



Dairy Industry Sustainability through Adding Value to Processing Sidestreams



Roundtable Workshop

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2024

Pridelnn Azure Westlands, Lantana Rd, Nairobi

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Background and Context

The Kenyan dairy industry contributes approximately 14% of the agricultural gross domestic product (GDP) making it a national key economic sector¹. Accomplishing the political ambition of doubling the consumption of milk and dairy products by 2030, including yoghurt, butter and cheese, will significantly increase valuable sidestreams such as sweet and acid whey from processing. Simultaneously, climate change impacts threaten to disrupt business-as-usual, adding pressure on the economy in general and the dairy sector in particular. The future thus offers opportunities for growth and innovation and poses challenges regarding resource availability, waste management, and access to affordable energy.

Opportunities include valorisation of sidestreams and byproducts such as whey into valuable food or feed products as part of a circular bioeconomy (CBE) are relevant in this context. CBE aims to shift from linear production-consumption models towards circularity for sustainable development. When applied in the dairy sector, CBE can contribute to the ambitions set out in the Kenya Dairy Industry Sustainability Roadmap 2023 - 2033 and help mitigate impacts from climate change through enhancing resource efficiency in the dairy value chain.

On this backdrop, the African Centre for Technology Studies (ACTS) is implementing a research and innovation project on circular bioeconomy for the Kenyan dairy sector (VALORISE) in partnership with Egerton University, Roskilde University, Technical University of Denmark, Arla Foods Ingredients, International Center for Tropical Agriculture, and East and Southern Africa Dairy Association (ESADA). The VALORISE project aims to examine how principles and practices of circular bioeconomy can be leveraged in the growing and modernizing of the dairy industry in Kenya towards sustainability. A key question of the project is:

“How can adding value to sidestreams such as whey be integrated in the Kenyan dairy industry to enhance business opportunities while lowering environmental footprint?”

One of the tasks of VALORISE is to develop shared, future scenarios for a circular dairy bioeconomy in Kenya. The project organized a half day roundtable workshop as a first step towards creating such scenarios. The workshop was organized using participatory scenario building approach and integrating the SEEDS method. This involved stakeholder exploring initial ideas that would need to be “planted” to develop alternative future scenarios of the Kenyan dairy industry development to shift towards circularity and sustainability envisioning pathways that enhance valorisation of sidestreams.

This report summarizes the proceedings of the workshop, capturing the key points from presentations, group sessions, and reactions and comments on the sessions by the participants.

1.0 About the Workshop

The stakeholder engagement workshop (see Annex 1 for the agenda), one of a series of activities under “VALORISE project” was held at Pridelnn Azure Westlands, Lantana Rd, Nairobi on 5th February 2024. The workshop gathered together 30 stakeholders representing dairy processors, government agencies,

¹ [The dairy industry in Kenya: production capabilities, investments, innovations and trends | Food Business Africa Magazine](#)

farmers, researchers and academic partners (see Annex 2 for participants list). The workshop aimed at achieving the following objectives:

- I. Understanding the status of processing in the dairy sector;
- II. Presenting emerging findings from the VALORISE project;
- III. Exploring and envisioning with the participants the future of the dairy sector that considers adding value to sidestreams such as whey;

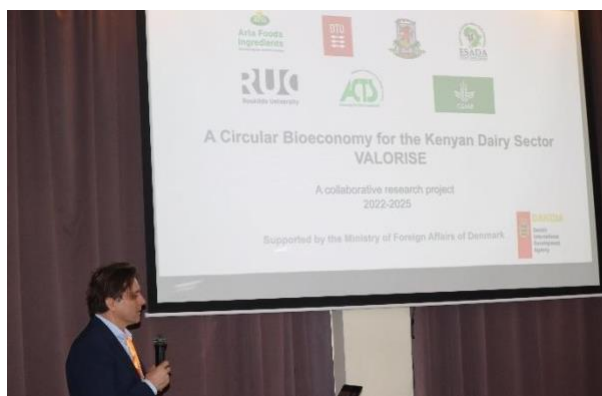
1.1 Workshop Methodology

The half a day workshop was organized into two key sessions, i.e., the presentation and group sessions. The presentation session was dedicated to setting the scene by providing an overview of the project's objectives, impacts of climate change on the dairy industry in Kenya, valorisation pathways for sidestream utilizations and status and outlook of Kenya's dairy industry. The group session focused on envisioning the various initiatives needed for optimal pathways for valorisation of whey while exploring the environmental, policy, and technological implications. Additionally, we invited an artist to the workshop and commissioned him to capture the proceedings of the workshop as an illustration. This artist impression is presented in Annex 3.

2.0 Summary of section 1: Presentations

2.1 Project Overview by Simon Bolwig (Roskilde University)

The issue of food loss and waste (FLW) on a global scale is significant. FLW contributes 3.3 billion tons of GHGs (8%) and constitutes 39% of the total materials lost in the food sector. Circular bioeconomy (CBE) models present a promising solution, leveraging organic waste and sidestreams as biofeedstock. This biomass can be transformed into a myriad of products spanning food, feed, fibers, bioenergy, and industrial raw materials.



The project objectives were to:

- Produce an integrated and comprehensive understanding of circular bioeconomy potential and dynamics in LMICs with a focus on milk processing
- Create a foundation of bioeconomic knowledge on which Kenyan dairy-industry stakeholders can act in applying biocircular principles to facilitate sustainable growth pathways
- Increase research capacity on circular bioeconomy (CBE) in low middle income countries (LMICs) including training of researchers with the skills to advance a research and innovation agenda in the growing CBE field.

2.2 Valorisation Pathways for Sidestreams

To reduce milk waste and maximize resource utilization in the dairy industry, the project proposed the following valorisation pathways for sidestreams:

- Prevent milk waste by improving transport and storage efficiency to reduce discarded or lost biomass.
- Reuse spoilt milk and whey by processing them into animal feed for dairy cows, calves, pigs, and chickens, which utilize proteins effectively.
- Utilize simple whey processing methods to produce whey-based drinks, butter flavorings, sweet sugars, and fermented dairy products.
- Implement advanced whey processing technologies to separate proteins from lactose, creating high-quality food ingredients while maintaining strict hygienic standards.

These strategies aim to enhance resource efficiency, reduce waste, and add value to by-products in the dairy industry. These scenarios formed the basis of discussion and exploration with the stakeholders.

2.3 Status and Outlook of the Dairy Industry presentation by the Kenya Dairy Board

The presentation by the Kenya Dairy Board offered valuable insights into the current state and future prospects of the dairy industry in Kenya. From cattle population and productivity to market demand and trends, the presentation delved into various aspects shaping the dynamics of this crucial sector as discussed below:

- **Cattle population and productivity:** Kenya has a substantial number of dairy cattle. However, the productivity per cow is quite low, with an average yield of only 3 liters of milk per day. This suggests inefficiencies in dairy farming practices, possibly due to inadequate feeding, poor breed quality, or lack of access to veterinary services.
- **Milk pricing:** The average price of milk for farmers is Ksh. 47 per liter. The minimum producer price is Ksh. 33 per liter, while the recommended best price is projected to be Ksh. 50 per liter. In 2023, the average producer price was around Ksh. 40 per liter. This price fluctuation indicates a volatile market, influenced by factors such as supply, demand, and production costs.
- **Milk cooling and processing:** There are approximately 476 milk coolers across the country. However, these are underutilized, with utilization rates below 50% for most months. This underutilization drives up the cost of cooling, as the fixed costs of operating the coolers are spread over a smaller volume of milk.
- **Processing facilities:** The Dairy Board has in its register 35 milk processing plants and 104 mini-dairies. Despite the number of facilities, the industry faces challenges in maximizing the efficiency and capacity of these plants.
- **Milk intakes and value:** Milk intake rose from 755 million liters in 2022 to 811 million liters in 2023, indicating growth in the dairy sector. The total value of milk intakes in 2023 was Ksh. 38.4 billion. The increase in intake suggests improved collection and perhaps better production techniques.
- **Product types:** Fluid milk products constitute a significant portion of the dairy



products manufactured. This dominance of fluid milk indicates consumer preference and market demand.

- **Market demand and trends:** As Kenya's population grows, the demand for milk and milk products is expected to increase. This trend provides an opportunity for dairy farmers and processors to expand their operations and increase production. There is a rising demand for long-life milk. This type of milk has a longer shelf life, making it more convenient for consumers and suitable for regions with less frequent access to fresh milk supplies.

Fermented milk products, such as yogurt and traditional fermented drinks, are gaining popularity due to their health benefits and consumer preference for varied dairy products.

Implications and Opportunities in the Dairy Industry

The dairy industry faces both challenges and opportunities that significantly impact its growth and sustainability. In this section, we explore key implications and opportunities that could shape the future of the dairy sector as outlined by the Kenya Dairy Board:

- **Improving productivity:** Addressing the low productivity of dairy cattle is crucial. This could involve investing in better breeding practices, nutrition, and veterinary care.
- **Utilization of milk coolers:** Improving the utilization rate of milk coolers could reduce cooling costs. This might be achieved through better coordination in milk collection and transport, or by increasing the volume of milk produced.
- **Processing and value addition:** Enhancing the capacity and efficiency of milk processing plants can help in meeting the growing demand for milk and milk products. Value addition through products like cheese, butter, and flavored milk could also provide new revenue streams.
- **Market development:** Expanding the market for long-life and fermented milk products can tap into changing consumer preferences and increase the overall demand for milk.

While the Kenyan dairy industry faces several challenges, there are also significant opportunities for growth and improvement. Strategic investments in productivity, processing capacity, and market development can help the sector to better meet the increasing demand for dairy products.

Kenya Dairy Industry Sustainability Roadmap (2023-2033)

The global concern on greenhouse gas emissions necessitates the need to integrate aspects of sustainability in the Dairy industry, hence formulation of the Dairy Industry Sustainability Roadmap (2023-2033).

The Pillars of the Dairy Sustainability roadmap are as shown below:



Figure 1: Pillars of the Kenya Dairy Sustainability roadmap

The Kenyan government is also implementing the Bottom-up Economic Transformation Plan (BETA)(2022-2027), prioritizing agriculture as a key pillar. Within this framework, the dairy industry has been identified as a critical value chain for transformation, leading to the formulation of the BETA Dairy Goals. The BETA Dairy Goals aim to promote the following:

Milk Production	Dairy exports	Milk Marketing	Revenue of small-scale farmers
Double the production of milk to 10billion litres per year	Grow exports of dairy produce to 1 billion litres per year	Increase the percentage of formally marketed milk from 30% to 50%	Increase revenue of small-scale dairy farmers to ksh56000 per month

Figure 2: The BETA dairy goals

2.4 Questions and remarks by participants

During the session, a participant posed an insightful question: "What can be done to help producers fetch higher prices?" The Kenya Dairy Board (KDB) provided the following responses:

- Encourage Farmers to Grow Their Own Fodder:**
 KDB advocates for promoting self-sufficiency among dairy farmers by encouraging them to cultivate high-quality fodder. This approach can significantly reduce feed costs while ensuring a consistent and nutritious diet for cattle. With improved nutrition, farmers can achieve higher milk yields and produce better-quality milk, thus enhancing their ability to command higher prices in the market.
- Adopt Intensive Feeding Practices:**
 Shift focus from having a large number of underfed cattle to maintaining fewer, well-nourished animals. Intensive feeding practices ensure that each cow receives optimal nutrition, resulting in increased milk production and improved quality, which can command higher prices in the market.
- Lobby for Reduced Cost of Animal Feeds:**

Advocate for government policies that reduce the cost of commercial animal feeds. This can be achieved through subsidies, tax reductions, or incentives for local feed production. Lower feed costs directly reduce production expenses, allowing farmers to retain more profit and potentially fetch higher prices for their milk.

2.5 Presentation on Climate Change Impacts and implications for the Dairy Industry

Africa suffers disproportionately from climate change impacts, with many people currently living at subsistence levels and many more on the brink of joining them. Kenya, in particular is recognized as highly vulnerable to the climate change impacts with a ranking of 152 out of 181 countries. The Arid and Semi-Arid lands (ASALs) which make up about 85% of the country are the most vulnerable and host approximately 38% of the population and 70 % of livestock. In response to these challenges, the Kenya Dairy Board (KDB) has developed a sustainability roadmap aimed at addressing key environmental concerns while promoting economic growth and social well-being. One of the primary focus areas of the KDB roadmap, aligned with the planet pillar, is sustainable milk processing. By implementing sustainable practices in milk processing, such as reducing greenhouse gas emissions, minimizing water usage, and promoting biodiversity conservation and land management, the dairy industry can mitigate its environmental impact while supporting the resilience of communities vulnerable to climate change.

The focus areas for sustainable milk processing as outlined in the KDB roadmap planet pillar are:

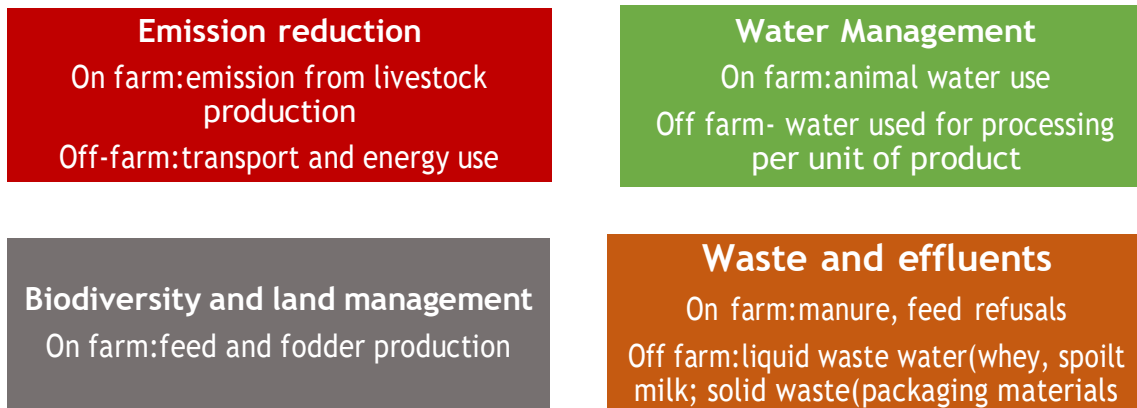


Figure 3: Focus areas of the planet pillar of the Kenya dairy sustainability roadmap

Contributing to the KDB roadmap with a valorisation perspective regarding the processing of sidestreams entails: moving from a linear system to a circular system. For instance, by making use of whey has several benefits such as waste reduction, substitute ingredient, diversification of products which contribute to market expansion

2.6 Presentation on the use of whey by Arla Food Ingredients

Arla Food Ingredients delved into the versatile applications of whey, a by-product of dairy processing, across various segments including infant nutrition, medical health, high-end sports nutrition, and food applications. The utilization of whey presents a multitude of opportunities, but finding the "sweet spot" where value is maximized is crucial for scalability.

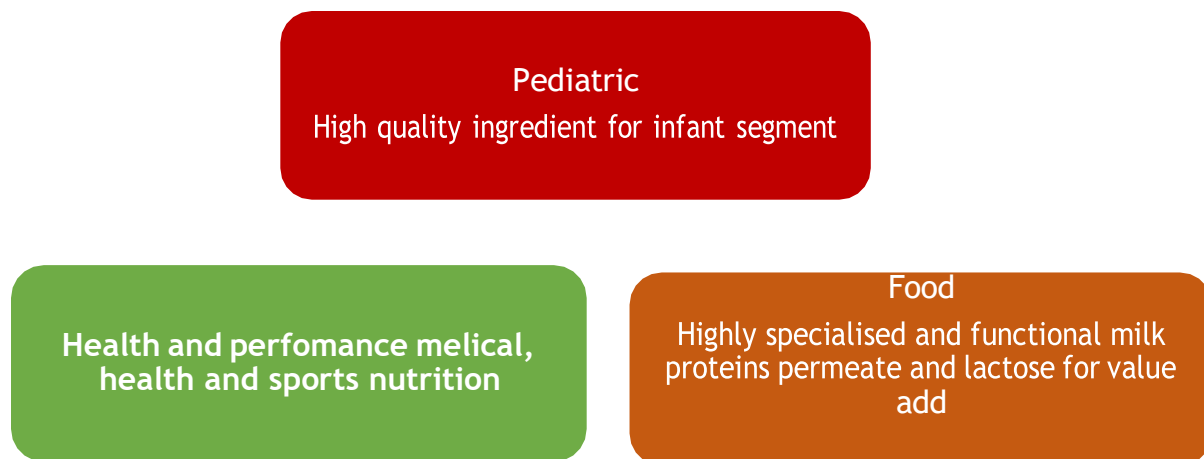


Figure 4: Different uses of whey

Arla Food Ingredients emphasized on the importance of leveraging the strengths and competitiveness of diverse partners to overcome constraints in whey utilization. One such example is the Gain Nordic partnership model, which prioritizes sustainability from environmental, economic, and social perspectives, while also focusing on promoting safe, affordable, culturally acceptable, and nutritionally adequate whey-based products.

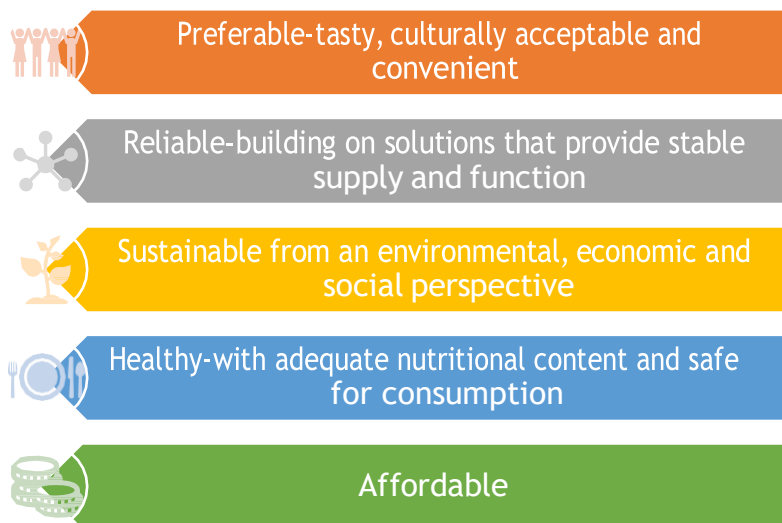


Figure 5: Illustration of the Gain-Nordic partnership model

2.6.1 Remarks and comments on Arla Foods presentation

During the discussion following Arla Foods' presentation, participants offered insightful comments on aspects concerning the utilization of whey by-products:

Expanding Beyond Fitness

Participants noted that while gym enthusiasts may be familiar with the benefits of acid whey, there exists a broader audience that remains untapped. This observation highlights the need for an educational initiative to bridge the knowledge gap and explore innovative applications of whey beyond the fitness domain.

Innovative Applications in Kenya

In Kenya, where cheese and whey production is not as prevalent as in other regions, companies like Raka Cheese are innovating by introducing liquid whey drinks for stabilizers. Additionally, Happy Cow is utilizing sweet whey to produce low-cost yogurt, thereby demonstrating creative ways to utilize whey as an ingredient. Furthermore, the introduction of whey butter by these firms showcases the potential for diversification within the dairy industry.

Need for consumer awareness

Participants highlighted the need to raise consumer awareness about whey products, noting that low levels of awareness remain a significant barrier to purchase whey-derived products. This lack of consumer confidence is exemplified by the discontinuation of the Raka cheese whey drink, underscoring the importance of education and marketing to improve acceptance and drive demand for whey-based products.

These comments underscore the importance of exploring diverse applications of whey by-products and leveraging innovative approaches to add value to the dairy sector, both locally and globally.

1.5 Presentation on the emerging findings from Valorise Project

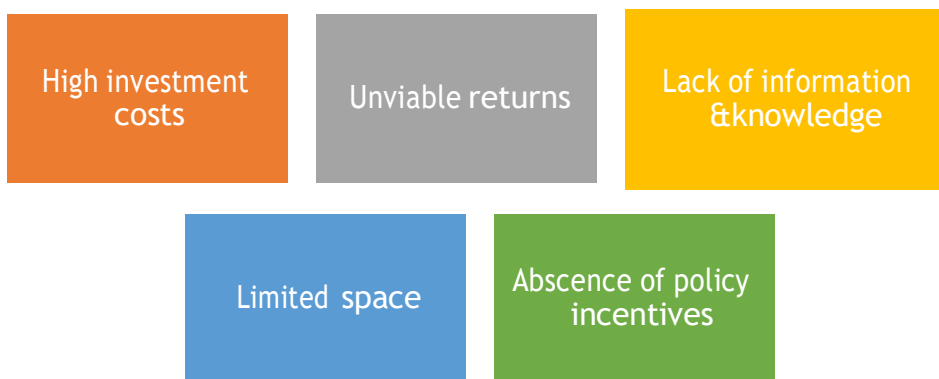
Kenya's dairy processing is growing in diversity of products. Processors have opportunities to integrate CBE as part of sustainable sector development. Most of the processors are currently not utilizing their sidestream e.g. only 2 processors are producing whey juice. The rest are mostly giving out for, free to pig farmers. The most common reasons why the sidestream is not utilized is unviable returns, and high cost of investments.

New products introduced by processors last 12 months include:

Market demand- Cheese	Consumer preference- Yoghurts	Processed milk	Planning to introduce
<ul style="list-style-type: none">-Mozarella-Paneer-Ricotta-Gouda and red cheese-Ricotta from whey	<ul style="list-style-type: none">-Goat milk yoghurt-Yoghurt with chocolate-Plant based yoghurts-Thicker yoghurt-Improved formulation of yoghurt	<ul style="list-style-type: none">-Tetra fino long-life milk-Fat free and lactose free milk-Coconut milk	<ul style="list-style-type: none">-Flavoured UHT milk-Probiotics-Butter

Figure 6: Preliminary finding of the research on the development of dairy products

According to the research findings the following are the reasons why investors do not utilize sidestreams:



2.7 Presentation on valorisation of cheese whey into protein ingredient for poultry feed formulation

During the session, Salma, an MSc student at Egerton University, shared insights into her MSc project focused on the potential application of whey in animal feeds. She emphasized the triple-win aspect of her study, which involves producing a protein-enhanced biomass for feed supplementation. This not only enhances animal nutrition but also contributes to increased dairy revenues. Salma highlighted the significance of whey as a source of essential amino acids like lysine and glutamate, which are often lacking in plant protein sources. Integrating whey biomass into poultry feed formulation offers a sustainable approach to recover whey nutrients while minimizing environmental pollution.

In response to the presentation on the findings of the Valorise project, participants raised several questions and with the following feedback provided:

Table 1: Queries and responses to valorisation of cheese whey into protein ingredient for poultry feed formulation presentation

	Queries	Responses
1	Why hasn't whey been produced for so long?	The volume of whey produced has historically been too small to justify turning it into a viable business case. However, with innovative approaches and increased awareness of its potential applications, there is an opportunity to explore whey utilization further.
2	How will the drying process be conducted	Various methods such as solar drying or oven drying can be considered to concentrate whey quickly and effectively, maximizing its value and production efficiency.
3	Does the protein content justify the cost of whey production, considering it is added as a feed additive?	Despite the relatively low protein content of whey, utilizing existing equipment used for yogurt production can streamline the processing process, reducing the need for additional investment and maintaining consistency in production techniques.

4	Through the process of producing, how will you do the drying- 20 litres can produce half a kg. solar drying, oven drying	Yes, we have considered methods to concentrate whey quickly and effectively. By streamlining this process, we can maximize the value derived from whey and improve overall production efficiency
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3.0 Summary of section 2 on Seed formulation- Group Session

The Three Horizons Framework is a strategic planning tool that divides change into three distinct timeframes: Horizon 1, representing the current state; Horizon 2, the transitional phase; and Horizon 3, the envisioned future. The participants embarked on an envisioning process to outline the visualization of the different seeds for valorisation of whey, based on the three-horizon framework while stating the different action to start, stop and continue to achieve a desired state in the context of valorisation of dairy sidestreams. The table 1 presented in section 3 highlights the key insights derived from the group discussions.

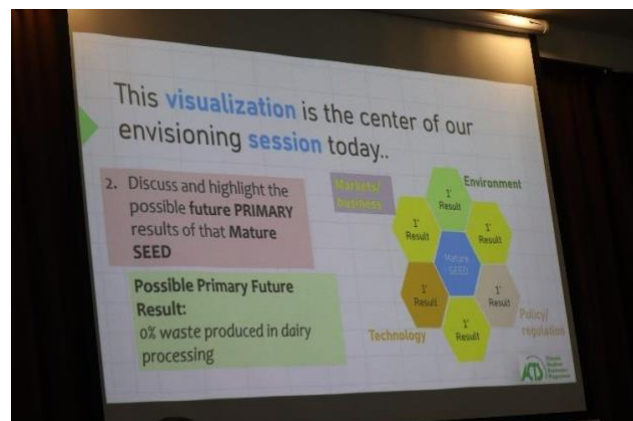


Photo 3: Picture representation of the visualization presentation

The session started off with a presentation on the highlight of a seed as innovative initiatives, practices, and ideas that are present in the word today, but are not currently widespread or dominant and how to picture the seeds when they are all grown and ready for harvesting. Visualization was the center of the envisioning session. The team were divided into groups and were tasked to do the following:

1. Define mature seed in 2050 using a statement and a vision
2. Discuss and highlight a possible future primary result of that mature seed with their implication on technology, policy, markets environment
3. Assess whether there are commonalities between or among the results



Photo 4: Participants in a group session

The SEEDS to be considered for valorisation were:

- SEED 1: Whey for animal feeds
- SEED 2: Whey for human food as powder
- SEED 3: Whey for human food as drink
- SEED 4: Whey for pharmaceuticals



The Table below captures the envisioning based on the discussions from the group sessions

Table 2: Summary of the envisioning process based on group discussions

	SEED	Statement	Vision	Environment implication	Technology implication	Policy implication	Markets implication
GROUP 1	Whey as animal feed (1)	Whey is not waste but a livestock feed ingredient	Zero whey waste in the dairy value chain	<p>Reduce waste from processing</p> <p>Increased demand for energy usage to process whey</p> <p>Less land used in cultivating of protein feed</p>	Develop new technology to process whey as a livestock feed ingredient	<p>-Enabling policy environment to allow for whey utilization for livestock feed</p> <p>Develop standards for whey products</p>	<p>New market development for dairy byproducts (whey)</p> <p>Availability of extra raw materials for the animal feed industry</p> <p>Improved revenue for dairy processors & farmers</p> <p>Alternative market for dairy sidestreams</p>

	Whey for pharmaceuticals (1)	A vibrant dairy sector supplying bioactive compounds to the pharmaceutical industry	Improved human health from whey ingredients	Reduced wastes	Develop new technology to process whey for the pharmaceuticals	Enabling policy environment to allow for whey utilization for pharmaceuticals Develop standards for whey products	New market development for dairy byproducts (whey Availability of extra raw materials for the pharmaceutical industry Improved revenue for Dairy processors Alternative market for dairy sidestreams
Group 2	Whey for Human food	Whey powder as a publicly accepted food additive	To establish whey powder as a widely accepted additive, enhancing nutritional value and food quality	Reduced environmental pollution Increased usage of energy Conserved water from drying	Product diversification	Enabling policy environment for utilization of whey as food Food procedure safety requirement	Larger food market share for dairy farmers Increase likelihood of consumer preferences through

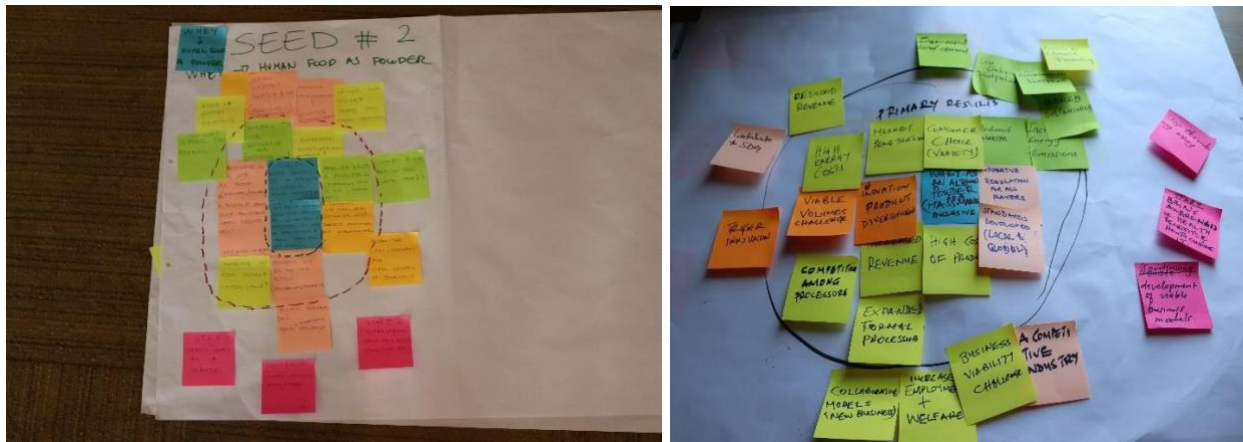
			for consumers	Cleaner and healthier environment		Need for incentives for clean energy supply for processors	product diversification Catalyse small-scale local equipment for innovation.
Group 3	Whey for animal feeds	Affordable nutrient dense feed for livestock		Reduced environmental pollution Reduced costs of waste treatment		Need for development of standards for whey use	Reduced costs of production to farmers Market growth for whey products

CONCLUDING REMARKS

In conclusion, the roundtable workshop provided valuable insights and discussions on various aspects related to the dairy sector's sustainability and potential for value addition. The workshop successfully achieved its objectives, including understanding the current status of processing in the dairy sector, presenting emerging findings from the VALORISE project, envisioning the future of the dairy sector, and formulating optimal pathways for integrating sidestream valorisation in the industry.

Key presentations highlighted the significance of addressing food loss and waste, the potential of circular bioeconomy models, and the importance of climate change resilience in the dairy industry. The group sessions on seed formulation provided a platform for envisioning the future of whey utilization in various sectors, highlighting potential environmental, technological, policy, and market implications.

Overall, the workshop facilitated constructive dialogue and collaboration among stakeholders, paving the way for innovative approaches to enhance sustainability and value addition in the dairy industry.



Snapshots of the visualization charts



Annex 1: Workshop Agenda

Roundtable Workshop on Dairy Industry Sustainability through Adding Value to Processing Sidestreams=-

Activity	Focus	Time	Responsible
Arrival and registration of participants	Registration and welcome	0830 – 0900	Erica Atieno and Luseka Mwanzi
Opening remarks	Introduction to VALORISE Introduction to workshop	0900 – 0915	Simon Bolwig Catherine Kilelu
Session 1: Setting the scene for envisioning sustainability			Chair: Catherine
Status and outlook of the Kenyan dairy sector	Presentation by KDB	0915 – 0930	Kenya Dairy Board
Climate change 2020-50 in East Africa and implications for the dairy sector	Climate-change in East Africa and implications for the dairy sector	0930 – 0945	Andreas Kamp Phyllis Wanjugu
Q & A to the panel		0945 – 1000	KDB, Andreas, Phyllis
Insights from the VALORISE project	Findings from the survey of dairy processors.	0945 – 1030	Bockline Bebe
	Technologies and products for valorization of whey.		Charlotte Sørensen (Arla Foods) Salma Molly
Q & A to the Panel		1030 – 1045	Bebe, Charlotte., Salma
Coffee & snacks		1045 – 1100	Erica Atieno
Session II: Envisioning sustainability through circularity			Chair: Joel
Introduction to the SEEDS approach to scenario development	Acquaint participants with the seeds approach in preparation for the next session	1100 – 1115	Joel Onyango
Stakeholders and experts co-create visions for circularity in the dairy sector	Nurturing of SEEDS to develop circular economy in the dairy sector	1115 – 1230	Joel Onyango (facilitator)
Plenary presentation on the identified visions	Presentation of visions and identification of needs	1230 – 1300	Joel Onyango (facilitator)
Wrap up and way forward (and lunch)	Next steps towards solutions on circularity for dairy sector development	1300 – 1330	Catherine Kilelu

Annex 2: Workshop Attendance List

	NAME	ORGANIZATION	EMAIL ADDRESS
1.	Catherine Kilelu	ACTS	C.Kilelu@acts-net.org
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Annex 3: Illustration of the Workshop Proceedings

