



Developing knowledge-based bioeconomies in sub-Saharan Africa: how can Sweden help?

The bioeconomy and its relevance to sub-Saharan Africa

Rapid globalization and the surge in global demand for food, feed, bioenergy, renewable materials and agricultural land are radically changing the conditions of the bioeconomy. These radical changes occur in agriculture, forestry and other economic sectors based on production or processing of biomass resources. At the same time, the biosciences and biotechnology are revolutionizing the production of biomass resources and how they are used.

Knowledge-based bioeconomies (KBBEs) are seen by many as key engines of sustainable economic growth: growth that is based on renewable resources and poverty reduction, and comes at minimal environmental cost, moving societies away from reliance on petrochemicals. KBBEs are also seen as means to revitalize rural communities, increasing their production and creating new opportunities to add value to crops locally.

A key feature of KBBEs is extending biomass production and processing beyond food, feed and fibre to include a range of agro-industrial and other value-added products with potential applications in many sectors, such as pharmaceuticals, green chemicals, industrial materials and energy. Also, advances in biosciences are helping to develop more productive and resource-efficient agricultural systems that are more resistant to pests, disease and climate change. Biotechnology is offering ways to replace inefficient and polluting industries with cleaner alternatives, especially biorefineries, maximizing the use of biomass, recycling waste streams as input for renewable bio-based products with close to zero greenhouse gas emissions, thus enhancing both their sustainability and their competitiveness (see Box 1).

Transforming the African agroprocessing sector so that it effectively adds value to the primary production and converts waste to valuable products in an environmentally friendly manner will be central in improving agricultural productivity in Africa. Diverse and resource-efficient agroprocessing and biomass value chains are central to KBBEs and also crucial to African farm and forest producers, supporting them to diversify their production and connecting them to local, regional and internal markets.

Box 1. Key features of a knowledge-based bioeconomy

- Use of advanced biotechnology tools such as DNA marker-assisted breeding, tissue culture and genetic engineering could;
- Increased crop productivity making crop breeding more precise, so crops can be developed that are more tolerant of factors such as drought, pests or poor soils;
- Assist the development of tailor made crops that have specific characteristics such as improved nutritional value or desirable qualities for specific industrial uses;
- Increase value addition opportunities using modern agroprocessing systems for high-quality food and agro-industrial products (e.g. biofuels, fibres, starch products, "green" chemicals and biodegradable plastics, oils, lubricants and detergents);
- Assist in conversion of biowaste to useful products, making more efficient use of resources and increasing value addition at agroprocessing plants, biorefineries etc. Possible products include feed and energy.

Key Messages

The agricultural and forestry sectors in many countries in sub-Saharan Africa face challenges such as low productivity, increased risks linked to climate change, poor market access and poor development of local biomass value chains and agroprocessing capacity. Developing modern, knowledge-based bioeconomies (KBBEs) in sub-Saharan Africa could boost national and local economies, reduce poverty, and help in achieving environmental sustainability ambitions.

Sweden is a global frontrunner in the development of its KBBE, in terms of both technical innovation and creating enabling policy environments and structures. Sweden could play a key role in assisting countries in SSA to develop KBBEs through:

- awareness raising, networking and dialogue;
- capacity-building and joint knowledge development; and
- innovation, upscaling and business incubation.



Sisal fiber derived from Agave grown in Tanzania. Sisal is used for biogas, electricity process heat and fertilizer. Sisal textile can substitute or enhance fiberglass. Photo by Bio-Innovate-ILRI/Albert Mwangi via Flickr CC BY-NC-SA 2.0

Transforming bioeconomies in sub-Saharan Africa

The transition to KBBEs in sub-Saharan Africa (SSA) will require a focus on agricultural innovation in areas such as sustainable agricultural intensification, food and other agricultural value chains, resource-efficient agroprocessing and market diversification (see Box 1).

Agroprocessing and other value-adding sectors such as processing of livestock, coffee, cotton, wood, sisal fiber and fruit, are vital to the economies of several African countries. However, they are currently hampered by inefficiency and generate large amounts of waste as well as being linked with severe environmental problems. The application of cutting-edge bioscience and biotechnology could help to transform them, reducing their environmental impact, producing a wider range of products with greater market value, and efficiently reusing waste. Knowledge about and connection to regional and international value chains would also help to support diversification and value addition. Moreover, transformation of agroprocessing sectors could create new jobs and raise economic returns for farmers and agribusinesses in the region.

BOX 2: Potential benefits of KBBEs for sub-Saharan African countries:

- Sustainable agricultural intensification, along with improved food security;
- Improved profitability of small-scale farming systems and increased livelihoods for the rural poor;
- More environmental sustainability, including improved resource efficiency, conversion of polluting waste to useful products, climate change adaption and mitigation;
- Greater energy security (through biomass-based renewable energy);
- Agro-industrial expansion which, if well planned and regulated, can support sustainable economic growth, increase employment opportunities and improve economic competitiveness for many countries.

Policy-makers and stakeholders in SSA countries are already engaged in planning how to realize the potential of future markets and the prospect of the modern bioeconomy. Long-term planning involves effective prioritization of investments in human capacity, science and technology infrastructure, innovation systems, entrepreneurial capacity, policy development and novel financing mechanisms. It also requires strategic, realistic and clear thinking on the potential of future bioresource production systems and which trade niches are the most adequate and suitable for countries in the region. Appropriate leadership, regional and international collaboration, continued donor assistance, public and private sector investments are also needed.

An important task in developing KBBEs in sub-Saharan Africa is to broaden the value addition opportunities for crops and other bioresources produced by smallholder farmers. This would help to revitalize farming communities in the region. Furthermore, road, rail, harbour and crop storage infrastructure is underdeveloped in many African countries. This is hampering farmers' access to distant markets, including regional and rapidly emerging urban markets, and often resulting in high post-harvest losses and low profitability. This argues for developing modern agroprocessing systems and other means of value addition close to primary production sites.

It is important to note that while the transition towards a KBBE is often associated with increased sustainability, there is some debate in scientific and public forums about whether or not it will necessarily lead to a better, more sustainable future. Frequently mentioned problems are the competition between food and fuel production and the potential negative effects of land-use change (particularly deforestation for agriculture) and agricultural intensification.

It is clear that the KBBE is not a silver bullet solution to food security and increased agricultural productivity and cannot be considered as something self-evidently sustainable. Instead it needs to be designed, planned, regulated and supported in such a way that it effectively functions as a driver of sustainability in the development, use and reuse of bioresources,

For countries in SSA, developing KBBEs offers major opportunities but also many challenges. One of the central questions for the region's policy-makers is how the millions of resource-poor smallholder farmers, so vital for food production and economic growth, can benefit from more knowledge-based bioeconomies.



A Tanzanian farmer on her maize plot, where she grows improved, drought tolerant maize variety TAN 250. Photo by Anne Wangalachi/CIMMYT via Flickr CC BY-NC-SA 2.0



Biogas facility in Karpalund, Skåne, Sweden. Photo by Jorchr via Wikipedia CC BY-SA 3.0

How can Sweden help African countries develop KBBEs?

Even though the momentum to meet the challenges and opportunities of the modern bioeconomy has to come mainly from African countries themselves, they can gain much through collaboration with more experienced countries, including Sweden. Sweden is a frontrunner in the transition towards a knowledge-based bioeconomy, both in terms of technical innovation (see Box 3) and of setting up enabling policies and structures.

Box 3: Some actors in the Swedish KBBE

Sweden has numerous actors engaged in innovations aimed at improving crop productivity using advanced bioscience based crop breeding, precision agriculture, and new disease and pest diagnostic technologies.

The forestry industry is a critical actor in the Swedish bioeconomy. The main forestry products in Sweden are still pulp, paper and wood. However, due to increased competition and reduced demand for paper, the industry is now looking at diversifying value-added production, through a biorefinery approach, maximizing use of biomass resources, especially converting wood into products such as fuels, green chemicals, novel building and packaging material.

Swedish agroprocessing industries, producing food and feed products are also active in developing a broad range of agro-based renewable products for industrial use. The Swedish sustainable innovation funding agency VINNOVA is supporting a large programme on bioinnovation to explore potential new bio-based industrial products. The programme involves about 58 partners from industry and academic research and will run until 2020 with a budget of 600 million SEK (around US\$70 million). An industrial chemistry company cluster in the city of Stenungsund, cooperate towards a vision they call Sustainable Chemistry 2030. This vision includes making a transition from current fossil fuel-based raw materials and energy to renewable alternatives (including agrowaste and household waste), minimizing risks from chemical products and contributing to a sustainable society by 2030.¹

¹ See Kemiföretagen i Stenungsund (undated). Sustainable Chemistry 2030. Factsheet. <http://www.kemiforetagenistenungsund.se/pdf/foldereng.pdf>.

Sweden could support countries in sub-Saharan Africa in developing KBBEs on a number of fronts, particularly:

Dialogue, networking and awareness-raising

- *Dialogue forums* and institutions such as the Swedish National Board of Trade and Business, the Swedish-East African Chamber of Commerce (SWEACC) and the Swedish International Agricultural Network Initiative (SIANI) could be employed to promote partnerships between African and Swedish businesses and between public sector and civil society actors.
- *A virtual bioeconomy collaborative network.* Setting up such a network could facilitate contacts, partnerships, and collaborative proposal development between actors in SSA and Sweden. A more ambitious alternative would be to mandate an institution for Swedish-SSA bioeconomy collaboration – either an existing institution or a new one created for the purpose.

Capacity building and joint knowledge development

- *Swedish-SSA R&D and innovation platforms.* Further support could be given to ongoing projects such as the African Bioenergy & Biofuels Business Assessment ABBBA and the Bio-resources Network for Eastern Africa Development Programme (Bio-Innovate), linking R&D actors with market and business actors in the area of bioscience innovation.
- *Swedish-SSA bioeconomy flagship project.* Such a project could address, for example, development of multifunctional local biorefineries for multiple uses (food, animal feed, fuel, fibres and other bio-based industrial products) or of agroprocessing and value chains to benefit African and Swedish farmers. It could involve actors from relevant Swedish industries, piloting promising technologies and exploring market opportunities in both in SSA but also in Europe, visualizing potentials, and acting as a platform for capacity building and further collaboration.



Improved bush beans perform better than local varieties, but delivery systems to get them to farmers are key. Photo by Stephanie Malyon / CIAT via Flickr CC BY-NC-SA 2.0

- *Sida-supported International Training Programme.* The Swedish International Development Cooperation Agency (Sida) could support a programme on the bioeconomy, focusing on value addition at primary production sites and development of bio-based products, targeting SSA, under its International Training Programme scheme.
- *Bioeconomy strategy best practice assessment.* Sweden could support African countries in their development of national and regional bioeconomy strategies.
- *Building SSA analytical capacity* to assess the economic potential but also resource conflicts and potential negative impacts in the development of KBBEs.

Upscaling, innovation and business incubation

- *Supporting business partnerships.* Swedish support could help to incubate and enable partnerships between private-

sector actors in Sweden and SSA. This could help to scale up and commercialize key agroprocessing, value chain, and waste-conversion technologies by demonstrating their technical viability and their ability to support economic growth, job creation and sustainable development in SSA. Within a comprehensive framework, Swedish actors could provide technical and financial support at various stages in the innovation and product development cycle; for example small incubation grants (from Sida), matching grants and soft loans (from SwedFund), and private equity and venture capital (Swedish private sector).

Swedish support could be linked to initiatives and funding mechanisms such as Power Africa (which is supported by Sida) and Green Climate Fund (GCF) of the Paris climate agreement, which both have clear bioeconomy components.

A summary of conclusions from the SIANI Bioeconomy Expert Group. The SIANI Bioeconomy Expert Group was set up in October 2014, with Sida support. The group's mission was to explore how Sweden can share experiences and collaborate with countries in sub-Saharan Africa in their efforts to develop KBBEs. This brief summarizes its conclusions. For more information download full report at siani.se or contact Ivar Virgin, SEI (ivar.virgin@sei.se)

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SIANI's mission is to enable sustainable food security and nutrition for all. SIANI is a member-based network that supports and promotes Swedish expertise and provides an open and interactive platform for engagement and dialogue in a global context



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