Project Brief

Circular Bioeconomy for the Kenyan Dairy Sector (VALORISE)

Introduction

In Kenya, dairy is a leading sector, processing 634 million litres of milk in 2018 and contributing 14% of agricultural GDP and 4% of national GDP. Per capita per annum consumption of milk and dairy products is over 110 litres and is projected to double by 2030 with increasing shares of processed products such as yoghurt and cheese. Milk is a major source of nutrition in Kenya, providing 7.3% of the calorific supply. According to KNBS, the total milk production in Kenya reached 6.03 billion litres in 2021 of which 4.64 billion is cow's milk). Processing of the various milk and dairy products increased to 830 million litres in 2021, compared to 637 million litres in 2015, a 30% growth.

Growth in processing will increase the volumes of side streams and waste generated by the industry, implying increased sustainability risks and concerns, considering food industry as food-processing accounts for 39% of total materials lost in the food and agriculture sector contributing to greenhouse gas emissions and related climate change effects. To meet increasing demand for quality and safe milk and milk products without comprising the state of the environment the dairy industry had developed a sustainability road map. Integration of circular bioeconomy (CBE) principles of utilization or valorisation of organic waste and side streams in the dairy processing and other bio-feedstock and convert into various products such as food, feed, fibres, bioenergy, and industrial raw materials, while optimizing energy and water use efficiency can contribute to a sustainability-driven Kenyan dairy sector development.

How can CBE be integrated in the dairy industry to lower the environmental footprint by shifting toward more sustainable practices and business models that will support the country in meeting its Nationally determined contributions and other climate mitigation targets?

The VALORISE Project

This VALORISE is a transdisciplinary project that seeks to examine how CBE principles of resource use – i.e., prevention, reuse, recycling, can be leveraged in the growing and modernizing dairy industry in Kenya. The project aims to create a foundation of bioeconomic knowledge on which Kenyan dairy-industry stakeholders can act in applying bio-circular principles to facilitate sustainable growth pathways. The research will unravel the application of circular bioeconomy (CBE) principles in an evolving food-processing industry in low-middle income countries (LMICs) focusing on dairy processing firms who are central value-chain actors and leverage points for sector-wide CBE development.

Integrating CBE principles through value addition of side streams is an important pathway toward sustainable food processing industry development, however, there has been limited understanding of its application in a country like Kenya. The project seeks to generate state of the art integrated and comprehensive knowledge on conditions, challenges and opportunities that can guide industry in developing new valorisation solutions into food and feed products through utilization of side streams. In dairy processing, side streams such as whey and others waste streams have shown a lot of promise, drawing from insights and experiences from other countries.

Relevant pathway types for CBE in the Kenyan dairy sector cut across:

Prevention: Reducing biomass (milk) waste. The focus here is on reducing the amount of milk that is discarded or lost due to inefficient transport, storage, and processing, including milk rejected at the gate due to low quality or glut situations.

Reuse: Processing spoilt milk, whey, and other side streams into animal feed options for cattle, pigs, and chicken. The use of such stream can offer an alternative protein source that can enhance yield, farm profits, and resource efficiency.

Reuse/cycle; Pathway 2: Processing surplus milk and whey into food ingredients using advanced technologies (e.g. separation of proteins from lactose) and complying with high hygienic standards. This can be a demanding pathway in terms of know- how, technical capacities, economies of scale and business options. There are fewer demanding options in this pathway such as butter flavor, potable alcohol and sweet sugars and fermented dairy products.

VALORISE addresses several SDGs: SDG 12: Responsible consumption and production, specifically 12.3 (reduce food losses along production and supply chains) and 12.5 (reduce

waste generation through prevention, reduction, recycling, and reuse); SDG 2: Zero hunger, SDG 9: Industry, innovation and infrastructure, and SDG 13: Climate action.

Project Objectives

The VALORISE project aims to achieve three main objectives:

- Produce an integrated and comprehensive understanding of CBE potential and dynamics in low- middle income country like Kenya with a focus on the growing dairy processing industry
- Create a foundation of bio-circular economy knowledge on which Kenyan dairy-industry stakeholders can apply bio-circular principles to facilitate sustainable growth pathways.
- Increase the capacity to conduct research on CBE in LMICs, including training a new cohort of researchers with the skills to advance a research and innovation agenda in the growing CBE field.

Project Work Packages

The project organized around 5 work packages as outlined below:

Work package 1: Analytical framework and mapping of actors and institutions in the dairy innovation system

This package elaborates integrative approaches applicable to bio-economy transitions in LMICs; and provides an overview of the dairy value chain and innovation system in Kenya with a focus on biomass side streams; and review state-of-the-art literature to develop an integrated framework for understanding bioeconomy transitions in LMICs with a focus on food-processing. In addition, this package focuses on mapping the actors in the Kenyan dairy innovation system and analysing policies, strategies, regulations, standards, and norms.

Work package 2: Analysis of dairy side streams, technologies, and potential products

Work package 2 entails quantification and assessment of current side streams along the dairy value chain; analysis of the physical, chemical and biological quality of major dairy side streams in the formal and informal sector; and assessment of the technical knowledge, technologies and side stream qualities and volumes needed for realising new valorisation products.

Work package 3: Analysis of firm incentives and opportunities to engage in valorisation

This work areas analyses firm-internal and external factors that shape incentives and opportunities for adding value to side streams for each valorisation pathway type. It also looks at technical, capabilities, financial and other barriers capabilities and how these can be removed. In addition, the research focuses on developing business models for selected valorisation solutions and products that a firm may consider.

Work package 4: Future scenarios for a circular dairy bioeconomy in Kenya

The focus is on developing a road map through scenario-building options that can guide stakeholders to consider during workshops to deliberate on the integration of CBE in dairy sector development.

Work package 5: Project management and communication

This package is primarily focused on the overall project coordination and communication. This will integrate knowledge translation, brokering to ensure the scientific knowledge generated is well synthesized and packaged in outputs targeted for dissemination to industry, policy, and other appropriate stakeholders.

Key Activities

To achieve the set objectives, the project will focus on several activities:

- Develop an analytical framework that integrates biophysical, technical, economic, and institutional factors to understand dairy bioeconomy transitions in LMICs.
- Map key actors, activities and institutions in the dairy value chain and innovation system with a focus on side streams.
- Analyse the flows, volume, quality, and spatial distribution of dairy side streams and estimate the volumes available for circular utilisation.
- Review relevant technical solutions and products that can match the current and future needs of a dairy CBE in LMICs.
- Analyse the incentives and opportunities (capabilities), the institutional context and business models that enable dairy firms to innovate and apply bio-circular principles.
- Explore future scenarios for a dairy bioeconomy development through stakeholder engagement.
- Disseminate results to R&D, policy, industry stakeholders and scientists.
- Strengthen the capacity of researchers in research methodology, scientific writing and dissemination, and project management.

Expected Outputs and Outcomes

VALORISE is expected to stimulate learning and linkages across research, industry, and the public sector on the topic of CBE in the Kenyan food sector. It will contribute to the knowledge, technologies, business models and regulations needed to develop a dairy CBE in Kenya. This should stimulate innovation, attract investments, and create new partnerships to enhance the valorisation potential for side streams as part of a sustainable dairy development. The expected scientific and industry relevant outputs and outcomes are:

- Improved knowledge of the characteristics, significance, and distribution of dairy side streams and of assessing dairy resource flows in a LMIC context.
- Understanding and application of the appropriate technologies, products, and business models for valorising biomass side streams in the Kenyan dairy industry.
- Understanding the relationship between firms' incentives and opportunities to innovate, unstable and emerging markets, and a regulatory set-up with an emerging focus on food-processing, safety, and waste reduction.
- Stakeholder engagement to develop visions and scenarios on opportunities to be enhanced and challenges to be addresses to enable integration of CBE in the dairy sector that can inform other sectors.
- Increased capacity to conduct trans-disciplinary research on CBE in an LMIC context. A new cohort of young Kenyan researchers trained in the skills needed to advance a research and innovation agenda in the growing CBE field.
- Increased capacity of the dairy industry by providing knowledge and stimulating networks for exploring access to technology, knowhow, and business models to enable valorisation as part of the sustainability development pathway of the sector.
- Raised capacity in policy formulation to support the necessary enabling environment for enhancing a bio-circular dairy industry.

Project Partners

The project is funded by Danish Ministry of Foreign Affairs and implemented by a consortium comprising the following partners:

- The African Centre for Technology Studies (ACTS)
- Roskilde University, Denmark
- Technical University of Denmark (DTU)
- Arla Foods Ingredients
- Egerton University
- The Alliance of Bioversity International and CIAT
- Eastern and Southern Africa Dairy Association (ESADA)

Contact information

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For more information on the project see: https://valorise.acts-net.org