



CHAPTER 2

The Converging Climate Change and Bioeconomy Agendas as a Pathway Toward Implementing the Post-Malabo CAADP Agenda

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Introduction

In June 2014, the African heads of state and government adopted the Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods. The declaration contains a set of concrete goals to be attained by 2025, known as the Comprehensive Africa Agriculture Development Programme (CAADP), which in turn functions as the main policy framework for the African Union (AU) in the agricultural sector. The declaration thus provided a new direction for a more focused approach to achieving the continent's vision for agricultural growth and transformation (AUC 2014). According to the African Union Commission (AUC) and the African Union Development Agency (AUDA-NEPAD), the CAADP was designed as a practical instrument and framework through which Africa was going to drive efforts to achieve the Millennium Development Goals. The importance of evidence to inform policy design and implementation, inclusive participation of multiple stakeholder groups at all stages of the policy process, and mutual accountability for actions and results are at the heart of the CAADP. These principles help formulate high-quality policies and ensure that successful policies are scaled up while unsuccessful ones are adjusted. Since the adoption of the Malabo Declaration, 10 years have elapsed, and considerable progress toward achieving some of its targets is visible across the continent. With the lifespan of the Malabo Declaration coming to an end, the AU proactively initiated the design of a new 10-year strategy, covering the period from 2026 to 2035. As Africa has embarked on designing this successor strategy, it faces multiple complex challenges compounded by the climate crisis. With the opportune timing of this Annual Trends and Outlook Report, this chapter explores how the convergence of the climate change agenda and the transition to a bioeconomy will shape future strategic political decisions across the continent, effecting an equitable and sustainable transformation of agrifood systems. Thus, the bioeconomy can be a solution to future challenges resulting from climate change (for example, climate adaptation) vis-à-vis the challenges of avoiding the unsustainable use of natural resources (through climate mitigation, land use change, and the sustainable use of inputs). Simultaneously, the bioeconomy will generate opportunities for new markets—including markets for bioproducts, bioenergy or food based on insects or waste, and carbon engineering (markets that are discussed in Featured Issue 1).

Existing Continental and Global Policy Frameworks Shaping Africa's Climate and Bioeconomy Policies

Several continental policy frameworks in Africa have already provided a basis for the development of sustainable bioeconomies. For example, a number of objectives and targets under the current Malabo Declaration commitments and the AU Agenda 2063 (Box 2.1) support the development of a bioeconomy, as they include frameworks for increasing biomass production and improving value addition across bio-based value webs, as well as for strengthening national science, research, and innovation capacities. In addition, strategies for energy, mining, industrialization, climate change, and trade have the potential to accelerate the transition to a bio-based economy. At the same time, a bioeconomy can also enable governments to meet their global commitments, including those made under the Sustainable Development Goals, national pathways under the United Nations Forum on Sustainability Standards, and climate commitments anchored in countries' national adaptation plans and nationally determined contributions. Moreover, there is an opportunity for African countries to connect with and learn from the bioeconomy strategies of and experiences in other regions, such as the European Union or countries in Latin America and Asia.

As African countries are in the process of defining the post-Malabo CAADP agenda, this is an opportune time to reassess how a bioeconomy would be anchored within the continent's development agenda and to design pathways that align the agenda's ambitions with the envisaged transition to a bioeconomy.

In the energy sector, there is a clear political commitment at the continent level to achieving a bioeconomy, as reflected in the Africa Bioenergy Policy Framework and Guidelines, a joint effort by the AUC and the United Nations Economic Commission for Africa (AUC and UNECA 2013). While this framework is primarily aimed at the country level, principles and guidelines are also provided for regional economic communities (RECs) to guide their regional policies and regulations for promoting a sustainable bioenergy sector. The policy framework seeks to address the increasing and fluctuating costs of fossil fuels at the global level as well as environmental degradation, while aiming to reduce the use of biomass (mainly in the form of charcoal, firewood, crop residues, and manure) for cooking. On the other hand, advanced bioenergy solutions such as briquettes, biochar, and biogas offer opportunities to replace petroleum-based

BOX 2.1—AFRICAN UNION AGENDA 2063

Several goals under Aspiration 1 of the African Union (AU) Agenda 2063 (a prosperous Africa based on inclusive growth and sustainable development) provide an impetus for the development of a bioeconomy. The second goal within Aspiration 1 promotes the development of education and skills, particularly in science, technology, and innovation. To meet this aspiration, the AU adopted the Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024). The 10-year strategy aims to transform Africa into a knowledge-based and innovation-led society through the promotion of human capital development, innovation, value addition, industrialization, and entrepreneurship. STISA-2024 identifies food security, nutrition, and the eradication of hunger as the top 3 of its 10 priority areas, ranked in terms of their ability to benefit from the increased application of science, technology, and innovation. The strategy highlights the elements of agricultural value chains that would benefit most from a transition to a bio-based economy as (1) research and innovation in cultivation methods, seeds, soil, and climate change; (2) value addition and food transformation; and (3) infrastructure and techniques for distribution.

To these ends, STISA-2024 calls upon AU Member States to upgrade their science, technology, and innovation infrastructure; to expand the availability of quality postgraduate education, including technical and vocational education and training; to strengthen the environment for innovation and entrepreneurship; and to introduce appropriate policies for national science, technology, and innovation programs. STISA-2024 emphasizes the need for African governments to allocate at least 1 percent of their countries' gross domestic product to research and development. It is thus an important enabler of Africa's advancement in the development of bio-based economies.

Aspiration 1 includes the goal of modernizing agriculture and promoting the sustainable use of biological resources on the continent under the heading "Environmentally Sustainable and Climate-Resilient Economies and Communities." This goal urges Member States to manage their natural resources sustainably, conserve biodiversity, foster sustainable consumption and production patterns, improve water security, strengthen climate resilience and natural disaster preparedness and prevention, and expand the provision of renewable energy. To achieve these objectives, African governments and the African Union Commission are implementing the Green Recovery Action Plan, with five priorities including to "embolden nature-based solutions and focus on biodiversity through work on sustainable land management, forestry, oceans and ecotourism" (Malabo Montpellier Panel 2022, 7X).

products, reduce pollution, and contribute to rural development. The continent-level bioenergy policy framework emphasizes regional coordination of the production, trade, and use of bioenergy, including the harmonization of policies that facilitate the development of a viable modern bioenergy sector led by RECs.

Moreover, in order to harness science and technology for the socioeconomic transformation of the continent and to elevate its role in the world economy, African leaders adopted Africa's Science and Technology Consolidated Plan of Action (CPA) in 2005. Countries are encouraged to align their national policies on science, technology, and innovation with this plan. One of the flagship programs of the CPA is the African Biosciences Initiative (ABI), which focuses on research and development (R&D) in biotechnology, biodiversity, Indigenous knowledge systems, and technology development. Its strategic objectives are to develop new biosciences to protect the environment and conserve biodiversity, to build and strengthen human capacity for biosciences, to promote access to affordable and world-class research facilities, and to harness Indigenous technology and knowledge for wealth generation and the sustainable use of natural resources. ABI feeds into the agricultural, environmental, and health strategies of the New Partnership for Africa's Development (NEPAD) and is implemented through four regional bioscience networks: the Southern Africa Network for Biosciences (SANBio), the Biosciences Eastern and Central Africa Network (BecANet), the West Africa Biosciences Network (WABNet), and the North Africa Biosciences Network (NABNet). A good example of regional integration of bioeconomies, these networks comprise institutions and laboratories that have agreed to share their infrastructure and human resources for R&D at the regional level.

While the development of the continent's next 10-year agrifood systems transformation agenda is ongoing, African countries are now at a crossroads: as shown above, the

foundations for national and regional bioeconomy development have been laid, and some African countries are already jumpstarting a bioeconomy transition. As the following section will show, integrating the combined ambitions of increasing climate resilience and promoting a bioeconomy into the post-Malabo CAADP agenda can support a sustainable agrifood systems transformation, one that will sustainably deliver improved nutrition outcomes.

Integrating Climate and Bioeconomy Ambitions into the Post-Malabo CAADP Agenda

The fifth commitment under the Malabo Declaration calls for improving households' resilience to climate- and weather-related risks and other shocks. While shocks were relatively uncommon in the past, in recent times their frequency and intensity have increased, with multiple crises becoming protracted and compounded. In addition to climate shocks, conflicts, health shocks, and economic shocks are frequent, complex, and large in scale (Badiane 2023; UNECA 2023). As a departure point, a recent AU assessment of African performance in agriculture transformation reported that, after two decades of implementing the CAADP, the continent has made enormous progress in economic and agricultural growth, improvement in poverty and nutrition outcomes, expansion of agricultural trade, and public investments in agriculture (AUC and AUDA-NEPAD 2023). In the same source, CAADP is credited with having raised the profile of agriculture and encouraged greater focus on the sector in terms of policy and investment, with strong linkages to overall economic growth. As Wambo Yamdjeu and Diop have recently reported (2024), upon request of the AU, AKADEMIYA2063 has, since September 2023, endeavored to take steps to help with the mobilization of expertise to assist in developing the technical content of the new strategy.

The recent work by AKADEMIYA2063 consisted of a thorough review of the commitment areas under the current Malabo Declaration to assess their continued relevance, weaknesses, and strengths. It also involved exploring opportunities to fill gaps, eliminate redundancies, and expand the CAADP agenda as necessary to meet the challenges and achieve the ambitions of its next 10 years while building on key lessons from the past two decades of CAADP implementation. This review was necessary to ensure that the suggested adjustments under the post-Malabo agenda are informed by evidence from the four cycles of the Biennial Review, including the indicators' number and relevance,

opportunities to redirect some of them, and the challenges encountered in calculating proposed new indicators (Wambo Yamdjeu and Diop 2024). The ongoing process is anticipated to culminate in the adoption of the next declaration by the time of the AU Extraordinary Summit, scheduled to be held in Kampala, Uganda, in early 2025.

The Post-Malabo Caadp Agenda: A Preliminary Account of Efforts to Embrace an Agrifood System Paradigm and Set New Ambitions

With technical backstopping from AKADEMIYA2063, the AU outlined key modalities that would facilitate the mobilization and deployment of technical expertise to help provide needed data, analysis, and evidence to support a high-quality post-Malabo CAADP agenda. To that effect, an operational model consisting of two work streams was set up: (1) a stakeholder engagement and dialogue workstream, and (2) a data and analytics work stream. These work streams operated concurrently, with a strong symbiotic relationship and the common goal of helping deliver a new strategy and action plan for agrifood systems transformation in Africa (for the years 2025–2036) (AUC and AUDA-NEPAD 2023).

Under the data and analytics work stream, 13 technical working groups (TWGs) were identified and assigned to (1) thoroughly examine each of the Malabo Declaration commitment areas to assess any necessary changes and expansions, (2) identify the topical issues as well as emerging challenges, (3) identify opportunities to deepen and strengthen these areas while addressing challenges, (4) propose ambitions for the next 10 years, and (5) identify potential indicators and targets to measure progress. With overall facilitation from AKADEMIYA2063, individual TWGs were convened by and composed of representatives from leading African centers of expertise, research and academic institutions, technical development agencies, and global partners.

On the paradigm of embracing agrifood systems, TWG 1, focused on “principles and values of the CAADP process (from narrow agriculture-led growth to agrifood systems)” (AUC, AUDA-NEPAD, and AKADEMIYA2063 2024, 3), was convened by the University of Ibadan (Ibadan, Nigeria), the AU Commission, and the United Nations Special Adviser on Africa. The AU adopted the African Common Position on Food Systems during the 2021 United Nations Food

Systems Summit (AUC 2021), signaling a deliberate and clear shift of paradigm from the agriculture-led growth that had been the main mantra of CAADP under the Malabo round to a movement to embrace an agrifood systems approach. With this shift in the background, the group that assessed Malabo Commitment 1, “recommitment to the principles and values of the CAADP process,” (AUC, AUDA-NEPAD, and AKADEMIYA2063 2024, 3) as per the scope of work described above (Olayide et al. 2024).

This TWG report stressed that agrifood systems transformation would provide (1) clear goals and much-needed direction for national plans, international cooperation, and private investments; (2) a basis for an African roadmap for implementation; (3) a framework for the accountability of African governments, donors, and the private sector for delivering results toward food systems transformation; and (4) actionable efforts on the ground to build on successful experiences and leverage the appropriate innovation and technology, including those from research and academic institutions in Africa. As the agrifood systems approach was consistent with the African Common Position in the 2021 United Nations Food Systems Summit, the submission by the TWG was to serve as the main reference document and departure point to inform strategic orientation and develop the AU’s new 10-year strategy on CAADP. By embracing this transition, as presented in Chapter 13 (“Climate Action and Bioeconomy Transition: Mainstreaming Environmental Sustainability in the Post-Malabo CAADP Agenda”), Africa is demonstrating its awareness of the complexities of the dynamics at play—whereby economics, agricultural development, and nutrition intersect—while being mindful of the urgency of integrating the relevant policies promoting sustainability across sectors.

TWG 10 focused on generating the new theory of change and results framework (RF) that are necessary to shape the new 10-year post-Malabo strategy. The theory of change provides a detailed roadmap for transforming Africa’s agrifood systems, one well aligned with bioeconomy goals in order to leverage biotechnology, promote circular economies, support innovation, strengthen value chains, integrate supportive policies, and build capacity. The post-Malabo RF builds on the CAADP RF applied to the Malabo Declaration (AUC/NPCA 2015). It also considers other CAADP-related strategic frameworks, which outline the essential steps and logical cause-effect relationships among activities, intermediate results, and outcomes. (Ulimwengu et al. 2024). Taking advantage

of such synergy helps foster sustainable growth, environmental conservation, and enhanced food security across the continent. While this strategy addresses critical challenges and leverages opportunities, it also aims to ensure sustainable, resilient, and inclusive agrifood systems that will contribute to the continent’s long-term development and prosperity.

As for the TWG 7 on enhancing the resilience of livelihoods and agrifood systems to shocks, recommended (Mbow et. 2024) that the future Kampala Declaration acknowledge the importance of building the resilience of agrifood systems in the face of multiple shocks and stresses, as well as the interconnectedness of such shocks and their implications for the following:

1. Food and nutrition security: At the household and community level, multiple shocks—such as climate change, economic disruptions, health shocks, and conflicts—severely impact food and nutrition security.
2. Ecosystem services and landscape restoration: Improving ecosystem services is crucial for sustainable development. Restoring degraded landscapes and soil health, as well as rehabilitating water sources and rainwater management systems, are vital steps.
3. Health and robustness of agrifood systems: The health and robustness of countries’ agrifood systems are critical for economic stability and food security. Shocks like pandemics and trade disruptions can cripple agrifood systems, leading to shortages and price spikes.
4. Overall economic resilience of Member States: Building the overall economic resilience of Member States requires a holistic approach, which includes developing adaptive strategies to manage climate risks, investing in infrastructure to withstand shocks, and fostering social and economic policies that promote equity and inclusion.

It is worth recalling that, 10 years ago, CAADP and the subsequent Malabo Declaration set out targets to stimulate agricultural growth across the continent. Targets were defined for finance, productivity, research, and sustainability within Africa’s agricultural sector, all of which, directly and indirectly, can advance a bio-based transition, as presented by the Malabo Montpellier Panel report titled *Nature’s Solutions: Policy Innovations and Opportunities for Africa’s Bioeconomy* (2022). For instance, the Malabo Declaration commits African governments to double their agricultural productivity from 2014 levels by 2025,

thereby ensuring that more biomass—a primary input for the bioeconomy—is available to drive the bioeconomy’s growth. The target further promotes agro-processing—also a key factor in a thriving bioeconomy. Supported by an increase in access to financing and by investment in research, the CAADP/ Malabo Declaration commitments reinforce the basis for a growing bioeconomy. In this way, the report by TWG7 concluded that the inclusion of targets on sustainability—specifically in land management and water use—will also help ensure that the transition to a bio-based economy preserves the environment and enhances resilience.

The Bioeconomy: An Emerging Integrated Policy Agenda in Africa

The complexity of agrifood systems transformation—with multiple, interlinked challenges spanning different sectors and stakeholder groups, coupled with multiple global and continental policy agendas that countries are required to implement—calls for a new paradigm in addressing these challenges while leveraging the opportunities available. While not a silver bullet, a focus on bioeconomy development provides an agenda to enhance the agrifood system’s productivity potential on the continent while simultaneously delivering sustainable products and services, providing healthy diets, and creating important employment opportunities (Aidoo et al. 2023). Bioeconomy was defined by the Global Bioeconomy Summit as “the application of science, technology, and innovation” to the sustainable production and use of biological resources to create innovative products, processes, and services for all economic sectors” (GBS 2020).

A bioeconomy can help African countries progress to more sustainable production and consumption practices, in addition to accelerating progress in their continental and global development commitments and climate targets. The adoption of a bioeconomy approach can hence contribute to food security and improved health and nutrition outcomes (see Chapter 8), accelerate the just energy transition (see Chapter 11), and contribute to sustainable economic and social growth. In fact, it could enable strategic policies and initiatives to align Africa’s agrifood systems transformation with local and global sustainable development commitments and the green growth agenda (Aidoo et al. 2023). The use of renewable biological resources, primarily from the agricultural sector,

therefore provides a platform from which to accelerate a global transition toward greater sustainability and resilience.

The Potential of a Bioeconomy Strategy to Contribute to Climate Change Adaptation and Mitigation

The transition to a bioeconomy puts countries on the path toward more sustainable use of inputs—including natural resources such as land, water, air, minerals, forests, fisheries, and wild flora and fauna—through more efficient production and processing practices and the reduction of input demand, while providing new sources of nutrients for people from biomass products. A central principle of the bioeconomy is the efficient use of natural resources and the circularity of production through the recycling and reuse of waste (Malabo Montpellier Panel 2022). The opportunities to develop new value-added products from biomass and waste, especially agricultural waste, offer some of the most noteworthy prospects for developing a bioeconomy and for doing so at scale. The application of cutting-edge bioscience and biotechnology to reuse and transform waste from agro-processing and other value-adding sectors and value chains such as livestock, coffee, cotton, wood, sisal fiber, and fruits offers clear entry points for Africa’s bioeconomy development and is strongly aligned with countries’ commitments to meeting international climate targets. As shown throughout this report, there are multiple examples from across the continent of industries in which this potential is already being harnessed. Moreover, biomaterial innovations present new employment opportunities in rural regions that continue to rely heavily on agriculture for income.

The growing demand for biomass also offers opportunities to mitigate and adapt to climate change and opens a pathway that would enable the agricultural sector to be decoupled from environmental degradation and resource depletion, in some cases achieving these goals simultaneously. Currently, several global mitigation scenarios rely on large emissions reductions across the agriculture, forestry, and other land use sectors and, at the same time, reforestation/afforestation and biomass use in a multitude of applications. Among these scenarios, the transition to a low-carbon, fossil fuel-free global economy is expected to depend extensively on bioenergy. Low-efficiency traditional biomass already forms a large source of energy for cooking, lighting, and heating across Africa. However,

such energy sources present serious negative impacts on health and living conditions, particularly for women and girls who in many countries continue to be the ones primarily responsible for cooking and spend more time in the house. High-efficiency, modern bioenergy can play an important role in providing sustainable, “green” energy to nearly 73 percent of the continent’s residents who live off the grid and, in turn, in improving local air conditions and reducing the pressure on Africa’s forests. In 2015, a study explored the potential of biogas production in Ethiopia using by-products from coffee processing, including husks, pulp, and mucilage. The findings showed that the anaerobic digestion of these products could generate as much as 238,000 megawatt hours (MWh) of electricity and 273,000 MWh of thermal energy. The coffee processing facilities could then use this energy, leading to cost savings and reduced greenhouse gas emissions (Chala et al. 2018).

Another example is a programmatic partnership facilitated by BioInnovate Africa that brings together scientists, researchers, innovators, and entrepreneurs in Kenya, Tanzania, and Uganda to develop new fuels for rural households from food waste (BioInnovate Africa 2019). The project looks to commercialize a fuel that offers a more environmentally friendly alternative to charcoal, paraffin, and firewood to meet household energy needs, while also reducing the reliance on imported petroleum-based products and deforestation for fuelwood. Using eggshells and fruit waste (mango, banana, watermelon, orange, and papaya sugars and peels), project scientists developed a bio-alkanol gel that burns without smoke or soot and can be used as a cooking fuel using existing infrastructure. Academic and business institutions from the three countries—including Maseno University and Lake Basin Development Authority, both in Kenya; the Tropical Pesticides Research Institute, Tanzania; and the National Agricultural Research Organization, Uganda—collaborated in identifying and developing the new technological product and have established a production facility for its commercial expansion (UNOSSC 2020).

There is also significant potential in combining restorative agriculture and forestry with bioenergy and other bioeconomy programs to sequester emissions and help protect and conserve biodiversity. For example, the greater adoption of locally adapted agroecological techniques such as agroforestry can restore biodiversity in agricultural landscapes. Meanwhile, increasing soil fertility by enhancing the accumulation of organic matter from decaying plant residues

reduces overreliance on chemical fertilizers and pesticides. Climate-smart agriculture and forestry approaches can offer co-benefits in food security, livelihoods, biodiversity, and health. Tree plantations, such as the Acacia senegal plantations producing gum arabic in eastern Africa, the rubber and teak plantations in West Africa, and the eucalyptus plantations of South Africa, can be a source of pulp, timber, and fuelwood, thereby relieving pressure on primary and protected natural forests (Malabo Montpellier Panel 2022). The use of timber products in construction and industry can also mitigate emissions from steel and cement production.

Moreover, combining agroforestry with livestock farming fosters the adoption of circular agriculture, in which external inputs are minimized and the environmental impact is thus reduced. Many smallholder farmers raise livestock and then use crop residue biomass as animal fodder, which reduces the available soil cover; if trees are grown on farms, however, there is more available biomass to meet livestock needs and thus to maintain constant soil cover and productivity (Helgason, Iversen, and Julca 2021). Hence, the expansion of Africa’s bioeconomy can provide several possibilities for engaging in global efforts to address climate change and natural resource constraints.

The Bioeconomy as a Resilience-Enhancing Strategy

Despite the progress highlighted in the fourth CAADP Biennial Review Report, Africa is not fully meeting its resilience-building goals, with only two countries on track (AUC 2023). The development of a bio-based economy presents important opportunities for rural development in Africa. If adopted with the principles of inclusivity, sustainability, and accountability at its core, a bioeconomy can significantly reduce poverty. This effect is particularly important for Africa’s rural areas, where a vibrant bioeconomy can boost agricultural productivity, support the expansion of green agro-industries, and create much-needed employment opportunities in the green economy. Meanwhile, greater uptake of biotechnology can also increase food availability and raise its nutrient content, while promoting new food (and nonfood) value chains and improving food safety.

Specifically, a bioeconomy can foster employment opportunities through a transformed and expanded agro-processing sector. Such a sector, which lies at the heart of a bioeconomy, can increase the production of agro-industrial and

other value-added products with potential applications in many sectors, such as pharmaceuticals, green chemicals, industrial materials, and energy (SIANI 2016). Employment opportunities are crucial in Africa: As a report by the Malabo Montpellier Panel (2024) indicates, around 60 percent of Africa's population is younger than 25 years, and more than a third is between 15 and 35 years old. In 2022, the median age across Africa was 18.8 years, compared with 35 in North America and 47 in Japan (Statista 2022). It is expected that by 2063, there will be more than 1 billion young people between 15 and 35 years old in Africa (PRB 2019), and by 2100, almost half of the world's youth will be from Africa (Rocca and Schultes 2020). Development of a bioeconomy therefore presents a crucial pathway to addressing un- and underemployment challenges and to improving the incomes and resilience of rural and urban populations.

B-BOVID Ltd., for example, is a medium-scale agricultural enterprise in Ghana. It operates a closed-system, circular palm value chain, producing palm oil for human consumption, kernel oil for industrial use (in such products as detergents, herbicides, and cosmetics), animal feed from kernel cake, organic fertilizer from waste and briquettes, and biogas from secondary waste. In addition to operating its own plantation, B-BOVID also purchases raw materials from outgrowers and provides infrastructure for smallholder farmers to produce their oil at one of two oil mills and processing factories. Farmers receive market prices for their produce, a share of the net profit, and access to training at an innovation center. With this program, B-BOVID has devised a model that adds value to palm production, including by- and co-products; it also provides a reliable market, employment opportunities, and income to smallholder farmers and contributes to reducing the environmental and climate impacts of the palm oil value web (Gomez San Juan et al. 2019).

The application of bioscience and biotechnology to the reuse and transformation of waste from agro-processing and other value-adding sectors into a range of products with greater market value can also create job opportunities. These sectors include livestock, coffee, cotton, wood, sisal fiber, and fruit, all of which are vital to the economies of several African countries. In Kenya, the start-up Mananasi Fibre applies a locally manufactured decorticator technology to tackle the challenge of repurposing pineapple plant waste. The machinery extracts fibers from the waste, providing a sustainable solution for both textile production and agriculture. Currently, Mananasi Fibre produces three types of products: raw fiber, which can be used in textiles, packaging, and papermaking;

a more refined material made of softened and disentangled fiber, used in various applications including textile production; and last, the decomposed remaining parts of the plant (leaf pulp, roots, and stems). This compost is ideal for both agriculture and gardens, where it can be used as a substitute for synthetic fertilizers.

In fact, the transformation of fruit waste into fiber for use in the fashion industry has significant potential for African countries: From cotton to leather, the creation of fashion's raw materials consumes vast amounts of resources and generates significant amounts of emissions. In addition, the fashion industry generates around 20 percent of the world's wastewater, as well as large amounts of microfibers that pollute the oceans (Fleming 2019). Amid growing calls for a more ethically and environmentally responsible clothing industry, the bioeconomy offers significant opportunities. Several fashion brands and companies have already moved toward using pineapple and banana by-products that would otherwise go to waste to produce fiber. An Italian company, Orange Fiber, started producing a viscose-like material (lyocell) made from oranges and wood pulp, while other fashion designers have pioneered mushroom-based leather alternatives (Fleming 2019; Provin and de Aguiar Dutra 2021; Jayaprakash et al. 2022).

In Zambia, forest-related activities represent more than 1 million jobs in the formal and informal sectors, and they supplement or sustain the livelihoods of up to 80 percent of rural Zambian households. Tree- and forest-based biomass products can be less vulnerable to climate shocks than some horticultural crops, including fruits and vegetables. This resilience makes a forest-based bioeconomy an important source of income for the most vulnerable groups, who are seeking to diversify their incomes to cope with the impacts of socioeconomic or climate shocks. The forest-based bioeconomy can also function as a safety net during lean seasons, conflicts, or other times of hardship, such as unemployment or illness, when farmers can collect and sell fuelwood and nonwood forest products to gain additional income (FAO 2018; Jonsson et al. 2021).

In addition, edible insects are an important source of protein and can be processed into more palatable forms. After being ground into paste or powder, they can be added to otherwise low-protein foods to increase their nutritional value. Black soldier fly larvae are also being used as a supplement for animal feed. More advanced technologies that isolate and extract insect protein are also becoming more readily available. These isolated protein sources can be used to

fortify food products in a consumer-acceptable form. As the uptake of edible insects for food and livestock feed increases, using agricultural by-products as feed for insect breeding could help reduce production costs. By-products—such as pomace from fruit and vegetable processing, cacao fruit remnants, or press cakes from palm oil production—are available in large quantities. They can, however, contain various indigestible components—lignin or polyphenols, for example—that need to be reduced before use (Fraunhofer Institute 2020).

A bioeconomy also offers the opportunity to promote local processing of underused crops that often have climate-resilient characteristics and are highly nutritious, thereby offering the dual benefits of providing employment, which enables wealth creation, along with addressing malnutrition challenges (see also Chapter 8). A bioeconomy can transform the African food processing sector by effectively allowing value addition to biomass, producing valuable food products in an environmentally friendly manner. The application of research and knowledge, both scientific and Indigenous, can expand conventional linear value chains into complex, interconnected value webs that reuse waste from processing to create new products. This transformation of Africa's food processing sector will create new value chains and markets in the food system.

The Bioeconomy as a Lever to Support Agrifood System Transformation Efforts

A bioeconomy has strong regional and local characteristics. Similarities in flora, fauna, and climatic and socioeconomic conditions motivate nations to identify contextually appropriate solutions (Malabo Montpellier Panel 2022). Moreover, with the increasing globalization of natural resources and the rise of governance structures that are built to manage the extraction and use of global biomass, strategic partners with differing comparative advantages can achieve the most efficient outcomes (Malabo Montpellier Panel 2022). Policies facilitating regional cooperation will be crucial in the development and scaling of Africa's bioeconomies.

Key issues hindering the growth of the bioeconomy on the African continent include a lack of dedicated policy and regulatory frameworks on bioeconomy promotion; challenges in research, development, and innovation; a lack of financing; a small (albeit growing) entrepreneurial sector; and gaps in infrastructure. Innovations in developing a sustainable bioeconomy in Africa offer real opportunities to address multiple challenges simultaneously. A report by the

Malabo Montpellier Panel (2022) draws attention to various fields of innovation that are rapidly evolving worldwide, where Africa would be well positioned to create its own unique approach. There is a real opportunity for Africa to jumpstart the growth of its bioeconomy, and the report shows how learning from successful policy innovation can facilitate and expedite the design and implementation of national bioeconomy strategies.

Although most African countries are still in the early stages of developing bioeconomies, trends at the global level—in particular in Europe, India, Latin America, and Southeast Asia—indicate a move toward a bioeconomy approach. In Africa, the East African Community's bioeconomy strategy is being finalized, while in some other countries the first generation of bioeconomy strategies is being developed (see Chapter 9). African bioeconomy agendas can address practical and concrete issues and opportunities, such as broader food security, carbon farming as part of the climate agenda, clean cooking fuels, bioplastics, sustainable construction, and biopharmaceuticals.

Important lessons can be drawn from the experiences of those African countries—particularly Namibia and South Africa—at the forefront of developing and implementing their national bioeconomy strategies: their policy and institutional innovations have shifted the needle toward systemic change and transformation, making them global pioneers of bioeconomy development (see also Chapter 9).

Country Entry Points

African countries are increasingly recognizing the importance of bioeconomy strategies for the development and transformation of their economies. As a result, bioeconomy policies are emerging at national and regional levels on the continent. South Africa launched its bioeconomy strategy in 2013 to foster its transition to a knowledge-based bioeconomy by guiding bioscience research, investments in innovation, and decision-making within a high-level framework. Namibia, on the other hand, launched its bioeconomy strategy in May 2024. Ghana, Kenya, Mali, Mozambique, Nigeria, Senegal, and Uganda have all taken great leaps forward in their bioeconomy policy development by designing policies that promote activities in bioenergy and biofuel production.

In fact, Senegal has issued two bioenergy strategies, one in 2008 and another in 2012, called *Lettres de Politique de Développement du Secteur de l'Énergie* (“The Energy Sector Development Policy Letter”). Bioprospecting policies have also been at the center of the strategies of some African countries, such as

Kenya and Mauritius, to tap into their unique biodiversity and commercialize knowledge about traditional bioresources. Other policy efforts to develop a bioeconomy at the national level include the adoption of national biotechnology strategies by eastern African countries, including Ethiopia, Kenya, Tanzania, and Uganda, while Mauritius developed a comprehensive ocean economy strategy in 2013. The development of a bioeconomy can be initiated via selected “gateway” sectors. The chosen sectors ideally align with the focus points of long-term national development plans (as well as with broader goals for food security, nutrition, and resilience), provide clear opportunities for innovation, or represent a comparative advantage or complementary approach. Chapter 9 provides a detailed overview of the bioeconomy pathways of three African countries (Ghana, Namibia, Uganda) and shares insights on the unique experiences of Brazil and Thailand in transitioning to a bioeconomy.

Conclusion

The design and subsequent implementation of the post-Malabo CAADP agenda provides an important opportunity for African leaders and their partners not only to move beyond boosting agricultural growth and transformation by embracing an agrifood systems lens but also to ensure that this transformation takes place in a sustainable way, while protecting yet leveraging the continent’s vast abundance of natural resources and biodiversity.

Transitioning to a bioeconomy through investment strategies aligned with climate change targets and priorities provides a pathway for countries and the continent as a whole to move closer to meeting this ambition. Such a pathway will require scaling up investments in new technologies, creating an environment that enables emerging companies to innovate, providing the training and education needed to drive a bioeconomy transition, and facilitating cooperation across borders, between regions, and with other continents, all while adapting to climate change.

As the subsequent chapters in this report will show, much can be learned from the experiences of countries leading the bioeconomy transition across the world, as well as from the bioeconomy innovations and inventions mushrooming across Africa. Moreover, identifying the gaps and trade-offs between sustainability and economic growth, as well as between sustainability and socioeconomic development goals (such as reducing poverty and addressing malnutrition) will form an important element of public policy guidance as

countries move toward updating their NDCs in 2025 and developing their bioeconomy strategies while also implementing the post-Malabo agenda. While there may be synergies and complementarity between sustainability and poverty reduction targets in the long term, there may well be negative trade-offs in the short term. Once these gaps and trade-offs have been identified, potential public policy strategies can be developed.