



CHAPTER 12

# Climate Action and Bioeconomy Transition: Mainstreaming Environmental Sustainability in the Post-Malabo Agenda of the Comprehensive Africa Agriculture Development Programme

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## Introduction

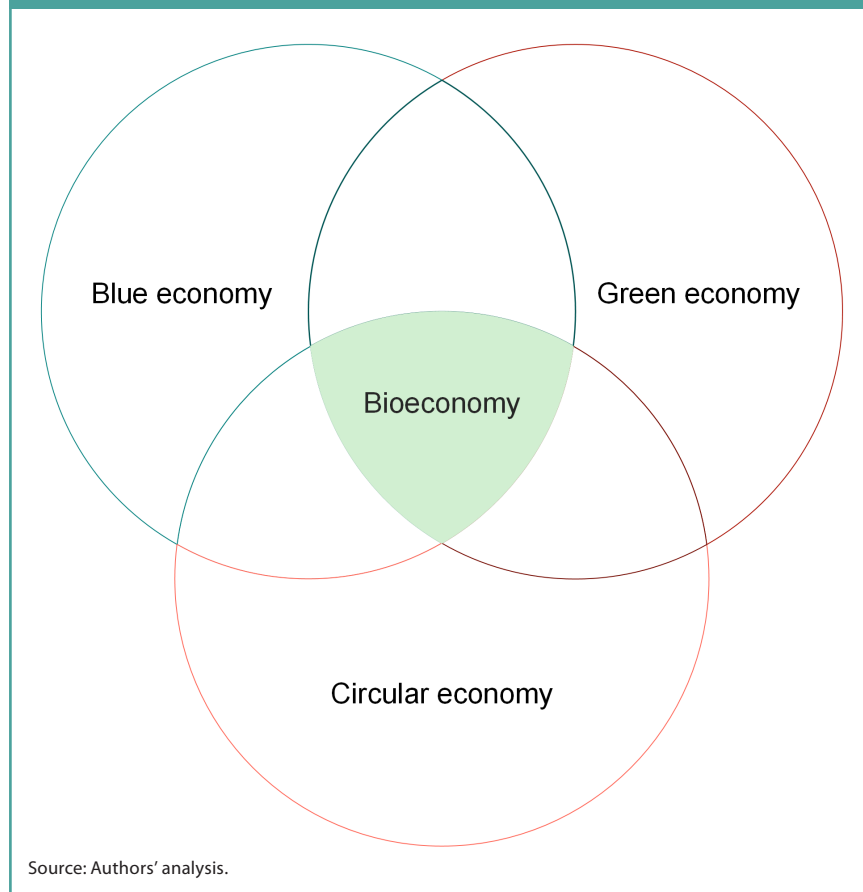
The concepts of the green economy, circular economy, blue economy, and bioeconomy started emerging in response to the multidimensional economic, socioecological, and climate change crises. These concepts are becoming popular in sustainability discussions in policy, scientific research, and business and are expected to promote sustainability through different pathways of transformation. Each of these frameworks offers a comprehensive package of solutions, yet all point toward renewable, bio-based processes and nature-based or nature-friendly solutions (Kirchherr, Reike, and Hekkert 2017; Geissdoerfer et al. 2017; D’Amato and Korhonen 2021). The bioeconomy, which is more focused on biological and nature-based/positive processes, is usually viewed as a more holistic concept that encompasses principles of the green economy, circular economy, and blue economy (Figure 12.1).

## Green Economy

The concept of the green economy emerged from the 2008 financial crisis and was amplified by climate change challenges, which pushed the international community to advocate for redirecting public and private capital to finance green activities rather than the business-as-usual “brown” economy. This paradigm shift was strongly renewed at the Rio+20 conference in 2012 (UN 2012). Though highly context specific, the green economy encompasses all solutions that contribute to reducing carbon emissions and pollution, enhancing energy and resource efficiency, and preventing the loss of biodiversity and ecosystem services (Figure 12.1). The green economy, therefore, must be inclusive and result in improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities. It is a low-carbon, resource-efficient, and socially inclusive economic model (UNEP 2011).

The green economy also enhances material and immaterial benefits from the biosphere (ecosystem services) to address human well-being, employment, and poverty alleviation while replacing fossil energy with abiotic renewable energy. Concrete actions are based on the assessment and accounting of ecosystem services, restoration and maintenance of ecosystems, and development of nature-based solutions and green infrastructure. Examples of success stories in agrifood systems include organic farming in Uganda, solar energy in food processing in Tunisia, and feed-in tariffs in Kenya (UNEP 2010).

FIGURE 12.1—INTEGRATED BIO-GREEN-BLUE-CIRCULAR ECONOMY FRAMEWORK



## Circular Economy

The circular economy is defined in opposition to the dominant and prevailing global linear economy in terms of the physical flows of materials and energy; it aims to support the development of regenerative production/consumption systems, where inputs and outputs are minimized by slowing, closing, and narrowing material and energy loops. Its roots are in the ideas of industrial ecology and industrial ecosystems (Winans, Kendall, and Deng 2017; Kirchherr, Reike, and Hekkert 2017).

The concept of the circular economy is based on the principle that society and economy inevitably depend on the global biosphere. The thermodynamics of energy and material are recognized but conflict with the belief that full circularity is achievable. Temporal and spatial trade-offs between societal goals are acknowledged, but in practice, some undesired effects occur, such as energy leakage and rebound effects or inefficiencies (Gonçalves Castro et al. 2022).

The circular economy emphasizes improving material and energy performance, preferring product reuse and remanufacturing over traditional recycling and preferring product sharing and multifunctionality over ownership and monofunctionality. Circular economy solutions include a rethinking of product/service design to allow for efficiency gains; a reduction of material and energy needed for production; long-term maintenance; repair, sharing, reuse, refurbishing, remanufacturing, and repurposing; recycling and reclassification of waste into inorganic and biological components; and renewability of energy sources. In the agrifood sector, circular economy is used to optimize the food supply chain by using insects such as the black soldier fly (BSF) to transform vegetable and fruit processing byproducts into feed (BSF larvae) for poultry or fish (Nath et al. 2023) or into organic fertilizer (Beesigamuka, Subramanian, and Tanga 2022). Another example is cacao waste that can be transformed into many other products using circular economy processes. For example, cacao pod husks can be used as an alternative animal feed source (after processing to remove a harmful toxin), and they can also be converted to biochar as a potent compost, helping to improve soil quality by adding organic matter and enhancing soil structure, which promotes healthier crop growth (Ombelet et al. 2024). Other examples, such as insect-based organic fertilizers, may also be of interest to farmers (Makokha et al. 2023; Beesigamuka, Subramanian, and Tanga 2022).

Overall, the circular economy contributes to reducing inputs and outputs in production/consumption systems by retaining material and energy flows within high value/functionality levels for as long as possible, improving social conditions through job creation and regional development, and building resilience to climate change (Ellen MacArthur Foundation 2019; Geissdoerfer et al. 2017).

## Bioeconomy

The bioeconomy leverages the potential of biological resources from land and sea for the development and commercialization of goods and services. It focuses on the use of biomass, with scientific knowledge and innovations driving this process (D'Amato and Korhonen 2021) of converting biomass into various products, from bioenergy and fuels to paper and commodities, textiles, chemicals, and pharmaceuticals. Bioeconomy products range from biomass-demanding, low-value products, such as biofuels, to high-value products requiring smaller biomass quantities, such as bio-based chemicals or compounds. The underlying principle of the bioeconomy is that it should be environmentally, socially, and economically sustainable. The bioeconomy has potential to replace lithosphere inputs (that is, fossils) with biosphere inputs (living biomass) in economic activities, thereby improving social conditions through job creation and regional development. The key actions are the development and marketization, through knowledge and technology, of innovative and high-value goods and services from the potential held in biological resources while ensuring sustainable sourcing and efficient resource use.

The International Advisory Council on the Global Bioeconomy (IACGB) currently defines the bioeconomy as “the production, use, conservation, and regeneration of biological resources to provide sustainable solutions (including information, products, processes, and services) in and across all economic sectors” (Ecuru, MacRae, and Lang 2022). The definition positions the bioeconomy as a cross-sectoral endeavor, which combines natural resources, scientific knowledge, and technologies with markets and business opportunities, as well as helping tackle societal challenges such as natural resource scarcity, waste generation, fossil fuel dependence, climate change, loss of biodiversity, and food and energy insecurity, all while achieving sustainable growth (Malabo Montpellier Panel 2022a). It further presents opportunities for climate mitigation through carbon sequestration in plant and forest matter and soils (referred to as carbon farming) and adaptation, particularly in Africa’s agricultural sector.

The inclusion of the bioeconomy as one of 20 program priority areas in the Strategic Framework 2022–31 of the Food and Agriculture Organization of the United Nations is seen as a key policy boost to its global advancement (FAO 2021). An analysis by the IACGB of various policies and strategies around the world showed agreement among policymakers that the bioeconomy is

contributing to climate neutrality, food and nutrition security, improved health, economic growth, and many other objectives aligned with sustainable development (IACGB, 2024; Makoni 2021; World Bank 2020b; Kamarulzaman and Mostapha 2020).

## Toward an Integrated Framework

In an ideal scenario, the bioeconomy promotes economic growth and social progress while decoupling development goals from increasing resource consumption and greenhouse gas (GHG) emissions (Malabo Montpellier Panel 2022; Ochieng and Onyango 2021; World Bank 2020b). It is considered a transformative pathway to achieving the African Union Agenda 2063, as well as several Sustainable Development Goals (SDGs) (Teye and Owusu 2021; Badu and Boateng 2022) and other global agendas on climate (United Nations Framework Convention on Climate Change [UNFCCC]) and biodiversity (Convention on Biological Diversity), while embedding principles of circularity and sustainability in all the agenda setting processes. Therefore, it should be seen as a unifying, integrated, and cross-sectoral framework that offers numerous opportunities to cope with global challenges by providing technology-based innovations (Okafor 2021). Transitioning to a sustainable bioeconomy can be achieved by effectively merging green, circular, and bioeconomy models into an integrated framework leading to climate-smart actions, thereby accelerating sustainable development (Figure 12.1). Doing so will require more engagement of communities and more involvement of science and technology innovations throughout all processes (Mensah and Enu-Kwesi 2022; Poku and Birner 2022; Teye and Owusu 2021; Ochieng and Onyango 2021; Asafu-Adjaye and Mahama 2019).

According to the Malabo Montpellier Panel (2022), evidence in Africa shows that the bioeconomy can contribute to sustainable development through innovative and less-resource-intensive agricultural technologies, thus increasing food security while decreasing environmental degradation (SDGs 2, 13, and 15). By improving circularity and promoting biotechnological innovations, the bioeconomy can contribute to optimizing resource consumption, thereby minimizing waste (SDGs 6, 11, and 12). The conditions required to achieve these goals include large-scale investment in bio-based innovations and economic infrastructure, capacity development of entrepreneurs, awareness

raising, incentives for market and non-market conditions (Mockshell et al. 2023; Piñeiro et al. 2020), and efforts to address socioeconomic and cultural challenges, including behavioral change (Yaro and Doku 2020; Okafor 2021; Adom and Amoako 2019).

## Structure of the Chapter

The objective of this chapter is to review bioeconomy trends and the bioeconomy's potential contribution to integrating the blue economy, circular economy, and green economy for sustainable agrifood systems. It is structured in three main sections. The first section presents a review of the key formal governance frameworks at Africa's continental, regional, and national levels pertaining to climate change, food systems, and development agendas, with a view to identifying enablers and regulators that can facilitate the integrated bioeconomy, which is at the intersection of the blue economy, circular economy, and green economy. The second section focuses on the main constraints to implementing climate actions and expanding bioeconomy uptake, while the third section discusses implications for Africa's growth.

## *Bioeconomy Development in Africa*

Policies are the primary enablers for developing sustainable bioeconomies in Africa. Though not explicitly designed to support the bioeconomy, most African agricultural and economic development policies have some enabling orientations and opportunities for the development of the bioeconomy across the continent. Some of these have been highlighted in the report titled *Nature's Solutions: Policy Innovations and Opportunities for Africa's Bioeconomy* (Malabo Montpellier Panel 2022a). This report leverages case studies and policy dialogues to show how Africa can develop sustainable bioeconomies that optimize social, economic, and environmental benefits and achieve societal prosperity. In this section, we summarize selected messages from that report and expand them based on new policies and criteria of analysis. We then focus on how the existing policies are supporting the critical driving forces of the bioeconomy, namely: (1) governance; (2) science, research, and innovation; (3) market and trade of bioproducts; (4) conservation of bioresources (preservation and sustainable use); (5) intellectual property; and (6) infrastructure development.

## At the Continental Level

### *Opportunities for Bioeconomy Development in Agenda 2063*

The African Union (AU) Agenda 2063 and its implementation instruments have created a solid foundation for the development of a fast-growing bioeconomy in the continent.

The fundamental principle of the bioeconomy is that it must be science-driven and sustainable. Aspiration 1 focuses on the governance of science, technology, and innovations, with Goal 2 underscoring the importance of education and skills revolution. This translated into the AU Science, Technology, and Innovation Strategy for Africa toward 2024. It is further connected to Goal 4 on the transformation of economies and job creation and to Goal 5 on modern agriculture for increased productivity and production. These goals are reflected in the Malabo commitments to stimulate agricultural growth in the continent, spanning finance, productivity, research, and sustainability (AUC 2014).

Through the Malabo Declaration (AUC 2014), AU member states committed to doubling agricultural productivity by 2025, yielding more biomass and an opportunity to trigger bioeconomy development and sustainable growth. This goal is further reflected in the promotion of agro-processing to halve postharvest losses for 5 to 11 AU priority commodities by 2025. Doing so facilitates the mainstreaming of bioeconomy principles and methods throughout the value chains, and is underpinned by increased access to finance, investment in research, and targets on sustainability in land and water management and water use.

Aspiration 1, Goal 7—which is related to the development of environmentally sustainable, climate-resilient economies and communities—aims for sustainable use of biological resources, management of natural resources, conservation of biodiversity, sustainable consumption and production patterns, improvements to water security, strengthened climate resilience and natural disaster preparedness and prevention, and an expansion of the provision of renewable energy, through the Green Recovery Action Plan (AUC 2021).

The Second Ten Year Implementation Plan (2023–2033) of Agenda 2063 recognizes the potential of biotechnology for sustainable food systems and industrial development. Biotechnology, as part of the bioeconomy, is expected to help transform seed systems and generate innovation, leading to safer and more nutritious food, industrial chemicals with fewer negative environmental impacts, and safer pharmaceuticals (AUC 2024b). The plan calls for increased

investment in bioscience research and processes that enable the translation of these research outputs to innovation and business.

### *Opportunities for Bioeconomy Development in the AU's Climate Change and Resilient Development Strategy and Action Plan (2022–2032)*

#### *Policies, Institutions, and Legal Frameworks*

The AU Climate Change and Resilient Development Strategy and Action Plan (AUC 2022) (abbreviated here as “the AU strategy”) contributes to the implementation of Agenda 2063. It draws on the UNFCCC climate action pathways for resilient development and builds on Africa’s efforts to achieve climate-resilient development pathways and accomplish the SDGs. The bioeconomy aligns well with its objectives and strategic intervention areas. The strategy recognizes that bio-based outputs are an indispensable component in the portfolio of low-carbon technologies that must be deployed to limit global warming to 2 degrees Celsius.

The AU strategy also clearly “seeks to enhance the adaptive capacities of Member States, and further seeks to promote low-emission growth pathways aligned with the 1.5-degree Paris Agreement goal and shaped by the principles of the green and circular economy, sustainable development, and poverty reduction” (AUC 2022, 6). The framework reinforces the need for a circular economy for sustainable development, systems, and value chain approaches; low-emissions industrialization; food systems transformation; and protection of land-based ecosystems, all of which are also consistent with bioeconomy principles. Three of the five top areas in food systems transformation (the priority area) promote (1) the enhancement of resilient food systems against climate effects while emphasizing nutrition outcomes and integrated planning, (2) the agroecological transition to reduce GHGs and dependencies on external inputs, and (3) stronger food system governance.

Specifically, the strategic intervention axis 1 (AUC 2022) focuses on strengthening policy and governance by enhancing inclusive, multiscale governance and institutional coordination, including adopting a “whole-of-economy” approach; considering the processes and not just the outputs when developing strategies; mainstreaming low-emission development across all levels of policies, frameworks, and action plans; and promoting public–private partnerships. These are clear opportunities for using the bioeconomy to accelerate the implementation of this strategy.



### ***Science, Research, and Innovation***

The AU strategy emphasizes science, research, and innovation as the main pathway toward transformative climate-resilient development—that is, transforming food systems; protecting land-based ecosystems; transforming energy systems; enhancing inclusive, low-emission industrialization; transforming the blue economy; and achieving digital transformation. It refers to the extensive use of smart, innovative, and climate-resilient technologies, renewable energy production, breed/variety development/switching, and technologies that preserve and enhance nutritional qualities in food. This requires thorough assessment and sustainable usage of biomass and bioresources to improve the productivity and quality of food products. The strategy also recognizes the importance of supporting research, extension, and implementation of public sector and market-based instruments toward agroecological, regenerative, nature-based, and Indigenous approaches for integrated farming and pastoral systems or resilient landscapes (practices to increase agrobiodiversity, conserve land and water, cycle nutrients, reduce waste, and enhance productivity). These are of particular interest in bioeconomy processes, for they infuse science, research, and innovation along food value chains, maximizing production, processing, marketing, and consumption sustainably while minimizing losses. Developing the bioeconomy, particularly for promising food value chains, will contribute to accelerating food systems resilience in an environmentally friendly manner while creating opportunities for industrial development, market segmentation, and sustainable green jobs adapted to youth and women.

Innovations and localization are critical to providing shared opportunities for climate resilience and the bioeconomy, particularly for technological transformation in energy, food systems, pharmaceuticals, information, and communication.

### ***Conservation of Bioresources (Preservation and Sustainable Use)***

The AU strategy further highlights the importance of an appropriate valuation framework for ecosystem services, the transition to more nature-positive production systems, and the development of “sustainable ecosystem-based approaches.” The strategy aligns with the bioeconomy, which relies on healthy biodiverse and resilient ecosystems, the provision of ecosystem services, and the sustainable management of biological resources (plants, animals, microorganisms, and derived biomass, including organic waste) and the circular transformation of

these into food, feed, energy, and biomaterials within the ecological boundaries of the ecosystems that it relies on (Palahí et al. 2020).

Nature offers more than 30 percent of the mitigation actions needed by 2030 to limit the worst effects of climate change through natural climate solutions. The bioeconomy aims to put the sustainable use of nature and natural resources at the heart of climate-smart solutions to reduce GHGs, avoiding further loss of nature and restoring important ecosystems.

### ***Market and Trade of Bioproducts***

Through the strategy for climate change and resilience, the African Union supports the development of market-based mechanisms to reward social and environmental outcomes (ecosystem outcome verification, bundling of ecosystem services with carbon markets for the agriculture sector, etc.), which is facilitated by the bioeconomy.

### ***Priority Value Chains for Bioeconomy Development***

The recent report on Africa’s development dynamics (AUC/OECD 2022) in food systems transformation identified two major value chains at the continental level that have strong linkages with the bioeconomy. The first is the agro-industry, specifically for fruits and nuts, whose linkage to the bioeconomy relates to its large workforce competitive advantage in key cash crops (that is, cashews, coffee, cocoa), their predominance in the market and trade landscape in favorable regions, and the increased food demand driven by population growth and urbanization. This aligns well with the Fourth CAADP Biennial Review Report (AUC 2024a), which showed that levels of agro-processing are rising and need strengthening to boost entire value chains in the agricultural sector.

The second major value chain is pharmaceuticals, due to its strong political momentum and national initiatives to boost manufacturing development, such as in Ethiopia and Zimbabwe, as well as the international cooperation mechanisms through the WHO resolution of 2021 sponsored by all 54 African countries (AUC/OECD 2022).

These two major value chains (pharmaceuticals and agroindustry) are linked and can reinforce one another. An example is the development of the cocoa value chain in Ghana, which has involved the health system in using extracts as alternative treatments for health issues.

There are, however, specificities within each Regional Economic Community (REC) (AUC/OECD 2022): wood in Central Africa; coffee and floriculture in East Africa; date palm and energy production in North Africa; and poultry, cashew nuts, textile, aquaculture, and edible salt in West Africa.

## At the Regional Level

### *The East Africa Community Vision 2050 and the East African Regional Bioeconomy Strategy 2021/22–2031/32*

The East Africa Community (EAC) is a pioneer in strategically embracing the bioeconomy agenda in Africa through its dedicated regional bioeconomy strategy (EAC 2022). This strategy is anchored in the East Africa Community Vision 2050 (EAC 2016) and other regional science, research, and innovation frameworks. The region's Vision 2050 has strong pillars of development that include ensuring food security, manufacturing and industrialization, natural resource management, and promotion of green growth.

The regional bioeconomy strategy is rooted in a critical analysis of its potential for the transformation of bio-based sectors for sustainable economic growth and development as provided in the broader framework of the Vision 2050 and AU Agenda 2063. It posits that scientific research, knowledge, and innovation can be applied through the bioeconomy model to the production of food, feed, fiber, fuel, and a wide range of agro-industrial and value-added products. This leads to yet more added value of local bioresources by maximizing all parts of primary produce and their products sustainably.

The region's priority is economic growth based on both traditional and emerging industries using bioresources to create and develop new markets that can enable an increase in the entire economy's competitiveness. The strategy provides the guidance needed for the optimal production and value addition of bioresources to improve economic growth, create jobs, add more value to primary production, generate wealth, and connect smallholder farmers to new bio-based value chains, sustainable industrialization, and regional competitiveness.

The EAC strategy focuses on creating new or improved bio-based products that add value at the local level and use resources in novel, innovative, and sustainable ways. Specifically, it covers optimization and innovative use of biomass and biological resources from agriculture, aquaculture, bioprospecting,

and forestry. The scope of the strategy covers alternative sources of food and feed, health and bioenergy services, and ecosystem services.

The objective of the first thematic area is to introduce new bio-based technologies and solutions to strengthen food and feed production, ensuring food security. The second is to develop a bio-based healthcare sector, contributing to a healthy population with improved well-being, addressing regional priorities, and building on Indigenous knowledge and practices. The third is to develop industries that stimulate sustainable economic growth and add value to underutilized renewable resources in the region to increase the production and use of sustainable bioenergy. The fourth is to develop a range of bioenergy products for both household and industrial purposes. The strategy provides opportunities for each member state to advance their bioeconomy in an area where they see a comparative advantage. Such territorial specialization would be facilitated by the African Continental Free Trade Area agreement that was signed by several member states in March 2018 in Kigali, Rwanda (World Bank 2020a).

To realize the promises of a modern bioeconomy, countries in the region need to develop national bioeconomy strategies with relevant detailed action plans. It appears necessary to set up a bioeconomy knowledge-sharing portal that provides a regional open-access repository for bioeconomy data and information (EAC 2022). Regional conferences and status reports will help increase stakeholder awareness and provide the latest scientific evidence on the status of the bioeconomy in the region.

### *Economic Community of West African States Regional Climate Strategy and Action Plan (2022–2030)*

#### *Toward Inclusive and Sustainable Development*

Unlike the EAC, the Economic Community of West African States (ECOWAS) does not have a dedicated bioeconomy strategy. However, the framework in *Vision 2050—ECOWAS of the Peoples: Peace and Prosperity for All* (ECOWAS 2022b) features many driving forces relevant to mainstreaming the bioeconomy to accelerate the region's sustainable development. The vision focuses on inclusive and sustainable development, which can be fostered through harnessing appropriate innovations across different segments of the development process.

Specifically, Pillar 4 targets transformation and inclusive and sustainable development (ECOWAS 2022b). The goal is to make ECOWAS a regional economic power in Africa and the world that optimally utilizes its human and

natural resources to improve the well-being of its citizens, as stipulated in the ECOWAS human capital development strategy. This pillar is therefore based on improving the population's living conditions by optimizing the benefits from economic growth resulting from changes to a population's age structure, quality of education and knowledge-building systems, creation of decent jobs for young people and women, and strengthening of resilience in public health. This pillar is also based on the structural transformation of economies driven by the digitalization of the economy, entrepreneurship, science and technology, and structuring investments in growth sectors. It aims to promote efficient management of natural resources and strengthen the region's resilience to climate change and exogenous shocks.

The *ECOWAS Regional Climate Strategy and Action Plan 2022–2030* (ECOWAS 2022a) covers a set of actions on strengthening environmental sustainability and climate change and on promoting sustainable economic growth and development, with a strong emphasis on economic transformation and industrialization, community enterprise development, promotion of innovations, quality products, value chain development, private sector development, public–private partnerships, and an improved business-enabling environment. All of these are key triggers of rapid bioeconomy growth in the region.

While the bioeconomy is not mentioned explicitly in the document, the blue and green economies are mentioned as “sectors of the future” in the strategic objective (ECOWAS 2022a), which aims to build the capacities of ECOWAS and its member states to implement policies and actions that combat climate change. In particular, these actions are to be achieved through education, gender mainstreaming, entrepreneurship, innovation, and support for research and technological development, all of which make use of economic opportunities and develop the blue and green economies.

The strategy recognizes that the region's economy is driven by resource-intensive models that contribute to the degradation of biodiversity and the environment, and are associated with low performance. This narrative must be shifted to more low-carbon models by mobilizing financial and technical solutions embodied in the ECOWAS member states' nationally determined contributions, which they committed to in order to meet the objectives of the Paris Climate Agreement, and thereby pave ways for more nature-based solutions, including bioeconomy models. The ECOWAS strategy specifically

includes science, technology, innovation, and education—vital components of bioeconomy models.

### ***Science and Technological Innovation***

ECOWAS has always considered science and technological innovation to be indispensable in initiating the socioeconomic and cultural development and competitiveness of its member states. It expressed its commitment to this innovation through Article 27 of the Constitutive Treaty on Scientific and Technological Cooperation (ECOWAS 2022a). Furthermore, ECOWAS adopted a regional policy on science, technology, and innovation (ECOPOST; ECOWAS 2011), alongside an action plan for its implementation. In addition, the REC developed a directive on science, technology, and innovation and a regulation on the criteria for the selection of ECOWAS Centres of Excellence, adopted at the 41st Ordinary Summit of Heads of State and Government on June 29, 2012 (ECOWAS 2012). ECOPOST's ambition is to transform ECOWAS member states into emerging economies through the development and use of science, technology, and innovation in the socioeconomic and environmental sectors to achieve sustainable economic and social development, meet the present and future needs of their populations, and ensure a better quality of life.

Science, technology, and innovation (STI) are indispensable to the achievement of the SDGs. If a determined effort is made to build capacity in developing countries, STI can play a leading role in improving productivity and economic growth, promoting social inclusion, and fostering environmental sustainability.

The strategies developed for implementing ECOPOST to address environmental, climate change, and biodiversity challenges have focused significantly on building scientific capacity for the protection, conservation, and sustainable use of biological resources. They also emphasize providing scientific information to decision-makers for the preservation of biodiversity; strengthening the scientific capacity of decision-makers, scientific actors, organizations, and other stakeholders to contribute to climate change adaptation; supporting the adaptation of rural and urban populations—especially the most vulnerable—through participatory action research; and promoting the sharing of scientific and local knowledge on climate variability and change.



## *Southern African Development Community*

Like ECOWAS, the Southern African Development Community (SADC) does not have a dedicated bioeconomy strategy, although two of its member states do (South Africa and Namibia). Notwithstanding this, the *SADC Vision 2050*, published in 2020, aims to transform the region into a competitive, middle- to high-income industrialized society (SADC 2020a). Among the nature-based economic models, the Vision explicitly features the green economy, calling it a fourth industrial revolution (or “Industry 4.0”) with new opportunities and challenges for industrialization. It is believed that, if Industry 4.0 is democratized and the green economy takes hold, new industrialization pathways will open up or be triggered, including green economy clusters, bioeconomy clusters, and novel Industry 4.0 platforms (SADC, 2020). The Vision creates an enabling policy environment for bioeconomy development as one of the pathways to amplifying desirable futures. It calls for the development of additional policies at the regional and national levels to improve readiness for Industry 4.0, support sectors (especially mining) in shifting toward a circular economy, and support the development of strong service sectors (such as industries that use clean energy).

The green economy aims to catalyze the socioeconomic transformation of SADC toward a resource-efficient, environmentally sustainable, climate change-resilient, low-carbon development path and equitable society (SADC 2015). It will achieve this through the transition toward sustainable production, distribution, and consumption of goods and services. This results in improved human well-being and economic growth over the long term while mitigating the exposure of future generations to significant environmental risks and ecological scarcities, which is in line with international trends and sustainable development commitments. This way, the green economy is seen as an action-oriented approach to reach sustainable development that addresses the main challenges observed in recent years (such as unemployment and inequality, economic vulnerability to energy prices, desertification, deforestation, soil erosion, and loss of biodiversity) and turns them into opportunities (SADC 2015).

The objective of Vision 2050 is to facilitate the balanced and accelerated attainment of the agreed-upon goals, anchoring on the three pillars of sustainable development: environmental sustainability, economic well-being, and social equity (that is, promoting the alignment of operational planning across the SADC Secretariat and member states). It is expected to build on and catalyze

these processes in the implementation of all SADC protocols, policies, and strategies, in particular the revised Regional Indicative Development Strategy, the recently approved Industrialization Strategy and Road Map, the Regional Infrastructure Development Master Plan, and the Regional Agriculture Policy.

As a result, the Regional Indicative Strategic Development Plan (RISDP) 2020–2030 (SADC 2020b) aims to find and use synergies across sectors, identify and avoid potential emerging bottlenecks and side effects, and fully harness green economy opportunities. The strategy provides information on the methodologies to be adopted to support customizing the approach at the country level, and identifies indicators to support each step of the policymaking process from a sectoral and integrated perspective at both the national and international levels.

The high-level strategic directives (or policy principles) of Vision 20250 identified indicate opportunities for SADC to foster the development of strategies, plans, and processes and to integrate mainstream green economy approaches into core development policies, strategies, and plans.

Green economy strategies and actions are proposed to achieve sustainable development. The strategies are underpinned by cross-sectoral linkages that may reach beyond national geographical boundaries and are based on the core goals of (1) improving energy and resource efficiency, (2) promoting low-carbon development, (3) supporting natural capital and ecosystem services, and (4) striving to improve equity and well-being.

## *Economic Community of Central African States Vision and Strategic Plan (2021–2025)*

The Economic Community of Central African States (ECCAS) also does not have a dedicated bioeconomy strategy. ECCAS defined a clear vision to promote a common future in an environment of peace, security, and stability, ensured by sustainable development, good governance, the improvement of its citizens’ living conditions, freedom, and justice. The priority areas of the Strategic Plan 2021–2025 (CEEAC 2021) include environmental integration and agriculture and rural development, which aim to preserve living conditions for future generations and ensure sustainable development by significantly and sustainably increasing the region’s production, productivity, and competitiveness for food security and access to regional and international markets. Considering the importance of the Congo Basin Forest and the region’s associated biodiversity and natural resource

endowment, integrated nature-based solutions are pivotal. Specifically, the region is promoting environmental economics through accelerating the structuring and operationalization of the green economy and corporate social responsibility system, the green economy fund, traditional know-how using natural resources, and the craft economy and small enterprises using biological and nonbiological natural resources.

The Congo Basin, estimated at 227 million hectares, is home to the world's second-largest tropical rainforest, which acts as the “lungs” of Africa. The Congo Basin Forest Commission is committed to further promoting the green economy by adopting public strategies that foster sustainable natural resource management, following guidelines that integrate private sector companies and civil society organizations, promote sustainable agriculture and sustainable value-added chains, pursue the objective of net-zero deforestation in all sectors of production (wood, mining, agro-food, infrastructure), institutionalize independent certification for natural resource exploitation, ensure strict compliance with mandatory environmental and social impact studies in all investment projects, and strengthen the organization of local populations in forest areas (CEEAC 2021). These guidelines are aligned with and provide opportunities for the bioeconomy to improve the integration of science, technology, and innovation in the process of green growth through investment in sustainable infrastructure, better management of natural resources, resilience to natural disasters, and enhancement of food security.

## *Constraints to Implementing Climate Actions and Expanding Bioeconomy Uptake*

Climate action in Africa advanced significantly with the convening of the inaugural Africa Climate Summit in 2023 in Kenya. This provided a convergence of ideas on climate action for African economies, and the resulting declaration acknowledged the impact of climate change on African economies, while also highlighting opportunities for increasing political collaboration and investments to unlock the potential of entrepreneurial opportunities across the continent in the utilization of renewable biological resources from the land and sea in the production of food, energy, and other goods and services (AUC 2023). Without making explicit reference to the bioeconomy, the African Leaders Nairobi Declaration on Climate Change and Call to Action highlights, in multiple

sections, concern for the impact of climate shocks and stresses on multiple sub-sectors related to the use of renewable biological resources of the bioeconomy.

Examples of subsectors related to the bioeconomy mentioned in the Nairobi declaration include the following:

- Scaling up access to finance and technology adoption for the use of renewable energy across the continent
- Supporting agriculture and forestry, both as sources of economic livelihood and as carbon sinks to lock in GHG emissions contributing to climate change
- Promoting the regenerative blue economy and supporting implementation of the Moroni Declaration for Ocean and Climate Action in Africa and the Great Blue Wall Initiative, while recognizing the circumstances of Africa's Island States
- Increasing continental collaboration through trade, technology transfer, and other means to maximize the benefits of the bioeconomy

The impacts of climate change on the bioeconomy of African countries threaten to move more people toward multidimensional poverty (World Bank 2023) due to a lack of opportunities and resources for growing prosperity. However, the Nairobi declaration shares opportunities ripe for market-creating innovations: for example, by highlighting that “600 million people in Africa still lack access to electricity while about 970 million lack access to clean cooking, and 400 million people in Africa have no access to clean drinking water and 700 million [are] without good sanitation” (Christensen et al. 2019), the declaration demonstrates the potential for entrepreneurship to create value propositions for these needs to be met through affordable and accessible means.

The Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods mentions both the value of the bioeconomy to wider economic prosperity and its vulnerability to environmental shocks and stresses, including climate change (AUC 2014.) While certain aspirational targets were set to be achieved by 2025, the subsequent biennial review (AU 2018, 2020, 2022, 2023) of self-reported progress toward achieving these targets showed that most countries are still not on course to achieve them. Member states agreed to track the seven commitments against 46 indicators: in the 2017 review, 20 of the 47 reporting countries were on track to achieve all commitments, but this declined to 4 out of 49 countries in the 2019 review, and

fell further to just 1 country in the 2021 review (AUC 2022). By the 2023 review, no country was deemed to be on track to achieve all the commitments and targets of the Malabo Declaration by 2025 (AUC 2018, 2020, 2022, 2024). The inability of governments to achieve these targets has a meaningful impact on the growth of the bioeconomy and its contribution to wider economic prosperity.

Analysis shows that 14 African countries are among the 20 most vulnerable to climate shocks and stresses globally (Chen et al. 2023). In this context, vulnerability measures a country's exposure, sensitivity, and ability to adapt to the negative impact of climate change. The literature has highlighted issues such as limited financial resources, weak institutional capacity, vulnerability to climate impacts, lack of technological infrastructure, and dependency on fossil fuels as barriers to making progress on climate action. For the bioeconomy, growth is stifled by issues such as limited research and development capacity, fragmented value chains, land use conflicts, technical capacity deficiencies, and limited public policy support (Aidoo et al. 2023).

In its report, the Malabo Montpellier Panel (2022b) noted that the enablers of a thriving bioeconomy in Africa include governance; demand for bioproducts; intellectual property; science, research, and innovation; infrastructure; finance; and partnerships and collaborations. It also explored the contextual use of public policy, highlighting four country cases (Ghana, Namibia, South Africa, and Uganda) where opportunities in the bioeconomy are being explored. In addition to these four countries, other African economies, including Kenya's and Nigeria's, are making progress toward anchoring the bioeconomy in their development plans.

Kenya's bioeconomy leads in export revenues, with tea, cut flowers, and coffee having the three highest revenues (Growth Lab 2024). Kenya also aims to achieve 100 percent renewable power by 2030 and to fuel the green industries of the future by 2040 (IRENA 2023). Although it does not have a national bioeconomy strategy, Kenya benefits from the EAC's bioeconomy strategy (EAC 2022), which aims to develop a low-carbon future for the region, link farmers to new value chains, and create incentives for the informal sector and productive partnerships (Ecuru 2020). Gatune and colleagues (2021) mapped out various scenarios for the growth of the bioeconomy in the East Africa region and suggested that to maximize the potential of the bioeconomy for shared prosperity, attention should be paid to “developing regional and national platforms to bring stakeholders together to ensure policy coherence, creating innovation platforms to drive R&D, developing outreach programs to communicate bioeconomy

prospects, and stimulating demand for bioproducts through mandates (e.g., ban on single-use plastics), incentives (e.g., government procurement quotas)” (11) and removing disincentives (such as taxes, regulatory red tape, etc.) that influence bioeconomy interventions.

Nigeria's investments in the bioeconomy have not been explicit in national policy. However, evidence indicates that a focus on biotechnology and bioenergy is an emerging area of priority, in addition to existing subsectors of the bioeconomy. Nigeria's Biosafety Bill was signed into law in 2015—establishing the National Biosafety Management Agency (NBMA)—and amended in 2019 (Nigeria, National Assembly of the Federal Republic of Nigeria 2019). It provides the NBMA with the authority to establish “a regulatory framework, an institutional and administrative mechanism for safety measures in the application of modern biotechnology in Nigeria with the view to preventing any adverse effect on human health, animals, plants, and environment” (Nigeria, National Assembly of the Federal Republic of Nigeria 2019, i). Since its passing, Nigeria has joined leaders on the continent in commercializing biotechnology agriculture products, using the *bacillus thuringiensis* (Bt) bacteria, which produces proteins that are toxic to certain insects. The commercial release of Bt cotton, Bt cowpea, and Bt maize aims to increase food security, guarantee livelihoods for farmers, and improve resilience to shocks and stresses (especially in the case of the Bt TELA maize that is drought tolerant and also resistant to the fall armyworm). Kansime, Rwomushana, and Mugambi (2023) estimate that economic losses due to the fall armyworm are valued at US\$9.4 billion. Although the country has a national biofuels strategy—requiring 10 percent of fuels to be blended with ethanol, which can be sourced from crops—there currently do not appear to be compelling political or commercial incentives to implement it (Nwozor et al. 2021).

An appraisal by the Malabo Montpellier Panel in 2022a and Chapter 9 of this report of progress made in various countries toward expanding the benefits of the bioeconomy in the face of climate constraints reveals that various countries are at different stages of developing dedicated approaches for the bioeconomy.

## *Implications for Africa's Growth*

As Africa embraces the bioeconomy, it is important to analyze the implications for the continent's future growth and development. Here we cluster these implications in three areas:

## Policy

Concerning policy, governments should start to create incentives and remove disincentives for bioeconomy advancements. These incentives could be economic, such as providing tax relief for bio-based products, or environmental, such as enforcing bans on unsustainable practices, as is being done by the bans on single-use plastics in Kenya, Rwanda, Tanzania, and Uganda. Such bans can provide incentives for industry and academia to develop biodegradable alternatives. Additionally, regulatory standards and their enforcement is critical to ensure investors' confidence. Standards for most bio-based products are lacking in many countries. For example, until recently, there were no standards on the use of insect proteins as ingredients in animal feed. Uganda and Kenya championed the development of these standards, which is leading to the growth of the BSF enterprise in the region. The current efforts by stakeholders in the insect protein value chain to have continent-wide standardization are commendable, and the same standards should apply to other emerging bio-based products. Most of all, policy incentives and associated standardization will ensure that bioeconomy industries, products, and services can compete favorably in domestic, regional, continental, and international markets. Therefore, a clear theory of change, impact pathways, and indicators must be developed as part of the policy design process.

## Financing

With respect to financing, governments need to design financing mechanisms that support the growth of bioeconomy enterprises. These financing mechanisms may be extended from traditional ones such as climate funds, biodiversity funds, or industrial development funds. It may be worthwhile to establish quotas within such funds to support dedicated bioeconomy projects. This is necessary given that bio-based innovations are inherently risky and take much longer to mature and reach the market. Even when they are in the market, their profitability may be low at first. Larger-scale investors or companies should see opportunities to grow their businesses using bio-based innovations. Such investors can be attracted when the right policies are in place, such as enabling regulatory standards for bio-based goods and services. Public financing should also be considered to support research and innovation in universities and research institutes to provide the pipeline for knowledge and skills for the bioeconomy. Therefore, deliberate measures should be taken to support financial mechanisms at national

and regional levels to promote bio-based products and services. Academics and policymakers are encouraged to monitor the development of their bioeconomies, including budgeting for and monitoring financial flows into bioeconomy projects.

## Skills

Bioeconomy enterprises are inherently knowledge intensive. Therefore, university scientists ought to be champions in linking their knowledge with industry. Good capacity-strengthening programs will be needed to build the right type of skill sets for the future economy, which will be the bioeconomy. The Second Ten Year Implementation Plan for the AU Agenda 2063 provides meaningful milestones for increasing skills in higher education (postgraduate training) as well as technical and vocational education and training (AUC 2024b). These plans should give specific consideration to skills necessary for the future of work and industries that result from advancing the bioeconomy in the continent.

## Conclusion

The bioeconomy is now widely regarded as a pathway for future growth and development, considering the need to lower or reverse global warming, preserve biodiversity, and, at the same time, ensure that people have decent jobs and livelihoods. Africa, which has significantly lower carbon emissions than other regions, has a competitive advantage in developing a sustainable bioeconomy. The EAC has set a good example by developing a dedicated, regional bioeconomy strategy; other regional economic blocks should do the same. Ultimately, when the bioeconomy strategies of the regions are put together, they would reflect a true African bioeconomy. The continent should harness opportunities for collaboration and partnerships globally in the advancement of its bioeconomy, while considering its unique needs, values, and competitive advantages.

In advancing its bioeconomy, Africa should always uphold the cross-sectoral nature of the bioeconomy, noting that digitalization will be a key enabler as much as the environment and industry. Ultimately, Africa's bioeconomy will be anchored in its agriculture and food systems, given that this sector contributes more than 30 percent of the continent's GDP. Therefore, every effort should be made to link food systems to every sector of the economy, and this chapter provides evidence that the bioeconomy is best suited to achieve that end.