



MINISTRY OF AGRICULTURE
& LIVESTOCK DEVELOPMENT



DAIRY CATTLE

MAKUENI COUNTY DAIRY CATTLE VALUECHAIN DEVELOPMENT STRATEGY

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FOREWORD

Nationally, livestock contributes about 50 percent of Agricultural GDP and over 10 percent of the National GDP. Dairy production is the largest contributor to the livestock GDP. The industry is on an upward trajectory with an estimated growth rate of 3% - 4 % per year. In the County, the CIDP recognizes dairy value chain as one of the main sources of household incomes and a crucial contributor to food security.

Vision 2030 which has been adopted as a new print for Kenya's development, emphasizes the enhancement of dairy productivity as key to increasing incomes, food security and nutrition. The Makueni County Integrated Development Plan also recognizes dairy value chain as one of the main sources of income for the people of Makueni. Through focusing on dairy value chain in livestock development, the county plans to ensure food security for all and to reduce absolute poverty levels from 39.9% to below National average.

The dairy cow population in Makueni County is estimated at 28,388 with estimated total milk production of approximately 27 million litres in the year 2021, and dropped to 22 million in the year 2022 and further dropped to 19.98 million litres in the year 2023 as a result of prolonged drought. This is against an estimated demand of 340 million litres and a current processing capacity of 0.47 million litres per annum. (Makueni livestock data, 2023).

The dairy sector in Makueni County employs about 21-40 percent of the entire population in the county with production being dominated by smallholder farmers who account for 80 percent of the total milk produced (Makueni livestock data, 2023).

On average each dairy farmer owns between one to four animals (MoALF, 2019). The revitalization of the Makueni County dairy sector started with the artificial insemination program funded by the county government in the year 2014. The objective was to produce breeds that are adaptable to the local climatic conditions and genetically high-yielding. The second initiative entailed rolling out a project characterized by massive fodder farming promotion.

Over the last couple of decades, the dairy sub-sector in Makueni county has seen substantive changes with major intensification, scaling-up and efficiency of production driven by demand due to human population growth and increase in disposable incomes. The revitalization of the Makueni County dairy sector started with the artificial insemination program funded by the county government, nutrition, feed efficiency, animal health and welfare, housing, automation, digital transformation, supporting policies and institutional framework, strategies and strong organizations.

In Makueni county, the dairy sector development strategy is aligned with Vision 2030, Medium Term Plan (MTP) IV, Agriculture Sector Transformation and Growth Strategy (ASTGS) and the BETA model that focuses on transforming the livestock sub-sector (including dairy) to a modern commercially-oriented sector through increased productivity and value addition.

However, the industry faces a myriad of challenges that affect productivity, calling for inclusive and collaborative interventions along the value chain actors as a platform

addressing comprehensively the sector's multiple challenges towards sustainable development by funnelling the global dialogue into local practice change, focusing on innovation, capacity building, incentive systems and enabling environments. This initiative if well-articulated, confers positive contribution of dairying to human well-being in a variety of different ways; nutrition through quality food products, income and employment, organic fertilizer as well as assets and savings. Therefore, dairy sector plays important role in lifting poor people out of poverty.

It's envisaged that the strategy will be used to revitalize the dairy sub-sector and guarantee the sustainability of dairying as a major socio and economic activity in Makueni, thereby improving the livelihood of the poor resource based communities and enhancing county dairy sector performance and industrialization in the local and regional market.

I congratulate the authors of this strategy for showcasing the important role of dairy cattle development towards uplifting economic status of Makueni dairy farmers.

CECM

**Department of Agriculture, Livestock, Fisheries and Cooperative Development
Makueni County**

PREFACE

The Ministry of Agriculture and Livestock Development developed a Dairy Master Plan 2010 – 2030, and Kenya Dairy Industry Transformation Strategy & Investment Plan 2022-2032, developed by the Kenya Dairy Board, currently guides the Dairy Industry. Dairy remains the single largest contributor to agricultural GDP of Kenya. The dairy sub-sector contributes about KES 237 billion, 4.5% of the Gross Domestic Product(GDP), approximately 14% and 44% of the Agricultural and Livestock GDP respectively. Kenya is one of the leading Country in Africa in dairy cattle production.

The Kenya constitution 2010 and the Vision 2030 envisages agriculture as a crucial sector that contributes to Kenya's economic development. It envisions raising incomes in agriculture, livestock and fisheries through efficient processing and adding value to her products before they reach the market.

Agriculture and livestock value chains are Makueni County's key economy drivers, putting it at a pivotal position in the continued effort to end hunger, achieve food security and improve nutrition in line with Sustainable Development Goals (SDG number 2- Zero hunger). This, therefore, calls for the agriculture sector to develop suitable strategies that will lead to the achievement of these goals.

The Department of Agriculture, Irrigation, Livestock and Fisheries Development, in collaboration with other departments and stakeholders, has taken the initiative to develop the Makueni Dairy Development Strategy. Over the 5-year implementation period, dairy will strive to become the leading sub-sector in social-economic development through production, value addition and marketing. This will be done by mobilizing and working with all stakeholders and development partners as the county seeks to maximize the utilization of all available opportunities and resources for the benefit of the entire community.

This strategy highlights the status of the dairy subsector, challenges and opportunities that are available, and proposes appropriate interventions for sustainable development of the dairy value chain. It proposes enhanced quality milk production through improved input access, enhanced animal nutrition and health, enhanced value addition, product development and market access. All these will increase household incomes and access to food at the household level.

The strategy targets to supports 9515 households across the 30 wards in Makueni county as well as 13 registered dairy cooperative societies and 16 self-help groups with a membership of over 8,000 an estimated annual turnover of over KES 22 million. Other target beneficiaries will be private dairy industry players and actors. To meet most of the actors aspirations, this Strategy was developed through a consultative process and multi-sectoral team of Panel of Experts (PoE).

The process was supported by the National Agricultural Value Chain Development project (NAVCDP). The PoEs comprised officers drawn from the various Directorates of the Ministry, and experts and practitioners drawn from public institutions, and private sector. The team carried out a diagnostic analysis of the status of the dairy industry in Makueni,

identified gaps in value chain nodes and formulated interventions needed for strengthening the weak value chain nodes while focusing on paradigm shift to transformative actions.

The process involved literature reviews, surveys, data mining and analysis, participatory and consultative engagement with industry stakeholders. This Strategy provides actions that address issues that affect dairy value chain productivity, trade, value addition, consumption, application of smart systems across the value chain and policy for enhanced efficiency and competitiveness. The cutting edge guiding principles in this strategy are inclusion, food safety, climate change, gender, circular economy and private sector participation. The strategy is aligned in principle to the aspirations of Vision 2030, and Sustainable Development Goals (SDGs) and the Makueni CIDP III

This Makueni County Dairy Cattle Value Chain Development Strategy 2024-2028 envisions enterprise that ensures sustainable food and nutrition security and incomes through three strategic objectives: Increase milk production and productivity for dairy farmers; Improve efficiency and capacity in milk value addition process; and, Increase access to structured markets. Further, the strategy gives the intentions and methods that the County government and dairy industry stakeholders will apply to transform the dairy industry as a way of addressing poverty, hunger, unemployment and negative trade imbalance. The strategy has identified the various value chain players along the entire dairy value chain, and the opportunities presented for development.

I wish to express my commitment in effective implementation of this Strategy. I invite all the relevant stakeholders and actors along the dairy value chain to read this document and identify the low hanging fruits and entry points that will guide their involvement and investment in supporting the implementation of the highlighted strategic interventions.

I wish to recognise the contributions and financial support of the National Agricultural Value Chain Development Project (NAVCDP) and the directors in the department of Agriculture, livestock, fisheries and cooperative development of this Makueni Dairy Cattle Development Strategy 2024- 2028.

Chief officer

Department for Agriculture, Livestock, fisheries and cooperative Development.

ACKNOWLEDGEMENTS

The development of this Strategy was made possible through the support of the National Agricultural Value Chain Development project (NAVCDP) I take this opportunity to thank and appreciate the National Coordinators of the two projects (NAVCDP).

This strategy was prepared by a multi-sectoral panel of experts from the public sectors, private sectors, non-governmental organizations, research institutes and institutions of higher learning who actively participated in and contributed to the development of this strategy. The County Executive Committee Member for Makueni County all of whom worked tirelessly to make this strategy a reality.

The County team borrowed heavily from the National Dairy Value Chain Strategy and register our gratitude to the team for providing a rich source of information on the dairy industry.

I am also grateful to the different Government of Kenya institutions, and representatives from the academia, civil society, the private sector, international organizations and development partners for their feedback and inputs during the validation.

Special thanks goes to the team that coordinated the development of the strategy under the leadership of, NAVCDP

It is not possible to mention everyone and every institution individually. Kindly take this acknowledgement as an expression of sincere gratitude. Finally, the contributions by staff and colleagues not specifically mentioned are appreciated.

Director, Livestock Development
Department for Agriculture, Livestock, fisheries and
cooperative Development.
Government of Makueni County

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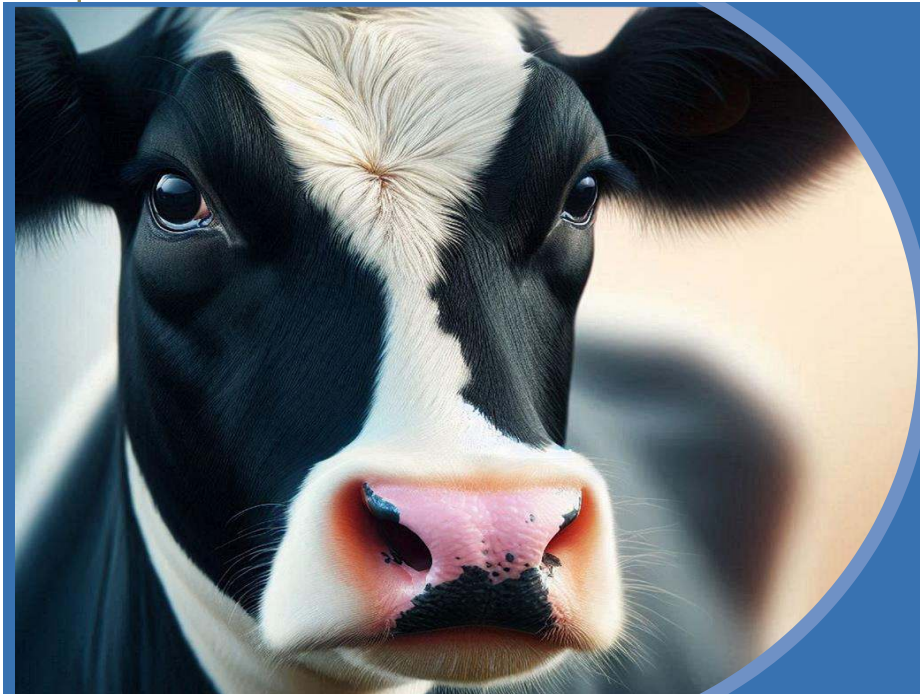
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1

1.0 INTRODUCTION

1.1 Background Information

- The dairy sector** involves the production and processing of animal milk from different species of livestock (cattle, camels, goat and sheep). Compared with other dairy animals, dairy cattle present many advantages in terms of ease of milking, udder size and the animal's ability to store milk, and milk yield. The dairy cattle industry supports over 150 million households globally (FAO, 2021).
- There are over 264 million dairy cows producing over 600 billion litres of milk per year globally. Figure 1 below shows the proportion of human population in different regions compared to proportion of milk produced (FAO, 2021). The Figure demonstrates that Africa, with the 18% of the world population, produces only 6% of dairy cattle milk.

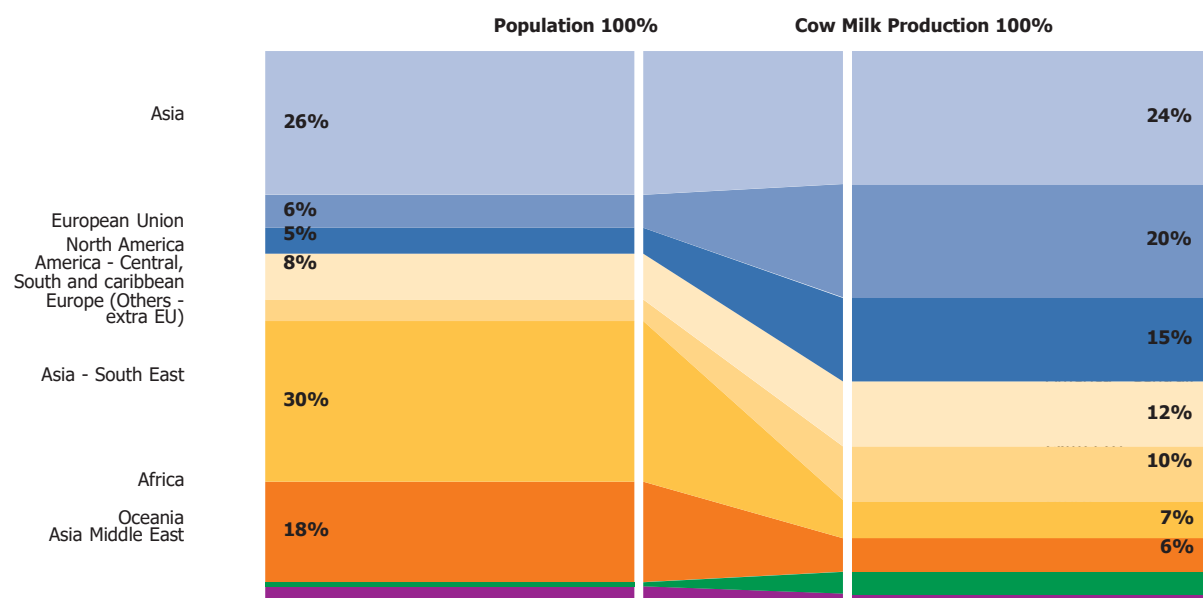


Figure 1: Cow milk production and population

3. With the world human population expected to increase to 10.5 billion, from 7.6 billion by 2067, an increase in demand for dairy products is expected globally. This should be an opportunity for more milk production, especially in regions which are not the main milk producers such as Africa.

Table 1: Dairy cattle milk production (billion litres) of leading countries in different parts of the world.

Position	Country	Year								
		2013	2014	2015	2016	2017	2018	2019	2020	2021
1	India	62.20	66.42	73.65	78.10	83.63	89.83	96.65	108.31	108.30
2	USA	91.28	93.47	94.62	96.37	97.76	98.69	99.08	101.29	102.63
3	China	30.01	31.60	31.80	30.64	30.39	30.75	32.01	34.40	36.83
4	Brazil	35.28	36.18	35.65	34.69	34.31	34.93	35.97	36.51	36.36
5	Germany	31.32	32.40	32.69	32.67	32.60	33.09	33.08	33.17	32.51
6	Russia	30.29	30.51	30.52	29.53	29.92	30.35	31.10	31.96	32.08
7	France	23.75	24.98	25.07	25.63	25.54	25.06	25.06	25.24	24.78
8	Pakistan	17.37	18.03	18.03	18.44	19.14	19.86	20.61	21.38	22.19
9	N.Zealand	19.47	21.32	21.94	21.18	21.46	21.95	21.79	21.87	21.89
10	Turkey	16.66	17.00	16.93	16.79	18.76	20.04	20.78	21.75	21.37

Source: FAOTAT, 2022

4. The dairy cattle milk production in Africa has been approximated at 22,000,000 MT produced from roughly 45 million dairy cows (FAO, 2022). Milk production in Africa is mainly dominated by smallholder farmers.
5. The per capita milk consumption in Africa is only 37 litres per person per year, compared to the world average of 104 liters (FAO, 2011), and the continent is a net importer of milk products. This implies milk production in Africa is very low. This trend is expected to worsen with high human population growth rate and production disruptions attributed to climate change. Table 2 presents the trends on dairy cattle milk production in top ten countries in Africa. It should be noted that, although similar dairy cattle breeds are used to produce milk in other regions of the world and Africa, the milk production in top producing countries in Africa are far much lower than other parts of the world (Table 1). This provides an opportunity for improved milk production in Africa to meet the growing demand. The table (Table 2) demonstrates that Kenya is one of the highest milk producers in Africa.

Table 2: Dairy cattle milk production (billion litres) of top ten producing countries in Africa.

Position	Country	Time								
		2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Kenya	3.69	3.43	3.44	4.12	3.56	3.78	3.98	4.05	4.64
2	Ethiopia	3.50	3.34	3.20	3.13	3.32	3.28	3.90	4.69	3.96
3	South Africa	3.26	3.34	3.54	3.55	3.64	3.75	3.87	3.85	3.84
4	Egypt	2.91	2.55	2.73	2.63	2.96	2.88	3.97	4.28	3.71
5	Tanzania	1.92	1.99	2.06	2.13	2.09	2.40	2.28	3.00	3.10
6	South Sudan	2.60	2.61	2.62	2.62	2.62	2.37	2.42	2.45	3.06
7	Sudan	2.80	2.81	2.86	2.90	2.94	2.97	2.99	3.01	3.00
8	Mozambique	2.02	2.27	2.23	2.15	2.53	2.71	2.75	2.77	2.74
9	Morocco	2.29	2.40	2.45	2.50	2.55	2.55	2.55	2.50	2.50
10	Algeria	3.37	3.55	2.93	2.82	2.67	2.42	2.48	2.42	2.41

Source: FAOTAT, 2022

6. Dairy production is one of the major economic and social activities undertaken by farmers in Makueni County. In 2023 the County produced approximately 20.1 million liters of milk with an average daily production of 54,900 litres from approximately 14,965 lactating cows. The total dairy herd is estimated at 28,388 animals, with most farmers keeping 2 dairy cattle on average. The average milk production per lactating cow per day is estimated at 3.9 liters. Sixty-nine percent of daily milk produced is traded to informal markets while 6% is sold to the formal markets dominated by Brookside Dairies Ltd. Of all the milk produced per day, 34% is consumed daily at home. The estimated annual per capita consumption of milk for the County is 63.0 litres against a national per capita consumption of 110 litres. Per capita milk consumption for Makueni is projected to grow from the current 63.0 Litres to 110 liters. Milk consumption has a positive impact on children, mitigating stunted growth and it provides food security for the county. It is estimated this backdrop, that 3% of total milk produced is fed to calves.

Table 3: Dairy cattle milk production in the six sub-counties of Makueni county

Position	sub county	time					
1.	Sub County	2018	2019	2020	2021	2022	2023
2.	Mbooni	7,696,253	7,342,459	7,773,000	6,995,335	5,596,268	5,036,640.9
3.	Makueni	6,344,305	6,372,158	7,142,000	6,428,894	5,143,116	4,628,804.0
4.	Kibwezi West	4,288,957	4,108,869	4,339,000	4,078,529	3,262,823	2,936,541.1
5.	Kibwezi East	3,794,001	3,641,459	3,864,000	3,477,787	2,782,230	2,504,006.8
6.	Kilome	3,713,168	3,835,412	3,608,000	3,392,493	2,713,994	2,442,594.9
7.	Kaiti	3,300,274	3,444,569	3,562,000	3,384,886	2,707,909	2,437,118.0

	Total	29,136,958	28,744,926	30,288,000	27,757,925	22,206,340	19,987,728.7
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1.2 The dairy sub-sector in Kenya and Makueni

7. The dairy sub-sector in Kenya contributes 4.5% of the Gross Domestic Product (GDP), approximately 14% and 44% of the Agricultural and Livestock GDP respectively (KNBS, 2022). The sub-sector is currently valued at KES 237 billion (SDL, 2022). The County Government of Makueni tapped on the synergy with development partners and through Public-Private-Partnerships (PPP) to enhance the value chain growth. As a result, milk production is currently valued at about Kes1.7 billion from an estimated, 27,757,925 Liters of milk in 2021, which is a 55.7% increase in production from 17,825,481 Liters in 2013(CSA 2022). As a result of prolonged drought milk production declined to 22,206,340 Liters in 2022 and further to 19,987,728.7 Liters in 2023.
8. The Kenyan human population has been estimated at 53.01 million (WorldOMeter, 2021) with per capita consumption of 73 litres (KDB 2023). This implies Kenya has a milk deficit of 550 million litres. This deficit is expected to worsen as the human population is projected to reach 62.54 million by 2027, while per capita milk consumption is projected to grow, from the current 73 litres, to 130 litres over the same period (FAO, 2019), thus creating a demand for 10 billion litres, above the current production of 5.02 billion litres. Without any gains in improved productivity and output, domestic milk supply will fall short of demand by over 4.5 billion litres by 2027 (KDB, 2023) and this is expected to negatively affect the dairy cattle value chain
9. The dairy value chain is ranked highly under the Bottom-up Economic Transformation Agenda (BETA) Government model as one with the highest potential impact in addressing high cost of living, generating revenue, increasing foreign exchange earnings, creating jobs and with inclusive growth. The BETA is aligned with Vision 2030, Medium Term Plan (MTP) IV and Agriculture Sector Transformation and Growth Strategy (ASTGS) that focuses in transforming the livestock sub-sector (including dairy) to a modern commercially oriented sector through increased productivity and value addition.
10. The Makueni County Integrated Development Plan also recognizes dairy value chain as one the main sources of income for the people of Makueni. Through focusing on dairy value chain in livestock development, the county plans to ensure food security for all and to reduce absolute poverty levels from 39.9% to below National average of
11. The population of Dairy Cattle (with crosses) and goats in Makueni County is 28,388 and 14,992 respectively with an estimated 19,871 lactating cattle. The indigenous herd has an approximate population of 95,583. (Makueni Livestock data 2023.)
12. Makueni County has a human population of 987,653 from 244,669 households (KNBS,

2019) with an estimated annual per capita consumption of milk of 63.3 liters way below the national per capita consumption 110 liters from KDB

1.3 Milk Production

1.3.1. Milk Production Trends

- 13.** Figure 2 presents the milk production trends in Kenya for the last seven years. The production trends demonstrate an increase in milk production. The production trends could be attributed to increasing number of dairy cattle (see Figure 3), improved management and breeding. Increasing the number of dairy cattle for improved milk production may not be sustainable due to limited production resources such as land, feed and water.

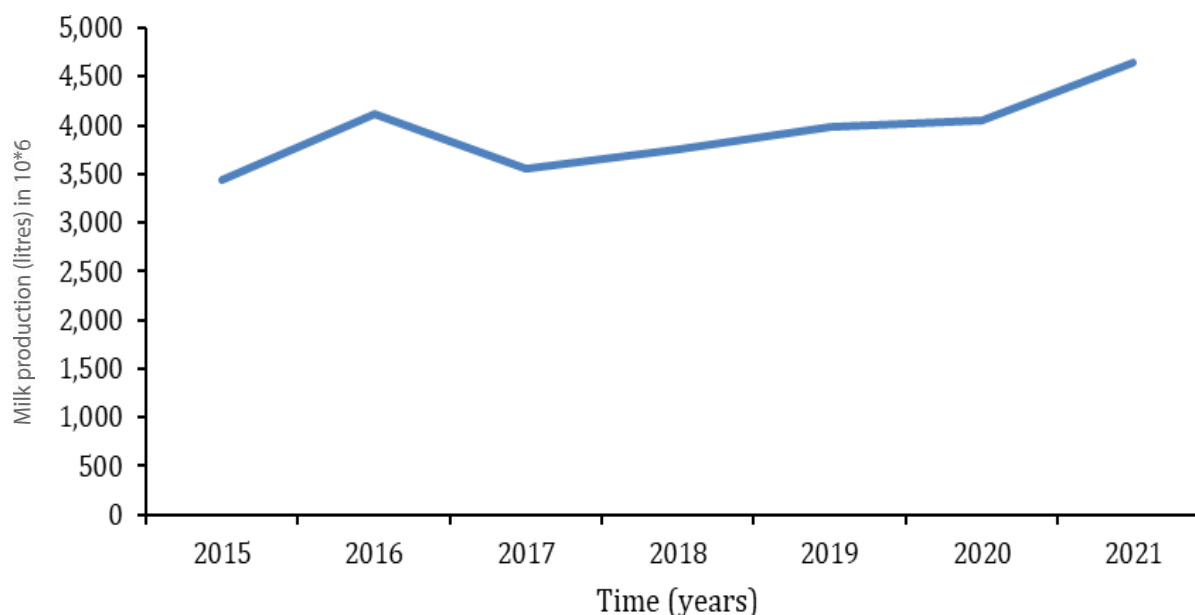


Figure 2: National milk production trend (2015-2021).

Source KDB, 2022

14. There is, therefore, need to increase productivity per cow rather than increasing the number of dairy cattle to meet the expected milk shortage.

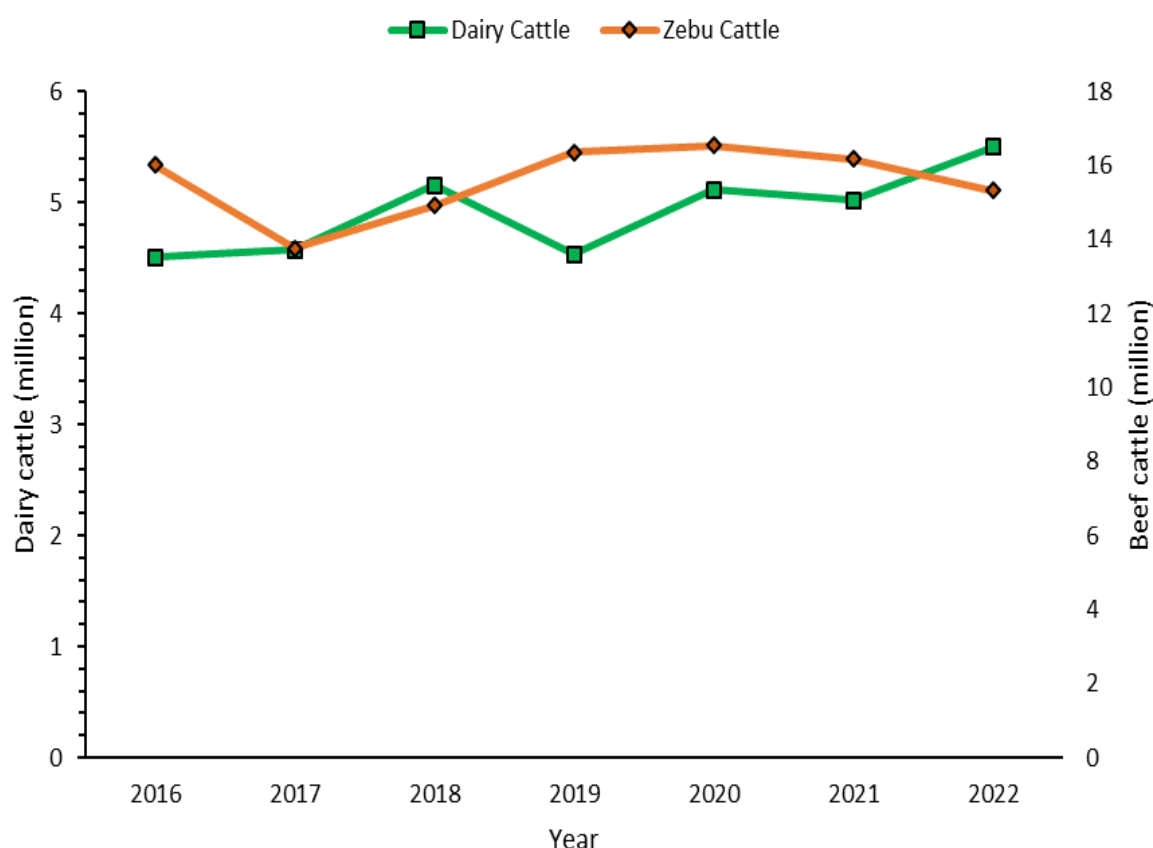


Figure 3: Dairy and beef cattle population trends in Kenya.

15. Milk production trends in Makueni County have shown an initial increase up to 2020 at 30,288,000 and thereafter a decrease to 27,757,925 Liters in 2021. This is as a result of the prolonged drought during which milk production declined further to 22,206,340 Liters in 2022 and 19,987,728.7 Liters in 2023. Dairy production in Makueni County is mainly concentrated in the Upper zones of Mbooni, Kaiti and Kilome Sub Counties. Significant production is also realised in Makueni Subcounty where dairying has been spreading in the drier parts of the county. The areas are also associated with high dairy animal population with more exotic breeds and established value addition and marketing structures. The potential in the drier areas lies in the vastness of the land for pasture production both under rain fed and irrigation systems.

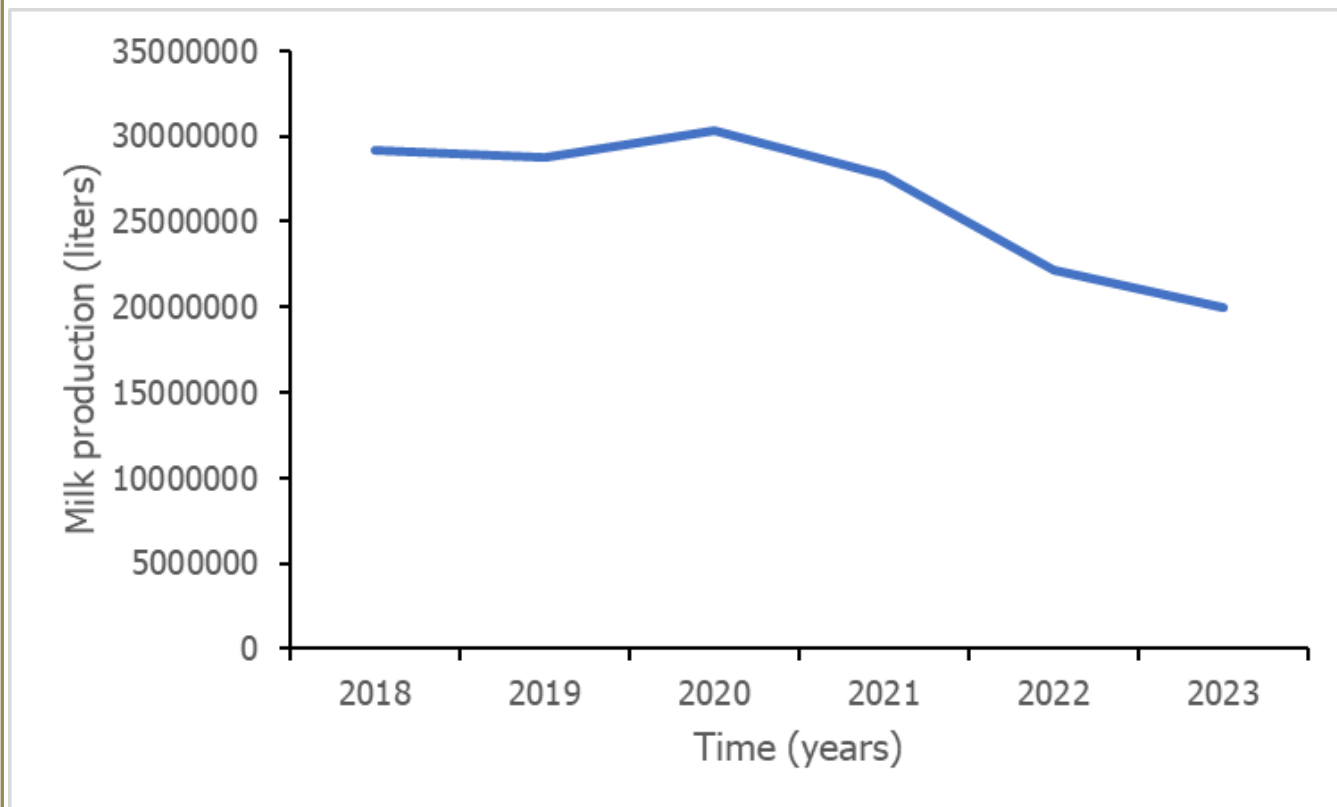


Figure 4: Milk Production trends in Makueni county.

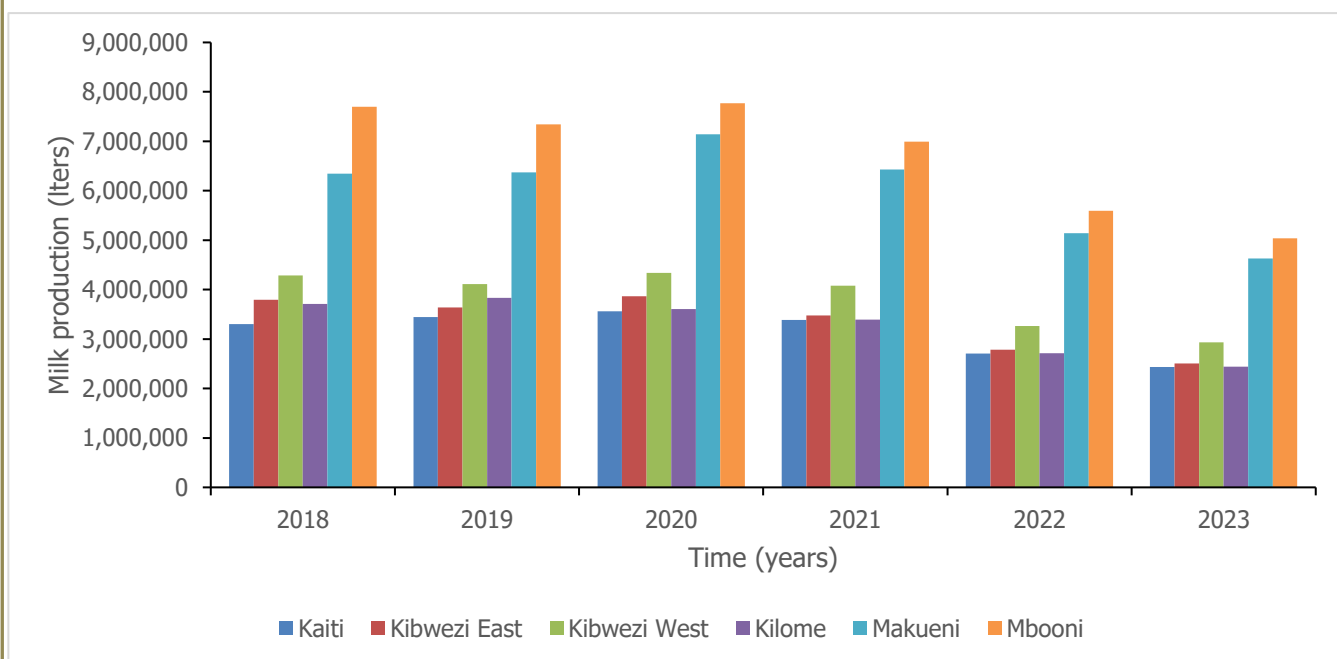


Figure 5: Milk Production trends per sub-county in makueni County.

1.3.2. Dairy Production systems

16. The dairy animals are mainly raised under three main production systems, which include intensive, semi-intensive and extensive systems. They can also be classified as smallholder/pastoral and large-scale systems. The smallholder/pastoral systems own 80% of the dairy animals and produce 70% of the milk. The smallholder systems are operated under subsistence units with herd size of 3-5 cows of exotic and their

crossed, kept under either intensive, semi- intensive or extensive systems. Dairy production systems are based on three common feeding systems for dairy cattle in Makueni: zero-grazing (i.e., stall feeding only), a mix of stall feeding and grazing (referred to as 'semi-zero grazing'), and grazing only, semi-zero, and open grazing systems, respectively. The average number of exotic and improved dairy cows per farmer is 2 (two). The population of dairy animals in Makueni is currently estimated at 28,388 of which 7515 are under zero grazing while 20,873 are reared under semi intensive rearing, the breed composition varies from Friesian, Ayrshire, Guernsey, Jersey and their crosses.

- 17.** On the other hand the pastoral systems raise indigenous cattle and their crosses under open extensive grazing systems. The animals mainly depend on natural pastures, hence move from one place to another during drought period depending on availability of water and pasture especially in the lower Makueni. In this system the livestock provide up to 90% of the human livelihoods (Nyariki and Amwata, 2019). The large scale farms own 20% of the dairy animals in Kenya and produce 30% of the milk. They are more capital intensive and commercial oriented.

1.3.3. Dairy Cattle Breeds and Breeding

18. Kenya has a dairy herd consisting of 5,017,991 dairy cattle comprising 6 dairy breeds and their crosses. The breeds include Friesian (37.3%), Ayrshire (26%), Guernsey (2%), Jersey (2.6%), Sahiwal (1.8%), and exotic crosses (30.3%) (SDL, 2022). The herds are mainly bred through natural and artificial insemination.
19. Makueni County also has various exotic breeds including Friesian and its crosses (55 %), Ayrshire and its crosses (40%), Guernsey and its crosses (3%) and Jersey and its crosses (2%). Natural mating, which is the use of live male animals for reproduction, is dominant method of mating in Makueni accounting for about 89% of total mating. This system is commonly used by the smallholder dairy cattle, goats, and pastoral farmers. The use of Artificial Insemination (AI) in dairy production is dependent on the geographical zone of farmers and production system. The use of AI among dairy farmers in high agricultural potential areas account for 81% of mating (Okello et al., 2021) while it is as low as 20% in ASAL areas(KMT, 2014).
20. Makueni County has had an animal breeding program through Artificial Insemination with 48 registered AI service providers. The average inseminations per month is estimated at 839 with an approximate of 10,068 inseminations per year which is inadequate for the 28,388 cows. The AI services are expensive for the farmers costing between KES 1,200 and 2,500 per insemination, depending on type of semen provided and the distance covered for the service.

1.3.4. Feeds and Feeding

21. In Makueni county, feeds contribute up to 70% of the cost of milk production. Despite its importance to milk production, the Makueni faces major forage deficits estimated at 56%. The total feed requirements were 121,490.3 MT for 2023 and are projected to increase to 171,476.17MT and 221,462.1MT for 2028 and 2033, respectively. In addition, total acreage required for pasture/browse production was 103,544 for 2023 and is projected to increase to 123,961 and 167,079 acres for 2028 and 2033, respectively.
22. The deficit is attributed to inadequate fodder production, low conservation, overgrazing, poor land management practices, and climate change effects. Forage wastage, estimated at 46% of the total annual production, further exacerbates the deficit (FAO, 2021).
23. Animal feeds present an opportunity to drive sustainable animal production systems in Makueni. However, this potential has not been fully exploited due to several challenges, including seasonal feed availability, low quality of feed resources, high cost of ingredients, weak feed policy environment, and inadequate data and information flow among feed industry stakeholders.

Table 4: Current and Projected Feed Resources Requirements for the Dairy Enterprise in Makueni

Summary of Dairy TMR Per Year			2028		2033	
	Feed requirements in MT	Acres require	Feed requirements in MT	Acres require	Feed requirements in MT	Acres required-factor improved production of hay per acre
Hay	60,745.1	47,643.2	75,931	9,628.4	90,392	59,080.2
Silage/Green chop- sugar graze	18,223.5	1,656.7	31,709.9	2,883	45,196.3	4,108.8
Maize grain	9,719.2	10,799.1	21,808.24	14,253.75	33,897.3	33,897.3
Sunflower cake (26% C.P)	14,578.8	52,067.3	21,978.23	14,364.85	29,377.6	104,920.1
cowpea/beans straws	12,149.0	6,074.5	8,334.33	5,447.27	4,519.6	2,259.8
Minerals	6,074.5		8,686.80		11,299.1	
Total	121,490.3	118,240.8	171,476.17	112,075.93	221,462.1	204,835.8

- 24.** Feed concentrates are rich in nutrients, including energy, protein, or both, and are used to supplement a basal forage diet. The cost of concentrates has been rising since 2021, with the price increases attributed to a shortage of raw materials. According to the Association of Kenya Feed Manufacturers (AKEFEMA, personal communication), the price of soya and oil cakes increased by more than 60% in 2021.
- 25.** Water is an important nutrient for dairy animals. The quantity and quality of water affect intake and, hence, productivity. Dry cows need about 30-50 litres of water daily, while lactating cows require between 50-100 litres of water daily. In Makueni, the quality and quantity of water are inadequate for optimal milk production in dairy cattle (SDL, 2021).

1.3.5. Dairy Farm Management

- 26.** Most of the farmers have limited skills in dairy farming practice. Farmers acquire dairy farm management skills from cultural backgrounds, elementary education, government extension, development partners, and agricultural shows. However, limited resources have constrained government-driven extension to facilitate farmers' outreach and capacity development. Further, reliable and efficient animal health services are essential to a vibrant dairy industry.

1.3.6. Milk Bulking and Cooling

27. Milk bulking and cooling is mainly done by the cooperative societies and milk processors. The current installed bulking and cooling capacity is 2.1 millionlitres per day from 700 coolers spread across the country (SDL, 2022).
28. Makueni county has 29 milk coolers with a total capacity of 30,200 litres per day located in the cooperatives and SHGs distributed across the county. The coolers were provided through projects by the county, national government and development partners. There is need for an additional 16 coolers to be placed closer to the farmers at the milk collection centres to help minimize post-harvest losses and enhance milk quality.

1.3.7. Milk Processing Infrastructure

29. There are 40 active milk processors in the country with an installed processing capacity of 4.7 million litres per day, of which 47.5% is utilized (SDL, 2023). Kenya processed an estimated 802 million litres in 2021 (KDB, 2021). This represent 27.5% of the total milk marketed. About 80% is processed by four leading milk processors, including NKCC, Brookside, Githunguri, and Meru Central Dairy (KDB, 2022). The balance is processed by the rest of otherprocessors that include 67 registered mini-dairies and 173 cottage industries (KDB, 2019). The volume of milk processed has been on the increasing trend since 2021 (Figure 4).

Quantity of Processed Milk in Kenya 2001 - 2021 in Million Litres

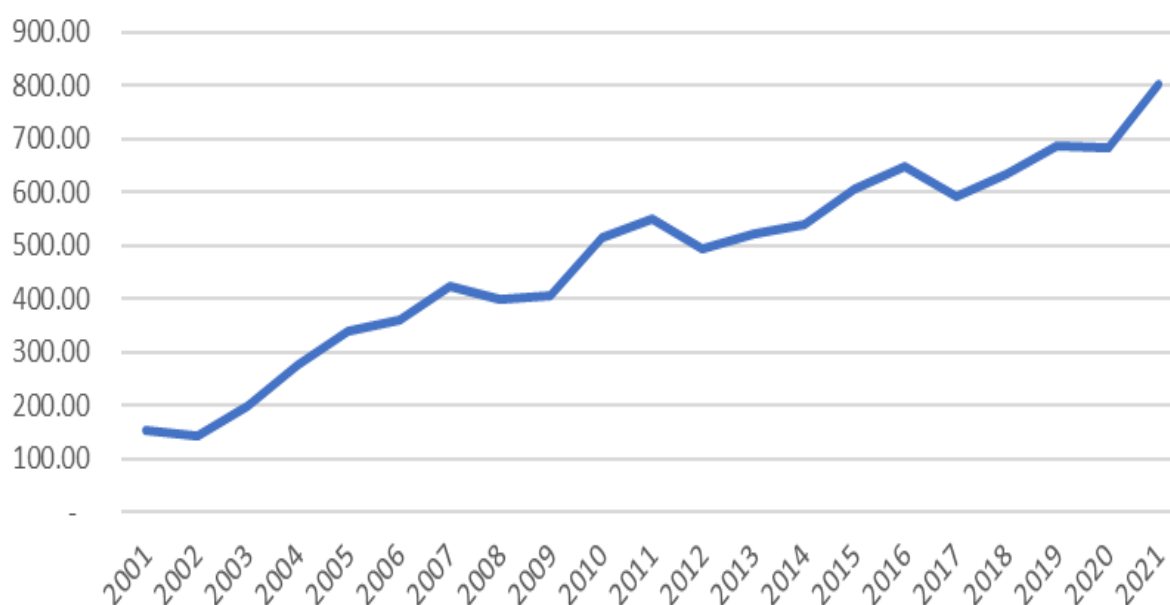


Figure 6: Annual quantity of milk processed in Kenya

About 88% of the milk is processed into liquid milk (long life and fresh milk)while the rest is taken up by other categories, i.e., yoghurt, milk powder,fermented, cultured milk

- 30.** There exists an extensive road network (a few kilometres all-weather) and milk collection routes. However, the 13 cooperatives often face operational and management challenges hindering them from operating at optimal capacity. There are 16 dairy SHG which are mostly amorphous. The 29 available coolers and 7 pasteurizers operate below capacity. The 186 milk traders can be transformed into milk transporters to supply the 7 processors with raw milk and the 1,578 retail outlets with processed milk.

1.3.8. Dairy Exports and Imports

- 31.** Exports of Kenyan dairy products grew steadily from 2007 to 2013, when a sharp decline was occasioned by trade barriers in the export market, fluctuating milk production, and a growing domestic milk demand, which exceeded supply by 2017. By 2019, exported milk accounted for 0.016% of the total processed milk (ITC, 2019) (Figure 6).

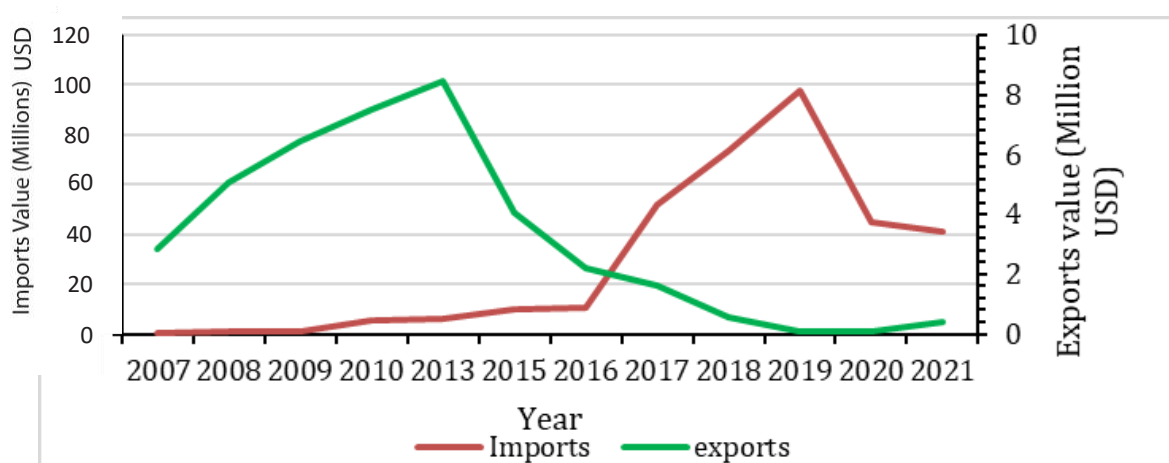


Figure 7: Value of Kenya dairy exports and imports (USD).

Source: International Trade Statistics.

- 32.** Due to the growing demand for domestic milk, Kenya's imports of dairy products have been on the rise since 2016. However, there was a decline in 2020 following the COVID-19 outbreak and government controls on dairy imports to cushion the local dairy industry. Uganda accounts for more than 95% of the total value of imported dairy products to Kenya (ITC, 2019). The milk imports to Kenya have been valued at KES 2.7 billion.

Figure 7 below shows the importation trends for milk products imports in Kenya (KDB, 2023).

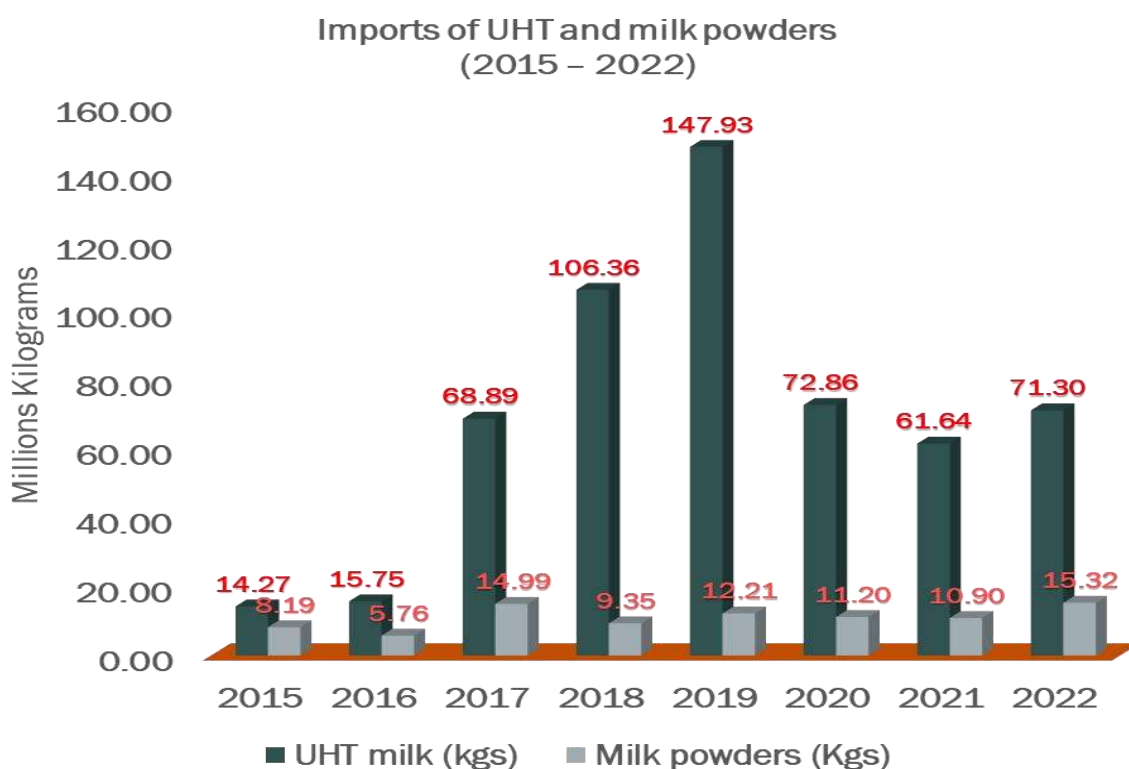


Figure 8: Imports of UHT and powdered milk.

1.3.9. Contribution of the Dairy Value Chain Livelihoods

33. The sector is a source of income particularly to youth, women, and PWDs involved in the value chain. The dairy value chain is the highest single agricultural enterprise contributor to the GDP (4.5%) (KNBS 2022). Livestock production is one of the major economic and social activities undertaken by smallholder farmers in Makueni County. In 2020 the County produced approximately 20.8 million liters of milk with an average daily production of 37,600 litres from approximately 14,965 lactating cows. The total dairy herd is estimated at 28,388 animals, with most farmers keeping 2-3 dairy cattle. The average milk production per lactating cow per day is estimated at 3.9 liters. Sixty-nine percent of daily milk produced is traded to informal markets while 6% is sold to the formal markets dominated by Brookside Dairies Ltd. Of all the milk produced per day, 34% is consumed daily at home.
34. The estimated annual per capita consumption of milk for the County is 63.0 litres against a national per capita consumption of 120 litres. Milk consumption at the household level needs to increase to meet the recommended amount of 220 litres by the World Health Organization (WHO). Milk consumption has a positive impact on children, mitigating stunted growth and it provides food security for the county. It is estimated this backdrop, that 3% of total milk produced is fed to calves.
35. The dairy industry creates direct employment for 13,689 dairy farmers generating revenue of approximately KES 1.9 million per day. The sub-sector also provides income and employment opportunities to animal health practitioners, processors, feed

and drug manufacturing companies and many other sectors such as financial institutions and insurance companies.

- 36.** The Government of Makueni County aims to use cooperatives as a tool to facilitate the commercialization of smallholder farm sector. Currently, most of the running cooperatives are characterized by weak management capacities, inadequate capital base, and low economies of scale. Inadequate milk collections, inadequate preservation facilities, instances of unpaid or delayed payments for farmer milk deliveries have been common, with the resultant negative impact on milk production and marketing. This necessitates a policy shift towards prioritizing farmer requirements, exploitation of external markets and the placement of a premium on efforts to increase dairy productivity and efficiency.
- 37.** The core activities within the milk value chain that directly affect the livelihoods of farmers include the provision of farm inputs, selection of cattle breeds, enhancing access to animal feeds and drugs. Improved business services to small farmers will greatly reduce their transaction costs that are usually large relative to the size of their output. This in turn creates competitive advantage through improved quality of milk and efficiency of the producer-owned groups. The Government of Makueni County intends to address all the above and other challenges within the dairy value chain to increase the incomes of the poor rural households to depend substantially on the production and trade of dairy products for their livelihood in all the sub-counties. This will increase agricultural productivity and incomes of smallholder farmers from agricultural and agribusiness activities in Makueni County.

1.3.10. Dairy Industry Regulatory Framework

- 38.** The dairy regulatory framework consists of various laws relating to quality and food safety, hygiene, environmental health standards, and public health. The laws include the Dairy Industry Act (Cap 336), the Co-operative Development Act (Cap 390), The Companies Act (Cap 486), The Public Health Act (Cap 242), The Standards Act (Cap 496), The Food, Drugs and Chemical Substances Act (Cap 254), State Corporation Act, Legal Notice Number 110, occupational health and safety regulations Act (2007) and the Fertilizers and Animal Foodstuffs Act (Cap. 345). While dairy related regulations have been mainstreamed, regulations governing the feed sector remain a challenge since feed regulations are combined with fertilizer regulations and are enforced by different agencies.

1.3.11. Justification

39. The Strategy focuses on the government of Makueni county aspirations on wealth creation, food and nutrition security and creation of decent employment through transformation of subsistence dairy farming systems into commercially oriented enterprises. This is in line with the aspirations of the government that targets to transform Makueni county into a middle-income economy and prosperous county that offer its citizens with a high quality of life through enhanced incomes, nutrition and food security.
40. The strategy proposes action plans necessary for the transformations needed to further steer dairy development in line with the other national and county development goals. The proposed interventions will be responsive to the emerging challenges in the sector. There is, therefore, need to develop a strategy to address the challenges in the sector which adversely affect livelihoods of the value chain actors.
41. The dairy sector in Makueni County faces many challenges key among them being changing climate, poor quality and unsafe milk, low availability of quality breeding stock, livestock pests and diseases, low milk volumes for processing, poor governance and management of dairy cooperatives and farmer groups, small and fragmented parcels of land that do not favor commercial fodder production, inadequate and poor-quality feed and farm inputs, stringent food safety regulations, environmental concerns. Despite these challenges some opportunities can be exploited. Key among them are premiumization and putting in place policy incentives to maximize marketing, improvement of dairy cattle, processing and value addition, fodder production and conservation, strengthening cooperatives, employment and use of ICT.
42. About 63% of the total area of Makueni county has land suitable for dairy farming. However, the average farm size of dairy farms is low at 5 acres, hindering large-scale commercial dairy farming. Out of the total population of 28, 388 dairy cattle, 14,965 (60%) are lactating producing an average of 37,600 litres per day. Just about 34% of the milk is consumed at home.
43. The dairy sector has contributed to the county's economy through employment creation, providing income opportunities to 13,689 dairy farmers and generating revenue. To enhance these, the strategy has identified 4 pillars to work on, 15 strategic issues to sort and 25 objectives to meet through 38 interventions. The key pillars revolve around building a profitable dairy enterprise through well-fed cattle of quality genetic potential, free from diseases and producing high quantity and quality milk that are value-added and marketed.
44. The county dairy strategy proposes actions and activities that are necessary for the

transformations, policy changes and development strategies required that are in line with Makueni CIDP aspirations. The action plans are proposed in awareness of the existing challenges in the sub-sector.

- 45.** The strategy aims at ensuring development of the dairy value chain in a sustainable way with the active involvement of all the stakeholders from the National government, county governments, development partners, the private sector and the user groups.
- 46.** The main objective of the strategy is to revitalize the dairy sub-sector and guarantee the sustainability of dairying as a major socio-economic activity in Makueni dairy sector, thereby improving the livelihoods of the farmers and stakeholders in the dairy value chain.
- 47.** The strategy will be implemented using the following specific objectives; to increase milk production and productivity for dairy farmers; to improve efficiency and capacity in milk value addition process and to increase market participation and access. Makueni County specifically aims to formulate relevant strategies and programs for the development of the dairy industry, design accurate mechanisms for their implementation, monitoring and evaluation by all stakeholders, introduce and leverage on new technologies, provide the county government with sound justification for more budget allocations for the development of the sector, provide and promote a road map for public-private partnerships to open up private investment in dairy sector, produce clear pragmatic framework and identify tools for implementation of interventions for greater impacts in various components of the dairy value chain and to address various cross-cutting and cross-sectional thematic issues of importance in dairy value chain development in the county.



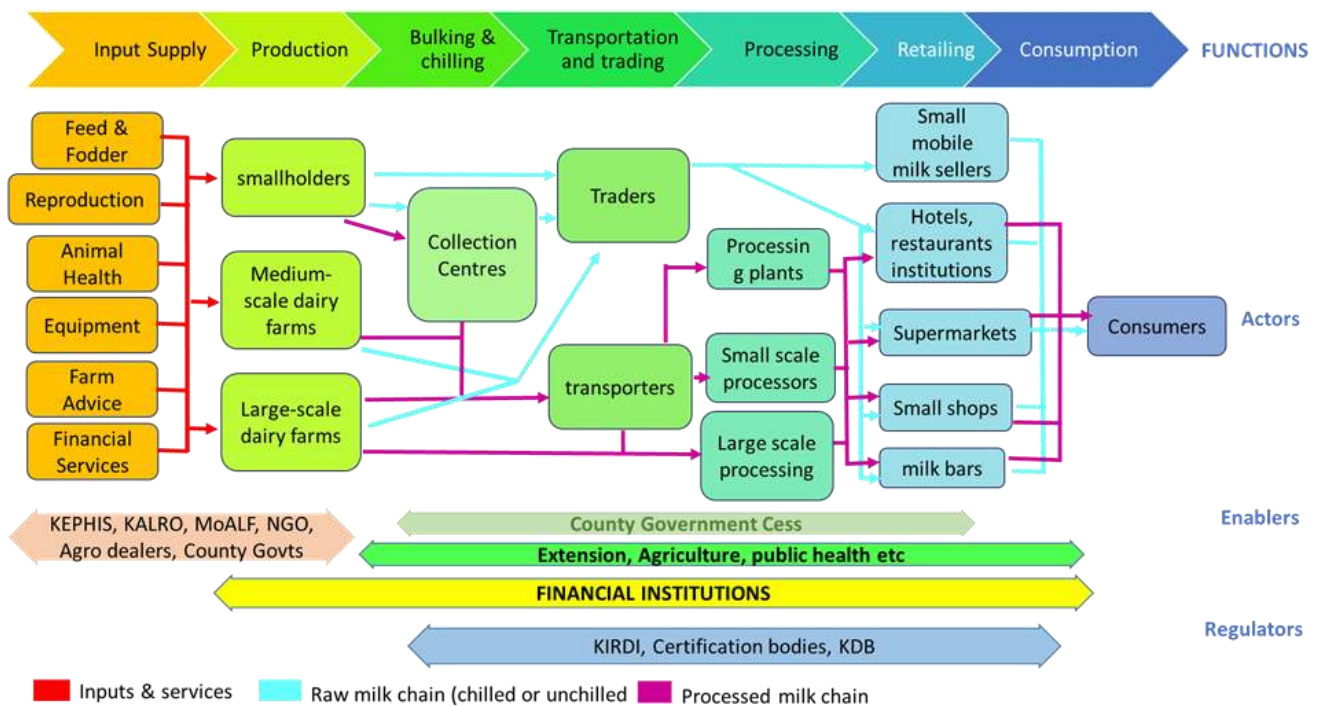
2

2.0 DAIRY VALUE CHAIN ANALYSIS

2.1 The Dairy Value Chain Structure

- 48.** Value chain is a series of sequential activities that add more value to the product at each stage in the process that the product passes through. Figure 9 below depicts the distinct stages in the dairy value chain in Makueni. They play a role in milk production; input and service provision; collection, chilling and bulking; processing; retailing and distribution; and consumption. Input and service providers include public and private sector players. They provide a range of services including feed supply, veterinary and AI services, breeding stock, extension services, testing and regulatory services. Access to these services is crucial for smallholder producers and traders.
- 49.** The dairy value chain links the actors and activities involved in delivering milk and milk products to the final consumer. The dairy cattle value chain functions include: input supply, production, bulking and cooling, transport, processing, packaging and storage, retail, and consumption. The schematic flow shows the formal and informal milk channels. The blue lines demonstrate the formal milk flow, while the green lines show the informal milk flow to the market. The red lines show the movement of inputs and services to the value chain. Of all produced milk in Makueni county, 54% is sold through informal market channels in raw form and 6% through formal milk market. Farmers who produce and sell small quantities of milk prefer the informal marketing channels because it's easily accessible and direct cash payments, and fueled by consumer acceptance of raw milk. The volume of milk processed in the county is very low at 6%. This is as a result of the high consumer demand for raw fresh milk which they obtain at the farm gate. Cooperatives also lack enough pasteurizers at to

pasteurize the milk before being sold to consumers. The main formal small-scale dairy processors in Makueni are Kathonzweni, Makiou, Kaiti, Kikima and Kibwezi DFCS.



2.2 Roles of Value Chain Actors

2.2.1. Inputs and Service Providers

- 50.** Agro-vet dealers (stockists) are the most predominant input suppliers. They provide animal health products, feed supplements, breeding services, information and input support. Agro-vets are managed by animal health service practitioners who offer embedded services in addition to selling products. Various regulators, policy institutions, and development partners also service the industry.

2.2.2. Farmers

- 51.** The dairy farming in Makueni is dominated by smallholder farm. The dairy industry creates direct employment for 13,689 dairy farmers generating revenue of approximately KES 1.9 million per day.

2.2.3. Milk collectors/ transporters

- 52.** Milk collection is by dairy cooperatives, self-help groups, traders, and individual farmers who deliver directly to the market or collection center. The milk is transported using motorbikes, feet, and vehicles. Producer price varies from KES 33 to KES 70 per litre (SDL, 2022) depending on marketing channels, seasons, volumes, and transport mode.

2.2.4. Farmer Producer Organizations

- 53.** Producer organizations (FPOs) include dairy cooperatives, self-help groups, CBOs, and private companies that deal with milk marketing. The FPOs collect milk from the farmers, bulk, cool, and sell it to the formal or informal milkactors. FPOs have coolers with capacities ranging from 50 –3,000 litres.
- 54.** There are 13 registered dairy cooperative societies and 16 self-help groups. The membership is over 8,000 with an estimated annual turnover of over KES 22 million. A significant number of county residents draw their livelihood either directly or indirectly from dairy enterprises. The role of co-operatives includes bulking of produce for economies of scale, value addition, market access and enhanced bargaining power.
- 55.** Cooperatives can be used as vehicles to facilitate the commercialization of smallholder farm sector. But most of the running cooperatives are characterized by weak management capacities, inadequate capital base, and low economies of scale. Inadequate milk collections, inadequate preservation facilities, instances of unpaid or delayed payments for farmer milk deliveries have been common, with the resultant negative impact to milk production and marketing. This necessitates a policy shift towards prioritizing farmer requirements, exploitation of external markets and the placement of a premium on efforts to increase dairy productivity and efficiency.
- 56.** Cooperatives should therefore be revamped to create employment and wealth. They will

promote the use of modern technology and contribute to development through production, procurement, marketing and extension services, sale of consumer goods, mobilization of savings to deepen access to affordable credit facilities. The county seeks to establish an umbrella milk marketing organization to carry the banner of promoting the dairy industry for the county.

2.2.5. Milk traders, processors, and retailers

- 57.** Informal milk traders and retailers include milk bars or kiosks, mobile traders, and milk vendors. Some mobile traders and vendors are seasonal and only active during peak production. While milk bars operate licensed businesses, mobile traders and vendors are not licensed, and their numbers remain uncertain.

2.2.6. Consumers

- 58.** The estimated annual per capita consumption of milk for the County is 63.0 litres against a national per capita consumption of 120 litres. Milk consumption at the household level needs to increase to meet the recommended amount of 220 litres by the World Health Organization (WHO). Milk consumption has a positive impact on children, mitigating stunted growth and it provides food security for the county. It is estimated this backdrop, that 3% of total milk produced is fed to calves.

2.3 Inventory and available resources/facilities

- 59.** There exists an extensive road network (a few kilometres all-weather) and milk collection routes. However, the 13 cooperatives often face operational and management challenges hindering them from operating at optimal capacity. There are 16 dairy SHG which are mostly amorphous. The 29 available coolers and 7 pasteurizers operate below capacity. The 186 milk traders can be transformed into milk transporters to supply the 7 processors with raw milk and the 1,578 retail outlets with processed milk.

Sub-County	No. Of Dairy Cooperatives	No. of Dairy SHG	No. of Coolers in the Locations	No. of Pasteurizers	No. of Processors in the Location	No. of Milk Traders	No. of Shops Retailing Processed Milk	No. of Milk ATM	Kms of Tarmacked/Murramed Dairy Routes	No. of Cottage Businesses
MBOONI	3	3	8	1	1	7	199	1	5	0
MAKUENI	2	6	10	2	3	20	173	5	80	3
KAITI	3	4	7	2	1	17	97	1	11	1
KILOME	3	0	2	1	1	20	85	1	6	5
KIBWEZI WEST	2	2	2	1	1	70	593	2	83	2
KIBWEZI EAST	0	1	0	0	0	52	431	0	0	0
MAKUENI COUNTY	13	16	29	7	7	186	1578	10	185	11

- 60.** A robust dairy infrastructure is needed to support the dairy sector. These include increasing capacities of processing facilities, revitalization of dairy cooperatives, strengthening of dairy self-help groups, installation of coolers, pasteurizers and milk ATMs.

Sub-County	No. Of Dairy Cooperatives	No. of Dairy SHG	No. of Coolers in the Location	No. of Pasteurizers	No. of Processors in the Location	No. of Milk Traders	No. of Shops Retailing Processed Milk	No. of Milk ATM	Kms of Tarmacked/ Murramed Dairy Routes	No. of Cottage Businesses
MBOONI	3	3	8	1	1	7	199	1	5	0
MAKUENI	2	6	10	2	3	20	173	5	80	3
KAITI	3	4	7	2	1	17	97	1	11	1
KILOME	3	0	2	1	1	20	85	1	6	5
KIBWEZI WEST	2	2	2	1	1	70	593	2	83	2
KIBWENZI EAST	0	1	0	0	0	52	431	0	0	0
MAKUENI COUNTY	13	16	29	7	7	186	1578	10	185	11

Table 5: Makueni County Dairy Infrastructure

S / N	milk processing plant	collaborators	capacity	Utilization	Remarks
1	Kathonzwe ni Dairy processing plant	USAID/RTI /ILRI Strathmore university business development Centre. Makueni county Government	1000 ltrs/hr	Not operational	Equipment and Installation not complete
2	Makiou	National	700	In use	2 coolers 3000

	DFCS	government and Makueni county Government	0 ltrs		litr capacity 1 cooler 1000 ltrs capacity
	Kikima DFCS	Makueni county Government	3000 ltrs per hr	Processing plant not in use	Challenges on leadership and governance Non Compliance with statutory requirement

Table 6: Makueni County Dairy current collaborators and partners

The conditions of the units is as follows:

S.No.	Cooperative with cooler	Status
1.	Nguu/Masumba DFCS	Installed but not tested
2.	Kilungu DFCS	3000 ltrs Installed
3.	Kibwezi DFCS	Installed
4.	Kalawa DFCS	Installed

Table 7: Makueni County Dairy cooler condition and installation

- 61.** A robust dairy sector calls for collaboration and public private partnership ,research institutions along its value chain with focus of strengthening of dairy self-help groups, and ensuring all installation of coolers, pasteurizers and milk at ATMs are operating

2.4 Economic Analysis

2.2.7. Current dairy enterprise profit and loss analysis

The current average number of lactating cows per farmer is 2.0 (SDL, 2023). Gross margin analysis shows that milking 2.0 cows is unprofitable and unsustainable This is due to low productivity (8 litres/cow/day) and few milking animals.

Table 8: Gross margin analysis of the dairy enterprise at current status.

Current situation- Farmer keeping 3 cows each producing 5 litres average/day suffers a loss of Ksh 5,800 per month

	QTY	PRICE	NUMBER OF COWS	PERIOD	AMOUNT IN KSH
Sale Of Milk(Kg)	5	60	3	300	270,000.00
Sale Of Manure(kgs)	7	3	3	365	22,995.00
Sale Of Bull Calf	1	3000	2	1	6,000.00
sale of culled cows	0.2	30,000	3	1	18,000.00
Sale Of Heifers	0.3	100000	3	1	90,000.00
					406,995.00
Labour(Persons)	1	10000	0	12	120,000.00
Dairy Meal	2	33	3	365	72,270.00
Mineral Salts	100	0.15	3	365	16,425.00
Hay	1	150	3	365	164,250.00
Silage	0	3	3	365	0.00
Lucern	0	20	3	365	0.00
Ai	2	5000	3	1	30,000.00
Veterinary Cost	1	500	3	12	18,000.00
Vaccination	1	500	3	1	1,500.00
Veterinary Visit	1	500	3	12	18,000.00
Insurance	0	4%	3	1	0.00
Miscellaneous	1	5	3	365	5,475.00
Deworming/	1	200	3	4	2,400.00
Calf Rearing	0.6	120	3	120	25,920.00
Transport	1	2	1	300	600.00
Depreciation	1	2500	1	1	2,500.00
Cow Loan	0	10%	-	0	-
Mgt	0	100,000.00	1	12	-
Farmer Mgt	0	1,000.00	1	12	0.00
					477,340.00
Dairy Stimulus Package	-	10%	-		-
Total Expenditure					477,340.00
Profit/Loss					-70,345.00
Monthly Profit/Loss					-5,862.08

2.2.8. Dairy enterprise break even analysis

Table 9 below demonstrates that a farmer with three cows and milking 60% of the head with productivity of 7 litres per cow per day will be able to break even.

Table 9: Break even analysis of the dairy enterprise

Breakeven : For 3 cows under current management practices a farmer must produce at least 6.5 kg/cow/day					
	QTY	PRICE	NUMBER OF COWS	PERIOD	AMOUNT IN KSH
Sale Of Milk(Kg)	6.5	60	3	300	351,000.00
Sale Of Manure(kgs)	7	3	3	365	22,995.00
Sale Of Bull Calf	1	3000	2	1	6,000.00
sale of culled cows	0.2	30000	3	1	18,000.00
Sale Of Heifers	0.3	100000	3	1	90,000.00
					487,995.00
Labour(Persons)	1	10000	0	12	120,000.00
Dairy Meal	2	33	3	365	72,270.00
Mineral Salts	100	0.15	3	365	16,425.00
Hay	1	150	3	365	164,250.00
Silage	0	3	3	365	-
Lucern	0	20	3	365	-
Ai	2	5000	3	1	30,000.00
Veterinary Cost	1	500	3	12	18,000.00
Vaccination	1	500	3	1	1,500.00
Veterinary Visit	1	500	3	12	18,000.00
Insurance	0	0.04	3	1	-
Miscellaneous	1	5	3	365	5,475.00
Deworming/	1	200	3	4	2,400.00
Calf Rearing	0.6	120	3	120	25,920.00
Transport	1	2	1	300	600.00
Depreciation	1	2500	1	1	2,500.00
Cow Loan	0	0.1	-	0	-
Mgt	0	100000	1	12	-
Farmer Mgt	0	1000	1	12	-
					477,340.00
Dairy Stimulus Package	-	0.1	-		-
Total Expenditure					477,340.00
Profit/Loss					10,655.00
Monthly Profit/Loss					887.92

2.2.9. Commercialization threshold

The projected gross margin analysis demonstrates that farmers make meaningful profits that can improve their livelihoods when they raise three lactating cows and increase productivity per

cow per day to 6.5 liters on average This translates to a profitability level of KES 10,655 per month from the current loss of KES 5862. To achieve the goal of this pillar, there is need for strategic investments on the other pillar on Productivity, Quality, Value addition and Marketing.

Table 10: Gross margin analysis of the envisaged commercial dairy enterprise

	QTY	PRICE	NUMBER OF COWS	PERIOD	AMOUNT IN KSH
Sale Of Milk(Kg)	15	60	10	300	2,700,000.00
Sale Of Manure(Bags)	15	2	20	365	219,000.00
Sale Of Bull Calf	1	3000	6	1	18,000.00
sale of culled cows	1	30,000	3	1	90,000.00
Sale Of Heifers	1	100000	2	1	200,000.00
					3,227,000.00
Labour (Persons)	2	10000	0	12	240,000.00
Dairy Meal	2	33	10	365	240,900.00
Mineral Salts	100	0.15	20	365	109,500.00
Hay	0.5	150	20	365	547,500.00
Silage	13	3	20	365	284,700.00
Lucern	4	20	20	365	584,000.00
Ai	1	5000	10	1	50,000.00
Veterinary Cost	1	500	20	12	120,000.00
Vaccination	1	500	20	1	10,000.00
Veterinary Visit	1	500	20	12	120,000.00
Insurance	100000	4%	20	1	80,000.00
Miscellaneous	1	5	20	365	36,500.00
Deworming/	1	200	20	4	16,000.00
Calf Rearing	1	240	3	120	86,400.00
Transport	1	2	1	300	600.00
Depreciation	1	2500	1	1	2,500.00
Cow Loan	0	10%	-	0	-
Mgt	0	100,000.00	1	12	-
Farmer Mgt	1	1,000.00	1	12	12,000.00
					2,540,600.00
Dairy Stimulus Package	-	10%	-		-
Total Expenditure					2,540,600.00
Profit/Loss					686,400.00
Monthly Profit/Loss					57,200.00

2.2.10. Value share

Value share for different actors in the dairy value chain is presented in Table 6 below. Processors receive the highest value share (52%) while producers (farmers) and retailers receive only 37% and 11%, respectively.

Table 11: Value share for stakeholders in the dairy cattle value chain

Chain actor	Variable costs	Revenue (Selling price)	Gross income	Gross margin	Added value	Value share
	A	B	C=B-A	(C/B) x 100	Revenue – previous actor's revenue	Added value / Retail price X 100
Farmer	56	60	4	6.6 %	56	46%
Processor	60	108	48	48.0%	63	52.5%
Retailer	108	120	12	10.0 %	12	10%



3

3.0 CONSTRAINTS IN DAIRY VALUE CHAIN

3.0 CONSTRAINTS IN DAIRY VALUE CHAIN

- 63.** Although the dairy sector has a robust value chain, the sector faces several challenges along the value chain. The constraints can be categorized along different pillars of the value chain such as production, value addition, quality and marketing.

3.1 Production pillar

3.1.1. Feeds and feeding

(i) Inadequate and low quality fodder

- 64.** Seasonality of feed resources is one of the major constraints to milk production, with an annual feed deficit estimated at 56% (SDL, 2022). The fluctuation is attributed to a combination of factors including erratic rainfall, small farm sizes (limited land for commercial fodder production), climate change, lack of quality pasture/fodder seeds, limited knowledge of fodder establishment and conservation, and limited mechanization and storage facilities for strategic reserves. The feed quality is also affected by contamination with aflatoxin and others, and inappropriate ration formulation and feeding.

(ii) High cost and poor quality feed supplements

- 65.** The high cost of dairy feed supplements further constrains milk production. The main sources of ingredients used in feed include locally produced maize, omena and by-products, which are also used as human food, hence presenting

a food security challenge. Other nutrient sources are imported, including sunflower, soya bean, cottonseed cakes and premixes. However, the availability of these ingredients has been a challenge due to competition in the international market. The shortage of feed materials for concentrate formulation has been estimated at 0.5 million MT (KMT, 2016). Makueni county being an arid and semi-arid area is characterized by scarcity of water quality and quantity.

(iii) Inadequate quality water

66. The quantity of water consumed by an animal depends on several factors such as environmental conditions, weight of the animal, and moisture content of the feed and production status. Total water content of the bodies of adult dairy cattle ranges between 56% and 81% of body weight. Dairy animals need 30-50 litres of water per day when dry and 50-100 litres per day when lactating (Njaruri et al., 2014). Makueni county being an arid and semi-arid area is characterized by scarcity of water quality and quantity.

3.1.2. Animal health management

67. The prevalence of pests and diseases is another constraint to milk production in the country. The main parasites include ticks, tsetse flies and internal parasites. Diseases of major economic importance include East Coast Fever (ECF), Contagious Caprine Pleural Pneumonia (CCPP), Foot and Mouth Disease (FMD), mastitis, and parasitic diseases. These health challenges are attributed to inadequate number of animal health professionals. These diseases cause production losses due to drop in production and drug withdrawal period during treatment. It further leads to economic losses due to drop in production and drug withdrawal period during treatment. Currently there are 11 surgeon vets and 30 animal health technicians including 180 veterinary paraprofessionals working in the county government. However, among the 180 veterinary paraprofessionals, most are working in agro vets and as private practitioners.(DVS, 2022).

3.1.3. Low quality dairy breeds

68. The quality of breeds in Makueni county remains low, with a yield of 5-10 litres/cow/day in high potential areas. On the other hand in low potential areas, the productivity is as low as 3-5 litres/cow/day (SDL, 2021). The main challenges include low uptake of innovative reproductive techniques e.g., AI and inadequate availability of improved adaptable dairy breeds. The breeds can, however, be improved through cross-breeding and enhancing of reproductive technologies such as AI.

3.1.4. Inadequate extension services and low adoption of TIMPs

The dairy industry has various technologies for production, breed improvement, feed and fodder supply, quality control, and processing, among others. However, these technologies and innovations have limited adoption along the value chain

due to low awareness on TIMPs and high costs of inputs. There is need for livestock extension agents to sensitize and train farmers on TIMPs. Currently, the ratio of extension officer to farm household stands at 1:1093 against the recommended ration of 1:400 (Odongo, 2014). There is also need to strengthen linkages between research, extension and other dairy value chain actors to enhance the dissemination and adoption of TIMPs.

3.2 Value Addition Pillar

3.2.1. Poor rural infrastructure and high transport costs

- 69.** Poorly constructed and maintained roads lead to high costs of milk collection and high rates of post-harvest milk loss. This could be more severe during the rainy season. This presents a challenge to farmers marketing milk, The poor road conditions also leads to spillage, hence the missing milk (milk loss). It also leads to spoilage due to long time taken to deliver milk to the coolers. The dairy industry requires that milk should be delivered to the cooling centers or the processing facility within two (2) hours after milking

3.2.2. Underutilization of milk bulking and cooling capacity

- 70.** Although the available milk bulking and cooling capacity is 30,200 litres and 29 coolers, the distributed across various dairy cooperatives. Installation and maintenance of the coolers has been a challenge including low volumes of milk This has resulted to under-utilization of the coolers as only 39% of the installed capacity is utilized.

3.2.3. Under-utilization of milk processing and packaging equipment

- 3.3** The industry faces the challenge of under-utilization of milk processing and packaging equipment. The current installed processing capacity in Makueni is estimated at 46,100 litres per day (department of livestock). The utilized capacity is estimated at 42.5%. The under-utilization could be attributed to either low productivity of milk and concentration of installed capacities mainly in dairy cattle producing zones.

3.4 Quality Pillar

This strategic objective aims to produce high quality raw milk that complies to regional and international quality specifications. This will lead to processing and marketing products that comply to regional and international quality and food safety standards transportation, bulking, processing and marketing. The constraints in this pillar are related to milk composition, microbial load and milk contamination and deterioration.

3.4.1. Low quality of milk

71. Milk quality challenges include high microbial load, aflatoxin, and pathogenic (disease-causing) micro-organisms, veterinary drug residues, and other undesirable chemicals that could be due to malpractices such as preservatives. The contamination and low quality could also be attributed to poor feeding and milk handling practices along the value chain. The contamination and low quality could also be attributed to poor feeding and milk handling practices along the value chain. The milk composition is an important factor of quality, especially when processing value added products. Contamination can further lead to milk loss more so in the formal milk market channel due to rejection
72. The milk quality standards in Kenya for butter fat should be minimum 3.25%, protein 3.3% and somatic cell count less than 3×10^5 CFU/ml (KeBS, 2019). Previous studies have indicated over 43% of the marketed milk has high levels of somatic cell count, microbial count and aflatoxin (Nyakabi et al., 2021). The microbial contamination in milk is higher than the recommended level of less than 2×10^6 CFU/ml and 1.028-1.034 at 20°C, respectively (KeBS, 2019).

3.5 Marketing Pillar

3.5.1. Low access and market participation

73. Weak and inadequate milk marketing groups are the major constraints in market access and participation. Weak governance and financial management systems for cooperatives and milk marketing groups result in misappropriation of resources, none and or late payment of farmers for milk delivered leading to loss of farmer confidence in the groups. Seasonality in milk production results in fluctuating periods of scarcity and excesses and corresponding price fluctuations. These fluctuations discourage farmers. There is need to sensitize and train farmers on TIMPs. As This pillar cuts across the value chain from production, due to competition in the other counties.



4

4.0 DESIGN PRINCIPLES

1. This strategy design was informed by factors such as inclusion, food safety, climate change, gender, circular economy and private sector participation.

4.1 Inclusion

2. The county has a population density of 121 persons per square km compared to the national average of 82 persons per Km². 49.5% of the population were male while 50.5% were female. The county's demographic profile depicts a youthful population comprising of 35% of persons aged below 15 years. This a category that will require economic opportunities some of which can be provided in the dairy value chain.
3. The strategy also recognizes unemployment and that the youth play an important role in the dairy sector as private service providers, especially in the provision of labor.

4.2 Climate Change Mitigation

4. The livestock sector is vulnerable to the impacts of climate change and extreme weather events. Enhanced temperatures and change in precipitation regimes across County have led to reduced productivity of livestock due to reduced feed and water availability.

5. The strategy will put in place mechanisms to ensure mitigation and adaptation of the climate change effects. For example, the pasture and fodder varieties established will be drought-resistant short season varieties to ensure early maturity while the dairy breeds will be drought and disease-resistant ones, which consume less feeds. Dairy farmers will be encouraged to establish bio-gas units for green energy production and utilization.

4.3 Food Safety

6. Milk is a highly nutritious product and also an excellent breeding ground for bacteria and other germs. Milk can be contaminated from many different sources such as livestock feeds, chemicals and antibiotics used on the farm or along the supply chain. Additionally, disease causing organisms that infect the cow or people who handle the milk, and substances deliberately added to milk can also contaminate milk. The strategy ensures that all actors along the dairy cattle value chain will comply to the industry regulations to provide clean milk.

4.4 Circular Economy

7. This is a model of production and consumption, which involves sharing, leasing, re-using, repairing, refurbishing and recycling existing materials to extend the life cycle of products. In addition to milk, dairy cattle produce manure that can lead to greenhouse gas emissions and milk contamination if not well managed. Manure management, through biogas model, would not only provide biogas (green energy) to be used in the farm for lighting or heating water but also slurry that is a good organic fertilizer to be used in pasture, fodder and crop production fields. Figure 9 presents circular economy in the dairy cattle production.

4.5 Private Sector Participation

- 35 |** Department of Agriculture, Livestock, Fisheries and Cooperative Development.



5

5.0 INVESTMENT AREAS

9. This dairy value chain development strategy focuses on three broad investment areas to address the gaps identified during the value chain analysis. The strategic objectives are to:
 - i. Increase milk production and productivity for dairy farmers
 - ii. Improve efficiency and capacity in milk value addition process
 - iii. Increase access to structured markets

5.1 Objective 1: To increase milk production and productivity for dairy farmers

5.1.1. Activity 1: Increase pasture and fodder production

10. To increase pasture and fodder production to meet the dairy cattle demands throughout the year, there is need to enhance large scale fodder production. This strategy intends to achieve this by investing in the following areas.
11. **Establishment of animal feed centers:** Animal feed centers will be in different agro-ecological zones. This should be done through contractual agreements and utilization of under-utilized public land.
12. **Fodder and pasture production:** For this to be achieved, commercial fodder production will be promoted for increased access to quality fodder and pasture. This will be done through identification, clustering, and capacity-building of fodder farmer groups, individual farmers, and fodder companies to establish the targeted fodder acreage on private or under-utilized public land. Focus will be on suitable varieties for different

agro-ecological zones targeting 16,813

acres. Capacity building will focus on business management, fodder establishment and conservation.

13. **Feed conservation:** Large hay barns with a capacity of more than 10,000 bales will be established for strategic fodder storage targeting the dairy cooperatives. The private sector, commercial fodder producers and dairy farmers will be capacity build to make this investment and ensure adoption of on farm feed conservation.
14. **Network of feed storage facilities (barns)** will be constructed in all 6 sub- counties for storage of feed resources and will be linked to the feed centers and coordinated at the county level. The private sector will be encouraged to invest in the establishment of the barns.
15. **Facilitate access to farm machinery:** This investment area aims to avail machinery for large scale fodder production, fodder harvesting and baling. This will be undertaken in a private-public partnership investment ventures. In this arrangement the government will provide agricultural mechanization on contractual basis and link farmers to established ward farmers credit facilities for fodder production. The resulting fodder will be sold to the feed centers.
16. **Develop local water resources:** The availability and quality of water is a major constraint in dairy production. Water sources will be developed to provide quality water to the dairy animals. Facilitate availability of 10,278,000 liters of quality water per day by Identifying existing dairy water needs, existing county dairy water suppliers, external dairy water suppliers and potential county dairy water suppliers
17. **Provide an enabling environment for the feed industry:** This will be done by creating awareness of feed standards, harmonizing county policies and regulations to avoid multiple taxes and levies, and capacity building for extension staff Development of forage production code of practice and its enforcement will be required. Implement the current Makueni county Animal feed strategy 2023 -2033

5.1.2. Activity 2: Increase availability of feed concentrate ingredients

18. The high costs and low quality of feed materials for formulation of feed concentrates in dairy farming negatively affect dairy cattle productivity. The strategy will address this issue by investing in the following areas.
19. **Increase local production of animal feed raw materials:** The feed centers will be sub-contracted and supported to produce raw feed materials for formulation of feed rations. Lucern, sunflower, fodder cow peas and thus targeting to produce 342,600 kg of concentrates daily.
20. **Enable use of GMO raw materials and bio technology products:** This will involve the review of relevant policies to advocate for local production and use of GMO raw

materials.

21. **Establishment of small scale feed milling plants:** The feed centers will be supported to mill, formulate and process concentrates using locally produced feed ingredients.

5.1.3. Activity 3: Increase access to inputs and provision of farm extension services

22. The adoption of TIMPs is dependent on availability of livestock extension agents and access to information. The inadequate number of extension agents and access to information should be addressed through:
23. **Public-Private Partnerships in Extension:** Link farmers to feed millers for sub-contracted production of feed ingredients and extension.
24. **Training for Dairy Farm Hands and farmers:** Animal milk handlers will be trained and simple training guides for milk handlers developed for use by ToTs. This will be done at the Makueni Agricultural Training Centre which offers level 3 artisan course on dairy management.
25. **Use of technology for information dissemination:** This involves utilization of big data and Disruptive Agricultural Technologies (DAT) to improve extension of agricultural information.

5.1.4. Activity 4: Improve quality of the dairy cattle herds

The major strategic issue is uptake of breeding technologies including A.I

The aim of this investment is to develop a genetically productive resilient and healthy dairy herd with high productivity of quality milk; To realize implementation of the strategy, the following investments will be;

- Map and register the AI service providers Provide registered AI providers with monthly set books
- Create linkages between service provider and farmers co-operatives
- Link AI service providers with financial services
- Capacity building for service providers
- Establish and promote AI Service hubs (at cooperatives, milk cooler etc.) to improve access to AI input
- Mobilize AI service providers into association
- Embrace integrated digital technologies for monitoring performance (Create/ Customize/Adopt monitoring and performance evaluation digital platform, To realize implementation of the strategy, the following investments will be undertaken.

26. **Use of Assisted Reproductive Technologies:** This investment will focus on promoting the use of breeding technologies (AI, Heat Synchronization) that enhance breeding of quality animals. The technique involve heat detection, breed and bull selection, and breed innovation (Friesian- Sahiwal cross) among others. This will be accompanied by training of AI providers and linking them to breeding centers/dairy groups.

5.2 Objective 2: To improve efficiency and capacity in milk value addition and processing

5.2.1. Activity 1: Increase milk bulking and cold chain development

To achieve this activity, the following investments will be undertaken:

27. **Enhance milk-cooling capacity in the 6 sub- counties:** The investment is aimed at enhancing utilization of available of cooler capacity. The investment will include rehabilitation of existing coolers which are non- functional and installation of new milk coolers where they don't exist.
28. **Build capacity of cooler operators:** This will involve building the capacity of cooler operators on milk hygiene. In addition, unemployed youth engineers will be identified and re-tooled on cooler management and link them to the collection centres/groups.
29. **Use of renewable power for milk processing:** The investment will support establishment of renewable energy plants such as solar and biogas for milk cooling and processing.

5.2.2. Activity 2: Increase value addition for milk and milk products

30. **Establishment of appropriate infrastructure for processing in areas with low processing capacities:**

Value addition refers to the increase of the value of primary agricultural commodities through a particular production process. It's achieved either through processing, cooling, pasteurization, drying, packaging, extracting or any other process that changes raw agricultural commodity into new product. In dairy the main milk products from value addition include fresh milk, fermented milk, yoghurt, milk shakes, long life milk, extended shelf life, cheese, butter and ghee. The strategy aims at doing value addition to 30% of milk produced through the following interventions

Identify milk products to be produced and value added

Carry out a feasibility study to establish size and products

Carry out market survey and identify competing products. Design marketing brands and identify marketing niche. Develop business model and identify required infrastructure. Identify required

processing machinery. Develop a business plan

Promote value added products and sensitize the population on the nutritive value of value-added products

Organize awareness campaigns and sales promotion. Sensitize the county government to incorporate school milk program in Ward Development fund

support women and youth self-help group to establish cottage enterprises

Carry out a feasibility study to establish size and products. Support identified youth and women groups to develop business plans/proposals. Link them to potential sources of funding. Facilitate purchase of equipment

Strategic intervention 5: Promote consumption of traditional dairy products

Brand and patent the local dairy products. Carry out promotional campaign on the product. Link with Kenya Bureau of Standards (KEBS). Sensitize supermarkets to include a section for traditional dairy products

31. This investment will be realized by increasing the volumes of processed milk to 50% as liquid milk, 25% fermented milk (yoghurt and mala), and the remaining 25% as high valued products. The Farmers Producer Organizations (FPOs)/SMEs in agro-processing will be linked to under-utilized processing facilities. The investment will target to install milk dispensers and link SMEs to established processors in the region for co-packaging and brand development. The investment should support women and youth self-help groups to establish dairy cottage enterprises.

Enhance efficiency in milk collection systems to reduce the cost of aggregation: This investment will focus on improving milk collection systems and quality monitoring procedures. This will cater for the many fragmented smallholder dairy producers with low volumes of milk, which delay milk collection and make it expensive. Strategic milk sheds will be mapped out within the framework of the cooperatives, and design strategic milk collection centers/ points to minimize milk losses and wastage. This activity will be achieved by building capacity of farmers on viable milk transportation models.

32. **Capacity building of milk transporters:** In collaboration with dairy groups, the investment will facilitate identification and training of transport operators serving, or with the opportunity to serve, dairy groups in milk transport and bulking.
33. **Strengthen research and innovation:** The investment will facilitate research and innovation and launch priority digital and data use cases for better decision-making on milk bulking, collection, value addition and processing, e.g., the use of mobile coolers.

5.2.3. Activity 3: Improve technology and enhance compliance with quality standards

34. **Building the capacity of SME processors:** The investment will facilitate capacity building of SME processors on value addition, product development and diversification, milk quality management, Good Manufacturing Practices (GMP), and synergizing with regulatory authorities.

5.3 Objective 3: To increase access to structured output markets

5.3.1. Activity 1: Build capacity of milk marketing groups

35. **Strengthen milk-marketing groups:** This investment area will be realized by establishing/strengthening milk marketing groups and building their capacity in terms of leadership, governance, and business management, among others. In addition, the investment will bridge market information asymmetry between dairy producers and other value chain actors through Kenya Markets Information Systems (KAMIS).
36. **Strengthen producer organizations:** This will focus on federating smaller milk marketing groups into large and more robust apex organizations. This would encourage farmers to sell their milk through cooperatives to processors, hence increasing the milk volumes in the formal sector.

37. **Consumer's awareness campaigns:** The milk regulators (KDB) and processors will promote processed milk consumption. This will enhance market for processed milk and milk products.

5.3.2. Activity 2: Diversification of milk and dairy products

The focus of this investment area is to enhance access to milk and other milk products that would target different market segments. These would be achieved via;

38. **Processing of diverse dairy products:** Processors process high value added products such as extended shelf life milk, yoghurt, butter, cheese, ghee etc, targeting the diverse market.
39. **Training and compliance to sanitary and phytosanitary measures:** With Increased target to regional markets, value chain actors will be trained on food safety and compliance measures to different market segments and regions.

6.0 Target Area and Beneficiaries.

6.1 Target sub -counties and Wards

The strategy targets 28,388 dairy cattle from 9,515 households from all the 30 wards. The farmers belong to one of the 13 dairy cooperatives and 16 self-help groups which will serve as the entry point for the various activities.

Sub County	Ward	HHs In Dairy Production	Exotic cattle Dairy /Crosses
Kaiti	Ilima	397	649
	Kee	264	431
	Kilungu	724	1183
	Ukia	460	752
Kibwezi East	Ivingoni/Nzambani	216	1171
	Masongaleni	110	597
	Mtito Andei	87	472
	Thange	126	683
Kibwezi West	Emali/Mulala	234	747
	Kikumbulyu North	40	128
	Kikumbulyu South	129	412
	Makindu	207	661
	Nguu/Masumba	259	827
	Nguumo	88	281
Kilome	Kasikeu	330	1826
	Kiima Kiu/Kalanzoni	232	1284
	Mukaa	389	2153
Makueni	Kathonzweni	396	1151

Sub County	Ward	HHs In Dairy Production	Exotic cattle Dairy /Crosses
	Kikumini/Muvau	390	1133
	Kitise/Kithuki	77	224
	Mavindini	136	395
	Mbitini	447	1299
Makueni	Nzaui/Kilili/Kalamba	329	956
	Wote/Nziu	430	1249
Mbooni	Kako/Waia	193	494
	Kalawa	575	1472
	Kisau/Kiteta	360	921
	Kithungo/Kitundu	838	2145
	Mbooni	764	1955
	Tulimani	288	737
Total		9,515	28,388

6.2 Number of beneficiaries

The target beneficiaries will be 9515 households involved in dairy production in the county, in addition to the the 13 dairy cooperatives and 16 self-help groups which will serve as the entry point for the various activities. Emphasis will be focused on vulnerable groups such as youth, women and people living with disabilities

IMPLEMENTATION MATRIX

Table 7: Implementation Matrix

Activities		Targets				
OBJECTIVE 1: Increasing milk production and productivity		Year 1	Year 2	Year 3	Year 4	Year 5
Activity 1: Increase pasture and fodder production						
i) Establish animal feed centers	No. of Enterprises	3	3	3	3	3
ii) Fodder and pasture production: Promote commercial fodder production	No. of Enterprises(Hectares)	200	200	200	200	200
iii) Feed conservation: Large hay barns with a capacity of more than 25,000 bales established for strategic fodder storage	No.	4	4	4	4	4
Facilitate access to farm machinery(AMS)	No. of Enterprises	35	35	35	35	35
	Tractors (35)	15	15	5		
	Mowers (35)	15	15	5		
	Balers (35)	15	15	5		
	Chaff cutters (9000)	3000	3000	3000		
	Forage harvester (6)	2	2	2		
	Silage packaging (6)	2	2	2		
Network of feed storage facilities (barns) will be constructed	No. of storage facilities(13)	3	3	3	3	2
	No. of Fodder Enterprises	30	30	30	30	30
Develop water resources for livestock	No. of water reservoirs developed	30	30	30	30	30
Provide an enabling environment for the feed industry	No. of policies and regulations harmonized	2				
	No. of bills reviewed	1				1
	Number of codes developed	1				1
Activity 2: Increase availability of feed concentrate ingredients						

i) Increase local production of animal feed raw materials	Acreage	300	300	300	300	300
ii) Enable use of GMO/biotechnology raw materials	Policy/ Regulation	2				2
iii) Establishment of small scale feed milling plants	No	2	1	1	1	1
Establishment of mineral processing plants	Number of mineral processors supported (10)	-	-	-	-	-
Activity 3: Increase access to inputs and provision of farm extension services						
i) Public-Private Partnerships in Extension	DFAs engaged	13	13	13	13	13
ii) Training for Dairy Farm management (MATC)	No. Trained	30	30	30	30	30
iii) Use of technology for information dissemination	Guides developed	200				
	No. of farmers trained	9,500	9,500	9,500	9,500	9,500
	No. of DFAs trained	13	13	13	13	13
Activity 4: Improve quality of the dairy cattle herds						
i) Establish dairy breeding centers and calf rearing farms	No. of Centres	-	-	-	-	-
ii) Improve production of animal seed (semen and embryos) breeding infrastructure	Cross-breed	-	-	-	-	-
iii) Use of Assisted Reproductive Technologies	No. assigned	-	-	-	-	-
	No. equipped labs	-	-	-	-	-
	No. of counties	-	-	-	-	-
	Nitrogen Plants established		-	-		-
	No. A.I providers trained	48	-			-
OBJECTIVE 2: To improve efficiency and capacity in milk value addition and processing						
		Year 1	Year 2	Year 3	Year 4	Year 5
Activity 1: Increase Milk Bulking and Cold Chain Development						
i) Enhance milk-cooling capacity in the Makueni county	No. of Coolers procured	4	3	3	3	3
ii) Build capacity of cooler operators	No trained	30				
iii) Use of renewable power for milk processing	No. of plants established	6	6	6	6	6

Activity 2: Increase value addition for milk and milk products: Establishment of appropriate infrastructure for processing in areas with low processing capacities

i) Enhance efficiency in milk collection systems to reduce the cost of aggregation in 30 wards	Capacity gap	30				
ii) Capacity building of milk transporters	Groups trained	13	13	13	13	13
iii) Strengthen research and innovation	No. of trained Boda Boda operators	61	60	61	61	61
	No. of Pasteurizers Installed	7	7	6		
	No of milk dispensers installed	5	5	5	5	5
Activity 3: Improve technology and enhance compliance with quality standards						
i) Building the capacity of SME processors	No	13	13	13	13	13
OBJECTIVE 3: To increase access to structured output markets						
		Year 1	Year 2	Year 3	Year 4	Year 5
Activity 1: Build capacity of milk marketing groups: Strengthen milk-marketing groups						
i) Strengthen producer organizations	No	39	39	39	39	39
ii) Consumer's awareness campaigns	No	6	6	6	6	6
Activity 2: Diversification of milk and dairy products						
i) Processing of diverse dairy products	No	4	4	4	4	4
ii) Training and compliance to sanitary and phytosanitary measures	No	4	4	4	4	4

BUDGET SUMMARY

Table 8: Budget Summary

Objective/ Activity		
1	Objective 1: Increasing milk Production and productivity	
1.1	Increase pasture and fodder production	
1.2	Increase local production of animal feed raw materials	
1.3	Increase access to input and service provision of farm extension services	
1.4	Improve the quality of the dairy herd	
2	Objective 2: To improve efficiency and capacity in milk value addition and processing	
2.1	Increase milk bulking and cold chain development	
2.2	Increase processing and value addition for milk and milk products	
2.3	Improve technology and enhance compliance with quality standards	
3	Objective 3: To increase market participation and access	
3.1	Build capacity of milk marketing groups	
GRAND TOTAL		

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ANNEXES

Annex 1: National Baseline and Vision data and projections

			Current Actual 2022	Targets for 2027	GAP ANALYSIS	% Increase
PILLAR	STRATEGIC AREA	DAIRY DEVELOPMENT INDICATORS				
PROFITABILITY	FARMER	Whats the average income per month (Ksh)	321	47173	46852	14596
	FARMER	Average number of dairy cattle per dairy farmer	3	6	3	100
	FARMER	Average number of lactating cows/farmer	1	4	2	167
	FARMER	Average volume of milk produced per dairy farmer (L/day)	11	58	47	433
	FARMER	Average volume of milk for family use(L/day)	1	1	1	67
	FARMER	Average volume of milk sold to neighbours(L/day)	9	50	42	469
	FARMER	Average volume of milk fed to calves(L/day)	1	6	5	433
	FARMER	Average size of a dairy farm (acres)	4	4	0	0
	FARMER	Total number of dairy farmers	1800000	836332	-963668	-54
PRODUCTIVITY	Cow	Total number of cattle	21200346	24662493	3462147	16
	Cow	Number of dairy cattle	5017991	5017991	0	0
	Cow	Number of mature dairy cows	2759895	3512594		0
	Cow	Number of lactating cows	1241953	2107556	865603	70
	Cow	number of dry cows	1517942	1405037	-112905	-7
	Cow	Number of Incalve heifers	677429	451619	-225810	-33
	Cow	Number of Weaners	677429	451619	-225810	-33
	Cow	Number calves <4 months	903238	602159	-301079	-33
	Cow	Mean live body weight of dairy cattle (Kgs)	350	400	50	14
	Cow	Average volume of milk produced per cow (L/day)	8	16	8	100
	Cow	Total annual production (Kgs)	4640864389			0

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		Current Actual 2022	Targets for 2027	GAP ANALYSIS	% Increase
Cow	Total annual milk production from dairy cattle (kgs)	3,248,605,072.30	12,308,128,324.80	9,059,523,252.50	279
Cow	Age at first calving (Months)	36	27	-9	-25
EXTENSION	Number of extension officers		4000	4000	#DIV/0!
EXTENSION	number of AGRICULTURE TRAINING INSTITUTIONS	307	307	0	0
EXTENSION	number of AGRICULTURE TRAINING INSTITUTIONS(Degree)	22	22	0	0
EXTENSION	number of AGRICULTURE TRAINING INSTITUTIONS(Diploma)	134	134	0	0
EXTENSION	number of AGRICULTURE TRAINING INSTITUTIONS(certificate)	151	151	0	0
EXTENSION	Total number of unemployed agriculture graduates			0	#DIV/0!
FEEDS	Annual Feed requirement (DM)	8791520	21978801	13187280	150
FEEDS	Napier/maize/sorghum (fodder/silage) (DM/MT)	2637456	6593640	3956184	150
FEEDS	Napier/maize/sorghum (fodder/silage) (Acrage)	219788	549470	329682	150
FEEDS	Rhodes/Bracharia hay(DM/MT)	2262956	6593640	4330684	191
FEEDS	Rhodes/Bracharia hay(Acrage)	565739	1648410	1082671	191
FEEDS	Legume fodder - Lucerne/Desmodium hay (DM/ MT)	17960	3296820	3287840	18306
FEEDS	Legume fodder - Lucerne/Desmodium hay (Acrage)	8980	1648410	1639430	18256
FEEDS	Maize/sorghum/casava grain (MT/DM)	289982	2197880	2016641	695
FEEDS	Maize/sorghum/casava grain (Acrage)	181239	1373675	1192436	658
FEEDS	Cotton/Sunflower/coconut seed cake (MT/DM)	872000	3296820	2206820	253
FEEDS	Cotton/Sunflower/coconut seed cake (Acrage)	1090000	4121025	3031025	278
FEEDS	Number of feed processors	305	462	157	51
FEEDS	Feed processing capacity per month (MT)	93888	142260	48372	52
FEEDS	Mineral salt (Kgs)	91578336	183156672	91578336	100
FEEDS	Premix (Kgs)	1813251	3077032	1263781	70
FEEDS	Number of Mineral salt processors			0	#DIV/0!
FEEDS	Total Mineral salt processing Capacity			0	#DIV/0!
FEEDS	Kg of Mineral salt required/day	250900	501799	250900	100
FEEDS	Kg of Mineral salt produced/day			0	#DIV/0!
FEEDS	Kg of Mineral salt imported/month			0	#DIV/0!
FEEDS	Volume of water required per cow	44	90	46	106

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			Current Actual 2022	Targets for 2027	GAP ANALYSIS	% Increase
FEEDS	Total volume of water required for dairy sector(in L/day)		219537106	451619190	232082084	106
Breeding	number of AI bulls in use in location		91	286	195	214
Breeding	Number of artificial insemination providers		1361	5430	4069	299
Breeding	Number of insemination per year		1265000	5946319	4681319	370
Breeding	Range of calving interval (Days)		450	400	-50	-11
Breeding	Number of inseminations/conception		2	2	-1	-25
Breeding	Number of dairy breeds		6	6	0	0
Breeding	Number of friesian cows		1871711	1871711	0	0
Breeding	Number of ayrshire cows		1304678	1304678	0	0
Breeding	Number of Guernsey cows		100360	100360	0	0
Breeding	Number of Jersey cows		130468	130468	0	0
Breeding	Number of Sahiwal		90324	90324	0	0
Breeding	Number of exotic X indigenous crosses cows		1520451	1520451	0	0
Breeding	Number of embryo transfers/month		10	20	10	100
Breeding	Number of bull stations		2	3	1	50
Breeding	Number of liquide nitrogen plants		1	4	3	300
Breeding	Number of commercial dairy farms		120	240	120	100
Breeding	Number of commercial calf Nurseries		0	8196	8196	#DIV/0!
Cow	Number of dairy cows registered by KSB		193193	1756297	1563104	809
Cow	Number of cows officially milk recording (DRSK)		1500	1756297	1754797	116986
Cow	Number of dairy cows with Breeding Value Estimates		0	1756297	1756297	#DIV/0!
Cow	Number of Dairy Cattle Breeding Programs		2	3	1	50
ANIMAL HEALTH	Number of Veterinary surgeons		3000	2091	-909	-30
ANIMAL HEALTH	Number of dairy cattle per vet surgeon		1673	2400	727	43
ANIMAL HEALTH	Number of Animal health technicians		4000	8363	4363	109
ANIMAL HEALTH	Number of dairy cattle per AHA		1254	600	-654	-52
ANIMAL HEALTH	Number of veterinary laboratories		8	8	0	0
ANIMAL HEALTH	Number of National Animal Health Insurance Fund (NAHIF)		0	1	1	#DIV/0!
ANIMAL HEALTH	Number of vaccinations per year		20071964	30107946	10035982	50
ANIMAL HEALTH	Total number of public dips		2000	1500	-500	-25
ANIMAL HEALTH	Animal movement route		47	38	-9	-19
ANIMAL HEALTH	Livestock market		47	38	-9	-19

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			Current Actual 2022	Targets for 2027	GAP ANALYSIS		% Increase
QUALITY AND VALUE ADDITION	VALUE	ADDITION	Number of cottage business	124	500	376	303
	VALUE	ADDITION	Volume processed by cottage enterprises per day	31250	500000	468750	1500
	VALUE	ADDITION	Volume of post harvest wastage (Kgs)	194916304	246162566	51246262	26
	VALUE	ADDITION	Number of coolers in the location	2550	10116	7566	297
	VALUE	ADDITION	Total capacity of coolers(in L/day)	7650000	30348810	22698810	297
	VALUE	ADDITION	Number of pasturizers	345	1265	920	267
	VALUE	ADDITION	Volume of milk processed (in L / day)	2068493	15174405	13105912	634
	VALUE	ADDITION	Number of processors	40	60	20	50
	VALUE	ADDITION	Total processing capacity (in L/day) million	4700000	1200000000	1195300000	25432
	VALUE	ADDITION	Total number of dairy products marketed	25	30	5	20
	VALUE	ADDITION	Total processing capacity fresh (in L/day)	1175000	100000000	98825000	8411
	VALUE	ADDITION	Total processing capacity long life (in L/day)	3290000	450000000	446710000	13578
	VALUE	ADDITION	Total processing capacity high value (in L/day)	163000	200000000	199837000	122599
	VALUE	ADDITION	Total processing capacity cheese (in L/day)	25000	50000000	49975000	199900
	VALUE	ADDITION	Total processing capacity powder (in L/day)	800000	200000000	199200000	24900
	VALUE	ADDITION	No of processors using renewable energy	5	60	55	1100
	VALUE	ADDITION	Number of laboratories	9	12	3	33
MARKETING	MARKETING		Total number of households	14053750	15636000	1582250	11
	MARKETING		What is the current human population	56215000	62544000	6329000	11
	MARKETING		Urban Population	14053750	25017600	10963850	78
	MARKETING		Rural Population	42161250	37526400	-4634850	-11
	MARKETING		Per capita consumption (in L/year)	78	130	52	67
	MARKETING		Total volume of milk required (in L/day)	12013068	22275945	10262877	85
	MARKETING		Total volume of raw milk produced (in L/day)	8010259	30348810	22338550	279
	MARKETING		Total volume of milk consumed on dairy farms(in L/day)	1538630	1191486	-347144	-23
	MARKETING		Volume of milk sold to neighbours (in L/day)	1294326	5831465	4537139	351
	MARKETING		Total volume of milk sold by traders(in L/day)	3559396	8747197	5187801	146
	MARKETING		Number of milk traders	3500	2000	-1500	-43
	MARKETING		Volume of milk sold to cooperatives(in L/day)	720000	14578662	13858662	1925
	MARKETING		Number of shops retailing processed milk	45000	67500	22500	50
	MARKETING		Average volume of milk sold per retail shop(in L/ day)	0	14815	14815	4761805
	MARKETING		Number of milk ATM	870	1305	435	50
	MARKETING		Volume of milk sold through ATM	304500	652500	348000	114
	MARKETING		Number of dairy cooperatives	350	800	450	129
MARKETING			Average volume of milk per coperative(in L/day)	2057	18223	16166	786

		Current Actual 2022	Targets for 2027	GAP ANALYSIS	% Increase
MARKETING	Number of dairy Self help group	2000	2500	500	25
MARKETING	Volume of milk sold to processors	2000000	1400	-1998600	-100
MARKETING	Volume of milk exported	14000	1,000,000,000.00	999986000	7142757

Annex 2: Profit and Loss analysis of the dairy enterprise at 2022 baseline

INCOME									
	SALE OF MILK(kg)	8	45	1	300	3240	145800		
	SALE OF MANURE(kg)	15	0.5	2	365	9	5701	3852	321
	SALE OF BULL CALF	1	3000	1	1		2202	321	
	SALE OF HEIFERS	1	60000	0	1		18478	52	
GROSS INCOME	TOTAL REVENUE						172181	0	
EXPENDITURE									
	LABOUR(PERSONS)	1	4000		12		48000	FEED QUANTITY	SALE UNITS
	DAIRY MEAL(KG)(70 KG BAGS)	0	37	1	365		0	0	0
	Dairy MINERAL SALTS(KG)	0.05	140	2	365		5321	38	
	SALT LICKS	0.01	0.014	2	365		0	0	
	HAY(14KG BALES) 400 bales/acre	6	15	2	365		68840	4589	4589
	SILAGE(KG) 30% DM 25,000 kg/acre	5	4	2	365		13834	3459	3459
	Protein legumes (KG) in 18 kg/bale	0	20	2	365		0	0	0
	AI (2 insemination/ conception)	2	1000	1	1		2700		
	VETERINARY COST	1	200	2	12		4998		
	Vaccination	4	50	2	1		417		
	Insurance	60000	0.00	2	1		0		
	Fuel (desiel-petrol)	0	100	1	1		0		
	Machine repair	0	4000	1	1		0		
	PPEs	0	2000	1	1		0		
	STAFF/SUPERVISOR/ SECURITY	0	20	2	365		0		
	Water	44	0.05	2	365		1663		

INCOME						
Vector control	1	30	2	12	760	
Electricity	0	15	1	12	0	
DEWORMING	1	200	2	2	1014	
Calf rearing	2	45	1	120	5543	123
TRANSPORT	0	1	1	300	3240	
DEPRECIATION	0		1	1	0	s
MGT	0	1,000	1	12	0	
TOTAL EXPENDITURE (IN KES)					168330	
PROFIT/LOSS (KES)					3852	
MONTHLY PROFIT/LOSS (KES)					321	
COST PER LITRE (KES)					52	

Annex 3: Gross margin analysis of the dairy enterprise at break even

PARAMETERS	QTY	PRICE(KES)	NUM- BER OF COWS	PERI- OD	VOL- UME OF MILK	AMOUNT IN KES	ANNUAL PROFIT/ LOSS	MONTHLY PROFIT/ LOSS	COST OF PRO- DUCTION PER LITRE
INCOME									
SALE OF MILK (kg)	6.9421	45	2	300	3749	168693			
SALE OF MANURE (kg)	15	0.5	3	365	10	7601	0	0	54
SALE OF BULL CALF	1	3000	1	1		2936	0		
SALE OF HEIFERS	1	60000	0	1		24638	54		
GROSS INCOME TOTAL REVENUE						203868	0		
EXPENDITURE									
LABOUR (PERSONS)	1	4000		12		48000	FEED QUANTITY	SALE UNITS	ACRES OF LAND REQUIRED
DAIRY MEAL (KG)(70 KG BAGS)	0	37	2	365		0	0	0	

MAKUENI COUNTY DAIRY VALUE CHAIN DEVELOPMENT STRATEGY

Dairy MINERAL SALTS (KG)	0.05	140	3	365		7095	51
SALT LICKS	0.01	0.014	3	365		0	0

PARAMETERS	QTY	PRICE(KES)	NUM- BER OF COWS	PERI- OD	VOL- UME OF MILK	AMOUNT IN KES	ANNUAL PROFIT/ LOSS	MONTHLY PROFIT/ LOSS	COST OF PRO- DUCTION PER LITRE
HAY (14KG BALES) 400 bales/acre	6		15	3	365	91786	6119	6119	15
SILAGE (KG) 30% DM 25,000 kg/acre	5		4	3	365	18446	4611	4611	0
Protein legumes (KG) in 18 kg/bale	0		20	3	365	0	0	0	0
AI (2 insemination/ conception)	2	1000	2	1		3600			
VETERINARY COST	1	200	3	12		6664			
Vaccination	4	50	3	1		555			
Insurance	60000	0.00	3	1		0			
Fuel (desiel-petrol)	0	100	1	1		0			
Machine repair	0	4000	1	1		0			
PPEs	0	2000	1	1		0			
STAFF/SUPERVISOR/ SECURITY	0	20	3	365		0			
Water	44	0.05	3	365		2217			
Vector control	1	30	3	12		1014			
Electricity	0	15	1	12		0			
DEWORMING	1	200	3	2		1351			
Calf rearing	2	45	1	120		7391	164		
TRANSPORT	0	1	1	300		3749			
DEPRECIATION	0		1	1		0			
MGT	0	1,000	1	12		0			
TOTAL EXPENDITURE (KES)						203868			
PROFIT/LOSS						0			
MONTHLY PROFIT/LOSS						0			
COST PER LITRE						54			

Annex 4: Gross margin analysis of the dairy enterprise at 2027 vision projections

	PARAMETERS	QTY	PRICE (KES)	NUMBER OF COWS	PERIOD	VOLUME OF MILK	AMOUNT IN KES	ANNUAL PROFIT/LOSS	MONTHLY PROFIT/LOSS	COST OF PRODUCTION PER LITRE
INCOME										
	SALE OF MILK (kg)	16	50	4	300	17280	864000			
	SALE OF MANURE (kg)	15	1	6	365	47	30405	566076	47173	24
	SALE OF BULL CALF	1	4000	2	1		7830	47173		
	SALE OF HEIFERS	1	100,000	1	1		82125	24		
GROSS INCOME	TOTAL REVENUE						984360	0		
EXPENDITURE										
	LABOUR (PERSONS)	1	6000		12		72000	FEED QUANTITY	SALE UNITS	ACRES OF LAND REQUIRED
	DAIRY MEAL (kg)(70 KG BAGS)	3	20	4	300		64800	3240	46	
	Dairy MINERAL SALTS (kg)	0.1	100	4	365		13140	131		
	SALT LICKS	0.0	20	2	365		71	0		
	HAY (14 kg BALES) 400 bales/acre	4.1	7	6	365		58743	8392	8392	21
	SILAGE (kg) 30% DM 25000 kg/acre	5	4	6	365		37946	9486	9486	0
	Protein legumes (kg) in 18 kg/bale	3	11	6	365		61540	5595	5595	19
	AI (2 insemination/ conception)	2	500	4	1		2700			
	VETERINARY COST	1	200	6	12		13328			
	Vaccination	6	50	6	1		1666			
	Insurance	100000	0.02	6	1		11107			
	Fuel (desiel-petrol)	0	100	1	1		0			
	Machine repair	1	3000	1	1		3000			
	PPEs	1	3000	1	1		3000			
	STAFF/SUPERVISOR/ SECURITY	0	20	6	365		0			
	Water	90	0.05	6	365		9122			
	Vector control	2	50	6	12		6757			
	Electricity	50	10	1	12		6000			
	Deworming	1	200	6	2		2703			
	Calf rearing (milk)	2	50	2	90		11087	222		

MAKUENI COUNTY DAIRY VALUE CHAIN DEVELOPMENT STRATEGY

PARAMETERS	QTY	PRICE (KES)	NUMBER PERIOD OF COWS	VOLUME OF MILK	AMOUNT IN KES	ANNUAL PROFIT/LOSS	MONTHLY PROFIT/LOSS	COST OF PRODUCTION PER LITRE
Calf rearing (milk replacer)	2	20	2 90		4435			
Transport	1	1	1 300		8640			
Depreciation	1	8500	1 1		8500			
MGT	1	500	1 12		6000			
TOTAL EXPENDITURE (KES)					418285			
PROFIT/LOSS					566076			
MONTHLY PROFIT/LOSS					47173			
COST PER LITRE					24			

