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Policy Paper

Supporting the Adoption of Biofermentation Process Technologies in Kenya: Towards the Creation of a Sovereign Industry

Michele Castegnaro, Dr. Veerle Vandeweerd

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Introduction

A worldwide transition to a more sustainable world that addresses the problems associated with a changing climate, reduced biodiversity, increased pollution, and natural resources scarcity is a must. This global imperative for a greener, sustainable, and circular economy necessitates innovative approaches to production and consumption patterns, using new, clean, and green technologies. It requires innovative companies to introduce these advanced technologies into the economy to craft sustainable economic development models aligned with the climate and sustainable development goals.

One such emerging technology that offers great potential for reducing CO2 emissions, better use of agricultural waste streams, less water and energy use, and making vast stretches of land available for biodiversity is biofermentation, which is an old technology used globally to produce beer, dairy and other basic products. It is a process that utilizes natural microorganisms to convert organic substances into valuable products, such as beer and yoghurt. Recent improvements in the technology now offer the opportunity to use this technology to produce a whole sweep of new and advanced products. This includes - but is not limited to - alternative proteins, biofertilizers and pesticides, pharmacological and cosmetic products, and products for the chemical industry, such as bio-plastic and bio-ethanol.

The use of advanced applications of biofermentation is limited in Kenya. Yet, as this policy paper shows, it offers great potential to help Kenya transition to more sustainable agriculture and chemical production patterns, reduce reliance on imports, create jobs, and make Kenya a market leader in the green economy. For such advanced applications to be viably adopted and developed in Kenya, forward-looking policies, regulations and legislations that provide a conducive environment for the growth and financing of these new applications, are required.

Based on expert knowledge and consultations, three areas were selected to spearhead the introduction of advanced application of the biofermentation technology in Kenya. These areas are animal feed protein, biofertilizer, and simple molecules as precursors for the chemical industry. In particular, protein for chicken feed, biofertilizer for beans, and acetic acid for the chemical industry were identified by experts as having great potential to succeed and leading to great economic savings.

Currently, Kenya imports 100% of its acetic acid, 70% of its poultry feed protein substitutes, and 50% of its fertilizer. By nurturing a local industry, Kenya can drastically cut these import dependencies, strengthening its economy, and fostering a more resilient supply chain. Despite this clear potential, the policy and legislative framework for biofermentation in Kenya is in its infancy. The absence of comprehensive and legally binding regulations creates an environment where emerging bio-based solutions struggle to compete against established, often less sustainable, conventional inputs.

There is some nascent legislation related to the introduction of biofermentation technology in Kenya. For example, some aspects of bio fertilizers are addressed in the Draft Biofertilizer and Soil Conditioners Bill developed in 2006. This bill, however, is not yet promulgated by Parliament. KEBS through standard KS 2290:2011 specifies requirements for organic fertilizers. While these standards provide some guidelines, they are not legally binding and do not cover all aspects of biofertilizer production and use.

These policy shortcomings leave the introduction of biofertilizer in a legislative vacuum, undefended from alternative and less sustainable conventional fertilizer inputs.

Analysis and Evaluation of the three pilot areas

1. Acetic/Lactic Acid

Acetic acid is a crucial chemical input for multiple industries in Kenya, with the textile industry consuming 35-40% of total demand, followed by food and beverage at 25-30%, pharmaceuticals at 15-20%, chemicals at 10-15%, and other applications accounting for 5-10%.

The Kenyan acetic acid market is currently dominated by imports, with no significant domestic production. Major suppliers include South Africa, China, and India. Kenya's potential competitive advantages in the local production of acetic acid include abundant agricultural feedstock and rising industrial demand. These factors provide a strong foundation for local production supported by strategic investments and capacity-building initiatives.

The potential contribution to Kenya's GDP by shifting to a bio-fermentation based production of acetic acid is estimated at 0.2-0.3%. This is primarily due to value addition through local production, reduced reliance on imports, and annual savings of approximately EUR 23.3 million in foreign exchange currently spent on imports. The utilization of sugarcane bagasse, priced at $45-50 per ton (EUR 41.85-46.50), would also generate additional revenue for sugar mills and create new value streams in the agricultural sector.

By establishing domestic production, Kenya could reduce its dependency on imports and stabilize prices for acetic acid, which are often subject to international market fluctuations. This would benefit local industries by providing more predictable pricing and improving supply reliability, making Kenya a preferred supplier for regional markets. Additionally, developing local production capabilities would create opportunities for backward linkages in the supply chain, such as partnerships with sugar mills for feedstock supply, further enhancing the sustainability and profitability of the venture.

In addition to direct economic benefits, establishing acetic acid production in Kenya could drive technological advancements and innovation within the country. By investing in new technologies and training local talent, Kenya could position itself as a regional hub for bio-based chemical production, fostering innovation-driven growth and contributing to a broader knowledge economy. The development of expertise in biofermentation and sustainable manufacturing could also spill over into other sectors, making this an attractive investment opportunity for those looking to support profitable, sustainable initiatives.

2. Bioinoculators and Biofertilizers

Bioinoculators and biofertilizers still account for a small portion (5%) of the total fertilizer requirement in Kenya. This is due to historical import dependency (30 yrs+) for inorganic (chemical) fertilizers, creating market dominance and a barrier to innovation and local production.

Bio fermented fertilizing solutions have all the elements to succeed: They are cheaper than the imported inorganic fertilizer (a 1:3 ratio), scientifically proven to offer superior yields, and provide environmental sustainability. Inorganic imported fertilizers are expensive to import, impoverish the soils, and are harmful for nature. Yet their import is heavily subsidized. Data drawn from the research paper "Utilising Biofermentation for Natural fertilizer production (2024)", assess the absolute substitution value of inorganic fertilizer with locally produced bioinoculators for legumes: about 95M$ worth of imports could be locally produced.

Local substitution of inorganic fertilizer with biofertilizer would offset a serious portion of imports while triggering local entrepreneurship in the Kenyan agriculture segment. It could attract local investment, and support employment and sustainability.

3. Chicken feed protein

Kenya faces a significant protein deficit in its poultry feed sector. There is an overall animal feed shortfall, and reliance on imports for protein-rich ingredients such as soybean meal and fishmeal. Poultry feed requirements constitute 30% of the total animal feed requirement in Kenya. The 80 million birds slaughtered in Kenya annually utilizes 3,200,000–4,400,000 metric tons of feed, which represents an annual protein utilization of 0.64–0.88 million metric tons. With a 45 - 60% deficit at current utilization levels, it is estimated that the total annual protein deficit ranges between 360,000 to 620,000 MT. This gap in feed protein is filled by the importation of soybean and fishmeal as primary sources, whose seasonal availability and fluctuating prices add further challenges to the feed sector.

Using biofermentation technology to produce animal feed could contribute significantly to job creation, rural development, and environmental sustainability in Kenya. Given the current protein deficit in poultry systems, the number of direct jobs that can be created assuming an industry standard of 10MT/yr is 60,000 - 71000 jobs annually. However, applying the typical multiplier effect of 1.7 to account for indirect jobs in logistics, maintenance, administration, and other support roles, approximately 102,000 to 120,700 total jobs can be created across the poultry feed protein value chain.

Conclusion

The evidence gathered suggests that a conducive policy environment directed at promoting the use in Kenya of biofermentation technology would spur national growth. Appropriate policy frameworks need to be developed for encouraging such development. In the absence of policy measures, currently dominant and consolidated positions will remain and tilt the balance towards the use of imported inorganic compounds, imports of chicken feed protein and acetic acid. Sticking with current practices will let forgo

positive effects on the economy, in particular agriculture, sovereign wealth creation in industrial sectors subject to unpredictable supply chain fluctuations, favouring inflation and speculation.

It is a sustainable technology that relies on the cooperative nature of bacteria and organic matter. It can contribute towards reducing the current trade deficit in products that presently are imported, in particular poultry and animal feeds, basic chemicals and bioinoculator/biofertilizers. The assessed total value of currently imported products in these domains amount to about 200M$ per annum.

The creation of a Kenyan biofermentation industry serving local markets would contribute to mitigate supply chain unpredictable fluctuations, attract investment, create qualified employment, and offer the opportunity for Kenya to become a beacon in the production and distribution of such local products into East Africa.

For this to happen, there is the need for a shift towards more sustainable practices and technologies, dictated by national interest, foreign debt mitigation, local wealth creation and sustainability.

Recommendations

The following policy elements aim to create a supportive environment for the development of a thriving biofermentation industry in Kenya, contributing to economic growth, sustainability, and reduced reliance on imports.

1. Research and Development

For the development of scientific expertise aimed at supplying the local industry with innovation.

- Stimulating R&D: define favourable fiscal and policy measures for companies and research institutions engaged in biofermentation research and development.
- Establish and fund a National Applied Biofermentation Centre: creation of a dedicated centre for applied research and innovation, in partnership with European research institutions and companies, including those that own selected bacterial strains requiring local adaptation.

2. Infrastructure Development

For the initial stages of an indigenous biofermentation industry:

- Support Pilot Plant Establishment and funding: Facilitate the establishment of a state-of-the-art multimodality biofermentation pilot plant in Nairobi, potentially through public-private partnerships
- Extension of Special Economic Zone status for entities investing in biofermentation process technology.

3. Market Access/Awareness

For promoting the introduction and pervasiveness of Kenyan biofermentation commercial products:

- Create enabling conditions for bio fermented produced products to fairly compete against subsidized imported products by enacting policies supporting sustainable and circular models.
- Progressive subsidies shift from inorganic to organic products (biofertilizers and poultry feed being the most strategic) thus reducing foreign dependence.
- Develop guidelines for the efficient use of products from biofermentation involving new practices with emphasis on sustainability.

4. Industry Support

For the effective development and scaling of a local industrial environment.

- Tax Incentives: define and enact incentives to companies engaged in biofermentation production, in the priority sectors of animal feed, biofertilizers, and industrial chemicals.
- Streamline Regulations: Simplify regulations and licensing procedures for biofermentation businesses to encourage investment and innovation.
- Promote Public Procurement: Encourage the use of biofermentation products in government procurement to stimulate demand and support local industries.
- Priority accorded to the development of productive capacity in rural areas, in proximity of the consumers for such products (agriculture and poultry).

5. International Collaboration

For ensuring exchange with international excellence centres and cooperation:

- Facilitate Partnerships: Encourage collaborations between Kenyan and international companies and research institutions in the field of biofermentation.
- South-North collaboration corridors in the domains of research, implementation, establishment, and go-to-market strategies with focus on gender-employable workforce.
- Foreign Investment Attraction: Promote Kenya as an attractive destination for foreign investment in biofermentation technology and related industries
- Establish a local venture capital fund in KES to support companies that are active in this field.

6. Education and Training

For the development of local expertise in process management and handling of biofermentation technologies:

- Specialized Training Programs: Create vocational training programs and university courses focused on biofermentation technology and its applications.
- Facilitate Knowledge Transfer: Support partnerships between Kenyan and international institutions to facilitate knowledge transfer and training in biofermentation.

The Authors

Michele Castegnaro, Director, TGL Services Ltd (KE)

Dr. Veerle Vandeweerd, Director, Sustainable Scaling Industries Ltd. (KE)

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Konrad-Adenauer-Stiftung e. V.

Jan-Ole Voß
Project Manager
jan-ole.voss@kas.de
kas.de
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