



# **Fostering a bio-economy in eastern Africa: Insights from Bio-Innovate**

# Fostering a bio-economy in eastern Africa: Insights from Bio-Innovate

## Editors

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# Acronyms

AATF	African Agricultural Technology Foundation
ABI	African Bioscience Initiative
ASEAN	Association of Southeast Asian Nations
AU	African Union
BecA	Bioscience eastern and central Africa
BGA	Blue-green algae
BIC	Biotechnology innovation centre
BIL	Banana Investments Ltd
BIO-EARN	The Eastern Africa Regional Programme and Research Network for Biotechnology, Biosafety and Biotechnology Policy Development
Bio-Innovate	Bio-resources Innovations Network for Eastern Africa Development
Biotechnology YES	Biotechnology Young Entrepreneurs Scheme
BIPCEA	Bioscience Innovation Policy Consortium for Eastern Africa
BIRAC	Biotechnology Industry Research Assistance Council
CAADP	Comprehensive Africa Agriculture Development Program
CEO	Chief executive officer

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CSIR	Council for Scientific and Industrial Research
Danida	Danish International Development Agency
DST	Department of Science and Technology
DTI	Departments of Trade and Industry
ETP	Effluent treatment plant
EU	European Union
ILRI	International Livestock Research Institute
IP	Intellectual property
ISAAA	International Service for the Acquisition of Agribiotech Applications
KALRO	Kenya Agricultural and Livestock Research Organization
KBBE	Knowledge-based bio-economy
KEPHIS	Kenya Plant Health and Inspection Service
NEPAD	New Partnership for Africa's Development
NGO	Non-governmental organization
NSI	National system of innovation
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
S&T	Science and technology
SDG	Sustainable Development Goal
SEARCH	Southern and Eastern African Regulatory Committee on Harmonization
Sida	Swedish International Development and Cooperation Agency
SME	Small and medium enterprise

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SSA	Sub-Saharan Africa
STI	Science, technology and innovation
STISA	Science Technology and Innovation Strategy for Africa
TCBN	Tissue Culture Business Network
TIA	Technology Innovation Agency
UK	United Kingdom
US	United States (of America)
WEMA	Water Efficient Maize for Africa

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# Bio-Innovate Africa

Bio-Resources Innovations Network  
for Eastern Africa Development



# Chapter 8

## Looking to the future

*Ivar Virgin, Stockholm Environment Institute*

### Eastern Africa, steps towards knowledge-based bio-economies

The bioscience revolution and the need to reduce dependence on fossil fuels and non-renewable resources is driving the current push towards knowledge-based bio-economies. The rapid advances in biosciences, including biotechnology and genetic engineering, are significantly shaping the knowledge-based bio-economy. The new frontiers in biosciences are not only revolutionizing medicines and health treatment, but also the ability to develop more productive and resource-efficient agricultural systems, with improved tolerance to pests, diseases and climate change. Modern bioscience can also greatly assist the transformation of inefficient and polluting bio-based industries into modern bio-refineries producing a large array of renewable products with close to zero emissions. All this is good news for eastern Africa where agriculture and agro-processing dominate the economy but, to a large extent, they still operate at a suboptimal level. While the region is experiencing an economic upswing, growth is predominantly based on extracting natural resources and large infrastructure projects. The region's economy continues to be dominated by low levels of value-addition in the production and processing of natural resources and the production of consumer goods, which are mostly for local consumption.

Science, technology and innovation have a crucial role to play in propelling economic growth, alleviating poverty and contributing to the region's SDGs. The United Nations SDG targets reflect consideration of a blueprint for global development in the years to come, and Africa's aspiration to become a continent of middle-income nations. The SDGs will frame national agendas and policies in the region over the coming decades and also influence the use and

production of biomass and bio-resources. This is particularly important given the pressing need to improve the profitability and productivity of smallholder farmers in the region.

Smallholders are the major producers of food and agricultural products in eastern Africa. To a large extent, however, they are poor, vulnerable and under increasing pressure to produce more, better quality food and agricultural products in a sustainable manner. Connecting smallholder farmers to markets, value chains and agro-processing opportunities is increasingly seen as one of the most important tools for elevating agricultural productivity, decreasing poverty and improving rural livelihoods in large parts of Africa. This is considered a vital element in the post-2015 development agenda. The challenge is to boost the agro-processing sector, which currently runs at a suboptimal level and produces large amounts of waste, leading to severe environmental problems. Transforming the agro-processing sector so that it adds value to primary production and converts waste to valuable products in an environmentally-friendly manner will be central to improving agricultural productivity in eastern Africa. A more dynamic, resource-efficient agro-processing sector is also important for inclusive growth and job creation in the region.

An appealing vision for eastern Africa countries would be to use bio-resources as a strategic base for inclusive and sustainable economic growth and for the development of knowledge-based bio-economies. The latter has significant potential to support several critical SDG goals and targets for the region, as well as development targets. These include promotion of:

- Increased crop productivity in a sustainable manner, contributing to improved food security.
- New and more diverse value-addition chains, improving profitability for smallholder farmers, agribusinesses and bio-enterprises.
- Environmental sustainability, including addressing climate change. This involves converting bio-waste, which is polluting freshwater systems and destroying ecosystems, into useful products.
- Energy security through replacing non-renewable resources with bio-based renewable energy.
- Agro-industrial expansion which could, if well planned, regulated and supported, improve economic competitiveness and stimulate sustainable economic growth over the long-term.

## Linking bioscience with markets

In eastern Africa, public research organizations and universities are central to adopting and adapting modern biosciences to meet broader societal needs, including the needs of smallholder farming systems and local agro-processing actors. Public organizations need to ensure that they have a minimal capacity to be effective in technology transfer and

dissemination. They also need to develop policies and structures that reward and foster entrepreneurship and innovation. All of this requires government commitment and increased investments in strategic R&D and innovation structures.

To a large extent, the R&D sector in eastern Africa is demand-driven and focused on producing technologies and knowledge that could be used to transform the region's agricultural sector. The key challenge, however, is that the majority of R&D is undertaken without including a business and market perspective. Consequently, R&D investments and promising bioscience research outputs seldom move out of the laboratory. The private sector in the region is risk-averse, trade-oriented and rarely engages with universities and public research organizations in innovation and commercialization. Supporting initiatives that strongly link public research organizations, universities and market actors could dramatically improve the chances of eastern African farmers, agribusinesses and agro-processors benefitting from the rapidly-advancing field of biosciences.

There is increased recognition in the region that building R&D capacity and linking it to the private sector is the first step in making bioscience applications available to local markets, farmers and agro-processing actors. There is also a need to enable innovation through building and incubating emerging businesses, creating market demand and establishing sustainable financing mechanisms. Nevertheless, the process of moving bioscience technologies and applications from public R&D institutions to the market is complex, thorny and involves much more than well-designed and well-executed R&D. This innovation process is also highly dependent on policies, institutions, financial and human resources. The key to successful innovation and technology dissemination is forging links among key actors at the appropriate time in the innovation cycle. These links will differ according to the type of technological innovation and the type of markets. In eastern Africa, there is a pressing need to support links between the public sector and various market actors. However, linking is not enough—incubation mechanisms, which support all actors to play complementary roles, are also needed. As shown in Asia, and many other parts of the world, professional business incubation services can greatly assist innovation actors with technology and market incubation. This includes services such as business case development, technology assessment and finding sources of finance for scaling-up and commercialization.

## Sustaining the momentum

There has been increasing interest in building bioscience capacity in eastern Africa as a way of matching the promises of modern biology with local needs. As a result, R&D capacity in the region is increasing, both in terms of highly-trained researchers and R&D infrastructure. Today, there are more than 10 well-equipped national R&D institutions in the region with the capacity to adapt advanced bioscience R&D to local needs and opportunities. There are also a number of regional R&D networks in which researchers can collaborate with other scientists

and practitioners at local, regional and international level. These networks provide highly valuable platforms for interaction between local and international scientists and for access to state-of-the-art facilities and technical expertise present in the region (such as the Beca-ILRI Hub, *icipe*, etc.).

Bio-Innovate is one of the most prominent bioscience networks, supporting multi-disciplinary biosciences research and product-oriented innovation. So far, Bio-Innovate is the only program in the region to take an integrated approach in linking value addition and agro-processing with primary agricultural production and environmental management. This approach includes harnessing opportunities for converting waste to valuable products, such as bioenergy, bio-fertilizer, food and feed by-products, and innovation policy analysis to support sustainable development at the regional level. Interventions of this nature will be crucial if countries in the region are to create sustainable bio-economies.

Regional platforms, such as Bio-Innovate, can foster partnership within academia, between the public and private sectors, and also between private sector actors, to provide opportunities for regional trade. They are, therefore, important mechanisms to catalyse and help countries in the region develop into knowledge-based bio-economies. Bio-Innovate, and its predecessor BIO-EARN, are success stories with substantive achievements to their name in scientific knowledge, human capacity development and technological products. These, and other relevant programs, can be used as stepping stones in the development of new initiatives creating even stronger innovation-driven, user-oriented bioscience innovation platforms, which promote and incubate new bioscience businesses in the region.

## Investing for the future

In this book we have argued for the important economic prospects offered by bioscience innovations for developing knowledge-based bio-economies in eastern Africa. We have also put the case for supporting innovation systems as a way of transforming bioscience technologies into specific innovations of value to farmers, agribusiness and other value-chain actors in the region.

To ensure food security and economic growth, governments in eastern Africa will have to increase investment in agricultural biosciences and bioprocessing technologies. The region also needs models and initiatives that can bridge the gap between science and markets and pave the way for new, productive investment both from the private and public sectors, and also from donors and social impact investors.

It is now time to take the next step in the design of new bioscience innovation platforms, learning from the past and investing in the future. Using the previous chapters in this book as a basis, some key guiding principles in the design of such new initiatives are:

- Regional innovation platforms, such as Bio-Innovate, are good mechanisms for enhancing South-South-North partnerships and also for strengthening regional cooperation in, and capacity building for, bioscience innovations in support of trade and development in the region.
- Linking R&D and market actors is essential in adopting modern bioscience applications to needs and opportunities in the region. A close engagement between R&D and market actors in the design of potential initiatives and projects is critical for successful deployment of technologies.
- Professional business incubation mechanisms, which ensure actors are properly interlinked and supported to play complementary roles, are a crucial component in future bioscience initiatives. Professional business incubator support, which links actors to the market and assists with building bio-businesses, is a necessary, but presently a missing component in the region's emerging bioscience innovation system.
- Successful deployment of innovations takes a long time and needs sustained investment and long-term government and donor commitment.
- New innovation initiatives need to have a robust business and end-user orientation, cultivating relationships with key partners capable of delivering innovations to market and to attract investment from the private sector and social impact investors.
- Governments in the region can promote the development of knowledge-based bio-economies in many ways, not least by creating an enabling environment for innovation. This would include: (i) progressive policies and regulatory frameworks creating incentives for market actors making use of bioscience technologies; (ii) certification and standards assisting innovation and new technologies; (iii) public procurements creating initial demand; and (iv) long-term funding for R&D and innovation structures.
- Definition of national priority areas and goals for bioscience research and innovation must be linked to long-term visions with bio-economy strategies guiding public, private and donor investment in new bioscience innovation initiatives.
- Developing funding mechanisms to support the deployment of innovations. Currently, investment in, and support for, bioscience innovation remains concentrated in the R&D phase of the innovation cycle, with inadequate provision for large-scale pilot tests, application and commercialization of technologies or products.
- Creative funding models for sharing the cost of bringing technologies and products to market need to be explored, tested and supported by governments and other funding agencies. This includes mechanisms to bridge funding gaps in the process of moving a technology and potential product through the innovation process. Governments, donors, private sector or social impact investors and commercial banks would potentially fund different parts of this process.



### **Bio-resource Innovations Network for Eastern Africa**

**Development Program (Bio-Innovate)** is an initiative that supports and promotes bioscience research and innovation activities in eastern Africa through the creation of effective partnerships along the bio-innovation value chain. The goal of Bio-Innovate is to catalyse the translation of bioscience research outputs into scalable and impactful bioinnovations. Bio-Innovate works in Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda.

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