



UNLOCKING AFRICA'S BIOECONOMY

Investing in Southern Africa's bioeconomy

A regional pathway for value creation,
resilience and green industrialisation

September 2026



This publication forms part of NatureFinance's *Unlocking Africa's bioeconomy* series, which explores how African countries and regions can move from biological resource potential to value-creating systems that strengthen resilience, support nature-positive growth and attract investment.

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A strategic brief for policymakers, finance and economic leaders, and value chain actors

About the authors

Monique Atouguia

Senior Consultant, Global Africa, NatureFinance

Indekhwa Anangwe

Manager, Impact & Trade, NatureFinance

Acknowledgements

This input paper was prepared by NatureFinance as a contribution to the G20 Initiative on Bioeconomy (GIB) under the 2025 South African G20 Presidency, with support from the African Climate Foundation, with research support from The Nature Conservancy, African Leadership University and auctusESG as part of NatureFinance's contributions. The development of this report benefited from discussions held during the GIB convenings in 2025 as well as with key SADC member government officials and stakeholders throughout the year. NatureFinance gratefully acknowledges the support and guidance of the South African G20 Presidency, the GIB Secretariat and the South African Department of Science, Technology and Innovation throughout the development process.

This paper was authored by the NatureFinance team, led by Monique Atouguia, but was inspired by and drew on the extensive and excellent work of many. With thanks to the NatureFinance team, namely Philippa Lockwood, Lucy Martin, Julie McCarthy, Fiona Napier and Ravanya Naidoo. Special thanks to the Department of Science, Innovation and Technology team, especially Ben Durham and Siyavuya Bulani for their fearless and forward looking leadership; to the CSIR team, in particular Rachel Chikwamba, Ereck Chakauya, Lara Kotzé-Jacobs and Ghaneshree Moonsamy, and likewise with thanks to Julius Ecuru, from icipe, BioInnovate Africa, both of whose organisations' innovative work continues to inspire and excite so many. To the African Climate Foundation team, who co-funded and supported this work, particularly Malik Dasoo, thank you for being co-visionary partners; and to the research consortium for their comprehensive and foundational work which informed this paper: Muhtari Aminu-Kano, Chetan Hebbale, Leigh-Ann Kant, Courtney Lowrance, Irene Mhlanga, Lekhani Raja, Sarah Roberts, Philip Samura, Sue Snyman and Cymroan Vikas.



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This paper was developed by NatureFinance, with support from the African Climate Foundation, with research support from The Nature Conservancy, African Leadership University and auctusESG as part of NatureFinance's contributions and support of the South African Presidency's G20 Initiative on the Bioeconomy. The views, opinions and recommendations expressed herein are those of NatureFinance and do not necessarily reflect the official positions or policies of the G20 Initiative on Bioeconomy (GIB), its member countries or any affiliated organisations and institutions. Any errors or omissions remain the sole responsibility of the authors.

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NatureFinance's mission is to align global finance with an economy that works for nature, climate and people.

Our work focuses on developing and implementing innovative tools, financial instruments and policy forms that help countries address the vicious cycle of debt, climate and nature crisis and make financial systems and economies more resilient and adaptive in a rapidly warming world.

We operate as a think tank and solutions lab, working in close partnership with a wide range of stakeholders including governments, financial institutions, development banks and civil society organisations.



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Abbreviations

ABS	Access and Benefit-Sharing
AfCFTA	African Continental Free Trade Area
AfDB	African Development Bank
AGF	African Guarantee Fund
AMITD	African Medicines Innovations and Technology Development Platform
ARAF	Acumen Resilient Agriculture Fund
ARV	Antiretrovirals
ASBP	African Seed and Biotechnology Programme
BABS	Bioprospecting, Access and Benefit-Sharing
BIDC	Biomanufacturing Industry Development Centre
BRI	Bioeconomy Readiness Index
BSF	Black Soldier Fly
C4IR	Centre for Fourth Industrial Revolution
CAADP	Comprehensive Africa Agriculture Development Programme
CBAM	Carbon Border Tax Adjustment Mechanism
CCPIS	National Climate Change Policy Implementation Strategy (Lesotho)
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of Southern Africa
DFI	Development finance institution
ENAIP	Eswatini National Agricultural Investment Plan
EPR	Extended Producer Responsibility
FAO	Food and Agriculture Organization
FPIC	Free, Prior and Informed Consent
GDP	Gross domestic product
GEF	Global Environment Facility
GIB	G20 Initiative on Bioeconomy
GIS	Geographical Information Systems
GMO	Genetically Modified Organism
ICIPE	International Centre of Insect Physiology and Ecology
ICT	Information and communications technology
IDC	Industrial Development Corporation

IFAD	International Fund for Agriculture Development
JETP	Just Energy Transition Partnership
MDB	Multilateral development bank
MVP	Minimum viable product
NAMPAADD	National Master Plan for the Arable Agriculture and Dairy Development
NBES	National Biodiversity Economy Strategy (South Africa)
NBSAP	National Biodiversity Strategy and Action Plan
NDC	Nationally Determined Contribution
NEMBA	National Environmental Management: Biodiversity Act
NEP	National Energy Policy (Botswana)
NFAP	National Fisheries and Aquaculture Policy (Malawi)
OPEC	Organization of the Petroleum Exporting Countries
PNIA	National Agriculture Investment Plan (DR Congo)
PPP	Public-private partnership
PSAEP	Sectoral Programme for Agriculture, Livestock, and Fisheries (Madagascar)
R&D	Research and development
RAP	Regional Agricultural Policy
RSB	Roundtable on Sustainable Biomaterials
SACP	Smallholder Agriculture Cluster Project
SADC	Southern African Development Community
SAF	Sustainable aviation fuel
SANBio	Southern Africa Network for Biosciences
SDG	Sustainable Development Goal
SEZ	Special Economic Zone
Sida	Swedish International Development Cooperation Agency
SIPS	Support to Industrialisation and Productive Sectors
SISR	SADC Industrialisation Strategy and Roadmap
SMME	Small, micro and medium sized enterprises
TIA	Technology Innovation Agency
TIG	Technical Implementation Group
TFCA	Transfrontier Conservation Area
USDFC	U.S. Development Finance Corporation
WBESF	Wildlife-based Economy Strategy Framework

Foreword

The Southern African Development Community (SADC) region is endowed with extraordinary biological wealth. This natural capital is central to who we are as a region: it is part of our shared heritage, a global asset of immense importance, and one of our greatest – yet still underrealised – sources of sustainable economic value. These resources do not recognise national borders, and neither should our collective ambition to protect, develop and deploy them for the benefit of our people.

Biodiversity already sustains livelihoods and contributes significantly to the economies of

Member States. However, its full potential to drive inclusive growth, sustainable industrial development and long-term prosperity has yet to be realised. A coordinated regional bioeconomy strategy, which includes bioentrepreneurialism across themes such as agriculture, agroprocessing, industrial bioinnovations, indigenous knowledge valorisation, bio and wildlife trade and ecotourism, among others, offers a compelling pathway to bridge this gap by deliberately aligning conservation objectives with industrialisation and socioeconomic transformation.

"At a time of growing climate volatility, global economic uncertainty and persistent youth unemployment, the bioeconomy presents a rare and time-sensitive opportunity to leapfrog towards more resilient and future-oriented development pathways."

For too long, much of the region's biomass has been exported in raw or low-value forms, with the greatest economic benefits realised outside the region. At a time of growing climate volatility, global economic uncertainty and persistent youth unemployment, the bioeconomy presents a rare and time-sensitive opportunity to leapfrog towards more resilient and future-oriented development pathways. It enables investment in emerging industries, the creation of resilient livelihoods rooted in environmental stewardship and the generation of sustainable, decent jobs for present and future generations. Yet while the bioeconomy can offer practical tools for adaptation and resilience, positioning nature both as a shock absorber and a transition driver, increasing climate change and biodiversity loss means that there is a limited window in which to harness the potential of the bioeconomy if the ecological infrastructure upon which it depends is not protected and invested in.

By recognising the bioeconomy as a green industrialisation opportunity and by working collectively to leverage SADC's strengths in knowledge, capabilities and biological resources, the region can transform nature-based assets into lasting economic value. This value, in turn, can underpin inclusive, green industrialisation that departs fundamentally from the extractive models of the past and instead builds innovative, biobased industries fit for the future.

The competitiveness of SADC's bioeconomy will not be determined by individual sectors or isolated value chains, but by how effectively Member States strategically position the bioeconomy and build interconnected regional value webs.

These value webs can maximise resource efficiency, enable industrial symbiosis, retain value within the region and strengthen regional integration. Through coordinated policies, harmonised standards and aligned investments, a regional bioeconomy strategy can unlock economies of scale, deepen regional value chains and position Southern Africa as a credible and competitive hub within the global green economy.

A regional strategy, therefore, represents not only an economic opportunity, but a collective commitment: to steward our natural capital responsibly, to industrialise sustainably and to ensure that the benefits of our region's biological wealth are shared broadly among all its people.



Ben Durham

Chief Director, Bio Innovation
Department of Science,
Technology and Innovation,
South Africa

Executive summary

For SADC, the bioeconomy offers a transformative economic growth and green industrial opportunity. It is a strategic response to intersecting risks including trade fragmentation, low value capture, balance of payment deficits, climate shocks, volatile commodity markets and youth unemployment. Investing in the bioeconomy is not simply about greening existing sectors, but about redefining the region's development model to be more resilient, inclusive and aligned with global transitions already under way.

By diversifying traditional sectors and value chains, biobased value chains strengthen domestic value addition and labour intensity and create incentives to invest in ecological infrastructure. Investing in the bioeconomy can increase macroeconomic resilience and futureproof the region's economy, while helping SADC become a market shaper for emerging green industries. These benefits are mutually reinforcing across economic, social and environmental outcomes (Figure 1).

This report examines SADC's current bioeconomy policy landscape, identifies the sectors with the greatest potential for economic growth, transition and job creation and provides a high-level financing landscape analysis. It highlights the factors that make SADC uniquely placed to harness this opportunity and argues that a more coordinated regional approach will benefit SADC Members and amplify national efforts.

"For SADC, investing in the bioeconomy is not simply about greening existing sectors, but about redefining the development model to be more resilient, inclusive and aligned with global transitions already under way."

FIGURE 1

The economic, social and environmental benefits of the bioeconomy



Trade & competitiveness

Reduced exposure to external trade shocks and improved access to low-carbon markets.



Climate resilience

Lower climate-related losses and greater resilience of key economic sectors.



Rural livelihoods

Stronger rural incomes and sustainable biomass supply chains.



Jobs & innovation

Expanded employment and innovation opportunities for youth and women.



Energy access

More reliable energy and lower production costs for bio-based industries.



Circular economy

Reduced waste management costs and new urban bioeconomy industries.

Source: Author's creation.

Priority sectors show clear opportunities for growth and transition

The report maps six high-potential bioeconomy sectors across SADC, showing how the region's biodiversity, biomass resources and underutilised labour can be translated into investable pathways for economic growth, job creation and resilience.

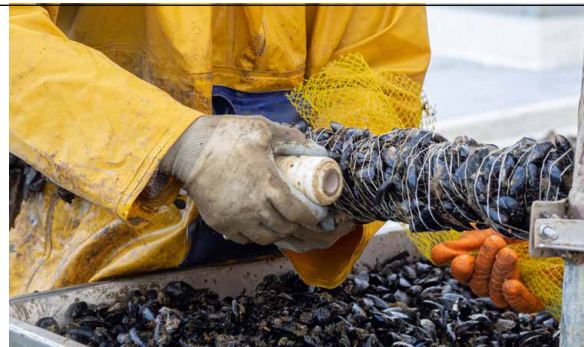


Agriculture, agroprocessing and food systems

Agriculture, agroprocessing and food systems remain the dominant bioeconomy opportunity across SADC, with significant potential to strengthen resilience, increase domestic value addition and reduce exposure to climate and price shocks.

Biotechnology and bioprocessing

Biotechnology and bioprocessing offer some of the highest-value opportunities for export earnings, import substitution and skilled employment, particularly in pharmaceuticals, industrial biotechnology, agricultural biotechnology and indigenous knowledge valorisation.



Bioenergy and biofuels

Bioenergy and biofuels can support energy security, reduce fossil fuel import dependence and improve trade competitiveness, but require stronger policy harmonisation, sustainability standards and regional coordination.

The blue economy

The blue economy offers pathways to diversify beyond terrestrial agriculture, create coastal, river and lakeside employment, strengthen food security and harness nature-based climate solutions through fisheries, aquaculture, marine biotechnology, seaweed, kelp and blue carbon ecosystems.



The circular and waste economy

The circular and waste economy remains a major untapped opportunity, with significant potential to transform organic waste, agricultural residues and industrial by-products into higher-value inputs across regional industries.

The wildlife-based and biodiversity economy

The wildlife-based and biodiversity economy can be strengthened by treating ecological infrastructure as a productive asset, with opportunities across tourism, wildlife ranching, bioprospecting, natural products, indigenous knowledge valorisation and conservation-linked finance.

Mainstreaming the bioeconomy requires whole-of-government coordination

Realising the bioeconomy as a transformation and resilience pathway for SADC requires mainstreaming the bioeconomy and ensuring coordinated use of industrial, trade, climate, labour and regional integration policy levers.

Fundamentally, this is an economic growth strategy that must be championed by all government sectors including finance, health, trade and industry ministries as well as national planning commissions, rather than solely by environment or science ministries. Many of these levers already exist; the bioeconomy provides a unifying framework to align and deploy them more strategically, with considerable economic benefits to be gained.

Regional coordination can turn fragmented efforts into investable opportunities

Better regional coordination can provide clearer signals for sectoral investment.

Regional agreements, strategies, frameworks and institutions can amplify national bioeconomy efforts, create coherence across country-level initiatives and help countries leverage collective competitive advantages.

The policy landscape shows that, currently, there is a lack of harmonisation across policies, a lack of cohesion across sectors nationally and regionally, and a lack of clear definitions, which causes implementation confusion. Moreover, overlapping mandates generate bureaucratic friction, and there is a lack of clear prioritisation both at national and regional levels.

The result is fragmented investment signals that continue to favour incumbent fossil fuel industries, uncertain regulatory environments that deter patient capital and missed opportunities for regional scale economies.

A more integrated and harmonised approach could align national and regional priorities, unlock larger markets and boost the economic and job creation potential of the bioeconomy. To realise these benefits at regional scale, four critical enablers are needed:

1. Identify regional competitive advantages and scalable sectoral opportunities, both for alignment and complementarity.
2. Ensure policy coherence to guide resource allocation, market development and industry investment.
3. Invest in critical skills, research capacity and enabling infrastructure.
4. Establish a baseline for monitoring, evaluating and tracking progress.

Five priority actions to accelerate the regional bioeconomy

Key recommendations to realise this regional opportunity.



Source: Kelpak

1

Explicitly name the bioeconomy as a key driver in the SADC Industrialisation Strategy and Roadmap (SISR) 2015–2063.

The bioeconomy speaks directly to each of the SISR's four pillars (productive capacity, competitiveness, regional integration and sustainable resource use) connecting natural capital to competitive, low-carbon industrial systems. It is a seamless fit for the SISR, but must be explicitly named within the strategy to become investment ready.

2

Develop a SADC bioeconomy framework or strategy.

A lack of harmonisation, unclear definitions and absent prioritisation across national and regional policies has produced fragmented investment signals and missed opportunities for scale. Developing a dedicated SADC bioeconomy framework or strategy would address these gaps directly, aligning national policies, investment priorities and standards to unlock larger markets.

3

Coordinate regional infrastructure and trade corridors to support cross-border bioeconomy value chains.

A trade corridors and clusters approach would strengthen cross-border bioeconomy value chains, with infrastructure strategically located according to each country's comparative advantage and cross-border access agreements ensuring that capabilities across the region are complementary rather than duplicative.

5

Use regional diplomacy to position SADC as a competitive global supplier of sustainable bio-based products.

SADC should actively leverage regional diplomacy and trade relationships to position itself as a competitive supplier of sustainable bio-based products on the continent and globally, securing market access and advocating for standards that reflect the region's strengths.

4

Pool regional expertise and finance to build shared R&D platforms, processing hubs and Special Economic Zones.

Shared investment in research platforms, biorefinery hubs, centres of excellence and data systems would accelerate knowledge diffusion and build the collective technical skills needed to compete in global markets. Bioeconomy-focused Special Economic Zones complement this by concentrating investment through targeted incentives to de-risk early-stage ventures and bio-innovation.

The bioeconomy must not be confined to a niche environmental agenda. To achieve its promise, it needs to form the basis of a whole-of-government and regional economic strategy. By deliberately aligning industrial, trade, climate, labour and regional integration policies, SADC can use the bioeconomy to leapfrog carbon-intensive development models, strengthen economic resilience and deliver inclusive growth for people and the planet.



Introduction

The bioeconomy is becoming a new engine of growth

The bioeconomy is a rapidly evolving economic paradigm that is increasingly recognised around the world as a key driver for sustainable development. It enables countries to reduce dependence on fossil resources, promote biodiversity conservation and present a model for a biobased economy across sectors.

In Africa, the bioeconomy could become a vital tool for growth, safeguarding the continent's natural assets while driving green industrialisation, opening high-value markets, building capacity and skills and creating resilient jobs. However, the continent currently derives less than 10% of the value of its biomass.¹

This report outlines how the bioeconomy can act as a central economic growth and industrial transformation strategy for SADC, making it more resilient to trade exposures, economic volatility, low value capture and climate and nature risk. Biobased value chains build this resilience by increasing domestic value addition, labour intensity and innovation while supporting adaptation and addressing emerging market demands.

To seize this transformational opportunity, bioeconomy priorities must be mainstreamed into industrial, trade, fiscal and finance policies.

SADC's bioeconomy is on a strong growth trajectory and several countries are developing dedicated strategies to harness the bioeconomy's potential. The current momentum offers a timely opportunity to develop a coordinated regional approach. A shared strategy can leverage competitive advantages, harmonise policies, pool resources, foster trade integration and position the region as a pioneering global player in nature-based industries.

Why the bioeconomy matters for SADC

For SADC, the bioeconomy offers exceptional promise. The region's extraordinary biodiversity, fertile land, rich agricultural landscapes, research and innovation capacity and abundant biomass provide a competitive edge in developing nature-based and high-tech value chains. Moreover, the region's promise of the demographic dividend, with a young, growing population, positions it to build a skilled workforce for emerging bioindustries.

According to the African Development Bank (AfDB), expanding the circular bioeconomy could increase Africa's gross domestic product (GDP) by 2.2% and generate 11 million jobs.² The bioeconomy also acts as a strong employment multiplier: evidence from the United States's biobased industry suggests that each direct job creates an additional 2.4 jobs across the value chain.³

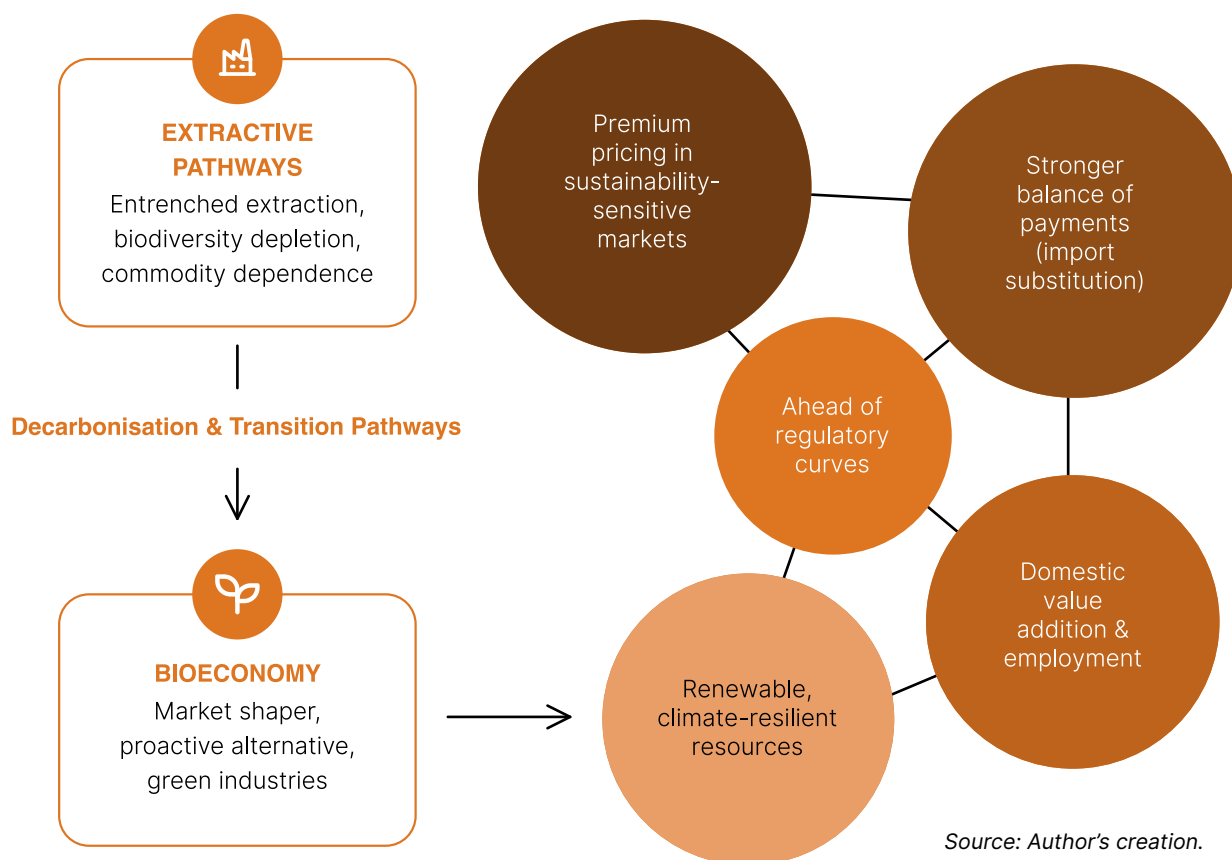
This employment potential is particularly significant given that small, micro, and medium sized enterprises (SMMEs) make up over 90% of businesses across most SADC countries⁴ and in Africa in general, generating a substantial portion of employment.⁵ The bioeconomy's reliance on locally available resources also makes it especially suited to SMME-led development, enabling businesses to innovate, trade and scale within their communities.

Beyond job creation, the bioeconomy can address critical development challenges including food

security, energy access and rural economic revitalisation. As these sectors scale with the support of development finance, nature-linked bonds, sustainability-linked loans and impact funds, they can lay the foundation for an inclusive green economy that fosters resilient, equitable growth across the region.

The alternative could be economically costly. AfDB and the African Climate Foundation have found that the continent could lose out on US\$25 billion per annum as a direct result of the European Union's Carbon Border Tax Adjustment Mechanism (CBAM), which places a tariff on carbon-intensive products; as former AfDB President Akinwumi Adesina said, Africa was "short-changed by climate change; now it will be short-changed in global trade".⁶

Rather than simply decarbonising existing extractive sectors to meet external standards, SADC can build a competitive advantage in emerging bioindustries from the outset. By increasing domestic value addition, strengthening regional value chains and creating new forms of value from renewable biological resources, it offers a pathway to leapfrog towards green industrialisation, diversify the economy and become a market shaper rather than a market taker (Figure 2). For nature-rich countries such as SADC Member States, this represents an opportunity to increase productivity, strengthen competitiveness and invest simultaneously in resilience, adaptation and ecological infrastructure.

FIGURE 2**The bioeconomy as a leapfrogging opportunity**

Defining the bioeconomy

The bioeconomy is used in different ways across countries, institutions and policy frameworks. Some definitions focus on biomass and biotechnology; others emphasise circularity, biodiversity, blue economy activities, nature-based solutions or industrial transformation. This variation matters because different definitions shape what governments prioritise, what investors fund and how sectors are measured.

For the purposes of this report, the bioeconomy is understood as the economic project of turning renewable biological resources into higher-value

products, industries and jobs, and replacing extractive, low-value exports with diversified, innovation-driven value chains. In short, the bioeconomy is an economy with a biobase, involving the use of biomass and biotechnology in the production of goods, services and energy.⁷

This framing is intentionally broad. It captures familiar sector-based categories, including the green, blue, red, white and circular economies, which many policymakers and practitioners already use (Figure 3). It also recognises that these concepts overlap with wider shifts towards nature-based, circular and biodiversity-positive economic models (Figure 4).

FIGURE 3
Sectors of the bioeconomy

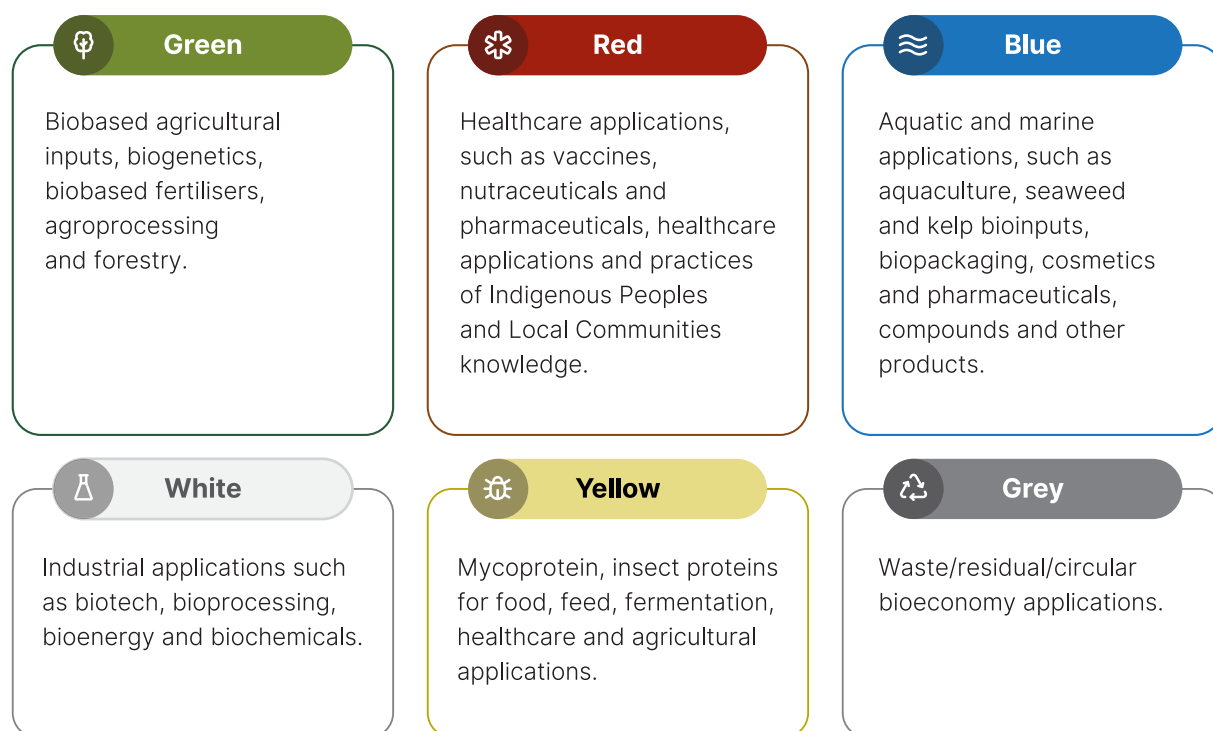
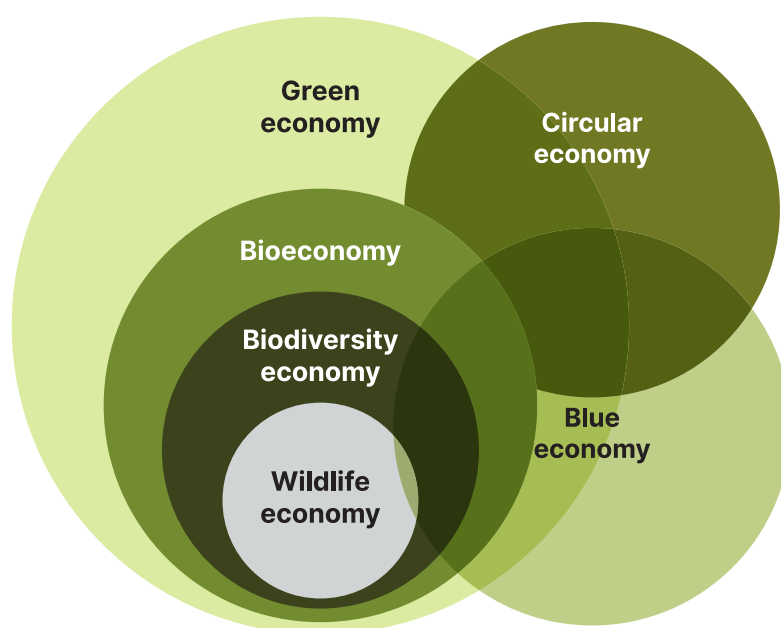


FIGURE 4
Intersecting concepts related to nature-based economies

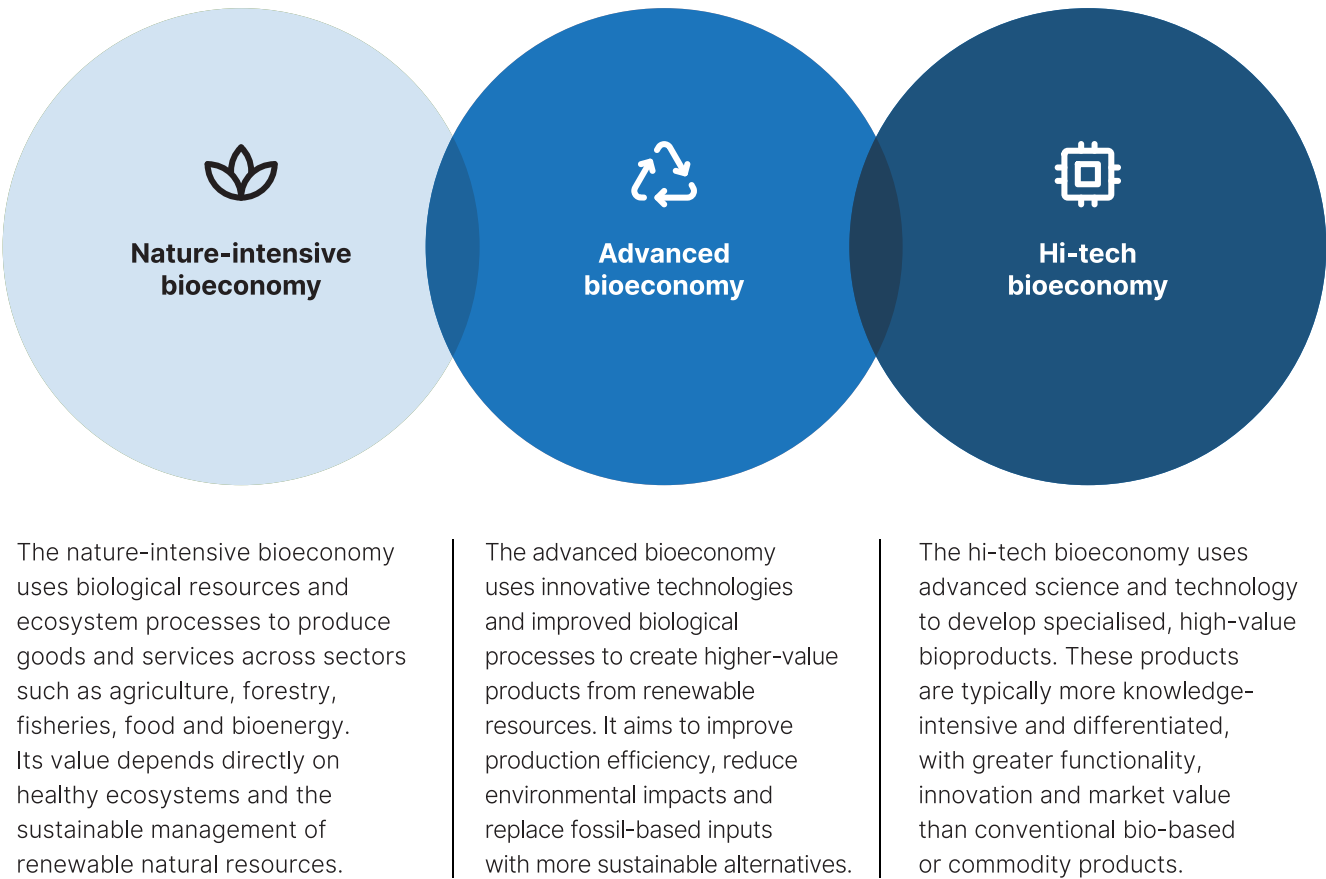


Source: D. Roe and S. Snyman, *Bioeconomy: A Transformative Step Towards Sustainability or Threat to Biodiversity and Social Justice?* (London: International Institute for Environment and Development, 2026).

The G20 Initiative on the Bioeconomy provides another useful way to distinguish the parameters of the bioeconomy. In 2024, under Brazil's G20 Presidency, members of the G20 Initiative on the Bioeconomy (GIB) agreed to 10 High-Level Principles on the Bioeconomy (Annex 1). These principles create a shared set of guardrails to underpin the development of the bioeconomy within the G20, aligned to international and national sustainable development commitments.

The G20 also acknowledged three broad bioeconomy types: nature-intensive, advanced and high-technology (Figure 5). These categories do not represent a hierarchy. Instead, they help show the range of bioeconomy activities, from sectors that depend directly on ecosystems and biomass to more technology-intensive applications such as biotechnology, bioprocessing and biomanufacturing. They also help clarify different capital needs, risk profiles and potential returns across the bioeconomy.

FIGURE 5
The G20's three bioeconomy types



Source: NatureFinance and Sustainable Finance Coalition, *Mapping Finance Solutions and Instruments Across the Three Bioeconomy Types* (NatureFinance, 2025).

The SADC context

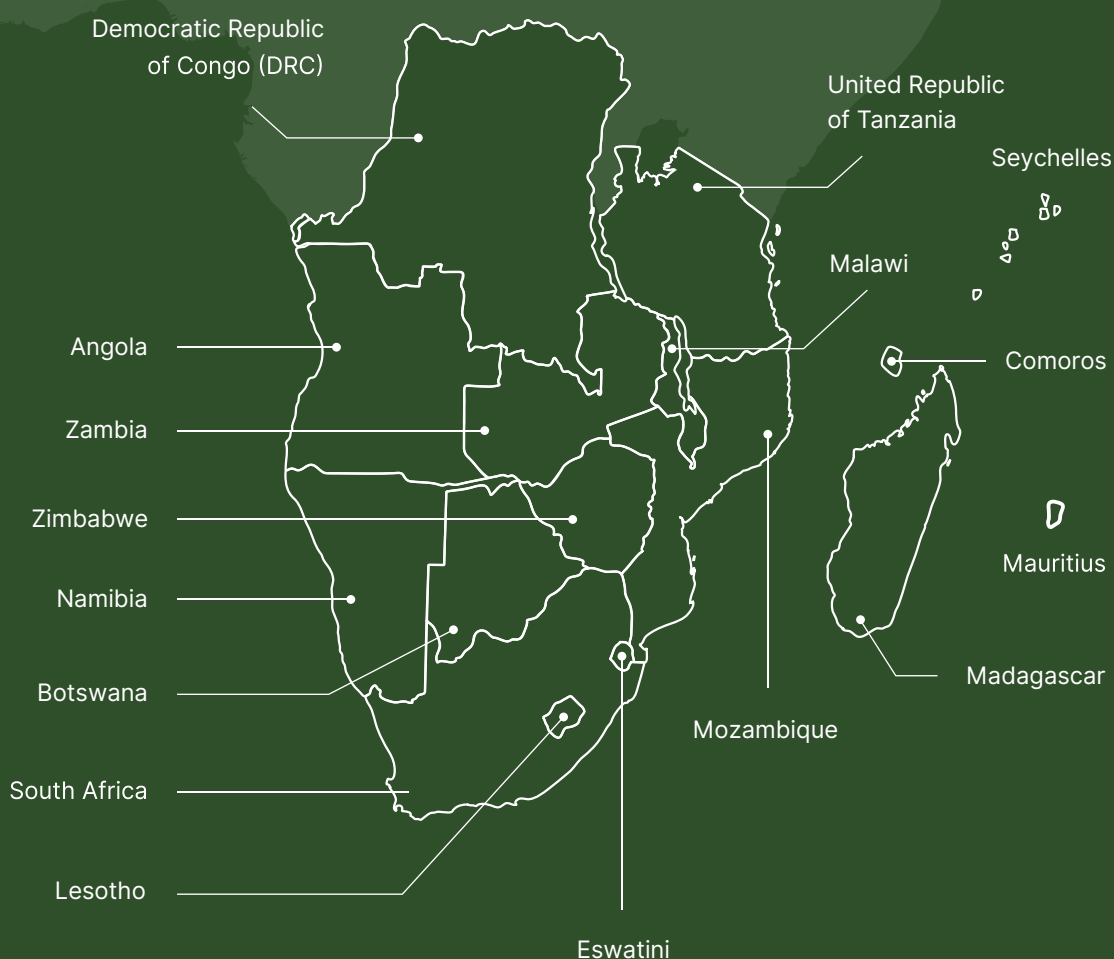
The bioeconomy opportunity



A region rich in natural capital and economic potential

SADC is an intergovernmental organisation established as a development community in 1992. Its goal is to promote sustainable and equitable economic growth and socioeconomic development through efficient productive systems, deeper cooperation and integration, good governance and durable peace and security among Member States. Comprising 16 Member States, with a landmass of almost 9.9 million square kilometres, SADC covers approximately one-third of the African continent (Figure 6).

FIGURE 6
Map of the SADC region



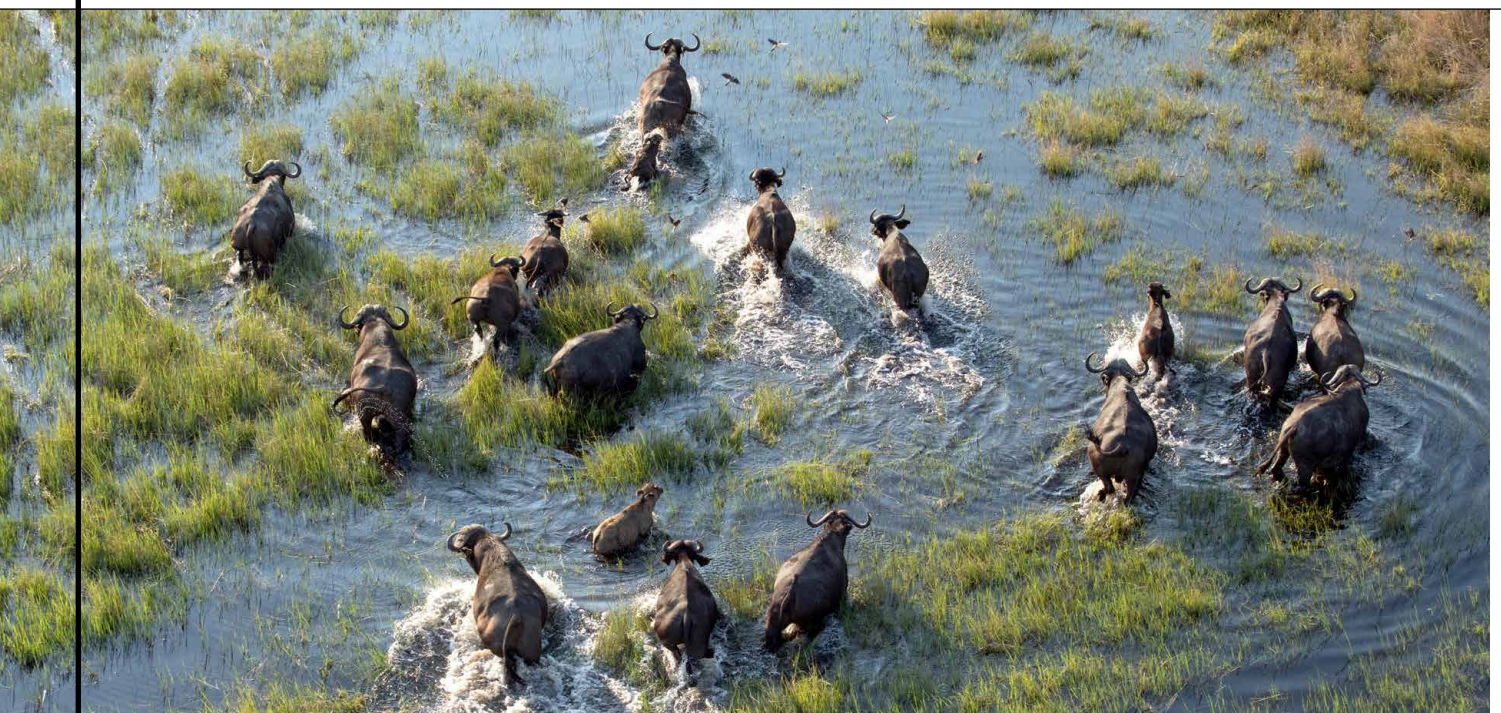
From resource extraction to value creation

The region has recently been in the spotlight due to increasing demands for a stable supply of critical energy transition minerals needed to help the world reach net-zero by 2050. These minerals are essential to the production of clean energy technologies, batteries and electric vehicles. SADC hosts an estimated 25% of the world's critical energy transition minerals. Member States including the Democratic Republic of Congo (DRC), Madagascar, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe are well-endowed with graphite, nickel, lithium, manganese, copper, cobalt and rare earth elements, all of which are currently in production.⁸

To prevent a return to simply extracting and exporting raw materials, the continent is currently advocating for beneficiation, local value addition, industrialisation, skills development and job creation. In other words, Africa needs to leverage its natural and mineral resources to drive industrialisation, move out of the market taker position and break historical extractive patterns. A number of SADC countries already have policies around critical minerals and how to best ensure their local beneficiation.⁹

Critical minerals represent only one dimension of SADC's strategic endowments. The region's biological wealth is vast, and yet historically undervalued. These resources offer a parallel pathway for SADC to shape global economic trajectories on its own terms.

The Okavango Delta is one of Botswana's most important tourism assets and a major example of the economic value of intact ecosystems. Its wildlife and landscapes are central to Botswana's high-value ecotourism industry, with tourism contributing almost 10% of national GDP when indirect contributions are included. Beyond tourism, the wetland supports fisheries, agriculture and natural products while providing ecosystem services including water regulation, carbon sequestration and wildlife habitat.



SADC notes that the region's natural heritage is of "global significance to the world's climate and biological diversity", home to "exceptional ecological processes", with over 40% of species endemic.¹⁰ This biodiversity density translates into tangible competitive advantages for biobased industries, the commercialisation of indigenous knowledge and practices, and the potential for nature-based solutions that command premium prices and investments in global markets.

South Africa is the third most biologically diverse country in the world, while Madagascar's endemic species richness relative to its land mass area is unparalleled. Lake Malawi and Lake Tanganyika host exceptionally high numbers of freshwater species and the Central Zambezian Miombo woodlands in Tanzania and Zambia are a centre of bird and butterfly diversity. Megafauna are abundant across the region, with Botswana supporting Africa's largest elephant population, while Tanzania hosts the world's largest remaining population of lions.¹¹

Leveraging these resources is essential to supporting communities in SADC. Between 40% and 85% of SADC citizens live in rural areas, where they depend on natural resources for survival. The SADC Biodiversity Action Plan notes, "there is a lack of knowledge for optimal and sustainable use of these natural resources in terms of both diversity of uses and in value adding processes and technologies. This in the long run also leads to environmental degradation through over-harvesting while poverty levels are getting worse. The improvement of biodiversity-based livelihoods and their diversification is therefore a strategic priority that will contribute to poverty reduction and a reduction in biodiversity loss."¹²

With global demand for sustainable, low-carbon products rising, SADC is well positioned to advocate for and enable the growth of a shared bioeconomy. It can do this by diversifying sectors, expanding rural livelihoods and building labour-intensive, climate-resilient industries that deliver conservation gains.

In this way, the bioeconomy can help SADC build climate resilience, strengthen rural economies and ensure that communities derive equitable benefits from the region's natural wealth while avoiding the significant economic cost of inaction.

By building their competitive advantage in the bioeconomy, SADC countries can:

- **Capture premium pricing in sustainability-sensitive markets**, rather than competing on undifferentiated commodity prices.
- **Strengthen balance of payments** through import substitution of biobased chemicals, materials and energy currently purchased internationally.
- **Position the region ahead of regulatory curves** rather than scrambling to meet evolving standards.
- **Create domestic value addition and employment** rather than exporting raw materials for processing elsewhere.
- **Build on renewable, climate-resilient resources** rather than depleting finite extractive assets.

Investing in new and diversified bioindustries, some of which can be sourced through tax or other revenue derived from traditional industries such as critical mineral or other mining, can help SADC economies to diversify, drive green industrialisation and create a suite of new jobs across value chains, sectors and rural and urban environments. Not only will this help meet the demands of new green and low carbon markets amid decarbonisation regulations, but it also represents an investment in resilience, making diversified sectors and supply chains less vulnerable to shocks.

Instead of replicating carbon-intensive industrial models, the bioeconomy allows SADC economies to build competitiveness around renewable

biological resources, regional value addition and climate-aligned production systems.

The bioeconomy as an economic resilience strategy

As SADC charts a new development trajectory for people and planet, the bioeconomy represents a transformative leapfrogging pathway that responds directly to the region's exposure to global trade shifts, climate volatility, commodity dependence and demographic pressure.

Mechanical Vapour Recompression is one example of the advanced processing technologies that can support higher-value biomanufacturing. Shown here at South Africa's Council for Scientific and Industrial Research (CSIR), the process recovers and recompresses vapour so that its heat can be reused during evaporation and concentration, reducing energy demand while enabling biological feedstocks to be processed into higher-value products.

The CSIR's wider biorefinery work includes converting waste biomass and industrial food-waste streams into products such as dried single-cell protein and pelletised feed ingredients. Together, these capabilities demonstrate how more efficient processing can help turn low-value biological residues into market-ready products within a circular bioeconomy.



Source: CSIR.

Trade rules are reshaping competitiveness

Trade exposure and shifting global rules present an increasingly urgent challenge for SADC exporters. Instruments such as the European Union's CBAM, evolving sustainability standards and traceability requirements are already reshaping access to key export markets.

Commodity-based exports produced with high carbon intensity or weak environmental safeguards risk becoming less competitive or facing outright exclusion. A bioeconomy approach enables SADC countries to pivot towards low-carbon, biobased products, such as sustainably produced agri-foods, biobased materials, high value biochemical inputs and green industrial inputs, that are better aligned with emerging trade regimes.

By processing biomass locally and embedding sustainability credentials at source, countries can reduce exposure to external regulatory shocks while strengthening regional and South–South trade. Moreover, biobased products often command premium prices in international markets, offering improved terms of trade compared to undifferentiated commodity exports.

Climate and nature risks are reshaping economic resilience

Meanwhile, climate volatility is no longer a future risk but a present economic and environmental reality. Recurrent droughts, increasingly severe flood events and shifting rainfall patterns are undermining agricultural productivity, infrastructure and fiscal stability across the region. Energy insecurity, exacerbated by both climate impacts on hydropower and infrastructure vulnerabilities, further compounds these challenges.

The South African Reserve Bank highlights the urgent need for SADC countries to address nature-related risks to ensure economic stability and resilience. The highest risks are physical risks (specifically, the degradation of ecosystem services that support economic production; SADC countries' net exports have average exposure of 67% to direct risks and 88% to indirect effects) and transition risks.¹³ The most striking of these nature related risks are water-related ecosystem services and climate regulation, which are critical for the region's economic stability, but are often inadequately provided.

This report calls on central banks and policymakers in Southern Africa to integrate nature-related risks into monitoring frameworks and, linked to this, highlights the urgency of strengthening data collection and modelling capacities to ensure transition strategies are effective and resilient. It emphasises the importance of protecting and restoring ecosystems, developing adaptive capacities in exposed sectors and implementing biodiversity-aligned policies.

The bioeconomy can offer practical tools for adaptation and resilience, allowing nature to act both as a shock absorber and a driver of transition. But there is a limited window to harness the potential of the bioeconomy – and to seize the opportunity, countries need to protect and invest in the ecological infrastructure on which the bioeconomy depends.

Examples include climate-smart and drought-resilient crops, landscape restoration to reduce flood risk, sustainable forestry to stabilise watersheds and other nature-based solutions that protect infrastructure and livelihoods. Decentralised bioenergy systems can enhance energy security, particularly in rural and peri-urban areas where grid access remains limited.

These interventions can not only reduce climate and biodiversity-related losses, but can also form the foundation of new economic activities in ecosystem services, bioinputs and resilient food systems.

Value addition can reduce commodity dependence

SADC's longstanding dependence on primary commodities further amplifies its vulnerability to global price cycles, currency fluctuations and external demand shocks. Minerals, raw agricultural outputs and unprocessed biomass dominate export profiles, capturing limited value and generating few linkages to domestic innovation or employment.

Bioeconomy value chains offer a route to structural diversification, enabling countries to convert existing biological resources into higher-value products such as biobased chemicals, pharmaceuticals, sustainable packaging and bioenergy.

This transition reduces reliance on extractive industries while anchoring growth in renewable, domestically available inputs. Critically, biobased value chains tend to be more labour-intensive than extractive industries, creating more jobs per unit of investment and distributing economic benefits more widely.

The bioeconomy can create jobs across the skills spectrum

Demographic dynamics sharpen the urgency of this transition. With a rapidly growing and predominantly young population, youth employment pressure is one of the most pressing development challenges facing SADC. Traditional sectors have struggled to generate sufficient decent jobs, particularly for young people entering the labour market each year.

The bioeconomy spans a wide spectrum of employment opportunities, from primary production and processing to research, digital services, logistics and entrepreneurship. Importantly, it creates pathways for skills upgrading, innovation-led SMMEs and rural-urban economic integration, offering more resilient employment than climate-exposed subsistence agriculture or capital-intensive extractive sectors.

For women, who make up the majority of smallholder farmers and informal agricultural workers across SADC,¹⁴ bioeconomy value chains offer opportunities for economic empowerment through increased access to formal markets, improved incomes and participation in processing and value-addition activities.

By leveraging its vast natural resources, growing workforce and emerging green industries, Africa is well positioned to develop a robust green labour market that supports both economic and environmental resilience. Figure 7 demonstrates some of these cross-sectoral opportunities.

FIGURE 7**Green jobs yielding the most value, Africa, 2025–2030**

Sector	Near term (2025–2030) + onwards	Commence focus now Though impact expected in 10+ years horizon, requires dedicated focus from today
		Long term (2030 + onwards)
Energy and power	• Solar • Wind • Geothermal • Hydro • Battery storage • Power transmission and distribution	• Bio-fuel • Green hydrogen • Bio-gas • Nuclear • Tidal and wave • Smart grid tech
Mobility and transportation	• Electric 2/3 wheelers • Charging infrastructure	• Electric buses • Electric 4 wheelers
Agriculture and nature	• Climate smart agri-technology • Aquaculture and poultry • Ecosystem conservation and NBS	• Water purification and desalination • Agro-forestry • Regenerative crop production
Construction and real estate		• Landfill management • Green building design and construction • Water management infrastructure
Manufacturing and materials	• Waste remediation and recycling	• Sustainable packaging • Sustainable fashion • Clean cooking • Sustainable building materials • Green chemicals
Financial and professional services	• Green finance (including green bonds) • Carbon markets and services	<i>Enabler across all value chains</i>

Source: FSD Africa, *Forecasting Green Jobs in Africa* (Nairobi: FSD Africa, 2024).

The bioeconomy offers a strategic response to intersecting risks: trade fragmentation, climate shocks, volatile commodity markets and youth unemployment. For SADC, investing in the bioeconomy is not simply about greening existing sectors, but about redefining the development model to build resilience to external shocks at a macroeconomic level, by deepening localised

value addition, diversifying sectoral development, investing in green industrialisation and investing in climate and biodiversity resilience.

By doing so, SADC can create a development model that aligns with global transitions already under way, in a way that is inclusive, people-centred and ecologically mindful.

Mapping the potential
**High-growth
sectors for
SADC's
bioeconomy**

Creating value across interconnected sectors

The bioeconomy is not a single sector but a cross-cutting economic transformation strategy that touches all sectors, from agriculture to manufacturing, energy and waste. What unites these diverse sectors is their shared foundation in renewable biological resources, their capacity to generate labour-intensive employment, and their alignment with emerging global market demands for sustainable, low-carbon products.

Unlike the just transition which has largely focused on decarbonising the energy sector, the bioeconomy represents a leapfrogging opportunity beyond this: creating economy-wide transformation towards a more circular biobased economy.

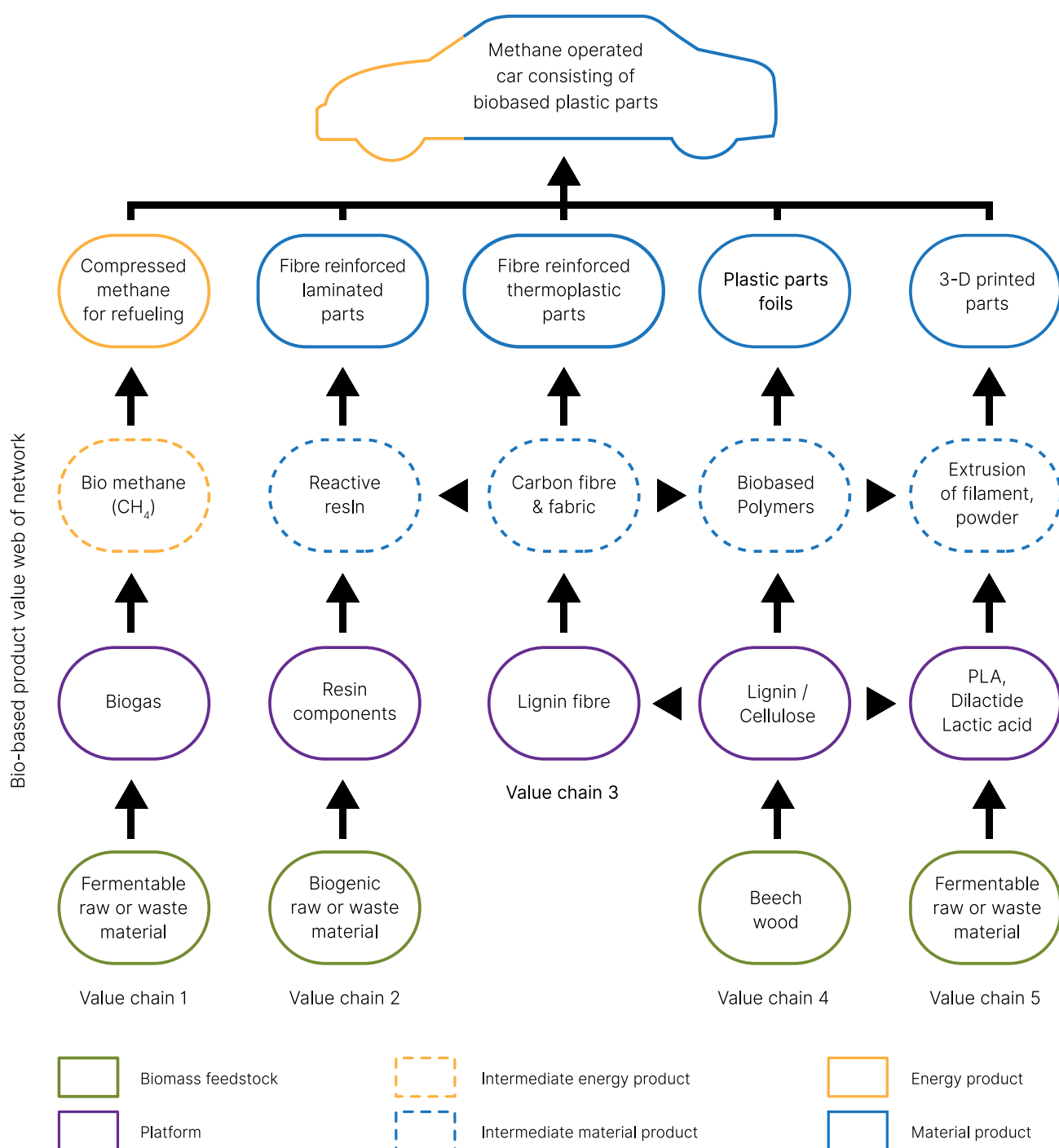
One strategic way to approach this, described by Lewandowski et al., is through **biobased value webs: a network of interconnected value chains**.¹⁵ Instead of one pathway, multiple products can come from the same biomass, with cross-sector linkages and circular flows.

For example, sugarcane, bioethanol, bioplastics and biochemicals can be developed, and from the “waste streams” of these products, fertiliser, energy, wax products and animal feed can be created. Thus, instead of producing one product efficiently as in traditional models, maximum value can be extracted from the whole system while reducing waste, increasing value creation and ensuring sustainability across lifecycles.

Figure 8 shows an example of a value web of a car operated with biomethane and built with biobased plastic parts, where multiple value chains are integrated, consisting of biomass feedstocks, platforms or building blocks, intermediate products and final material and energy products.¹⁶

FIGURE 8**A single biomass feedstock can support multiple bio-based value chains**

Bio-based value webs in practice. A single biomass feedstock can generate multiple products across integrated value chains, which is illustrated here through a car operated with biomethane and built with bio-based plastic parts.



Source: Lewandoski et al. (eds), *Bioeconomy: Advancing the Transition to a Sustainable, Biobased Economy* (2026).

SADC could apply this thinking to a number of biomass value webs. As a starting point, this section examines six high-potential bioeconomy sectors across SADC, demonstrating how the region's competitive advantages in biodiversity, biomass density and underutilised labour can translate into investable pathways that address the region's core vulnerabilities: trade exposure, climate volatility, commodity dependence and youth unemployment. This represents an integrated industrial transformation strategy that, with coordinated regional action, could position SADC as a first mover in biobased industries.

In many SADC countries, the bioeconomy is currently driven through sector-specific policies, the most common of which are agricultural, biotechnology and biodiversity policies. These provide natural starting points for integrating the bioeconomy into policy frameworks. A number of emerging policies and developments also exist across bioenergy and biofuels, the blue economy, the circular and waste economy and the wildlife-based economy, reflecting the region's diverse natural endowments and development priorities.

Regen Organics demonstrates the potential of the yellow, or insect, bioeconomy by turning locally available organic waste into high-value agricultural inputs. At its facility in Kilifi, Kenya, the company raises Black Soldier Fly larvae on residual organic feedstocks before processing them into KuzaPro, a protein-rich ingredient for poultry, fish, pig and pet food.

KuzaPro contains around 40% protein and can replace imported feed ingredients such as soy and fishmeal, reducing pressure on forests and marine ecosystems while shortening supply chains. By combining organic waste treatment, insect protein production and regenerative fertiliser, Regen Organics shows how circular bioeconomy models can create new products, reduce emissions and strengthen local food systems.

Source: Regen Organics.





KEY SECTOR 1

Agriculture, agroprocessing and food systems



Market context and competitive advantage

Agriculture dominates SADC's economic landscape, but the sector faces multiple threats: climate vulnerability undermining productivity, low value capture from unprocessed commodity exports and exposure to price volatility. Climate shocks (including droughts, floods and unpredictable seasonal shifts) to agriculture severely debilitate countries' abilities to predict foreign and local earnings, disrupt fiscal planning and destabilise balance of payments.

The bioeconomy transforms agriculture from a source of vulnerability into a platform for resilience. By integrating climate-smart and regenerative practices, biobased inputs (such as biofertilisers and biopesticides), advanced agroprocessing and diversified crops, SADC can strengthen food security, capture more value domestically and reduce import bills for agricultural inputs.

SADC's diverse agroecological zones, year-round growing seasons in many areas and proximity to both EU and emerging Asian markets provide structural advantages. As CBAM and sustainability standards reshape trade, SADC producers adopting climate-smart practices can gain preferential access for premium sustainability-sensitive markets while competitors face penalties.

KEY NUMBERS

US\$1 trillion

projected gross production value of Africa's agriculture sector by 2030

3-5x higher margins

for processed agricultural products compared with raw commodities

377,000 new jobs

projected in climate-smart agriculture in Africa by 2030



Key sub-sectors of the agricultural bioeconomy

Climate-smart agriculture technologies

These tools include agroforestry, drip irrigation, conservation agriculture and drought-resilient crop varieties that maintain productivity under climate stress while sequestering carbon, addressing both adaptation needs and emerging carbon market opportunities.

Biobased agricultural inputs

Locally produced biofertilisers and biopesticides reduce import dependency (strengthening balance of payments), lower input costs for farmers and align with organic and sustainable agriculture premiums in export markets. In South Africa, wine farms are using kelp and seaweed-based

fertilisers that have boosted yields by up to 60%.¹⁷ These biobased inputs improve soil structure, stimulate microbial activity, enhance nutrient availability and increase water retention.

Agroprocessing and value addition

Moving from raw commodity exports to processed foods, specialty ingredients and certified organic products captures significantly higher margins.

Biotechnology applications

Crop improvement technology, biogenetics, biofertilisers and biostimulants, biopesticides and precision agriculture increase yields and resilience while creating skilled employment in research and development (R&D), extension services and technical support.

The giant kelp *Ecklonia maxima*, harvested from the cold Atlantic waters off southern Africa, underpins a high-value bioeconomy linking marine ecosystems with agriculture. Kelpak, a South African biotechnology company and manufacturer of seaweed-based biostimulants, transforms this renewable marine resource into natural biostimulants that support root development, enhance crop resilience and improve yields.

Founded in 1978, the company uses its proprietary Cellburst® extraction technology, a high-pressure physical extraction process, to preserve the kelp's naturally occurring plant-active compounds and nutrients. Kelpak products are now distributed in more than 80 countries, demonstrating how a locally sourced marine resource can be transformed into a globally traded agricultural biostimulant.



Source: Kelpak.



Employment and economic potential

Africa's agricultural sector is projected to reach a gross production value of US\$189.1 billion by 2025 and US\$1 trillion by 2030, contributing 30% to GDP.¹⁸ More than half of the employed people in SADC are employed in agriculture – often, or predominantly, at a basic semi-subsistence or small-scale level.¹⁹ Further up the value chain, agroprocessing generates strong employment multipliers, with each processing facility supporting jobs in primary production.

By 2030, Africa's agriculture and biobased sectors are projected to generate up to 700,000 new green jobs, with over 377,000 arising from climate-smart agriculture technologies.²⁰ Employment growth needs to be accompanied by upskilling in order to empower more active participation in markets.



Investment requirements and returns

Climate-smart agriculture requires patient capital: funding for farmer training, input systems, and market linkages, typically through grants, concessional loans, and donor funding. Returns are stable, driven by reduced risk and premium pricing rather than rapid scale. Newer instruments are beginning to widen access to this capital. Bio-Bonds, for instance, extend affordable, long-term financing directly to smallholders, channeling private investment into regenerative farming practices and reducing reliance on donor funding alone.²¹

Agroprocessing has a different investment profile. It is more capital-intensive, requiring infrastructure such as warehouses, machinery, equipment and logistics, but it offers higher profit potential in return. Processed and branded products typically command 3–5 times higher margins than raw commodities.²²



Strategic levers for regional coordination

Improving regional coordination represents one of the most practical and immediate opportunities to realise the economic potential of the agricultural bioeconomy. Better regional alignment across policies, financial systems and market frameworks can reduce uncertainty, strengthen market structures and create more investable conditions across value chains.

- **Harmonised organic and sustainability certification styles** to reduce transaction costs for producers and exporters seeking to serve multiple markets, easing the compliance burden that currently discourages cross-border expansion.
- **Shared research platforms** to accelerate variety development and technology diffusion, strengthened by closer regional linkages between universities, research institutions and the private sector to speed up the translation of innovation into commercial outcomes.
- **Coordinated trade promotion positions** to strengthen regional negotiating leverage and present a more unified value proposition to global buyers and investors.
- **Regional standards for bioinputs**, such as biofertilisers and biopesticides, drive economies of scale by enabling large-scale manufacturing, streamlining cross-border trade and lowering compliance costs. By harmonising standards across SADC, producers avoid fragmented, localised testing requirements, cutting per-unit costs and easing market entry.



KEY SECTOR 2

Biotechnology and bioprocessing



Market context and competitive advantage

SADC has significant potential in biotechnology and bioprocessing, driven primarily by its rich biodiversity, strong focus on agricultural development and regional initiatives in pharmaceuticals and industrialisation. Across pharmaceuticals and health, the region is working through initiatives such as the SADC Pharmaceutical Programme to build capacity to produce essential medicines, including antiretrovirals (ARVs) and vaccines, in order to reduce import dependency and lower the burden of diseases such as HIV and AIDS, tuberculosis and malaria.

Biotechnology is similarly applied to enhance agricultural productivity and sustainability, including through the development of climate-resilient crops and biopesticides, while indigenous knowledge systems are leveraged for healthcare, pharmaceutical, nutraceutical and cosmetic applications. While the overarching goal of these initiatives is to foster self-reliant economies, decrease import dependency and build regional resilience through collective action and innovation, a significant opportunity also lies in value addition, as moving from exporting raw agricultural products toward higher value-added supply chains could substantially increase export earnings.

For SADC, assuming adequate capitalisation and investment, this creates a clear opportunity in this sector. The region's biodiversity offers a rich base of biological feedstocks for high-value compounds, and its combination of competitive labour costs and a steadily growing skilled workforce positions it well to supply emerging biotechnology industries.

KEY NUMBERS

US\$73.4 billion

value of the pharmaceutical and biotechnology market in Africa in 2022²³

+88% market growth

projected to reach **US\$138.2 billion by 2030²⁴**

14,000 full-time jobs

required in Africa by 2040 for vaccine manufacturing, R&D and biotech startups



Key biotechnology and bioprocessing sub-sectors

Biopharmaceutical manufacturing

Local production of essential medicines, including ARVs, antimalarials and vaccines, can reduce import dependency, strengthen healthcare security, create high-skilled jobs and position SADC as a supplier to African and global markets. The COVID-19 pandemic and recent livestock disease outbreaks exposed clear vulnerabilities in pharmaceutical and vaccine supply chains, making regional manufacturing capacity a strategic priority.

Industrial biotechnology

Converting biomass into biochemicals, bioplastics, biopackaging and industrial biobased inputs replaces imported fossil-based products with domestic renewable alternatives. This is import substitution at industrial scale, strengthening balance of payments while creating manufacturing jobs. Applications span construction materials, packaging and textiles.

Agricultural biotechnology

Development of climate-resilient crop varieties, biofertilisers, biopesticides and veterinary biologics serves both domestic agricultural needs and export markets across Africa and developing regions with similar agroecological conditions.

Indigenous knowledge valorisation

Indigenous knowledge valorisation is the active process of validating, elevating and integrating Indigenous knowledge, cultures, and practices into modern socio-economic, political, or scientific frameworks. SADC's rich biodiversity and traditional medicine systems represent untapped intellectual property. Scientific validation, standardisation and commercialisation of traditional medicines, cosmetic ingredients and nutraceuticals with equitable benefit-sharing transforms cultural heritage into economic value while maintaining community rights.



Employment and economic potential

Biotechnology in SADC is creating jobs across pharmaceuticals, indigenous knowledge valorisation, agriculture and industry. Programmes such as the Support to Industrialisation and Productive Sectors support antiretroviral production, while South Africa's bioeconomy strategy drives agricultural biotech employment.

In light of countries' biotechnology ambitions, including efforts to ramp up local vaccine manufacturing, an estimated 9,000 to 14,000 full-time jobs will be required in Africa by 2040 for vaccine manufacturing, R&D and biotech startups.²⁵ Botswana already plays a leading role in biotechnology research and animal vaccine production in southern Africa, pointing to a regional capability which could be further expanded.

Bioprocessing jobs focus on converting biomass into biofuels, bioplastics, biopackaging, construction materials and other industrial biobased inputs, requiring skills in R&D, manufacturing and quality control. South Africa's Biomanufacturing Industry Development Centre illustrates this job-creation potential. The sector also includes vaccine, diagnostic and biopharmaceutical production, with rising demand for professionals in manufacturing, research and regulation as local health solutions become a higher priority.



Investment requirements and returns

To achieve its employment and economic potential, scaling up the biotechnology sector across SADC requires significant upfront capital for R&D facilities, pilot plants, quality assurance systems and regulatory compliance infrastructure. This makes regional coordination essential, as pooling resources across SADC makes investments viable that individual countries could not justify alone. Returns manifest across multiple dimensions, including direct employment in manufacturing, upstream jobs in biomass supply chains, reduced

import bills, improved health outcomes and potential export earnings. Development finance institutions increasingly recognise biotechnology as a strategic priority, with blended finance structures helping de-risk private investment.

SADC countries could draw on the International Centre of Insect Physiology and Ecology (icipe) and Council for Scientific and Industrial Research (CSIR) investment models (Box 1 and Box 2) as reference point for structuring their own funding approaches, mobilising capital for shared facilities while building national capacity.

BOX 1

BiolInnovate Africa and icipe: Unlocking Africa's bioeconomy potential

BiolInnovate Africa is a flagship programme of the International Centre of Insect Physiology and Ecology (icipe), advancing a science and innovation-driven bioeconomy across eastern Africa. Supported by the Swedish International Development Cooperation Agency and implemented in partnership with over 300 cooperation partners, BiolInnovate operates across eight countries: Burundi, Ethiopia, the Democratic Republic of Congo, Kenya, Rwanda, South Sudan, Tanzania and Uganda.

The programme's core mission is to translate cutting-edge bioscience into market-ready, biobased solutions, bridging persistent gaps between research, enterprise development, investment and policy. Working across the full innovation pipeline – from laboratory discovery and early-stage de-risking to industry standards and regulatory support – BiolInnovate Africa plays a catalytic role in unlocking Africa's bioeconomy potential.

Through targeted innovation grants, technical assistance and partnerships with industry, BiolInnovate Africa supports scientists to develop biobased products to minimum viable product stage and beyond. Innovations span agriculture, health and waste valorisation, including biofertilisers, biopesticides and fungicides, chitin-based wound-care products, biobased malaria supplements, enzyme applications for leather processing and black soldier fly-based animal feed and insect-enriched foods now supplying markets and schools.

BiolInnovate Africa demonstrates that with the right enabling finance, partnerships and policy environment, African scientists can deliver world-class biobased innovations, driving industrial transformation, job creation and resilient development while reducing dependency on imported inputs and fossil-based systems. The programme shows that the primary constraint is not scientific capacity but access to early-stage finance, market linkages and policy support.

BOX 2**Bridging public and private finance: The Council for Scientific and Industrial Research**

The growth of the bioeconomy in the SADC region depends heavily on the strength of national scientific institutions and agencies, which play a central role in research, skills development and technological advancement. These bodies generate the knowledge and innovations that underpin both traditional and emerging bioeconomy sectors. The Council for Scientific and Industrial Research (CSIR) plays a particularly critical role.

The CSIR develops the bioeconomy in South Africa by translating scientific research and innovation into market-ready products, supporting SMMEs and utilising indigenous knowledge through world-class facilities and expertise. The only institution of its kind on the continent, it runs several key programmes to develop African scientific and industry expertise. CSIR functions as a foundational bridge between science, innovation and market development, solving small and established business problems with biobased innovation and exploring commercial viability to help businesses develop:

Biorefinery and waste beneficiation: The CSIR leverages its Biorefinery Industry Development Facility to convert various biomass waste streams into high-value chemicals and materials. This includes developing biocomposite materials as alternatives to fossil-based plastics.

Industry and SMME support: The Biomanufacturing Industry Development Centre provides technical and product development support, facilities and expertise to SMMEs to help them move from concept to commercial products. This support encompasses technology validation, pilot-scale production, product formulation and quality assurance, which lowers the barrier for entrepreneurs to enter the market.

Indigenous knowledge commercialisation: Through the Indigenous Knowledge-based Medicines and Innovation Centre at the University of the Free State, the CSIR collaborates with traditional knowledge holders and healers from across the continent to scientifically validate, standardise and commercialise traditional medicines and products (e.g., African ginger for asthma treatment) in compliance with national and international regulations. Benefit sharing, commercial and business arrangements are a key function of the Indigenous Knowledge commercial process to ensure financial remuneration pathways are well established.

Advanced facilities and technologies: The organisation establishes and operates cutting-edge national facilities available for industry and academia, such as bioprocessing pilot plants and a biopharmaceutical investigational facility for the local development and production of critical diagnostics, drugs and potential vaccines.

Research and innovation: The CSIR spearheads R&D in green chemistry and biocatalysis to transition industries away from harmful chemicals towards sustainable solutions, such as developing biocides through enzymatic modification of orange oil to produce insect repellent.

Workforce training: The African biomanufacturing workforce training and skills development programme offers a Biomanufacturing Technologies course, which is critical to the development of an industry-ready workforce. The course provides comprehensive competency building and skills transfer across all aspects of biomanufacturing.



Strategic levers for regional coordination

SADC already has strong foundations for regional collaboration in this sector, including through South Africa's bioeconomy strategy, the translational research and innovation infrastructure provided by the CSIR, the SADC Pharmaceutical Programme's focus on ARV production, and the Southern Africa Network for Biosciences (SANBio) as an existing coordination platform, alongside growing private sector activity. Together, these can foster collaboration, accelerate the diffusion of innovation and strengthen the human capital base required to scale the bioeconomy.

Building on these assets will require deeper regional alignment and scaled investment rather than starting from scratch, involving several levers:

- **Shared R&D infrastructure and centres of excellence**

Regional coordination could establish a network of specialised centres, each focusing on a specific bioeconomy subsector based on comparative advantage, minimising duplication across the region. Other SADC countries could adapt the CSIR model to their

own contexts, pooling regional resources for shared facilities and building national capacity through similar programmes.

- **Coordinated industrial planning**

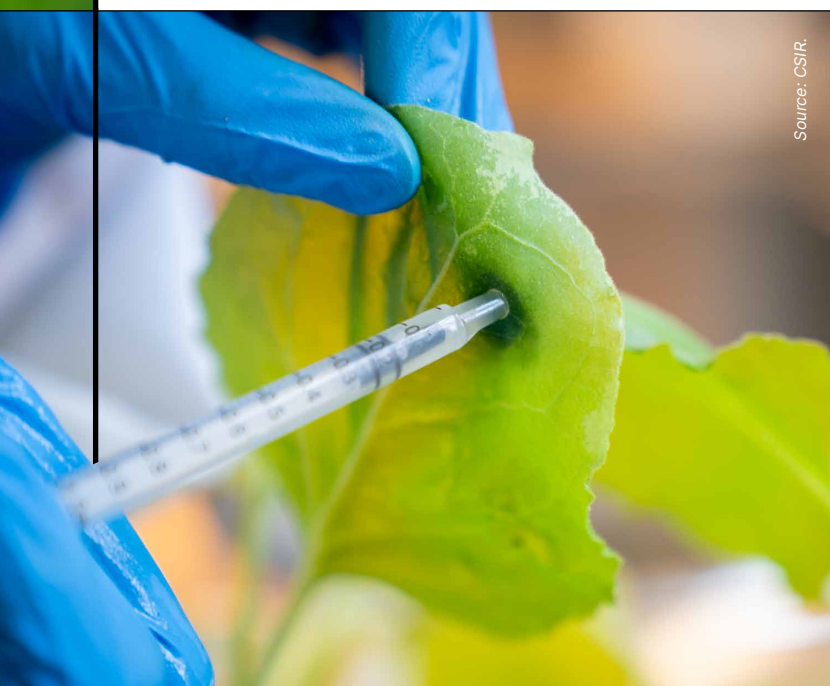
Siting bio-refineries and processing facilities near feedstock sources and transport corridors would improve competitiveness and reduce logistics costs across the value chain.

- **Regional intellectual property and benefit-sharing frameworks**

Regional frameworks will protect traditional knowledge while enabling responsible commercialisation, ensuring that value generated from indigenous knowledge and biological resources is fairly shared with the communities and countries of origin. Harmonised regulatory frameworks for pharmaceuticals and bio-based products would also create a predictable regional market with greater scale.

- **Collective bargaining**

Joint negotiation on technology transfer and manufacturing licences will strengthen SADC's negotiating power and secure more equitable access to critical technologies across the region.



Source: CSIR.

At South Africa's CSIR, researchers are developing new forms of crop protection that use biological mechanisms rather than conventional chemical treatments. Shown here, a plant leaf is treated with a solution containing short RNA molecules that can help a plant recognise and disable the genetic material of invading viruses.

Such approaches illustrate how biotechnology can strengthen plants' own defence responses, offering more targeted tools for protecting harvests, reducing crop losses and supporting more resilient agricultural systems.



KEY SECTOR 3

Bioenergy and biofuels



Market context and competitive advantage

Bioenergy and biofuels offer a compelling response to one of the region’s most binding development constraints and competitiveness threats: energy access and security. Across SADC, load-shedding disrupts manufacturing, hydropower vulnerability creates seasonal economic volatility and petroleum import bills drain foreign exchange. At the same time, emerging sustainable aviation fuel mandates threaten to make SADC’s tourism and export sectors uncompetitive if the region cannot supply low-carbon energy for transport.

Alongside renewable energy roll-out, decentralised bioenergy systems address these issues by enhancing domestic energy access and security. Proximity to EU markets seeking sustainable fuels also creates a first-mover advantage in supplying biofuels for sectors such as aviation and maritime transport, where few alternatives currently exist.

This can put SADC’s abundant, currently underutilised agricultural biomass waste to productive use (Figure 9) and can ensure continued competitiveness in global markets as these sectors decarbonise. Beyond energy security, bioenergy and biofuels offer opportunities for rural development, agricultural growth and diversification, and foreign currency savings.

KEY NUMBERS

US\$17.6 billion

projected value of Africa’s bioenergy market by 2035

40 million litres per year

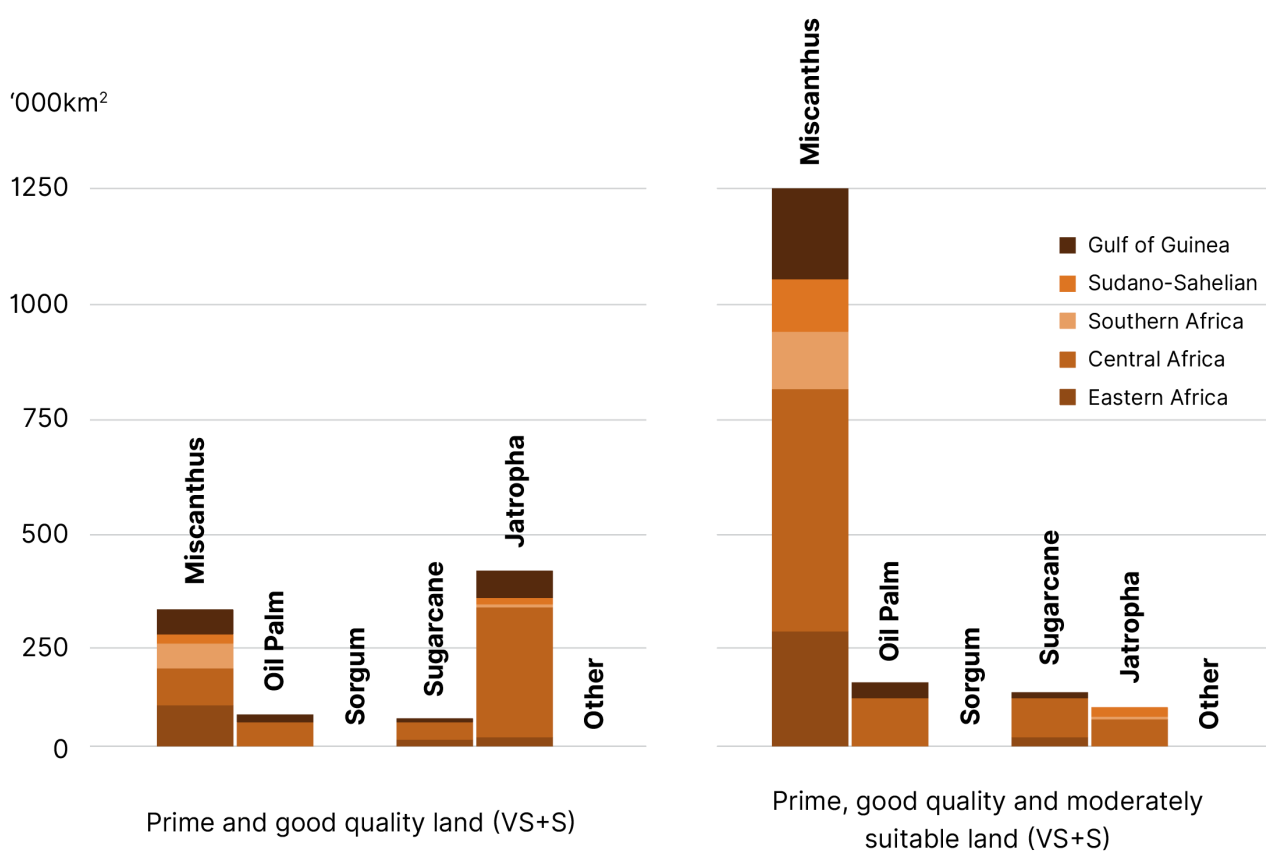
produced by one of Zimbabwe’s largest ethanol producers

2 million jobs

expected from Africa’s renewable energy sector by 2030

FIGURE 9**Geographic distribution of feedstocks used to create biofuels across Africa**

Miscanthus, jatropha and sugarcane are shown to be the best performing feedstock to be used to create biofuels like sustainable aviation fuel. Coordinated planning on where to locate biorefineries can optimise feedstock logistics.



Source: RSB (Roundtable on Sustainable Biomaterials), *Fuelling the Sustainable Bioeconomy: Landscape-Level Programmes* (Geneva: RSB, 2022).



Key bioenergy and biofuels sub-sectors

Sustainable aviation fuel

With current technology, aviation simply cannot electrify at scale; sustainable aviation fuel is the only credible decarbonisation pathway for global airlines. As the European Union and other major markets roll out strict blending mandates (with targets rising as high as 70% by 2050), demand for reliable sustainable aviation fuel suppliers will surge.²⁶ SADC can position itself as a competitive producer, drawing on existing work such as the [Roundtable on Sustainable Biomaterials'](#) 10-year sustainable aviation fuel road maps for Ethiopia and South Africa, which have already demonstrated technical and commercial feasibility.

Agricultural residue-to-energy

Turning crop residues, bagasse and other agricultural by-products into biogas, bioethanol or power converts waste liabilities into energy assets. This is especially compelling for agroprocessing zones where energy-intensive industries operate next to abundant feedstocks, reducing waste management costs and improving energy security.

Biodiesel from vegetable oils

Several SADC countries already grow suitable feedstocks and have basic processing capacity. With coordinated regional standards and blending requirements, the region can create the market certainty and scale investors interest to expand production and upgrade facilities.

Decentralised bioenergy for rural electrification

Small-scale biogas systems using agricultural and household organic waste offer a practical, locally owned solution to energy poverty in off-grid areas. Beyond providing clean electricity and cooking fuel, these systems generate employment across installation, maintenance and feedstock supply chains, helping to keep economic value within rural communities.



Employment and economic potential

By 2030, Africa's renewable energy sector is expected to generate up to 2 million jobs, approximately 70% of all projected green jobs, with solar energy alone accounting for around 1.7 million of these positions.²⁷ Bioenergy currently contributes a modest 1–3% of GDP, but with a green transition, it could grow to a low single-digit share by 2050. Africa's bioenergy market is projected to reach US\$3 billion by 2025 and US\$17.6 billion by 2035, with renewables expected to boost GDP by 6.4% by 2050 – a portion of which will come from bioenergy.²⁸ Key skills required for the development of this sector include renewable energy engineering, biomass management and energy policy.

SADC has significant economic potential for biofuels production, with bio-ethanol from sugarcane already being produced and blended with petrol in several SADC member states (prominent producers include Malawi, South Africa and Zimbabwe – see Box 3 on Zimbabwe's biofuel production) and biodiesel from vegetable oils is also in production. Likewise, Angola and Zambia are actively exploring biogas projects from agricultural waste.

BOX 3**Zimbabwe's biofuel mandatory blending**

Zimbabwe presents one of the earliest and most successful stories in southern Africa of transitioning to mandatory fuel blending. The country's approach to biofuels is anchored in a three-phase strategic framework aimed at achieving universal access to sustainable energy by 2030 through the mandatory blending of bioethanol and biodiesel into the transport sector. The policy prioritises the use of non-grain feedstocks, such as sugarcane for ethanol and jatropha for biodiesel, to mitigate potential conflicts between food security and energy security. By establishing a regulated market with mandatory blending targets and licensing for large-scale producers, the country seeks to reduce its dependence on imported fossil fuels and stabilise the national energy supply.

To reduce oil imports and help ensure energy independence, the government has introduced an ethanol-petrol blend (E5 to E10; i.e., 5–10% ethanol and 90–95% petrol) via the Chisumbanje ethanol project, which entered into operation in 2011, run primarily by Green Fuel.²⁹ The Chisumbanje plant is now one of the largest ethanol producers on the African continent and processes thousands of tons of sugarcane daily, while also generating its own electricity via steam and producing around 40 million litres per annum.³⁰

Using locally produced ethanol, the state has curtailed fuel import expenditures, saving millions in foreign exchange and creating agricultural and industrial jobs. The transition should continue to catalyse successful rural industrialisation and job creation within the green fuel initiatives. Challenges remain regarding feedstock yields and the need for internationally recognised sustainability standards. Towards 2030, the focus is on shifting toward scaling up production to achieve E85 (i.e., 85% ethanol and 15% petrol) to significantly lower the national carbon footprint and reduce import substitution of petroleum products.³¹



Investment requirements and returns

Bioenergy investment needs vary widely, spanning low-capital rural biogas systems to capital-intensive biorefineries for sustainable aviation fuel production, which require significant investment and economies of scale to be commercially viable.

Policy certainty on blending mandates, off-take agreements and sustainability certification is critical for attracting private investment,

particularly at the capital-intensive end of this spectrum. Development finance can help de-risk investment through guarantees and early-stage equity, crowding in private capital that would otherwise view these projects as too risky.

Returns manifest through reduced import bills and improved energy security, job creation across biomass supply chains, and potential export earnings from sustainable aviation fuel and other biofuels sold into markets with binding decarbonisation mandates.



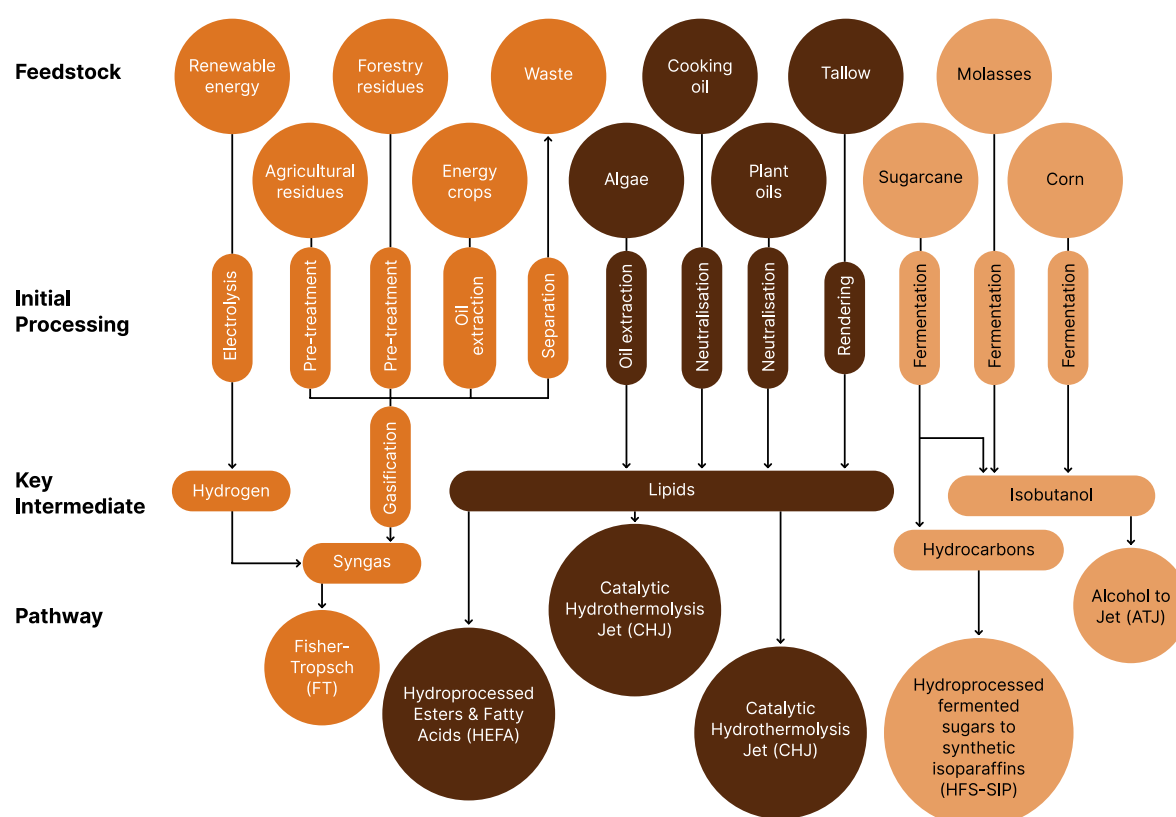
Strategic levers for regional coordination

Strong regional coordination on feedstock aggregation, processing infrastructure and market access is essential to unlock investment and competitiveness in bio-based energy and fuels including:

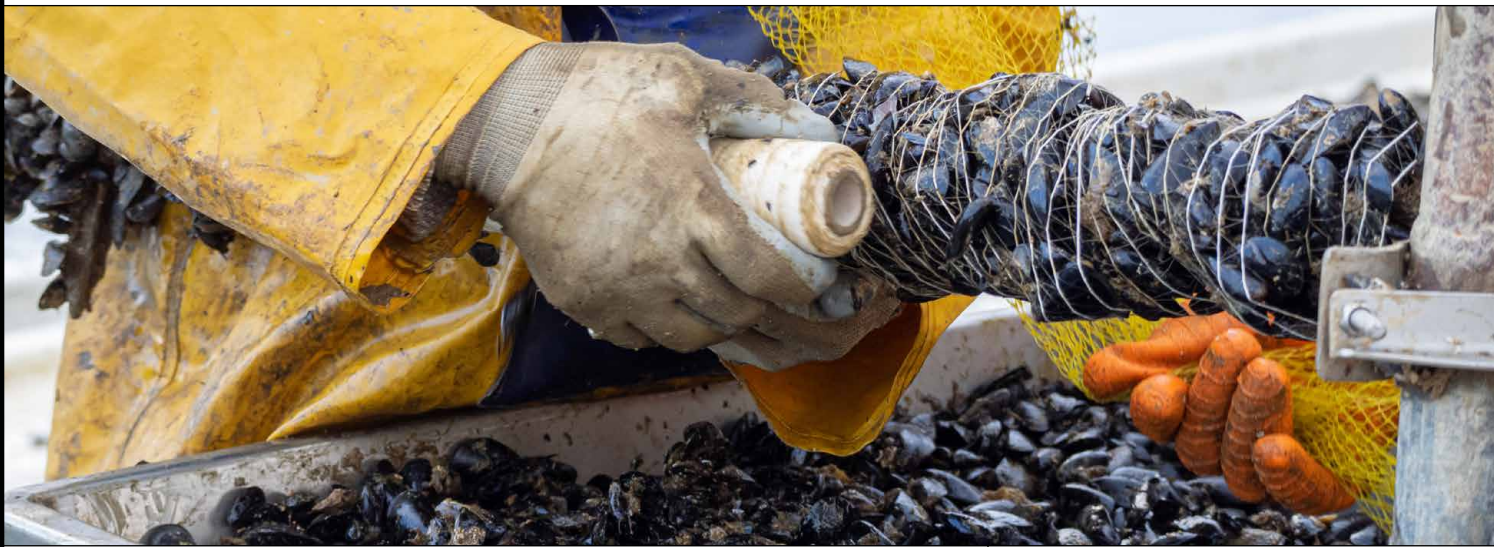
- **Policy certainty on harmonised blending mandates across SADC** would create predictable demand and build the scale needed for serious capital mobilisation.
- **Shared sustainability standards** would lower transaction costs and safeguard access to international markets.
- **Greater integration of regional power grids** would allow bioenergy to complement other renewable sources, helping stabilise supply and support broader energy transitions.
- **Collective trade negotiations** would strengthen the region's position on sustainable aviation fuel export standards and market entry.
- **Coordinated planning on where to locate biorefineries** can optimise feedstock logistics and improve processing efficiency (Figure 9 and 10).

FIGURE 10

Feedstocks and Sustainable Aviation Fuel (SAF) pathways



Source: RSB (Roundtable on Sustainable Biomaterials), *Development of Sustainable Aviation Fuel in Ethiopia: A Roadmap* (Geneva: RSB, 2021).



KEY SECTOR 4

The blue economy



Market context and competitive advantage

SADC's extensive coastlines, which includes two large marine ecosystems (Benguela and Agulhas Currents), and numerous inland lakes and rivers, represent a rich aquatic resource base with exceptional market opportunities. The blue economy offers pathways to diversify beyond terrestrial agriculture, and create coastal, river and lakeside employment, while harnessing nature-based climate solutions (blue carbon ecosystems such as mangroves and kelp forests), and addressing food security through sustainable fisheries and aquaculture.

Currently, the blue economy contributes approximately 2% of SADC's GDP, equivalent to around US\$13–14 billion.³² This fails to capture the sector's potential contribution. Although some areas are overutilised, for the most part the blue economy is underdeveloped, with low value addition relative to SADC's aquatic resources and the livelihoods it could support. Where terrestrial agriculture and extractive industries face increasing climate stress and commodity price volatility, aquatic resources offer complementary diversification that could strengthen overall economic resilience given growing global demand for marine-derived products. Some Member States have already articulated and mapped this potential well; the Seychelles, for example, has created a strategic policy framework and road map for the sector.³³

SADC's relatively pristine marine environments and emerging sector development create first-mover opportunities before markets become saturated. However, sustainable management frameworks are essential: overfishing, plastic pollution and poor fishing practices can undermine this opportunity and destroy long-term value and community livelihoods.

KEY NUMBERS

57 million jobs

could be supported by Africa's blue economy by 2030

2% of SADC GDP

contributed by the blue economy in 2023

~US\$22 million

estimated value of South Africa's kelp value chain in 2023



Key sub-sectors of the blue economy

Artisanal fisheries and aquaculture

Opportunities include strengthening capacity in fish farming technologies, processing facilities and value addition to expand beneficiaries in fish value chains. Taking these steps could increase food security and diversify exports, since sustainable seafood commands premium prices in international markets.

Marine biotechnology

This includes creating cross-sectoral products and processes from marine organisms, ranging from agricultural inputs (biofertilisers, biopesticides) to healthcare applications (pharmaceuticals, nutraceuticals), alternative packaging materials and novel industrial compounds.

Trade and logistics infrastructure

This involves improving trade corridors, modernising ports and harmonising policies and quality standards to facilitate intra-regional fish trade and leveraging the African Continental Free Trade Area. Regional coordination can reduce transaction costs and enable SADC producers to access premium markets collectively.

Blue carbon ecosystems

SADC countries should protect and invest in mangroves, seagrass beds and kelp forests that

sequester carbon at rates exceeding terrestrial forests while also providing protection for coastal and estuary habitats as well as livelihood opportunities. Investment in restoration and conservation can help countries access carbon markets while delivering adaptation benefits that reduce climate-related fiscal losses, while simultaneously ensuring investment in the ecological infrastructure which underpin blue economy activity.

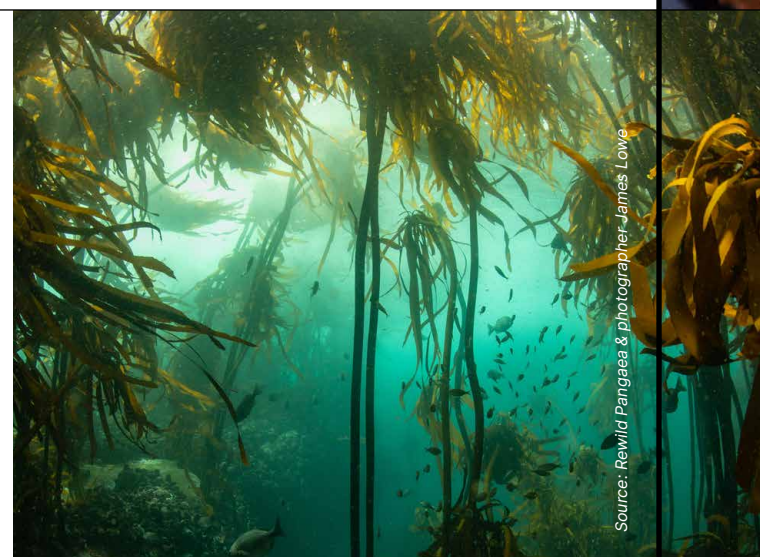
Marine renewable energy

Harnessing wind, tidal, wave and hydropower from coastal and aquatic sources can contribute to bridging energy gaps and strengthening energy security, particularly in coastal regions.

Seaweed and kelp cultivation

This is a rapidly scalable, relatively low-capital sub-sector of the blue economy. As seaweed and kelp can often be harvested without removing the stem, cultivation supports "seaforestation," allowing forests to regrow and persist, and offering incentives to invest in ocean conservation with substantial carbon sequestration co-benefits alongside their economic value and livelihood support (Box 4). However, while seaweed farming holds strong potential to contribute to sustainability objectives, the social and ecological risks of scaling up global production need greater attention to ensure just, equitable and sustainable industries.³⁴

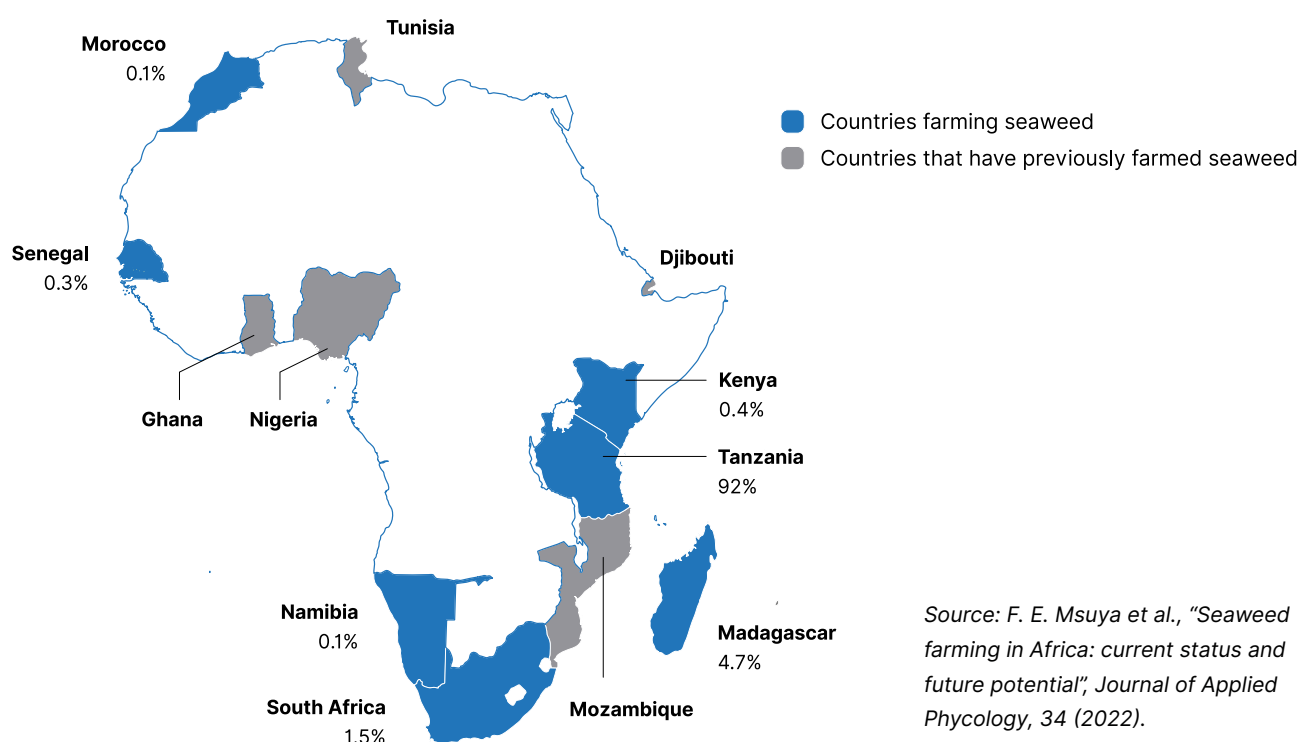
Kelp forests represent one of the blue economy's most promising renewable biomass resources. Along South Africa's West Coast, Rewild Pangaea is working with the Indigenous Nama community to restore degraded rangelands and former diamond-mining landscapes using native vegetation, while exploring kelp-based fertilisers and livestock feed as the foundation for new local bioeconomy value chains. Kelp-derived biostimulants can improve soil health and support more sustainable agricultural production, linking healthy marine ecosystems to the regeneration of degraded terrestrial landscapes. The wider initiative aims to restore 10,000 hectares of communal land and reinvest at least 60% of future revenues from nature credits into community-owned economic development.



Source: Rewild Pangaea & photographer James Lowe

BOX 4**SADC seaweed and kelp production**

Africa's total seaweed production is currently around 200,000 tonnes annually, mainly from Madagascar, Morocco, South Africa and Tanzania. The SADC region's output remains minor compared to the Asian market, which dominates global production. Seaweed has a wide range of uses beyond human consumption, which remains a primary global driver of demand. These include use as a biostimulant and biofertiliser in agriculture, as animal feed and as an input for cosmetics, pharmaceuticals, textiles and bioplastics.

FIGURE 11**Distribution of African seaweed farming (2018)**

Tanzania, and the island of Zanzibar in particular, has a relatively well-established industry, which is primarily focused on farming red seaweed species like *Kappaphycus* and *Eucheuma* for export, providing crucial livelihoods for coastal communities, especially women. South Africa's industry focuses more on the wild harvesting of red and brown algae (kelp) for the production of phycocolloids, abalone feed and agricultural biostimulants (such as that of Kelpak and Afrikelp).

The total South Africa value chain was worth R357 million (ZAR; c. US\$22 million) in 2023; 64% of biostimulant and liquid fertiliser products produced were exported.³⁵

Land-based integrated aquaculture is also developing, linking seaweed production with abalone farming. Kelp Blue in Namibia was recently awarded a 15-year commercial licence to cultivate giant kelp (*Macrocystis pyrifera*) offshore, highlighting the potential for large-scale projects.



Employment and economic potential

The blue economy offers diverse job opportunities across sectors including coastal and marine tourism, fisheries, seaweed and kelp farming, shipping, renewable energy, marine biotechnology and conservation.³⁶ By 2030, the blue economy is projected to create 57 million jobs across Africa, driven by growth in fisheries, aquaculture, marine biotechnology, and coastal and marine tourism.³⁷ This employment is especially significant for inclusive development and rural-coastal economic integration, as it often sustains livelihoods in coastal and lakeside communities where alternative economic opportunities are scarce.

In particular, the seaweed economy stands out for its economic potential, with farming creating accessible income opportunities for coastal communities and particular promise for empowering women who make up a large share of the labour force in some areas.³⁸ Analysis suggests that a strong expansion of the global seaweed industry could unlock substantial value and job creation, with a potential internal rate of return of over 20% for individual farms, attracting increased investment to the African continent.

The blue economy could support 57 million jobs across Africa by 2030, including livelihoods in coastal and lakeside communities where economic opportunities are often limited.



Strategic levers for regional coordination

To build the future of the SADC blue and seaweed economy, regional cooperation and international partnerships should be leveraged to develop coordinated strategies, attract investment and implement best practices. Organisations such as the African Union Development Agency New Partnership for Africa's Development, the World Bank and the FAO are working with Member States on programmes such as SADC PROFISHBLUE to build capacity, improve value chains and promote sustainable growth.³⁹

Scaling the industry will rely on the continued development of:

- **Harmonised fisheries management and aquaculture standards** can prevent a race to the bottom on overfishing as well as creating guidelines around development and regulation, R&D, product-market, and community participation and commercialisation.⁴⁰
- **Shared quality and certification systems** can make it easier for producers to trade within the region and access premium global markets. Collective negotiation under the African Continental Free Trade Area and in international fisheries agreements can strengthen SADC's bargaining position, and integrated coastal-zone management frameworks are essential for balancing economic opportunities with environmental integrity and the rights of coastal communities.
- **Regional marine biotechnology platforms** would allow countries to pool expertise and avoid duplicating research as they explore and commercialise marine-derived compounds.



KEY SECTOR 5

The circular and waste economy



Market context and competitive advantage

Sub-Saharan Africa currently generates the least amount of global waste, but its total waste is set to increase by 124% by 2050.⁴¹ Waste governance is generally weak and, currently, the collection rate in the region is less than 31%.⁴² Much of this sector is in the informal economy, making the value chain difficult to value and measure accurately, and largely fragmented and undercapitalised. However, the sector also presents the region with a unique leapfrogging opportunity: 50% of waste generated is organic, opening up space for the region to pioneer waste valorisation and green industrialisation.⁴³

SADC's rapid urbanisation is generating increasing waste volumes that strain municipal budgets and create environmental hazards. Meanwhile, the region imports significant quantities of materials (plastics, chemicals, fertilisers) that could be partially substituted through waste valorisation. The circular bioeconomy (Figure 12) can help transform waste from a cost centre into an economic opportunity, while at the same time addressing environmental challenges related to climate and land.

KEY NUMBERS

11 million jobs

could be supported by Africa's circular economy by 2030

50% of waste

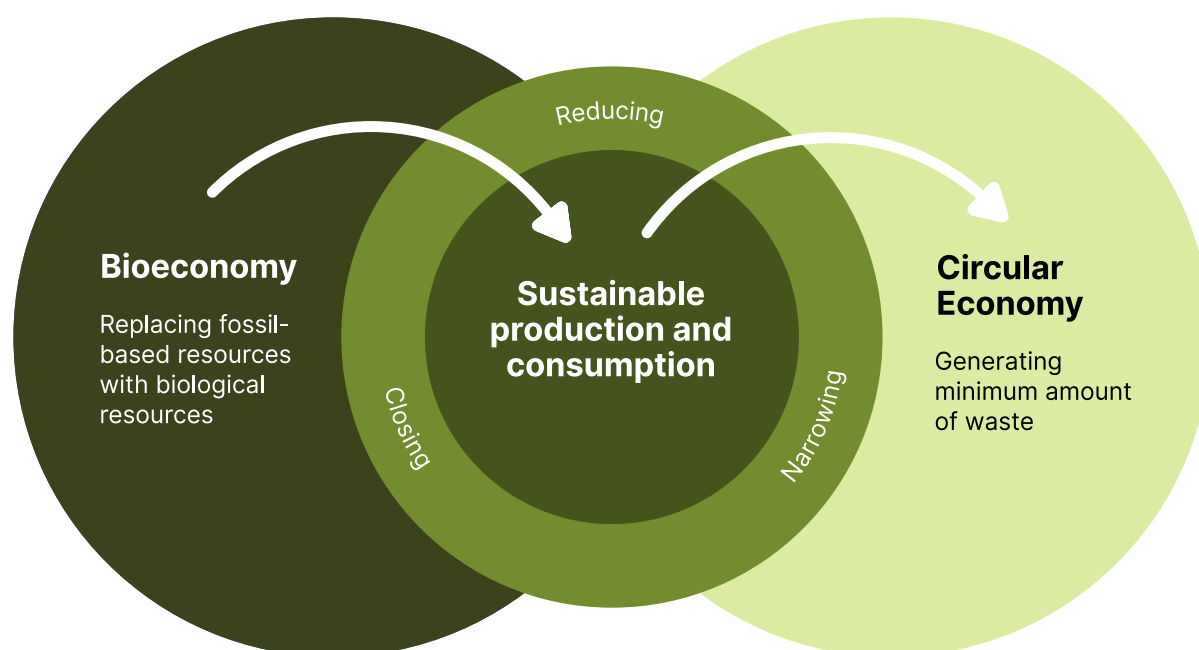
generated in sub-Saharan Africa is organic opening up space for the region to pioneer waste valorisation

2.2% of Africa's GDP

estimated contribution of circular economy strategies by 2030

FIGURE 12**The circular bioeconomy can turn waste streams into economic value**

The circular bioeconomy can help transform waste from a cost centre into an economic opportunity while simultaneously addressing environmental challenges.



Source: E. C. D. Tan and P. Lamers, "Circular bioeconomy concepts – a perspective", *Frontiers in Sustainability*, 2 (2021).

The SADC region is actively promoting a shift from linear "take-make-waste" models to a circular economy model, focusing on reducing waste, reusing resources and recycling materials to foster sustainable growth in the region. Key initiatives like the SADC Circular Economy and Extended Producer Responsibility platform,⁴⁴ led by the SADC Business Council, are developing strategies, policies and platforms to guide Member States and businesses in implementing these waste-to-wealth practices.

Actions include improving household waste separation, licensing facilities, promoting green procurement and tackling issues like e-waste and hazardous chemicals. Waste-to-value initiatives, such as South Africa's Waste Management Strategy (2020) and Namibia's biomass utilisation programmes, demonstrate how biomass resources central to the bioeconomy can be transformed into bioenergy, compost and other products. Where conventional waste management is purely a cost, the circular bioeconomy makes it revenue-generating, aligning fiscal and environmental objectives.



Key sub-sectors of the circular bioeconomy

Organic waste conversion

Municipal and agricultural organic waste can be transformed into compost, biogas, animal feed (via insect protein or mycoproteins) and biochemicals. This addresses waste management costs while producing valuable inputs for agriculture and energy.

Black soldier fly systems

Black soldier fly larvae are highly efficient bio-converters, with the ability to consume double to quadruple their body weight daily: a single black soldier fly larva can eat from 150 - 200 mg of organic waste per day; with a population of 10,000 larvae consuming roughly 1.8 to 2 kg of food scraps daily.⁴⁵ They transform the leftovers into odorless nutrient-rich frass (used as fertiliser) and the pupae can then be processed into a high-protein biomass suitable for animal feed. This reduces feed imports while solving waste challenges. Several SADC countries have emerging black soldier fly operations with strong growth potential.

Industrial symbiosis in agroprocessing zones

Clustering food processing, biomass energy and by-product utilisation facilities creates efficiency through waste-to-feedstock loops. One facility's waste becomes another's input. This has been seen in transforming banana and pineapple fibres for an extensive number of biopackaging applications from car dashboards, food packaging and hair fibres.

Plastic waste valorisation

While problematic environmentally, plastic waste streams can be converted to fuel or construction materials, or recycled – bridging towards eventual biobased plastic substitution.

E-waste processing

Growing electronic waste contains valuable metals and rare earths. Proper processing creates jobs while recovering materials and preventing environmental contamination.

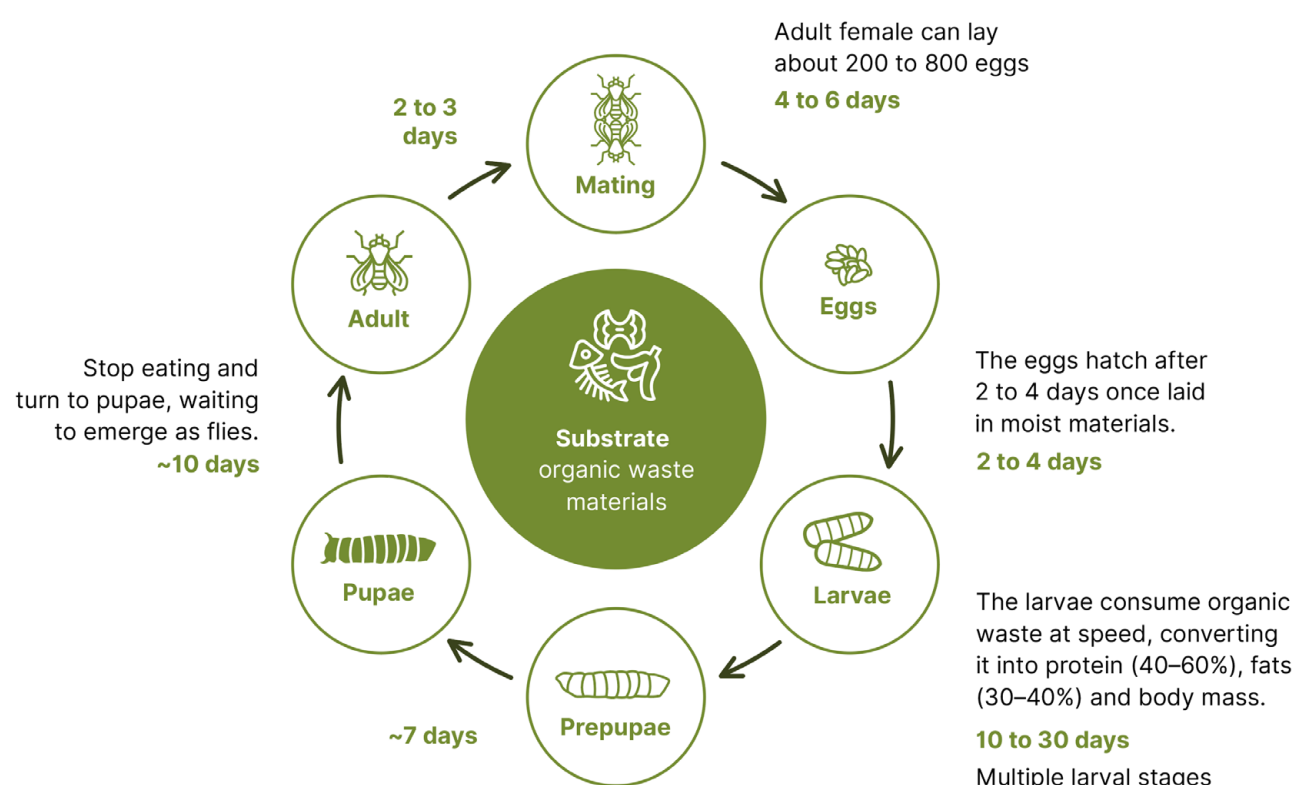
Tailings and wastewater treatment

Biotechnology and nanotechnology applications for mining tailings and industrial wastewater reduce environmental liabilities while potentially recovering valuable materials.

With half of sub-Saharan Africa's waste made up of organic material, the region has a significant opportunity to turn growing waste streams into valuable inputs for agriculture, energy and industry.

FIGURE 13**The life cycle of the black soldier fly**

This diagram illustrates the complete metamorphosis stages of a black soldier fly, starting from the egg stage, through multiple larval stages, pupation and culminating in the adult form.



Source: M. Salahuddin, A. A. A. Abdel-Wareth, K. Hiramatsu, J. K. Tomberlin, D. Luza, and J. Lohakare, "Flight toward sustainability in poultry nutrition with black soldier fly larvae", *Animals*, 14 (2024)



Employment and economic potential

As part of the broader circular bioeconomy, this sector spans bioremediation,⁴⁶ recycling, and the transformation of waste materials into new products, energy or services. These activities support diverse job opportunities across technical, operational and ecosystem-management roles. Skills in environmental science and management, ecology, waste engineering, biotechnology, conservation biology and related fields are increasingly important as the sector expands.

The circular economy is already generating jobs in SADC across waste management, sustainable

agriculture and eco-industrial development.

Examples include food waste and recycling jobs in South Africa and Zambia, and green manufacturing opportunities in Zimbabwe.

At scale, circular economy strategies could create 11 million jobs across Africa and raise Africa's GDP by 2.2%, while linking the region to a global market valued at over US\$500 billion. There are also important overlaps with insect and blue economies – for instance, the use of black soldier flies in organic and agricultural waste management. The rich protein larvae can also be sold as a key ingredient in animal feed as well as in nanotechnology being applied to tailings management and water treatment.

The MycoHab project in Windhoek, Namibia, demonstrates a biobased value web in practice. Completed in 2024 and developed by redhouse studio with MIT for Standard Bank Group, MycoHab is the world's first self-supporting structural mycelium building.

The process uses harvested encroacher bush to grow edible mushrooms before transforming the spent substrate into structural mycelium blocks. In total, the project converted 12 tonnes of encroacher bush into 3 tonnes of food for market and 925 building blocks.

The mycoblocks achieved net storage of 12 tonnes of CO₂, while bush harvesting supported the regeneration of 1.3 hectares of grassland. Together, these outcomes show how a single biomass feedstock can generate food, sustainable construction materials, carbon storage and ecological restoration.



Source: redhouse studio and the MycoHab team.

BOX 5**Economic benefits of integrating circular economy principles into the bioeconomy**

- **Resource efficiency:** Cascading biomass use across multiple value chains reduces waste generation and lowers demand for virgin raw materials. This, in turn, cuts municipal waste management costs, delivering immediate fiscal savings for local governments.
- **Employment opportunities:** Recycling, bioprocessing, waste valorisation, bioremediation technologies and sustainable agriculture create new jobs and open opportunities for enterprise development.
- **Innovation and resilience:** Circular bioeconomy models drive biotechnological and digital innovation, strengthening the competitiveness of domestic industries while building resilience against supply chain disruptions.
- **Trade and balance of payments:** By substituting imported raw materials and products with domestically produced bio-based alternatives, circular economy approaches strengthen the balance of payments and reduce exposure to external price volatility.

**Investment requirements and returns**

Circular economy investments range from low-capital options, such as community-scale composting and small black soldier fly systems, to capital-intensive ventures, such as industrial-scale waste processing and biorefineries, with return profiles and payback periods varying accordingly. Policy frameworks that mandate waste separation, extended producer responsibility schemes and green procurement create stable demand for circular economy products and services, de-risking investment and helping attract both public and private capital.

The sector's alignment with global sustainability and carbon reduction trends also makes it attractive to impact investors, with blended finance structures increasingly used to lower investment thresholds and bridge early-stage ventures towards bankable, revenue-generating operations. South Africa's proposed blended-finance Waste Infrastructure Fund illustrates this approach in a SADC context, combining public and private capital to fund waste-to-value projects that convert disposal costs into recovered revenue.⁴⁷



Strategic levers for regional coordination

The circular and waste economy remains a major untapped opportunity to transform waste streams into higher-value inputs across regional industries. Realising this will require:

- **Harmonised waste classification and regulatory frameworks**, mandating waste separation, extended producer responsibility and green procurement through platforms like the SADC Circular Economy framework. This can help transform practices around e-waste and hazardous chemicals, and create stable
- **Targeted skills training** for circular economy jobs, such as waste engineering, materials recovery and environmental management, that will become essential as the sector expands and formalises.
- **Shared quality and certification standards for secondary materials**, making it easier for producers to trade recovered inputs across borders and access premium markets that demand verified, high-quality recycled content.

Dried (left) and wet (right) mycoprotein produced by South African biotechnology company MycoSure. Using submerged fermentation, fungal mycelium rapidly converts renewable biological feedstocks into a nutrient-dense protein biomass for food ingredients. The technology demonstrates how biotechnology can transform biological resources into high-value products that strengthen food security, reduce the environmental footprint of protein production and create new bio-based manufacturing opportunities.



Source: MycoSure.



KEY SECTOR 6

The wildlife-based and biodiversity economy



Market context and competitive advantage

SADC's extraordinary megafauna and flora, and protected areas are globally significant ecological assets that generate economic value through tourism, hunting, wildlife ranching, bioprospecting and derived products (Figure 14). The wildlife-based economy demonstrates that conservation can be economically productive rather than purely a cost, aligning environmental and development objectives. Research by the African Leadership University's School of Wildlife Conservation shows that wildlife can be treated as an investable economic asset that drives inclusive growth and conservation outcomes across Africa especially with growing consumer demand for authentic wildlife experience.⁴⁸

The region is also advancing its own policy foundation through the SADC Wildlife-based Economy Strategy Framework,⁴⁹ which aims to scale nature-based value chains and strengthen community benefits and cross-border cooperation. Transfrontier Conservation Areas expand this cooperation by linking landscapes and creating opportunities for shared tourism, trade, conservation financing and livelihood models.

KEY NUMBERS

**4.6 % of
SADC GDP**

estimated contribution
of wildlife-based
economies in 2023

95,000 jobs

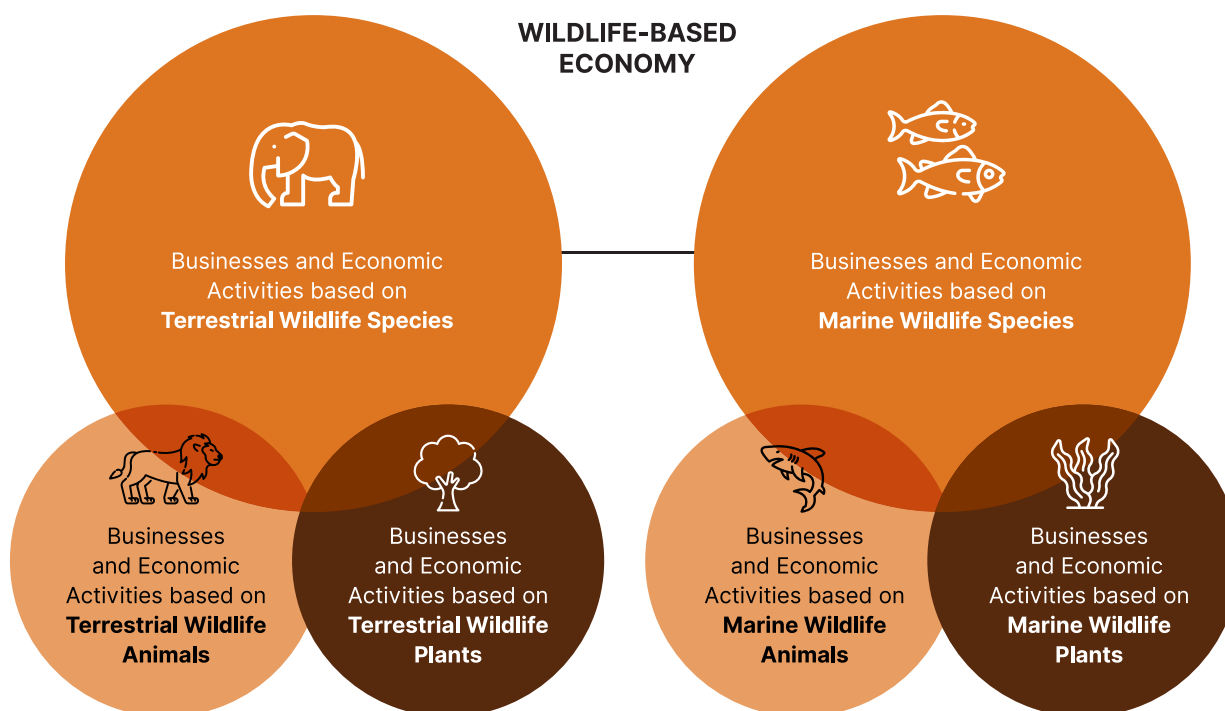
supported by hunting
tourism in South Africa

**US\$42.9
billion total
revenue**

from wildlife-based safari
tourism across Africa

FIGURE 14

Diagrammatic depiction of the definition of a wildlife-based economy



Source: SADC, Wildlife-based Economy Strategy Framework.



Key sub-sectors of the wildlife-based bioeconomy

Wildlife-based tourism

SADC's unparalleled biodiversity and megafauna attract high-value ecotourism, particularly from Europe, North America and increasingly, Asia. However, overtourism and benefit leakage to foreign operators can undermine sustainability and local support. Post-COVID recovery offers a reset opportunity to strengthen community participation and sustainability standards but also to secure more private sector investment in conservation to prevent single revenue business models.

Hunting and wildlife ranching

Regulated hunting on private and communal lands generates revenue while incentivising conservation. Wildlife ranching provides sustainable protein while maintaining biodiversity.

Conservation-linked carbon and biodiversity credits

Protected wildlife areas qualify for carbon and biodiversity finance, creating revenue streams that fund conservation while demonstrating the economic value of intact ecosystems.

Non-timber forest products

Honey, essential oils, medicinal plants and specialty foods can diversify rural income. South Africa's Aloe Ferox value chain demonstrates this potential (Figure 15).

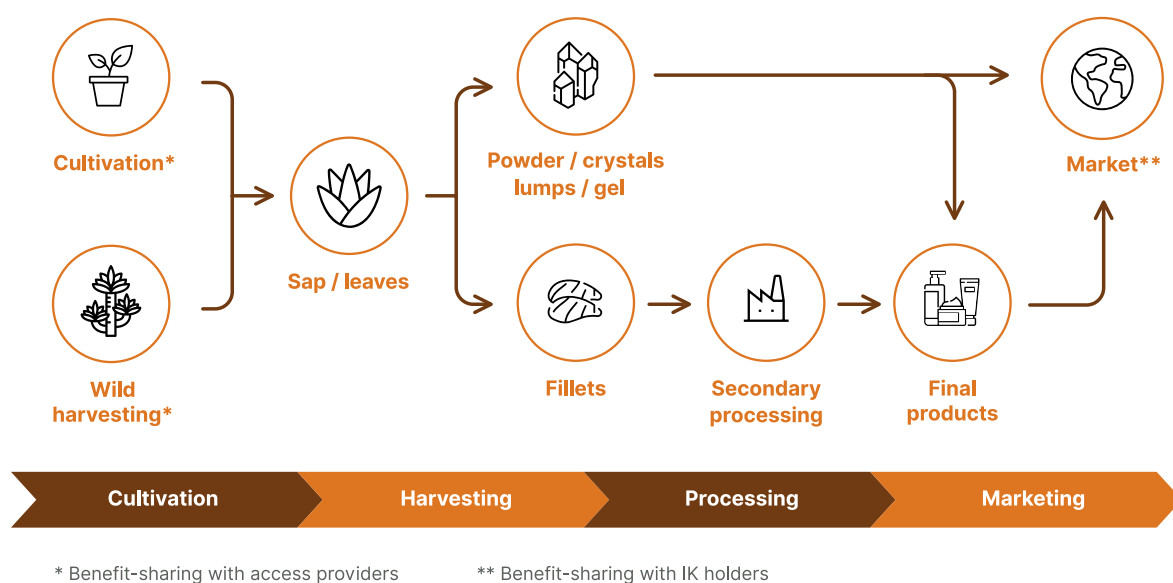
Bioprospecting and natural products

SADC's biodiversity provides genetic resources for pharmaceuticals, cosmetics and agricultural applications. Equitable benefit-sharing with communities is essential for social license and sustainability (Box 6).

FIGURE 15

Aloe Ferox bioprospecting value chain

Typical value chain for South Africa's Aloe Ferox industry, from wild harvesting and cultivation through processing to final products, showing benefit-sharing points with access providers and indigenous knowledge holders.



Source: Department of Planning, Monitoring and Evaluation, South Africa, "Typical value chain: Aloe ferox industry".

BOX 6**South Africa's Access and Benefit-Sharing framework for local beneficiation and value addition**

South Africa is a leader in the Nagoya Protocol on Access and Benefit-Sharing, which aims to ensure that the benefits from use of genetic resources are shared equitably. It is both a primary provider of genetic resources and a proactive enforcer of Access and Benefit-Sharing regulations. Ratifying the Protocol in 2013, South Africa was one of the first countries to implement strict bioprospecting laws, protecting indigenous knowledge and setting global benchmarks for equitable benefit-sharing with local communities.

To harness the country's rich biodiversity and indigenous knowledge while ensuring fair benefits for local communities, South Africa has implemented an Access and Benefit-Sharing framework aligned with the Convention on Biological Diversity. Its key objectives are promoting local beneficiation, enhancing the economic value of biological resources by ensuring benefits from their use are shared with local communities, and preventing biopiracy by protecting South African biodiversity from unauthorised exploitation.

Even before the Nagoya Protocol was formally adopted in 2010, South Africa had enacted the National Environmental Management: Biodiversity Act and its associated Bioprospecting, Access and Benefit-Sharing Regulations (2008),⁵⁰ governing access to genetic resources and traditional knowledge. In the formal negotiations for the Protocol, South Africa served as a key negotiator, representing a Pan-African voice in setting international Access and Benefit-Sharing standards.

These policies have translated into real economic benefits for indigenous communities. The best-known example is the Rooibos Benefit-Sharing Agreement of 2019 with the Khoi and San people, in which the industry committed to sharing a benefit levy of 1.5% from the farm gate price of Rooibos, recognising the role of traditional knowledge and decades of cultivation expertise.⁵¹ This case grounded the importance of Free, Prior and Informed Consent as an ongoing, dynamic process rather than a one-time event.

This enabling policy is supported by initiatives such as Biowatch South Africa, which assists local communities in negotiating fair terms with businesses interested in accessing biodiversity, as well as the Biodiversity Economy Strategy,⁵² which trains local farmers and entrepreneurs in sustainable harvesting techniques and product development.

South Africa's Access and Benefit-Sharing framework exemplifies a strategic approach to harnessing biodiversity for economic development while safeguarding ecological infrastructure and traditional knowledge and preventing biopiracy. By promoting local beneficiation and equitable benefit-sharing, South Africa offers a model for other nations balancing biodiversity conservation with socioeconomic development.



Employment and economic potential

Current wildlife-based economy employment in SADC is not systematically reported, but the sector is estimated to contribute about 4.6% of the region's GDP, underscoring its significance for livelihoods and rural economies.⁵³ Recent studies show that hunting tourism contributes approximately US\$2.5 billion per year⁵⁴ to South Africa's economy and supports around 95,000 jobs. Across the continent, wildlife-based tourism generates roughly US\$42.9 billion⁵⁵ annually and is a major employer in rural areas.

The wildlife-based economy provides employment for skilled, semiskilled and unskilled workers, including many women, and supports local livelihoods and SMME development. Wildlife-based tourism, inland and marine fisheries, wildlife ranching and farming, bioprospecting, natural forestry and plant-based products all present livelihood opportunities, with related value chains offering extensive employment multipliers.

By 2030, the SADC Wildlife-Based Economy Strategy Framework envisions a globally recognised, sustainable wildlife-based economy that drives job creation and inclusive growth. It identifies country-specific value chains with strong employment potential: South Africa in game meat and beekeeping; Madagascar in honey; Angola, Mozambique and Zambia in timber; Botswana and others in hunting; Mauritius in game ranching; and Malawi and the DRC in wildlife tourism.



Investment requirements and returns

Wildlife-based economy investments include tourism infrastructure (lodges, access roads, interpretation centres), community conservancies, anti-poaching systems and bioprospecting R&D. Community ownership, participation and equitable benefit-sharing models are critical. Wildlife-based economies fail without local buy-in and equitable benefit-sharing.

Returns manifest through direct employment, capacity-building, enterprise opportunities for local businesses, conservation funding and positioning SADC as a premier sustainable tourism and wildlife-based product destination.

Current wildlife-based economy employment in SADC is not systematically reported, but the sector is estimated to contribute about 4.6% of the region's GDP, underscoring its significance for livelihoods and rural economies.



Strategic levers for regional coordination

Despite the economic opportunities, the wildlife-based economy faces challenges, including human–wildlife conflict, poaching and illegal wildlife trade, ownership and benefit-sharing models that do not always equitably address local communities, and climate-driven ecosystem stress. Unlocking the full potential of SADC's wildlife based economy equitably will require continued regional coordination and community-centred models that treat local communities as rightful beneficiaries and active stewards.

Stronger regional coordination is essential to unlock the potential of SADC's wildlife-based economy including:

- **Formation of a Technical Implementation Group for the SADC Wildlife-Based Economy Strategy Framework**, to coordinate implementation across member states and align national efforts with regional priorities.
- **Support for Transfrontier Conservation Areas**, which create landscape-scale tourism and trade opportunities and allow wildlife to move across borders, strengthening ecological resilience and shared economic benefits.
- **Regional certification systems** for sustainably sourced wildlife products, which can improve market access and support premium pricing.
- **Shared research platforms** on human–wildlife conflict and climate adaptation, enabling countries to pool expertise and tackle common challenges more effectively.
- **Joint tourism branding and marketing**, positioning SADC as an integrated destination rather than a set of competing countries, and enhancing visibility and competitiveness in global markets.



Source: African Baobab Alliance.

Baobab is one of Africa's fastest-growing bioeconomy value chains. Harvested from wild baobab trees, the fruit can be processed into high-value ingredients for the food, beverage, cosmetics and personal care industries, creating rural incomes while incentivising biodiversity conservation.

The African Baobab Alliance brings together producers, processors, researchers and businesses from across the continent to strengthen quality standards, improve processing technologies and expand international markets. Capacity-building workshops bring together leading baobab producers from across Africa to share knowledge, strengthen local processing capacity and support the growth of a sustainable regional baobab industry.



Mainstreaming
the bioeconomy

From individual sectors to a regional strategy

Building a whole-of-government approach across SADC

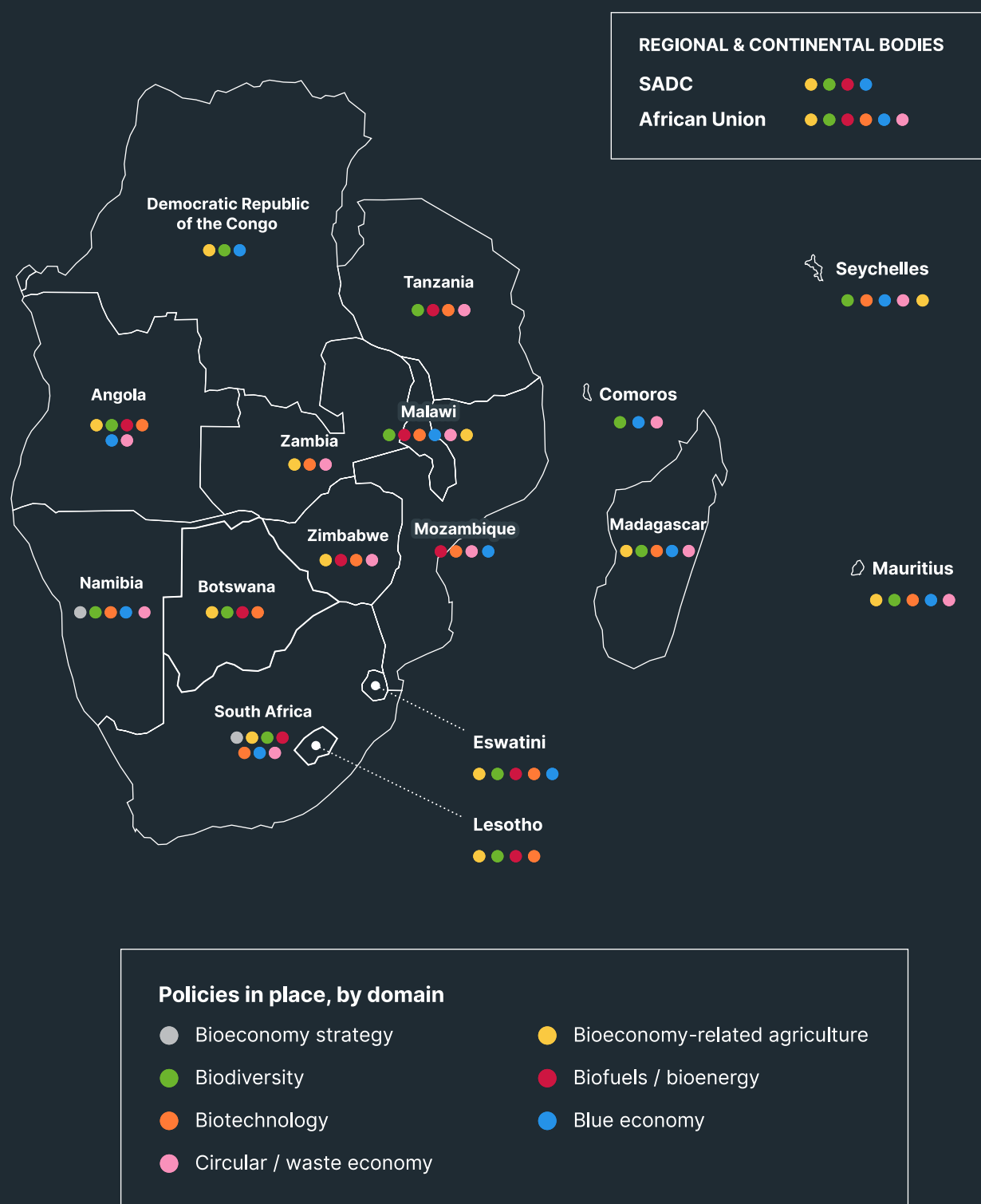
The bioeconomy's full potential will not be realised through sectoral initiatives alone. Individual countries pursuing isolated sector development face higher costs, limited scale and weaker market competitiveness. A more coordinated SADC approach can help pool resources, harmonise standards, locate infrastructure strategically and strengthen the region's negotiating position.

Strong regulatory frameworks and institutions are therefore central to a thriving bioeconomy. They set investment priorities, mobilise capital, channel finance toward strategic industries and create the enabling conditions for investments that can benefit populations for generations. SADC Member States have established diverse bioeconomy-related policy frameworks across multiple sectors, as shown in Figure 16 (see Annex 2 for full details).

The real opportunity now lies in deliberately mainstreaming the bioeconomy as a core economic strategy, moving from fragmented initiatives to a coherent, whole-of-government regional approach that gives investors confidence and unlocks the region's market potential.

FIGURE 16

SADC member states are already implementing bioeconomy-related policies



Source: Authors' creation.

SADC has strong foundations for the bioeconomy

Figure 16 clearly shows that the Southern African bioeconomy is evolving along multiple, interconnected pathways, each reflecting different levels of technological intensity, investment readiness and policy maturity. Most SADC countries anchor bioeconomy-related policies across agriculture, indigenous knowledge and practices, biofuels and bioenergy, biodiversity and biotechnology, with a growing number expanding into the blue economy and circular economy sectors. Many SADC countries have also integrated bioeconomy-relevant issues into sectoral strategies. This means that the region has begun to build an enabling environment to grow and scale bioeconomy sectors.

Beyond these enabling policies, SADC countries already score quite well on the Bioeconomy Readiness Index (BRI) (Figure 17) which assesses countries' capacity to leverage and scale bioeconomy development based on four critical determinants.⁵⁶ These are:

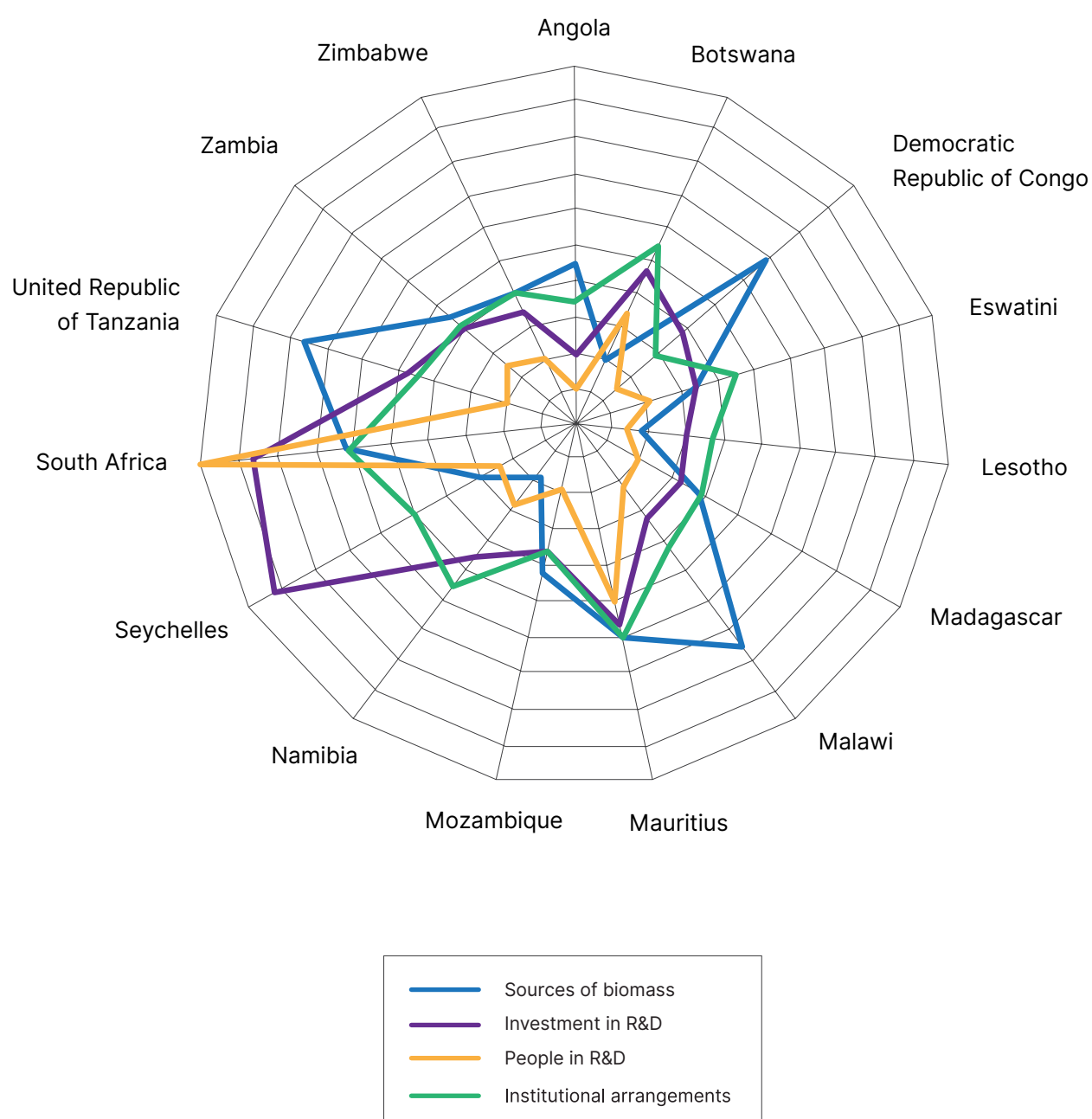
- **Sources of biomass:** Biological resources that can substitute for fossil resources.
- **Investment in R&D:** Funding for the development and commercialisation of bioeconomy products and processes.
- **People in R&D:** Human capital with sufficient knowledge to add value across bioeconomy value chains.
- **Institutional arrangements:** Systems enabling competitive implementation of bioeconomy solutions.

For Africa as a whole, the top countries in terms of readiness to adopt the bioeconomy as climate action are South Africa, Kenya, Mauritius, Rwanda and Morocco. In general, although many African countries have relatively abundant natural biomass, they are poorly equipped for full adoption and economic diversification, largely due to low investment in R&D and lack of people employed in R&D. The key challenges to the bioeconomy's development on the continent are low government spending on R&D, lack of patent applications, insufficient numbers of researchers and technicians in R&D, lack of collaboration between universities and industry and underdeveloped institutional arrangements, especially in relation to the rule of law and the quality of infrastructure.⁵⁷

South Africa, one of the only African countries with a dedicated bioeconomy strategy,⁵⁸ has the highest BRI score on the continent, speaking to the importance of an enabling policy environment. The country's 20-year bioeconomy journey offers instructive lessons (Box 7). Beginning with a biotechnology strategy in 2001, establishing coordinated institutions in 2009 and adopting a comprehensive bioeconomy strategy in 2013, South Africa now sees the bioeconomy contribute 8.3% of GDP and provide 1.2 million–1.5 million jobs. South Africa's experience demonstrates that the bioeconomy is a viable industrialisation pathway that delivers jobs,⁵⁹ exports and climate resilience.

FIGURE 17**SADC countries show different levels of bioeconomy readiness**

The Bioeconomy Readiness Index reveals SADC's strong existing potential to develop the bioeconomy across its four determinants: sources of biomass, investment in R&D, people in R&D and institutional arrangements (Oguntuase and Adu, 2021).



BOX 7**Key lessons from South Africa's experience**

- 1. Identify market opportunities first:** Understanding demand, both domestic, regional and export, guides investment toward commercially viable sectors and value webs.
- 2. Build national innovation systems:** Coordinated R&D infrastructure (like CSIR), pilot facilities and commercialisation support bridge the gap between laboratory discoveries and market-ready products, and are critical enablers for national and regional ecosystems.
- 3. Recognise that local markets alone are insufficient:** Trade orientation must be embedded from the start. Biobased products often need scale to compete with established fossil-based alternatives, requiring regional market access.
- 4. Support indigenous knowledge holders:** Equitable benefit-sharing with communities creates social licence, protects intellectual property and ensures sustainable access to genetic resources.
- 5. Maintain an all-of-government approach:** Bioeconomy development requires coordination across finance, trade, industry, science, environment and agriculture ministries, not siloed sectoral initiatives.
- 6. Acknowledge that long-term commitment is required:** Bioeconomy development spans electoral cycles. Political commitment, institutional continuity and patient capital are essential for transformative outcomes.

However, even for regional leaders, challenges remain. South Africa's R&D expenditure in 2020–2021 was 0.6% of GDP, and the trajectory is trending downwards. Even with this relatively low level of public R&D investment, South Africa ranks 30th globally on the ThinkBiotech Biotechnology Innovation Scorecard, ahead of countries including Hungary and Poland, despite those countries investing approximately 1.5% and 1.6% of GDP in R&D, respectively.⁶⁰

A core challenge is boosting business participation and private investment and effectively translating investments in R&D into widespread innovation for inclusive growth. By contrast, the post-World War II R&D intensity that drove rapid expansion in the economy of the United States peaked at 80% government R&D

expenditure immediately after the war, declining gradually as business sector expenditure rose.⁶¹ In the 10–20 year period in which this shift took place, the US became a global technology leader. This underscores the catalytic role of strategic public R&D investment in creating conditions for subsequent private sector leadership.

Although launched after the BRI study, Namibia's Sustainable Bioeconomy Strategy 2024–2029⁶² means that two SADC countries now have dedicated bioeconomy strategies, and others are in development. South Africa and Namibia's experiences demonstrate how targeted frameworks can mobilise resources, guide investment and coordinate cross-sectoral initiatives in ways that sectoral policies alone cannot.

Despite different contexts, South Africa and Namibia share three priority areas that could inform national strategies elsewhere, as well as a future regional framework:

- **Agroprocessing and rural enterprise development:** Both countries are investing in value addition, innovation platforms and support for smallholder integration.
- **Climate-smart agriculture:** Both strategies prioritise adaptation through drought-resistant crops, agroforestry and regenerative practices.
- **Marine bioeconomy:** As two of Africa's largest exporters of seaweed and kelp, both countries are well-positioned to scale marine bioeconomy initiatives, demonstrating sector-specific regional collaboration potential.

These shared priorities highlight the potential for a coordinated SADC bioeconomy strategy that builds on national strengths while promoting inclusive and sustainable growth across the region.

Strategies to promote the bioeconomy in Africa must focus on targeted investments to support R&D activities, building efficient innovation systems, improving the level of education, training and skills related to the bioeconomy and supporting market development to enhance competitiveness. To attract foreign investment into the bioeconomy sectors, African countries also need to improve general governance, the quality of their infrastructure and the rule of law.⁶³

What this policy mapping and readiness demonstrates is that while the region has a good enabling environment and the potential to grow a transformative bioeconomy, unlocking that potential in SADC requires supportive regulatory frameworks, coordinated institutions and strategic financing mechanisms that function coherently across national and regional levels.



At South Africa's CSIR, a researcher conducts a carbon-dioxide mineralisation test in the biodegradation testing laboratory. The automated respirometric system measures the carbon dioxide released as microorganisms break down a material, enabling the CSIR to assess the complete biodegradability of biobased materials and biodegradable products under simulated compost, soil, freshwater, marine and anaerobic-digestate conditions.

This type of testing infrastructure provides the evidence needed to verify biodegradability claims and support the development of bio-based materials for market use. It is part of the wider capability required to build circular value chains: linking product innovation and local manufacturing with credible standards, environmental performance and consumer confidence.

Regional coordination can create scale

While an enabling policy convergence can be seen across the region, per Figure 16, national policies do not necessarily align with regional priorities. Added to this, unclear definitions create confusion in implementation while overlapping mandates generate bureaucratic friction. At both the national and regional levels, a lack of clear prioritisation holds back efforts to drive forward coherent initiatives.

The result is fragmented investment signals that continue to favour incumbent fossil fuel industries, and uncertain regulatory environments that deter patient capital – all of which are missed opportunities for regional scale. A more integrated and harmonised approach could align national and regional priorities and unlock the economic and job creation potential of the bioeconomy in the region by improving coherence and institutional support for the growth of the bioeconomy. Regional agreements, strategies and institutions can amplify national bioeconomy efforts, provide coherence and scale to country-level bioeconomy initiatives, help meet international commitments and leverage regional competitive advantages on the global stage.⁶⁴

If the bioeconomy is to become a leapfrogging and resilience pathway for SADC, industrial, trade, climate, labour and regional integration policy levers must be used in a coordinated way. This is fundamentally an economic growth strategy, and so must be led by ministries of finance, trade and industry and national planning commissions, not solely by environment, agriculture or science ministries. Importantly, many of these levers already exist; the bioeconomy provides a unifying framework to align and deploy them more strategically.

Several regional policies, strategies and initiatives already provide foundations for enhanced

bioeconomy coordination. These include the SADC Biofuels Framework and the Regional Agricultural Policy, the SADC Wildlife-Based Economy Strategy Framework and the SADC Blue Economy Strategy.

However, at the moment, disconnect between regional frameworks and national implementation limits effectiveness. To translate regional ambitions into country-specific action, policy integration must be formalised through clear and coherent links, agreements and institutional connections to national strategies and implementing agencies. Building regional scale makes it easier to ensure circularity in the bioeconomy – for example, greater collection of agricultural waste as a biomass feedstock is critical for the technological and economic feasibility of biofuels or biochemical production.

Beyond policy, the SADC Secretariat plays an important role in facilitating knowledge exchange, joint research and policy harmonisation. Institutions like SANBio pool expertise and resources across borders and can act as incubators for bioeconomy efforts in health, agriculture and industrial biotechnology. SANBio is already a key regional collaboration and infrastructure sharing platform, operating on a “hub and node” model, with the CSIR in South Africa serving as the central hub. This allows 12–13 Member States (including Botswana, Malawi, Namibia and Zimbabwe) to share world-class laboratory facilities and multidisciplinary expertise that individual countries might lack.

Regional financing initiatives like the Protocol on Finance and Investment and the SADC Business Council are broad in scope and do not directly target the bioeconomy, but they could offer useful entry points. For example, the 2023 Memorandum of Understanding between SADC and the SADC Business Council to strengthen private sector collaboration could be leveraged to attract bioeconomy investment in areas such as agriculture and biotechnology.⁶⁵

Political momentum and business leadership must also be harnessed. The bioeconomy was explicitly named as a key lever for achieving sustainable, resilient and climate-responsive economies and supply chains in the South Africa B20 final communique in 2025, which called on countries to “integrate circular and bioeconomy value chains by linking energy, water and agriculture systems to create jobs, deepen industrial competitiveness and cut emissions”⁶⁶. Whether through public procurement initiatives (such as the BioPreferred Program in the United States), tax incentives or incentives for private sector bioeconomy R&D, the region should capitalise on this momentum to capture the SADC bioeconomy opportunity.

Likewise, regional development finance institutions such as the AfDB and the Development Bank of Southern Africa (DBSA) can play an active market shaping and development role – de-risking regional markets, investing in new industries or helping existing industries to transition and diversify toward bioeconomy development across the region. Development finance can be guided towards investments which demonstrate the interdependence of grey and green infrastructure.

Integrating the bioeconomy in the SADC Industrialisation Strategy and Roadmap

The SADC Industrialisation Strategy and Roadmap (SISR) calls for shifting SADC from a commodity-dependence economic model to diversified, value-added, innovation-driven economies, through mutually reinforcing pillars:

building industrialisation as a catalyst for transformation; enhancing competitiveness; and furthering regional integration including emphasising on sustainable resource use.⁶⁸ The bioeconomy is the mechanism that connects all three, turning natural capital into competitive, low-carbon industrial systems.

The bioeconomy is a form of green industrialisation that offers leapfrogging opportunities across multiple sectors, which can be leveraged regionally by:

- 1. Mapping regional biobased value webs (not just value chains).**
 - 2. Developing flagship bioindustrial clusters and corridors.**
 - 3. Aligning science, technology and innovation systems around biotech and biodata platforms.**
 - 4. Creating a regional bioeconomy investment facility.**
-

The SISR points to a number of sectors ready for industrial cluster development, such as agroprocessing, pharmaceuticals and the blue economy. The bioeconomy is a seamless fit for the SISR, but the opportunity needs to be explicitly and systemically identified to be investment-ready. Clear examples of how to maximise value per unit of biomass across regional and transboundary value webs, whether through biorefineries, agroindustrial parks, circular industrial parks, multi-product biomass utilisation or waste-to-value systems need to be outlined; in other words, clear road map thinking is needed on how to translate national industries into biobased production systems to make them more scalable and competitive.

The region already has an enabling policy environment to realise this opportunity. Member States are increasingly embedding bioeconomy-related goals within national development strategies and policies and aligning them with broader agendas. Mainstreaming the bioeconomy across the region is last lever to unlocking this green industrial leapfrogging opportunity.

What effective mainstreaming requires

Mainstreaming the bioeconomy across SADC will require both the political will to prioritise it and the institutional mechanisms to translate that will into action.

1. Align economic and sectoral priorities

Bioeconomy development requires coordinated action across finance, trade and industry, national planning, central banks, and science and technology institutions to align incentives, investment frameworks, industrial and economic development strategies, infrastructure planning and innovation systems.

To attract investor capital and create predictable operating environments, policy alignment is needed – so bioeconomy priorities need to be reflected in development agendas, industrial and trade policies, fiscal and monetary planning and green taxonomies and in Nationally Determined Contributions (NDCs) and National Biodiversity Strategy and Action Plans (NBSAPs).

Botswana's Sir Seretse Khama International Airport Special Economic Zone illustrates how targeted industrial infrastructure can support domestic value addition and connect bioeconomy industries to regional and global markets. The flagship mixed-use zone includes a dedicated agri-industry precinct for agriculture and agroprocessing, including horticulture, aquaculture and floriculture, alongside pharmaceutical manufacturing, logistics and other industries. Located next to Botswana's largest international airport, the zone is designed to bring production, processing and export infrastructure together in one investment-ready ecosystem.



2. Embed the bioeconomy in national development commitments

Embedding bioeconomy priorities within NDCs, NBSAPs and Sustainable Development Goal (SDG) action plans positions bioeconomy investments to attract concessional climate finance by clearly linking them to mitigation and adaptation commitments.

It also establishes the monitoring and accountability systems that strengthen domestic policy implementation and provide the transparency investors expect. Importantly, integrating the bioeconomy into these high-level commitments elevates it to a national priority with presidential and ministerial backing, unlocking cross-government coordination and access to global technical support.

Brazil's inclusion of the bioeconomy in its NDCs and NBSAPs offers an instructive model. Embedding bioeconomy development within international climate and biodiversity commitments allowed Brazil to achieve three objectives: demonstrate practical pathways for meeting climate and nature goals, enable cross-governmental collaboration with the bioeconomy as a national priority backed by presidential authority and unlock access to international climate finance that would otherwise remain unavailable.⁶⁸

3. Establish cross-government governance mechanisms

Using a whole-of-government approach can create the fiscal, regulatory and technological conditions needed for a competitive and scalable regional bioeconomy. This requires coordination across ministries and agencies with responsibility for finance, trade, industry, science, environment, agriculture, infrastructure and skills.

South Africa's Just Energy Transition Partnership offers one example of how a cross-cutting government cooperation and finance mobilisation mechanism can mainstream a transition agenda as a national priority across government ministries.

4. Create investment-ready ecosystems

Special Economic Zones (SEZ) focused on the bioeconomy sectors offer another proven mechanism for concentrating investment, streamlining approvals and creating demonstration effects.

SEZs can provide targeted incentives such as tax holidays, infrastructure provision and streamlined permitting for biorefineries, biotech clusters or circular economy industrial parks. This can help de-risk early-stage development while building sectoral ecosystems.

Turning policy into implementation

Mainstreaming requires institutional mechanisms, not just policy documents. Effective bioeconomy development requires governance structures with real authority, which means establishing inter-ministerial coordination committees with dedicated secretariat support, decision-making power and their own budget lines, complemented by high-level presidential or prime-ministerial councils that can resolve inter-agency bottlenecks and provide sustained backing.

National budgets should include explicit bioeconomy allocations to move beyond ad-hoc funding, while performance agreements for permanent secretaries should incorporate concrete delivery targets to drive national accountability. At the regional level, a SADC bioeconomy coordination mechanism can harmonise national approaches, align infrastructure planning, facilitate policy exchange and present a unified voice in continental and global negotiations.

With the right fiscal strategy and institutional mechanisms, revenues from extractive industries can be channelled into building a more resilient, renewable economic base. Presently, SADC countries are experiencing growing demand for critical minerals alongside ongoing fossil fuel extraction, but this does not have to conflict with bioeconomy development.

Windfall taxes on mineral exports, carbon-pricing mechanisms and targeted levies on high-emission sectors can be used to fund bioeconomy R&D, provide concessional finance for biobased SMMEs, invest in processing and biorefining infrastructure, pay for skills programmes in biotechnology and provide support for accessing premium export markets. Using finite resource revenues to build renewable bioeconomy capacity can help ensure a structural transformation, directing resource rents, often captured by narrow interests, towards more inclusive, employment-rich economic development.

Four critical enablers for a thriving regional bioeconomy

SADC's ability to capture first-mover advantages in biobased industries, which individual countries cannot achieve alone, depends on coordinated regional action. To make a regional strategy work, translating sectoral opportunities into measurable economic outcomes will require deliberate action across four interconnected enablers: strategic investment coordination, policy coherence, innovation, skills and infrastructure development, and accountability and adaptive management mechanisms.

1. Coordinate strategic investment to pool resources and mobilise private capital

To set strategic priorities, SADC needs to identify regional competitive advantages and ascertain where sectoral opportunities for scaling and circularity align or diverge. Clear sectoral prioritisation sends powerful signals to investors, de-risking decisions and directing capital towards high-impact opportunities.

Coordinated investment mobilisation is essential for scaling the regional bioeconomy. Clear and widely adopted green taxonomies that recognise bioeconomy sectors allow pension funds, development finance institutions (DFIs) and impact investors to deploy capital with confidence, supported by consistent classification and reporting frameworks. Blended-finance structures can help de-risk early-stage ventures and capital-intensive infrastructure, drawing in private investors who might otherwise remain hesitant. At a regional level, coordinated financing through institutions such as the AfDB and DBSA can ensure that investments are complementary rather than duplicative, pooling resources for transformative projects that no single country could fund alone.

Public-private partnerships (PPPs) for shared assets such as biomass aggregation hubs, processing facilities, testing laboratories and upgraded trade corridors can further reduce individual investor risk while creating the foundational infrastructure on which multiple enterprises depend. The SADC Business Council and similar regional platforms can act as strategic coordination mechanisms, matching public investment and policy incentives with private sector capabilities, fostering PPPs for bioeconomy projects, directing R&D towards high-priority sectors and co-investing in blended finance instruments that bridge the gap between public objectives and commercial viability.

Importantly, this coordination addresses a critical market failure: bioeconomy infrastructure and early-stage innovation require patient capital with longer time horizons than most private investors are prepared to accept. Strategic public investment de-risks these foundational investments, enabling subsequent private sector participation at scale.

2. Harmonise policies and standards to unlock investor confidence

The current state of policy fragmentation represents a latent market opportunity waiting to be activated. For example, inconsistent national biofuel mandates and policies across SADC make investors hesitant to commit capital to large-scale infrastructure and processing facilities – the very investments needed for global competitiveness. Similarly, divergent standards for biobased products create trade barriers within the region, preventing SADC producers from achieving the scale necessary to compete internationally.

To strengthen long-term outcomes, bioeconomy initiatives should be aligned with broader development goals, such as climate and economic resilience, ecological infrastructure investments and conservation, food security, sustainable development and inclusive growth.

If bioeconomy priorities are embedded in national development plans, industrial and trade policies, and green taxonomies, they can create policy certainty and unlock private investment.

These priorities should be likewise reflected in development agendas, industrial and trade policies, and fiscal and monetary planning, as well as in green taxonomies. This clarity can build confidence for domestic capital investors and regional and national development finance institutions, making it easier to raise capital for projects.

Strategic policy alignment can help deliver measurable returns. For example, when SADC countries adopt harmonised biofuel blending mandates, they create predictable demand across a shared regional market, giving investors the certainty they need to commit capital to large biorefineries. Instead of assessing fragmented national markets, investors can plan at regional scale, making competitive biorefining viable and turning policy alignment directly into investment mobilisation.

Coordinated sustainability standards and certification systems, aligned with international agreements, also reduce transaction costs and make cross-border value chains easier to operate. A regionally harmonised standard, potentially positioned as a “SADC sustainable bioeconomy” benchmark, would allow producers to meet a single set of requirements recognised by international buyers. This can help lower compliance costs, especially for SMMEs, while strengthening the region’s credibility as a supplier of high-quality, certified products to international premium markets.

At the Council for Scientific and Industrial Research (CSIR), participants gain hands-on experience with bioprocessing and downstream processing technologies. Practical training equips scientists, engineers and technicians with the skills required for product development, process scale-up, recovery and quality control in industrial biomanufacturing.

Investment in people must sit alongside investment in research institutions, pilot plants and testing facilities. Together, these capabilities can help SADC retain more value from its biological resources by developing and manufacturing higher-value biobased products within the region.

Source: CSIR.



On trade, aligned trade facilitation measures such as digital verification tools, dedicated customs processes for biobased goods and shared product-classification systems could further ease intra-regional movement of materials. Today, biobased products often face more complex customs procedures than fossil-fuel alternatives, undermining their competitiveness. Regional alignment removes these friction points and allows biobased industries to compete on a fair footing.

Coordinated industrial planning is equally important. By looking at feedstock availability, infrastructure and market access at a regional scale, SADC can avoid duplicating capital-intensive investments and instead place facilities where they will generate the highest returns. A regional biorefinery in Mozambique, for example, could leverage sugarcane feedstock and serve multiple SADC markets, while a biotechnology research hub in South Africa could specialise in R&D. This kind of strategic specialisation maximises limited capital and strengthens the entire value chain.

Finally, continental and regional frameworks and platforms can amplify regional efforts. SADC fora, such as the SADC Business Council, can then be better leveraged to match public investment and incentives to grow and develop the bioeconomy further – fostering PPPs to invest in SADC bioeconomy investment projects, driving R&D in high priority sectors and co-investing in blended finance instruments. The African Union's industrialisation priorities and the African Continental Free Trade Area provide platforms for policy harmonisation, investment mobilisation and cross-border value-chain development. Aligning national and regional actions within these broader continental strategies can help create coherence that attracts long-term capital and enables projects that no single country could deliver alone.

3. Invest in innovation, skills and infrastructure development to build competitive advantages

Human capital, research capacity and physical infrastructure are multipliers that can determine whether SADC maximally captures bioeconomy value within the region. Strategic investments in these foundations will enable the region to move from exporting raw biomass to manufacturing high-value biobased products.

Critically, regional coordination enables specialisation and efficiency. Not every country needs complete infrastructure across all bioeconomy subsectors. Strategic allocation based on comparative advantage, potentially with cross-border access agreements, maximises return on investment while building complementary capabilities.

At the same time, systemic disadvantages in current trade frameworks need to be addressed. Many tariff schedules and product standards still group biobased products together with their fossil-fuel equivalents, placing bioeconomy producers at a competitive disadvantage. Harmonised product classification, preferential treatment for sustainable bio-based goods and coordinated advocacy for reforms in international trade rules are all essential steps to level the playing field and unlock the region's full bioeconomy potential.

4. Develop a baseline for monitoring and evaluating progress

What gets measured gets managed. Establishing clear baselines, indicators and monitoring systems ensures bioeconomy investments deliver the promised economic, social and environmental

outcomes while enabling course corrections based on evidence. A SADC strategic monitoring framework linked to the six priority areas can help create a reference point for measuring progress and assessing alignment with regional and global commitments, including NDCs, NBSAPs, SDGs and the African Union's Agenda 2063.

This monitoring framework serves multiple purposes, demonstrating impact to investors and DFIs, identifying bottlenecks requiring policy

intervention, showcasing SADC success stories to attract additional investment and ensuring accountability to communities and stakeholders. Importantly, the baseline function addresses a current gap: many bioeconomy projections lack comparison points, making it impossible to assess whether projected job creation or economic growth represents meaningful progress. Establishing current employment, production and trade baselines would enable credible impact measurement.

BOX 8

Priority investments in bioeconomy infrastructure and capabilities

- **Biotechnology and biosciences education and research institutions** that produce the scientists, engineers and technicians required for biomanufacturing, R&D and quality control. Regional centres of excellence (building on institutions like the CSIR, SANBio and BioInnovate) can accelerate knowledge diffusion.
- **Translational infrastructure to bridge discovery and application** in the bioeconomy by de-risking scale-up, enabling regulatory-ready development, accelerating commercialisation and supporting industry participation. This infrastructure converts research into viable biobased products, builds local manufacturing capability, strengthens innovation ecosystems and aligns scientific investment with societal, economic and sustainability priorities.
- **Entrepreneurship and business development support** specifically tailored to bioeconomy SMMEs, including access to technical facilities (pilot plants, testing laboratories), business advisory services and links to finance. This addresses the “missing middle”, where early-stage ventures are too large for microfinance but too small/risky for commercial banks.
- **Digital and information and communications technology infrastructure** for precision agriculture, supply chain traceability, quality verification and market linkages. Blockchain-based certification, satellite monitoring of sustainable practices and digital marketplaces connecting producers with buyers reduce information asymmetries and transaction costs.
- **Specialised trade infrastructure, including cold chain logistics, bioproduct testing facilities and certification bodies** that meet international standards. Without this enabling infrastructure, even excellent products cannot access premium markets.
- **Intellectual property rights management systems that protect innovations** while ensuring equitable benefit-sharing, particularly for indigenous knowledge commercialisation. This builds trust with communities and creates legal certainty for investors.

Mobilising capital for the regional bioeconomy

Aligning finance with the needs of the bioeconomy

Global interest in nature-positive investments is rising and low emissions global markets demand is growing – from biofuels to bioplastics to biobased and biochemical inputs into high emission industries such as construction.⁶⁹

As a result, SADC is beginning to see modest growth in bioeconomy finance. Countries are adopting diverse approaches to mobilise capital, from PPPs and investment incentives to concessional finance.

However, financing for the bioeconomy in the SADC region is still at an early stage, with investment concentrated in sectors demonstrating clear commercial viability and quick returns. Private investment remains concentrated in sectors such as sustainable agriculture, wildlife value chains, ecotourism, timber, nutraceuticals and emerging sectors including medicinal cannabis. As a result, despite the scale of SADC's bioeconomy potential, investment remains fragmented, reflecting a structural misalignment between bioeconomy risk characteristics and prevailing financial systems.

Investment is concentrated in commercially mature sectors, leaving most of the bioeconomy underfinanced

Many bioeconomy activities are characterised by long gestation periods, biological and climate dependencies, fragmented value chains and exposure to policy volatility. This is especially the case with early-stage bioeconomy ventures for which markets are still less established than in traditional sectors. Such ventures sit poorly with short-tenor, collateral-driven lending models and conventional return expectations. As a result, capital is rationed precisely where catalytic investment is required to move from pilot initiatives to scalable commercial platforms.

The divergence between accelerating global demand and shallow capital depth highlights a structural financing challenge. The absence of mature pipelines, bankable revenue structures and credible risk mitigation mechanisms limits investment at scale. In practice, this results in fragmented transactions rather than sustainable capital deployment. So, building a stronger business case for the bioeconomy will be essential to attract deeper private sector engagement.⁷⁰

While the region has typically drawn on traditional finance mechanisms and conventional lending models, the structural characteristics of the bioeconomy require a broader and more deliberate financing architecture. Once policy coherence and credible market signals are established, the region can draw on a larger toolkit of sustainable finance solutions and mechanisms designed to align financial flows with economic, environmental and social objectives with diverse investor risk-return requirements.

Different sectors need different types of finance

Bioeconomy investments span a wide risk continuum – from working capital for established nature-intensive enterprises to patient, high-risk capital for cutting-edge bioenergy, biomaterials and biotechnology. No single financial instrument can address this spectrum.

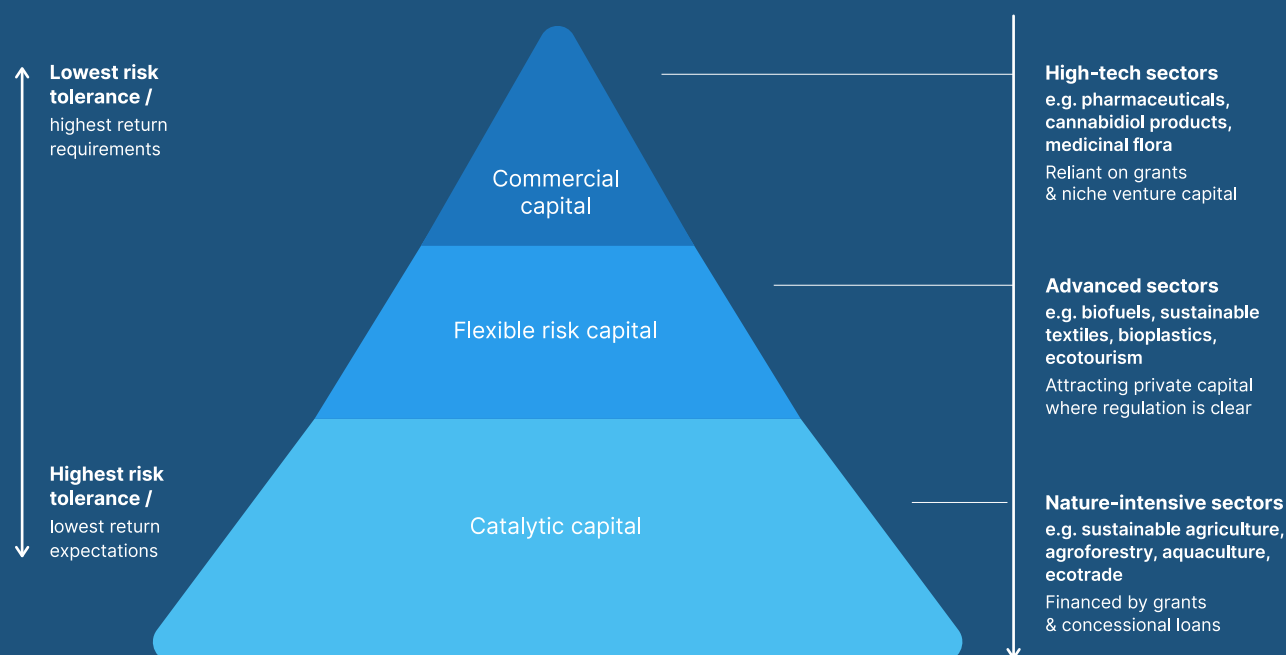
A scalable financing strategy, therefore, depends on capital stacking, in which public and concessional capital absorbs early-stage, policy and market-creation risks, thereby crowding in commercial lenders and institutional investors as projects mature toward predictable cashflows and bankable scale. This layered approach can provide the organising framework for the financing instruments discussed in the following sections.

The capital stack refers to the hierarchy of funding sources used to finance a project or company. Each layer reflects a different level of risk, return and repayment priority, helping to align the needs of investors with those of bioeconomy initiatives. (Figure 18).

This structure highlights the importance of blended finance, where different forms of capital are layered strategically to de-risk early-stage investments and unlock private capital for bioeconomy growth. By allocating risks to investors with differentiated risk appetites, capital can be mobilised across the full value chain while maintaining financial discipline (Figure 19).

FIGURE 18**The bioeconomy capital stack**

Different bioeconomy sectors require different types of capital depending on their maturity, risk profile and investment readiness.



Source: Authors' creation.

● Commercial capital

Grants, technical assistance facilities, first-loss capital and concessional public funding.

These secured lending instruments prioritise capital preservation and predictable repayment. Investors require strong downside protection and stable cashflows. Equity capital also sits at this level as residual risk-bearing capital seeking higher returns, particularly in advanced or high-growth bioeconomy ventures. Investors at this level are repaid last but can realise the highest returns.

● Flexible risk capital

Impact funds, subordinated debt or convertible instruments.

These carry higher risk than senior debt but benefit from partial downside protection provided by the catalytic capital beneath them. They seek moderate financial returns while supporting scale-up of commercially viable bioeconomy segments.

● Catalytic capital

Venture capital, private equity and project sponsorship.

These instruments are typically non-return-seeking catalytic capital, designed to de-risk or absorb early-stage, technology or market-creation risks, with the aim of enhancing project bankability and crowding in commercial capital.

FIGURE 19**Mapping bioeconomy finance solutions and instruments**

	Nature Intensive	Advanced	Hi-Tech
GRANTS & PUBLIC FUNDING	●	●	●
Sovereign & multilateral grants	●	•	•
Grants & subsidies (GEF, UN-REDD)	●	•	•
Conservation trust funds	●	•	•
Environmental funds	●	•	•
Conservation fees	●	•	•
Government innovation grants & tax incentives	•	●	•
R&D grants (Horizon Europe, DARPA)	•	•	●
DEBT & BONDS			
Sustainability-linked bonds	●	•	•
Green & blue bonds	●	●	•
Debt-for-nature swaps	●	•	•
Conservation outcome bonds	●	•	•
Biodiversity credit-linked bonds	●	•	•
MARKET & RESULTS-BASED MECHANISMS			
Payment for ecosystem services	●	•	•
Carbon markets & biodiversity credits	●	•	•
Biodiversity offsets	●	•	•
Insurance products	●	•	•
EQUITY & PRIVATE CAPITAL			
Venture capital & private equity/debt	•	●	•
Corporate investment & strategic partnerships	•	●	●
Public-private partnerships (PPPs)	•	•	●
Stock market, IPOs & licensing agreements	•	•	●
IP, TECH & LICENSING			
IP & licensing-based financing	•	•	●
Technology transfer & licensing agreements	•	•	●
DEMAND-SIDE & MARKET-SHAPING			
Green public procurement	•	●	•
Bankable projects (investor meet & match)	•	●	●
BLENDED / CROSS-CUTTING			
Blended finance	●	●	●

Shared instruments carry more than one dot. Type assignments interpreted from the source graphic — adjust as needed.

Source: NatureFinance and the Sustainable Finance Coalition, Mapping Finance Solutions and Instruments Across the Three Bioeconomy Types (Geneva: NatureFinance and the Sustainable Finance Coalition, 2025), <https://www.naturefinance.net/wp-content/uploads/2025/06/FINAL-MappingFinanceSolutionsAndInstrumentsAcrossTheThreeBioeconomyTypes-1.pdf>.

Financing instruments for the bioeconomy

Closing the bioeconomy financing gap in the region requires structured deployment of instruments that reallocate risk and crowd in private capital. A range of mechanisms is already in use across the region. This section outlines these tools and their role within an integrated financing architecture.

Public and catalytic finance for early-stage development and innovation

Public and catalytic finance plays a foundational role in scaling the bioeconomy, by funding research infrastructure, de-risking early innovation and mobilising private investment. Across the region, national institutions are already performing this catalytic function.

In South Africa, the Industrial Development Corporation and the Technology Innovation Agency provide loans, equity investments and direct funds (or co-funding) for projects. Mauritius channels support through its Research and Innovation Council, particularly in marine biotechnology and sustainable agriculture. Zambia allocates public funds for biotechnology research and innovation through its Ministry of Higher Education. These approaches reflect the catalytic role of public finance, although disparities in institutional capacity and funding scale remain evident across countries.

Similarly, dedicated bioinnovation funds further strengthen early-stage ecosystems by targeting startups and SMMEs. The BioInnovate Africa programme provides grants, incubation support, mentorship and lab access for scientists and

entrepreneurs translating biologically based research discoveries and inventions into businesses in Eastern Africa.⁷¹ Similarly, Kenya's Green Investment Fund targets early-stage agritech and nature-tech startups, aiming to structure investment-grade opportunities and attract foreign investors through equity co-investments, demonstrating how catalytic capital can be deployed strategically to crowd-in private co-investment.⁷²

These interventions show that dedicated innovation vehicles and technical assistance facilities are critical in bridging the gap between laboratory-scale discovery and investment-ready enterprise. Strengthening these foundational layers will be essential to unlocking deeper pools of commercial capital across the bioeconomy value chain.

Blended finance and impact funds for scaling commercial models

Impact-oriented investment funds have demonstrated how private capital can be mobilised into sectors that would otherwise struggle to attract institutional participation. The Moringa Fund, for example, focused on large-scale agroforestry projects across Africa, uses DFIs like the Global Environment Facility (GEF) and bilateral investment from countries such as Spain as junior tranches to absorb initial risks or lower returns, thereby crowding in commercial capital that would otherwise not invest.

It has restored 25,000 hectares of land, supporting 20,000 farmers and creating over 9,000 jobs. By pairing investment capital with its Agroforestry Technical Assistance Facility, the fund strengthens operational capacity, improves productivity and enhances project bankability for businesses and smallholders.

Blended funds can structure investments in processing infrastructure, sustainable land-use transitions and biobased manufacturing by absorbing initial risk while maintaining commercial discipline. Crucially, they provide a mechanism through which development objectives, such as ecosystem restoration, rural employment and climate resilience, can be integrated into investment structures without undermining financial viability, helping to move from pilot initiatives to portfolio-scale deployment. Well-structured blended vehicles that combine catalytic risk absorption, technical assistance and commercial governance standards can create investable platforms capable of attracting pension funds, impact investors and private equity into the bioeconomy value chain.

Using risk-sharing instruments to crowd-in private capital

Risk-sharing instruments are critical to unlocking commercial lending for bioeconomy SMMEs that are viable but perceived as high-risk. Targeted credit guarantees can materially de-risk by reallocating a portion of downside risk, enabling financial institutions to expand to lending to bioeconomy

value chains without compromising prudential standards. By covering a part of potential losses in the event of default, partial credit guarantees reduce financiers' exposure and improve the risk-adjusted return profile of portfolios.

The African Guarantee Fund (AGF) partners with financial institutions and offers both individual and portfolio guarantees, and has expanded lending to SMMEs across multiple African markets through its Green Guarantee Facility (Box 9). By de-risking loans for climate-smart and environmentally sustainable businesses, the facility has unlocked over US\$200 million in private capital. AGF's partner financial institutions have issued US\$650 million in loans to over 7,000 women-led SMMEs, significantly enhancing their access to credit.

Beyond SMME lending, export credit guarantees represent a complementary instrument for scaling trade-oriented bioeconomy value chains. In contexts where compliance with international standards and heightened payment and political risks when entering new markets are material challenges, such instruments are critical for enabling biobased enterprises to scale beyond domestic markets.



Researchers at Real IPM-Biobest working on fungal biopesticides developed through a BioInnovate Africa-supported project, PROSAFE, led by the International Centre of Insect Physiology and Ecology (icipe), Kenya, in partnership with Busitema University/Kyambogo University, Uganda; the University of Nairobi (UON), Kenya; Real IPM-Biobest Company Limited, Kenya; Kenya Biologics Limited, Kenya; and Hottiserve East Africa Limited, Kenya.

The microbial biopesticides, marketed as sustainable pests' management innovation, are developed from naturally occurring entomopathogenic fungi such as *Metarhizium anisopliae* strains to provide biological alternatives to synthetic pesticides, protecting crops while reducing toxic chemical inputs and supporting biodiversity.

Source: Valine Moraa, BioInnovate Africa, icipe.

BOX 9**De-risking SMME finance for green growth through the African Guarantee Fund**

The African Guarantee Fund (AGF) launched in 2011 by the AfDB and partner governments, was created to improve SMME access to finance across Africa. SMMEs account for more than 80% of output and jobs in most African countries but face an estimated credit gap of US\$140 billion to US\$170 billion, with nearly 70% unable to access external financing.

AGF addresses this gap by offering a range of financial solutions, including individual and portfolio loan guarantees, bank fundraising and equity guarantees, and capacity-building for partner financial institutions. Since its inception, it has unlocked over US\$3.5 billion through partnerships with approximately 200 financial institutions in 40 African countries.⁷³

AGF's model has been tested successfully across diverse African markets and can be scaled within SADC to unlock much-needed capital for key sectors such as agriculture, renewable energy, tourism and manufacturing. Its targeted support for women, youth and green enterprises is especially critical to SADC's goals for sustainable development, job creation and climate resilience.

Deploying insurance and sovereign risk instruments more strategically

In the SADC bioeconomy, certain risks are systemic and cannot be absorbed at enterprise or lender level. Climate shocks, political and regulatory instability and currency volatility affect investment decisions in nature-intensive and land-based sectors. Addressing these risks requires insurance and sovereign risk instruments that provide macro-level stability and enable long-term capital participation.

Index-based agricultural insurance, for example, offers payouts linked to predefined indicators such as rainfall levels rather than actual assessed losses. This approach allows farmers to invest with greater confidence. The Nairobi-based microinsurance company Pula has insured more than 20 million smallholder farmers across Africa, Asia and Latin America, providing over US\$120 million in payouts to help farmers recover from climate shocks.⁷⁴

Initiatives like this demonstrate how index insurance can strengthen smallholder resilience by reducing income volatility, improving creditworthiness and making agricultural and agroforestry enterprises more attractive to lenders.

At the sovereign level, political risk insurance can be decisive in attracting foreign and institutional capital into bioeconomy projects by covering risks such as expropriation, political violence or currency inconvertibility. This kind of coverage lowers the perceived downside risks of cross-border investments.

The Nature Conservancy's Nature Bonds program illustrates this approach, combining debt refinancing with conservation finance. In Gabon, a 2023 debt-for-nature conversion was supported by US\$500 million in political risk insurance from the U.S. Development Finance Corporation, unlocking more than US\$160 million for marine conservation and blue economy initiatives.⁷⁵

Insurance also has potential in conservation tourism, where revenue guarantees can protect community-run enterprises against downturns in visitor numbers. Although still at an early stage, pilots in Kenya's community conservancies show how such mechanisms can stabilise incomes, sustain conservation activities and deliver local economic benefits.⁷⁶

Mobilising public-private partnerships as effective delivery platforms

While financial instruments structure capital and allocate risk, PPPs can translate financing into operational delivery. In the SADC bioeconomy, where projects often combine environmental stewardship, community participation and commercial viability, PPPs provide an institutional mechanism to align incentives, pool resources and allocate responsibilities across public authorities, private operators and local stakeholders. They are also especially relevant in sectors where scale, infrastructure or long-term management capacity are critical.

Within SADC, there are already strong examples of PPPs driving bioeconomy-related initiatives. Rwanda's Akagera National Park entered a PPP that brought in private management expertise and investment, resulting in increased wildlife populations, higher tourism revenue and profit-sharing with government and communities, demonstrating how private management expertise and capital, combined with sovereign oversight, can restore ecological assets while generating tourism revenues and fiscal returns.⁷⁷

Similarly, in Mozambique, partnerships between the Ministry of Agriculture and Rural Development and private firms in bioenergy and biotechnology demonstrate how PPP structures can facilitate commercialisation while maintaining public development objectives.

Innovative models such as the Enduring Earth's Project Finance for Permanence approach further demonstrate how binding commitments between governments, donors and private actors can secure long-term conservation financing. These arrangements are particularly relevant for nature-intensive segments where sustained stewardship is essential to maintaining asset value.

Figure 20 shows a range of successful financing solutions for bioeconomy projects in Africa. These instruments demonstrate that SADC does not face an absence of tools, but rather, a need for structured coordination and sequencing.

The challenge lies in deploying these existing mechanisms within a coherent capital stack that allocates risk meaningfully. SADC must deploy these tools sequentially and in combination, ensuring that risks are absorbed where tolerance is highest and commercial capital is mobilised where returns are credible and durable. Only through such structured coordination can fragmented transactions evolve into sustained, system-wide investment across the bioeconomy value chain.

FIGURE 20**Successful bioeconomy financing initiatives in Africa**

Initiative	Country/region	Instrument	Key features/outcomes	Characteristics and structure
Gabon Blue Bond	Gabon	Blue bond / debt conversion	Historic US\$500 million “Blue Bonds” project unlocks US\$163 million for ocean protection and management	Model for ocean-based conservation financing in coastal SADC countries
DBSA Green Bond	South Africa	Green bond	€200 million raised for sustainable agriculture, forestry, and energy	Highlights multilateral development bank (MDB) role in scaling green infrastructure and bioeconomy financing
Acumen Resilient Agriculture Fund (ARAF)	Ghana, Kenya, Nigeria, Uganda	Impact equity fund	US\$58 million fund supporting climate-resilient agri-SMEs	Replicable model for de-risking smallholder-focused bioeconomy ventures
African Local Currency Bond Fund	Africa-wide	Blended finance facility	Supports domestic bond markets, SDG-aligned investments	Enhances local capital mobilisation for SADC bioeconomy priorities
African Guarantee Fund (AGF)	Africa-wide	Credit guarantees	US\$200 million unlocked for SMMEs, 7,000 women-led businesses	Boosts SMME access to credit for climate-smart, biobased enterprises
SADC Transfrontier Conservation Area Financing Facility (Peace Parks Foundation)	Mozambique	Grant	US\$1.62 million grant supports community-led conservation in Limpopo National Park, addressing gaps in private investment	Demonstrates the essential role of grants for funding community-based and small-scale projects
Smallholder Agriculture Cluster Project (SACP) (Organization of the Petroleum Exporting Countries (OPEC) Fund, International Fund for Agriculture Development (IFAD), private sector)	Zimbabwe	Concessional loan	US\$15 million loan boosts smallholder incomes through climate-smart, market-linked farming	Highlights the importance of concessional loans for agricultural incentives and transformation
Akagera National Park PPP	Rwanda	Conservation PPP	Increased wildlife, tourism income, forest product business development, non-timber forest products, fisheries revenue sharing	Scalable model for eco-tourism and community benefit-sharing in parks
Continental Africa Water Investment Programme	SADC	Blended finance	Support in de-risking and mobilising large-scale investment for climate-resilient water infrastructure	Aims to reduce dependence on grants and aid, fostering sustainable, long-term financing for water security

Sources: DBSA, 'DBSA Launches Green Bond' (2021); ARAF (n.d.); African Local Currency Bond Fund (n.d.); AGF, 2022 Annual Report (2023); Peace Parks Foundation (2023); OPEC Fund (2022); Sabiiti, KT Press (2023); AIP Water (2024).

Catalysing the potential and plugging the financing gaps with a joint financing facility: The African Bioeconomy Finance Hub

In an effort to scale bioeconomy-related finance, an African Bioeconomy Finance Hub was conceptualised from South Africa's G20 Initiative on the Bioeconomy. The African Bioeconomy Finance Hub is led by FSD Africa and the African Natural Capital Alliance in partnership with NatureFinance. The Hub aims to unite a pan-African network of stakeholders across

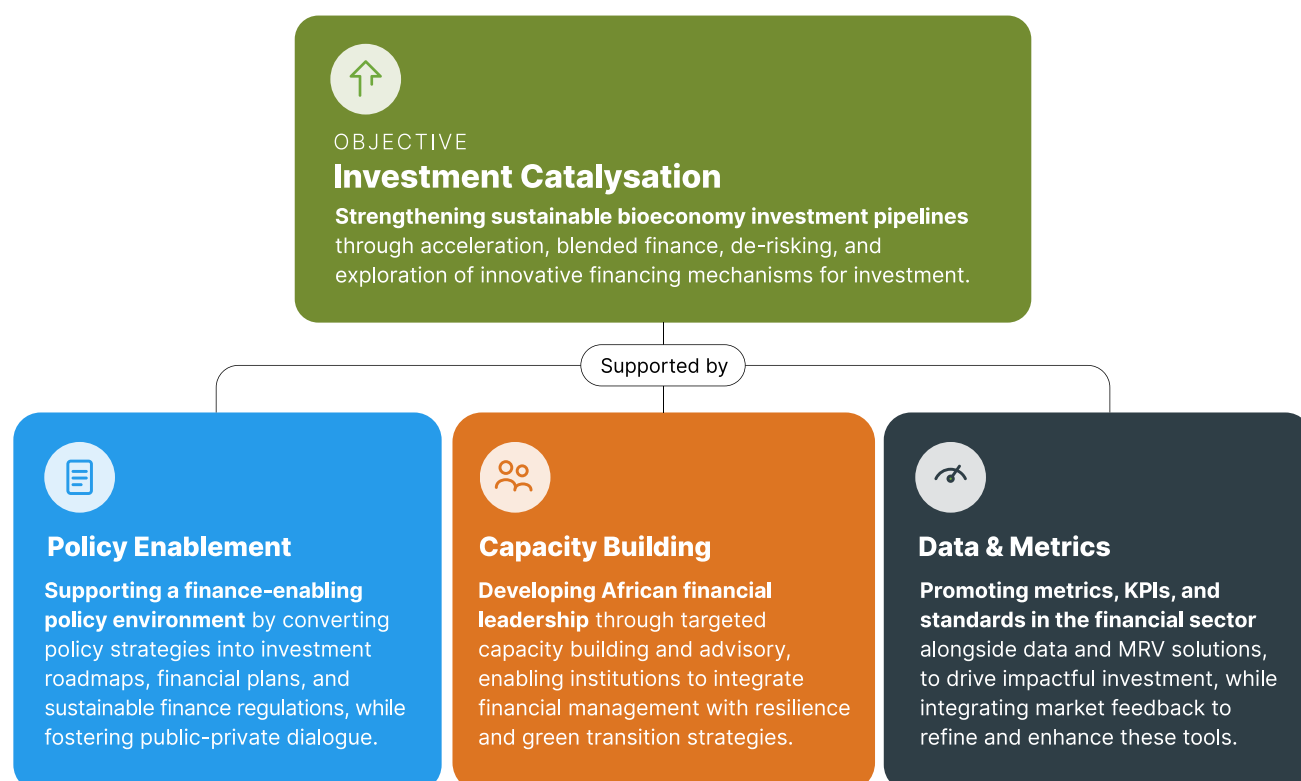
governments, investors, financial institutions, knowledge partners and Indigenous Peoples and Local Communities to catalyse finance.

The Hub will build upon existing initiatives, focusing its efforts across four critical thematic pillars: policy enablement; capacity-building; investment pipeline generation; and data and metrics (Figure 21).

The Hub aims, by 2035, to support the continent in capturing 50% of its biomass value, up from 10% today. To move from concept to implementation, the first three years of the Hub are dedicated to advancing three flagship bioeconomy use cases, which are currently being defined. The programmatic implementation of the three use cases will be guided by stakeholder-validated road maps and action plans, including informing fundraising efforts and forming strategic partnerships to support delivery.

FIGURE 21

Unlocking finance through the African Bioeconomy Finance Hub



Source: Authors' creation.

Conclusion

The foundations are in place to unlock SADC's economy

This report has examined the policy, finance and opportunity landscape for the bioeconomy in Southern Africa, demonstrating that the bioeconomy represents far more than a collection of emerging sectors. It is an economy-wide green industrialisation and resilience strategy that can help SADC respond to trade fragmentation, climate and nature risk, commodity dependence and youth unemployment while creating new opportunities for value addition, employment and economic diversification.

Across the six priority sectors examined in this report, clear opportunities exist to strengthen regional competitiveness and create new sources of economic growth.



Agriculture, agroprocessing and food systems

Agriculture, agroprocessing and food systems remain dominant and have significant potential for higher value addition and resilience.



Biotechnology and bioprocessing

Biotechnology and bioprocessing present the highest value chain and export earnings opportunity.



Bioenergy and biofuels

Bioenergy and biofuels offer significant energy security and trade competitive advantages but require policy harmonisation and regional coordination.



The blue economy

The blue economy offers pathways to diversify beyond terrestrial agriculture, create coastal employment and harness nature-based climate solutions, while also addressing food security.



The circular and waste economy

The circular and waste economy remains a major untapped opportunity, with significant potential to transform waste streams into high-value inputs across regional industries.



The wildlife-based and biodiversity economy

The wildlife-based and biodiversity economy can be leveraged by investing in SADC's ecological infrastructure as a productive asset. Many of these policies also speak explicitly to indigenous knowledge valorisation and bioprospecting.

The policy mapping presented in this report also shows that the Southern African bioeconomy is already evolving along multiple, interconnected pathways, each reflecting different levels of technological intensity, investment readiness and policy maturity. Most SADC countries have established bioeconomy-related policies across agriculture, indigenous knowledge and practices, biofuels and bioenergy, biodiversity and biotechnology, with a growing number expanding into the blue economy and circular economy sectors. Many have also integrated bioeconomy priorities into broader sectoral strategies, demonstrating that the foundations of an enabling policy environment are already in place.

This emerging policy landscape is complemented by encouraging levels of bioeconomy readiness. Across the region, countries already demonstrate strong potential in the four determinants measured by the Bioeconomy Readiness Index: sources of biomass, investment in R&D, people in R&D and institutional arrangements.⁷⁸ Together, these findings suggest that the region possesses many of the natural, institutional and scientific assets needed to grow and scale the bioeconomy.

However, the report also identifies a clear implementation gap. There remains a lack of harmonisation across policies, limited cohesion across sectors nationally and regionally, and inconsistent definitions that create implementation challenges. Overlapping institutional mandates generate bureaucratic friction, while the absence of clear regional priorities continues to produce fragmented investment signals and uncertain regulatory environments that discourage patient capital. These represent missed opportunities to leverage regional scale and strengthen SADC's collective competitiveness.

A more integrated and harmonised regional approach could align national priorities, strengthen policy coherence and unlock the full economic potential of the bioeconomy. Regional agreements, strategies and institutions can amplify national efforts, create larger and more predictable markets, support shared infrastructure and research, and leverage SADC's collective competitive advantages in global markets.

Unlocking the transformational potential of the regional bioeconomy offers SADC the opportunity to build competitive advantage in emerging bioindustries from the outset and become a market shaper rather than a market taker in a new global development paradigm. Investing in bio-based industries can help capture premium sustainability markets, strengthen balance of payments, retain greater domestic value and employment, and build resilience to future economic and environmental shocks.

Ultimately, the bioeconomy should not be viewed as a niche environmental agenda, but as a regional economic development strategy. By recognising the bioeconomy as a green industrialisation opportunity and working collectively to leverage its knowledge, capabilities and biological resources, SADC can move beyond extractive development models and build the innovative, biobased industries that will define its future.

Recommendations

SADC already has many of the policies, institutions and financing instruments needed to turn the bioeconomy into a genuine leapfrogging and resilience pathway. What is now required is coordinated deployment.

Closing this gap requires action on three fronts: **building the political will** to prioritise the bioeconomy, **creating the enabling conditions** for a regional strategy to function, and **taking a small number of priority actions** that can be implemented immediately.

Building political will

Mainstreaming the bioeconomy across SADC will require both the political commitment to prioritise it and the institutional mechanisms to translate that commitment into action. Critically, leadership must come from ministries of finance, trade and industry, and national planning commissions—not solely from environment, agriculture or science ministries.

In practice, this means:

- **Aligning economic and sectoral priorities** so bioeconomy goals sit inside industrial, trade and fiscal policy rather than beside it.
- **Embedding the bioeconomy in national development commitments** such as NDCs and NBSAPs, where it can unlock concessional climate finance.
- **Establishing clear cross-government governance mandates.**
- **Building investment-ready ecosystems,** including Special Economic Zones, that concentrate incentives and de-risk early-stage ventures.

Creating the enabling conditions

Once political commitment is established, the next priority is creating the enabling conditions that allow a regional bioeconomy strategy to function effectively.

- **Coordinated strategic investment** can pool resources and mobilise private capital at a scale no single Member State could achieve alone.
- **Harmonised policy and regulatory standards** can give investors the confidence to commit capital regionally rather than assessing fragmented national markets.
- **Investment in skills, research capacity and enabling infrastructure** can build the technical and human capabilities the regional bioeconomy depends upon.
- **Establishing a credible monitoring baseline** can close an important evidence gap by enabling progress in jobs, investment and economic growth to be measured consistently over time.

Priority actions: what to do now

The following actions represent the most immediate and practical steps SADC can take to accelerate the regional bioeconomy.

1

Name the bioeconomy explicitly in the SADC Industrialisation Strategy and Roadmap (SISR) 2015–2063.

The bioeconomy already supports all four SISR pillars—productive capacity, competitiveness, regional integration and sustainable resource use—but must be explicitly recognised to become investment-ready.

2

Develop a dedicated SADC bioeconomy framework or strategy.

A lack of harmonisation, unclear definitions and absent prioritisation have produced fragmented investment signals and missed opportunities for regional scale. A dedicated regional framework would align national policies, investment priorities and standards while unlocking larger regional markets.

3

Coordinate regional infrastructure and trade corridors.

A trade corridor and industrial cluster approach would strengthen cross-border bioeconomy value chains, with infrastructure strategically located according to each country's comparative advantage.

4

Pool regional expertise and finance.

Shared investment in research platforms, biorefinery hubs, centres of excellence and data systems would accelerate knowledge diffusion and build the collective capabilities needed to compete internationally.

5

Use regional diplomacy to position SADC as a competitive supplier of sustainable bio-based products.

Acting collectively rather than as competing national suppliers would strengthen market access and help shape the standards governing future global bioeconomy markets.

Approached in this way, the bioeconomy is not a niche environmental programme but a whole-of-government, regional economic strategy. By deliberately aligning industrial, trade, climate, labour and regional integration policy, SADC can leapfrog carbon-intensive development pathways, strengthen economic resilience and deliver inclusive growth for both people and nature.

Annexes

Annex 1. The G20 High-level Principles on Bioeconomy⁷⁹

1. Integrate and promote sustainable development across its economic, social and environmental dimensions, contribute to eradicating hunger and poverty and improving health and well-being, whilst ensuring global food security and nutrition.
2. Be inclusive and equitable, uphold the rights of all persons, including Indigenous Peoples and members of local communities, promote gender equality and the participation of all stakeholders.
3. Advance mitigation and adaptation efforts against global climate change, in line with applicable multilateral climate agreements.
4. Contribute to the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, subject to national laws and in line with applicable international agreements and instruments.
5. Advance sustainable consumption and production patterns and the efficient and circular use of biological resources, whilst promoting the restoration and regeneration of degraded areas and ecosystems.
6. Be developed through safe, secure and responsible use of science, technology, innovation and traditional knowledge, with potential benefits, risks and impacts assessed scientifically.
7. Benefit from robust and coherent policy frameworks that foster trade for bioeconomy products and services, market conditions, sustainable business models, decent jobs, local value creation and private sector and civil society participation.
8. Utilise transparent, comparable, measurable, inclusive, science-based and context-specific criteria and methodologies to assess their sustainability throughout the value chains.
9. Be fostered by international collaboration and cooperation that addresses global challenges, leverages complementary strengths, innovation and entrepreneurship and promotes financing, capacity building and sharing of best practices.
10. Be based on country-specific approaches and implemented in line with national priorities and regional and local circumstances.

Annex 2. SADC bioeconomy policy landscape

Country/ Region	BRI Bioeconomy Readiness Index (Africa ranking)	Bioeconomy strategy	Agriculture	Biodiversity/ wildlife	Biofuels	Biotechnology	Blue Economy	Circular Economy
African Union	-	-	Policy Framework for Applications of Genome Editing in African Agriculture (2023); Framework for Irrigation Development and Agricultural Water Management in Africa (2020); Comprehensive Africa Agriculture Development Programme (CAADP) Strategy and Action Plan: 2026–2035 (2024)	African Convention on the Conservation of Nature and Natural Resources (Algiers Convention) (Revised 2003)	Africa Bioenergy Policy Framework and Guidelines (2013)	Biosafety and Biosecurity Initiative 2021 – 2025 Strategic Plan (2021); African Seed and Biotechnology Programme (ASBP) (2007)	Africa Blue Economy Strategy (2019); Policy Framework And Reform Strategy For Fisheries And Aquaculture In Africa (2014); 2050 Africa's Integrated Maritime Strategy (2050 Aim Strategy) (2012); African Charter On Maritime Security And Safety And Development In Africa (Lomé Charter) (2016)	African Union Circular Economy Action Plan (2024–2034) (2023)
Angola	-	-	The National Grain Plan (PLANAGRÃO) 2023–2027 (2022); The National Plan for the Promotion and Development of Livestock (PLANAPECUÁRIA) 2023–2025 (2023)	National Biodiversity Strategy and Action Plan (2019–2025) (2020); National Biodiversity Strategy and Action Plan (NBSAP) 2007–2012 (2006); Law No. 8/20 approving the Environmental Conservation Areas Act (2020)	Resolution No. 122/09 approving the Strategy for the Development of Biofuels in Angola (2009)	Executive Decree No. 62/11 approving the Regulation on Biosecurity (2011)	Benguela Current Convention (2013); Presidential Decree No. 177/22 approving the Action Plan of the National Strategy for the Sea of Angola 2030 (2022); The National Plan for Fisheries (PLANAPESCA PLANAGRÃO O) 2023–2027 (2022)	Presidential Decree No. 265/18 approving the Regulation for the Transfer of Waste destined for Reuse, Recycling and its Valorization to the outside of the Country (2018); Presidential Decree No. 196/12 approving the Strategic Plan for the Management of Urban Waste (PESGRU) (2012)

Botswana	10	-	National Policy on Agricultural Development (Revised 2014); National Master Plan for the Arable Agriculture and Dairy Development (NAMPAAADD) (2002)	National Biodiversity Strategy and Action Plan (NBSAP) (2016); National Biodiversity Strategy and Action Plan (NBSAP) (2007); Botswana Tourism Policy (2021), Wildlife Policy (2013); Community Based Natural Resources Management Policy (2007)	National Energy Policy (NEP) (2021); Botswana Energy Regulatory Authority Act (2016)	Medicines and Related Substances Act (2018)		
Comoros	-	-		National Biodiversity Strategy and Action Plan (NBSAP) (2017)			Moroni Declaration on the Blue Economy (2023); Sustainable Blue Economy Policy (2024)	Circular Economy Framework (2023)
DR Congo	29	-	Stratégie Sectorielle de l'Agriculture et du Développement Rural (2010) (Sectoral Strategy for Agriculture and Rural Development); Plan National D'investissement Agricole en RDC (PNIA) 2014–2020 (2013) (National Agriculture Investment Plan 2014–2020)	Strategie et Plan D'Action Nationaux de la Biodiversité 2016–2020 (2016) (National Biodiversity Strategy and Action Plan 2016–2020); Stratégie Nationale De Conservation De La Biodiversité Dans Les Aires Protégées De La République Démocratique Du Congo (2012) (National Strategy for the Conservation of Biodiversity in Protected Areas of the Democratic Republic of Congo); Plan national stratégique d'action en matière de la diversité biologique 2002–2010 (2002) (National Strategic Action Plan for Biodiversity 2002–2010)			Plan d'Action National pour la Gestion Durable des Ressources Environnementales Marines et Côtières de la République Démocratique du Congo (2010) (National Action Plan for the Sustainable Management of Marine and Coastal Environmental Resources of the Democratic Republic of Congo); National Water, Hygiene and Sanitation Program (2019)	

Eswatini	26	-	Comprehensive Agricultural Sector Policy (2005); Eswatini National Agricultural Investment Plan (ENAIIP) (2015)	Swaziland's Second National Biodiversity Strategy and Action Plan (2016); Game Control Act (No. 37 of 1947)	Swaziland (Eswatini) National Biofuels Development Strategy and Action Plan (2009); National Energy Policy (2018); Kingdom Of Eswatini Energy Masterplan 2034 (2018)	Eswatini Biosafety Act (2012); Draft National Biosafety Framework For The Kingdom Of Swaziland (2006)	National Water Policy (2018)	
Lesotho	31	-	Lesotho Climate-Smart Agriculture Investment Plan (2019)	National Strategy On Lesotho's Biological Diversity: Conservation And Sustainable Use (2000); National Climate Change Policy Implementation Strategy (CCPIS) (2017); Lesotho National Action Programme in Natural Resource Management, Combating Desertification and Mitigating the Effects of Drought (2013)	Lesotho Energy Policy 2015–2025 (2015)	National Biosafety Policy (2005)		
Madagascar	-	-	National Strategy to Face Climate Change in Agriculture-Livestock-Fishery (2014); Programme sectoriel agriculture, élevage, pêche/ Plan national d'investissement agricole (Sectoral Programme for Agriculture, Livestock, and Fisheries/National Agricultural Investment Plan, PSAEP/PNIAEP) 2016–2020) (2015)	Stratégie Nationale de Gestion Durable de la Biodiversité (2002) (National Strategy for Sustainable Biodiversity Management); Stratégie Nationale REDD+ (2018) (National REDD+ Strategy)		Politique et Structure Nationales de Biosécurité à Madagascar (National Biosafety Policy and Structure in Madagascar) (2004)	Establishing the general organization of Maritime Fishing, Decree No. 94-112 (1994); Stratégie Nationale de Bonne Gouvernance des Pêches Maritimes à Madagascar (National Strategy for Good Governance of Maritime Fisheries in Madagascar) (2012)	Extended Producer Responsibility for Waste Electronic and Electric Equipment (Decree No 2015930).

Malawi	17	-	Malawi Agriculture Policy (2016); Malawi National Irrigation Policy (2016); National Agricultural Investment Plan (NAIP) (2018)	National Biodiversity Strategy and Action Plan II (NBSAP II) 2015–2025 (2015); National Forest Policy (2016); National Climate Change Management Policy (2016)	Malawi Energy Policy (2018); Malawi Renewable Energy Strategy 2017–2030 (2017)	Malawi's Biosafety Act (2007); National Biotechnology and Biosafety Policy (2008)	National Fisheries and Aquaculture Policy (NFAP) (2016)	Environment Management (Plastics) Regulations (2015)
Mauritius	3	-	Plant Protection Act (2006);	National Biodiversity Strategy and Action Plan 2017–2025 (2017); Environment Protection (amendment) Act (2008); National Forestry Policy (2006); National Environment Policy (NEP) (2007)		Strategy for development of Pharmaceutical and Biotechnology sectors in Mauritius (2022); The Genetically Modified Organisms Act (2004)	Policy for the Blue Economy in Mauritius (2023); Fisheries and Marine Resources Act (2007); Maritime Zones Act (2005); Integrated Coastal Zone Management Framework (2010); The Beach Authority (Amendment) Act (2022)	Roadmap and Action Plan for a Circular Economy in the Republic of Mauritius (2023)
Mozambique	28	-			Resolution No. 22/2009 approving the Policy and Strategy on Biofuel (2009)	Draft National Biosafety Framework of Mozambique (2005); Decree No. 6/2007 approving the Regulation on Bio-Safety related to Genetically Modified Organism (GMO) (2007)	Blue Economy Development Strategy (2024)	Decree 79/2017, Regulation on The Extended Producer Responsibility of Producers and Importers of Packaging (2017)
Namibia	12	The Namibia Sustainable Bioeconomy Strategy (2024–2029) (2024)		Strategic Action Plan for Sustainable Bush Value Chains in Namibia (2019)		Namibia's Biosafety Act (2006); National Policy Document: Enabling the Safe use of Biotechnology (1999)	Benguela Current Convention (2013)	National Solid Waste Management Strategy (2017); Plastic bag levy (Section D to Part 3 of Schedule No 1 of Act No 20 of 1998)

SADC	-	-	SADC Regional Agricultural Policy (RAP) (2013)	Protocol on the Development of Tourism (1998); SADC Protocol on Environmental Management for Sustainable Development (2014); Wildlife-based Economy Strategy Framework (2023); Green Economy Strategy and Action Plan (2015); SADC Climate Change Strategy and Action Plan (2015)	SADC Framework for Sustainable Biofuels (2009)		Improving Blue Economy Trade Corridors in the SADC Region (2024); Protocol on Fisheries of the Southern African Development Community (SADC) (2006)	
South Africa	1	The Bio-Economy Strategy (2013)	Agricultural policy in South Africa (1998)	Draft National Biodiversity Economy Strategy (NBES) (2016); National Environmental Management: Protected Areas Act (2003)	Biofuels Industrial Strategy (2007)	National Biotechnology Strategy for South Africa (2001); Genetically Modified Organisms Act (1997)	Benguela Current Convention (2013); Aquaculture Development Bill (2018); Marine Spatial Planning Act (2018); Sea Fisheries Act (1988); National Environmental Management: Integrated Coastal Management (2008); Maritime Zones Act (1994)	National Waste Management Strategy 2020 (2020); Draft Amendments to the Regulations and Notices regarding Extended Producer Responsibility (2020); Plastic Bags Regulation Environment Conservation Act (2003)
Seychelles	-	-	National Food Policy (2013); National Agricultural Investment Plan (NAIP) (2015-2020)	National Biodiversity Strategy and Action Plan (2015)		National Biosafety Framework (2010)	Blue Economy Strategic Policy Framework (2018)	National Circular Economy Framework (2023)

Tanzania	11	-		Environmental Management Act (2004)	National Energy Policy (2005)	National Biosafety Framework for Tanzania (2004); Biotechnology Policy of Tanzania (2010); Tanzania Biosafety Regulations (2009)		ReduCE-waste: controlling e-waste imports in Tanzania (2021); National Solid Waste Management Strategy (2018)
Zambia	14	-	Second National Agriculture Policy (2016); Zambia Climate-Smart Agriculture Investment Plan (2019)			Zambia's Biosafety Act (2007); Biotechnology and Biosafety Policy (2003)		The Extended Producer Regulations Statutory instrument No.65 (2018); National Solid Waste Management Strategy for Zambia (2014); The Solid Waste Regulation and Management Act (2018)
Zimbabwe	22	-	National Agricultural Policy Framework (2018); National AgriTech strategy (2021); Climate Smart Agriculture Investment Plan (2019)		Biofuels Policy of Zimbabwe (2020)	National Biotechnology Authority Act (2006)		Plastic Packaging and Plastic Bottle Regulations (2010); Environment Management Act (Effluents and Solid Waste Disposal) Regulations (2007)

Endnotes

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