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Sectoral Value Chain Mapping and Technology Needs Assessment in Bungoma County, Kenya

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ABSTRACT

A Value Chain Mapping and Technology Needs Assessment exercise was conducted in Bungoma County, Kenya. The study aimed to identify key industries, analyze their value chains, and assess technological gaps to enhance productivity, efficiency, and sustainability. Bungoma County's economy is predominantly agricultural, with maize, sugarcane, and dairy as major sectors, alongside emerging industries such as natural herbs, coffee, and sunflower processing. Through extensive field research, stakeholder interviews, and data collection, the assessment provides a comprehensive analysis of production, processing, and distribution activities within these value chains. Key findings highlight the need for improved post-harvest management technologies, modern agricultural practices, and advanced processing facilities. Additionally, investment in affordable irrigation systems, farm machinery, and digital solutions for market access is identified as critical for sectoral growth. The survey serves as a strategic resource for county governments, investors, SMEs, and local communities, offering data-driven recommendations to strengthen value chains and promote economic development.

Keywords: Agro-processing, Value Chains, Mapping, Technology Needs

1.0 Introduction

A value chain mapping survey was conducted in Bungoma County by Kenya Industrial Research and Development Institute (KIRDI) under the Kenya Industry and Entrepreneurship Project (KIEP) on behalf of the Ministry of Investment, Trade, and Industry, with funding from the World Bank Group (IBRD-IDA). A Value Chain Mapping and Technology Needs Assessment (VCMTNA) is essential in assessing the status of value chains, identifying technology needs and addressing these challenges using intervention measures [1]. Value chain mapping identifies key activities and actors involved in production, processing, and distribution, while a technology needs assessment evaluates the tools, machinery, and systems required to improve efficiency and competitiveness. This combined approach helps pinpoint technological gaps and opportunities for investment [1].

Bungoma County which is located in western Kenya, is a key agricultural region with a strong reliance on maize, sugarcane, and dairy farming. Emerging sectors such as natural herbs, coffee, and sunflower processing present new agricultural economic frontiers [2].

However, the agricultural sector faces challenges, including low productivity, poor infrastructure, limited market access, and underdeveloped value chains. These obstacles hinder economic growth and limit income generation for smallholder farmers and agro-processors. The assessment focused on Bungoma's agriculture and agro-processing sectors, particularly small and medium enterprises (SMEs), which often struggle with outdated technology and high production costs. Key areas for improvement include modern farm machinery, post-harvest handling technologies, digitization for market access, and efficient processing facilities. Addressing these gaps will enhance productivity, reduce losses, and improve the quality of agricultural products. Beyond economic benefits, adopting modern technology is crucial for ensuring the sustainability and resilience of Bungoma's agricultural sector. Climate change,

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fluctuating market conditions, and evolving consumer demands require innovative solutions that support long-term agricultural viability. By integrating advanced technologies into farming and processing, Bungoma can increase product value, improve competitiveness, and create new market opportunities.

The findings of this study provide actionable insights for policymakers, investors, county government officials, SMEs, and development partners. The recommendations aim to foster inclusive economic growth, enhance productivity, and promote innovation within Bungoma's agricultural value chains.

2.0 Methodology

To enhance the productivity, innovation, and competitiveness of Kenyan SMEs, particularly in Bungoma County, a value chain approach was adopted for the Agro-processing sector. This approach aligns with the project's objectives of increasing technology uptake, improving managerial skills, and fostering innovation. Value chain analysis, with its pro-poor focus, aims to improve efficiency, quality, and inclusivity in economic activities. By analyzing all stages - from inputs to distribution and final consumption - the approach identifies gaps and opportunities for enhancement. It promotes competitiveness, greater market access, better livelihoods, and poverty reduction, directly supporting the project's goals. The key agricultural products identified were; herbal, dairy, coffee, and sunflower. For each, the study mapped key stages and actors, covering areas such as ownership structures, technology needs, skills gaps, value addition, quality management, and waste handling. Data was gathered through literature review, stakeholder interviews, facility visits, and direct observations of production processes.

2.1 Study Area

Bungoma County which is located in western Kenya, borders the republic of Uganda to the North-west, Trans-Nzoia County to the North-east, Kakamega County to the East and South-East, and Busia County to the West and South-west. The county covers 3,032.2 sq. km, with an elevation ranging from 1,200 to 1,800 meters above sea level and a mean temperature of 23°C. It has a population of approximately 1.6 million people, with females making up 52% and males 48% of the population respectively. The population by age distribution is that around 45.9% are under 14 years, 51.4% are between 15-64 years, while 2.3% are over 65 years. Bungoma has a population density of approximately 453.5 people per sq. km across the the nine sub-counties of; Bumula, Kanduyi, Kimilili, Sirisia, Kabuchai, Tongaren, Webuye East, Webuye West, and Mt. Elgon. The County is rich in natural resources, including fertile agricultural soils, rivers, and forests. While some resources are optimally utilized, others face under or over-exploitation. Since 2013, the County Government, through the Department of Agriculture, Livestock, Fisheries, Irrigation, and Cooperatives, has supported farmers with free fertilizers, seeds, and equipment, alongside improved livestock and irrigation kits. However, the blue economy remains underdeveloped or virtually non-existent in some areas [3].

2.2 Sample Study Area

The sample study areas selected for the survey included; Chwele, Kanduyi, Mt Elgon and Bumula that have a higher number of SMEs doing value addition in agro-processing. The areas were selected because many SMEs doing value addition in agro-processing are domiciled in these areas.

2.3 Data Collection and Analysis

Information was collected using structured and unstructured questionnaires, key informant interviews and focus group discussions. This approach provided insights into coffee, sunflower, herbals and dairy markets and prices. The findings further highlighted infrastructure and technology gaps, informing targeted intervention/recommendations to enhance Bungoma County's Agro processing sector and promote sustainability in the areas mentioned.

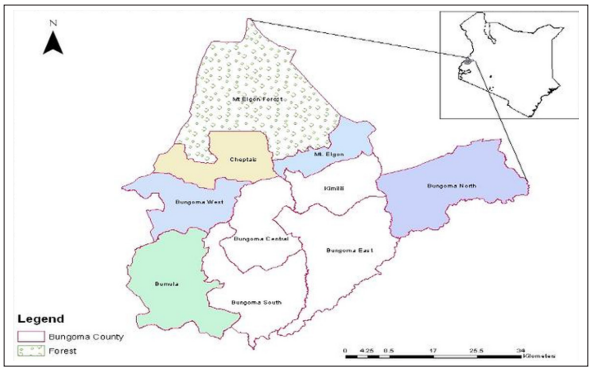

Figure 1: Bungoma county (state source)

3.0 Value Chain Findings

3.1 Key County Programs/Projects

Bungoma County's third County Integrated Development Plan (CIDP III) for 2023-2027, titled "Accelerating Socioeconomic Transformation to a More Competitive, Inclusive, and Resilient Economy: The Bottom-Up Approach," outlines a strategy for growth focused on economic development, poverty reduction, job creation, and improved service delivery. The plan prioritizes uplifting marginalized communities and ensuring equitable distribution of economic benefits. Additionally, a sectoral value chain mapping and technology needs assessment conducted in the County analyzed key sectors, with a particular emphasis on agriculture, identifying technology gaps to enhance efficiency, sustainability, and overall sector performance [4].

3.2 Main Crops Produced in Bungoma County

Bungoma County produces a wide range of crops, categorized into food, industrial, and horticultural crops, with an emerging focus on natural herbs. Major food crops include maize, beans, cassava, and vegetables, while industrial crops such as sugarcane, coffee, and tea dominate. The county also grows cotton, oil crops, and tobacco. Horticultural crops include vegetables, fruits like bananas and pineapples, and flowers, though flower farming is still in its infancy. With two major sugar factories and numerous small-scale milling and processing facilities, Bungoma requires more investment in value addition in agro-processing to fully leverage its agricultural potential.

3.1.1 Herbal

The natural herbs value chain in Bungoma County presents significant potential, thanks to the rich biodiversity and traditional herbal medicine knowledge within local communities. These herbs are not only used for medicinal purposes but also play a key role in producing cosmetics, essential oils, and other value-added products. If properly mapped and developed, the sector could greatly contribute to local livelihoods, food security, and economic growth.

3.1.2 Coffee

Bungoma County boasts a rich variety of medicinal plants, both wild and cultivated, with many local farmers relying on traditional herbal knowledge for treating common ailments. Herbal medicine is an important part of the county's culture and economy. During a technological needs assessment, the KIRDI team visited Mrs. Wanyela of Mumbuzuma Enterprises, a herb business along the Kanduyi-Malaba Highway, to learn about the growing demand for natural herbs locally and internationally.

Cultivation and Harvesting of Natural Herbs

Key Herbs found and used in Bungoma County:

Some of the key herbs that are cultivated or harvested in Bungoma include:

Table 1: Showing some of the key herbs that are cultivated or harvested in Bungoma

Name of plant	Uses
Aloe Vera	Used in cosmetics, skincare, and medicine
Moringa	Known for its nutritional value, used in dietary supplements and health products
Peppermint	Used for teas, medicinal purposes, and essential oils
Chamomile	Used for tea and in medicinal products
Bitter Leaf (*Vernonia amygdalina*)	Used in traditional medicine for various ailments
Eucalyptus	Used for oils, medicinal purposes, and as a natural repellent
Lemongrass	Used in culinary, medicinal, and essential oil production
Turmeric	A key herb used for its anti-inflammatory properties, and for its use in the food industry.

Actors in Natural herbs Value Chain:

Table 2: Showing the key actors in the natural herbs value chain Herbal value chain

Actor	Tasks
Farmers	Provide source of raw materials
Village traders	Sell and advertise products
Retailers	Buying and selling the herbal products
Processors	They process the herbs and prepare them for use
Transporters	Transport raw materials and finished goods
Distributer/Exporters	Link producers with the retailers
Gatherers	Collect the required herb material for processing
Government	The herbal environment does not have stringent Government regulation

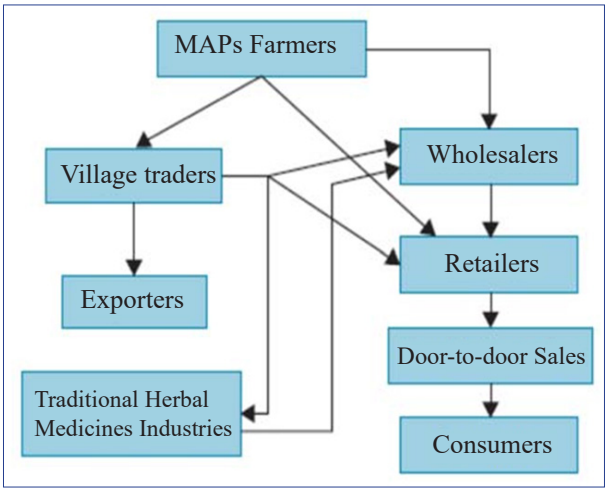

Figure 2: Showing framework for Herbal Value Chain actors

Table 3: Showing Challenges, opportunities, possible interventions and expected outcomes long the Herbal plant value chain.

Challenges/ Opportunities		Interventions	Expected Outcome
• Lack of modern equipment for value addition • Lack of Knowledge and Training • Limited Access to Quality Seeds/Planting Materials • Inconsistent Farming Practices • Pests and Diseases • Lack of drying technology • Lack information on Intellectual Property rights • Lack of/limited branding and marketing strategies including social media	• Lack of modern equipment for value addition • Lack of Knowledge and Training • Limited Access to Quality Seeds/Planting Materials • Inconsistent Farming Practices • Pests and Diseases • Lack of drying technology • Lack information on Intellectual Property rights • Lack of/limited branding and marketing strategies including social media	• Creation of CMFs with modern equipment • Provide • training facilities • Supply quality seeds • training on best methods of farming • supply of approved pesticides • supply of drying equipment • management standards by KEBs • Continuous skills upgrade through Trained herbalists	• Safe production of the herbal products • Quality herbal products • Increased production • Improve herbal plant quality • Environment conservation • Prevention of degradation • Well dried herbs for longer shelf life • Access to international markets

3.1.2 Coffee Value Chain

In Bungoma County, coffee is grown in several areas that benefit from the county's favorable climate and fertile soils. The coffee-growing regions in Bungoma are:

a) Mt. Elgon Region

The slopes of Mt. Elgon, which straddles the border between Kenya and Uganda, offer ideal conditions for coffee cultivation. The rich volcanic soils, combined with a high-altitude climate, provide an excellent environment for growing high-quality Arabica coffee.

b) Bungoma West Sub-County

Areas in Bungoma West, including places like Kanduyi and Mangateni, also have a notable presence of coffee farming. The climate in these parts supports both large and small-scale coffee farmers.

c) Kimilili Sub-County

Kimilili, located to the southeast of Mt. Elgon, is another key area where coffee farming takes place. It is known for having fertile soils and a favorable climate, which supports the cultivation of Arabica coffee.

d) Sirisia Sub-County

Sirisia is also home to coffee farming, with some farms producing high-quality beans, though the region is also known for growing crops like maize and sugarcane.

The coffee value chain in Bungoma County, Kenya, like in other coffee-growing regions of the country, involves several stages from production to the final consumption of coffee. Key stages in the coffee value chain include:

Coffee Farming (Production Stage)

- **Smallholder Farmers:** Coffee in Bungoma is predominantly grown by smallholder farmers in Mt. Elgon. These farmers typically grow Arabica coffee, although some farmers may also grow Robusta.
- **Farming Practices:** Coffee is grown in relatively small plots of land, with family labor playing a significant role in production. Most farmers use traditional farming methods, but there is increasing adoption of better practices for increased yield, including training in good agricultural practices (GAP).

Harvesting and Post-Harvest Handling

- **Harvesting:** Coffee beans are typically harvested once a year, during the main harvesting season, which usually occurs between October and December.
- **Post-Harvest Processing:** After harvesting, coffee beans must be processed. In Chesikaki, coffee is often processed at the farm level using either wet or dry processing methods in the various coffee factories(cooperatives) within Mt. Elgon subcounty:
  - **Wet Processing:** Coffee cherries are pulped to extract the beans, which are then fermented, washed, and dried.
  - **Dry Processing:** Beans are dried with the cherry intact before being hulled.
- **Quality Control:** Ensuring that coffee beans are processed properly is crucial for maintaining the quality of the final product. Many farmers rely on local cooperative societies or washing stations for processing, which can sometimes lead to inconsistent quality due to inadequate processing facilities.

Milling and Grading

- After processing, coffee beans are taken to milling facilities where they are hulled, sorted, and graded based on size and quality. The grading process is important as it determines the price that the coffee will fetch in the market.
- **Milling Plants:** In Bungoma, there are two milling plants located in Chesikaki and Musese that process the coffee from different cooperative societies. These plants are operated by farmer cooperatives.
- **Quality Assurance:** The quality of the coffee is critical, and it is typically classified into grades. Premium grades command higher prices in both domestic and international markets.

Marketing and Sales

- **Cooperative Societies:** Many smallholder coffee farmers in Bungoma are members of cooperative societies, which help in collective marketing of the coffee. These cooperatives often negotiate the sale of coffee to exporters or processors on behalf of their members.
- **Private Companies and Middlemen:** In addition to cooperatives, private companies and local traders also play a role in purchasing coffee beans from farmers. They may offer better prices or quicker payments, but sometimes at the expense of the farmer's long-term sustainability.
- **Domestic and Export Markets:** Coffee from Chesikaki Coffee mill, like other Kenyan coffee, is primarily exported, with major markets including Europe, the United States, and Dubai. However, there is also a growing domestic market for high-quality Kenyan coffee, especially in urban centers.

Export and International Trade

- **Exporting Coffee:** Once coffee is milled and graded at the Chesikaki Coffee Mill, it is exported through the Nairobi Coffee Exchange (NCE), which is the main coffee auction in Kenya. At the auction, buyers from around the world purchase coffee, and it is shipped to various international markets.
- **Exporters and Traders:** There are several exporters and traders who act as intermediaries between farmers and international buyers. These exporters are responsible for ensuring the coffee meets international quality standards and complying with export regulations.

Value Addition (Processing into Coffee Products)

- **Roasting and Packaging:** Coffee can also go through an additional value-added stage where it is roasted and packaged for the retail market. This is done by specialized companies that process green coffee beans into roasted coffee, which is then sold locally or internationally.
- **Local Roasters:** Some local roasters in Kenya, especially in major towns like Bungoma, process coffee into roasted beans or ground coffee, which is sold in cafes or supermarkets.
- **Specialty Coffee:** There is an emerging market for specialty coffee in Kenya, including high-end blends that cater to local and international markets. Farmers are also exploring ways to enter this lucrative market.

Consumption

- **Local Consumption:** Coffee consumption in Kenya is growing, and urban populations are increasingly consuming locally produced coffee. In Mt. Elgon and the larger Bungoma, though coffee consumption is low, recently few local people are seen in coffee cafes, supermarkets and restaurants serving locally sourced coffee.
- **International Demand:** Kenyan coffee, including that from Bungoma County, is renowned for its high quality, particularly its bright acidity, full body and fruity notes, making it in demand in international specialty markets.

Overall, the coffee value chain in Bungoma County has a lot of potential, but it requires improvements in infrastructure, technology, and market access to ensure that farmers can fully benefit from coffee production.

Quality assurance: the process of quality assurance is done by experienced managers through visual inspection. They check for the different processes and their suitability for producing quality coffee. The suitability is assessed on the basis of existing standards like moisture content levels.

Plant layout: Most of the facilities were set up with the front side being used as a dispatch outlet shop and the back yard as the production/processing space.

Waste management: The waste generated was in the form of cascara and coffee dust that was piled and disposed of. The waste generated forms other value chains.

Process optimization: Most of the staff supervising production had been trained through coffee processing before.

Table 4: Challenges, opportunities, possible interventions and expected outcomes along the coffee value chain

Challenges	Opportunities	Interventions	Expected Outcome
• Low Farmer Incomes • Lack of Infrastructure • Climate Change and Pests • Access to Financing: • Lack of quality standards • Lack of value addition of waste • Global pandemics • Lack of organized value addition	• Availability of coffee research centers • Training and Capacity Building • Availability of cooperative to lend finances • Government depts	• Value addition products • Plant better varieties/ invest in new techs • Improved Access to Inputs and Financing • Market diversification through research of better varieties	• Better prices to famers • Increased production • Increased sales • Environment conservation • better production /Jobs creation • Enhanced County revenue streams

- **Coffee producers/farmers:** They are in charge of producing the beans, from them cultivation, care and harvest until they are processed
- **Coffee traders:** They collect the parchment coffee, pool it together and form batches for foreign buyers
- **Importers:** They organize logistics to transport the coffee to the roasting company.
- **Roasters:** Roast coffee, in some cases grind it, and package it for distribution to final customers
-
- **Distribution companies:** Link producers with the retailers
- **Government:** Regulation of activities in coffee subsector

Coffee Value chain Actors in Bungoma County

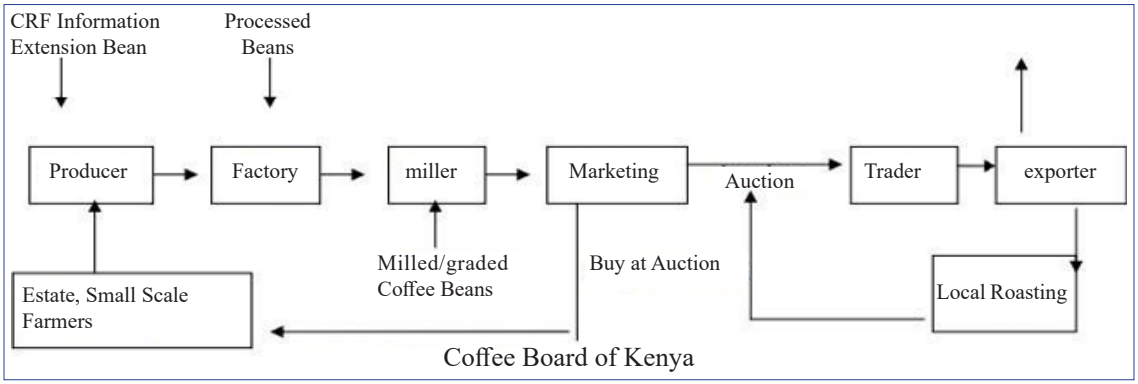

Figure 3: Showing a map a typical coffee mill

3.1.3 Dairy Industry Value chain

Bungoma County has a large number of smallholder dairy farmers, as well as some medium-scale farms, who contribute to both local and regional dairy production. Dairy farming is practiced in several areas of Bungoma County, with notable concentration in the following regions:

i. **Kimilili Sub-county:** Known for its significant dairy farming activities, with many farmers engaging in both small-scale and commercial dairy production.
ii. **Webuye East and Webuye West Sub-counties:** These regions have seen a rise in dairy farming due to the availability of pastureland and access to markets.
iii. **Chwele and Mt. Elgon Sub-counties:** Located in the highland areas, these sub-counties are well-suited for dairy farming, especially for farmers who keep dairy cattle for both milk and beef production.
iv. **Kabuchai Sub-county:** Another key area where dairy farming is practiced, benefiting from both local consumption and regional trade in milk and dairy products.

These areas are characterized by a favorable environment for dairy farming, including good pasturelands and access to dairy markets, both locally and nationally.

Overview of the Dairy Value Chain in Bungoma County
Production (Farm Level)

- **Farmers:** The majority of dairy production in Bungoma County comes from smallholder farmers. These farmers typically own a few dairy cows and produce milk primarily for local consumption or sale.
- **Cattle Breeds:** Dairy farmers often keep indigenous breeds like the East African Zebu, as well as crossbreeds and exotic breeds like Friesian, Ayrshire, and Jersey, which are higher-yielding.
- **Milk Production:** The milk production system is highly dependent on seasonal rainfall, which affects pasture and feed availability. As a result, milk yields can fluctuate, and farmers may struggle to maintain consistent production

Input Suppliers

- **Animal Health and Veterinary Services:** The supply of veterinary services and medicines is essential for maintaining healthy dairy cattle. However, some farmers lack easy access to affordable veterinary care and animal vaccines.
- **Feeds and Supplements:** The availability of quality animal feed, including silage, concentrates, and mineral supplements, is critical. However, many farmers still rely on locally grown feed, which may not be nutritionally balanced.
- **Breeding Services:** Artificial insemination (AI) services are available but may not be accessible to all farmers due to cost or geographic barriers. Some farmers use natural breeding through bulls.
- **Training and Extension Services:** Extension services by government and non-governmental organizations (NGOs) play a role in educating farmers on best practices in dairy farming, but there are gaps in coverage and resources.

Collection and Processing

- **Milk Collection:** Many farmers deliver their milk to local milk collection centers, which may be managed by cooperatives, private buyers, or processors. These centers aggregate milk from multiple farmers and ensure its transportation to processing plants.
- **Processing Plants:** There are several small and medium-sized dairy processors in Bungoma County, and these plants process raw milk into various dairy products, including fresh milk, yogurt, cheese, and butter.

Value Addition

- **Product Diversification:** In recent years, there has been a rise in value-added dairy products such as yogurt, cheese, and butter, which offer higher profit margins than raw milk. Local processors such as Elsie Gakuo of Galsy Investment Limited are exploring new markets for processed dairy products within and without Bungoma county

Marketing and Distribution

- **Local and Regional Markets:** Milk and dairy products are primarily sold within the county and neighboring counties. Milk is distributed through local retailers, supermarkets, and milk kiosks. Some milk is also transported to urban centers like Nairobi.
- **Consumer Demand:** The demand for dairy products is steadily increasing, driven by population growth and a rising middle class. However, competition from other regions and processed dairy products from large-scale processors can affect local market share.

Policy and Support Services

- Government and NGO Support: The county government, in collaboration with national agencies and NGOs, has been providing support to improve the dairy value chain. This includes promoting dairy farming through training programs, facilitating access to credit, and improving veterinary services.
- Cooperatives: Dairy cooperatives play a significant role in enhancing the bargaining power of smallholder farmers, offering training, input supply, and market access. However, the effectiveness of these cooperatives varies across the region.

Table 5: Challenges, opportunities, possible interventions and expected outcomes along the dairy value chain Bungoma County

Challenges	Opportunities	Interventions	Expected Outcome
• lack of knowledge on value addition • Lack of Infrastructure • Inconsistent Milk quality	• Training • Investment in infrastructure centers • Training in milk production	• Value addition products training • Provision of infrastructure at micro level	• Improved production by famers • Better infrastructure and improve dairy products • Consistent good quality milk

• Poor livestock genetics • Veterinary services	• Training in technology development • Training and Capacity Building	• Feeds formulation training • Access to quality livestock genetics • Provision/access to veterinary services	• Improved livestock, improved milk production • Improved and healthy livestock • Enhanced County revenue streams

Dairy Industry Actors

- Input and service providers, - Provide inputs to the dairy chain, such as financing and raw materials
- farmers, - Raise and care for dairy cows to produce quality milk
- transporters, Transport dairy products to industry or consumer points
- dealers,
- dairy farmer cooperative societies, these are collecting and also processing center for farmers
- milk processors, -Process the milk
- marketers, and retailers-sell products to consumers

The value chain has many actors. Each of these players or actors in the value chain carry out various value adding services to the industry in order for the chain to be efficient.

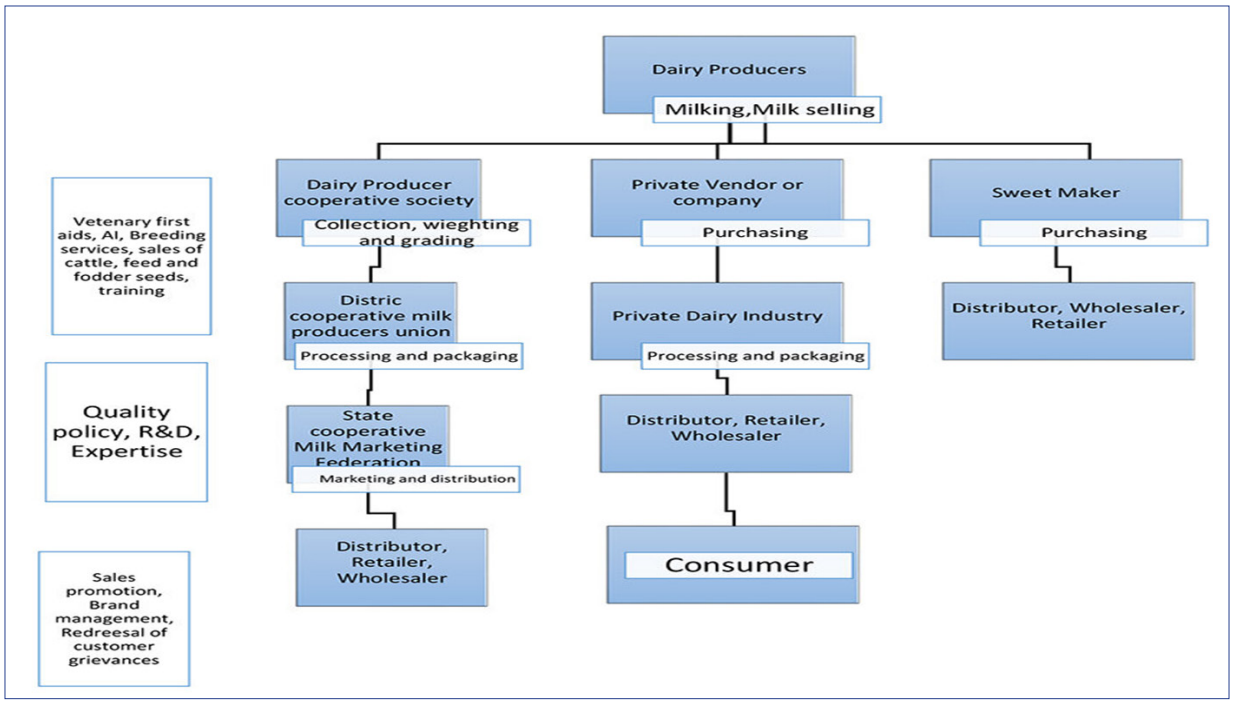

Figure 4: Framework for the Dairy Value Chain

3.1.4 Sunflower value chain in Bungoma County

The sunflower value chain in Bungoma County, Sirisia constituency, holds an important position in boosting the economy of the county in terms of growing of oil plants and processing of edible oil. Sunflower is widely adapted and one of the major oil crops grown in Bungoma county. It is regarded as a high value cash crop and a source of high-quality edible vegetable oil and the county has very suitable soils and climate for sunflower production. During KIRDI teams visit to SMEs in this value chain, farmers attributed the low production to poor agronomic practices, inadequate pest and disease control, lack of high yielding seed varieties, shortage of good quality seeds at planting, low producer prices, shortage of sunflower seed for processing, lack of access to credit, and market information, weak research - extension – farmer linkages and low adoption of developed technologies.

Based on discussions with SMEs, it was observed that an acre of land yields at least 1,000 kilograms of sunflower seeds. Farmers are increasingly opting for sunflower cultivation over maize, recognizing its numerous advantages under similar growing conditions.

Sunflower value chain is naturally inclusive with women and youth participating in farming, processing and distributing edible oil. Therefore, a stable partnership between key actors in the sunflower value chain will continue to attract more youth to participate in the value chain and contribute significantly on improving livelihoods in Bungoma County.

Quality assurance: Kenya has an established standard for processing sunflower edible oil, which should be certified by KEBS. This standard outlines the required properties and ingredients. However, many SMEs involved in sunflower oil processing are either unaware of these regulations or do not

prioritize compliance. Instead, they rely solely on physical inspection after sieving to assess the oil's quality. As a result, the bottled product is used immediately after processing without undergoing further quality checks.

Process optimization – Most of the SMEs who carryout production of edible oil from the sunflower plant have undergone on the job training and apprenticeship from NGOs who supported sunflower cultivation in the county.

The Technology

The process of extracting oil from sunflower seeds involves the use of an oil press machine and sieves. First, the sunflower seeds are shelled and dried to a moisture content of approximately 10%. They are then crushed using an oil screw press machine, and the extracted oil is purified by passing it through a fine cloth sieve to remove impurities.

Utilities: Utilities include electricity and water

Waste and waste management: There is no specific waste management procedure for the leftover sunflower seed cake. However, the cake is dried and repurposed as animal feed, effectively minimizing waste and ensuring its utilization.

Value Chain Actors in the Sunflower Value Chain

Table 6: Showing actors in the Sunflower Value Chain

Actor	What they do
Land owners	Provide raw materials for oil production
Processors	Extract oil from the sunflower seeds
Distributers/Brokers	Distribute sunflower products
Consumers	Purchase sunflower oil and other sunflower products
Transporters	Transport the sunflower products to different markets

Figure 5: Showing sunflower crop oil pressing machinery SMEs use for edible oil production from sunflower

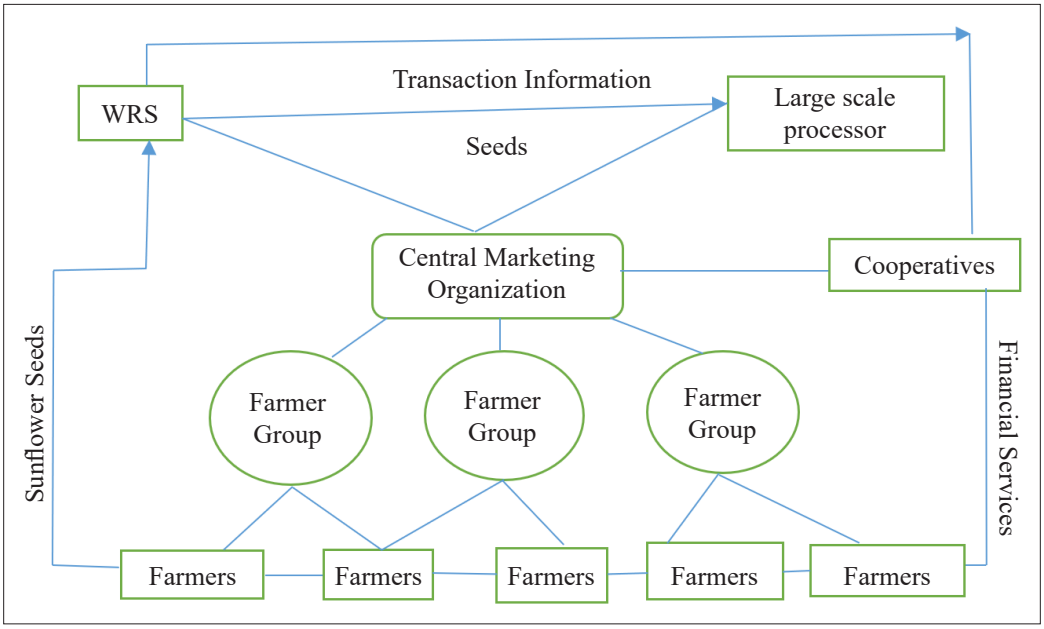

Figure 6: Showing framework for actors in the Sunflower value chain

Table 7: Challenges, opportunities, possible interventions and expected outcomes along the Sunflower value chain

Challenges	Opportunities	Interventions	Expected Outcome
• Limited improved sunflower seeds-Inadequate availability of improved sunflower seeds, recycling of low yield seeds, low productivity. • Limited sunflower seeds for processing- Inadequate sunflower seeds for processing, existing hybrid seed is still expensive, post harvest handling is poor, the use of outdated processing technology • Limited access to finance and crop insurance- limited access to credits for both millers, agro dealers and smallholder farmers, limited availability of crop insurance • Poor Quality Sunflower final products to Compete for Local and International Market- lack of appropriate packaging materials, lack of KEBS certification to most of the processors	• Increased production of improved sunflower seeds • Increased production of sunflower seeds for processing • Improved access to finance and crop insurance • Quality Sunflower final products to Compete for Local and International Market	• research activities by agricultural Research Institute (KALRO) • Improve on soil and technology for seed production • Plant better varieties of seeds • Lessen demand in order to access to finance • Government to provide resources for certification and KEBS mark etc	• Improved production by famers • Better prices • Increased sales • Enhanced County revenue streams • More oil production • More raw material availability, more farmers planting, many SMEs value adding • Access to international markets and more product sales

Technology Needs Assessment

The Technology Needs Assessment (TNA) project adopts a country- or county-driven approach, led by national institutions such as government ministries and agencies. These institutions collaborate with a diverse range of stakeholders to ensure an inclusive and participatory process. By working with regional centers or counties, the project facilitates the implementation of technology action plans, which are further refined through project concept notes. Ultimately, the TNA enhances organizational performance by assessing existing systems, identifying challenges and opportunities, and recommending strategic interventions to drive growth and innovation.

Conclusions

The primary research work undertaken in this study involved conducting a value chain mapping across agro-processing SMEs in Bungoma County, in order to understand each of them as well as the challenges and gaps in each, which will lead to support direct change/ initiatives in their operation. Major gaps included interruptions in power supply affecting the business processes; absence of standard operating procedures to conduct verification and improve efficiency; minimum levels of processing of raw agricultural produce; counterfeits available in the market which compromise product quality and output; and the availability of unsuitable equipment for their work, and outdated technologies which require improvement.

Recommendations

Agro-processing plays a crucial role in transforming raw agricultural products into high-value goods, unlocking economic potential and creating job opportunities across the value chain - from farming to processing, distribution, and marketing. Bungoma County stands to benefit significantly by adopting advanced processing techniques and technologies, which can improve efficiency, reduce waste, and enhance the competitiveness of local products in both domestic and international markets. The team observed the dedication and resilience of SMEs in the County, but a common challenge was the lack of necessary equipment for value addition. To address this, we recommend the establishment of Common Manufacturing Facilities (CMFs) to support micro-groups that cannot independently finance their processing needs. Additionally, to enhance productivity and sustainability in agro-processing, the County should focus on:

- Ensuring a stable and adequate power supply.
- Standardizing operating processes through well-defined SOPs.
- Enhancing value addition to improve product quality and marketability.
- Strengthening quality assurance measures for agricultural inputs.
- Promoting technology adoption through training and the acquisition of efficient equipment.

By implementing these recommendations and fostering a supportive environment for SMEs, Bungoma County can enhance agro-processing activities, leading to increased economic opportunities, improved livelihoods, and sustainable industrial growth.

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References

1. United Nations Industrial Development Organization (UNIDO). Agro-value chain analysis and development: The UNIDO approach. UNIDO Report. 2009.
2. Bungoma County Government. Agricultural and economic profile: Key sectors and emerging opportunities. Bungoma County Development Report. 2025.
3. Bungoma County Government. County profile: Demographics, natural resources, and agricultural development. Bungoma County Development Report. 2025.
4. Bungoma County Government. County Integrated Development Plan III (2023-2027): Accelerating socioeconomic transformation to a more competitive, inclusive, and resilient economy. Bungoma County Government Report. 2023
5. Karuga S. Dairy value chain analysis timau milk shed for micro enterprises support programme trust, Draft Report. 2009.
6. Muriuki HG. Dairy development in Kenya: Food and Agriculture organization of the United Nations, Rome. 2011.
7. FAO. Medicinal plants for conservation and health care, Non-Wood Forest Products No.11, Rome. 1997.
8. Bungoma County Government. Terms of Reference and Tools for Technology Needs Assessment. 2024.
9. Rees D, Njue E, Makini F, Mbugua D. A review of Agricultural practices and constraints in Southwest Kenya. Kitale; Kenya Agricultural Research Institute. 1997. 68-73.
10. County Government of Bungoma - County Integrated Development Plan (CIDP) 2023-2027.
11. Hussain LAS, Inzoli F, Golinucci N, Stevanato N, Rocco MV, et al. FEEM Approach to Supply Chain Analysis the Coffee Sector in Kenya. 2020.