

CHAPTER 1

Introduction

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Taken together, long-term dynamics such as demographic changes, urbanization, and a continent-wide nutrition transition pose a complex set of challenges to African agrifood systems. These challenges are further compounded by the frequent and extreme weather events linked to the deepening climate crisis, whose effects range from prolonged droughts, floods, and disease outbreaks, to rising sea levels, increasing heatwaves, and changing rainfall patterns. Left unmitigated, the likely effects on agricultural yields and productivity, infrastructure, broader economic growth, and community livelihoods risk unraveling the progress made in improving food security and nutrition, as well as alleviating poverty. In one of the latest illustrations of climate change impacts across Africa, several thousand people lost their lives in Libya after torrential rain caused two dams to collapse in September 2023. The recent El Niño–induced droughts and floods across Southern Africa have led the United Nations and its partners to call for urgent action, as more than 30 million people across the region face the effects of severe drought. The consortium has warned that millions could be pushed into acute hunger unless support is urgently mobilized before the next lean season (WFP 2024). These shocks are seriously disrupting production cycles and hampering the ability of countries to guarantee food security for their populations.

While Africa only generates about 4 percent of global greenhouse gas emissions (WMO 2023), the continent is particularly vulnerable to climate change and suffers disproportionately from its effects. Africa south of the Sahara is facing the brunt of the climate crisis, with many regions seeing decreased agricultural productivity due to climate stresses and shifting rainfall patterns. At the same time, coastal nations are confronting rising sea levels that threaten livelihoods and critical infrastructure.

Africa’s agrifood systems must adapt to a changing climate to ensure that they can continue to support livelihoods, generate sustainable incomes, and provide nutrition, while doing so in an environmentally sound manner (Malabo Montpellier Panel 2022a). Building adaptive capacity and resilience to climate change is therefore a top policy priority for African governments, one which requires concerted action and multistakeholder and multisectoral cooperation. These efforts must go hand-in-hand with efforts to “bend the curve,” or flatten the upward trend in warming, and to adopt nature-based

climate solutions for emission reductions, such as agroforestry and sustainable land and soil management. Other important actions include leveraging knowledge and biological resources to develop a sustainable bioeconomy to provide products, processes, and services that optimize social, economic, and environmental benefits and accelerate societal prosperity (Malabo Montpellier Panel 2022b). The African Union’s adoption of a Climate Change and Resilient Development Strategy and Action Plan and the 2021 Green Recovery Action Plan (AUC 2022) demonstrates continent-level commitment to address the climate crisis. In the draft of the new 10-year Strategy on CAADP, which is currently in preparation, the African Union is elevating the topic even further as it seeks to build and strengthen the interlinkages between agrifood systems transformation and climate change (AUC 2024).

Last year’s 28th session of the Conference of Parties (COP28) to the United Nations Framework Convention on Climate Change occurred at a critical moment, as efforts to achieve the Paris Agreement goal of limiting the rise in temperatures to 1.5 degrees Celsius above pre-industrial levels failed to yield expected results. As COP28 kicked off, global CO₂ emissions from fossil fuels were expected to grow 1.1 percent in 2023. Recent findings suggest that emissions have effectively grown on average 0.5 percent a year over the last 10 years, with 2023 likely to be the peak (Climate Analytics 2023).

Within the context of climate change and the need to preserve the natural resource base and biodiversity upon which African economies and livelihoods depend, the bioeconomy presents a promising avenue for sustainable development in Africa. Innovations in developing a sustainable bioeconomy in Africa offer real opportunities to address multiple challenges simultaneously. As reported by Aidoo and colleagues (2023), the overlapping and interlinked challenges of food systems, and their heterogeneity, mean there is no “silver bullet” to improve their sustainability. However, among feasible solutions, the bioeconomy has been noted as a pivotal trajectory for enhancing the food system’s productivity potential and delivering sustainable products and services (Gatune, Ozor, and Oriama 2021; Nyarko et al. 2021). The narrative around the bioeconomy has evolved, with the current metadiscourse positioning it as a growth pattern that applies science, technology, and innovation to the sustainable production and use of biological resources to create innovative products,

processes, and services for all economic sectors (Kruger et al. 2020; Global Bioeconomy Summit 2020; Bugge et al.2016).

This 2024 edition of the Annual Trends and Outlook Report (ATOR) thus seeks to clarify the convergence between the climate change and bioeconomy agendas in the context of the post-Malabo CAADP agenda. It provides an overview of the latest data and analytics needed for better-informed programmatic instruments for sustainable climate-centered interventions, and for those seeking to harness the potential of the bioeconomy as a new paradigm to sustainably transform agrifood systems in Africa. There is growing recognition of the importance of sustainable biological processes and products among emerging and advanced economies. As such, the 2024 edition of the ATOR addresses the pressing question of how Africa’s agrifood systems actors can be better equipped to tackle the impacts of climate change, while simultaneously reshaping and transforming economies to align with sustainability standards and nature-based solutions. Industries related to construction, food and agriculture, bioenergy, and biopharmaceuticals are significantly connected to or based on bioprocesses. The use of biomass in these industries can reduce impacts on the environment and global climate, create new and well-paid jobs, and spark further innovation. The bioeconomy thus serves as a new paradigm for addressing climate change and sustainable economic development at the same time.

This edition of ATOR focuses on the following six specific objectives:

1. Document and share research evidence and trends in adaptation and mitigation options for African agriculture;
2. Examine the impacts of climate change on agriculture and African economies, and the risks and vulnerabilities, as well as opportunities, for agrifood systems transformation;
3. Examine advances in the tracking of greenhouse gas emissions;
4. Discuss bioeconomy opportunities for African economies, including from the perspective of regional cooperation and integration to enhance the bioeconomy’s potential in Africa;
5. Document and share best practices and lessons learned from bioeconomy initiatives and projects in Africa and other regions, which can be integrated into ongoing strategies that foster inclusive and equitable growth, job creation, and rural development in Africa;
6. Analyze and discuss the financing of climate change and bioeconomy agendas in Africa as a way to remove major constraints for many African countries and thus accelerate progress in climate adaptation, food safety, and other key food systems issues.

The 2024 ATOR seeks to inform the ongoing preparation of the post-Malabo CAADP agenda, led by the African Union, and to highlight the importance of aligning and harmonizing the agendas for nutrition, food, climate change, and sustainable economic development, as well as opportunities for doing so. This edition comes at a critical moment for Africa, as the continent prepares to adopt its new 10-year strategy to drive agrifood systems transformation in January 2025.

With a total of 12 thematic chapters and two featured issues, the 2024 ATOR seeks to bridge the knowledge gap around linking the climate change and bioeconomy agendas by generating new evidence and compiling existing research. It covers specific topics related to climate change and the bioeconomy within the context of African agrifood systems transformation, with chapters organized into three sections on climate change, bioeconomy, and policy actions.

Impacts of and Responses to Climate Change

The first six chapters of this year’s ATOR assess trends, impacts, and responses to climate change. In Chapter 2, Wambo Yamdjeu and Glatzel describe the connection between climate change and the bioeconomy. The authors review the evolving policy landscape and propose to strengthen Africa’s shared development focus by adopting a bioeconomy lens. The authors discuss the convergence of the climate change and bioeconomy agendas within the context of the post-Malabo CAADP development and provide direction for improving existing policy efforts on both key themes.

In Chapter 3, Tankari and Fofana review existing evidence on the impacts of climate change on the macroeconomy and agrifood systems, analyzing the impacts of climate change on African economies and highlighting opportunities for agrifood systems transformation. The authors describe the effects of climate change on economic growth, underemployment, and other macroeconomic indicators, and examine how the three types of agrifood systems, which include traditional, modern, and transitional systems, are affected by climate change.

In light of growing recognition that reducing methane emissions might be a more effective strategy to mitigate global warming, Faye, Dia, Dia, and Ly use satellite remote-sensing data to address the gaps in methane emissions data across African countries. Chapter 4 assesses current methane concentrations across the entire continent, explores the relationship between methane emissions and crop types cultivated, and analyzes the potential relationship between methane concentration trends across cropland and climate parameters such as temperature and rainfall. Through this comprehensive data analysis, the authors aim to identify trends, patterns, and spatial distributions of methane emissions and examine their concentrations over time and across different geographical locations and crop types to uncover critical insights into the drivers of methane emissions.

Chapter 5, authored by Yade, Dia, and Grace, addresses climate change in African agrifood systems through the lenses of environmental change, health outcomes, and household vulnerabilities. It aims to provide a comprehensive overview of how climate change influences these interconnected domains, driving home the need for integrated and adaptive strategies and painting a holistic picture of the challenges and potential pathways to resilience.

In Chapter 6, Thomas examines the likely impact of climate change on African agriculture between now and 2050 and presents a set of modeled results for the continent and the five subregions, drawing from crop and bioeconomic models that use multiple climate models as inputs. The chapter outlines the impact of climate change on the major crops for the continent and each subregion, describes the climate models used in the analysis, and presents key agricultural commodities for the continent and each subregion. Thomas also describes Africa's climate, along with changes that have been observed already, outlines crop model results for Africa, and lastly, presents the results of the

bioeconomic model, which considers how climate change affects other countries, particularly the comparative advantages of Africa under climate change.

With a focus on climate adaptation options in Africa, Chapter 7 offers a detailed review and assessment of Africa's climate adaptation policies and actions in terms of the typologies of actions, state of implementation, and effectiveness. Authors Tadesse and Barry also examine key priority challenges facing African countries in the design and implementation of their adaptation plans, aiming to shed light on priority areas for policy actions and implications for the post-Malabo African agriculture development agenda. A summary of the conceptual and empirical discourses surrounding adaptation actions, with a special focus on building resilient and adaptive agriculture in Africa, is also provided.

Bioeconomy and New Opportunities

In Chapter 8, Abe-Inge, Aidoo, Kwofie, and Ulimwengu explore the potential of a nutrition-sensitive circular bioeconomy in transforming Africa's food systems, examining both the challenges and opportunities that lie ahead. Through this lens, the authors seek to provide a better understanding of how to harness the bioeconomy's principles to achieve sustainable development goals, ensuring that food systems not only support economic growth but also advance health and environmental objectives across the continent.

This edition of the ATOR takes a deep dive into a selection of country-level bioeconomy experiences in Africa, Latin America, and Southeast Asia that showcase good practices, policy innovations, key drivers, and success stories. In Chapter 9, Glatzel, Virchow, Nakitto, Niyonsenga, Babu, Srivastava, and Kashandula analyze governance structures—policies, regulations, and institutions—that form a conducive and enabling bioeconomy environment, and identify the context-specific entry points each government has taken to transition to a bioeconomy. Although all bioeconomy approaches require an overarching strategy and vision, they can range from small-scale and artisanal approaches to large, industrial-scale interventions. The key is that a bioeconomy should leverage a country or region's specific local conditions and natural competitive advantages to drive economic transformation while also providing an opportunity to positively contribute to agrifood systems transformation and catalyzing untapped potential to support both climate change mitigation and adaptation. With experiences from Africa, Asia, and Latin

America, the chapter offers a tour d’horizon of existing experiences in different political and economic settings around the world.

Following a report by the Malabo Montpellier Panel (2022) on the opportunities presented by a bioeconomy for Africa, this edition of the ATOR presents the business case for adopting the bioeconomy as a new paradigm for sustainable economic growth and development. In particular, the report looks at employment generation, opportunities for women, private sector investments, and new competitive value chains, among others. It provides an overview of major technological innovations as well as existing initiatives at the heart of promoting the bioeconomy, including bio-incubators. The role of the bioeconomy in response to shocks (such as those related to climate, markets, and health) is also assessed and discussed, with a specific focus on the bioeconomy’s welfare impacts and its contributions to climate change adaptation and mitigation efforts.

The business case for the bioeconomy is highlighted by the ATOR’s Featured Issue 1, authored by Ecuru and Osano, which contends that the bioeconomy would be attractive to policymakers because it poses no risk to the environment and is appealing to consumers. The authors offer a review of existing bioeconomy opportunities for African countries, while also encouraging governments to embrace this novel concept and take advantage of development solutions based on the continent’s existing natural resources.

Policy Actions

Among several agendas important to agrifood systems transformation efforts in Africa are financing for climate adaptation and the just energy transition. In Chapter 10, D’Alessandro, Adeniyi, and Araba present an overview of the current state of climate finance flows to food systems in Africa, then analyze the prevailing barriers that hinder the effective mobilization and use of climate finance for food systems adaptation in Africa. The authors draw attention to the opportunities arising from a wide range of innovative financing tools and mechanisms to mobilize additional finance from both the public and the private sectors, with a focus on blended finance. Lastly, the authors offer a detailed description of the key building blocks to a conducive enabling environment for climate-related investments in agrifood systems.

This edition of the ATOR endeavors to review and explore the key regulatory changes needed to foster renewable energy in Africa, analyze green energy as an output and input of the bioeconomy, and assess and track existing channels through which transitions to renewable energy sources are taking place, including solar, biofuel, hydro, wind, and green hydrogen. Discussions on energy efficiency have been gaining prominence, including within the research community and among African policymakers, and warrant a thorough review of the adoption of energy-saving technologies and reductions in biomass consumption.

Chapter 11, authored by Khennas and Sokona, reviews the existing evidence and debates on a just energy transition and low-carbon pathways in Africa, with the purpose of prompting discussions among researchers, policymakers, and practitioners. In the chapter, the authors give an account of this topic, which is still a relatively new area of research in Africa.

In Chapter 12 on climate action and the bioeconomy transition, Ecuru, Savadogo, and Araba offer a review of bioeconomy trends and the bioeconomy’s potential contribution to integrating the blue, circular, and green economies for sustainable agrifood systems. The first section focuses on key formal governance frameworks at Africa’s continental, regional, and national levels relevant to climate change, food systems, and development agendas. The authors look to identify enablers and regulators that can facilitate the integrated bioeconomy, which is at the intersection of the blue, circular, and green economies. The second section focuses on the main constraints to implementing climate actions and expanding uptake of the bioeconomy, while the third section discusses implications for Africa’s growth.

A thorough literature review is needed to better understand the implications for African economies of the Global Green Agenda and the European Green Deal, to which the European Union has committed to achieve climate neutrality by 2050, delivering on the commitments of the Paris Agreement (Council of the European Union 2023). This review would also help illustrate potential partnerships between Africa and other regions that are playing leading roles, take stock of ongoing negotiations and prospects for climate action and the bioeconomy in Africa, review existing continental strategies on climate change and disaster reduction, and explore conditions for developing an African bioeconomy strategy.

Deconinck's assessment of the rise of environmental impact reporting in agrifood systems bridges this knowledge gap. In Featured Issue 2 of this edition, the author draws attention to powerful long-term drivers that are increasing both the demand and supply of quantified environmental impact information in agrifood systems and the potential impacts on small producers in African countries, as well as on the emerging bioeconomy landscape.

Chapter 13, a standing feature in each edition of the ATOR, reviews Africa's progress in implementing CAADP processes and progress on the CAADP Results Framework (RF) indicators. This analysis highlights areas of strong performance that need to be sustained or accelerated, as well as areas of weak performance that require urgent attention to enable the continent to meet its Malabo Declaration agricultural transformation goals. In particular, the chapter discusses progress in the CAADP implementation process and on 27 of the 38 CAADP RF indicators for which cross-country data are available.

Building on last year's edition, titled African Food Systems Transformation and Post-Malabo Agenda (Ulimwengu, Kwofie, and Collins 2023), the 2024 ATOR could not be timelier, especially now that Africa has made the strategic move to fully embrace the agrifood system paradigm. The report provides an expanded body of knowledge and bridges the knowledge gap to inform an important effort that seeks to renew the overarching policy framework of the African Union. As of this writing, efforts by the African Union to design a new strategy to transform agrifood systems in Africa have been ongoing for nearly two years. This edition of the ATOR offers the best possible evidence and analysis to help key actors involved in the process make informed choices as they chart a new strategic direction for Africa between 2026 and 2036.