernize their agri-food sectors.

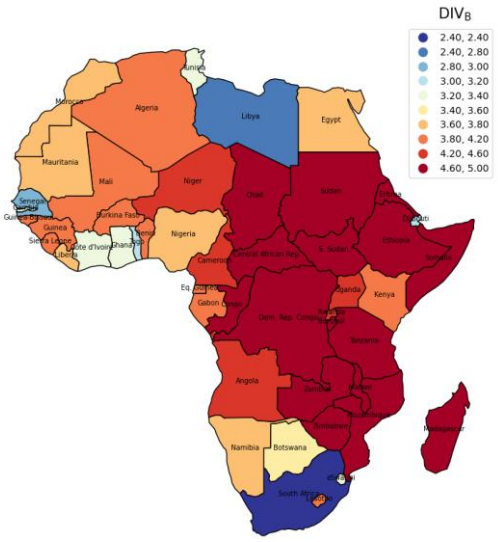


Figure 4: Geospatial and Data Infrastructure Indicator: Most African countries maintain a national geospatial agency and agricultural data portals, have access to Earth-observation platforms, participate in global geospatial initiatives, or leverage GIS for land and crop monitoring.

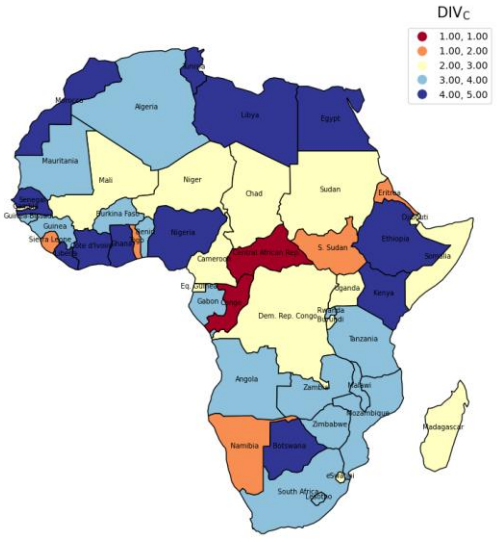
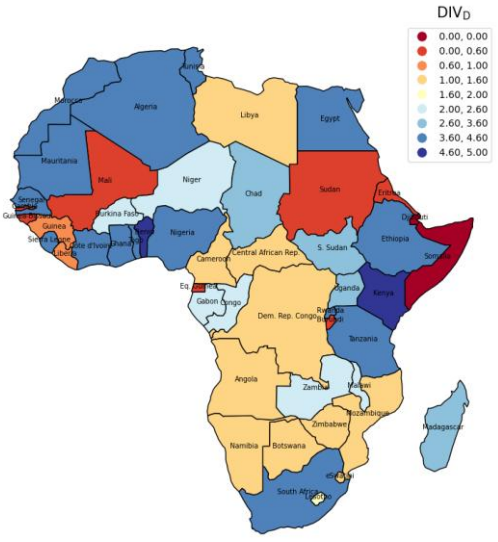


Figure 5: Policy, institutional, and financing enablers dimension indicator: Evaluates the enabling environment for digital agriculture by tracking the presence of a national digital economy strategy, public investment in agri-digitalization, innovation hubs, data policy frameworks, and public-private partnership engagement.



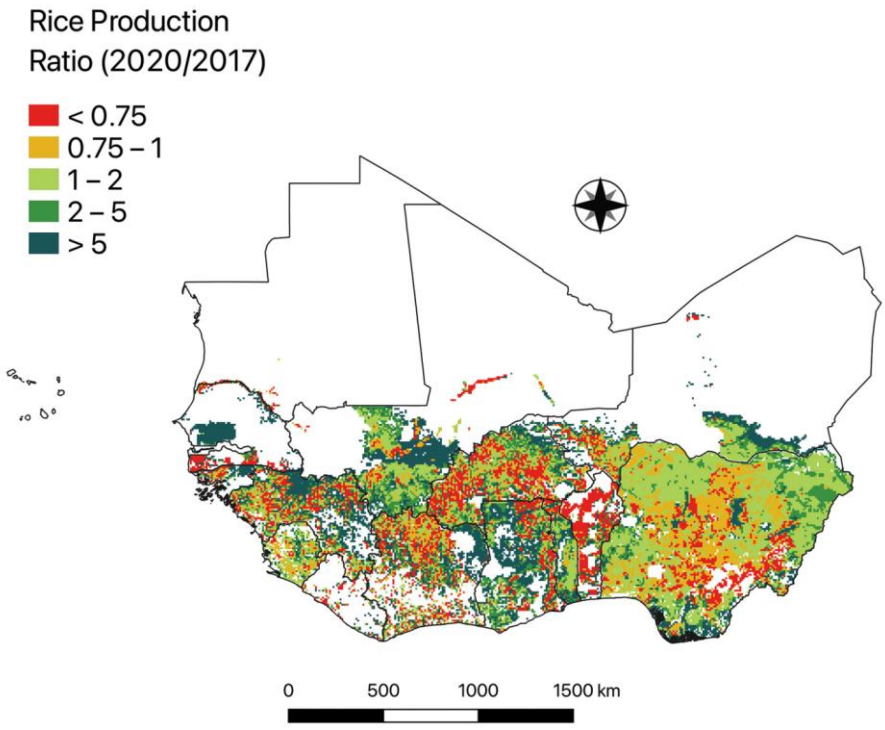
3 Examples of Climate Data Intelligence and Governance

While data intelligence involves converting vast and diverse raw data into actionable insights that inform strategic investment decisions and policies, data governance involves setting policies, processes, roles, and standards that ensure data accuracy, accessibility, security, consistency, and appropriate and ethical use. The sections below provide some examples showing the transformation of GeoAI data into actionable insights and cascading global initiatives to regional data systems.

3.1 GeoAI-Based Agricultural Evidence Systems

GeoAI—the combination of geospatial data and artificial intelligence—is reshaping how Africa observes and manages its environment. Machine-learning algorithms applied to Sentinel or CHIRPS data can now predict yields (Ly et al., 2021), detect crop stress, and map soil moisture with high accuracy. An example of a rice production forecast is shown in Figure 6. These capabilities enable early drought warnings, optimize irrigation, and track land-use change.

Figure 1: The 2020 predicted rice production as a share of the 2017 production for western Africa. If the ratio is above unity, the 2020 predicted production is expected to exceed the 2017 production. A ratio smaller than unity means an expected decrease in production in 2020 compared to 201 (from Ly et al., 2021).



Yet, technical capabilities alone is insufficient. Without data standards, metadata documentation, and institutional oversight, AI models risk producing opaque or biased outputs. As the World Bank (Schroeder et al., 2021) notes in *What's Cooking: Digital Transformation of the Agri-food System*, digital agriculture can deepen existing inequalities if data governance and inclusion frameworks are

not in place. Transforming data into intelligence, therefore, requires embedding GeoAI within robust governance systems grounded in transparency, accountability, and equity. In agriculture, this transformation enables AI models trained on remote sensing data to forecast crop production before harvest (Figure 6), supporting food security planning, resource allocation, and market stability.

3.2 GeoAI-Based Adaptation and Resilience Metrics

While mitigation and carbon trading dominate global discourse, Africa's most immediate priority is adaptation. Emerging frameworks, such as AKADEMIYA2063's GeoAI-based Adaptation Metrics for African Agriculture (GAMA), demonstrate how resilience can be measured systematically. GAMA integrates remote-sensing datasets, including Sentinel, CHIRPS, and MODIS, with vegetation indices derived from optical bands (e.g., NDVI, SAVI), alongside local statistics and machine learning techniques. This combination generates tiered indicators that monitor phenology, management practices, productivity and resilience, water use, and systemic adaptations. The crop-type maps produced using geospatial and AI-based machine learning methods serve as the core foundation for calculating most of these indicators.

By translating adaptation into quantifiable metrics, GAMA addresses accountability and finance challenges. Adaptation metrics enable governments to demonstrate progress, justify investments, and attract performance-based funding. In this sense, adaptation data are more than technical outputs—they are the foundation of African data governance.

3.3 Governing Climate Data: From Global Rules to Regional Systems

The adoption of the UN carbon-crediting mechanism under Article 6.4 represents a structural shift in global climate finance. Unlike voluntary markets, this mechanism is centrally supervised by a UN Supervisory Body. It issues verifiable emission-reduction credits—known as Article 6.4 Emission Reductions (A6.4ERs)—which can be authorized for use as Internationally Transferred Mitigation Outcomes (ITMOs).

For African countries, the opportunity lies in accessing new finance flows through credible MRV systems; the risk lies in exclusion if data are not validated or interoperable. In response, the ECOWAS Commission has begun advancing a regional carbon-market platform (e.g., a workshop in Accra in September 2025), and West African nations adopted the Pointe Sarène Declaration in October 2025, which commits them to aligning MRV systems, standardizing registries, and advancing regional carbon-market infrastructure. This is an example of how global rules and opportunities can be translated into a regional system through a practical, responsive data governance framework. African countries and regions should be able to translate the global opportunities through integrated GeoAI platforms.

4 From Climate to Development Intelligence

Once established for climate, robust data-intelligence systems can evolve into broader development-intelligence ecosystems that support decision-making across sectors such as agriculture, energy, water, health, urban planning, and trade. The same principles—interoperability, ethical governance, and data quality—apply beyond climate data. These systems ensure that data from different domains can be shared, analyzed, and reused to strengthen evidence-based policymaking across Africa's development priorities.

In the energy sector, for example, initiatives such as the *Energy Access Explorer* developed by the World Resources Institute demonstrate how open geospatial data and analytics can guide investment and planning for clean-energy access in Africa (World Resources Institute, 2023). By integrating satellite imagery, population data, and infrastructure layers, such platforms enable governments and private investors to identify off-grid communities, plan renewable-energy expansion, and track the equity of energy access outcomes.

In public health, the Africa CDC has advanced a continental framework to strengthen and harmonize health-data governance, promoting cross-border interoperability and secure data sharing among African Union member states (Africa CDC, 2025). This effort aims to create consistent data standards, privacy safeguards, and real-time information systems that allow African countries to anticipate and respond collectively to health threats.

Meanwhile, in sanitation and urban infrastructure, the World Economic Forum (2023) highlights how integrating datasets—from rainfall and water quality to service-delivery performance—enables cities to design more inclusive and climate-resilient sanitation systems. Linking hydrological monitoring with digital dashboards helps municipal authorities anticipate flooding risks and improve investment targeting for low-income settlements.

The technological backbone for these initiatives draws on the same Earth-observation and analytics infrastructure that underpins climate monitoring. Platforms such as Sentinel and Landsat provide spatially consistent data across environmental and socio-economic domains, supporting integrated decision-making across agriculture, urbanization, and health (Zhang et al., 2023). Together, these examples show that when climate-data infrastructures are governed ethically and linked across sectors, they form the nucleus of development-intelligence ecosystems that enhance resilience, efficiency, and transparency in Africa's sustainable-development agenda.

5 Policy Actions and Investment Priorities

Data intelligence is both an ethical and economic domain. As CIGI (Yusuf, B. 2024) warns, Africa faces the risk of "data-extractivism" when external actors capture local data without equitable value-sharing. Although there is no definitive estimate for the full economic benefit, analysts argue that robust data-governance frameworks could unlock significant value for Africa's economies. Treating data as a sovereign asset, therefore, serves both justice and efficiency. This can be achieved through robust data-governance frameworks with strong protection and sovereignty laws, sector-specific rules, and community-led models that ensure data-owning communities have a say in managing and benefiting from their data.

Africa's ability to transition from fragmented data systems to a coherent data-intelligence architecture will depend on targeted policy actions that strengthen institutional, technical, and governance foundations. The following seven policy actions represent mutually reinforcing pillars of this transformation.

Table 1: Policy actions

Policy Recommendation	Rationale	Expected Gains	Strategic Alignment
1. Establish Regional Data-Intelligence Hubs	Regional hubs hosted by RECs (ECOWAS, SADC, EAC) can centralize MRV, adaptation metrics, and GeoAI analytics. They foster collaboration, standardize methodologies, and coordinate cross-border data sharing.	• Harmonized, verifiable MRV data strengthens credibility in carbon markets. • Shared analytical capacity reduces duplication and costs. • Accelerates regional readiness for Article 6 implementation.	Enhances Africa's credibility and participation in global climate-finance systems.
2. Develop a Continental Data-Governance Framework Aligned with the AU Data Policy Framework	Most countries lack fully operational governance frameworks aligned with the AU (2022) standard. A continental framework would unify ethical, legal, and technical norms for environmental and development data.	• Clear rules on data ownership and access. • Greater interoperability and trust in African datasets. • Legal certainty across national and regional systems.	Builds the governance backbone for interoperability and cross-sector integration.
3. Invest in Digital Infrastructure and Data Quality	Reliable digital infrastructure (broadband, cloud systems, and calibration networks) is essential for accurate, high-frequency monitoring and AI-based analytics.	• Improved accuracy of climate and socio-economic data. • Strengthened early-warning systems and decision dashboards. • Shared infrastructure benefits energy,	Lays the technical foundation for evidence-based adaptation and resilience tracking.

		agriculture, and health sectors.	
4. Strengthen Institutional Capacity for MRV and Adaptation Tracking	National institutions often lack sustained resources and expertise for continuous data collection and verification. Targeted investments and training are needed.	• National agencies can meet Enhanced Transparency Framework (ETF) requirements. • Integration of GeoAI-based adaptation metrics (GAMA) in national planning. • Improved access to climate finance through verified data.	Builds institutional credibility and strengthens Africa's adaptation evidence base.
5. Promote Public–Private Partnerships in GeoAI	Collaboration with private tech firms and research institutions can mobilize investment and innovation in AI-driven analytics and data platforms.	• Faster deployment of predictive models and decision tools. • Technology transfer and new jobs in data science. • Enhanced efficiency in crop, forest, and infrastructure monitoring.	Expands Africa's GeoAI innovation ecosystem and supports cross-sector integration.
6. Create a Continental "Data Integrity Fund"	A dedicated fund managed by AU, AfDB, and RECs would finance verification, audit, and long-term stewardship of environmental datasets.	• Improved data validation and audit mechanisms. • Greater investor confidence through transparency. • Sustainable financing for open-data and MRV platforms.	Reinforces credibility and transparency in climate-finance systems.
7. Embed Data Ethics and Inclusion Across All Systems	Equitable access, citizen participation, and ethical safeguards are essential to prevent exclusion and bias in AI and data use.	• Strengthened public trust and accountability. • Inclusion of women, youth, and marginalized communities in data ecosystems. • Alignment with global standards on fairness and transparency.	Ensures social legitimacy and sustainability of Africa's data-intelligence architecture.

6 Conclusion

Africa's ability to achieve climate resilience and sustainable growth depends as much on robust data governance as on emissions targets. By implementing the recommendations outlined—establishing regional data-intelligence hubs, developing a continental governance framework aligned with AU policies, investing in digital infrastructure and data quality, strengthening institutional capacity for MRV and adaptation tracking, promoting public–private partnerships in GeoAI, and embedding data ethics and inclusion—Africa can transform fragmented digital systems into a coordinated, trustworthy, and cross-sectoral intelligence architecture. The convergence of GeoAI, digital transformation, and climate finance provides an unprecedented opportunity for Africa to transition from a data recipient to a data producer, harnessing its digital and geospatial assets to drive evidence-based policy, attract climate finance, and build resilient, multi-sectoral development intelligence systems.

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