

BIOECONOMY GROWTH PROSPECTS FOR EASTERN AFRICA

21 – 22 OCTOBER 2020

CONFERENCE PROCEEDINGS













Partners

The First Eastern Africa Bioeconomy Conference; 21 – 22 October 2020 was organized by the following partners:

- International Centre of Insect Physiology and Ecology (icipe)/BioInnovate Africa, Nairobi, Kenya.
- The East African Science and Technology Commission (EASTECO), Kigali, Rwanda.
- The Stockholm Environment Institute (SEI) Africa Centre, Nairobi, Kenya.
- The Scinnovent Centre, Nairobi, Kenya.
- The African Technology Policy Studies Network (ATPS), Nairobi Kenya.

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- ATPS: Nicholas Ozor
- SEI: Ivar Virgin, Rocio Diaz-Chavez, Lawrence Nzuve
- The Scinnovent Centre: Maurice Bolo

Authors

These conference proceedings were prepared by:

- The Stockholm Environment Institute (Ivar Virgin, Rocio Diaz-Chavez, Javan Ochido, Jane Morris (consultant))
- The Scinnovent Centre (Maurice Bolo)
- The International Centre of Insect Physiology and Ecology (icipe)/BioInnovate Africa (Valine Moraa, Shira Mukiibi, and Julius Ecuru)
- The East African Science and Technology Commission (Fortunate Muyambi)

Citation



PREFACE

This was our first Eastern Africa Bioeconomy Conference, the first conference of its kind in the region and on the African continent. The conference with its theme "Bioeconomy growth prospects for Eastern Africa" is paving the way for a broader discussion on how a modern bioeconomy can contribute to sustainable development for the region. It was completely virtual considering the COVID-19 pandemic, which affected many lives, and disrupted the economy and our social life. The challenging times, notwithstanding, the conference was an opportunity to reflect on how science and the bioeconomy could be ways to overcome COVID-19 and other related challenges of our time like locusts' invasions, climate change and jobs.

Today, more than 65% of our population in Sub-Saharan Africa depend on biological resources for food, energy, medicine, and other uses. They use these biological resources in their raw form and dispose of significant portions as biological waste. At the conference, it was reiterated that with science and innovation, value can be added to the biological resources, and wastes used to generate wealth.

It was also demonstrated that Africa can create new business prospects and diversify its economic growth by investing in a sustainable bioeconomy. A draft regional bioeconomy strategy for eastern Africa was presented during the conference. The strategy facilitates a shared East African vision on how to harness bioscience knowledge for sustainable biobased growth, including joint capacity building and harmonised policies, which will create opportunities for society, not least women, and the youth. This shared vision is in line with the SDGs 2030 and the East African Vision 2050 for growth and sustainable development.

The conference illustrated how scientists, policy makers and business leaders can work collaboratively to create new business prospects, jobs, and economic diversification, especially for youth, women, and farming communities who are custodians of most of the biological resources. Such collaborative partnerships are essential for developing and implementing the regional sustainable bioeconomy strategy. The need for collaborative partnerships has become even more visible in the wake of COVID-19 pandemic, which has challenged scientists in Africa to contribute home grown solutions, not only for managing the disease but also addressing the need for the long-term prosperity of the region.

We believe that the conference opened opportunities for collaboration in the development of a sustainable bioeconomy in eastern Africa, and other regions of Africa. BioInnovate Africa and East African Science and Technology Commission (EASTECO) would like to continue engaging stakeholders in the region and form new partnerships for the different aspects of sustainable bioeconomy, including policies and strategies technologies, innovation, and business prospects.

Special appreciation to partners for the conference, who were icipe/BioInnovate Africa, the EASTECO, the Stockholm Environment Institute – Africa Centre, The Africa Technology Policy Studies Network, Scinnovent Ltd, and Bioinnovations company Ltd.

Fortunate Muyambi

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Ag. Executive Secretary, EASTECO

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EXECUTIVE SUMMARY

Globally, the promotion of a bioeconomy is highly placed on the political and business agenda for many countries as a major strategic driver for the transformation of biobased sectors for sustainable economic growth and development. Bioeconomy growth offers the opportunity for countries in Eastern Africa to achieve many of the UN 2030 Agenda Sustainable Development Goals and supports the African Union's Agenda 2063 and the regional aspirations of EAC Vision 2050. To generate sustainable economic growth and new employment opportunities, countries in Eastern Africa have the opportunity to develop and strategically invest in value addition to its bioresources, and in its agricultural and bioprocessing sector. Such investments would make better use of the region's abundant natural resources including under-utilised agricultural waste materials to produce value added products with applications in many sectors including food, health, energy and industrial goods. A more optimal use of bioresource in the region would generate wealth, improved rural livelihoods and connect smallholder farmers to new biobased value chains.

With this as a background, the East Africa Science and Technology Commission (EASTECO), the BioInnovate Africa Programme, The Stockholm Environment Institute (SEI), African Technology Policy Studies (ATPS) and The Scinnovate Centre organized the first regional bioeconomy conference ever in Eastern Africa, with the conference theme "Bioeconomy growth prospects for Eastern Africa". The conference was held on-line on 21 – 22 October 2020 and was attended by some 200 participants from the region and worldwide. The conference provided opportunities for scientists, technologists and innovators from the academic, public and private sectors to network and share their experiences on the bioeconomy development in Africa and how to build an appropriate enabling environment to foster its growth. The conference also showcased a range of bioinnovation activities and capacity building efforts currently under way in the region.

The conference was divided in two parts, the first part **Science and Society** dealt with policies and overall bioeconomy development and its relevance for Eastern Africa. The second part, **Innovation and Industry** was dealing in more detail with biobased innovation in the region, showcasing local bio-innovation efforts and initiatives, not least those organised and supported through the BioInnovate Programme.

The first session of the **Science and Society** part of the conference focused on how bioeconomy can support sustainable economic growth in the region. The development of a regional innovation-driven bioeconomy strategy for the EAC was also presented, a strategy that will be presented to the EAC Council of Ministers for approval. The strategy has been developed in an open and broadly consultative regional process including a variety of perspectives to reflect different contextual realities in the countries in the region. The main objective of the regional strategy is to harmonise efforts in building bioeconomies in the region and to inspire and catalyse the development of national strategies and bioeconomy policy agendas in the region. The East African Bioeconomy Observatory (EABO) was also presented. This Observatory is a regional open access repository for bioeconomy data and information supporting the region with science-based evidence on the development of sustainable bioeconomies. Speakers in this session highlighted the importance of sustainable bioeconomy, not only as a new growth area, but as the means to achieving the SDGs 2030 for the region. One of the keynote speakers in this session, Professor Joachim Von Braun, Center of Development Research (ZEF), Germany and Co-Chair of the International Advisory Council on Global Bioeconomy, commended the organisation of the Conference, the development of a regional Bioeconomy strategy and an East African Bioeconomy Observatory (EABO) which he thought was pioneering the Bioeconomy development in Africa.

The second session, a Ministerial Panel on Sustainable Bioeconomy as the Driver of Growth in Eastern Africa focused on how, countries, regional bodies and governments can support sustainable bioeconomy driven regional economic growth in Africa. The speakers recognised the importance of the conference as a venue for sharing ideas and knowledge about available bioeconomy opportunities within the region and in Africa. There is high appreciation and commitment for bioeconomy development, visualised not least by the supportive bioeconomy governance development process in Uganda and in Ethiopia. At the same time the speakers also highlighted the critical gaps in terms of capacities and structures for tapping into bioeconomy opportunities, particularly in terms of human capacity, lack of venture capital and inadequate access to technology and know-how which is stifling the development of the bioeconomy in the region

In the third session a more detailed description of the East African Regional Bioeconomy Strategy was presented. The session also included a presentation of the current situation with regard to bioeconomy development in six Eastern African countries, namely Burundi, Ethiopia, Kenya, Rwanda, Uganda, and South Sudan.

The second part of the conference, Innovation and Industry started with session four including parallel workshops

- Workshop 1: Food systems and agriculture.
- Workshop 2: Biobased industrial development
- Workshop 3: Health and wellbeing
- Workshop 4: Sustainable energy

In these workshops, a series of Bioeconomy initiatives in the various sectors driven by private sector actors and public-private innovation consortia were presented and discussed. The presentations all concretely visualised the strong entrepreneurship and the exciting opportunities for bioeconomy development in the region, but also the challenges and factors stifling innovation and bioeconomy growth.

The second day of the workshop started off with a session five, a session on **sustainable bioeconomy**, **youth and employment in Africa**. In this session, job creation opportunities through biobased economic growth were discussed dealing with questions such as:

- What employment or job creation prospects does a sustainable economy offer?
- How can youth, women and other groups be effectively involved in sustainable bioeconomy development?
- What kind of policy incentives are necessary to ensure an inclusive sustainable bioeconomy?

The following sixth session, *Women and Sustainable Bioeconomy in Africa.* focused on the potential for empowerment of women in the emerging African bioeconomy. A particular feature of this session was the presentations from women scientists supported through the BioInnovate Africa Fellowship for Women Scientists (BA-FWS), and the launch of an Alumni Network for these women Fellows.

In the seventh session, *Speed networking with BioInnovate Africa pilot commercial enterprises*, a number of BioInnovate Africa supported projects, having gone through business incubation and acceleration, presented their bio-based products, their enterprises and their prospects for further growth through collaboration and further investment.

In session eight *Speed networking with participants of the BioInnovate Africa bioscience innovation bootcamp/ academy,* the concept and ideas behind the bioscience innovation bootcamp was introduced and discussed. The bootcamp will be organized for entrepreneurial scientists in eastern Africa to support the development of innovative and commercially viable biological based ideas in areas including, but not limited to, agroecology, food and feed, wastewater treatment, biopharmaceuticals, bioenergy, biomaterials, disease diagnostics, and green chemicals. Presentations on potential bioinnovations by a number of entrepreneurial scientists were also made.

In the closing session, session nine, speakers commended the Conference initiative convening various Eastern African actors discussing how to develop an innovation-driven bioeconomy propelling inclusive economic growth, job creation and sustainable use of bioresources in the region. They concluded that the two-day conference clearly visualised how collaborative research and innovation in the various spheres of the bioeconomy can contribute to the development of more productive and sustainable food, health, industry, energy systems in the region. They also called for a process where countries in eastern Africa develop their own bioeconomy strategies, policy frameworks and corresponding implementation plans for going forward.

INTRODUCTION

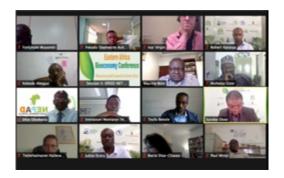
Why the conference?

Bioeconomy growth offers the opportunity for countries in Eastern Africa to achieve many of the UN 2030 Agenda Sustainable Development Goals and supports the African Union's Agenda 2063 and the regional aspirations of EAC Vision 2050. To generate sustainable economic growth and new employment opportunities, countries in Eastern Africa have the opportunity to develop and strategically invest in value addition to its bioresources, and in its agricultural and bioprocessing sector

With this as a background, the East Africa Science and Technology Commission (EASTECO), the BioInnovate Africa Programme, The Stockholm Environment Institute (SEI), African Technology Policy Studies (ATPS) and The Scinnovate Centre organized the first regional bioeconomy conference ever in Eastern Africa, with the conference theme "Bioeconomy growth prospects for Eastern Africa". The conference was held on-line on 21 – 22 October 2020 and was attended by some 200 participants from the region and worldwide. The conference provided opportunities for scientists, technologists and innovators from the academic, public and private sectors to network and share their experiences on the bioeconomy development in Africa and how to build an appropriate enabling environment to foster its growth. The conference also showcased a range of bioinnovation activities and capacity building efforts currently under way in the region.

About the conference

In total, 394 persons registered for the conference and participated in the various sessions. The virtual 2-day conference was divided into two parts, the first part Science and Society dealt with policies and overall bioeconomy development and its relevance for Eastern Africa. The second part, Innovation and Industry dealt in more detail with biobased innovation in the region, showcasing local bio-innovation efforts and initiatives, not least those organised and supported through the BioInnovate Programme. The conference used an online platform (Cvent) and included a website-based platform for registrations, virtual conference sessions & exhibitor booths.









A graphical presentation of the people who registered for the conference.

DAY 1, PART 1: SCIENCE AND SOCIETY

SESSION

01

Sustainable Bioeconomy Development in Eastern Africa

This session focused on how sustainable bioeconomy can support growth in Africa, with a special emphasis on Eastern Africa. Speakers highlighted the importance of sustainable bioeconomy, not only as a new growth area, but as the means to achieving the SDGs. Speakers also discussed the trends in global efforts to transition to biologically based growth, and highlighted the kind of policies required, including the value created or added by adopting a regional bioeconomy strategy. The key questions dealt with during the session were

- Why is sustainable bioeconomy important for Eastern Africa?
- What kind of partnerships are necessary to achieve sustainable bioeconomy development in Africa?
- In what ways would a Regional Strategy foster sustainable bioeconomy development in Eastern Africa?

Dr Segenet Kelemu, Director General, International Centre of Insect Physiology and Ecology (icipe), Nairobi, Kenya



With its abundant resources a sustainable bioeconomy offers many opportunities for Africa to diversify its economy and ensure active participation of all sectors including men, women and youth. Bioeconomy is a good model for balancing economic development, environmental sustainability and social inclusion which are key tenets of the AU Agenda 2063 as well as the ST&I Strategy for Africa. Bioeconomy is also a chance for Africa to innovatively exploit its biological resources into commercial ventures that will lead to inclusive growth and social development. R&D and Innovation is central to the development of a thriving Eastern African Bioeconomy. ICIPE's research is putting science behind Africa's rich natural biological resources and working on how to add value to and protect this rich East African biodiversity, delivering products that are environmentally safe and healthy. The pandemic has revealed the fragility of the way of life in the region and beyond, and demonstrates the need to take care of our natural ecosystems and our natural resources. ICIPE is also proud of being the host institution to BioInnovate Africa, an organisation which links science to business to improve lives in the region, supporting creative ideas and innovations to create sustainable businesses as well as fostering bioeconomy policies.

Professor Måns Nilsson, Executive Director, Stockholm Environment Institute (SEI), Stockholm, Sweden.



The bioeconomy has many different facets and in different regions it means different things. In Europe sustainability and reducing greenhouse gases is the key feature of the bioeconomy and we are currently talking about the new EU green deal to transform the European economy to a low carbon economy and climate neutrality. In Eastern Africa, the underlying principles are the same but here it is very much a transformation of economies making better use of abundant natural resources and the under-utilized agricultural system to produce value added products, new jobs, improved livelihoods, biobusinesses and a biobased sustainable economic growth. The bioeconomy is also about using the latest scientific research, knowledge and innovation for production of food, feed, fibre, fuel and a wide range of industrial and value-added products. For this reason, value addition to bioresources needs to be at the centre of African bioeconomy strategies and in Eastern Africa where much more value can be added to the 300 million tons of annual agricultural primary produce than is done today. A growing, modern and sustainable bioeconomy has the potential to support many critical SDG development goals in the region. For example, (i) job creation through a green industrialisation revitalising bioprocessing and biomass value chains in the region; (ii) improved food security fulfilling SDG 2 through improved food value chains and processing providing healthy, affordable and nutritious food for a growing population; (iii) supporting SDG 3 targets and improved health using the biodiversity in the region to develop new biobased health and medicinal products; (iv) a green industrialisation creating new bio-based products, such as biomaterials for construction, enzymes for improving sustainability and efficiency of bioprocessing industries, biobased substitution for petrochemicals etc. A vibrant bioeconomy can also improve opportunities for farmers, not least small-scale farmers, connecting them to new market opportunities and value chains both locally and nationally, but also internationally. Finally, protecting the environment through converting biowaste which today is threatening the ecosystem and freshwater resources to useful products is also a key component of an East African bioeconomy.

A regional bioeconomy strategy, a regional approach and regional partnerships spearheaded by BioInnovate Africa has many advantages, such as catalysing national bioeconomy policy development, harmonising bioeconomy policies, strategies, regulations and standards for trade of bioproducts in the region. Collaborating on capacity building for new biobusinesses and working with partners to jointly increase attractiveness for international investments and ventures will also benefit all countries in the region.

Fortunate Muyambi, Acting Executive Secretary, East African Science and Technology Commission (EASTECO), Kigali, Rwanda.



Bioeconomy implements natural resource technologies and offers a realistic platform for attaining sustainability. It follows on from the fossil economy and develops a range of products and services. It also involves knowledge based sustainable utilisation of environmentally beneficial clean technology and renewable natural resources. There are immense biological resources in the region. Governments and policy makers in the region are faced with the challenge of investing in technologies that link smallholders to markets, value chains and agroprocessing opportunities. Science, technology and innovation are critical drivers of the bioeconomy, and lay the groundwork for the transition from primary production to added value products. EASTECO fosters the development of bioeconomy in Eastern Africa. Rapid globalisation and the advent of new technologies and trade regimes, and growing global demand for food, feed and renewable materials are changing the conditions for utilisation of genetic resources. There is a need for supporting initiatives that effectively link public research organisations, universities and market actors that will dramatically improve the chances of Eastern African farmer, agribusinesses and agroprocessors benefitting from the rapidly developing field of biosciences. Bioincubators are also improving the chances of bioscience innovation benefits reaching smallholder farmers, resource poor communities and a broad group of market actors.

The main objective of the project "Developing an Innovation-Led Bioeconomy Strategy for Eastern Africa" (BiSEA) supported by BioInnovate Africa has been to develop a regional bioeconomy strategy and a policy agenda shared by the countries in the Eastern Africa region. The regional bioeconomy strategy has been developed by the BiSEA project in close consultation with Science and Technology Councils and Commission and relevant ministries and stakeholders in all six BioInnovate countries (Ethiopia, Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda) and South Sudan. The BiSEA project partners have been the East African Science and Technology Commission (EASTECO) in Rwanda, African Technology Policy Studies Network (ATPS) in Kenya, Scinnovent Center in Kenya, Bio-Innovations Ltd in Uganda and the Stockholm Environment Institute, (SEI) - Africa Center in Kenya. The stakeholder engagement has been an open, transparent and a broadly consultative process including a variety of perspectives to reflect different contextual realities in the countries in the region. Consequently, the directions, advice, input and guidance to the drafting process comes from a broad set of stakeholders through a number of regional and national consultation which has included (i) Government and policy bodies, (ii) Industrial and commercial actors, (iii) Practitioners, farmers etc and (iv) Academia. The main objective with the regional strategy is to harmonise efforts in building bioeconomies in the region and to inspire and catalyze the development of national strategies and bioeconomy policy agendas in the region

Christophe Bazivamo, Deputy Secretary General (Productive and Social Sectors), East African Community (EAC), Arusha, Tanzania



The East African Bioeconomy Observatory (EABO) was developed by East African Science and Technology Commission (EASTECO) with support from the BioInnovate Africa Programme, and in consultation with a project consortium (African Technology Policy Studies Network (ATPS), the Scinnovent Centre, Bio- Innovations Ltd, and Stockholm Environment Institute (SEI) - Africa Center) working with the Science and Technology Councils/Commission and relevant ministries and stakeholders in all six Bio Innovate countries (Ethiopia, Burundi, Kenya, Rwanda, Tanzania and Uganda) and South Sudan. The Bioeconomy observatory contains background materials on the bioeconomy development in the region. It will be an increasingly useful resource for countries in the region to develop their national bioeconomy strategies and subsequent policy interventions creating new jobs and a sustainable bio based and inclusive economic growth in the region.

The EABO is a regional open access repository for bioeconomy data and information, which will support EAC, national policymakers and stakeholders with science-based knowledge for the promotion of a sustainable bioeconomy. The portal will facilitate access to bioeconomy knowledge resources from a wide range of scientific disciplines and sources including, the sustainable production of renewable biological resources and their conversion into valuable products.

The goal of EABO is to a provide a regional open access repository for sustainable bioeconomy data and information and will assist policy makers to monitor the development of the bioeconomy and assess its impact and accordingly, support the implementation of the Regional Bioeconomy Strategy for Eastern Africa. Specific objectives of the EABO are:

- 1. To strengthen regional policy framework for bioeconomy data management
- 2. To identify, filter and avail relevant bioeconomy information
- 3. To contribute to filling national and regional bioeconomy information gaps
- 4. To improve the quality and dynamism of eastern African bioeconomy related policies through analysis and communication of bioeconomy data.
- 5. To provide to eastern African decision-makers up-to-date information on bioeconomy trends and enhance their knowledge base for policymaking
- 6. To facilitate networking and knowledge sharing among stakeholders
- 7. To reinforce regional and international bioeconomy cooperation.

KEYNOTE PRESENTATION

Professor Joachim von Braun, Director, Center for Development Research (ZEF) University of Bonn; Germany



In the last seven to eight years more than fifty countries in the world have launched bioeconomy strategies and related policies, and an international advisory committee on bioeconomy has been established. Life science innovations are the centre of the bioeconomy accompanied by social innovations and digitization which is growing quickly. Bioeconomy is about innovative products, processes, and changing behaviour and it's about good jobs particularly in rural areas that are attractive for young people. These are driving forces of the bioeconomy in Asia, Latin America and Africa. Bioeconomy is now defined as the knowledge-based production and use of biological resources to provide product, processes and services in all economic sectors within the frame of a sustainable economic system. The concept of the bioeconomy is embedded in a circular economy and seeks synergies with other innovations especially renewable energy. A sustainable bioeconomy protects and makes use of nature while at the same time supporting global food security, climate protection, and the regeneration of natural resources particularly fertile soils, clean energy, and clean water. Bioeconomy is encompassing all economic sectors and can be compared to the information and communications technology because of its penetration of the economy driven by two forces i.e., innovations and demand; from

industries and consumers. Establishing a sustainable bioeconomy offers the opportunity to decouple economic growth from resource consumption through efficient technology and innovation. We can expect that technological progress particularly in life science will lead to the development of biobased products that combine sustainability with increased consumer benefits. Many of these key breakthroughs in research are highly relevant for Africa, such as novel food and medicines and the industrial bioeconomy with bio-based products with special properties and functions, microbial based bioplastics and bio-based materials for packaging, functional textiles, recyclable clothes, bio-based processes and technologies such as bio-based 3D printing, bionics and robotics, bio-manufacturing. That puts bioeconomy at the centre of new industrial strategies as Africa is headed towards industrial transformation.

Change to biobased and resource light society requires a collaboration between politics, civil society, economy science and citizens. Government policies and strategies can help minimize conflicts that are embedded in any transformation. The need for international cooperation arises particularly regarding measuring footprints and monitoring the impact of an expanding bioeconomy. Africa and East Africa has the possibility to leapfrog into the bioeconomy. Four big opportunities in the immediate future for the African bioeconomy are: (i) Boosting of the food systems transformation, (ii) Transformation of the wood and charcoal-based cooking with local energy grids, (iii)Urban biosystems transforming to no waste economy in the fast-growing urban centres of Africa with circular economy elements, (iv)Technological innovations in support of Africa's industrialization, bringing together the bio and the digital innovations. The Food Systems Summit in 2021 provides a big opportunity to integrate food systems transformation with the bioeconomy. It is of global importance that Africa engages in forums of this nature.

SUMMARY OF DISCUSSIONS

The key partnerships required to develop a bioeconomy in the region involve (i) merging opportunities in the agricultural and digital sectors, (ii) providing innovation platforms such as ICIPE that are attractive to public and private sectors.

The bioeconomy initiatives in the region should go much broader, embracing the whole continent.

Policy makers should develop innovation-friendly policies on a regional basis, eg that facilitate product registration.

There needs to be more awareness building and advocacy to ensure that policy makers and the general public are aware of the potential of bioeconomy.

African governments need to invest in bioeconomy and not just rely on foreign support for capacity building and investment in start-up companies

SESSION 02

Ministerial Panel on Sustainable Bioeconomy as the Driver of Growth in Eastern Africa

This session focused on how sustainable bioeconomy could be a key strategic area for regional cooperation and how countries in the region, regional and continental bodies such as the EAC, AU, UNECA, and international partners, such as European Union's Joint Research Centre can collaborate in the development of sustainable bioeconomies in Africa. The key questions the addressed were.

- 1. How can governments support the development of sustainable bioeconomies and sustainable bioeconomy driven regional economic growth in Africa?
- 2. How should public policy evolve in support of sustainable bioeconomy development and what should be prioritized?
- 3. How should regional and continental bodies like the EAC, AU, UNECA, etc. respond to the challenge of sustainable bioeconomy development ,and what is the role of networks in developing sustainable bioeconomy?

Marios Avraamides in charge of the European Commission's Knowledge Centre for Bioeconomy at the Joint Research Centre (JRC)



Dr. Marios highlighted that, investments by public and private sectors in the bioeconomy act as a key driver of economic development and transformation in Europe. A sustainable bioeconomy needs to capitalize on scientific and technological advances and must be built on sound knowledge and data. The JRC is also establishing an observatory on forestry and forest degradation to provide better access to data on biomass supply chains. The EC recently updated its European bioeconomy strategy which is aligned to the SDGs and has 14 concrete actions to support strategy implementation. The JRC is leading three of the 14 actions: (i) Enhancing the knowledge base and monitoring system for the bioeconomy (ii) Establishing a knowledge centre for bioeconomy. The Centre provides knowledge analysis for sustainable evidence-based policies. (iii) A monitoring system which will be launched in the upcoming global bioeconomy summit. The JRC is interested to collaborate with African partners in supporting knowledge based development of sustainable bioeconomies. The JRC is also supporting various projects including in the forest service in Africa and a water and energy ecosystem project around Lake Victoria.

Dr. Elioda Tumwesigye Uganda's Immediate Former Minister of Science, Technology & Innovation and the chair of science and technology in African Union member states since December 2019,



Dr Tumwesigye's presentation focused on how Uganda can contribute and tap into the opportunities presented by the bioeconomy. Dr.Tumwesigye reiterated that the crosscutting and multi-facetted nature of bioeconomy offers unique opportunity to comprehensively address inter-connected societal challenges such as: food and nutrition security; health; emerging infectious disease outbreaks; natural resource depletion; fossil resource dependence and climate change while achieving sustainable development. Uganda appreciates bioeconomy as a crucial element of a circular economy recycling of resources including waste, and allowing optimization of the use of biological resources. To support adoption and integration of bioeconomy in its national development plans there has been an establishment of appropriate government directorates and departments on biosciences and Bioeconomy, biosafety and biosecurity; R&D coordination, innovation and intellectual property management, technology development; and technology uptake, commercialization and enterprise development, and is strengthening the leadership

capacity of its National Council of Science and Technology. A Ugandan bioeconomy policy and strategy is underway. There are also plans to establish a Biosciences Science and Technology Park which will host technological infrastructure such as research laboratories, technology development workshops, prototyping facilities, testing & analytical facilities to facilitate the entire product and technology development process into final commercialization. More specifically the Uganda biosciences science and technology park seeks to (i) Strengthen biobased SMEs' competitiveness and R&D competency through provision of infrastructures for applied research to pilot production and commercialization (ii) Develop and grow biobased industries through scientific knowledge, technology transfer and bioincubation addressing national challenges of industrial development, export-oriented manufacturing, employment and wealth creation; (iii) Advance biosciences technology and knowledge acquisition through tailor made human resource development programmes to promote local content, generate employment and create wealth. (iv) Strengthen regional and international collaborations with scientists and expertise providing access to world class technology, knowledge critical to industries, and R&D bridging biosciences knowledge gaps and adding value to national bioresources for a bioeconomy led society transformation, and; (v) Ensure sustainable utilization of the existing abundant biodiversity resources through accelerated R&D for industrialization, environmental protection and conservation. Focus areas include commercial insects, high value and innovative food products, processing aids such as food additives, enzymes, bionutraceuticals, livestock and fish feeds, biomass based renewable energy, biofertilisers and biopesticides, biomaterials, biofibres, biopharmaceuticals, biocosmetics, flavours and fragrances, biopackaging and biowaste valorisation. Enabling policies and regulatory frameworks are being developed, and a comprehensive financing framework has been established.

Dr Ahmedin Mohammed Ethiopia's State Minister of Innovation and Technology



Dr Mohammed stressed the wide variety of geographical and climate variations in the Eastern Africa region, which have led to wide, and largely unexplored, biodiversity. He articulated that while the Eastern African economies are mainly dependent on agriculture, countries in the region have not fully made use of modern technologies for increased agricultural and economic growth. Moreover,Ethiopia has frequent crop failures leading to food insecurity, but the current government is committed to poverty alleviation, and is working on appropriate policy reform to build a strong knowledge based industrial foundation. A 10-year development grand plan has been developed to make the country prosperous, which includes a roadmap for biotechnology development at national level. The digital economy and bioeconomy play key roles for sustainable economic development. Globally, governments need to develop new and innovative ways of thinking to deal with the need for increased food production for a growing global population. Science, technology and innovation are central to the bioeconomy, but to date there has been insufficient industrial capacity relevant to the bioeconomy. However, the development of agroindustrial parks in Ethiopia will serve as the basis for expansion of biobased enterprises. Regional and continental bodies play a central role in supporting use of regional research and infrastructure. He noted the urgent need to place bioeconomy in the political and business agenda and that Africa can leapfrog the bioeconomy by:

- Developing and implementing robust bioeconomy strategies
- Leveraging the existing STI policies to promote knowledge and innovation
- · Allocating increased public funding for bioeconomy research
- Enhancing Private-Public Partnerships and close cooperation with the private sector
- Increasing agricultural productivity by supporting farmers to access facilitates such as agro-processing centres which have enormous potential for enhancing agribusiness

Prof. Jerome Afeikhena, Special Adviser to the Commissioner for Rural Economy and Agriculture, African Union Commission, Ethiopia



Professor Afeikhena's presentation focused on how the continent can leverage the potential of bioeconomy. He mentioned that collaboration within the African continent is key, and that the bioeconomy will play a big role in job creation, enhanced public health, food security and climate change mitigation. He noted that the EAC regional bioeconomy strategy is a timely initiative and a huge opportunity for East Africa to transform its agricultural and bioprocess systems, and also food systems in view of the upcoming 2021 UN food systems summit. In order for the regional strategy to be effective, countries in the region also need to develop national bioeconomy strategies. The African Union can help countries in the region to further develop the policy agenda. At continental level there is a Blue Economy Strategy and a Circular Economy Action Plan is under development, which will add value to the regional Bioeconomy Strategy. There is also need for strategy implementation plans with clear milestones to help monitoring on how countries are progressing towards modern Bioeconomies.

Mama Keita Director of the sub-regional office for East Africa of the United Nations Economic Commission for Africa (UNECA)



The East African economy needs diversification to thrive, and a bioeconomy provides that opportunity. COVID-19 has created economic and health shocks to the society, and has also demonstrated that countries are very vulnerable to the loss of tourism income. With a functional bioeconomy, the region can produce biobased pharmaceutical products locally improving health and increasing job creation. The East African region has great potential, and already today countries in the region are exporting products and services connected to the bioeconomy, and profitability is very high for the companies operating here. Bioeconomy is evidence based, knowledge and investment intensive, thus there is a need for collaboration to generate required knowledge. The private sector needs to be informed about the opportunities in a range of sectors. Successful implementation of the strategy will require inclusivity, involving all stakeholders including youth and the private sector. Collaboration on harmonisation of regulatory frameworks and policies will be essential, as well as collaboration to address issues such as improvement of the business environment, affordability of energy, availability of a skilled labour force, access to finance for SMEs, and taxation regimes. The African Continental Free Trade Area (ACFTA) is a huge opportunity to open the market for bioeconomy based products and services where countries should be building on synergies rather than competing with each other.



KEY POINTS AND EMERGING ISSUES AND SUMMARY OF DISCUSSIONS

- This conference is an important venue for sharing ideas and knowledge about available bioeconomy opportunities within the region, in Africa as whole, but also overseas, such as the EU. Key bioeconomy stakeholders in the region need more of these kind of conferences at national and regional levels. There are potentials to be explored, whilst working hard to overcome policy, knowledge and technology barriers.
- There is an appreciation of the level of commitment at all levels for bioeconomy development, circular economics and benefits sharing from related biobased value chains. However, there are critical gaps in terms of capacities to tap into these opportunities, not least in terms of human capacity and where large part of the youth are left out due to inadequate education and skills.
- Inclusiveness and partnership between academia, governments, private sector and civil society in the development of thriving bioeconomies in the region is of paramount importance
- There is need to invest in the bioeconomy, but in most parts of eastern Africa there are big financial gaps and lack of venture capital.
- Inadequate access to technology and know-how is stifling the development of the bioeconomy in the region
- Ministerial commitment needs to be ensured among a wide range of other priorities, and crosssectoral coherence needs to be strengthened
- Creating public awareness on the importance of bioeconomic development in the region through disseminating easily digested information can contribute to the development of a sustainable bioeconomy in the region, as opposed to only having the information for the elite and experts in the various sectoral areas
- The issue on Intellectual Property (IP) ownership to products of bioeconomy innovation and research in the region needs to be addressed and taken seriously.
- Sustainability and environmental protection are key components in the development of bioeconomies in the region

SESSION 3

Bioeconomy Strategies and Policies for Eastern Africa



Facilitator- Dr Maurice Bolo – Director, The Scinnovent Centre, Kenya.

This session featured a presentation of the East African Regional Bioeconomy Strategy and a presentation of the current situation as regards to bioeconomy development in six East African countries, Burundi, Ethiopia, Kenya, Rwanda, Uganda, and South Sudan.

KEY ELEMENTS OF THE REGIONAL BIOECONOMY STRATEGY FOR EASTERN AFRICA:

Mr Fortunate Muyambi, Acting Executive Secretary, EASTECO.



The core objectives of the strategy are to support

- Food and nutrition security through improving farm profitability/productivity and ability to produce nutritious food products
- Health, through development of biobased drugs and vaccines to address key health problems in the region
- Rural and urban livelihoods and creation of new jobs through the development of new biobased value chains and bioprocessing of primary produce and biowaste
- The Environment, through reducing Green House Gas emissions, reducing biowaste and protection of vital ecosystem services

Some of the key messages in the Strategy are:

- The development of a modern bioeconomy in Eastern Africa has significant potential to support several critical development goals and targets for the region
- Value addition to bioresources is at the centre of the Bioeconomy, where value can be added to primary produce creating innovative and novel food, feed, fuel, and health products and biomaterials.
- Converting biowaste and agricultural residues into useable products is also
 a central part of the bioeconomy, improving the efficiency of the agro and
 bioprocessing industries in the region and providing feedstock for novel biobased
 products.
- A regional bioeconomy strategy for Eastern Africa can support regional collaboration and harmonised policies, strategies, regulations and standards for biobased products, facilitating trade and economies of scale and concerted actions to build capacity in key areas of the bioeconomy
- In order to realise the promises of a modern bioeconomy, countries in the region need to develop an enabling environment, where strategic capacity building, partnerships, business incubation, financing mechanisms and supportive policies are key

BIOECONOMY DEVELOPMENT IN THE REGION, PER COUNTRY

In this panel the current status (policies, structures etc) and future vision for bioeconomy at the country-level were presented and discussed, including issues such as

- · Available policies and policy options
- · Opportunities and entry point of actors and potential of bioeconomy in the countries
- · Market and non-market opportunities
- Existing gaps, challenges and needs for additional support- i.e., role of collaborations and partnerships in developing a vibrant bioeconomy in your country.

Ethiopia

Kassahun Tesfaye, Director General, Ethiopian Biotechnology Institute, Ministry of Innovation & Technology, Ethiopia.



Ethiopia is considered as one of the 10 fastest growing economies in Africa and has huge biodiversity which it can explore to build its bioeconomy. The country also has a large land mass, good agricultural infrastructure, large agrobiodiversity, a growing population and an abundant workforce and is in the process of establishing a number of agro-industrial parks. Ethiopia has various development policies in place related to the bioeconomy including the president's Green Legacy Initiative, the national biotechnology roadmap and the agricultural sector development strategy. A recent expansion of the sugar industry including expanded sugarcane cultivation area and establishment of processing factories presents opportunities for developing the Ethiopian bioeconomy further. Inspired by the regional bioeconomy strategy, Ethiopia is developing a national bioeconomy strategy where the Ethiopian Academy of Sciences is a key actor. In this process a number of challenges in respect to bioeconomy development have been identified such as, inadequate access to novel technologies, inadequate infrastructure and lack of investment capital. In this context it is important to investigate how the increasing Foreign Direct Investments (FDI) in Ethiopia have and will contribute to the bioeconomy development and growth of various bioeconomy sectors.

Kenya

Benson Mburu, National Commission for Science, Technology and Innovation, Kenya.



Kenya's economy is dependent on the use of bioresources, with agriculture, forestry and fishing contributing about 35% of GDP in 2019. This contribution is highly skewed towards crop production (at 26%) with livestock contributing 3% and fishing contributing 0.5%, indicating that despite the abundance of aquatic biomass, its potential has not been fully exploited. The opportunities for bioeconomy development in Kenya are many and the country has a rich heritage of traditional knowledge and cultural practices on use of bioresources that can be harnessed for economic activities. There is an opportunity to further add value to agrobased exports which to a large extent are unprocessed. There are also opportunities for novel biobased industrial growth, such as manufacturing of biobased health products and cosmetics and bio-based construction materials. In order to tap into the opportunities, Kenya needs to build its human resources able to adopt and develop appropriate technologies and to use and safeguard indigenous traditional knowledge. Favourable policies, (e.g. tax regimes, standards etc) to encourage local biobased production, product marketing and market penetration need to be developed.

Linking and incubating innovation actors, stimulating public-private partnerships and developing favourable financing models for bioeconomy are also key to develop the Kenyan Bioeconomy. Kenya has already made commendable progress in terms of developing policy frameworks/policies in support of bioeconomy development e.g. land use policy, tourism policy, climate change policy, water policy, food and nutrition among others. Its national development blueprint, the Vision 2030, together with other strategies such as the Big Four Agenda and the climate change strategy all support implementation of these policies. National institutions such as NACOSTI, NEMA, KALRO, KEPHIS, KWS, are dedicated to addressing issues related to using and protecting biodiversity. However, Kenya needs to harmonise policies and coordinate government efforts in support of bioeconomy development including development of policies for biobased value addition and technology adoption.

Uganda Peter Wanyama, Ministry of Science, Technology and Innovation,



The development of a Ugandan bioeconomy requires a multi-sectoral initiative, but current policies are fragmented or obsolete and cannot effectively foster bioeconomy development in the country. For example, the national drug policy does not include traditional medicine and health practices, which can be seen as a missed opportunity. But, Uganda is now making commendable progress which includes the initiation of the process of defining the bioeconomy in the Ugandan context and an impact assessment of the bioeconomy related regulatory regime. Uganda has also developed a draft national bioeconomy policy which focuses on: (i) bio-medical innovations to boost the country's health systems (ii) revolutionising the agricultural sector through increased research and production; (iii) value addition to contribute to the country's agro-industrialisation (iv) domesticating the regional bioeconomy strategy and aligning it to the Ugandan bioeconomy policy under development.

South Sudan Clara Lumori, University of Juba, South Sudan,



South Sudan doesn't have a bioeconomy policy or strategy but the process of developing the regional bioeconomy strategy is a platform and process South Sudan will use to develop its own bioeconomy policies and strategy. There are some opportunities which will support the bioeconomy in South Sudan such as its human resources and young growing population where 70% of South Sudan's population is below 35 years of age. Emerging regulatory policies, South Sudan development plans, the South Sudan Vision 2040, and a comprehensive agricultural master plan which prioritizes food security are supporting the bioeconomy in the country. In terms of challenges, political instability in South Sudan remains a huge challenge as well as climate change and rampant deforestation. Weak institutional capacities, including a lack of coherent policies, lack of an STI policy coupled with high illiteracy levels will impede efforts toward promoting bioeconomy. To move to the next level of developing its bioeconomy, bioeconomy being a new concept in the country South Sudan requires support to build public awareness and the capacity of its stakeholders where establishing bioeconomy research and innovation centres are key. Coherent policies in support of bioeconomy development, linking and incubating innovation actors, stimulating public-private partnerships and developing favourable financing models for bioeconomy are key to develop the bioeconomy in South Sudan

Burundi

Steve De Cliff, Executive Secretary, National Commission of Science, Technology and Innovation, Burundi.

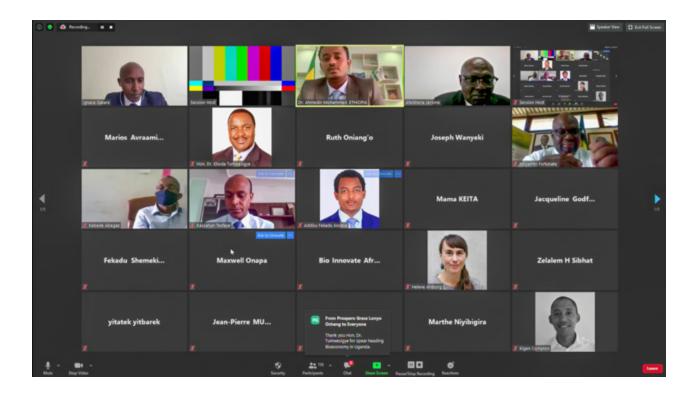


Burundi's economy largely depends on agriculture but there is a huge gap in knowledge development and skills to add value to agro and bioproducts. Burundi lacks a legal framework in support of the bioeconomy and there are inadequate links between the consumer market, business and innovation actors and the knowledge generation institutes. More work needs to be done in Burundi to promote investment in bioinnovation and biobusiness. In this regard inclusiveness, involving youth and women, and partnership between academia, governments, private sector and civil society in the development is important. Political will and government support for thriving bioeconomy in Burundi will be crucial. Some of the key priority areas that needs intervention include (i) agriculture and food security, which entails promotion of biobased novel food products and (ii) biobased medicines and health products using and adopting indigenous knowledge.

Rwanda Eugine Mutimura, National Council for Science and Technology, Rwanda



To foster bioeconomy, Rwanda has invested in building a science and technology framework, through its new STI policy, which is accompanied by an implementation framework. Rwanda is also deliberate in youth inclusion. Some of the challenges they face include landmines and landslides and there needs to be further work on how to overcome the challenges posed by policies that hinder bioeconomy development. FAO is supporting countries in developing sustainable bioeconomy strategies, including Rwanda.





SESSION O4

Parallel Workshops

This session included four parallel workshop visualising key bioeconomy actors, entrepreneurs and novel biobusinesses in four areas,

- Workshop 1-Food systems and agriculture
- Workshop 2-Bio-based Industrial Development
- Workshop 3-Health and well being
- Workshop 4-Sustainable Energy

WORKSHOP 1

FOOD SYSTEMS AND AGRICULTURE

Chair:



Prof Ruth Oniang'o, Founder and Director, Rural Outreach Africa & 2017 Africa Food Prize Laureate

Co-chair:



Dr. Moses Osiru, Manager, icipe/ Regional Coordination Unit of the Regional Scholarship, and Innovation Fund (RSIF)

This session focused on how bioeconomy can sustainably strengthen food and feed production and ensure food security in the region. The session showcased examples of how new biobased technologies and solutions can support developments such as value addition to food crops, livestock, and microbial products to provide opportunities for smallholder farmers and SMEs, and development of a variety of novel and healthy food and feed products for growing local and international markets.

DEVELOPMENT AND VALIDATION OF LACTIC ACID STARTER CULTURES FOR ENSET (ENSETE VENTRICOSUM) FERMENTATION

Dr. Addisu Fekadu Andeta, Arba Minch University, Ethiopia



Enset (Ensete ventricosum) is drought tolerant, domesticated in Ethiopia, and over 20 million Ethiopians use enset as a staple food where Kocho is a main food product. The problem lies in traditional enset processing methods which are labor intensive and time consuming. The processing also lacks well defined starter cultures which results in long fermentation times and variable quality. For this reason, lactic acid bacteria strains were screened for the development of starter culture(s) specific for enset fermentation. To this end, 158 isolates grown were obtained from fermenting enset and traditional starter material. They were screened based on their biochemical characteristics. Three promising strains, two Lactobacillus plantarum and one Leuconostoc mesenteroides, were selected and evaluated under field conditions. As a result, inoculated enset showed a faster colonization of lactic acid bacteria than the uninoculated biomass. The three starters appeared to be suitable for enset fermentation.

EFFICACY TRIAL: ASSESSING THE IMPACT OF A BIOFARMING INPUT ON MAIZE IN KITALE, KENYA

Peter Mbogo, PhD and Kassim Owino, SeedCo Research, Kitale, Kenya



The essence of this trial was to assess the impact of SeedCo SynqBioGrow BioFarming input of selected beneficial bacteria strains on maize yield, soil health and farmer profitability. Impacts in Kenya for maize growers have been improved business performance, livelihoods and increased financial stability. For the consumers, benefits include a higher quality, improved food safety, lower prices, and higher nutrition per purchasing unit. There is also a potential for carbon credits to fund Kenya's conversion to biofarming by looking at the carbon absorbed and stored in the roots and released to the soil. In conclusion, the application of SynqBioGrow can enhance crop growth, yield and quality, improve root development and increase efficiency of fertilizer uptake, eliminate the use of both pesticides and fungicides in farming systems improving food safety and lowering agricultural chemical toxins in local water supplies.

AGRI-FOOD SYSTEMS AND FOOD SECURITY: THE ROLE OF FOOD COMPANIES IN EAST AFRICA

Ana P Aponte, Development Director, Inclusive Business Sweden



The challenge globally is that more than two billion people suffer from hidden hunger, a chronic deficiency of micronutrients, mainly caused by poor and unvaried diets. The effects are devastating not only for those affected but also for the progression of societies and economies as a whole. Universal access to safe and nutritious food requires crossdisciplinary action to ensure micronutrients available in soils and crops are absorbed by the human body. In East Africa, the majority of diets are not varied, and today comprised mainly of maize, rice, millet and sorghum. Most low-income urban consumers purchase their food and up to 60% of that food is processed. Many of today's processed foods however lack nutritional density. Food processing companies now have a unique opportunity to combat hidden hunger through the raw materials and value addition methods they choose to use in their production. Traditional grains are amongst the most nutrient dense foods if used as whole grain, but the use of whole traditional grains varies. Grain consumed today in East Africa is heavily refined and has lost most of minerals and vitamins. Cereals are seeds designed by nature to survive until it is time to grow and micronutrients are often bound in complex phosphate compounds such as phytate and only released when certain environmental criteria are met, and thus not readily available. To access these nutrients, grains need to be processed. By adopting hydrothermal processing of whole grains using simple and inexpensive modern techniques, food companies can create products with more accessible micronutrients that can increase potential iron availability almost equivalent to red meat and increase zinc absorption by up to 400%. What people consume depends on cultural and social norms and on what is available and affordable. Victims of hidden hunger may not understand the importance of a balanced, nutritious diet. Food companies and public institutions can, given informed consumers and market creation, play a key role improving food processing and increasing bioavailability of food nutrients

EXPLORING THE UNTAPPED POTENTIAL OF JACKFRUIT

S. Nansereko and J.H. Muyonga, Makerere University, Uganda





who said that under-consumption of fruit and vegetables is among the top ten risk factors leading to micronutrient malnutrition and is associated with the prevalence of chronic diseases. Jackfruit, despite being widely grown, nutritious and highly versatile, has a low contribution to nutrition and incomes. Jackfruit is the largest known tree-borne edible fruit in the world. The fruit weighs up to 30 kg and yields 50-80 tons per hectare annually. Multiple parts of the crop are usable for food, fodder for cattle and goats, wood for timber, and firewood. Jackfruit has not been sufficiently incorporated in the general food system because of gaps in knowledge on its nutritional and nutraceutical value, processing and utilization methods and preservation methods. A rudimentary marketing system results in low consumption especially among urban populations and youth. As a result, the position of jackfruit in food systems is weak, the value chain is underdeveloped, postharvest losses are high, and farm gate prices are low. Although the role of jackfruit is limited and its role in future food systems is uncertain, the potential for value addition and increased utilization of jackfruit is considerable.

MICRONUTRIENTS ENRICHED FOODS: ALGAL RESOURCES FOR BIOLOGICAL PRODUCTS AND BIO-FORTIFICATION OF STAPLE CROPS

Dr. Eng. Emmanuel Manirafasha, CEO Healthy food & feed Co, Rwanda



The most pressing global health challenges are food security and nutrition, and the burden of associated chronic diseases (diet induced diseases, foodborne illnesses, premature aging). More than 800 million people are currently suffering from hunger and over two billion people are suffering from excess weight and there is thus an urgent need for healthy diets available to everyone. Technology dissemination on the use of algal resources can provide novel food, food supplements and micronutrients for enriched food. Innovative use of algal resources can create rural jobs and contribute to bioeconomy and sustainable development. Microalgae constitute two-thirds of the earth's biomass and should be considered as an industrial feedstock in a biobased production system including in East Africa. Algal resources exhibit high productivity and produce a broad range of bio-active compounds and can be used for a range of applications such as biofertilizers and biofuels. Algal metabolites may also help prevent specific diseases and could be used to promote health and longevity. The CEO of Healthy food & feed Co is engaged in various stakeholder collaborations include partnerships with academia, and other industries.

SUMMARY OF WORKSHOP 1 DISCUSSIONS

The presentations offered a picture of how bioeconomy can sustainably strengthen food and feed production and ensure food security in the region. Expedited growth of value addition in agri-food production will be critical in attaining Eastern Africa's ambitious developmental goals and addressing the bottlenecks of food production and converting agro-industrial waste into valuable food and feed products.

WORKSHOP 2:

BIO-BASED INDUSTRIAL DEVELOPMENT

Chair:



Dr Nicolas Ozor, Executive
Director, African Technology
Policy Studies Network

Co-chair:



Mr Alex Tumukunde, Founder and Chief Executive Officer, BioInnovations Company Limited

This session focused on how to build biobased industries that add value to strategic and often underutilised renewable bioresources in the region. This includes agro- and bio-waste that can be converted to valuable products, creating jobs and at the same time minimising environmental degradation. A key question for this session was on how to advance a "biologisation of the economy" and to identify drivers and hurdles as well as governance and enabling frameworks for emerging new biobased technologies, innovations and markets.

MICRO FIBRILLATED CELLULOSE A NOVEL MATERIAL FOR THE GROWTH OF THE BIOECONOMY

Denis Ssekimpi, Hya Bioplastics, Makerere University, Uganda



Biomaterials from plant fibres have been an emerging trend as a replacement for fossil feedstock due to the environmental benefits and the low cost of sourcing the raw materials in nature. However, a major drawback to their application in some applications is the insufficient mechanical properties exhibited by most of these materials. This deficiency requires innovation and technological advancement in the processing of biomaterials for more applicability. Microfibrillated cellulose (MFC), a component of cellulosic plant fibre, the raw materials of most biomaterials, has been identified as a way of improving the mechanical properties of the fibres used in various applications. Hya Bioplastics has developed a low-cost method of producing MFC for improving fibre based products, involving (i) feedstock pretreatment where agricultural waste and water hyacinth is effectively dried, milled and delignified (ii) Low-cost production of MFC using a high speed blender technology (iii) Addition of other biomaterials and (iv) Thermoforming of prepared composites into various product forms (plates, cups, packaging material etc). Hya Bioplastics has plans for commercialization of its MFC products

REFRACTANCE WINDOW DRYING OF FRUITS- A CASE OF SMALL SCALE AGRO PROCESSORS IN UGANDA

Faith Namayengo, Department of Human Nutrition and Home Economics, Kyambogo University, Uganda



Uganda produces a variety of fruits, vegetable and herbs and much goes to waste because of limited post-harvest processing methods. These losses can be reduced by use of drying techniques. Although many drying technologies are available in Uganda, there is limited documentation on the design, operation, and processing parameters. The Refractance Window Drying Technology (RWDT) is a novel drying technology that dries liquid food, purees and slices into powders or sheets with added value. Being a new technology, there was need to undertake a Techno Economic Analysis (TEA) to establish the performance of the technology in comparison to the existing technologies. The Objective of the study of the techno economic analysis (TEA) was to compare the processing potential of the refractance window drying technology to the existing fruit drying technologies in two districts of Uganda. This analysis revealed unique attributes of RWDT and parameters for optimizing the drying process. RWDT presents opportunities for producing a variety of high-quality dried products at a relatively affordable cost and adoption of RWDT may contribute to reduction of post-harvest losses, contributing to value addition and improve incomes of farming households

A ZERO WASTE TANNERY PROCESS WITH FULL RECOVERY OF VALUABLE INDUSTRIAL PRODUCTS: POTENTIAL FOR EAST AFRICAN BIOINDUSTRY DEVELOPMENT

Francis Mulaa, Department of Public Health Pharmacology and Toxicology, Faculty of Veterinary Medicine, University of Nairobi, Kenya



Ever-increasing environmental pollution in the leather industry has resulted in the closure of the majority of tanneries in the region and thus necessitated the development of an ecofriendly enzyme-based biotechnology as an alternative to pollution causing chemicals. Dr Mulaa and his colleagues have developed a zero waste biobased processing technology by removing hair and hydrolysis products of grease by enzyme biocatalysis, reducing and eliminating the need for solvents, chemicals and energy demanding methods in the tannery. Apart from using less chemicals the technology improved the quality of leather, but also helped to improve the waste recovery resulting in a close to zero waste tannery process with full recovery of wool, gelatin, hydroxyapatite, and protein hydrolysate powder.

THE DEVELOPMENT OF AGRO-INDUSTRIAL CENTERS IN ETHIOPIA

Teklehaimanot Haileselassie; University of Adds Ababa; Ethiopia



Agriculture is the mainstay of the Ethiopian economy, accounting for about 43% of GDP, 76% of national employment and 28% of total export earnings. In Ethiopia, agro-industries account for the largest share of manufactured goods. However, the contribution of agroprocessing to the overall GDP, employment opportunities and earnings from export has been minimal. Ethiopia's agro-exports are currently limited entirely to primary and unprocessed goods despite the increase in global and domestic demand for Processed Agricultural Products (PAPs). The country has realized that industrialization will closely depend on transforming the agricultural sector and its agroprocessing sector as reflected in the consecutive Growth and Transformation Plans which include developing specialized industrial parks. To facilitate this process Ethiopia has established the Industrial Parks Development Corporation (IPDC) and connected regulations enabling industrial parks to be developed by public and private enterprises. Accordingly, several agroindustrial parks have been constructed in various corridors of the country specializing in sectors such as textiles, garments, leather products, sugar and pharmaceuticals. A new generation of industrial parks in the country is the Integrated Agro-Industrial Parks (IAIPs) which aim to revolutionize the agriculture sector. The business model of the IAIPs promotes value addition and improved efficiency of the commercial food supply chain. Commodities to be processed in the IAIPs includes coffee, livestock, cereals, sesame, pulses, honey, fruits and vegetables. The size of each IAIP is from 250ha to 1000ha and they will be established within a 100 kilometer radius from input source and output markets and will link to a set of novel Rural Transformation Centers (RTCs). The IAIPs and the RTC will together create improved conditions for public private partnerships, new innovative biobased value addition opportunities, agro and biowaste recovery and new enterprises creating off farm jobs and biobased economic growth So far one industrial park, the Bure Agro-industrial Park in Amhara has been inaugurated and three more IAIPS are under constructions

BAMBOO AS AN ADVANCED ALTERNATIVE RAW MATERIAL FOR WOOD AND WOOD-BASED COMPOSITES: TRENDS AND PROSPECTS

Rene Kaam Director, Central Africa Regional Office, International Network for Bamboo and Rattan (INBAR).



Bamboo is a giant grass, which grows naturally in East Africa, and covers more than 1.2 million hectares in the region. It is an important fast growing non-timber forest product and has for long been used as a construction material in the region due to its ready availability, ease of workability and its strength. In Ethiopia for instance, over 10 million Ethiopians are living in bamboo houses . The renewed interest in bamboo as a construction material has revitalized the utilisation of bamboo not only as a cheap renewable resource but also as a durable material with multiple uses and many value addition opportunities. In southern China for example, the bamboo industry has in many areas become a backbone for industry development and created economic growth and poverty alleviation in rural areas. With new technologies, bamboo fibres can serve as a source material for the rapidly growing global market of engineered bio-composite wood, where wood or grass fibres are mixed with various other biobased additives forming renewable, light and durable materials that can be made stronger than steel. Bio-composite material based on bamboo can thus be an important basis for biobased industries in the region, producing building material, furniture, biobased plastics, textiles, pulp for paper, green chemicals, and health products. It is also an important source for bioenergy and can be used carbonised and in chips, and several companies producing bamboo products exist in the region. Bamboo is considered as one of the fastest growing plants on earth and under good management a hectare of bamboo planted by smallholders in the region could yield approximately 40 tons of raw bamboo fibre per year. Sustainable harvesting of bamboo and increased bamboo use can also help to reduce deforestation, contributing to climate change mitigation, improved soil conservation and mitigation of flood disasters.

SUMMARY OF WORKSHOP 2 DISCUSSIONS

The presentations visualised the remarkable resource in the region available for biobased industrial development. They also showed the entrepreneurship and the capacity of actors in the region to develop promising biobased innovations. The discussion centred around the difficulty in moving from pilot scale to commercial scale and the lack of venture capital and inabilities of emerging companies and SMEs to absorb and fund the commercial development processes



WORKSHOP 3:

HEALTH AND WELL BEING

Chair:



Dr Maxwell Otim, Director of Science, Research and Innovation, Ministry of Science, Technology, and Innovation, Uganda Co-chair:



Dr Ivar Virgin, Senior Research Fellow, Stockholm Environment Institute (SEI)

The session focused on how to build a bio-based healthcare sector that addresses regional priorities and builds on traditional indigenous knowledge and practices. The issues on how to connect the use of local bio resources, modern bioscience and traditional knowledge to improve health and well-being in the region were also an important part of the session.

ALTERNATIVE TO GUMS AND RESINS FOR MEDICINAL AND BEAUTY PRODUCTS

Fidel Wambiya, a Market Systems Development professional at the IMARA Program.



Plant gums and resins from the drylands of Kenya are among key natural resources with potential to improve livelihoods of rural communities in terms of food security, income generation and foreign exchange earnings. The IMARA programme is leading the development of gums (such as gum Arabica) and resins, fodder, poultry and honey value chains to diversify income options for pastoralists through Cooperatives in Marsabit, Isiolo and Samburuin counties in Kenya. The program has adopted a model to support Laisamis Gums and Resins Cooperative by linking them to markets, facilitating capacity building initiatives on business management and technical assistance on quality collection of products. The project is supporting the community to use bioeconomy opportunities through (i) Collection centres where the project has established a collection cooperative which mobilizes the community members and links them to markets. (ii)Training on handling and value addition to ensure quality preservation.

AN INTEGRATED 'PUSH-PULL' AREA WIDE CONTROL OF TSETSE FLIES IN EASTERN AFRICA

Paul Mireji, Kenya Agricultural and Livestock Research Organization (KALRO.)



This BioInnovate Africa supported innovation project is developing improved tsetse fly repellents and attractants based on 'push' and 'pull' tactics acting synergistically and rapidly to suppress tsetse fly populations and consequently improve livestock health and human health. The tsetse repellent and attractant blends in this project are based on compounds derived from waterbuck and is in the order of five times more effective than the existing and on the market tsetse fly repellent technologies. With plans for commercialization, the innovation consortia will formulate and produce blends encapsulated on nanoparticles for controlled release and further incorporated in custom release devices such as plastic and textile fabrics among others. The release device for the attractant blend will be customized for placement within traps and/or targets while that for the repellent blend will be customized for placement on animals.

PLANT-BASED EXTRACTS TO PREVENT MALARIA IN EASTERN AFRICA

Professor Tatien Masharabu, University of Burundi.



The use of plant extracts as repellents has been proven as an effective way to prevent mosquito bites and malaria infection. The Catnip plant is one of the numerous plant species containing mosquito repellent characteristics and it is a natural and safer alternative to the synthetically driven chemicals and insecticides that may cause ecosystem damage and health problems. The objective with this BioInnovate Africa supported innovation project is to provide affordable plant-based mosquito repellents (soap, spray, lotion) for malaria control in the region. Models and methods for catnip production, repellent extraction and formulation, safety and efficacy tests are developed by the innovation consortium. The validated repellent will undergo certification by the relevant authorities before distribution to the market using a model whereby catnip plant will be locally grown by smallholder farmer who will be part of the value chain as raw material suppliers.

SUMMARY OF WORKSHOP 3 DISCUSSIONS

The presentations showed the resources in the region available for addressing health and well being, but also to build new livelihoods and new biobased enterprises in the region. The discussion centred around the difficulty in moving from pilot scale to commercial scale and the lack of venture capital and inabilities of emerging companies and SMEs to absorb and fund the commercial development processes.

WORKSHOP 4:SUSTAINABLE ENERGY

Chair:



Dr Rocio A. Diaz-Chavez, Deputy Centre Director, Research Stockholm Environment Institute -Africa Centre Co-chair:



Ms Shira Mukiibi, Business Development Manager, BioInnovate Africa, icipe.

The session was focused on the development of a range of bioenergy products and biotechnology for both household and industrial purposes that offer opportunities for expansion of biomass production that can create value-added at low opportunity cost by improving degraded or poorly maintained lands.

APPLICATION OF BIO-PROCESSES FOR INDUSTRIAL WASTE REMEDIATION

Karoli Njau, BioConversion Technology Africa Co. Ltd.



This BioInnovate Africa Program supported project is an enterprise to market integrated bio-process innovation for treatment of agro-processing waste-water in Eastern Africa. It has been registered in Tanzania and Uganda for this purpose with a sister company in Addis Ababa being registered. Some projects have been successfully implemented. The approach is energy recovery in form of biogas which is either used directly by the agro/bio-waste producing entity to generate heat for heating processes or converting the biogas into heat energy and electric power using combined heat and power engines. The other approach is water and nutrient recovery and re-use by the agro/bio-waste generating entity or the neighbouring communities for agriculture. The sludge produced in that process is a bio-fertilizer which can be processed, packed, and distributed for use to supplement carbon, phosphorus and nitrogen in soils. Environmental compliance is met by generating final effluent which meets the national standards for discharge into the environment through the combination of biotechnologies.

BUILDING A SUSTAINABLE BIOETHANOL COOKING FUEL INDUSTRY IN KENYA

Greg Murray, CEO, KOKO Networks.



He told the audience that they commercialize liquid ethanol cooking fuel in a lowcost manner such that it's able to undercut charcoal and kerosene costs by leveraging partnerships with the downstream fuel industry such as Vivo Energy where the fuel is stored by KOKO hardware. The next step involves a distribution system of the biofuel through a network of automated fuel dispensers that are located around the city of Nairobi for access within about five minutes of low-income communities. Smart microtankers are used for distribution and houses use two burner stoves. KOKO produces the distribution hardware on the stations and the small corner stores in neighbourhoods including the hardware and the software used to control the flow of fuel, payments, data and appliances. The potential impact of households switching to biofuels on jobs, income, health, and the environment are all positive. Recommendations for improved technology adoption include removal of VAT and import tariffs on stoves and fuel to enable lower consumer prices, enforcement of tougher regulations and controls on dirty fuels, stove financing and subsidy programmes to encourage lower-income household to access modern stoves, development of fiscal incentives and international partnerships to create more opportunities for commercial expansion, and means to unlock climate financing to develop the biofuel ecosystem further

EAC BIOENERGY DEVELOPMENT STRATEGY AND INVESTMENT PLAN

Fred Ishugah East African Centre of Excellence for renewable Energy and Energy Efficiency Makerere University.



The strategy is being adapted from the Bioenergy Development Strategy and Investment Plan for Eastern Africa, which was prepared by African Union Commission (AUC) in partnership with the UN Economic Commission for Africa (ECA) and the African Union Development Agency (AUDA-NEPAD) under the Programme to Modernize the Bioenergy Sector in Africa. The vision of the strategy is to secure a sustainable supply and utilization of bioenergy in the EAC region by creating an enabling environment to accelerate the wide scale dissemination and deployment of modern bioenergy technologies in the EAC through increased knowledge and understanding of the bioenergy systems, attracting investment, and adhering to sustainability principles. The strategy is built on the following market enablers: (i) Planning and decision-making information and awareness, (ii) Creation of an enabling environment for public and private sector investments, (iii) Harmonization of policies and regulations, getting political commitment, (iv) Availing appropriate finance and risk mitigation, (v) Capacity building and skills enhancement, (vi) Standards setting and enforcement and (vii) Identifying champions in each country to achieve the strategy objectives. The implementation of the regional bioenergy strategy and investment plan will be at two levels, at regional and national level. At national level, it is proposed to set up Thematic Working Groups. At regional level, a Bioenergy Technical Working Group is proposed. The strategy is expected to: contribute to increased energy access for productive purposes for the rural populations particularly women; contribute to increased food productivity and security; increase job opportunities, especially in the rural areas and thereby reduce rural-urban migration; increase income levels of the populations, especially in rural areas and thereby improve living standards; reduce the risks and chores of women and children related to wood collection and indoor air pollution; reduce the dependence on the use of wood resources and contribute to the enhancement of the forest and the environment in general; reduce the dependence on imported fuels; spur local and national economic activity and improve socio-economic activity of the region.

SUSTAINABILITY OF BIOGAS AND SOLID BIOMASS VALUE CHAINS: A CASE STUDY IN ETHIOPIA

Berhane Kidane, Senior Researcher (EEFRI)



Berhane told the audience about the work on biomass indicators that had been developed by the Global Bioenergy Partnership (GBEP) in Ethiopia. Solid biomass (charcoal and firewood) fuel, is the globally preferred sustainable type of energy. However, charcoal and firewood are still used in their most rudimentary, unmodified form with low efficiency of thermal conversion and a long range of social and environmental problems. The traditional and inefficient conversion process of woody biomass into charcoal generates high rate of GHG and non-GHG toxic emission. As a response, there was a launch in Ethiopia of the National Improved Cook Stoves Program in 2013 scheduled to run to 2030, with five-year phases aligned with the government's Growth and Transformation plan and by 2017, 11 million improved cookstoves were distributed. In the case study, two bioenergy pathways were selected; Biogas for households and institutions from organic waste (animal dung and human excrement) and solid biomass (charcoal, firewood) produced with advanced technologies, such as improved carbonization, and used in improved cookstoves for cooking and heating. Benefits of biodigesters and more efficient, modern cookstoves include clean and renewable energy, time savings for cooking and wood collection, health benefits through reductions in smoke and household air pollution, and the high value of the bio-slurry. At national level the benefits include reduction of the overexploitation of biomass cover, rural employment, income generation, micro and small enterprise development. At global level the benefits are manifested as a reduction in greenhouse gas emissions. The recommendations given were that biogas is a competitive option to replace the traditional energy sources for cooking. However, the constraints identified in the dissemination of a domestic biogas programme include: low incomes of most rural households to afford new technologies, scarcity of water, scattered population patterns, gender imbalance in decision-making at household level and low awareness of benefits with biogas technology. Therefore, revising the biogas implementation strategy and crafting inclusive biogas policies is important. Adopting different types of biogas digesters with reduced running costs, is also key. Developing an integrated strategy on energy, fodder and dung productivity, practising stationary cattle rearing and awareness creation on diverse biogas feedstocks are also essential. In case of the solid biomass, the current state of the solid biomass sector in Ethiopia is unsustainable where most of the biomass is coming from areas which either has a low biomass productivity or is classified as nationally conserved forest areas and protected wildlife sanctuaries. Therefore, the afforestation programmes should work aggressively to narrow the gap between supply and demand of solid biomass. Moreover, developing an integrated strategy that focuses on the controlled use of exotic invasive species such as Prosopis juliflora and other potential woody biomass species is also essential.

DAY 2 PART 2: INNOVATION AND INDUSTRY (CONTINUED)

SESSION 05

Sustainable Bioeconomy, Youth and Employment in Africa

Chair: Dr Flora Tibazarwa, Director, Southern Africa Innovation Support Program, Namibia



The presentations and discussion in this panel focused on:

- Employment/Job creation prospects in a Bioeconomy
- Effective involvement of youth, women and other groups in sustainable bioeconomy development.
- Policy incentives necessary to ensure an inclusive sustainable bioeconomy.

BIOECONOMY, YOUTH AND JOBS: EXPERIENCES FROM SOUTH AFRICA (KEYNOTE ADDRESS)

Dr Ben Durham, Chief Director, Bio-Innovation at Department of Science and Innovation, South Africa



In South Africa, bioeconomy refers to activities that make use of bio-innovations based on biological sources, materials and processes to generate sustainable economic, social and environmental development. In the bioeconomy the entire innovation system/ network, ranging from ideas, research, development, productization and manufacturing to commercialization should be used to their full potential in a coordinated manner. Over the years, South Africa has made significant advancements in bioeconomy and in 2013 the country launched its bioeconomy strategy. The bioeconomy strategy focuses on the impact and not just the technology, adopting a complex system approach with multiple stakeholders as opposed to a project approach. The South Africa bioeconomy strategy address four main themes including: (i) health innovation (ii) agricultural bio-innovation (iii)industrial and environmental biotechnology, and (iv)indigenous knowledge-based technology innovation. In the last three years, South Africa has developed 1,091 training courses and trained more than 25,000 farmers and community members on mycotoxins, nutrition and beans production among other subjects. The Department of Science and Innovation has invested more than R53 million (US\$3.5M) and the Industrial Development Corporation of South Africa (IDC) together with South Africa's Technology Innovation Agencyhave contributed more than R163 million (US\$11M) toward the bioeconomy strategy. In health, for every R1 invested by the government, R2 has been leveraged from external funding, both philanthropic funding and the private sector. In agriculture, resources have been tripled by partnering with industry. Investment in indigenous knowledge is still being driven largely only by government funding, but nevertheless over 30 SMMEs have been established. In industry a range of products have been developed, including biobased chemicals, biobased materials and bioenergy and a range of companies have spun out of this thematic area, including CapeBio which is now producing Covid 19 PCR reagents and Agriprotein which is producing insect protein and fertilizer from food waste. In the agriculture sector, the initiative has resulted in various products including: pre-breeding lines, new cultivars by local seed breeding companies, new beef breeds and animal health vaccines currently in trial, aquaculture SMMEs, a databank on beef genomics, and a foot and mouth disease care centre. The investments have also resulted in agro-processing and value chain analysis for various crops. The strategy has led to capacity development programmes producing post-graduates at Masters and PhD levels. An Agriculture Bio-Innovation Partnership Programme (ABIPP) has also been established. The farmer is a

key player in the agriculture sector, and academic projects will get nowhere without the involvement of farmers. Some of the South African bioeconomy metrics for 2020 are as follows: approximately 8% of national GDP is currently attributed to the bioeconomy, including 2% of national GDP attributed to agriculture (an estimated 2% is attributable to the circular economy). Some 1 600 000 people are employed in the SA bioeconomy. In 2018 1051 people were trained in doctoral degrees in natural and agricultural sciences, directly contributing to skilled youth. Some R700 billion was recorded in Bioeconomy related sales of which some R280 billion was in exports. The unit value of export is increasing, indicating that the technological sophistication of South African bioeconomy products is increasing. However it should be noted that the development of a bioeconomy is a long process and cannot be driven by government alone, although governments have a critical role to play. Innovation is a crucial input, but not the only input, and it must be spread across government departments. It requires a systems approach to address the complexities, such as value chains, skills, equipment, infrastructure, innovation support, industry regulation, the market etc. It must also be a team effort, one person cannot take a good idea all the way to the market. Help, guidance and partnerships are needed to be successful. There are multiple benefits, beyond just jobs, including developing renewable resources, sustainability, reduced carbon footprint, and increasing the value of science as a growth stimulator. It also enables countries to take advantage of their indigenous knowledge of which there is a wealth in Africa. Africa is biomass rich, forming the basis for a bioeconomy. Dr Durham finished by stressing the opportunities for bilateral and multilateral partnerships, as well as the opportunities to link with the Global Bioeconomy Summit and the BioAfrica Convention, which in future will start to move beyond South Africa to other African countries

PANEL PRESENTATIONS AND DISCUSSION ON SUSTAINABLE BIOECONOMY, YOUTH AND EMPLOYMENT IN AFRICA

EXPERIENCES FROM NAMIBIA

Mr Paulus Mungeyi, National Commission Research, Science and Technology, Namibia.



Youth unemployment dominated mainly by women is high in Namibia and currently at 46%, primarily in rural areas. Agriculture, forestry and fisheries are just behind the mining sector in their contribution to the economy, and employ 15% of youth. The bioeconomy has the potential to contribute to job creation and solve several social challenges, such as poverty reduction and health improvements. Agriculture, environment, and manufacturing are key for the economic growth in Namibia. There is a draft national Science, Technology and Innovation policy and a draft policy on Indigenous Knowledge Systems. These policies form a basis for and enabling the formulation and the development of a national bioeconomy strategy and policy now under development with the objectives of (i) Developing and maintaining research and development infrastructures that foster bio innovations and drives competitiveness in research. (ii) Foster development of infrastructure in bioinnovation sector (ii) Capacity building i.e. bio engineers and bio entrepreneurs for the bio-related industry. (iii)Promote innovation through collaborations and partnerships. (iv) Align and streamline resources available for bio entrepreneurs. (v) Support establishment of mentorship programmes to help bioinnovators harness their potential. Advocacy and awareness of the potential for entrepreneurship in rural areas is needed. There is an urgent need to facilitate investments for financial services, and providing incentives aimed at empowering youth and bioentrepreneurs operating along the agriculture supply chain. A sustainable bioeconomy strategy must be an enabling framework that will provide a platform for mentoring programmes. A development bank in Namibia has just launched a Women and Youth loan scheme to encourage their inclusion in the economy. A Finnish funded SADC initiative is aimed at developing leadership and entrepreneur skills in female owned biobusinesses. A Bioinnovation Strategy should stimulate other new initiatives..

AN FAO PERSPECTIVE

Dr Anne Bogdanski, Food and Agriculture Organization.



A systemic Bioeconomy's approach has the potential to transform food systems in a sustainable way, support job creation, economic growth, and address the needs of youth and women in Africa. The positive impact of Bioeconomy needs to be demonstrated in moving towards sustainability and meeting the SDGs. There is need for a transformative action to drive the global transition towards more sustainable, inclusive and equitable food systems which is a big chunk of the bioeconomy today. One in nine people globally suffer hunger, and 3 billion people do not have access to a healthy diet. Malnutrition is not just undernourishment, it is also obesity and non-communicable diet related chronic diseases. These are rising in parallel to undernourishment. At the same time, food loss and waste remains a key issue around the world. About a third of all food produced globally is lost. Due to Covid 19, all these challenges have increased, with more people in poverty. Biodiversity and ecosystem services we depend on are significantly threatened, with more than a million species at risk of extinction. A transformative action is needed to drive the global transition towards more sustainable, equitable and inclusive food systems. This is needed to tackle environmental degradation, keeping bioeconomy within the planetary boundaries, to fight hunger and poverty, and create jobs to promote economic growth. Bioinnovations such as microbial products, alternative proteins, plastic alternatives etc play a very big role in accelerating this transformation. Apart from building bioeconomies, countries also need to invest in monitoring the progress of bioeconomy to show its impact and gauge its success. There is also a need for policies and processes ensuring that bioinnovations are scrutinized making sure they contribute to SDGs, including job creation, and inclusive economic growth, also benefitting youth and women. International cooperation and exchange of experiences is key. FAO's project on sustainable bioeconomy guidelines supports countries in the development of circular bioeconomy strategies and action plans has shown that working together with different countries, and being advised by different countries, makes all the difference through sharing good practices, lessons learned, and sharing policies. In 2016, FAO established the International Sustainable Bioeconomy Working group to support knowledge exchange on sustainable and circular bioeconomy, and members from Eastern Africa would be welcome to join the group..

A YOUTH PERSPECTIVE

Mr. Ahad Katera, Chief Executive Officer, Guavay Company Ltd, Tanzania



The company produces crop specific organic fertilizer products. The current bioeconomy is not exciting for the youth especially in comparison with the tech sector. Bioproducts are not seen on social media, showing that the sector is still at a very preliminary stage for young entrepreneurs. Discussions are still at high levels i.e. international, regional and national levels and need to be brought down to a local context. There is a lack of actors on the ground who can lay down these policies and strategies into the market. Markets don't wait for policies, so there is a need for rapid action before new products arrive from other countries that could have been produced in the region. There are huge needs for investment in research and development work, engaging and including the youth. Guavay Company has been trying to do research and development for five years, supported by BioInnovate Africa, and yet the business is still not profitable due to suboptimal levels of investment. Small businesses lack collateral to be able to attract financing. Most investors find the bioeconomy a risk area. There is a need to finds ways to bring in investors with experience in the bioeconomy. Sharing experiences and customizing the processes to engage the youth in the bioeconomy will be vital for the region.

A GENDER PERSPECTIVE

Ms Barbara Alupo, Gender and Inclusion Specialist, World Vision, Uganda



World Vision looks at issues of health, livelihoods, and child protection. The inclusion of gender issues in bioeconomy is essential to address SDG 5. Women play a critical role in Bioeconomy because they deal directly with natural resources which form the corner stone of their work, beliefs, and a basis for survival. More women than men are engaged in domestic labour and unpaid work. In Africa 70% of the agricultural production is in the hands of women and 90% of women manage household water and fuel wood. A deliberate focus on women for bioeconomy means; (i) More effective solutions to climate change solutions. (ii) Increased incomes and food security at household levels. (iii)Improved health and nutrition at household level. Gender considerations need to be taken into account at many level, e.g. who owns the resources, given that in Africa most land passes from a father to a son. The success of any innovation will depend on beliefs and perspectives, roles and responsibilities, needs and priorities, and decision-making power which need to be considered at gender level. Many laws and policies are gender blind or biased towards men. The most effective way to achieve equality is through a twin track approach i.e. an approach that looks at the woman and the product being brought on board. Any implementation plans and strategies should identify gender issues within it and deliberately focus on addressing these issues so as to bring about gender and inclusion in the bioeconomy.

A UNESCO PERSPECTIVE

Dr. Ahmed Fahmi, Chief of the Section of Innovation and Capacity Building in the Natural Sciences Sector at UNESCO



The key question here is how to attract Africa's Youth to building a Sustainable Bioeconomy? A part of the answer is to (i) Improve and harmonize Interdisciplinary education curricula and training needs in the bio-sector to reflect industry requirements (ii) facilitate the development of innovation ecosystems i.e involving the formal sector, NGOs, and the informal sector and establishing biotech parks for collaborations between universities and industry. (iii)upgrade existing research infrastructure based on research networks and partnerships (iv) enhance the capacity of the regulatory authorities on safety of biotechnology research. In education there is a need for diversification of the types of higher learning qualifications, the types of learning modalities, the profiles of teachers or faculty, and the types of learners who are looking to re-skill, up-skill or enroll in lifelong learning courses (training of employees on the job). There is also a need for evolving academic and vocational STEM linked to current biotech developments, including dynamic multidisciplinary education and demand-based short-term training activities. Mentorship and mobility programmes for post-graduates are important. Building an innovation ecosystem involves the formal sector, NGOs and the informal sector. Science parks and technology business incubators need to get universities and industries to work together. For the success of a circular bioeconomy adding value to products that improve livelihoods of people, emphasis needs to be laid on enhancing international alliances to promote large-scale experimentation not only for education and research in eco-innovation, but also in terms of governance and financial innovations needed to operate larger enterprises and a scale up of technical solutions. To address the impact of bioeconomy on the environment, there needs to be a better match between conservation, research, training, ecological monitoring, and sustainable socio-economic development of communities. There is also a need to engage with other sectors such as engineering.

QUESTIONS AND ANSWERS ON PRESENTATIONS

Question 1 How can one develop and promote services-that utilise bio and food waste for food security and health improvements?

Answer (Dr Ben Durham) What is needed is the entrepreneurial drive and the right policy and regulatory environment fostering waste conversion. For instance, in South Africa there is a company called Agriprotein that uses food waste to produce fertilizers and feed products using fly larvae, improving food productivity, and contributing to health. Governments can create the ecosystem and an enabling environment to enable innovation, entrepreneurship and inclusive collaborative efforts, but it cannot all be steered by government.

Question 2 How much of South African Bioeconomy is as a result of genetic engineering.

Answer (Dr Ben Durham) Agriculture forms a small percentage of GDP in South Africa (between 2 - 4%). Most of the maize, cotton, and soya grown in South Africa are genetically modified and this has had a positive impact in crop productivity and for value addition industries. Bioeconomy, however, at 8% of GDP is much bigger than the contribution of maize, cotton, and soya. Genetic engineering is therefore one element in a highly complex system and even if genetic engineering contributes to the bioeconomy it is by no means the only factor that propels the bioeconomy development.

Question 3 How do you measure the contribution of the bioeconomy to your GDP?

Answer (Dr Ben Durham) The National Advisory Council on Innovation put together a team of experts that came up with the methodology. Data and various statistics on growth, production etc is collected from different institutions. The data are sifted and evaluated to determine which data can be connected to the bioeconomy sphere and which are data are attributed other industrial and development spheres codes. The data for bioeconomy is then brought together to determine the contribution of bioeconomy to the GDP. These data have not been published yet but will be published in a couple of months.

Question 3 Vocational training, industrial placements and mentorships. What does UNESCO do to make sure that this actually happens and what are the available programmes to push this in our economies?

Answer (Dr. Ahmed Fahmi) For instance, UNESCO has a program called the UNESCO-L'Oréal Awards for Women in Science Programme that helps women give lectures, master classes, and galvanizing women for science and science for women. Women can apply for this. This is an example that can be replicated. There are also various UNESCO chairs (800 across the globe) that help and advise students about their careers and options. Mentorship is not just for students alone, it can be done for other groups of stakeholders, such as our politicians, as well.

Women and Sustainable Bioeconomy in Africa

Chair: Dr Alice Litta, National Livestock Resources Research Institute, Uganda



This session focused on the role and potential for women's empowerment in the emerging African bioeconomy. Following two introductions by Dr Peggy Oti Boateng and Prof Ruth Oniang'o, presentations were made by women entrepreneurs and scientists supported through the BioInnovate Africa Fellowship designed to:

- Provide an opportunity for early and mid-career women scientists to enhance their experience, skills and knowledge in innovative ideas, especially in bioscience thematic areas.
- Offer an opportunity to work on a project outside your country under the guidance of a mentor.
- Offer a mobility programme outside one's country with well-equipped laboratories.
- Support and fund entrepreneurs to change the lives of the community related to these ideas

INTRODUCTION 1

Dr Peggy Oti Boateng, Director, Division of Science Policy and Capacity Building, UNESCO, France.



The global reality is that we have a world population - 7.8 billion (16.7% in Africa), a rampant urbanization, overexploitation of some natural resources, biodiversity loss, climate change challenges and relative ageing of some populations. We also have a digital transformation which is the new paradigm for global economic acceleration. Some 17 % of the world population lives in Africa (51% being women), where 65% are under 35 years and where 10 million youths in Africa enter the workforce each year. Before COVID-19, Africa's economies were growing at a rate of 5-10%. Africa's ability to compete on the global market depends on its ability to innovate using science, engineering, technology and innovation to transform its natural and human resource capability into value added goods, processes and service. This can be done through education and training equally accessed by both men and women. Bioeconomy offers great opportunity for sustainable socioeconomic transformation to ensure no one is left behind. There are opportunities for new and emerging Bioeconomy careers including (i) food production, biodiversity, research and innovation building back on Covid-19, mentoring women in science, bio-innovation, and bio-economic transformation. (ii) Positioning for fund mobilization through dialogues, mapping of donors and their interest areas, joint partnerships for research proposals, involvement of the diaspora, visibility through exhibitions, building credibility. (iii) Synergy of actors to advance women and bio-innovation in Africa including policy makers and development partners, science communicatiors, university leaders, engineers and scientists, the private sector and environmentalists and (iv)Transformational shift for the future we want in Africa including supporting multi-skilled populations, mobility, creativity and agility. Facilitating innovation and promoting partnerships and collaborations

INTRODUCTION 2

Prof Ruth Oniang'o, Founder and Director, Rural Outreach Africa & 2017 Africa Food Prize Laureate.



This is a great time for women to be in science where mentorship for women is key for continuation of innovation. Women in science are critical and not involving women in science is detrimental to the society.

TESTIMONIALS FROM BIOINNOVATE AFRICA FELLOWS ON THEIR BIOECONOMY RESEARCH PROJECTS

Nadege Mugisha, Lecturer, University of Burundi, BioInnovate Africa Fellow, 2018 and 2019



During the fellowship, she was attached to a project within Makerere University (Refractance Window Drying Technology). The Fellowship exposed her to various opportunities and learning including: (i) Improved knowledge on innovation, research, and publication (ii) Working at a renowned research centre. (iii) Now being a member of two organizations for women in science (iii) A submission of research proposal for a PhD application. (iv) Submission of a proposal for a grant to be used on energy generation in municipal solid waste in Bunjumbura city (v) Intentions to publish one or two articles before the end of the year.

Desta Mulu Gebeyehu, Lecturer – Hawassa University, Ethiopia, BioInnovate Africa Fellow 2019-2020



The Fellowship enabled her to: (i) Think beyond research and explore how her research can benefit the community. (ii) Grow her career through exposure to a new lifestyle and new working environment. (iii) Access collaboration opportunities with other researchers.

Agnes Ikolot Otwani, Regional coordinator, Kenya Tsetse and Trypanosomiasis Eradication Council, BioInnovate Africa Fellow 2019-2020



The Fellowship gave her an opportunity to: (i) work closely with three Masters students. (ii) gain insights and experience on the Ugandan culture, traditional knowledge and local solutions towards tsetse fly control. She reckons that this traditional knowledge should be integrated with scientific knowledge to form a good basis for control of both tsetse flies and nagana disease.

Martha Niyibira, Makerere University, BioInnovate Africa Fellow, 2019-2020



The Fellowship gave her an opportunity to work at two renowned institutions (Icipe and JKUAT) under the guidance of seasoned experts on sensory evaluation and nutritional analysis. She was able to extract and characterize high quality chitosan from locusts, crickets, and grasshoppers for use as a preservative for bread. She expanded her network and gained exposure into the latest trends and technological advances in her field of research.

Gloria Deogratias, Researcher, Tanzania Industrial Research and Development Organization, BioInnovate Africa Fellow, 2018-2019



Gloria's research project was on unlocking the commercial potential of new sorghum and millet varieties for improved nutrition and social economic gains in East Africa. The Fellowship gave her an opportunity to work with the latest lab equipment, when examining the texture of properties of the generated products, and the digestibility properties. Data generated enabled the drafting of a paper that helped with improving writing skills.

Diana Namayanja, Research Scientist – National Livestock Resources Research Institute, NARO Uganda, BioInnovate Africa Fellow, 2019-2020



The Fellowship offered her high-level support and experience in insect science. She has gained collaboration opportunities and access to professional networks as well as an opportunity to present a paper to the Entomology Association of Uganda members entitled 'An overview of Insects for food and feed – the case for grasshoppers, cricket, and black soldier fly'. Her research and scientific skills have been enhanced and she has been motivated to enroll for a PhD. The fellowship has also built her confidence and self esteem.

Speed Networking with BioInnovate Africa Pilot Commercial Enterprises: Pitches by BioInnovate Africa Project Implementing Partners

Moderated by: Growth Africa

Chair: Mr Ian Lorenzen, Executive Director & Partner, Growth Africa



This session used BioInnovate Africa supported projects and bioenterprises to demonstrate the potential of biological based innovation to create growth prospects for Africa. Project Leaders pitched their bio-based products and/or enterprises that have gone through business incubation and acceleration through the BioInnovate Africa Programme.

Presenter	Organisation	Product
Kigen Compton	BioBuu	Insect protein for animal feed
Mathews Dida	Maseno University	Striga-resistant maize and finger millet
Benson Nyambega	Eco-Gel Ltd	Renewable fuel from biowaste
Ahad Katera	Guavay Company Ltd	Organic fertilizer from biowaste
Settumba Mukasa	Senai Farm Supplies Ltd	Certified seed potatoes
Karoli Njau	BIOCON Africa Ltd	Design of systems for waste conversion
Kabede Abegaz	Almi Foods Manufacturing PLC	Sorghum food products
Sarah Mubiru	Aroma Honey Toffee	Sweets from honey with no added sugar
John Kimario	OKOA Mushroom Supplies	Improving mushroom value chains

BIOBUU KENYA LIMITED

Kigen Compton Co-founder and Managing Director



Located in Dar es Salaam and Mombasa, BioBuu solves two problems (i) Scarcity of affordable, sustainable and quality sources of protein for animal feed where the two main choices now are soy beans and feed mills (ii) Greenhouse gas emissions from decomposing waste. BioBuu collects the waste and feed it to the soldier fly larvae to get two products; insect protein and organic fertilizer. Six years of R&D has enabled them to develop a scalable model with each location capable of delivering 30tons per month of defatted insect protein and 100 tons per month of organic fertilizer. They work with farmers, feed mills and customers buying finished feed or fertilizer replacing fish meal or soy beans. BioBuu builds strategic partnership with actors in the animal, nutrition and environmental impact fields. The company works from 3 locations where investment of some \$500,000 per location has been made. BioBuu also has a support or tech centre where some \$500,000 has been invested. This centre is important providing knowledge and technology support for the other facilities and for keeping up with the changing requirements for the industry. A conservative estimation for a fiveyear return on investment is between 30 and 40 percent. Besides commercial partners they are exploring partnerships with technical experts such as animal nutritionists and biobusiness incubation expertise assisting in complexities of commercializing products.

PROMOTING STRIGA-RESISTANT MAIZE AND FINGER MILLET VARIETIES IN KENYA AND UGANDA

Professor Mathews Dida, Maseno University.



Striga weed is a major problem in western Kenya, northern and eastern Uganda. The project seeks to deliver new markets for striga-resistant maize as well as finger millet varieties. The value proposition is to offer maize and finger millet varieties resistant to Striga weed resulting in better yields and incomes for farmers in Kenya and Uganda. This is done through partnerships with seed companies commercializing new varieties bringing better returns to farmers, collaborators and financial supporters. The route to market is through engaging with and licensing of striga resistant varieties to seed companies and merchants operating in western Kenya, northern, and eastern Uganda. The project is promoting several maize varieties including Maseno varieties EH14, EH11, EH12 and some finger millet varieties that are resistant to striga weed particularly in Uganda.

GUAAVAY COMPANY LTD

Mr. Ahad Katera, Co-founder and CEO of Dar es Salaam, Tanzania



Guaavay addresses two challenges: (i) soil infertility that leads to low crop production and (ii) the abundance of organic waste in major fast-growing urban areas. They are turning organic waste and other bioproducts into blended, industrial-grade and crop-specific organic fertilizers. Compost is used as raw material and blended with other bioproducts to fit in the market. The product is granulated for effective handling in terms of fertilizer application, transportation logistics where bulkiness of the product is reduced by up to 30% making it convenient for customers. The product is already in the market targeting small, medium, and large-scale avocado, rice and onion farmers with sales of USD 74,000 in two years. They are currently working to certify the product to EU standards for the export market. The next steps are to expand their investment by about USD 377,000 through in debt investment or soft loan to scale up operations and develop partnerships to support smallholder farmer capacity building and market development work. Their niche markets and customization of products to certain farmers gives them a competitive advantage and enables them to compete with large companies addressing markets more broadly. The real value of the product i.e. improving soil fertility and increasing yield is also an effective marketing tool.

SENAI FARM SUPPLIES LTD

Prof. Settumba Mukasa, Uganda



Senai Farm Supplies focuses on efficient production and delivery of certified sweet potato seeds to farmers in Uganda to reduce the high prevalence of diseases that cause yield losses and increase the yield of farmers They are producing quality seed for elite sweet potato varieties through tissue culture and virus indexing technologies, and a network of zonal seed multipliers to sustainably carry out secondary multiplication close to the farming communities. They also supply certified and quality seed of elite sweet potato varieties, meeting various niche market demands, to farmers in 12 districts at affordable prices to the smallholder poor farmers. They are also partnering with private export companies who have identified some niche varieties that have potential export markets to create a whole value chain right from the lab to the export hub.

BIOCON AFRICA LTD

Prof. Karoli Njau, Tanzania



BIOCON Africa provides quality consulting services and engineered system design in waste management, wastewater treatment, design of industrial and domestic biogas systems as well as research and development in natural science and engineering. Their aim is to deal with highly loaded organic waste and treat it by creating products that can be of use, and particularly energy. Their focus is on industry, to fill a gap by offering treatment systems that can deal with industrial waste waters. Their biggest limitation is enhanced capacity to handle projects holistically, to market BIOCON, to acquire equipment for design and analysis, and upfront capital costs to cater for projects. Local governments are among their key stakeholders because they provide access to abattoirs. BIOCON has built a system that works well to deal with wastewater from abattoirs. Challenges lie in the upfront cost of the investment.

ALMI FOODS MANUFACTURING PLC

Prof. Kabede Abegaz, Ethiopia



Almi Foods commercializes sorghum products for improved nutrition and socio-economic gains in Eastern Africa. They have a technology for nutritious and healthy foods production able to scale up and an experienced professional team for startup business. The technology has been adopted for business use in three countries (Tanzania, Ethiopia, and Uganda). They target low/middle income groups at the bottom of the pyramid and generate revenue from sale of products and by-products. They are seeking support and partnerships for additional machine procurement and more effective sorghum agroprocessing. They aim for a more modernized and efficient sorghum processing plant to reduce production costs and increase volume for a larger market.

AROMA HONEY TOFFEE

Dr. Sarah Mubiru, Uganda



Aroma Honey Toffee is working in apiculture value chains in Uganda, Kenya, and Rwanda, to address the excessive, unhealthy consumption of sweets made from processed sugar. Aroma Honey Toffee produce sweets/candies produced from honey and contain zero processed sugar. Honey is known to contain numerous medicinal properties and is a source of numerous minerals useful to the human body and African honey is sourced from her flora rich in health giving and medicinal flora. In addition, the honey toffees contain ginger, coconut, groundnuts and arabica coffee sourced from African farmers. They are planning to develop their own outlet and to have franchises across Africa starting in Kenya and Rwanda. Strategic partners are honey producers. Their target is for 4 million honey toffees consumed annually across East Africa by 2025 with margins of USD 1 million. They require USD 200,000 to source equipment for mass production and establishment of marketing and distribution arrangement and are exploring partnerships. Acquiring certification is a current challenge.

OKOA MUSHROOM SUPPLIES ENTERPRISES LIMITED

John Kimario, Tanzania



The company is optimizing mushroom value chain benefits for better livelihoods and environmental protection among smallholders and SMEs. The major challenge they face is a costly and limited access to quality, nutrient rich substrate materials, challenges in mushroom cultivation and lack of value addition and bio-waste conversion facilities and market linkages. They also face underdeveloped markets with minimal value addition to the product, lack of standards for quality and packaging. OKOA seeks to create links and fill gaps along the mushroom value chain by targeting small and medium scale entrepreneurs in Tanzania and Rwanda; and to improve production, processing, and marketing efficiency

QUESTIONS AND ANSWERS ON PRESENTATIONS

Question 1 What are the opportunities for liaising with NGOs, some of whom have investment impact capital that they might be interested in investing in the right businesses? What would be the profile of the ideal investor?

Answer (Kigen Compton): Ideally one would want someone who was very hands-on and has the expertise to help the business along. However this also has downsides and it is a personal choice.

Answer: (Karoli Njau): Any investor that really pushes the agenda of the company would be welcome. It doesn't matter if they are international or local.

Answer: (Herb Rhee): As someone who is working with BIOCON, the best investor would be a social investor, however a purely financial investor would also be OK.

Question 2 How many of you are proactively working with governments at national or local level?

Answer: Kebede Abegaz: Yes we are actively working with government, it would be difficult to move forward without their support.

Answer: Karoli Njau: While a company needs to be profitable, support for young companies is needed to enable them to grow. This needs innovative practices, such as soft loans from government. Local companies need to be given the opportunity to be considered first as suppliers, and this needs some high-level interventions from government. Support for private companies from within universities needs to be investigated (what is the relation between the affiliated institution and the spin-off company?)

Speed Networking with Participants of the BioInnovate Africa Bioscience Innovation Bootcamp

Chair: Dr Robert Karanja, Co-founder, Villgro Kenya



This session introduced upcoming youth bio-based projects that will join a the BioInnovate Africa bioscience innovation bootcamp. The BioInnovate Africa bootcamp is organized for entrepreneurial scientists in eastern Africa. The scientists will be empowered to develop innovative and commercially viable biological based ideas in areas including, but not limited to, agroecology, food and feed, wastewater treatment, biopharmaceutical, bioenergy, biomaterials, disease diagnostics, and green chemicals.

KEYNOTE ADDRESS

DOING BIOECONOMY BUSINESS IN EASTERN AFRICA

Dr Yifru Tafesse, Senior Director, Ethiopian Agricultural Transformation Agency



Eastern African countries are among the fastest growing economies in the continent. With its natural resources the region is on the right track for development. More importantly, its dynamic population, right skillset with a robust leadership in place is the most important resource that can be mobilized to liberate our citizens from absolute poverty and bring about sustainability and economic transformation in the region. Advancements of science and technology such as the digital revolution, drones, artificial intelligence etc. in the global arena have created opportunities for us to exploit and further experience growth and development in the region. Recent global challenges such as COVID-19, desert locust infestation, and floods in have created extremely alarming and unprecedented threats to health, food security, and lives in the region. Unchecked population growth, migration, lack of employment opportunities etc. are also further complicating those challenges. Humans have been addressing complex challenges for ages and will continue to face these challenges unless governments pay serious attention to investing in advancing science and technologies, research and innovations. In this regard, initiating and promoting knowledgebased economies through adopting biotechnologies has become more crucial than ever before. Bioeconomy is one of the initiatives that leads to a sustainable knowledge-based economy. It employs biological sciences to advance adoption of biotechnologies with the goal of addressing regional and global challenges using BioSolutions across the food system, health and industry. To this end, the initiative taken by BioInnovate Africa and icipe in collaboration with the East African Science Technology Commission in organizing the 1st East African Bioeconomy Conference is a great step forward in advancing the bioeconomy in the region and bringing Eastern African countries together to improve and harmonize bioeconomy strategies and policies. This conference has brought together regional and international stakeholders including governments. Such collaborations not only help towards to address the challenges mentioned earlier but also place a solid foundation to do business and advance sustainable knowledge-based economies. Adopting a harmonized bioeconomy strategy with robust regulations would create an enabling business environment to attract bioeconomy investors in this region, promote entrepreneurial scientists through knowledge bio-based products, share knowledge, and promote trade thereby enhancing green growth and competitiveness in the region.

PITCHES BY PARTICIPANTS OF BOOTCAMP/ACADEMY SESSION

The following bootcamp participants pitched in this session:

Presenter	Organisation	Product
Genet Tsegaye	Ethiopian Biotechnology Institute	Biogas from coffee waste
Gekonge Duke	University of Nairobi	Wine from guava
Alexander Mzula	Sokoine University of Agriculture	Vaccines for tilapia
Musinguzi Mark Musiimenta	Makerere University	Biodegradable food packaging
Rene Uwamugirimfura	Green Utility for Africa	Solar powered storage stations for agricultural produce
Robert Karanja	Vilgro Africa	Incubator and impact investor

INDUSTRIAL COFFEE WASTE WATER TREATMENT INTEGRATING WITH PYROLYSIS REACTOR

Genet Tsegaye, Ethiopian Biotechnology Institute



Coffee wastewater is acidic in nature making it difficult for biological treatment or biogas production. The solution lies in preparing carbonized coffee pulp through a pre-treatment mechanism, which removes toxic chemical compounds from the solid coffee waste enabling it to be used for biogas production. The technology involves pretreatment by biomaterial, generation of optimal biogas yield using biomaterial and biological treatment, and generation of energy using carbonization of coffee solid waste. The progress so far is (i) Completion of carbonization of coffee pulp product efficiency test at laboratory scale. (ii) Ongoing design of pyrolysis reactor for carbonization and energy generation (iii) Ongoing development of prototype production of pyrolysis reactor (iv) Completion of evaluating efficiency of integrated coffee waste-water treatment and biogas yield. There is also a plan to start construction of a pilot scale treatment plant. This treatment mechanism is efficient, cost effective and it has a key idea to solve waste treatment management system as well as generate energy and recycle treated water for manufacturing. The technology therefore has an economic value for coffee production industry and private companies. In addition, the technology has the potential to produce briquette charcoal at a commercial scale creating job opportunity for community.

AGRO PROCESSING OF UNDERUTILIZED GUAVAS INTO WINES AND OTHER PRODUCTS

Gekonge Duke, University of Nairobi, Kenya



Guava fruits are neglected due to low marketability, low consumption and a lack of value addition. Pera Foods, a startup company intends to resolve the high annual losses of the guavas and tap into the economic potential of fruits through value addition. The Progress so far (June 2019 to date) involve products formulation, standardization, branding and products patenting. A consumer acceptance has been established and ongoing marketing and sales has generated 500,000ksh. The next steps includes business registration, factory setup and commencement of commercial guava products processing by 2021.

The economic potential of Guava fruit which grows well in most of the counties within the country is over 10,000 metric tonnes annually with an estimated value of over \$1.1 million. Processed fruit and fruit product will fetch higher revenues. Nationally, the annual economic value for processed fruits exceeds \$100 million, with more than 67 million litres of wine consumed in Kenya. Pera Foods has tried to process and sell guava products without standard preservatives, but this has not been successful so safe and approved standards and preservatives in fruit processing are used.

DEVELOPMENT OF A NOVEL VACCINE AGAINST AEROMONAS HYDROPHILA TO IMPROVE TILAPIA PRODUCTION IN EAST AFRICA

Dr. Alexander Mzula, Sokoine University of Agriculture, Tanzania



In Tanzania, the aquaculture contributes 1.4% to the national GDP. However, there is a trend whereby aquaculture increasingly contributes to household food security and incomes. This innovative idea in Dr Mzula's project is solving tilapia disease outbreaks caused by the bacterial infections of Aeromonas hydrophila through vaccination rather than treating fish with antibiotics. The idea is to develop an environmentally friendly vaccine for A. hydrophila to improve tilapia farming. The progress so far involves the completion of epidemiology and disease investigations and a completion of laboratory phase vaccine tests. The next steps are larger scale field tests and if successful also commercialisation through licensing. The support the project would need are linkages to potential investors or business/commercialization partners and an assistance in finalizing field trials and providing relevant data for national regulatory and approval processes.

HYA BIOPLASTICSPACKAGING

Musinguzi Mark Musiimenta, Makerere University, Uganda



There is rampant plastic pollution in East Africa where large part (some 37%) of total used single-use oil-derived plastics are being disposed directly to the environment. HYA bioplastics is creating biodegradable food packaging material from re-engineered plant fibres, including fibres from sugarcane, maize plantations and water hyacinth. Beeswax is also used for coatings. Part of the solution is to create low-cost biodegradable materials that can be used in various applications (including food packaging, interior designs and jewelry etc) made from 100% re-engineered plant fibres. The renewable fibre product produced by HYA bioplastics using a patent-pending process has improved physical properties including good tensile strength and hydrophobicity with a good premium physical appearance. The company has received project funding and completed its first prototyped fibre board and has also developed key partnerships for product marketing. Currently, they are using a facility that produces some 100 fibre boards and plates per day and they are now looking for support and funding to setup a small-scale industrial facility to better serve the immediate local market, and in due course scaling up to selling to other countries. The fibre board is sold at \$0.52 per tray with margins of 50% because of a short supply chain, locally sourced materials, and customized designs for packaging. HYA has developed a competitive edge in that their products are less expensive than imported (by restaurants) equivalent products. In terms of design, they have moulds that can cater for customization of designs targeting different type of users. The annual market size for renewable fibre and biopackaging material in Kampala alone is estimated to be \$1,200,000, with 30-40% of demand coming from high-end restaurants using imported customized packaging at \$1.3/unit. For the mid-range restaurants that use cheaper packaging, market size is \$7,400,000 at \$0.52. HYA bioplastics staff have received mentorship from some leading industry professionals and Makerere University has been offering laboratory facilities for testing materials. Additional networking support is

needed to better link to industry leaders, potential investors/commercialization partners and promote product and company publicity. Some of the major limitations stifling the up scaling of production and sales include regulation and laws in Uganda, where the plastic ban is not efficiently implemented. Inadequate funds for modern equipment for design and production of biobased packaging material, lack of access to laboratory facilities and lack of venture capital are some of the other challenges they face.

GREEN UTILITY FOR AFRICA

Rene Uwamugirimfura, Founder and MD



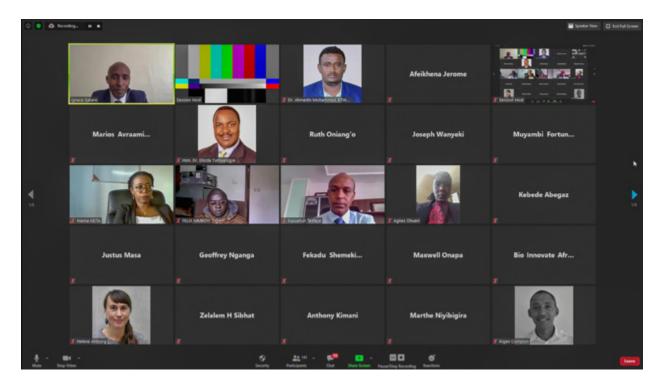
Post-harvest storing and handling of primary produce is key to improving food security and value addition in Eastern Africa. Some 45% of food wastage in Africa is due to lack of cold and dry storage leading to a 25% loss of annual income to some 470 million small farmers. Efficient drying and storing of or primary produce can help address the crisis of food insecurity and also emergency crises such as the one brought about by the COVID-19 pandemic Solar powered cold and dryer stations is a viable and sustainable solution to this problem. Solar-powered cold and dryer stations can potentially significantly improve livelihoods for smallholder farmers and small traders by reducing the post-harvest loss of crops, increasing profits by boosting farmers' bargaining power at marketplace, and unlocking regional and international markets to smallholders in remote rural areas

VILLGRO KENYA

Dr Robert Karanja, Co-founder



East Africa is a hotbed for bioeconomy innovations. Villgro works with BioInnovate Africa to nurture these innovations to create jobs and wealth. There is a critical need for innovators to have manufacturing facilities to bring their ideas to fruition. There is a role that academic institutions can play in guiding innovators to achieve their goals in terms of academicals expertise and offering a platform for the idea/research to come to fruition instead of licensing to industry out there to bring the research to fruition.



09

Closing Remarks



Chair: Dr Maurice Bolo, Managing Director, The Scinnovent Centre, Kenya

Dr Maurice Bolo, Managing Director, The Scinnovent Centre, Kenya.



It is important that we build on the momentum created here and to continue tapping into the knowledge gained over the past two days, the new insights that we have had and the potential for partnerships and collaborations that may emerge out of this. We urge the participants and organizers to continue to promote and exploit these existing opportunities. The joint participation of the private sector and the research community will enable opening of investment opportunities and opportunities for further private sector engagements. There is a lot of work and knowledge in the academic spheres that needs to be shared with the private sector. As a consortium we are looking to finalize the regional bioeconomy strategy for East Africa, taking it through the formalization processes and publication journey. Now is the time for engaging national representatives in the East African region in preparing implementation plans for this strategy as well as supporting the countries to make their own strategies and engage with the process going forward. We are looking forward to more bioeconomy conferences.

Dr.Silas Obukosia, Principal Programme Officer and Regional Coordinator, African Union Development Agency, Nairobi, Kenya



Key areas highlighted during these two days have been partnerships, strategies, bioeconomy innovation in the region and how to garner policy support to take forward regional and national bioeconomy agendas. A strong country support and a regional bioeconomy strategy with clearly defined outcomes will be critical. The conference has visualized how research and innovation in the various spheres of the bioeconomy in Africa can contribute to our food systems, health, industry, and energy spurring our development and also how important women and youth are in driving the bioeconomy forward.

Dr.Sunday Ekesi, Director of Research and Partnerships, icipe.



Despite the challenges of the current pandemic we have been able to meet digitally showing that combining bioeconomy and technology is a clear development pathway for the continent. Sustainable Bioeconomy is a means for Africa to contribute to the UN Sustainable Development Goals 2030, the development and aspiration of AU agenda 2063, and the Science Technology and Innovation strategy for Africa, 2024. Sustainable Bioeconomy offers many opportunities for Africa to diversify its economy and ensure participation of all sections including women and youth. We have abundant resources. We are biomass rich. True bioeconomy can transform our food systems. There are several technological innovations that can support our industries, our biobased processing and how to convert waste to usable products. Icipe is committed to a sustainable bioeconomy in

East Africa to harnesses investments, scientific research and capacity building to promote innovation that delivers products that are not just environmentally friendly and safe but healthy. We look forward to building partnerships with governments to put in place enabling legislation for a successful deployment of bio-based inventions and solutions. We want to collaborate fully with the private sector which is one of the key elements of deploying and using biobased knowledge and attracting investments. Partnership will be central in everything we do and in doing this we will also be able to collaborate between our regional actors such as the East African Community, the African Union Commission, United Nations Commission for Africa and other partners like the European Commission. Some important recommendations that have been voiced through these two days includes (i) the need for strategy implementation plans, policy alignments, harmonization of biobased standards in terms of products and processes across the region (ii) unlocking flows of capital, and investments and (iii) extending the regional approach in eastern Africa to other African countries and regions in Africa sharing knowledge and experiences.



