



CHAPTER 19

Conclusion

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The 17th edition of the Annual Trends and Outlook Report (ATOR 2025) sets out to analyze whether and under what conditions innovative technologies can become a foundational pillar of the continent's agrifood system transformation. The evidence across all chapters converges on a central message: accelerating progress toward ending hunger and eradicating poverty in Africa is a complex ambition requiring a bundle of technical, institutional, and socio-political innovations.

Over the past two decades, the Comprehensive Africa Agriculture Development Programme (CAADP) has mobilized investments, strengthened accountability mechanisms, and placed agriculture at the center of the continental development agenda. However, the emerging challenges of slower productivity growth, heightened climate risks, and structural constraints underscore that incremental approaches will no longer suffice. Africa requires a decisive shift toward innovation-driven, data-guided, and institutionally enabled transformation. The Kampala CAADP Declaration reflects this shift by reframing the agenda as a whole-system transformation effort that anchors science, technology, and innovation as strategic assets for the future of African food systems.

Conventional technologies, such as irrigation, breeding, the use of improved seeds, and chemical inputs, have the potential to significantly increase agricultural productivity in Africa. However, a notable bottleneck is governance. Establishing an enabling environment that provides sufficient incentives for farmers and value chain actors to adopt these advanced technologies will be critical.

ATOR 2025 makes clear that the "technology frontier" is not defined by a single breakthrough but by the integration of multiple technological domains—biological, digital, engineering, ecological, and institutional. Technologies such as genome editing, plant biotechnology, digital advisory services, precision irrigation, geospatial intelligence, AI-enabled monitoring, insect farming, integrated aquaponics, and digital twins reveal the vast landscape of emerging opportunities. What determines whether these innovations generate broad-based impact is not their novelty alone, but the governance of the systems, i.e., institutions, coordination mechanisms, and incentives that enable them to scale and adapt to African realities.

Technology as a Systemic Driver of Productivity and Resilience

The report highlights several frontier technologies with immediate and long-term potential for transforming African food systems. Advances in agricultural biotechnology and genetic improvement continue to offer powerful tools for boosting crop and livestock productivity, particularly under increasingly variable climatic conditions. The chapters show how genome editing, improved seed systems, genomics for livestock breeding, and advances in phenotypic characterization can lift yield ceilings and accelerate gains in resilience. Realizing these benefits requires sustained attention to the continent's science ecosystems, regulatory structures, and institutional capacities, which are critical to translating research into practice.

However, innovative digital and geospatial technologies—including satellite-based monitoring, AI-supported crop forecasting, digital extension platforms, and real-time analytics—stand out as transformative enablers.

On the one hand, these innovations enhance decision-makers' and producers' ability to anticipate risks, manage climate variability, and optimize scarce resources. Digital twins, which integrate biophysical models, agro-meteorological data, and machine learning, illustrate the next generation of predictive tools with the potential to reshape risk management and farm-level decision-making. More importantly, it underscores a central theme: data and predictive analytics are becoming essential infrastructure for African agriculture, comparable in importance to irrigation, extension, and functioning markets.

On the other hand, digital technologies enable new forms of governance systems, e.g., interactive cloud-based knowledge and information management systems, digital market and e-learning platforms that disruptively increase knowledge production and use, as well as decrease transaction costs of market participation, especially for small-scale farmers.

Water management and irrigation technologies remain leverage points for strengthening climate resilience and agricultural performance. The chapters underscore opportunities for broader use of small-scale irrigation, water harvesting, and resource-efficient technologies. The emergence of low-energy, sensor-enabled, and precision-based approaches opens pathways for Africa to

accelerate progress, particularly when integrated with geospatial tools, climate information, and digital financial services.

Innovations such as insect farming, circular-economy solutions, aquaponics, organic-waste valorization, and integrated nutrient management are reshaping resource-use and production systems. These frontier solutions model the principles of climate-smart and regenerative agriculture, strengthening environmental stewardship while creating new economic opportunities, especially for youth and small enterprises.

Institutions, Governance, and Innovation Ecosystems: The Real Technology Frontier

Across the chapters, a consistent theme emerges—technology delivers its full benefits when embedded within capable innovation systems. Successful adoption and scaling depend on supportive institutions, coherent regulatory frameworks, predictable policy environments, and well-organized diffusion pathways. International experiences, including those of China and Latin America, demonstrate that long-term public investment, strong research institutions, coordinated innovation programs, and effective public-private partnerships are central to sustained performance gains.

Africa has made meaningful progress in strengthening many of these components, yet significant opportunities remain to coordinate further, align regulations, and improve the interface among research, policy, and practice. The chapters on seed systems, R&D, extension, producer organizations, and CAADP monitoring highlight areas where systems strengthening can accelerate the uptake of frontier innovations. Data ecosystems require continued investment to support timely policy analysis, track performance, and enable responsive planning under the evolving CAADP framework.

Producer organizations and cooperatives, often the backbone of rural economies, emerge as vital actors for technology diffusion, knowledge sharing, aggregation, and market access. Their involvement is essential in ensuring that digital tools, climate information, improved seeds, and management practices reach farmers inclusively and effectively. Strengthening these organizations enhances the reach and equity of technological transformation.

The overarching insight is clear: Africa's technological frontier advances most effectively when accompanied by strong, well-coordinated, and adaptive institutions capable of mobilizing innovation at scale.

Inclusive Innovation as a Driver of Systemic Transformation

The report underscores that technological progress must be inclusive to deliver system-wide benefits. Persistent disparities—whether related to gender, youth employment, digital access, or geographic inequalities—shape how different groups engage with and benefit from new technologies. Ensuring inclusion requires proactive measures: building human capital, investing in digital literacy, designing technology platforms with user diversity in mind, and creating financial mechanisms that expand access for women, youth, and small-scale producers.

The continent's demographic profile—marked by a rapidly expanding youth population—presents a unique opportunity to accelerate digital adoption, entrepreneurship, and labor productivity. Empowering young scientists, developers, farmers, and innovators is indispensable to building a resilient, competitive agricultural future. Emerging African science institutions, innovation funds, and regional research networks are demonstrating promising models of leadership in this space. Their work reflects a growing continental movement toward innovation sovereignty, where African-led solutions are designed, validated, and scaled within African ecosystems.

Data, Evidence, and Knowledge Systems as Foundations for Transformation

ReSAKSS continues to serve as Africa's principal platform for data, analytics, and evidence-based agricultural policy. The CAADP Results Framework and Biennial Review have become global benchmarks for accountability, mutual learning, and policy coherence. As the continent transitions to the new CAADP 2026–2035 agenda, the importance of high-quality, integrated data systems becomes even more pronounced.

The chapters highlight that data ecosystems must evolve to keep pace with technological change. Integrated digital platforms, geospatial analytics, interoperable systems, and dynamic statistical infrastructure are essential for tracking progress, modeling scenarios, managing climate risks, and informing strategic decisions. As innovations such as AI, digital twins, and Earth observation tools become central to agricultural management, investments in data governance,

institutional capacity, and technology adoption will be critical to ensure that evidence continually guides policy and investment choices.

Africa's Path Forward: From Technology Adoption to Technology Leadership

The evidence presented across all chapters points to a future in which Africa is positioned not only to adopt technologies but also to shape global technological trajectories relevant to climate adaptation, food security, economic diversification, and sustainable resource management. Africa's demographic energy, diverse agro-ecologies, maturing innovation ecosystems, and growing regional integration create a powerful platform for forward-looking transformation.

Five strategic priorities are essential to guide Africa's next decade of innovation-driven transformation:

- 1. Strengthen innovation ecosystems and science institutions.** Long-term investments in research, regulatory coherence, regional harmonization, and sustainable financing are central to unlocking scientific and technological potential.
- 2. Promote inclusive mechanisms for technology dissemination.** Empowering producer organizations, SMEs, digital innovators, and youth-led enterprises will broaden access and deepen the impact of emerging technologies.
- 3. Expand digital and climate intelligence infrastructure.** Investing in geospatial tools, digital twins, AI-driven analytics, and real-time data systems will be essential for managing climate risks, improving planning, and optimizing resource use.
- 4. Prioritize climate adaptation and resilience in technological agendas.** Climate-smart technologies across crops, livestock, water systems, and circular economy domains will remain essential for safeguarding productivity under changing conditions.
- 5. Strengthen governance, coordination, and accountability mechanisms.** The CAADP monitoring architecture will continue to anchor the continent's agricultural transformation and must evolve to reflect broader agrifood system objectives.

Toward a New Vision for Africa's Agrifood Systems

This ATOR affirms that Africa's agricultural future will be shaped not only by new technologies but also by renewed systems, institutions, and approaches to organizing knowledge, markets, and governance. Africa is entering an era in which digital, biological, and ecological innovations converge to create complex technological ecosystems that can support resilient, competitive, and sustainable agrifood systems.

With coherent strategies, inclusive innovation, strong data-driven governance, and sustained investment, Africa can confidently move toward the forefront of global agricultural transformation. The ATOR 2025 calls for ambition, collaboration, and foresight. Africa has the scientific expertise, political momentum, and technological opportunity to redefine its agricultural future. The task ahead is to convert this potential into sustained, inclusive, and transformative progress across the continent.