

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

REPUBLIC OF KENYA



GOVERNMENT OF MAKUENI COUNTY



MANGO

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2024 - 2028

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FOREWORD

Kenya's economy is predominantly dependent on agriculture. The sector contributes approximately 21% to the country's Gross Domestic Product (GDP) and an additional 27% through manufacturing, distribution, and service-related sectors. In addition, the sector is mandated to ensure the country is food secure, to generate incomes and provide employment both directly and indirectly for the population. Sustained agricultural growth is, therefore, critical to uplifting the citizen's standards of living.

The country's long term development strategy, the Kenya Vision 2030, and the Bottom- Up Economic Transformation Agenda (BETA) emphasize the role of agriculture in the economy. The Fourth Medium Term Plan (MTP IV) 2023 - 2027 that implements the Bottom-Up Economic Transformation Agenda (BETA) identifies Agriculture as one of the core pillars of the economy that will bring down the cost of living, eradicate hunger, create jobs and foster inclusive growth.

The Agriculture Sector Transformation and Growth Strategy, ASTGS (2019- 2029), whose overall goal is to revolutionize agriculture from subsistence to an innovative, commercially-oriented, and competitive sector capable of providing Kenyans with employment opportunities and increased incomes. The County Integrated Development Plan (CIDP,2023-2027) roots for a resilient economy for sustainable development and promotes agro-processing for Horticultural produce. In line with the County Agriculture and Livestock policy,2020 Mango is recognized as one of the potential value chain that can create economic growth both at the County and household level. The County has prioritized value chains based on their income potential, dietary diversity, competitiveness and county priorities beyond food production. Similarly, the county has invested in establishment of Makueni Fruit Processing Plant whose objectives are reduced Post-harvest losses, Stabilized prices and Creation of employment.

Given the importance of mango production in the County, the Department has endeavored to develop this comprehensive, practical and all-inclusive Makueni Mango Value Chain Development Strategy, for the period 2024 – 2028, to address the growth and development of the industry. This strategy identifies the main industry constraints and also proposes the interventions to address the same through a multi-faceted approach by the various players in the industry.

I, therefore, urge all actors and stakeholders to play their respective roles for smooth implementation of this strategy.

Joyce Mutua,

County Executive Committee Member,

Department of Agriculture, Livestock, Fisheries and Cooperative Development

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PREFACE

The Agricultural Sector Growth and Transformation Strategy (ASTGS, 2019-2029) was developed to guide the sector towards the envisaged transformation and modernization of agriculture. The ASTGS postulates that food security requires a vibrant, commercial and modern agricultural sector that will support the country's sustainable economic development and the country's commitment to regional and global agenda. The strategy's key focus is to shift from subsistence to commercial agriculture through modernization of on-farm production and input markets, value addition along value chains and creation of meaningful jobs in the sector that target and retain the youth. The ASTGS prioritizes three anchors with nine flagships to drive the 10-year transformation. These include increase in farmer incomes, increase in agricultural output and value addition and, increase in household food resilience.

Mango is one of the most important fruits grown in Makueni and Currently we are leading in production in the country. Within the horticulture sector, mango is the most important fruit in the county in terms of value earned followed by citrus and avocado. We have over 4.311 Million Mango trees covering 19,903 Ha of land and grown by over 70,000 farm families, producing 199,626 MT valued at KES 5.9 Billion, AFA 2024. In addition, the Mango sector engages other actors including the Input suppliers, Service provider's, Traders, Transporters and Processors while also incorporating other players.

The county has put a lot of effort in promoting production and productivity of the mango value chain through provision of certified mango seedlings in the mango growing regions, reviving the farmer producer organization's (13 cooperatives). In addition, the County embarked on creation of Areas of Low Pest Prevalence (ALPP) with an objective of improving the quality of mango so as to access the lucrative export markets i.e. European Union. The County initiative of creating an enabling environment has attracted the mango trader's –Exporters, processors to enter into contract with mango producer's thus providing guarantee for market. The crop is predominantly grown in Makueni, Mbooni and Kaiti sub-counties. There exists great potential for expansion in the following Wards; Mavindini, Kathonzweni, Kitise/Kithuki, Kalawa, Kikumbulyu South, Kikumbulyu North, Nguu Masumba, Nguumo, Thange, Masongaleni, Ivingoni/Nzambani, Mtito Andei and Kasikeu. Alongside, there are initiatives to rejuvenate the old orchards and diversification of mango varieties by introducing late maturing ones.

However, mango production and productivity continue to face various constraints. These include input supply constraints, low production of mangoes and low productivity, adverse effects of climate change, pests and diseases, limited access to financial services, limited access to global good agricultural practices, limited processing capacities, seasonality of processable mango supply, and limited awareness of mango value-added products by

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industry players. Other constraints include low demand for mango value-added products, competition from cheaper mango puree from India, poorly organized or un-coordinated marketing system, and a lack of supportive policy and regulatory framework among others.

In response to these constraints, this Mango Value Chain Development Strategy, 2024-2028, envisions a transformed mango industry that is vibrant and commercially-oriented, contributing to economic empowerment and sustainable food and nutrition security through the following four strategic objectives: to increase mango production and productivity in the county by 30%, to increase access to profitable output markets for mangoes, to increase processing and value addition efficiency in the County and to create an enabling environment for the mango value chain actors.

Therefore, the strategy has identified key constraints in the industry as: inadequate access to clean planting material; high cost of agro-chemicals, low production and productivity associated with limited technologies; and inadequate market infrastructure for post-harvest fruit handling which in turn limits market access. Main interventions proposed in the strategy include increasing production and productivity of mangoes, improving market access, enhancing processing and improving the regulatory environment of the mango sub-sector in Kenya. To promote export trade, the key investment areas include growing more export mango varieties, development of temperature- controlled storage/aggregation, and cold chain solutions in addition to supply of aggregation and packaging solutions to streamline production processes and increase the competitive edge of the Kenyan mango sub-sector. Additionally, processing of mangoes by SMEs for local and export market in addition to commercial fruit processors is expected to contribute to the growth of the sub-sector. Further, the strategy has identified the various value chain players along the value chain, and the available opportunities which if utilized will go a long way towards development of the industry.

Dr. Victoria Kyalo

Chief Officer –

Agriculture

Department of Agriculture, Livestock, Fisheries and Cooperative Development

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ACKNOWLEDGEMENT

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 NAVCD project for the support and commitment availed during the development of this strategy that enabled the seamless completion of the document.

Special gratitude goes to the leadership of the Department, under the County Executive Committee Member, Department of Agriculture, Livestock, Fisheries and Cooperative Development, The Chief Officer, Department of Agriculture, Livestock, Fisheries and Cooperative Development for their support and guidance in the development of this strategy.

This strategy was developed through the concerted efforts of the technical experts from the Public Sector, Private Sector, Non-Governmental Organizations, Research Institutes and Industry Regulators. Special thanks go to the Mango Value Chain Strategy Development team that coordinated the development of the strategy.

It is not possible to mention everyone and every institution individually. However, kindly take this acknowledgement as an expression of our sincere gratitude. For our staff and colleagues who took part in this process, your contributions are highly appreciated.

Mary Muteti
County Director of Agriculture,
Department of Agriculture, Livestock, Fisheries and Cooperative Development

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ABBREVIATIONS AND ACRONYMS

AFA	Agriculture and Food Authority
BETA	Bottom-up Economic Transformation Agenda
B2B	Business to Business Linkages
CRA	Climate Resilience Agriculture
EU	European Union
FPOs	Farmer Producer Organizations
FSRP	Food Systems Resilience Project
FPEAK	Fresh Produce Exporters Association of Kenya
GAP	Good Agricultural Practices
GCC	Gulf Council Countries
GDP	Gross Domestic Product
GHGs	Green House Gases
Ha	Hectares
HACCP	Hazard Analysis & Critical Control Point
HCD	Horticultural Crops Directorate
ICIPE	International Center for Insects, Physiology, and Ecology
ICT	Information Communication Technology
IPM	Integrated Pest Management
ITC	International Trade Center
KALRO	Kenya Agriculture and Livestock Research Organization
KCSAP	Kenya Climate Smart Agriculture Project
KEBS	Kenya Bureau of Standards
KENGAP	Kenya - Good Agricultural Practices
KEPHIS	Kenya Plant Health Inspectorate Services
MoALD	Ministry of Agriculture, Livestock Development
MOU	Memorandum of Understanding

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MT	Metric Tonnes
NARIGP	National Agricultural and Rural Inclusive Growth Project
NAVCDP	National Agriculture Value Chain Development Project
PCPB	Pest Control Products Board
PO	Producer Organization
SMEs	Small and Medium Enterprises
ToTs	Trainer of Trainers
VCA	Value Chain Actor

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1. Background

1. The agriculture sector contributes 33% of the Gross Domestic Product (GDP) to Kenya's economy and adds another 27% through linkages to other sectors such as manufacturing, distribution, and services (KNBS, 2020). The Horticulture Crops Directorate (HCD) estimated that in 2020, horticulture contributed 26% of the agricultural GDP and that exports from flowers generated 72%, vegetables generated 16%, and fruits 12%. Agriculture is one of the five key pillars for economic development and transformation as envisaged under Vision 2030 and interventions to realize this are outlined in the sector blueprint Agriculture Sector Transformation and Growth Strategy 2019-2030. The Bottom-up Economic Transformation Agenda (BETA) 2022-2027 identifies the mango fruit value chain as a priority in terms of increasing volumes and value of agricultural exports.

2. Mango remains among the most exported fruits accounting for 15.5% of the total earnings in 2020 (HCD, 2023). In Africa, Kenya is the fourth leading mango producer, at 758 374 MTs (HCD, 2022), after Malawi, Nigeria and Egypt. Kenya remains the biggest producer in East Africa, producing about 43% of East Africa's total production by volume. Investing in the mango value chain can therefore lead to significant social - economic impacts.

3. The main challenges of the mango value chain include pests and diseases, inadequate post-harvest management practices, low production and productivity, inadequate infrastructure to support the value chain development (roads, aggregation structures), leading to over 30% post-harvest losses. Poor organization of marketing agents substantially increases logistics time and costs. Processors operate at about 40% of their installed capacity as a result of seasonality of production, shortage of varieties suitable for processing and competition from fresh produce buyers, while exporters are challenged by high cost of air freight, hence making Kenyan mangoes to be expensive globally. Mango fruit fly remains the main challenge in the production of mango in the country. Main diseases affecting mango include anthracnose and powdery mildew. There is also existence of old mango orchards with diminishing returns and inadequate agronomic skills on mango production. In addition, there is a succession challenge in that young generation is not incentivized to take up mango production.

According to AFA Yearbook of Statistics 2023, mango production, as a fruit, is third in terms of value earned at 15%, avocado second at 15.3% and bananas third at 33.4%. It is estimated that Kenya has 163,664 acres of mangoes and a total of 12,857,143 mango trees of which, 70% are in production (9,000,000 trees) (MoALD) Draft Mango promotion strategy, 2021). There have been different estimates on the number of mango trees in the main mango growing regions of Kenya. However, Onyango, K et al (2023) estimated the growth rate in mango growing in the last decade to be around 9.2% per year. Based on the figures obtained from studies done since 2010 and the estimated growth rate of 9.2%, the current tree population (2024) can be placed at beyond 10 million trees.

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4. Out of the 47 Counties in Kenya, 20 are producing mangoes as shown in Table 3. The area under mangoes increased from 56,668 Ha in 2021 to 66,234 Ha in 2022 (HCD, 2022). There was a substantial increase in value from KES 12.2 billion in 2021 to KES 13.38 Billion in 2022 - KES 1.14 Billion or a 9.3% increase attributed to an increase in production and improved average farm gate prices. The area under production reduced by 0.5% from 66,234 Ha in 2022 to 65,870 Ha in 2023. Additionally, the quantity reduced by 3%, from 758,374 MTs to 736,663 MTs.

5. The average productivity in early years is estimated at between 300 to 500 fruits (100kg) per tree. Spacing in the orchard, with a standard spacing of 8m x 8m, gives a population of 64 trees/acre. Under intensive production, an orchard can accommodate 92 trees to a spacing of 6m x 5m. On average, the first economic harvest is at five (5) years after planting, with a tree yielding 300 fruits (estimated to be 100 kgs) increasing to about 600 - 700 fruits (about 225kgs) in subsequent harvests with good agronomic practices. Farmers have reported that at the 10th year of harvest, a well-managed tree can yield 1,200 fruits. In Kenya, small-scale farmers plant between 5-50 trees, medium-scale farmers over 100 trees, and a few large-scale farmers at 10 hectares with approximately 2,500 trees.

1.1 Mango Production and Demand Trends

6. Mango production in Kenya has been increasing over the last four decades from an estimated 400 MTs in 1961 to 738,321 MTs in 2021 (AFA Yearbook of Statistics, 2022), a trend attributed to the increased demand in the domestic, regional and international markets for fresh and processed mangoes as well as the introduction of mangoes to new growing areas. The Kenya Population and Housing Census: Volume IV 2019 estimates that in Kenya, there are 796,867 households growing mangoes (KHPC, 2019). The draft National Mango Promotion strategy, 2021, estimates that there are just over 200,000 small-scale farmers that derive their livelihood from mango production with many more benefitting from the mango value chain in trading, transport, export, and processing. For the purposes of this strategy, it is prudent to consider all mango farmers as estimated in the KPHC IV, 2029, by the Kenya National Bureau of Statistics.

7. Kenya's mango industry has a key competitive advantage by having a long mango season that runs from October to March (high season), and another shorter season that runs from April to June (short season), covering mainly the Coastal region. This means Kenya is able to sell mangoes to the market when other suppliers like India and Pakistan are off-season. The seasonality calendar shown below (Table 2) indicates that Kenya starts taking her mangoes into the international markets starting October, with volumes intensifying between December and February. This is a season when the major competing countries do not have mangoes in the market.

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Table 1: Seasonality calendar of major mango producing countries

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tanzania												
Kenya												
Ghana												
Egypt												
Ghana												
South Africa												
Brazil												
KEY	High Season									Low season		

1.1.1. Mango Production in Kenya

2 In Kenya, mango is predominantly grown in the Coastal, Eastern, and Central regions, some parts of the Lake region and North Rift of Kenya. Annex 1 shows the land suitability for mango production in Kenya. Mango production is suited to a broad tropical climate ranging from humid to dry with optimum temperature range for tree development and fruit growth between 24° to 30°C. Annual rainfall of 500-1000 mm is sufficient for successful mango cultivation.

1. The ideal soil types include the sandy soils found at the Coastal strip of Kenya and lower parts of Eastern region to the volcanic murram soils in mid- altitude agro-ecological zones in Upper Eastern, areas in the Rift Valley and slopes of Mount Kenya. The loam and black cotton soils prevalent in several Counties in Kenya also provide suitable growing conditions. The Counties where mangoes are currently growing have mostly suitable conditions and furthermore, the diversity of agro-ecological zones in Kenya makes the country landscape largely suitable for wider production of mangoes.

2. The mango tree is a perennial plant; spacing depends mainly on the vigour of the cultivar/ rootstock and the environment. When the trees are planted densely, they grow upright and tall, thus producing fewer fruits which are of poor quality. Tall trees usually present a harvesting problem and create difficulties during spraying and pruning. Jurgen G (2003) observed that grafted trees are spaced at 8 x 10 m or 10 x 12 m, though at the coast seedlings require 12 x 14 m. Field trials at the KALRO have since shown that various spacing options may be adopted as shown in table Table 3. Inter-cropping mangoes with short-lived fruit trees such as papaya or low lying annual crops (mostly greengrams and beans) is widely practiced as a way to better utilize land in widely spaced young plantations.

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Table 2: Mango spacing options

Option	Spacing	Production system	Threshold	No. of trees
Standard spacing 1	9 m x 9 m	Low potential areas – Rain fed	1 acre	50
Standard spacing 2	8 m x 8 m	Low to medium (mostly Rain fed and irrigation	0.5 acre	32
Intensive production	6 m x 5 m	With irrigation	0.5 acre	46

2.1.1. Key Mango Producing Counties

The leading Counties in mango production in 2022 ranked by value were Makueni (27%), Kilifi (17.6%), Tana River (8.1%), Meru (6.6%), Lamu (5.8%), Siaya (5.0%), and Machakos (4.9%), of the national value of mangos as outlined in Table 4 and 5. The mango production counties with estimated production units for 2022 are outlined in Figure 2.

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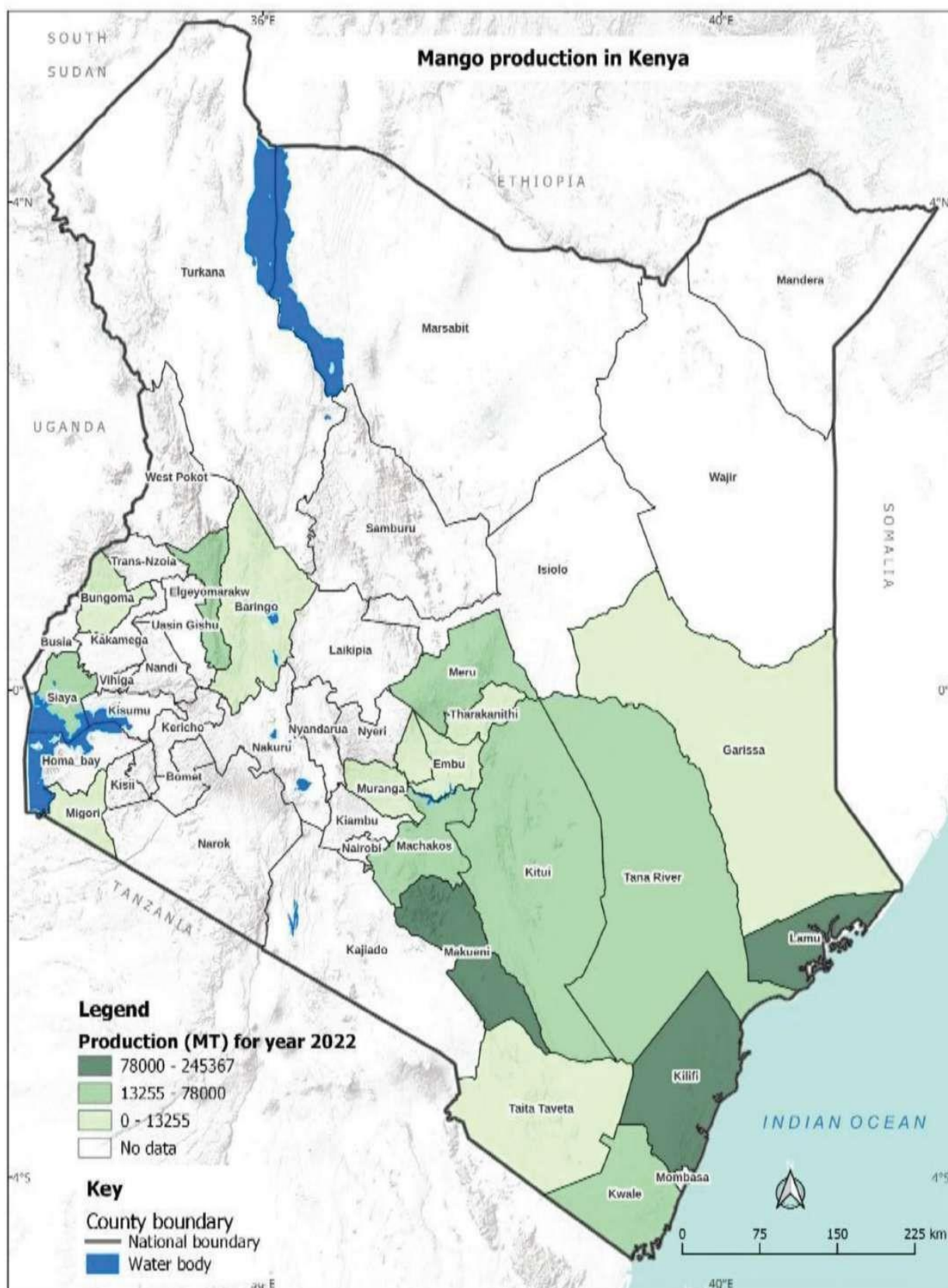


Figure 1: Key Mango producing Counties

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Table 3: Mango production in Counties by area, value and volumes (2021 – 2022)

	County	2021			2022			Percent of Total Value 2022
		Area	Volume	Value	Area	Volume	Value	
1.	Makueni	20,414	281,398	4,163,470,000	22,422	245,367	3,614,947,000	26.6%
2.	Kilifi	6,374	50,236	969,259,500	8,974	153,931	2,355,240,000	17.3%
3.	Tana River	1,243	19,764	533,520,000	2,486	39,292	1,081,440,000	7.9%
4.	Meru	4,417	49,773	937,442,190	5,625	47,854	883,568,633	6.5%
5.	Lamu	6,248	136,576	1,698,640,000	7,000	78,000	1,003,200,000	7.4%
6.	Siaya	1,059	10,360	220,525,000	2,550	19,531	674,310,000	5.0%
7.	Machakos	2,740	24,497	413,876,750	2,782	24,046	656,625,000	4.8%
8.	Elgeyo Marakwet	895	11,716	262,491,150	985	20,000	463,600,000	3.4%
9.	Kwale	2,105	25,254	505,080,000	1,956	20,250	390,220,150	2.9%
10.	Kitui	2,701	27,010	539,750,000	2,651	13,255	293,575,000	2.2%
11.	Embu	1,610	18,159	240,851,000	1,770	10,140	281,700,000	2.1%
12.	T. Nithi	1,274	11,461	275,610,530	1,204	11,556	275,134,000	2.0%
13.	Migori	494	7,211	236,564,820	504	7,871	204,133,000	1.5%
14.	Murang'a	945	10,183	165,390,882	931.8	11,555	203,684,735	1.5%
15.	Kirinyaga	396	11,452	170,350,000	370	9,172	192,813,333	1.4%
16.	Baringo	211	3,051	74,975,000	297	3,977	122,660,000	0.9%
17.	Bungoma	239	3,603	68,080,000	181	3,034	106,190,000	0.8%
18.	Garissa	642	7,862	106,500,000	649	6,656	92,901,000	0.7%
19.	Taita Taveta	272	4,236	55,140,000	423	7,200	87,175,000	0.6%
20.	W. Pokot	171	2,250	8,612,000	1,209	11,811	386,287,350	2.8%
21.	Others	2,219	22,269	600,086,018	1,265	13,876	244,830,150	1.8%
Total		56,668	738,321	12,246,214,840	66,234	758,372	13,614,234,324	100.0%

Source: AFA-Horticulture Crops Directorate, 2022

2.2 Mango Varieties Grown in Kenya

1. There are about 60 mango varieties grown in Kenya (MOALD&F, 2022) out of which seven (7) varieties are commercially produced in small, medium-scale and large-scale farms. They include Ngowe, Boribo, Apple, Kent, Dodo, Tommy Atkins, and Vandyke (Table

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- 6). Apple is the main variety grown in the eastern part of Kenya accounting for about 50%, while Ngowe is the main variety grown in the coastal area accounting for approximately 48%. Apple is the main variety exported (about 70%).
2. In Kenya, early maturing mango varieties include: Haden, Ngowe, Dodo, and Apple. Mid-season varieties are Sabine, Peach, Sabre, Tommy Atkins, Vandyke. The late maturing varieties include Kent, Sensation and Keitt.
3. Recommended rootstock mango types include Sabre, Peach, Turpentine and 13-31. Detailed analysis of each mango variety is available at KALRO, specifically in the “Procedural Manual for Production and *Commercialization of Mango Clean Planting Material*” (Watani, 2022).
4. The main mango varieties in demand and grown globally include Alphonso, Carabao, Ataulfo, Francis, Haden, Keitt, Kent, Kensington Pride, Tommy Atkins, Graham, Sindhri, Dhasseri and Kesar. Alphonso mango is considered number one in taste and flavour. Popular export varieties in Kenya include Apple, Kent, Tommy Atkins, Ngowe and Vandyke. Main processing varieties in Kenya include Ngowe and Apple.

Table 4: Mango varieties grown in Kenya

Variety	Coast (%)	Eastern (%)
Ngowe	48.9	4.4
Small-fruited local varieties	18.9	19.3
Apple	17	49.1
Boribo	12.6	
Batawi	2.2	
Others (mainly improved varieties)	0.4	
Sabre and Peach (cultivated for rootstock production)		8.5
Tommy Atkins		7.9
Kent		5.6

Source MOALD, 2021

1.1 Mango Marketing and Value Addition

The Kenyan mango market comprises several segments. The main ones include export, fresh fruit, processed fruit for direct consumption, and fruit used in food preparations. Rockefeller Foundation (2017) estimated that most of the produce is absorbed by local markets (80%), followed by processors (8%) and exporters (2%). The Ministry of Agriculture (2022) estimated that 423,362,792 kg of mangoes was marketed domestically (representing about 57% of annual production). Using estimated data, the mango market segments were further evaluated as shown in Figure 3 below. The domestic markets comprise over 22 structured open-air markets and up to 300 grocery stores across the country, accounting for 90 percent of mangoes marketed through

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informal markets with only 10 percent through cooperative societies. These markets are characterized by over- supply during the peak season and scarcity during the low season. Mangoes are perishable and delicate fruits, and thus to mitigate the risk of spoilage, farmers are inclined to sell soonest after harvest. Most small-scale farmers do not have on-farm storage facilities and rely on marketing agents to connect to the market (Owuor, 2020)

There are many intermediaries between the farmer and the final consumer, thus increasing transactional costs and ultimately less returns. Poorly organized marketing systems and information asymmetry for the value chain further reduce the bargaining power for the chain actors, particularly for the farmer who, in most instances, has limited access to current market information.

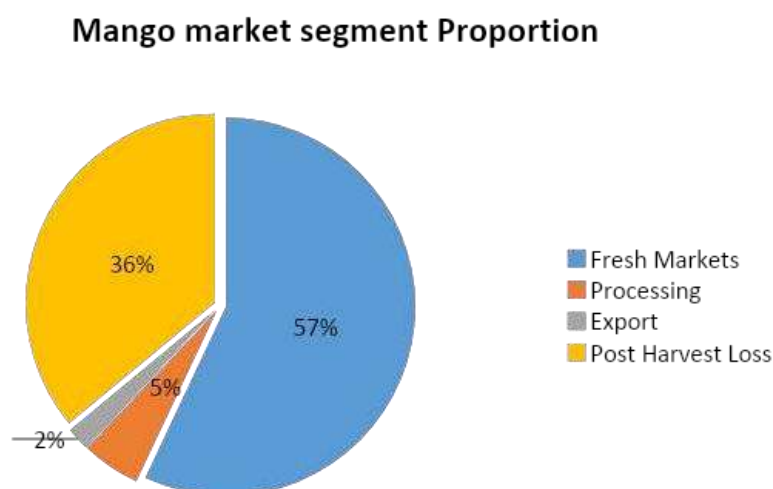


Figure 2: Mango market segment proportion

Calculation by : Mango Value chain strategy development team: MoALD, 2023

2.2.1. Value Addition

- 3 Value addition in mangoes may include any of the following: cleaning, cutting/slicing, packaging, drying, freezing, and extraction for preservation. In Kenya, although the commonest value addition methods are processing into pulp/puree and drying, in terms of economic value to farmers and other key actors, it also includes proper post-harvest management of mango fruits, processing waste and its export for higher monetary returns. There are over ten (10) possible mango value added products; Pulp (puree), juice, dried mango, jams, wine, pickle, leather, powder, jelly, smoothie, chutney, canned slices (Table 7).
- 4 The waste produced during mango processing is a rich source of utilizable components. This waste can be converted into value added by-products and

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helps reduce environmental pollution.

Table 5: Mango value added products

Ripe mangoes	Mango pulp/puree, mango squash, mango syrup, mango juice, mango fruit bars, mango jam and mango wine
Raw Mangoes	Mango pickle, mango chutney, mango slices, mango powder and raw mango beverage
Processing by-products	Kernel flour, starch/fat from kernels, pectin from peels, biogas from peels, substrate for production of SCP (Single Cell Proteins for human consumption or animal feed

Processing of mango fruit into the diverse shelf-stable products makes the seasonal fruit conveniently available to consumers all year round. Through research and food product development, there are now unique and diverse processed mango products with specific qualities and nutritional attributes that are in demand by a wide array of consumers. Some of the common processed products from mango fruit include pulp (puree), juice concentrate, ready-to-drink juice, nectar, wine, jams, jellies, pickles, smoothies, chutney, canned slices, chips, leathers, and powder. Minimum processing of mango fruit as fresh- cut product has also gained importance among health-conscious consumers.

Apart from the primary products from mango fruit, mango pulp or powder can be used to enrich/fortify or flavor secondary products such as yoghurt, ice cream, beverages, and soft drinks. By-products of mango processing, such as the peel and kernel, have been shown to be rich in bioactive compounds including carotenoids, polyphenols, and dietary fibers. These by-products can be used in food fortification and manufacture of animal feeds, thereby gaining greater value from the fruit while reducing wastage.

4.1.1. Mango Exports:

The export market is usually formal, structured and organized. A hallmark of the export market is strict adherence to quality standards, Phytosanitary requirements and other export regulations and norms (Owuor, 2020; World Bank, 2020; Wango et al., 2020). Exporters mostly source their mangoes through marketing agents and small-scale out- grower farmers or producer organizations. For the Kenya mango producers, the main mango export market is the Middle East where a big percentage of apple mangoes go to. HCD estimates that Kenya exported over 12,000 MT of mangoes valued at KES 1.8 billion in the year 2022. In 2023,

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mangoes contributed 14.8% of the total fruit value and 7.6% of the total value of horticulture in the country (HCD, 2024).

Between 2016 and 2018, mango valued at KES1.6 billion was exported, accounting for 12.57% of total fruits exports (HCD 2020, ERA, 2017). The sudden drop in export value in 2020 to KES1.05 billion was greatly attributed to the Covid-19 pandemic as outlined in Figure 4.

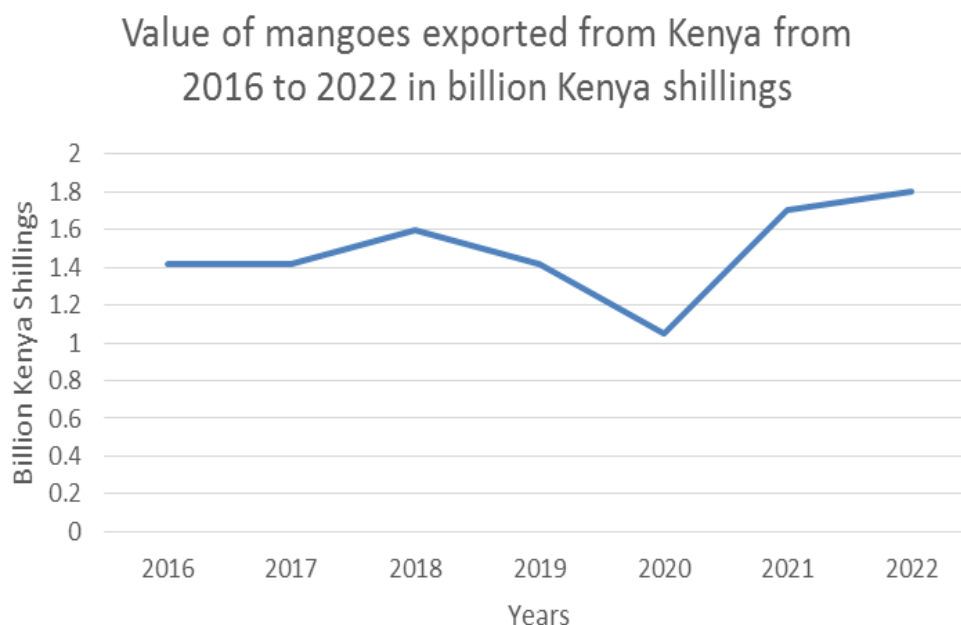


Figure 3: Kenya Mango export trend from 2016 to 2022 (Billion Kenya Shillings)

Source: HCD 2022

The ITC trade map below (Figure 5) shows that in 2023, Kenya contributed 4% of total global mango exports. This represents Apple and Ngowe mango varieties mostly exported to the Middle East (GCC). The contribution of mango export from Kenya to the European Union including the UK is low, and is limited by variety as well as non-adherence to commercial and private voluntary standards

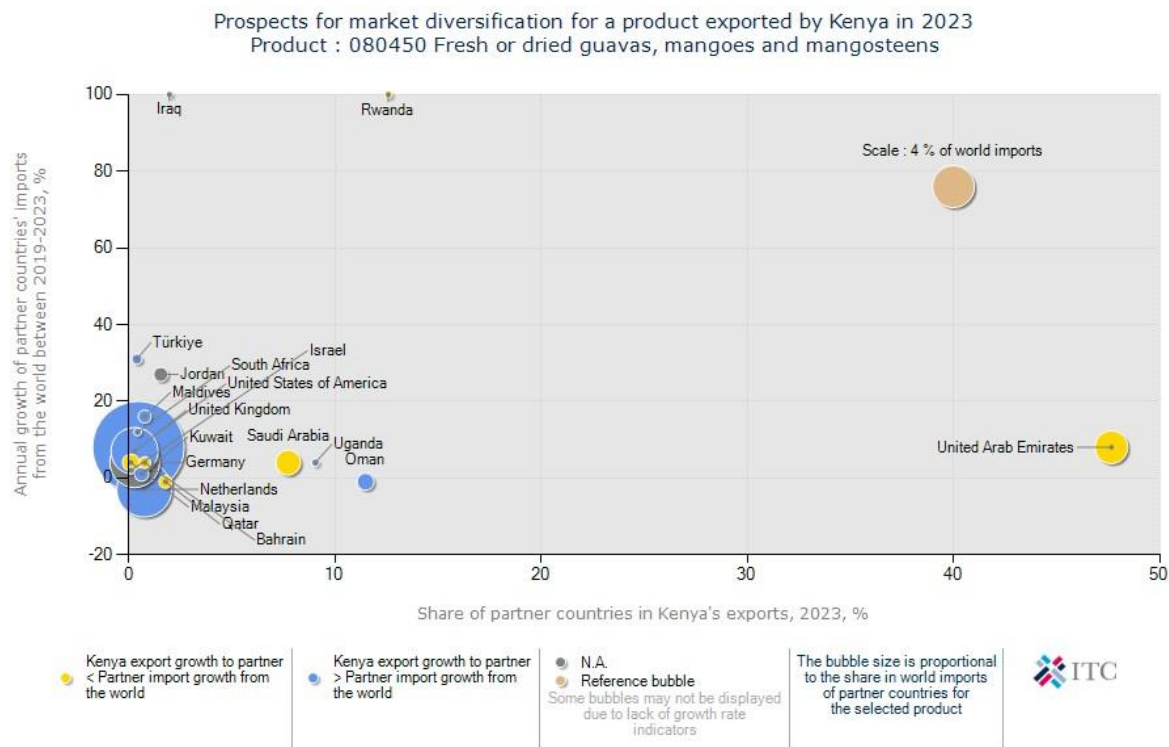


Figure 4: Prospects for market diversification of fresh or dried guavas, mangoes and mango steens exported by Kenya in 2023

It is worth emphasizing that less than 5% of Kenyan mango production reaches the export market. On the other hand, the total exports of mangoes globally have increased by more than 10% per year for the past ten years (UN Comtrade). This growth in the mango export market, in combination with a highly domestically focused Kenyan mango industry, suggests that there is significant value to be captured by re-orientating the Kenyan mango sector toward exports

MAKUENI COUNTY OVERVIEW OF THE MANGO VALUE CHAIN

Makueni County leads in mango production in Kenya with over 4 million Mango trees covering 19,904 Ha of land and grown by over 70,000 farm families, producing 199,626 MT valued at KES 5,988.78 billion (AFA 2024). Mango farming in Makueni County contributes about 40 percent of the total farm household income. The main varieties produced are Apple, Ngowe, Tommy Atkins, Kent and Keitt. The Apple Mango is very popular owing to its demand in the export market and its fast growing. Other varieties now in demand in the export market are Kent and Tommy Atkins. For processing Ngowe is the most preferred. the main mango producing sub counties are as shown in figure below;

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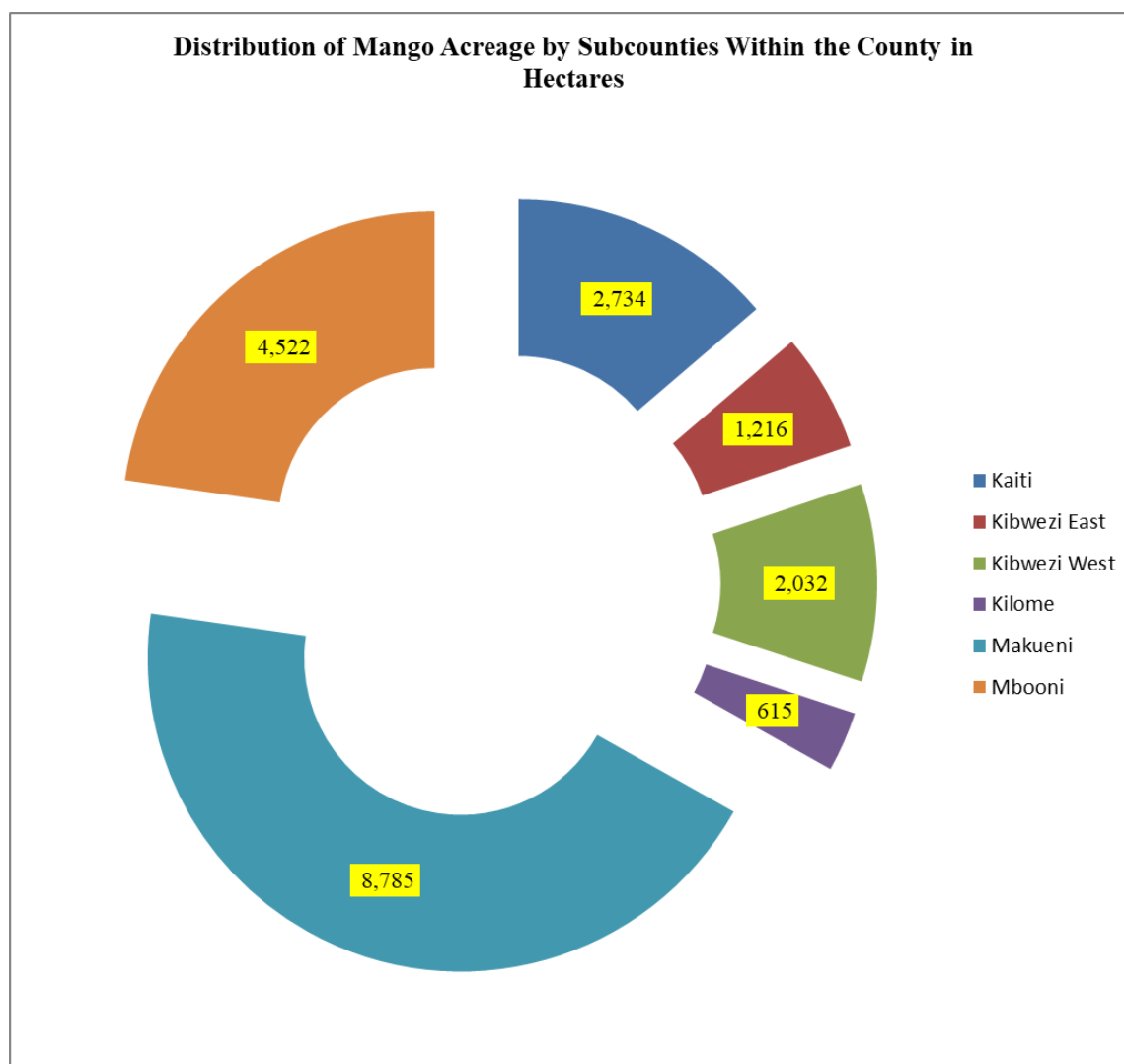


Figure 5: Distribution of mangoes

Table 6: Summary of Mango Production

Summary of Mango Production; Area, Volume and Value Trends in Makueni County												
Metrics	Area (Ha)				Volume (MT)				Value (KES) millions			
Years	2020	2021	2022	2023	2020	2021	2022	2023	2020	2021	2022	2023
Makueni's Total	21,985	20,414	22,422	19,904	159,622	281,398	245,367	199,626	3,033.54	4,163.47	3,614.95	5,988.78
Kenya's Total	62,236	56,669	66,234	76,793	793,281	738,321	758,374	909,922	14,968	12,246	13,614	19,607
% Contribution	35.3	36	33.9	25.9	20.1	38.1	32.4	21.9	20.3	34	26.6	30.5

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Source: AFA Yearbook of Statistics 2024

Chart 1: Area (Hectares) of Mango and No. of Mango Farmers by Wards in Makueni County

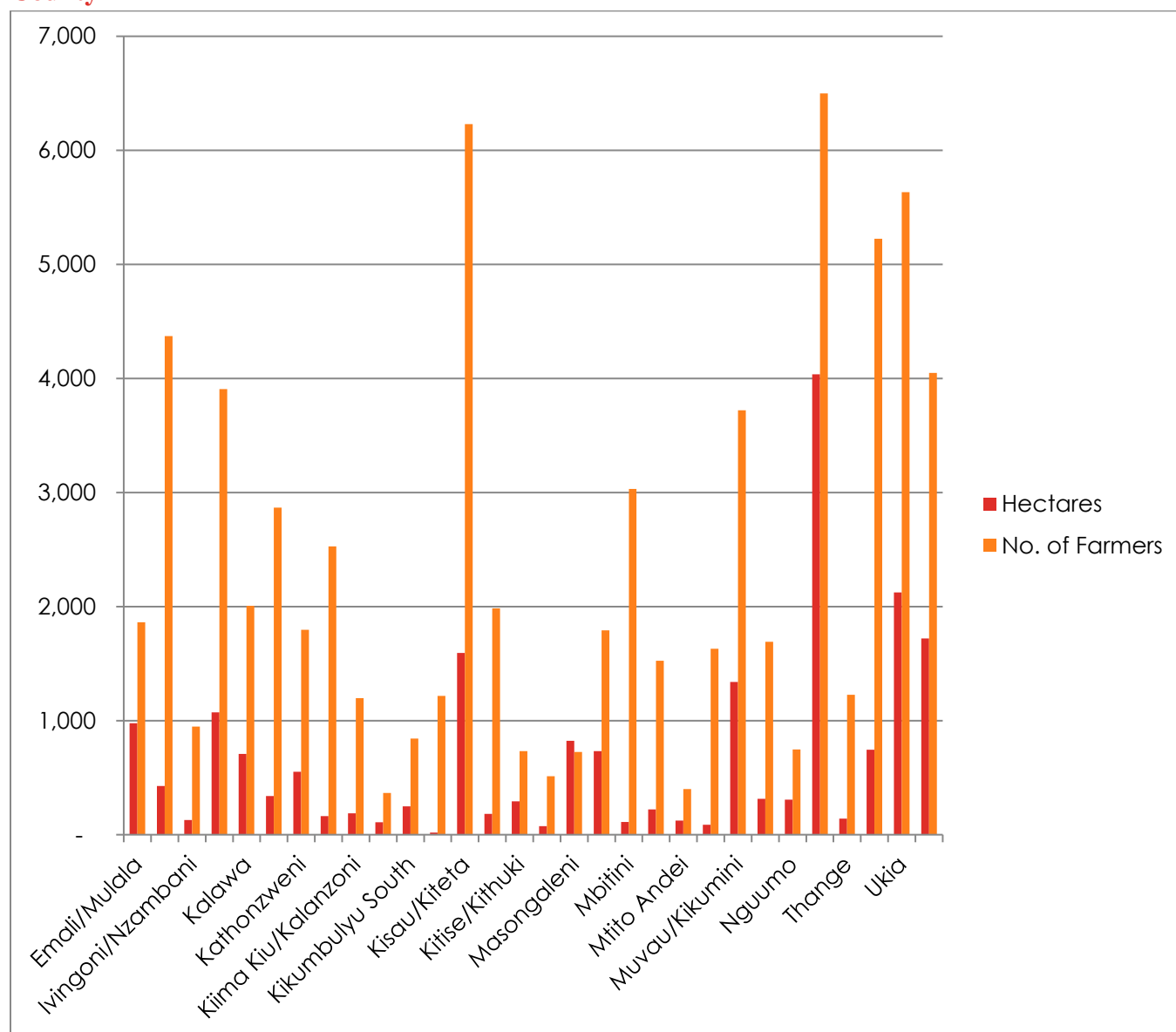


Figure 6: Area (Hectares) of Mango and No. of Mango Farmers by Wards in Makueni County

Area is obtained from KIAMIS DATA 2023 while number of farmers is from 2019 Kenya Population and Housing Census

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Table 7: Area (Hectares) of Mango and No. of Mango Farmers by Wards in Makueni County

Ward	Hectares	No. of Farmers
Emali/Mulala	978	1,862
Ilima	428	4,372
Ivingoni/Nzambani	129	947
Kako/Waia	1,073	3,906
Kalawa	707	2,007
Kasikeu	340	2,867
Kathonzweni	551	1,797
Kee	163	2,528
Kiima Kiu/Kalanzoni	188	1,197
Kikumbulyu North	108	366
Kikumbulyu South	249	843
Kilungu	20	1,216
Kisau/Kiteta	1,593	6,231
Kithungo/Kitundu	182	1,985
Kitise/Kithuki	293	732
Makindu	75	513
Masongaleni	822	726
Mavindini	733	1,791
Mbitini	112	3,031
Mbooni	222	1,524
Mtito Andei	125	401
Mukaa	86	1,630
Muvau/Kikumini	1,338	3,720

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Nguu/Masumba	314	1,692
Nguumo	308	748
Nzaui/Kilili/Kalamba	4,038	6,500
Thange	140	1,226
Tulimani	744	5,224
Ukia	2,124	5,634
Wote/Nziu	1,720	4,049
TOTAL	19,903	71,265

Area is obtained from KIAMIS DATA 2023 while number of farmers is from 2019 Kenya Population and Housing Census

DEMAND FOR MANGOES IN THE COUNTY AND BEYOND

The demand for mangoes in Makueni is estimated at 250,000MT per annum distributed as per the market segments below; Local-162,500 MT (65%), Regional-12,500 MT (5%), Export-37,500 MT (15%), Processing-20,000 MT (8%), Others-17,500MT (7%). (SIVCAP,2020)

PER CAPITA CONSUMPTION of mango in Kenya is 18 kg and target to reach 20kg by 2027.

DEMAND, SUPPLY GAPS

The demand for mangoes in Makueni is 250,000MT per annum while supply in 2023 was 199,626 MT per annum thus having a deficit of 50,374 MT. (AFA yearbook of statistics,2023)

CHAPTER 2

VALUE CHAIN ANALYSIS

2.1 Mango Value Chain Structure

To develop this strategy, a value chain analysis was undertaken. The analysis identified gaps and opportunities along the mango value chain. The gaps and opportunities were prioritized, and investment areas (intervention areas) along the value chain identified to make the value chain more competitive. The key value chain actors, both direct and indirect, are as described below and a value chain map drawn to visualize the functions, actors, chain support services, and context (Figure 7).

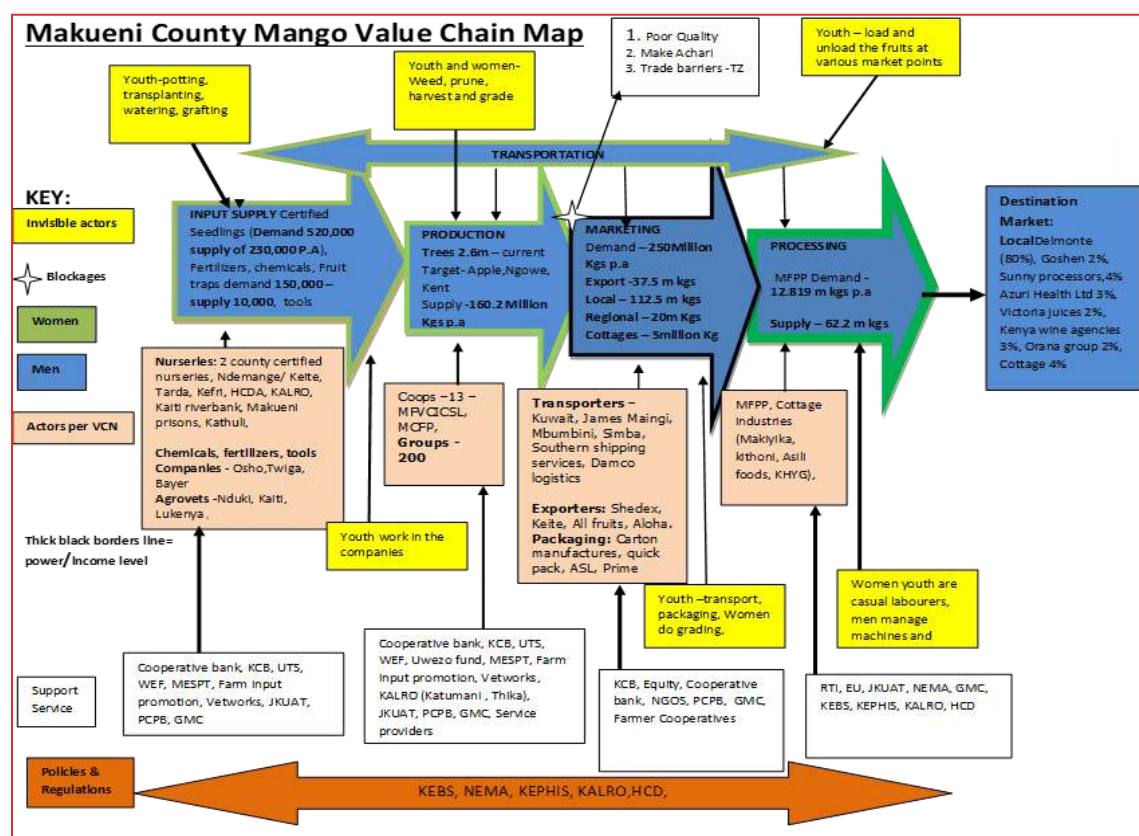


Figure 7: Makueni County Mango Value Chain Map

Mango Value Chain Actors

In order to create synergy along the value chain, this strategy recognizes the complexity of interests, relations, and capacities of the various value chain actors. In this strategy, the value chain actors discussed include: Input suppliers, farmers, agro-dealers, traders, marketers (wholesale and retailers), processors and exporters

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Table 8: Summary of Value chain actors

Input providers	Producers: Farmers	Aggregators/Exporters	Processors	Market
	Small-holder farmers	Aggregators/ Traders FPOs.	Mango Puree processors like makueni fruit processorsDried mango processors like	Domestic Market
1. Seedling suppliers			Iviani Farm, Asili Foods, Goshen Farm exporter, Vert Ltd,	Wet markets: Wakulima, Kongowea, Kisii Grocery stores
• KALRO	Medium-scale holder farmers	Exporters like Keitt, Goshen, RTC fruit,	Mango Puree processors like Makueni fruit processors Dried mango processors like	Regional Market in
• Kenya Prisons		Aggregators/ Traders FPOs.	Iviani Farm, Asili Foods, Goshen Farm exporter, Vert Ltd,	East African countries
Registered tree seedling nurseries like Kathuli, Palma, Muundani 1. Agro-dealers, Farm chemicals and	Large-scale farmers		Mango Puree processors like Makueni fruit processors Dried mango processors like	Export Market

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farm equipment suppliers(215)				
2. Integrated Pest Management (IPM) solution providers like Real IPM, Kenya Biologics, Farmtrack consulting				
3. Irrigation solutions suppliers like sunculture			Iviani Farm, Asili Foods, Goshen Farm exporter, Vert Ltd,	Gulf Council Countries EU

2.2.1 Input Suppliers

a. Mother Blocks and Nursery Operators

The provision of the right inputs at the right time is critical in unlocking the potential of the mango value chain. Mango farmers require clean planting materials (root stock seedlings and scions for grafting) and these needs to be sourced from certified operators. There are a few mother blocks in the country, and most nurseries are operated either by individual farmers, cooperative societies, government agencies such as KALRO, Kenya Plant Health Inspectorate Services (KEPHIS) and universities who undertake multiplication of seedlings and regulatory services. The main role is to supply certified mango seedlings. In Makueni, KEPHIS has currently certified two operators.

Horticultural Crops Directorate (HCD) reports that there are approximately 110 registered fruit tree nurseries in Kenya. Makueni currently has eight. The key concerns include a limited supply of certified seedlings, poor distribution networks for small nurseries, and inadequate capacity among operators to manage their nurseries effectively.

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b. Agro-Dealers

The main players are agrochemical companies (manufacturing) and agricultural input suppliers (distribution). The main manufacturers include Bayer East Africa, Syngenta, Twiga chemicals. Others like Osho chemicals, Botachem, Greenlife crop protection, Amiran are agents in Kenya. They also offer farm-based farmer capacity building and demonstration on use of their products. In addition, the main distributors in the county are Makamithi enterprises, Lukenya Agrovat, Tazama among others. The major agricultural inputs include fertilizers, pesticides, spraying and plant handling tools, Personal Protective Gear, and irrigation kits. Agro-input distributors comprise large and independent or small dealers that distribute agro-chemicals and diverse farming equipment and machinery, usually with distribution networks based at regional, wards and village outlets. The main area of concern in this node is mainly access to and distribution of quality inputs to farmers.

c. Farmers

Farmers are the primary actors in the mango value chain, playing the dual role of producers and consumers. Most farmers in Makueni fall under the smallholder category. There are about 19,312 of these farmers (94% of total mango farmers) with farm size ranging from 0.01 – 2 acres. Medium scale farmers are 887 with farm size ranging from 2.1 -5 acres, accounting for 4.5% of total mango farmers and 269 large-scale farmers with farm size more than 5 acres accounting for 1.3% of total mango farmers. The key concern is that this category of smallholder farmers has inadequate technical know-how in mango production and usually limited access to market information vis-à-vis their colleagues in the other categories. However, cutting across the divide, there is low uptake of late maturing varieties which fetch better prices as they sell when all others have cleared in the farms. Varietal preferences for different geographical locations also wanting e.g. doing Apple mangoes in high altitude areas.

d. Traders

The actors involved in mango trading in Makueni include farmers, brokers, local/village assemblers, wholesalers, retailers, and exporters. Mango wholesalers outsource mangoes directly from farmers in rural areas or use local agents to purchase mangoes from farmers on their behalf. Others purchase directly from rural assemblers/aggregators and then sell to wholesalers, processors and retailers. Wholesalers are an important link between local agents and retailers, although some of the local agents also sell directly to retailers including supermarkets, hotels, and institutions like hospitals, schools, and kiosks.

Mangoes are usually sourced from the production areas and taken to wholesale markets in the major urban centers, the main ones being Nairobi (Wakulima, Kangemi, Eastleigh, Githurai and Kawangware) and Mombasa (Kongowea). The main locally traded varieties being Ngowe, Apple, Tommy Atkins, Kent and the local mango types. Most of the mangoes are

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delivered in open trucks, cartons and sacks, and this usually affects their quality during handling, packaging, and transportation. The major concern by the traders is fruit quality.

e. Processors

The main mango processors in Makueni fall into two categories; small medium enterprises (including cottage level operators), and commercial processing plants. In Kenya, large scale processors prefer the ‘Ngowe’ variety due to its large size (and thus yield per kg), brix content and other parameters that result into good quality pulp. Processable varieties in the county include the Apple and Ngowe. Makueni County fruit processing plant processes puree and recently introduced ready to drink juice while Goshen Farm Exporters Ltd processes various tropical fruits, including dried mango. The Iviani Farm in is a new SME involved in mango drying, targeting the different market segments for mango crisps. Burton and Bamber in Kithimani as well as Vert ltd in Machakos County are involved in processing of puree and dried mango for the local, regional and export markets. These Processors source mangoes from the County.

It is estimated that the main processing firms operate around 40% of installed capacity because of supply shortages and idle capacity that results from significant post-harvest losses, fluctuating seasonal production and competition with local fresh fruit and export markets, which offer more competitive prices.

f. Exporters

The current (2021) global demand is estimated to be 56.23 million MTs per year with a per capita consumption of 9.8 kg. This situation positions Kenya’s mango industry well to participate in the export market. Makueni enjoys one of the longest mango seasons which (September to March). This gives mango farmers a competitive advantage as it makes it possible to supply main export markets (The Middle East and Europe) when big suppliers like India and Pakistan are off season.

There are three mango varieties grown in Kenya that form the bulk of exports; Apple, Ngowe and limited quantity of Kent. There is a gap in supply of varieties that are popular in key European import markets (FAO. 2022. Major Tropical Fruits: Preliminary results 2021. Rome). In the more prime markets of the EU, popular mango varieties include Tommy Atkins, Keitt and Kent. The markets with greatest potential for Kenya’s mango exports are Europe and United Arab Emirates. Up to 55% of all mangoes in Europe are imported, or traded by the Netherlands while Germany has the largest consumption market for mangoes (Ministry of Agriculture, 2022).

There are up to 5 registered exporters according to the Horticultural Crops Directorate (2021) and most of these export mangoes among other fruit and vegetables. However, a number of exporters face difficulties in procuring quality fruit due to poor agronomic and post-harvest practices. Kenyan exports also tend to be priced substantially higher than the

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competition due to the lack of sea freight options and high cost of logistics. Efforts to lower logistics related costs, improve aggregation efficiencies and reduce post-harvest losses will improve Kenya's competitiveness in the international market. The strategy intends to build a vibrant, profitable, and sustainable climate resilient mango industry that maximizes market opportunities and profitability for Kenyan mango value chain actors by the year 2030. The focus will be to spur sub-sector growth in the areas of production, quality, marketing, value addition and profitability for all value chain actors while ensuring sector collaboration and coordination among all stakeholders in the industry.

2.3 Economic Analysis

It has been estimated that a minimum of 50 trees on one one-acre pure stand with a spacing of 9m x 9m is commercially viable. In this production unit, a farmer investing in good agronomic practices will harvest quality fruit of the recommended size and weight per piece (300 - 350 grams). At the farm gate, producers with quality mangoes attract prices in the range of KES 5 (local market) to KES 14/- per piece, (KES 15 to KES 42 per kg (1kg of mangoes = 3 pieces) (Table 8).

2.3.1 Commercial Threshold for Mango Farming

The economic analysis has considered three aspects; a) commercialization threshold for a mango farm enterprise based on one acre of 50 trees at the 7th year of production;

b) gross margin analysis based on two scenarios - a one-acre farm enterprise with 64 mature trees at 7th year and producing about 100 kg of fruit per tree and at a farm gate price of KES 25 per kg; and a one-acre farm with intensive production system, 92 mature trees producing 225 kg per tree and farm gate price of KES 30 per kg, and;

c) profit/ value share distribution among key mango value chain actors (Farmer, Trader, Processor and Exporter). An acre can have up to 64 trees (spacing of 8mx8m; and 92 trees under intensive production with 6m x 5m spacing) (Annex 2 and 3).

The minimum commercialization level has been estimated based on a cost of production of between KES 3 to 5 per fruit (KES 9 – 15 per kg), a capital outlay cost of KES 260,956 per acre, and refers mainly to orchard establishment and maintenance costs.

Gross margin analysis: Mango is a perennial plant (a tree crop) that starts production of marketable volumes of fruit from the fifth year and increases between 500 to 600 plus fruits per year (225kg) in subsequent years. The main variable costs at farm level are associated with crop husbandry activities, farm inputs, fruit handling practices and labour. A representative gross margin analysis has been estimated at the seventh year for this strategy based on two scenarios; and assumes a best-case scenario of intensive production at 92 trees per acre (Annex Scenario 2).

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Mango Commercialization: Breakeven NPV

BENEFITS	From Yr 5-15
No of trees	50
Fruits per tree	333
Total Fruits	16,650
Price/Fruit (KES)	7
Gross Income	116,550
Operational Costs	
4.00 per fruit	66,600
Total Cost	66,600
Free cash flow per Year	49,950

Breakeven NPV:
$$NPV = \frac{R_t}{(1+i)^t}$$

Year	From YR 6
Initial capital outlay (Ksh)	260,956
Average free cash flow per year	49,950
Time of the cashflow (years)	10
Discount rate	18
Sum of present value (Ksh)	260,956
Less Initial Outlay	260,956
NPV	0.0
Indicators for M& E	
Land area (acre)	1.0
No trees	50
No fruits per tree	333
Total no fruits	16650

2.3.1 Value share

Value share is expressed as a percentage of an actor's added value of the overall retail price or consumer price. The size of the value share reflects the amount of cost and risk that an actor has put in the chain.

In this strategy, the value share in the mango value chain has been considered between farmers, traders, exporters and processors. The value share is presented in the Tables 8, 9, 10 below.

- Value Share between Farmer and Trader – Retailer.
- Value Share between Farmer, Trader and Processor – Retailer.
- Value Share between Farmer, Trader and Exporter – Retailer.

In the first channel that comprises the Farmer and Trader/Retailer, the value share contributions for the actors are 60% and 40% respectively, while the corresponding gross margins are 18% and 12%. The second channel has more actors comprising the Farmer, Aggregator, Processor and Retailer with value shares of 9%, 2%, 24%, and 65% respectively, and gross margins of 12%, 10%, 29% and 50%. The third channel is made up of the Farmer, Aggregator, Exporter and Retailer with value shares of 15%, 14%, 53% and 18% respectively, and corresponding gross margins of 58%, 34% and 38% and 45%.

The analysis of the three channels, through which farmers sell their mangoes, indicate that the export channel has a fairer distribution of benefits and the farmer is better rewarded for his/her effort, cost and risk. In the export channel, the farmer is contributing 15% in value share and has an impressive gross margin of 58%. This could mean the farmers are benefiting more from improved production, increased productivity and reduced costs through the export channel compared to the other channels.

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Table 9: Value share between farmer and trader

Chain actor	Variable costs (KES/Kg)	Revenue (Selling price) KES/Kg	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	15	18.00	3	16.7%	18	60%
Trader/ Retailer	23.00	30.00	7	23.3%	12.00	40%
						100%

Table 10: Value share between farmer, trader and processor

V/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	15	17	2	12%	17	9%
Aggregator	19	21	2	10%	4	2%
Processor (Puree)	50	70	20	29%	49	24%
Retailer (Juice)	100	200	100	50%	130	65%
						100%

Table 11: Value Share between Farmer, Trader and Exporter

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	15	36	21	58%	36	15%

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Aggregator	46	70	24	34%	34	14%
Exporter	125	200	75	38%	130	53%
Retailer	220	245	25	10%	45	18%
						100%

CHAPTER 3

VALUE CHAIN CONSTRAINTS

3.1 Input Supply

8. The mango value chain begins from the input segment, where healthy, true-to-type seedlings are used. Other mango inputs consist primarily of poly bags, planting media, fertilizer/ manure, mother blocks, agrochemicals, and top working equipment. However, it's worth noting that data availability is wanting across the nodes. The main constraints at this node include:

9. **Inadequate clean planting material and certified mango nurseries:** Ninety percent (90%) of the nurseries where producers buy the seedlings are not certified, and this makes it difficult for producers to be sure of the variety. The small number of certified mango seedlings undermines productivity, fruit quality, and market access for Kenyan mango farmers, ultimately limiting their incomes and the growth of the sub-sector. Currently there are 13 nurseries registered by HCD and only 2 are certified by KEPHIS in the county, providing farmer's access to high-quality, and disease-resistant mango seedlings of improved varieties though inadequate.

10. **Inadequate certified mother blocks:** To supply scions for grafting, the existing mother blocks are domiciled at KALRO centers and prisons. Other mother blocks in Makueni County are domiciled at the 2 certified nurseries within the County. Thus, they are inadequate and are thinly spread within the County to meet nursery operators' needs. Inadequate certified mother blocks for mango in the County constrain the availability of quality planting materials, leading to productivity challenges, pest and disease risks, limited market access, and overall stunted growth of the mango industry.

11. **Limited research on propagation:** inadequate resource allocation to the mango sector has constrained research and development of the mango value chain thus low commercialization. The strategy proposes to engage public private partnerships to enable greater private sector participation in mango Research and Development agenda, in addition to enhancing facilitation of the introduction of improved mango varieties with global appeal as envisioned in the draft National Agriculture Research Systems Policy.

Limited technical know-how on technologies/innovations about nursery establishment: The limited technical know-how and technologies for mango nursery establishment in the county undermines the availability of quality certified planting materials, leading to productivity challenges, pest and disease risks, and missed market opportunities for mango farmers. To sustain the supply of planting media, there is a need for nursery operators to understand seed selection, grafting, planting media and proper care and management (pests and disease control) of seedlings. The nursery operators need to be supported with technical skills capacity enhancement on nursery management before their registration and certification.

3.2 Production

12. **Low mango production in acreage:** In Makueni County, mango production is concentrated in Makueni, Mbooni and Kaiti sub-counties. Other areas are along Athi River in Kibwezi East and West and some pockets in Kilome sub-county. Currently we are producing 199,626 MT against an annual demand of 250,000 MT which has a deficit of 50,374 MT demand. However, there are vast areas with big potential for mango acreage expansion but are still not utilized. This is the case in Mavindini, Kathonzweni, Kitise/Kithuki, Kalawa, Kikumbulyu South, Kikumbulyu North Nguu Masumba, Nguumo, Thange, Masongaleni, Ivingoni/Nzambani, Mito Andei and Kasikeu wards where large areas remain unutilized for rain-fed and irrigated mango production. This would also address the potential for increasing tree cover with the objective of climate change mitigation.

13. **Low productivity per tree among many mango farmers.** This is mainly due to poor crop husbandry practices and old orchards. On average, our mango trees yield below 200 fruits (70 kgs) per tree, but with good management, they can yield up to 500 – 600 fruits (180kg – 200kg) by the 7th year. Inadequate awareness and adoption of appropriate mechanization technologies and innovations for weeding, spraying, pruning compounds the challenge and in some instances results to the mango value chain unattractiveness to the youth. The consequential results are reduced/minimal incomes for smallholder farmers, neglect and farmers seek alternative high value crops like pixie oranges thus stagnating the industry growth and underutilizes the county's agro- ecological potential. Proper field management practices such as manure application, pruning, pest, disease, and weed control will increase tree productivity i.e. Technologies, Innovations and Management Practices (TIMPS).

Adverse effects of climate change in the County: Climate change is another challenge facing the mango industry in Makueni County. Changes in temperature and rainfall patterns have led to alterations in the flowering and fruiting of mango trees, thus resulting in reduced yields and increased susceptibility to pests and diseases. This has constrained mango production and productivity due to variations of seasonal climatic conditions. Frequent droughts and water scarcity leads to drying up of mango trees and low yields per tree. In addition, low uptake and adoption of efficient water harvesting and use of technologies, innovations and management practices contribute to low mango yields. Climate change poses a significant threat to mango production in the County, with alterations in temperature and rainfall patterns leading to low yields per tree. Moreover, warmer temperatures and altered rainfall patterns have created an environment more favourable for the proliferation of mango pests and pathogens, resulting in increased crop losses; the low adoption of efficient water harvesting and use of technologies, as well as innovative management practices, has exacerbated these challenges, as farmers often lack access to the necessary information, resources, and support to implement effective adaptation strategies. This

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strategy recommends building the capacity of mango farmers and promoting the adoption of climate-smart agricultural practices such as Technology, innovations and management practices (TIMPS) as crucial for the long- term sustainability of the mango industry in the county.

High cost and absence of Value Chain-based pesticides and chemicals: Even though major pesticides and chemicals needed for the control of pests and diseases are available, their prices are too high and beyond the reach of many smallholder farmers. In relation, New taxes imposed are pushed on to the end consumer during the production cycle. There are about **7 pesticides registered by the PCPB for use in mango production** in Kenya. However, despite being available, none of these chemicals are specific to mango production. The producers are faced with the challenge of knowing the right pesticides and chemicals and when to use them. For example, there are no listed and registered products for mango weevils in Kenya. Consequently, producers end up using pesticides registered for other crops on mangoes. This improper use of pesticides can result in the rejection of mango produce, particularly in the international markets, due to the presence of chemical residues. Addressing this challenge requires the registration of mango - specific pesticides, the development of affordable formulations, and the provision of training and guidance to farmers on safe use of these products.

Pests and Diseases infestation: Pests and diseases are the leading causes of low production of mangoes and, thus, the profitability of the mango value chain. The most important pests include fruit fly, mango seed weevil, mango aphids, mango mealy bug, thrips, mango scales, whiteflies, blackflies, mango leaf coating mite, mango leaf hopper, bark eating termites, and mango gall flies while the main diseases are anthracnose, black rot, die back, bacterial canker, stem end rot, and powdery mildew. For example, according to Kenya Plant Health Inspectorate Services (KEPHIS) and International Center of Insect Physiology and Ecology (ICIPE), the yield loss on mangoes caused by the fruit fly pest in Kenya is between 40% – 80% of the crop, depending on the locality, season, and variety. Disease and pest control is complicated by having old, tall, and large canopy trees, which are difficult to spray without a motorized pump. Limited skills to operationalize the few motorized pumps and poor crop management practices lead to flower and fruit drop, thus, low production and productivity.

The fruit fly infestation and mango seed weevil contribute to a loss in productivity and quality. The fruit fly (*Bactrocera (invadens) dorsalis*) was first reported in Kenya in 2003 (Lux et al 2003), before spreading to most parts of the country. Fruit fly infestation in Kenya affected export of mangoes due to quarantine restrictions in lucrative markets such as the EU and USA. KEPHIS and other stakeholders have implemented various mitigation measures to comply with the EU regulations. Some of these measures include the establishment of Low Pest Prevalence Areas (LPPAs) in two regions in the county

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implemented in two wards (Masongaleni and Nzau/Kilili/Kalamba) in the first phase covering 4,770 HA (3,675 farmers) in 2020. From this initiative, according to data analyzed in 2021, fruit fly population had reduced by 91.5% in Masongaleni and 86% in Nzau/Kilili/Kalamba wards respectively resulting in improvement of quality mango fruits and subsequent reduction in post-harvest losses in the said areas. In the second phase, LPPA was established in 8 wards (Wote/Nziu, Ukia, Kako/Waia, Kisau/Kiteta, Muvau/kikumini, Kathonzweni, Kitise/Kithuki and Mavindini) targeting 10,000 mango farmers. Awareness creation within mango farming communities, development of mango dossier for phase 1 was done, and market access incentives through the Public-private partnership were achieved. This strategy proposes establishment of hot water treatment plant(s) under the public-private partnership.

Table 12: Examples of mango pests and diseases

Pest	Disease
Mango Fruit Fly (<i>Ceratitis</i> spp. and <i>Bactocera</i> spp.) Fruit flies cause significant yield losses, with reports of 40-80% of mango fruits being damaged or destroyed by the pest. It is considered a quarantine pest in major export markets like the EU	Anthracnose (<i>Oidium mangiferae</i>) The disease can cause significant yield losses, with reports of up to 95% losses in some cases. It affects leaves, flowers, and fruits, leading to reduced fruit quality and marketability
Mango seed weevil (<i>Sternochetus mangiferae</i>). The pest is considered a quarantine pest in the EU. This disrupts the mango export supply chain and reduces earnings for farmers and the industry	Powdery mildew (<i>Colletotrichum gloeosporioides</i>) Powdery mildew can cause extremely high reductions in mango yield, sometimes reaching 70-90% on individual plants
Scale insects (<i>Coccidae: Hemiptera</i>) The presence of scale insects on mangoes and other fruits has led to trade restrictions and export barriers to important markets like the EU and China	Die-back (<i>Botryosphaeria ribis</i>), causes the death of twigs and branches, starting from the tips and progressing downwards. It affects 30-40% of mango trees, severely impacting on the overall productivity of mango trees
Mealybug (<i>Drosicha mangiferae</i>) The mango mealybug is considered an invasive and problematic pest for mango production in parts of Africa, including Kenya	Bacterial canker (bacterium spp.) It causes dark, sunken lesions on fruits leading to rotting and premature fruit drop, affecting the quantity and quality of mangoes available for sale.

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Limited Global GAP certification: Europe offers prime market opportunities for Kenyan mangoes in the international mango market. Moreover, the improved varieties, which include Apple, Kent, Tommy Atkins, Keitt, Van Dyke, and others, have some of the best flavors compared to other varieties grown in other parts of the world. Despite all these advantages, Kenyan mangoes have very limited opportunities in the European Union markets, which require Global GAP certification. Currently, this remains a major hindrance to getting into the European Union markets and limits our mangoes to only the Middle East markets where conditions are less prohibitive. Attaining Global GAP Certification is a lengthy and costly process, including sustaining the compliance process through certification renewal. Therefore, there is a need to provide supportive incentives to producers such as financial support or subsidies to help offset the costs of obtaining and maintaining Global gap certification

Additionally, establishing low pest prevalence zones and promoting hot water treatment for mangoes could help ensure our mangoes meet the stringent phytosanitary requirements of the European Union markets, coupled with concerted marketing effort to increase awareness of the Kenyan fruit. These measures would unlock the full potential of our mango exports to the lucrative European Union market.

Limited access to financial services for mango producers: Many mango producers do not have access to credit facilities from financial institutions. Many of the lenders give a grace period of only one month when producers need inputs, and yet mangoes are harvested, in most cases, six months after getting financing. This makes it difficult for producers to access finances for expansion. Moreover, the lack of contracts from major buyers makes producers unattractive to credit providers. Thus, the lack of access to affordable financial services is a major constraint to the growth and competitiveness of the mango value chain within the county. Addressing this challenge by expanding the availability of credit, savings, and insurance products tailored to the needs of mango value chain actors is crucial for unlocking the full potential of the County mango industry.

3.3 Processing

Mango processing can be classified into cottage or industrial. Cottage processing can be done both at the farm and also at SME level. Whereas most processors or farmer groups at the farm level use simple equipment, small & medium enterprises establish processor units while industrial processing requires more complex equipment that need intensive capital investment. At the processing node, the main challenges include:

Limited capacity among Small and Medium sized Enterprises (SMEs) to process quality products that are competitive in the local and regional markets. The limited capacity of SMEs to process mangoes into value-added products leads to high post-harvest losses, inconsistent product supply, inability to meet market demand, and reduced incomes for farmers. Access

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to credit facilities for SMEs to invest in processing technology and skills development is crucial for SME growth to increase mango off-take at farm level.

Seasonality of processable mango supply as the primary raw material for processing; The seasonality of mango production in the County which mainly lies within the December to March window creates significant challenges for the mango processing industry, including underutilization of capacity, inconsistent supply, post-harvest losses, and difficulty in planning and investment. Addressing these issues through improved storage, processing technology and better coordination across the value chain could help stabilize the mango processing sector. These issues would be addressed through introduction of late maturing mango varieties, adoption/use of technologies for off season production and processing. Finally, better coordination across the value chain could help stabilize the mango processing sector.

Limited awareness of mango value-added products by processors and industry players; Supply not well organized, with processors often lacking information on alternative marketing possibilities and value addition options leads to poor market access and high transaction costs. Currently, our processors have only two known mango processed products i.e. dried mango and puree.

Low demand for mango value-added products; Low demand for processed mango products within the county results in underutilization of processing capacity, seasonal operations, inability to meet export potential, high post-harvest losses, and reduced incomes for farmers. Addressing the constraints in the mango processing sector, such as improving supply chain coordination and investing in modern processing technologies, and promotion of local consumption of processed products could improve consistent demand of processed products in the market.

Competition from cheaper mango purees (and concentrate) from India; The influx of cheaper mango pulp from India poses a significant challenge for Kenyan processors, who are struggling to match the low prices. This is putting pressure on their profit margins and making it harder for them to retain customers in both domestic and export markets.

Low profit margins from mango puree as it is an intermediate product. The low profit margins from mango puree as an intermediate product have negatively impacted the overall profitability of the mango business in Kenya, as processors struggle to match the low prices of imports from India. This is a major challenge the industry is working to address through initiatives to reduce post-harvest losses and target higher-value export markets. The processors need incentives to seek higher-value export markets through participation in international trade fairs and exhibitions to create linkages with international traders in processed mango products.

3.4 Marketing

Poorly organized/un-coordinated mango marketing system; Farmers have few formal trading areas where quality control systems, buying and selling transactions, and efficient price determination mechanisms can take place. Poor organization of small-scale mango farmers in the county undermines their competitiveness, negotiating power, and access to profitable markets. The lack of an effective, coordinated mango marketing system in the county has led to high post-harvest losses, price volatility, and limited market access for mango farmers which are major constraints on the growth and profitability of the mango industry. A well-structured mango marketing system through strengthening of and establishment of farmer producer organizations (FPOs) is very important to streamline the mango enterprise.

Inadequate fruit handling facilities (aggregation and pack house); Low production by individual farmers, inadequate physical infrastructure and poor/dilapidated infrastructure in the markets, such as roads, cooling facilities, collection centers, and market facilities affect productivity. This coupled with inadequate fruit handling and aggregation infrastructure in the county has led to high post-harvest losses, price volatility, weak bargaining power for farmers, and challenges for processors - all of which have negatively impacted mango prices in the county.

Price fluctuations due to the seasonal production and thus supply of fresh mangoes; The seasonal nature of mango production in the county creates significant challenges for both farmers and marketers. Stabilizing mango prices and improving processing capacity are crucial to enhancing the competitiveness and resilience of the mango value chain.

Inadequate promotion and branding campaigns to promote fresh mangoes in export markets and mango value-added products; The inadequate promotion and branding of our fresh mangoes and mango products in export markets limits market diversification, prevents our producers from capturing higher prices, and undermines incentives for quality and value-addition improvements across the value chain. Organization of promotional campaigns such as trade fairs, mango conference, participation in National and international trade fairs and exhibitions need to be enhanced.

3.5 Policy and Regulatory Framework

The horticulture policy and regulatory framework in Kenya has a significant impact on the marketing and growth of the mango sub-sector in the following ways:

Enabling Environment; The partnership between the AFA and the mango-producing counties aims to create an enabling policy and regulatory framework that supports the growth and development of the mango industry. This includes developing regulations and guidelines to facilitate improved production, marketing, and trade of mangoes.

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Pest-Free Protocols; KEPHIS has played a critical role in designing and enforcing protocols for establishing areas of low pest prevalence (ALPPs) for mangoes. This has been crucial in lifting the previous export ban on Kenyan mangoes due to fruit fly infestations. The county will continue to work with KEPHIS in designing and enforcing protocols for establishing areas of low pest prevalence (ALPPs) for mangoes.

Facilitating Market Access; The policy and regulatory efforts have helped open up new export markets for Kenyan mangoes, Makueni included such as Jordan, the UAE, and China. This diversification of export destinations reduces the industry's reliance on traditional markets and enhances its competitiveness.

Promoting Sustainable Practices; The policy framework supports the adoption of integrated pest management (IPM) technologies and other sustainable practices among mango farmers to improve productivity and quality while minimizing environmental impacts.

Strengthening Institutional Coordination; The formation of the Makueni mango value chain platform has to an extent assisted to coordinate the efforts of various stakeholders, including the public and private sectors, to address challenges across the mango value chain, enhance self-regulation and ultimately an enabling environment for all value chain actors.

The mango, as a traded fruit, is guided by the National Horticulture Policy 2012, but there is need for specific end-to-end legal and regulatory frameworks to guide the mango value chain.

CHAPTER 4

STRATEGY DESIGN PRINCIPLES

14. The mango value chain Development strategy is designed on the following principles: inclusion; private sector participation, and climate smart agriculture.

3.6 Inclusion

15. Nationally, over 1,000,000 people derive their livelihoods from mangoes along the value chain (HCD report, 2021). The sub sector also employs people as market agents, transporters, processors, vendors, and exporters (private sector). Mango value chain contributes to household nutritional security by generating income, thus enabling families to participate in dietary diversification. All gender groups are represented in the value chain segments.

16. Women play a significant role in the production processes namely planting, weeding, farm yard manure application and trading at the retail groceries, main markets and by the roadside. The gender roles within the value chain have been implied culturally owing to the African cultural norm where some activities are considered masculine so women will be exempted from engaging in such activities unless with the aid of modern machinery.

17. Youth are assigned the role of harvesting, aggregation, spraying and transportation of the fruits because they are deemed energetic. Men carry a great responsibility in the value chain, including security, pruning, spraying, packaging, transportation and during value addition in processing plants. The public sector is equally active when it comes to the enactment and implementation of policies and regulations.

3.7 Private Sector Participation

18. The implementation of this mango value chain development strategy is private sector-led through partnerships and collaboration. This is in order to embrace commercial business models that will increase the competitiveness and growth of the mango sub-sector sustainably. This approach aims to have a broader and deeper engagement with the private sector players in the mango value chain, while letting the government play a more facilitative role. In the county, Iviani farm, Vert ltd, Keitt Exporters, Goshen Farm Exporters Ltd have worked closely with the department in provision of access to markets for the county mango farmers. In addition, Goshen Farm Exporters Ltd sought to support farmers on variety diversification with the famous Aphonso that is a preference for Europe markets. On the other hand, Milly Fruit Processors Ltd has offered to support farmers with re-establishment of mango orchards through provision of sabre rootstock.

3.8 Climate Smart Agriculture (CSA)

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19. Mango is an important component of agroforestry systems. It plays a role in reduction of greenhouse gases, reduces soil erosion and is part of conservation agriculture. In addition, it is amenable to inter-cropping with short duration crops such as pulses, thus enhancing soil fertility management and crop diversification. The private sector expression of interest to establish intensive mango production acreages will go a long way to bolster afforestation efforts in the county in a bid to enhance carbon sequestration.

20. The aim of adopting CSA practices in mango production is to increase productivity and household incomes, strengthen the resilience of ecosystems and livelihoods to climate change, and reduce Green House Gases (GHGs). Thus, the strategy will highlight mechanisms to reduce the impact of climate change such as breeding of new varieties, and adopting new technologies in the management of pests and diseases. The strategy will adopt climate smart agriculture where farmers will practice micro irrigation through use of farm ponds and drip irrigation

CHAPTER 5

INVESTMENT AREAS

21. The mango value chain development strategy will focus on four broad investment areas to address the gaps/constraints in the value chain analysis. The strategic focus shall be on increasing mango production and productivity, building the capacity of the farmers, processors and industry players on value addition, and developing markets and marketing infrastructure

22. The strategic objectives are:

- i. To increase mango production and productivity in the county by 30% by 2028.
- ii. To increase access to profitable output markets for mangoes by 2028.
- iii. To Increase processing and value addition efficiency in the County.
- iv. To create an enabling environment for the mango value chain actors

5.1 Objective 1: Increase mango production and productivity in the county by 30% by 2028.

23. **Activity 1: Build the capacity of nursery operators through training, equipping, and certification:** The existing nurseries are located within the mango growing areas in line with the mango suitability map. There is a need for establishment of three model nurseries at suitable sites with the most current technologies for training and research purposes. To ensure the sustainable availability of certified planting material, we need to have a minimum of 10 certified nurseries established through partnering with the private sector and other actors. Nurseries should be equipped with the necessary nursery materials and operators imparted with requisite skills on aspects like media preparation and treatment, grafting, hardening off, pest and disease control, and misting, among others. This activity will involve supporting these nurseries to be registered by HCD and certification by KEPHIS. The nurseries will supply desirable improved varieties (Tommy, Kent, Van dyke, Keitt, Apple and Alphonso) that are popular, high quality and in demand for both domestic and export markets. Ngowe variety will be promoted to meet increasing needs of mango pulp processors.

Activity 2: Establishment of mother blocks for provision of rootstock and scion materials for desirable varieties for processing and export: This will entail Identification, mapping and establishment of 3 mother block sites for provision of superior rootstock and scion materials. The following are the recommended superior rootstocks - Sabre, Peach, Turpentine and 13-1 by KALRO. The effort requires a multi-institutional team approach comprising officers from extension, KALRO, HCD, and KEPHIS.

Activity 3: Promote mango production in potential regions in the wards and optimize production in existing areas: Campaigns to upscale mango growing will target wards with high potential to expand mango production. The purpose will be to develop a mango production marshal plan to increase the number of farmers growing mangoes through the establishment of new orchards especially along river Athi where irrigation can be done to

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promote offseason production, productivity and growing of high yielding mango varieties for the different market segments. To promote the export market, the focus will be on Keitt, Kent, Tommy Atkins and Alphonso varieties while Ngowe, Alphonso and Apple shall be prioritized for processing.

Activity 4: Support training of service providers to give technical support to value chain actors: To develop a pool of technical resource persons within reach of smallholder farmers, extension service providers on specific field operations will be conducted. The recommended ration of Technical resource person to number of farmers is 1:200. This will include trainings on unproductive trees to rejuvenate them and change to superior and more marketable varieties where necessary, and training on pruning, spraying, pest and disease control and harvesting/fruit handling techniques. The trained service providers need to be supported with basic tools to provide services to farmers. The county TVET (ATC) will continuously support this activity with a well-developed curriculum for the mango value chain.

24. **Activity 5: Support Farmer Producer Organizations (FPOs) to attain Global GAP Certification and /or KS 1758.** For purposes of increasing the quality of our mangoes in the domestic and international markets, it will be necessary to support on technical services for adherence to Global GAP-GRASP/KS1758 training and certification services for Global GAP option 2 and KS 1758 standards. The focus will be to capacity build 10 FPO's from the main mango growing areas on Global GAP Option 1 and KS 1758 certifications.

25. **Activity 6: Improve fruit harvesting and post-harvest handling** This will involve the development of training materials on proper fruit handling techniques and training of service providers, extension officers and farmer's in partnership with private sector players.

26. **Activity 7: Establishment of new and Maintenance of the existing areas of low pest prevalence in mango growing areas:** There are already 2 existing areas of low pest prevalence (LPPA) in the county but we need to add new LPPA to include the areas with potential for mango acreage expansion. There is therefore need to maintain these low pest prevalence areas to ensure the gains so far achieved are sustained in collaboration with KEPHIS, ICIPE, MoALD, PCPB and other interested partners

27. **Activity 8: Review and disseminate Technologies, Innovations and Management Practices (TIMPs):** The county TOTs/Extension will disseminate TIMPs that address, yield, soil fertility, and water management. Of particular importance are TIMPs that will address pest and disease management, flower induction, quality mangoes, and irrigation system to enable off-season production. There is need for increased research in partnership with KALRO to develop/validate new TIMPs for continuous improvement in production and productivity.

5.2 Objective 2: To increase access to profitable output market for mangoes by 2028

28. **Activity 1: Development of markets and market infrastructure.** This will entail: construction and equipping market infrastructure in the county. The key market infrastructures will include equipped aggregation centers, including fruit ripening chambers, fruit handling and treatment facilities. Special emphasis will be on hot water/ vapor treatment for management of fruit fly menace, and cold chain logistics to enhance food safety for local and export markets. The target is to develop one common user facility within the main fruits producing belt in the County. Specific equipment to include recommended weighing scales, sorting and grading tables, and fruit handling items (crates, pallets) shall be available where producers, traders, marketing agents, and transporters trade in mangoes in line with a set of pre-agreed guidelines.

29. **Activity 2. Strengthening of Mango Value Chain Platforms:** There is need to make the existing Makueni Mango Value Chain Platform vibrant in order to continuously bring together the different Value Chain actors and stakeholders, enhance self-regulation of the sector and ensure farmers get a fair share within the value chain.

30. **Activity 3: Participation in 2 annual domestic and international trade fairs/ exhibitions to promote and brand Makueni mango.** This will involve facilitating development of Makueni mango brand, incentivize the SME's to participate in domestic, Regional, international trade fairs/exhibition to promote county mango products e.g. local agricultural shows and fairs.

5.3 Objective 3: To Increase processing and value addition efficiency in the County

31. **Activity 1: Build the capacity of processors and industry players on value addition.** Develop capacity of the existing and new processors to undertake mango value addition including introduction to diverse value added products. These processors need be supported to undergo necessary training on emerging value addition technologies and acquisition of required certifications from regulators. Special emphasis will be on women and youth groups to grow their enterprises.

32. **Activity 2: Business incubation of SMEs involved in mango value addition:** This will aim to support SMEs survive and grow, during the start-up period, growth-oriented business support services and resources tailored to young firms, retaining market share, building or accelerating growth in the local industry and diversifying. This will include supporting the SMEs to develop business models in addition to participation in trade development initiatives as part of market development for mango value-added products. This will broaden their exposure and networks, thus enabling them to access the premium markets. Emphasis should focus on business development, brand development, patenting, support to

conduct promotional campaigns and market linkages.

33. Activity 3: Support processors to acquire appropriate mango processing technologies to enhance the competitiveness of their products. Incentives geared towards supporting processors to acquire appropriate agro-processing equipment for drying, juicing among other value addition operations. This activity aims at developing the capacity of processors to attain recommended food safety management certifications like Hazard analysis and critical control points (HACCP).

5.4 Objective 4: To strengthen the mango value chain regulatory framework

34. Activity 1: Facilitate development of mango regulatory framework through appropriate technical working groups. This may also include data repository and management.

35. Activity 2: Facilitate sector working groups at the county level to roll out the regulatory framework.

36. Activity 3: Capacity building and technical assistance to enhance enforcement and compliance.

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CHAPTER 6

TARGET AREA AND BENEFICIARIES

6.1 Target areas for expansion

103 Currently Makueni has over 4 Million Mango trees covering 19,904 Ha of land and grown by over 71,265 farm families. Annual production is estimated at 199,626 MT valued at KES 5.989 billion. The main mango producing sub counties are Makueni, Mbooni and Kaiti. However, there is high potential for expansion in Kibwezi West, Kibwezi East and Makueni sub-counties.

104 **The County has the following main existing processors** namely the Makueni Fruits Development and marketing Authority, Iviani farm and Makueni County Fruit Processors Co-operative. However, there are other processors based in Machakos county-Vert Ltd and Burton & Bamber who source from Makueni County farmers. There are also other offtakers like Keitt Exporters, Premier Foods, Kenisan Exporters, RTC fruit etc. These and many more will be crucial for the development of the value chain.

105 Other beneficiaries will be service providers, nursery operators and farmer producer organizations and common interest Groups.

106 The engagement of mango value chain actors will be based on and further developed by stakeholders. Data and facts will guide the selection to ensure that it is based on available socio-economic data and will include: (i) potential to develop and improve the production of mangoes in existing growing areas, opening up new production areas, and extending the production season (ii) potential to develop and improve access to markets, (iii) availability of farmers who can undertake commercial production, (iv) socio-economic data and the population of mango farmers, and (v) potential SMEs to participate in value addition and agro-entrepreneurship.

Table 13: Main Mango producing wards and beneficiaries

Ward	No. of Farmers
Emali/Mulala	1,862
Ilima	4,372
Ivingoni/Nzambani	947
Kako/Waia	3,906
Kalawa	2,007
Kasikeu	2,867

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Kathonzweni	1,797
Kee	2,528
Kiima Kiu/Kalanzoni	1,197
Kikumbulyu North	366
Kikumbulyu South	843
Kilungu	1,216
Kisau/Kiteta	6,231
Kithungo/Kitundu	1,985
Kitise/Kithuki	732
Makindu	513
Masongaleni	726
Mavindini	1,791
Mbitini	3,031
Mbooni	1,524
Mtito Andei	401
Mukaa	1,630
Muvau/Kikumini	3,720
Nguu/Masumba	1,692
Nguumo	748
Nzaui/Kilili/Kalamba	6,500
Thange	1,226
Tulimani	5,224
Ukia	5,634
Wote/Nziu	4,049
TOTAL	71,265

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Table 14: Mango Strategy Implementation Matrix

OBJECTIVES/ACTIVITIES	TARGET						
	Baseline	2024	2025	2026	2027	2028	Total
Objective 1: Increase mango production and productivity in the Country by 30 % by 2028							
Activity 1: Build the capacity of nursery operators through training, equipping, and certification			5	5			10
Activity 2: Establishment of 3 mother blocks for provision of rootstock and scion materials of desirable varieties for processing and export markets			1	2			3
Activity 3: Carry out 26 promotion campaigns on mango production in potential wards and optimize production in existing areas			13	13			26
Activity 4: Support training and linkages of 210 Service providers to give technical support to value chain actors			105	105			210
Activity 5: Train and support 10 farmer producer organizations (FPOs) on Global GAP Certification and /or KS 1758			5	5			10
Activity 6: Training 210 Service providers on proper fruit harvesting and handling techniques			105	105			210
Activity 7: Establishment (1) and maintenance of	Continuous						

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existing (2) ALPP’s in the County							
Activity 8: Support technology transfer initiatives to main mango growing areas to disseminate Technologies Innovations Management Practices (TIMPs	Continuous						
Objective 2. To increase access to profitable output markets for mangoes							
Activity 1: Development of 3 new common user facilities (Kibwezi, Kalamba and Wote) (Aggregation center with coolers, hot water/vapor treatment, post-harvest handling facilities) to increase direct uptake of mangoes from farmers for onward trading			1	2			3
Activity 2: strengthening of the Makueni Mango Value Chain Platform			1	1	1	1	4
Activity 3: Participation in 2 annual international trade fairs/exhibition to promote and brand Makueni mango			2	2	2	2	8
Objective 3. To increase mango processing efficiency and value addition in the county							
Activity 1: Build the capacity of 10 SME processors and industry players on value addition			10				10
Activity 2: Conduct 3 market studies of suitable			1	1	1		3

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mango value-added products and market potential							
Activity 3: Support business incubation for 10 mango SMEs in mango value addition			10				10
Activity 4: Support 10 SMEs to acquire appropriate processing equipment/ technologies			10				10
Objective 4. To create an enabling environment for the mango value chain							
Activity 1: Support technical working groups to develop a mango regulatory framework			1				1
Activity 2: Facilitate 1 sector working groups to roll out the regulatory framework			1				1

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CHAPTER 7

Budget

1. The estimated budget for the implementation of the Makueni Mango value chain Development strategy for the five (5) year period is KES. The budget includes the cost of implementation of strategies for increased mango production, developments of market infrastructure, capacity building in value addition, and development of guidelines to enhance the mango regulatory frameworks.

7.1 Project Budget Summary

Table 15: Project Budget Summary

OBJECTIVES/ ACTIVITIES	BUDGET						
	Rate/Unit (KES)	2024	2025	2026	2027	2028	Total (KES)
Objective 1: Increase mango production and productivity in the Country by 30 % by 2028							
Activity 1: Build the capacity of nursery operators through training, equipping, and certification	700,000		5	5			7,000,000
Activity 2: Establishment of 3 mother blocks for provision of rootstock and scion materials of desirable varieties for processing and export markets	500,000		1	2			1,500,000
Activity 3: Carry out 26 promotion campaigns on	500,000		13	13			13,000,000

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mango production in potential wards and optimize production in existing areas							
Activity 4: Support training and linkages of 210 Service providers to give technical support to value chain actors	15,000		105	105			3,150,000
Activity 5: Train and support 10 farmer producer organizations (FPOs) on Global GAP Certification and /or KS 1758	1,000,000		2	5	3		10,000,000
Activity 6: Training 210 Service providers on proper fruit harvesting and handling techniques	15,000		105	105			3,150,000
Activity 7: Establishment (1) and maintenance of existing (2)	17,500,000		2	1			52,500,000

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ALPP's in the County							
Activity 8: Support technology transfer initiatives to main mango growing areas to disseminate Technologies Innovations Management Practices (TIMPs	100,000		15	15			3,000,000
Objective 2. To increase access to profitable output markets for mangoes							
Activity 1: Development of 3 new common user facilities (Kibwezi, Kalamba and Wote) (Aggregation center with coolers, hot water/vapor treatment, post-harvest handling facilities) to increase direct uptake of mangoes from farmers for onward trading	100,000,000		1	2			300,000,000
Activity 2: strengthening of the Makueni	300,000		1	1	1	1	1,200,000

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

Mango Value Chain Platform							
Activity 3: Participation in 2 annual international trade fairs/exhibition to promote and brand Makueni mango	1,500,000		2	2	2	2	12,000,000
Objective 3. To increase mango processing efficiency and value addition in the county							
Activity 1: Build the capacity of 10 SME processors and industry players on value addition	500,000		10				5,000,000
Activity 2: Conduct 3 market studies of suitable mango value-added products and market potential	1,000,000		1	1	1		3,000,000
Activity 3: Support business incubation for 10 mango SMEs in mango value addition	1,000,000		10				10,000,000
Activity 4: Support 10 SMEs to acquire	2,000,000		10				20,000,000

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

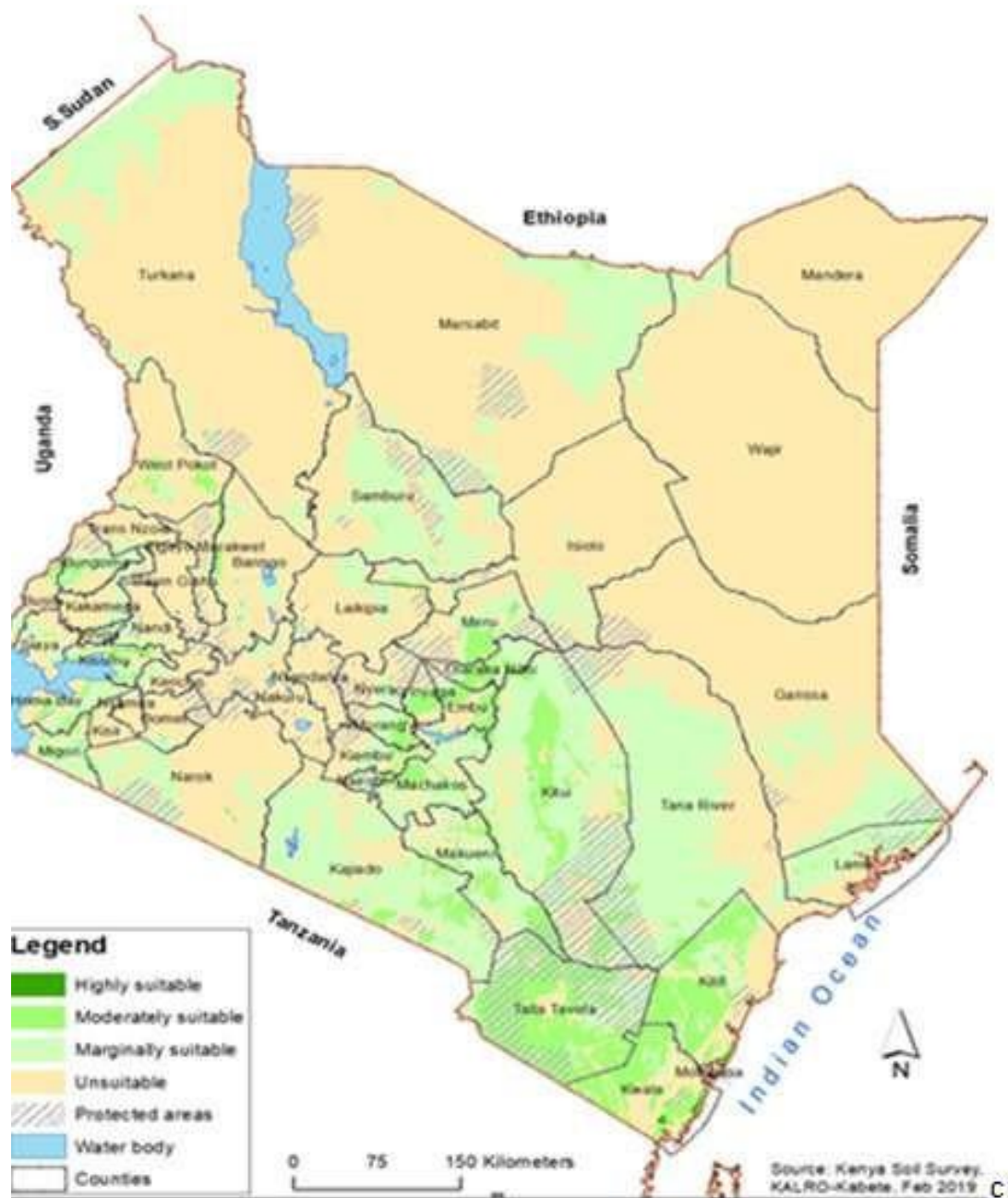
appropriate processing equipment/ technologies							
Objective 4. To create an enabling environment for the mango value chain							
Activity 1: Support technical working groups to develop a mango regulatory framework	5,000,000		1				5,000,000
Activity 2: Facilitate 1 sector working groups to roll out the regulatory framework	6,000,000		1				6,000,000
TOTAL							455,500,000

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

ANNEXES

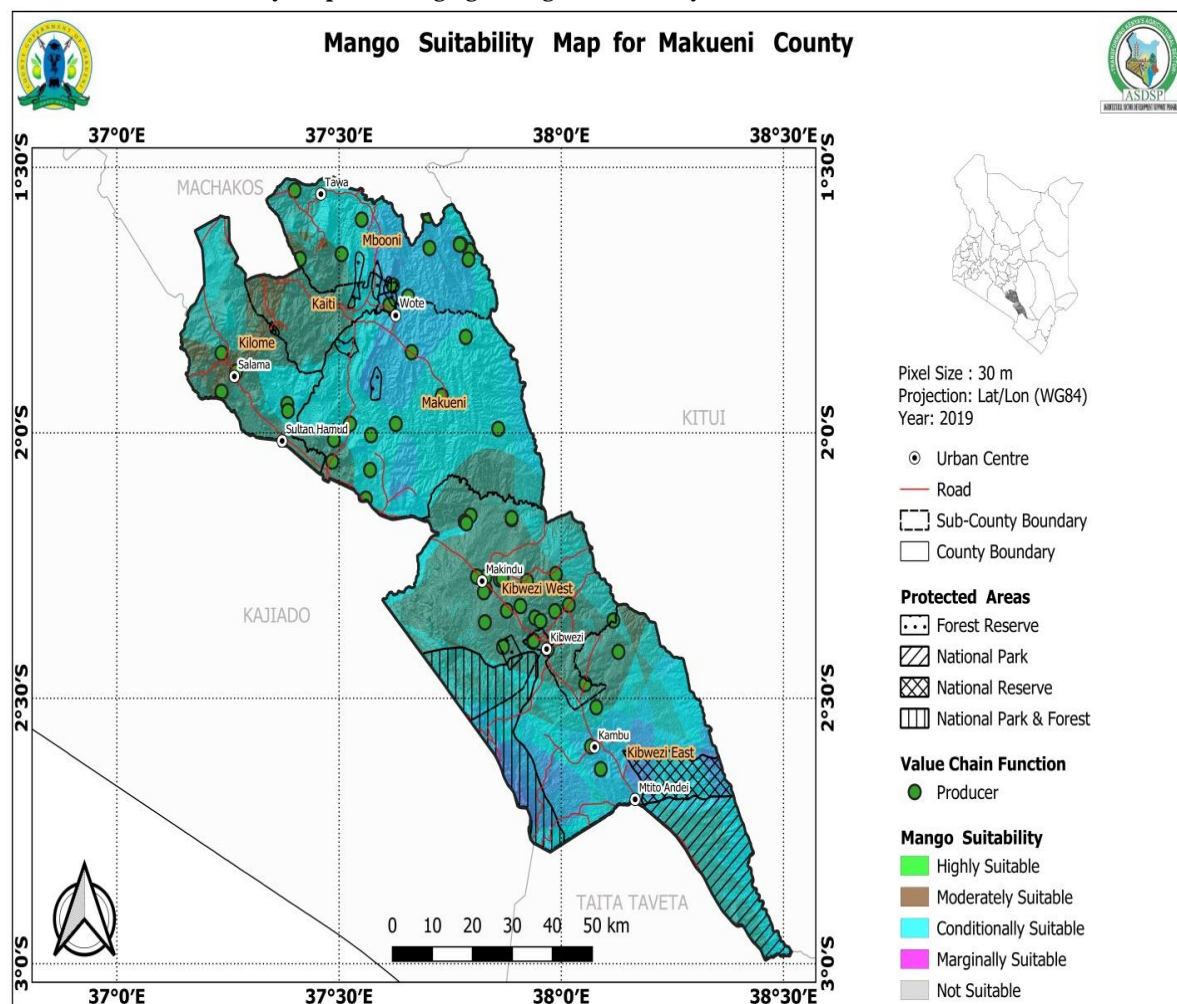
Annex 1: Land suitability map for mango growing in the country

LAND SUITABILITY MAP FOR MANGO GROWING IN KENYA



MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

Annex 2: Land suitability map for mango growing in the county



MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

Annex 3: Gross Margin Analysis; for 1 Hectare of Improved Mango Varieties Under Average Management

Gross Margin Analysis for 1 hectare of Improved mango varieties under Average management									
ITEM	Year and Cost								
	1	2	3	4	5	6	7	8	9
No. of plants per ha	123	123	123	123	123	123	123	123	123
Yield (No. of fruits/tree)	-	0	20	80	250	450	600	800	1000
Yield (Total Number of fruits per ha)	-	0	2,460	9,840	30,750	55,350	73,800	98,400	123,000
Yield (Tons/ha) -1 fruit=400gms	-	0	0.984	3.936	12.3	22.14	29.52	39.36	49.2
Returns/@ KES 5 per fruit/ha	-	0	12,300	49,200	153,750	276,750	369,000	492,000	615,000
Land preparation	4,000	0	0	0	0	0	0	0	0
Cost of grafted seedling (KES 150/Seedling)	18,450	0	0	0	0	0	0	0	0
Hole preparation (Digging and filling) 200 per hole	24,600	0	0	0	0	0	0	0	0
Planting	6,150	0	0	0	0	0	0	0	0
Manure/Year(2.5 MT)	7,500	7,500	7,500	7,500	7,500	7,500	7,500	8000	8000
Fertilizer DAP /Year	6,500	0	0	0	0	0	0	0	0
Fertilizer CAN/NPK /Year	-	-	2,300	2,500	3,000	3,000	5,000	5,000	6,000
Insecticide cost	3,000	3,000	3,500	4,000	5,000	5,000	6,000	6,000	7,000
Fungicide costs	5,000	5,000	6000	7000	7000	7000	8000	8000	10000
Labour cost/year	10,00	10,00	10,00	10,0	10,00	10,00	10,00	1000	1000

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

	0	0	0	00	0	0	0	0	0
Total Cost/year	81,100	25,500	29,300	31,000	32,500	32,500	36,500	37,000	41,000
Cash flow /year	(81,100)	(25,500)	(17,000)	18,200	121,250	244,250	332,500	455,000	574,000
INVESTMENT ANALYSIS OF Mangoes – 1 Ha									
Money Flows (KES)	End of Year								
	1	2	3	4	5	6	7	8	9
Initial investment	81,100	25,500	29,300	31,000	32,500	32,500	36,500	37,000	41,000
Annual revenue	0	0	12,300	49,200	153,750	276,750	369,000	492,000	615,000
Annual Costs	81,100	25,500	29,300	31,000	32,500	32,500	36,500	37,000	41,000
Gross annual flow	(81,100)	(25,500)	(17,000)	18,200	121,750	244,250	332,500	455,000	574,000
Notes									
Production is expected to start from 3rd year after establishment of orchard									
At year 3 and 4, though the farmer gets some revenue, the amount does not cover the cost of production incurred over the years.									
Farmer begins to break-even from year 5 selling at KES 5 per piece									
Cumulative production from 3rd to 5th year will be 17,220 kg (43,050 fruits @ approx. 400gm)									
Cumulative cost of production for the period is KES 199,400									
This means that the cost of production of 1 kg of mango is KES 11.58 (199,400/17,220)									

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

Annex 4: Mango Value Chain datasheet; November 2023

		Parameters	Units	Current Actual 2022	Targets for 2027	GAP ANALYSIS	Increase (%)
M	1	Global population	No.	8,033,545,117	8,333,078,316	299,533,199	4
M	2	Global per capita consumption	kg	9.8	12.1	2	23
	3	Global production MT	MT	58,956,698,000	64,774,500,392	5,817,802,392.16	10
		Global demand (MT)	MT	56,234,815,819	100,830,247,624	44,595,431,805	79
		Global Exports	MT	2,300,000,000			
	4	Global Imports	MT	2,200,000,000	2,417,094,337	217,094,337	10
M	5	Kenya population	No.	56,215,000	62,544,000	6,329,000	11
M	6	Per capita consumption Kenya	kg	18	20	2	11
	8	Annual Production	kg	758,374,000	879,160,998.28	120,788,998	16
M	7	Amount demand-Local KE	Kg	1,011,870,000	1,250,880,000	239,010,000	24
M		Total available for marketing	kg	435,546,822	791,244,898	355,698,076	82
Q		Post-harvest loss	kg	303,348,800	87,916,100	(215,432,700)	-71
P		Total produced	Kgs	758,372,000	879,160,998	120,788,998	16
		Global Yield (MT) per Acre	MT	5.5			
P	9	Total imported (MT)	-		219,790,250	219,790,250	#DIV/0!
M	7	Farm Consumption	kg	19,476,378	21,618,780	2,142,402	11
		Actual Marketed in Kenya (Domestic Market)	kg	423,362,792	773,915,257	350,552,465	83
M		Total Export Amount of Mango	kg	12,184,030	17,329,641.14	5,145,611	42

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

M	#	sold by informal traders	kg	381,026,513	619,132,206	238,105,693	62
M		Number of Registered Marketing Agents	No.	74	81	7	10
M		Amount sold by cooperatives/ farmer groups	kg	42,336,279	46,569,907	4,233,628	10
M		Number of registered exporters	No.	35	93	58	166
M		Open markets (Wet market)	No.	22	235	213	968

		Parameters	Units	Current Actual 2022	Targets for 2027	GAP ANALYSIS	Increase (%)
		Total number of farmers		796,867	1,000,000	50,555	25
8		Number of mango varieties	No.	60	60	-	0
P/B		Mother Blocks	No.	2	12	10	500
P/B		Number of registered nurseries	No.	110	178	68	61
P/B		Number of certified nurseries	No.	110	178	68	61
P/B		Total number of seedlings	No.	1,320,000	3,552,192	2,232,192	169
P/B		Number of seedlings per nurseries	No.	12,000	20,000	8,000	67
P/B		Total number of certified seedlings	No.	12,000	20,000	8,000	67

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

P/Q	Number of areas of low pest prevalence/certified area of export	No.	2	20	18	900
P/Q	Mango Harvesting pole and hook	No.	4,044	5,055	1,011	25
P/Q	Number of Agro-dealers	No.	10,000	12,500	2,500	25
P/Q	Technical advisor	No.	-	5,000	5,000	
P/Q	Number of Mango training centre of excellence	No.	1	7	6	600
P/Q	Mango demonstration farm	No.	1,100	4,500	3,400	309
P/Q	Number of TVETS skilling Technical advisor/farmer	No.	26	47	21	81
Q	Number of simple coolers-small aggregation center	No.	44	660	616	1400
Q	Mobile cold chain (export)	No.	`	`	`	`
Q	Number bulk coolers (MTs)/pack houses	No.	30	47	17	57

		Parameters	Units	Current Actual 2022	Targets for 2027	GAP ANALYSIS	Increase (%)
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MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

Q		Number of postharvest treatment facilities (General)	No.	1	22	21	2100
Q		Number of hot water bath facilities(export)	No.	2	3	1	50
VA		Kg processed	kg	72,000,000	118,686,735	46,686,735	65
VA		Number of Mango processors (Puree)	No.	10	11	1	10
VA		Number of Mango cottage processors (crisp, wine, juice)	No.	12,000	12,010	10	0
VA		Installed daily (Average) processing capacity per processor	MT	43,227	56,195	12,968	30
		Utilized (Average) daily Processing Capacity	MT	25,936	44,956	19,020	73
VA		Number of processed products categories		10	15	5	50
VA		Volume of Mango processed in kg/ day		259,364	449,563.64	190,200	73
M/Q		Number of transporters (local market)		79	103	24	30

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

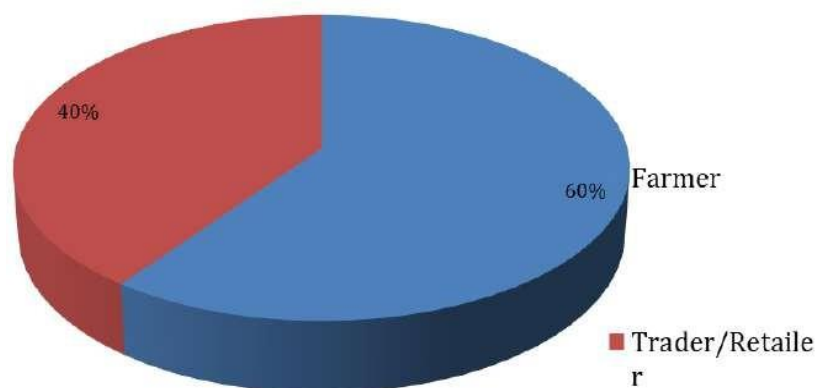
Annex 5: Mango Orchard Establishment Costs

Item	Description	Rate KES	total	5 years
Land preparation (Initial)	1 acre	5000	5,000	5,000
Fruit tree seedlings (rootstock) + grafting	50	100	5,000	5,000
Planting holes	50	100	5,000	5,000
Water (20 litres@ 1/- per litre / Plant/1 a month/3months for five years)		12,000	12,000	36,000

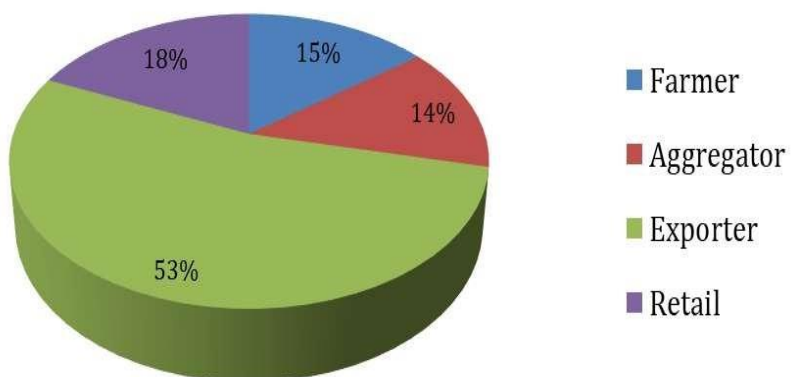
Item	Description	Rate KES	total	5 years
Manure application labour (@50/- per tree once/year)	50	50	2,500	12,500
Cost manure/acre for first three years	5 Tonnes	Lump Sum	20,000	60,000
Spraying @ 10 times/year @50/-	1 acre 10 sprays/ year@100/- per pump	1,000	1,000	5,000
Farm chemicals 2 litres pesticides/yr x 2500	1 acre using 2 litres of spray chemicals @2,500	5,000	5,000	25,000
pruning, pest scouting,	50 trees 100/- per tree 2 times a year	100	10,000	60,000
weeding, Clearing	1 acre weeding per year	3,000	3,000	6,000
Subtotal for establishment costs				217,500
Management costs per year	20% total cost			43,500
GROSS TOTAL				261,000

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

Value share Farmer to Trader/Retailer

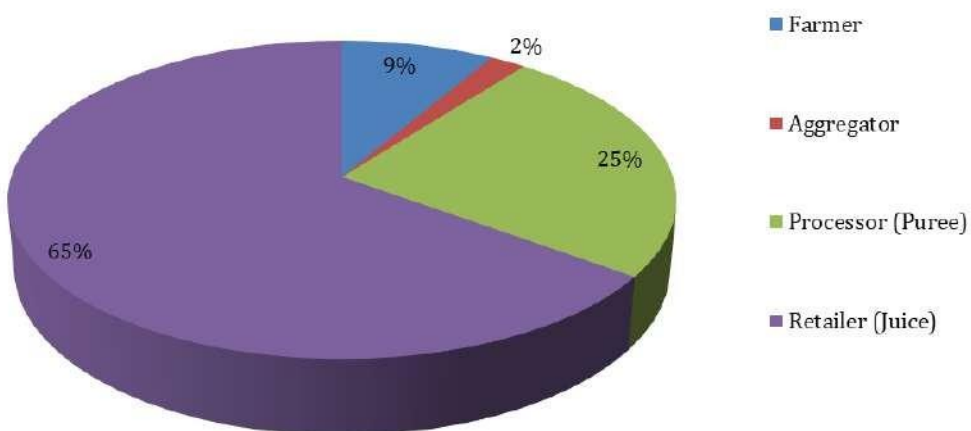


Value share



Value Share: Farmer Aggregator Processor Retailer

Value share



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MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

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Vision 2025 Makueni County

CIDP 2023-2027 Makueni County

CSA 2022 Makueni County

MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

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MAKUENI COUNTY MANGO VALUE CHAIN DEVELOPMENT STRATEGY

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