



**USAID**  
FROM THE AMERICAN PEOPLE

# USAID-KAVES MANGO VALUE CHAIN ANALYSIS



**January 2015**

This publication was prepared by Fintrac Inc. for review by the United States Agency for International Development.



**Fintrac Inc.**

[www.fintrac.com](http://www.fintrac.com)

[info@fintrac.com](mailto:info@fintrac.com)

**US Virgin Islands**

3077 Kronprindsens Gade 72

St. Thomas, USVI 00802

Tel: (340) 776-7600

Fax: (340) 776-7601

**Washington, DC**

1400 16th Street, NW

Suite 400

Washington DC 20036

Tel: (202) 462-8475

Fax: (202) 462-8478

**USAID-KAVES**

Karen Office Park

3<sup>rd</sup> Floor Baobab, Suite H

Langata, Road, Karen, Nairobi

## FORWARD

*The goal of the Kenya Agricultural Value Chain Enterprises (USAID-KAVES) project is to increase the productivity and incomes of smallholders and other actors along targeted agriculture value chains, thereby enhancing food security and improving nutrition.*

*This report is one of a series of detailed analyses covering five value chains (maize, dairy, mango, ware potato, and French bean) conducted by USAID-KAVES to identify critical constraints/gaps and prioritize high-return program interventions that will contribute to the program's core objectives of:*

- *Increasing the competitiveness of selected agricultural value chains to mitigate food insecurity, improve nutrition, and increase the incomes of the rural poor;*
- *Fostering innovation and adaptive technologies and techniques that improve nutritional outcomes for rural households, sustainably reduce chronic under-nutrition, and increase household consumption of nutrition-dense foods; and*
- *Increasing the capacity of local organizations to sustainably undertake value chain work.*

*While drawing upon the extensive body of existing research on targeted Kenyan valued chains, USAID-KAVES' analysis further builds on and updates those findings with primary data obtained through field surveys and interviews with value chain participants.*

# CONTENT

Executive Summary	6
1. Introduction and Background	11
2. Consumption and Demand Analysis	13
2.1 National Demand Estimation	13
2.2 Export Demand	14
2.3 Price Seasonality Trends	16
2.4 Characteristics and Requirements of Principal Buyers	16
2.5 Summary of Key Findings	17
3. Supply Analysis and Production Potential	18
3.1 Overview of Production Areas and Varieties	18
3.2 Production Trends and Key Drivers of Production	20
3.3 Supply Projections	21
3.4 Supply Constraints and Threats	22
3.4.1 Productivity Constraints	22
3.4.2 Marketing and Postharvest Constraints	22
3.4.3 Poor Transportation and Marketing Infrastructure	23
3.4.4 High Cost of Transportation	23
3.5 Summary of Key Findings	23
4. The Mango Value Chain MAP	24
4.1 Input suppliers	24
4.1.1 Seedlings Suppliers	25
4.1.2 Fertilizer Suppliers	25
4.1.3 Other Farm Inputs	26
4.2 Farmers	26
4.2.1 Smallholder Farmers	26
4.2.2 Medium and Large Scale Farmers	27
4.3 Marketing actors	28
4.3.1 Small-Scale Rural Assemblers/Brokers	28
4.3.2 Wholesalers	28
4.3.3 Transporters	29
4.4 Processors	29
4.5 Exporters	29
4.6 Retailers	30
4.7 Summary of Findings	31
5 Margins Analysis	33
5.1 Farmers	33
5.2 Rural Assemblers/Brokers	37

5.3	Wholesalers	37
5.4	Transporters	38
5.5	Retailers	38
5.6	Exporters	38
5.7	Processors	39
5.8	Summary of Value Accumulated	40
5.9	Summary of Key Findings	41
6	Business Enabling Environment	43
6.1	Supporting Organizations	43
6.1.1	Implementing Institutions	43
6.1.2	Private Sector Associations	44
6.1.3	Research, Extension, and Information	45
6.1.4	Service Providers	45
6.2	Regulatory and Policy Environment	45
6.2.1	Legal and Regulatory Framework	45
6.2.2	Policy Regime	46
6.2.3	Devolution of Agricultural Policies	46
6.2.4	Price Control and Taxation	46
6.2.5	Grades and Standards	47
6.3	Infrastructure	47
6.3.1	Transport Infrastructure	47
6.3.2	Rural and Urban Market Facilities	47
6.3.3	Irrigation	47
7	Upgrading Interventions	48
ANNEX I: REFERENCES		50
ANNEX II: LIST OF ACRONYMS		52

# EXECUTIVE SUMMARY

*Mango is an important cash crop in Kenya, particularly in semi-arid areas where there are limited income generating activities available to local communities. Production has increased by an average of at least 13 percent since 2000, while exports have increased by an average of more than 18 percent in the same period. Kenyan yields (13.1MT/HA) compare favorably with global averages, however a number of quality and cost issues often prevent Kenyan producers from getting their product to market. More research is necessary to map and quantify the number of mango trees, varieties, age and future yield potential since current official data differs significantly from the data collected by targeted field surveys. Postharvest losses, estimated at up to 40 percent of total production, continue to weigh down the volume of produce available for domestic, export and processing markets. The demand for processed mango in the country is currently outstripping supply, with processors operating at only 40 percent capacity. There are opportunities for smallholders in both domestic and export markets, but to profit from market access, they need to substantially increase the quality of their fruit. There is a need to improve efficiency along the whole value chain and reduce the cost of doing business through investments in production, postharvest infrastructure, storage and aggregation facilities.*

## INTRODUCTION AND METHODOLOGY

There are over 200,000 small-scale farmers in Kenya that derive their livelihood from mango production. Many more benefit from the economic opportunities provided by the mango value chain, including trade, transport, export, and processing activities. The potential benefits of the sector are currently limited by supply conditions; to move beyond these limitations, stakeholders in the sector must focus on improving orchard management, access to quality planting material, and control of pests and diseases. There is also a shortage of varieties suitable for processing into juice. It is estimated that more than 1.5 million new mango trees were established in the last five years, reflecting the growing interest in the mango as a source of income for rural households.

Since many studies in the past have analyzed various aspects of the mango value chain, a desk review was carried out to determine existing gaps in the literature and to identify areas for further data collection and analysis. The team built upon the existing literature by carrying out a SWOT analysis in consultation with all members of the KAVES technical team, KAVES' subcontractors, and other mango stakeholders, to help guide the remaining aspects of the research. Based on this process, field surveys, focus group discussions (FGDs) and key informant interviews were carried out to update existing information, analyze secondary sources, and provide primary data specific to the KAVES target areas. Data collected as part of the KAVES baseline survey of 1,800 farmers was analyzed and pooled with a second panel survey selected from the first 16,000 farmers receiving KAVES' support. Finally, a smaller survey of traders was carried out to obtain specific information on costs and margins at different levels of the value chain. Primary data validation was carried out through a series of FGDs with farmers, traders and processors in selected target counties.

## SUMMARY OF KEY FINDINGS

### Consumption and Demand Analysis

Demand for mangoes will be driven by growth in fresh, processing, and export markets. Neither processors nor exporters are currently able to satisfy their demand for mango; interviews suggest that only 40 and 50 percent of their demand is met, respectively. Domestic demand for fresh mango fruit is projected to grow from 610,000 MT in 2014 to 955,000 MT in 2022, mainly driven by income and population growth. Demand for mango in the processing industry is projected to grow from 50,000 MT in 2014 to an estimated 250,000 MT in 2022, driven by increased demand for juice in the local and regional markets. Additionally, export demand for fresh fruit is expected to grow from 13,900 MT in 2014 to 51,000 MT in 2022, driven by seasonal production advantages and diversification of markets

and products. Taking these markets together, total demand is expected to increase from 623,900 MT in 2014 to 768,600 MT in 2017 and 1,006,000 MT in 2022.

### Supply Analysis and Production Potential

Mango production grew by an impressive 22 percent between 2006 and 2011 (HCDA, 2010, 2012), and is expected to continue grow quickly through 2022. This growth is being driven by an increase in area under production, increasing yields from newly established orchards, and investment in good orchard management technologies. Additional growth will come from non-traditional production areas in North Eastern, Nyanza, Western and Rift Valley regions. Production is expected to reach 878,000 MT in 2017 and 1,415,000 MT in 2022. Accounting for postharvest losses (which are forecast to drop from 40 percent in 2013 to 25 percent in 2022), available supply is expected to reach 614,000 MT in 2017 and 1,057,000 MT in 2022. Given these forecasts, Kenya will struggle to meet demand in 2017, with a potential supply deficit of 154,600 MT. However, by 2022, supply is expected to exceed demand by 51,000 MT, which will likely open up further opportunities for processing and export.

### The Mango Value Chain Actors

**Input Suppliers:** Important input suppliers to the mango value chain include nursery operators and agro-chemical dealers. There are an estimated 200 certified nurseries and over 8,000 agro-chemical dealers in the country. Access to seedlings remains a major challenge for farmers. Likewise, long average distances to agro-chemical dealers limits the ability of farmers to buy appropriate inputs.

**Farmers:** There are approximately 200,000 smallholder farmers, supplying approximately 65 percent of total national mango production. Farmers tend to have inadequate knowledge of orchard management, which is compounded by limited access to inputs, expertise and potentially useful public services or infrastructure—leading to low yields and low returns to their labor.

**Marketing Agents:** These include village assemblers, brokers and wholesalers, who face numerous challenges ranging from poor infrastructure and unreliable transport, high post-harvest loss rates, to relatively expensive raw materials. A lack of appropriate transport and packaging technologies contribute to the high post-harvest losses. Inadequate organization of marketing agents substantially increases logistics times and costs, including those related to aggregation.

**Processors:** There are four established mango processors, with a total installed capacity of 88,000 MT per year. More plants planned in Makueni, Kitui and other counties. Most processors specialize in pulp and juice, with only one currently producing concentrates. Processors operate at about 40 percent capacity, as a result of shortages of suitable raw material created by seasonality, shortage of varieties suitable for processing and competition from fresh produce buyers.

**Exporters:** Kenyan mangoes are relatively expensive in export markets because of the high cost of air freight. Despite high prices, Kenyan mangoes sell in Middle Eastern markets because they are available outside of Indian and Pakistani seasons. In addition to high prices, exporters face difficulties in procuring high quality fruit due to poor postharvest practices, high local transport costs, and lack of cold chain facilities in many production areas.

### Margins Analysis

The analysis shows that the establishment cost for an acre of mango is about KSh38,500 (50 trees) and a further KSh14,500 per year to maintain it for 25 years. At full maturity (5-7 years), an acre yields 12 MT per year, at unit cost of KSh1.37 per kg. Our results indicate that investing in improved mango production is profitable, with internal rates of return (IRR) ranging from 57% to 89% over the 25 years. From the farm gate, the mangoes go through mostly the fresh produce markets, but increasing to processing and export markets as well. The flow results in the costs, value added and gross margins summarized in Table 22 (reproduced below). The value of mangoes increases by KSh73 from farm gate to retail markets, KSh33 through processors, and KSh149 through exporters. The greatest generator of value along the fresh mango market channel is the retailer at 45 percent, followed by wholesalers at 25 percent and farmers at 22 percent. Among marketing actors, exporters earn the highest absolute

margins (KSh39 per kg) despite paying the highest prices, while processors pay the lowest prices and earn the highest margins (51 percent).

### Summary of Cost and Gross Margins for Mango Value Chain Actors (per kg)

Item	Producer	Assembler	Wholesaler	Retailer	Processor*	Exporter*
Purchase price	-	18	24	42	13	36
Total cost	2.30	19	32	57	17	112
Selling price	18	24	42	75	36	151
Gross margin	16	5	10	18	18	39
Percent gross margin	87%	22%	22%	24%	51%	26%
Value added	16	6	18	33	23	115
Percent of value added	22%	8%	25%	45%	68%	77%

Source: USAID-KAVES calculations. \* Assumes direct procurement from farmers

In terms of economic value, for every KSh1 invested in mango production a further KSh32.60 and KSh65.65 is created through the fresh fruit and export channels, respectively. Approximately KSh24-36 of the value created is retained in the rural economy for every kilogram of mangoes produced. From the 360,000 MT of mangoes available in 2013, mango producing rural economies earned approximately KSh10.8 million (assuming an average KSh30 retained value per kg), which makes mango production a powerful economic driver. These rural incomes can more than double through improved systems and, from our projections in Section 3.3, would more than triple by 2022.

### Enabling Environment

**Policy regime:** The government has articulated its support for the horticulture sector through the development of the horticulture policy. Under the LAPSET corridor development strategy, large-scale production of mangoes with out-grower schemes was identified as one of the three priority agricultural value chains, a promising development for the Kenyan mango sector, which could boost production by up to 200,000 MT.

**Supporting Organizations and Institutional Actors:** Institutional structures to support the development of the mango industry remain weak. There are a lack of standards and enforcement mechanisms to ensure production, handling, and processing of quality mango products. Research in the mango industry remains passive and unsupportive of industry's aggressive push for increased market share regionally or abroad.

**Infrastructure:** Poor rural feeder roads, lack of appropriate transport infrastructure (including port facilities for export), inadequate market structures, and lack of produce collection and storage facilities are some of the infrastructure challenges causing market inefficiencies along the mango marketing chain.

## UPGRADING INTERVENTIONS

Based on the information and analyses provided above, this section outlines interventions for the mango sector, with a focus on small-scale producers, that will increase on-farm productivity, streamline aggregation, and improve storage and postharvest systems. These are organized into three strategic components:

1. **Increase productivity** - agronomic and pest management technologies that will increase yields, improve quality and raise productivity
2. **Aggregation and marketing** – including a national mango survey; group capacity building; and establishment of collection centers, with grading systems and the appropriate provision of rural transportation and packaging services;
3. **Postharvest handling and standards** – training and new techniques to improve quality and reduce wastage.



The three components are supported by eight strategic interventions and 26 objectives that will increase productivity, streamline aggregation, and improve market systems for fresh and processed mangoes. Interventions have been selected that will contribute directly to the goals and objectives of KAVES, and are highly scalable through private sector partnerships, with varying levels of public sector support. The interventions all rely heavily on the mass adoption of new technologies, supported with specialist training and extension; new sources of investment and credit to unlock value chain constraints; and engagement of private sector partners for market development and sustainability.

Recommended interventions	Specific upgrading objectives	Challenges	Expected results
<b>Strategic intervention I: Increase Productivity</b>			
<b>1. Increase awareness and planting of varieties for processing</b>	1. More linkages established between nursery operators and mango farmers 2. Quality of certified tree nurseries improved 3. Farmers have more information on different varieties	<ul style="list-style-type: none"> <li>• Predominance of varieties unsuitable for processing</li> <li>• Time lag between planting and production</li> <li>• No national mango strategy</li> <li>• Weak regulation of nurseries</li> </ul>	<ul style="list-style-type: none"> <li>• Better distribution of varieties</li> <li>• Increase in marketing agreements</li> <li>• Increased productivity and production over the medium term</li> </ul>
<b>2. Promote integrated pest management</b>	4. Input suppliers and farmers have more information on approved agrochemicals 5. Increase in trained teams to provide spraying services 6. Reduction in mango weevil and fruit fly infestation 7. More productive orchards	<ul style="list-style-type: none"> <li>• Erroneous or lack of pesticide labelling</li> <li>• Lack of qualified trainers</li> <li>• High cost of pesticides approved for export markets relative to generics</li> <li>• Fake products</li> </ul>	<ul style="list-style-type: none"> <li>• Improved fruit quality</li> <li>• Reduced postharvest losses</li> <li>• Increased production</li> <li>• Better prices and higher income from mangoes</li> </ul>
<b>3. Increase use of custom fertilisers</b>	8. Fertility and organic content of orchards increased 9. Farmers adopt soil testing and use custom fertilizer 10. Fertilizer application systems improved	<ul style="list-style-type: none"> <li>• Cost</li> <li>• Most farmers plant trees to avoid input costs</li> <li>• Absentee growers</li> </ul>	<ul style="list-style-type: none"> <li>• Improved yields</li> <li>• Better quality fruits</li> <li>• Time to first crop reduced</li> <li>• Higher sales and incomes</li> </ul>
<b>Strategic intervention II. Increase aggregation and collective marketing</b>			
<b>4. Support a national mango survey</b>	11. Data obtained on distribution and age of varieties for market forecasting 12. Baseline established for county level planning 13. Greater interest in Kenyan mango products from international buyers	<ul style="list-style-type: none"> <li>• High cost of satellite imaging</li> <li>• National consensus of stakeholders required</li> </ul>	<ul style="list-style-type: none"> <li>• New national mango strategy formulated and agreed</li> <li>• Export sales of fresh and processed mango increase</li> <li>• Farmers' sales and incomes increase</li> </ul>
<b>5. Build capacity of farmer groups</b>	14. More marketing groups formed 15. Availability of pruning, spraying and harvesting services increased 16. More collection centres established 17. Marketing agreements increased	<ul style="list-style-type: none"> <li>• Large distances between farms</li> <li>• Resistance from brokers</li> </ul>	<ul style="list-style-type: none"> <li>• Increased sales and incomes</li> <li>• Orchard management improved</li> <li>• Market risk reduced</li> </ul>

<b>Strategic intervention III: Improve quality and reduce postharvest losses</b>			
<b>6. Improve postharvest handling systems</b>	18. Farmers trained on harvesting indices and field handling 19. Sorting and grading at field and collection centre levels increased 20. Improved fruit quality 21. Improved shelf life of the fruit	<ul style="list-style-type: none"> <li>• Large size of trees</li> <li>• No price incentives</li> <li>• Investment needed</li> </ul>	<ul style="list-style-type: none"> <li>• Higher returns to farmers and first level traders</li> <li>• Exports increased</li> <li>• New markets supplied</li> </ul>
<b>7. Introduce quality standards</b>	22. Farmers trained and adopting new national standard KS 1758:2005 23. Standard weights and measures adopted	<ul style="list-style-type: none"> <li>• No price incentives</li> <li>• Weak regulatory</li> </ul>	<ul style="list-style-type: none"> <li>• Increased market access</li> <li>• Safer products</li> <li>• Higher net returns</li> </ul>
<b>8. Scale up niche processing operations</b>	24. KHCP-assisted microprocessors evaluated 25. New investments in mango products obtained 26. New products developed	<ul style="list-style-type: none"> <li>• Food safety standards difficult to meet for export markets</li> <li>• Local market for dried fruit still small</li> <li>• May need new investment</li> </ul>	<ul style="list-style-type: none"> <li>• Processing industry growth</li> <li>• Reduction in postharvest wastage</li> <li>• Rural employment created</li> </ul>

# I. INTRODUCTION AND BACKGROUND

Mango is the second most important fruit crop in Kenya after bananas in terms of production volumes. In 2012, the Horticultural Crops Development Authority (HCDA) estimated annual mango production at 781,706MT, with a value of KSh13.5 billion. It is also of growing importance as an export crop, accounting for 15.6 percent of the total value of fruit exports and 3.6 percent of the total value of horticulture exports in 2012. Mango export earnings increased from KSh623 million (US\$7.2 million) in 2009 to KSh1 billion (US\$11.8 million) in 2011.

Mango can be cultivated in a variety of different agro-ecological zones across Kenya, ranging from sub-humid to semi-arid zones, and grows in areas that are often not suitable for other cash crops (Kehlenbeck, K., et al. 2010). The principal areas of mango production include the eastern and coast regions (responsible for 85 percent of national mango production), followed by Central Region and other emerging producing areas such as Nyanza, Rift Valley, North, and Western Region (HCDA, 2012). The two main varieties of mango produced in Kenya include Apple (50 percent of produce from Eastern Region) and Ngowe (49 percent of produce from Coast Region).

There are over 200,000 small-scale farmers that derive their livelihood from mango production. Many more benefit from the mango chain in trading, transport, export and processing. Within the eastern and coast region, more than 1.5 million new mango trees were established in the last five years, pointing to the growing importance of the fruit to small-scale farmers. These farmers face challenges related to proper orchard management, access to quality planting material, pests and diseases, and market access. Mangoes are also an important driver of the growing fruit processing industry for domestic and export markets. However, most of the mango processing firms operate at or near 40 percent capacity, due to a lack of raw material suitable for processing companies.

The report is organized as follows: Section 2 provides an analysis of domestic consumption and demand characteristics. Section 3 examines production/trade trends and estimates future supply under various scenarios. Section 4 describes the roles and dynamics affecting the various players across the mango value chain (highlighting key actors, their interactions and critical constraints and gaps). Section 5 examines gross margins along the value chain using primary data collected through field surveys. Section 6 provides an overview of key constraints to the business enabling environment. Based on the gaps, constraints and opportunities identified, Section 7 provides recommendations for “upgrading interventions” along the value chain where USAID-KAVES is best placed to stimulate increases in productivity, and reductions in postharvest losses.

## Methodology

Because various aspects of the mango value chain have been the subject of numerous other studies and analysis over the past decade, a preliminary SWOT analysis was carried out in consultation with all members of the USAID-KAVES technical team, subcontractor Farm Concern International (FCI) and other mango sector experts to determine the most critical gaps and constraints within the value

### Justification for Mango as a USAID-KAVES Targeted Value Chain

- ◆ An important source of income for smallholders in the arid and semi-arid areas of the country, with over 200,000 small-scale farmers that derive their livelihood from mango production.
- ◆ Growing importance of the commodity as an export crop.
- ◆ Potential for supporting agribusiness development in trade, export and agro-processing.
- ◆ Growing fruit juice demand locally and internationally of which mango is an important raw material.
- ◆ Kenya boasts among the highest mango productivity in the world and can exploit its favorable agro-climatic conditions for mango cultivation
- ◆ Kenya’s competitiveness in the mango sector is partly derived from the seasonality of production
- ◆ Buyers of Kenyan mango are a ready market, seeking to expand import volumes

chain and to identify areas where further data collection, research, and analysis were needed to prioritize interventions. Based on this initial SWOT analysis (see Table I), field surveys, focus group discussions (FGDs), and key informant interviews were carried out to update outdated information, validate secondary sources, and particularly to obtain primary information specific to USAID-KAVES' targeted geographical areas.

Table I: SWOT ANALYSIS

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> <li>• Availability of subsidized fertilizer</li> <li>• Availability of grafted seedlings</li> <li>• Availability of fertile and productive land</li> <li>• Favorable climatic conditions with reliable rains</li> <li>• Availability of fresh, processing and export markets</li> <li>• Increasing demand for juices</li> <li>• Value chain with many actors</li> <li>• Production season advantage over competing countries in the Middle East market</li> </ul>	<ul style="list-style-type: none"> <li>• High cost of inputs, including pesticides, fuel, fertilizer, and seedlings</li> <li>• Price fluctuations and delayed payment by buyers</li> <li>• Inadequate storage facilities</li> <li>• Disease and pest infestation, especially mango weevil, fruit fly and anthracnose</li> <li>• Poor postharvest management and Good Agricultural Practices</li> <li>• High cost of aggregation</li> <li>• Production of many varieties in small scattered quantities</li> <li>• Lack of water for supplementary irrigation</li> <li>• High postharvest losses</li> </ul>	<ul style="list-style-type: none"> <li>• Substantial installed processing capacity</li> <li>• Growing domestic markets</li> <li>• Value addition into other products</li> <li>• Formation of producer groups for better marketing</li> <li>• Export markets in Middle East</li> <li>• Production of early maturing varieties for export markets</li> </ul>	<ul style="list-style-type: none"> <li>• Rapidly declining soil fertility</li> <li>• High and escalating cost of inputs</li> <li>• Unpredictable weather patterns</li> <li>• High prevalence of pests and diseases</li> <li>• Competition of cheap fresh mango imports in Kenya's mango export destinations.</li> <li>• Competition from cheap imported juice concentrates.</li> </ul>

All relevant studies and data were reviewed and are discussed in this study, in some cases with alternative analyses carried out and interpretations made. These are referenced throughout the study and all sources are listed in Annex I. Supplementary data was collected using Rapid Rural Appraisal (RRA) surveys with mango farmers in the larger Makeni and Machakos Counties and interviews with wholesalers in major mango markets in Mombasa and Nairobi to determine farm gate prices, methods of pricing, access to markets and challenges faced by farmers in accessing inputs, services and markets. Stakeholder consultations were also conducted with processors, mango exporters, HCDA, and the FPEAK mango commodity coordinator to validate production and market information. Finally, a smaller survey of mango wholesalers was carried out to obtain specific information on margins and losses at the wholesale level.

## 2. CONSUMPTION AND DEMAND ANALYSIS

This section provides a discussion of current demand conditions and provides estimates of demand growth through 2022. We build consumption and demand scenarios to evaluate the future of the mango industry in Kenya, including how changing demand in the fresh and processed industry will affect returns to farmers and industry alike.

### 2.1 National Demand Estimation

There are three sources of demand for mangoes in Kenya: the fresh market, the processing market and the export market. Demand is estimated to have grown at 24 percent per year between 2006 and 2009, outpacing global and regional demand of 2.2 percent and 3.4 percent, respectively (GoK, 2012). The most recent per capita consumption estimate from the GOK suggests that Kenyans consume 12.7 kg of mango per year (GoK, 2012). Using mango production data from HCDA and the GOK's population statistics for 2012, we estimate slightly lower annual per capita consumption at 12.45 kg.

The Kenya Mango Business Plan (GoK/FPEAK/ITC, 2012) estimates annual per capita consumption of mango as follows: fresh market (300,000 MT, 83.3 percent), processing market (50,000 MT, 13.9 percent), and export market (10,000 MT, 2.8 percent) in 2013. The report assumes 40 percent of the mangoes are lost as a result of postharvest losses, in line with estimates from industry sources. The same report also estimates dramatic long term increases in demand for Kenyan mangoes based upon growing regional and international demand: by 2022, fresh market demand is expected to reach 707,384 MT, the processing market is expected to reach 300,000 MT and the export market is expected to hit 50,000MT<sup>1</sup>. To meet the expanded demand the Plan envisages a reduction in postharvest losses from the current 40 percent to 25 percent by 2022 and an annual growth rate of production of 10 percent. This optimistic rate of potential growth is shared by Grow Africa (2012), which notes considerable opportunity to increase mango production to supply the domestic, processing and export industries. In our analysis, we estimate that per capita consumption of 12.45 kg in 2014 will grow to 18.1kg by 2022, as a result of increased consumer incomes in line with GDP growth (i.e., at five percent per year) as consumer incomes grow.<sup>2</sup> We also assume the population will grow at a declining rate from 2.7 percent to 2.5 percent as shown in Table 2.

**Table 2: Projected Mango Consumption in Kenya 2012 – 2022 (MT)<sup>3</sup>**

Year	2012	2013	2014	2015	2016	2017	2020	2022
Population (000)	41,920	43,052	44,214	44,329	45,482	46,619	50,201	52,742
Population growth rate (%)	2.7	2.7	2.6	2.6	2.5	2.5	2.5	2.5
Per capita consumption (kg)	12.45	13.1	13.8	14.5	15.2	16	17.4	18.1
Total Domestic Consumption ('000 MT)	522	564	610	643	691	746	873	955
Domestic Fresh Consumption ('000 MT)	472	514	560	568	591	621	673	705
Domestic Processed Consumption ('000 MT)	50	50	50	75	100	125	200	250
Projected Export (000MT)	10	11.8	13.9	16.3	19.2	22.6	36.8	51.0
Total Demand ('000 MT)	532	575.8	623.9	659.3	710.2	768.6	909.8	1,006

Source: GoK Investor Roundtable on Investment Opportunities in the LAPSET Corridor; Investor presentation. May 2012, Authors Calculations

<sup>1</sup> Other recent demand estimates produced by the government (e.g., GoK May 2012)<sup>1</sup> are considered unrealistic based on the exclusion of postharvest losses from their calculations.

<sup>2</sup> This is the current estimated GDP growth rate in Kenya, which has been forecast to increase to about 7 percent in 2015. This is a conservative growth compared to the estimated 24 percent recorded between 2006 and 2009.

<sup>3</sup> This assumes a conservative annual growth rate of 10% compared to the 24% growth rate observed between 2006 and 2009.

Local demand is projected to increase from 564,000MT (fresh 514,000 MT fresh and 50,000 MT processed) in 2013 to 746,000MT (621,000 MT fresh and processed 125,000 MT processed) in 2017 and 955,000MT (705,000MT fresh and 250,000MT processed) in 2022. These estimates are broadly in line with the Kenya Mango Business Plan. Based upon these projections, in 2022, 26 percent of the local consumption will be processed compared to 10 percent in 2013. The local mango processing industry is estimated to be operating at only 40 percent capacity, largely due to an erratic supply of mangoes (Mango Working Group, July 2011). Mango processors interviewed for this report noted that plants tend to process mango for about four months per year given the poor supply of raw materials. They also mentioned that it is difficult to compete with the fresh and export markets, which are able to offer better prices.

## 2.2 Export Demand

Kenya remains a small player in the international mango trade, exporting approximately two percent of national production or one percent of the fresh mango traded on the world market (GoK/ITC/FPEAK, 2012).<sup>4</sup> In 2011, Kenya earned KSh1 billion (US\$11.8 million) from mango exports.<sup>5</sup> Between 2006 and 2010, Kenya's mango exports grew by 17.7 per annum, the sixth fastest rate of growth across exporting economies (ITC, 2012). We project exports will grow to 22.6 MT in 2017 and to 51,023 MT in 2022 (Table 3). These projections corroborate the National Mango Business Plan estimate of 50,000 MT in 2022 (GoK/FPEAK/ITC, 2012). Similar to the processing sector, mango exporters cannot procure sufficient volumes of mango to meet demand for their product. Exporters suggest that they can only meet 50 percent of potential export demand due to the limited supplies of quality fruit that meets export requirements (Mango working Group, July 2011). Three distinct export markets are discussed below, highlighting the potential for increased trade in the near term. Of these, only the Middle East makes up a sizable portion of the current export basket. The quality of produce and the varieties produced mean that importers still prefer mango from other markets, but this is changing gradually.

**Middle Eastern Market:** The Middle East remains the principal buyer of Kenyan mango, with the United Arab Emirates (UAE) purchasing nearly 90 percent of the country's exports. Saudi Arabia has also become an important buyer of Kenyan mango, growing by 5 percent between 2006 and 2010. Overall, Kenya's exports to the Middle East grew by 18 percent between 2005 and 2008, second only to Yemen (26 percent). Other exporters experienced significant declines in growth to the same market, including India (15 percent), Pakistan (6 percent) and Egypt (66 percent) (ITC, April 2012).

**Table 3: Kenyan Mango Exports to the Middle East, by Volume (MT) and Value (KShM)**

Year	Quantity MT	Value KSh Millions	Growth Rate
2007	3,152	211	
2008	5,948	404	89%
2009	8,977	623	51%
2010	8,386	804	-7%
2011	10,685	1,015	27%
Average	7,430	611	40%

Source: UN Comtrade

The Kenyan mango market share in Middle East has increased from 3 percent to 7 percent showing the potential for Kenya to continue selling in the market (Table 4). Recent analyses of the sector have concluded that Kenya's share of the Middle Eastern market will continue to grow; most recently the Mango Business Plan projected a doubling of exports as a share of total production from two percent to about four percent. Kenyan exporters report that their success in these markets is primarily attributable to two factors:

- The suitability of Kenya's Ngowe variety for juicing, which represents the primary form of consumption for imported mangoes in these markets, and
- The relative absence of competing volumes from India, Pakistan and Yemen during the Kenyan export season.

<sup>4</sup> Kenya does not import any fresh mangoes but imports mango juice concentrates.

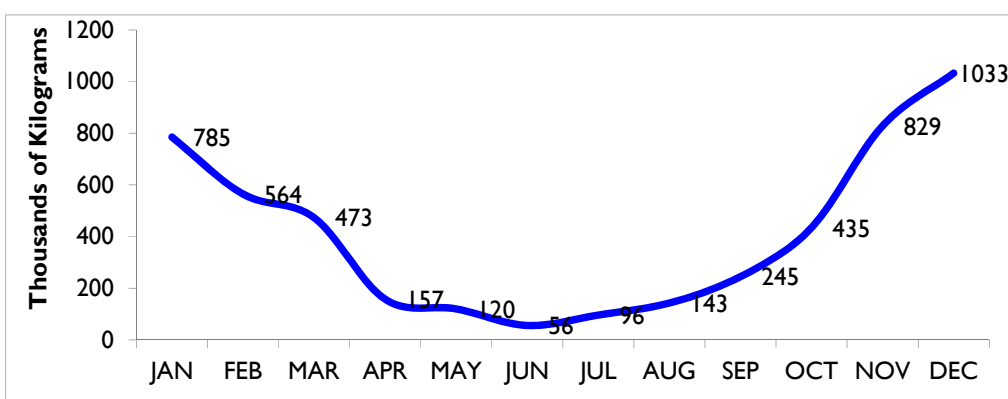
<sup>5</sup> Disaggregated fruit export data for 2012 and 2013 not currently available

**Table 4: Middle East Mango Import Trends 2006 – 2010**

Imports	2006	2007	2008	2009	2010	CAGR
Volume (MT)	86,490	153,107	123,410	164,678	97,909	3%
Value (000 US\$)	54,432	97,303	90,129	114,835	63,194	4%
Value (US\$/MT)	629	636	730	697	645	1%
Kenya's market share			3%	3%	7%	

Source: ITC, 2012

Kenyan mangoes remain significantly more expensive than those from India or Pakistan. The high CIF price is partially explained by the use of airfreight to transport the mangoes.<sup>6</sup> The airfreight cost per kilogram of fresh/ perishable cargo from Nairobi to Middle East is a minimum of US\$0.8 (Kenya airways freight costs). However, while Kenya mango export prices are higher than competitors over the year, the seasonality of production provides Kenya with a window of export opportunity. India, which is a major competitor in the UAE market, starts exporting in March with exports peaking in June, while production in Kenya peaks in the months of October to December, when production in other countries is low (Figure 1).

**Figure 1: Kenya Mango Exports, in Thousand Kilograms (Jan – Dec 2012)**

Improving the efficiency of Kenya's shipping system (e.g., port and sea freight) and quality of mangoes through improved production and postharvest handling, will enhance Kenya's chances of continuing to meet or exceed the growth trajectories laid out in this chapter.

**European Union Market:** In 2010 the European mango market was estimated at 370,000 MT (ITC, April 2012). The market peaks in December-January as a result of the Christmas and new year celebrations period (ITC, April 2012). This happens to be also the peak period for production of mangoes in Kenya. About 10% of the mangoes are transported by air and are of superior quality targeting high end markets. There is little near term possibility of market growth in EU for Kenyan mangoes. This is due to the high cost of air transport, failure to comply with lack of traceability requirements, limited adoption of Global Good Agricultural Practices (GAP), and lack of suitable varieties. In addition, the preferred varieties in the European market are Kent and Tommy Atkin which are not widely grown in the country. Mango weevil and fruit fly common pests affecting mango production in Kenya are prohibited in the European market.

**China Market:** In 2009 China and Hongkong imported (126,349 MT) of world mango imports and this rose to (101,076 MT) by 2012. Although Kenya has not exported mango to China, the current direct airlink and good trade relations provides a potential market for Kenyan mango exporters. The cost of air transport could however be a major bottleneck. The major trading partners with China on mango are Thailand, Indonesia, Phillipines and Mynamar which have a distance advantage.

<sup>6</sup> Lack of a regular dedicated horticulture berth at the port, lengthy documentation procedures by KRA and KPA, and a lack of regular arrivals and departures of vessels hamper sea freight in Kenya.

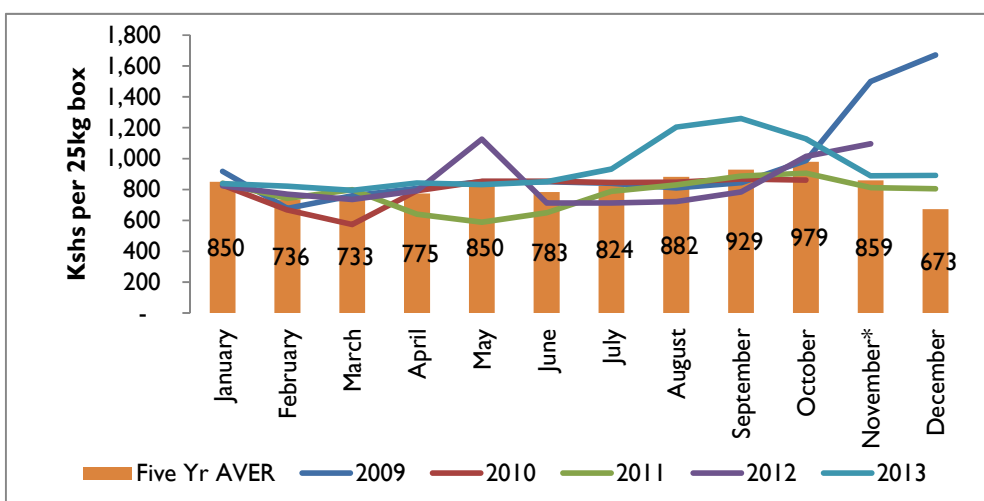
**Regional Markets:** Regional trade in mango is not expected to grow significantly in the near term. Tanzania is the principal destination in the region; available statistics from UN Comtrade show that Kenya exported an average of 2,310 MT per year between 2008 and 2010 (Mbwika, 2012).

As Kenya considers opportunities for expanding export market for fresh mangoes, four questions arise: (i) How can the structure of the grower-exporter relationship be changed to permit effective product traceability? (ii) Can Kenya continue to compete in the markets of the Middle East against cheap competition from Pakistan and India? and (iii) Does it make sense for Kenya to convert its varietal mix in order to compete effectively on the European market? (iv) Does Kenya have any regional or local options that would be an improvement over its current sales to Tanzania?

### 2.3 Price Seasonality Trends

Ministry of Agriculture price data shows minimal price variation across months (Figure 2). The wholesale price per 25kg bag over the 2009 – 2013 period shows that there has been a steady increase (21.4 percent) in prices from KSh 774/25kg bag to KSh 940/25kg bag. On a monthly basis the prices are lowest between January and June. This coincides with the main harvest period of Ngowe mangoes in the coast region, which is October to March (ABD, March 2009). The prices tend to peak between August and November when production is especially low.

Figure 2: Ngowe Mango Nominal Wholesale Monthly Prices in Nairobi Markets 2009 -2013



### 2.4 Characteristics and Requirements of Principal Buyers

There are three principle markets for mangoes in Kenya: the domestic fresh fruit market, the processing market, and export market. Mangoes destined for the domestic fresh market do not have to meet stringent quality requirements, with the exception of those targeted at high-end supermarkets and tourist hotels. However, local buyers do pay attention to insect damage, variety, and maturity of the fruit. In a study conducted in the coast province, Ndung'u et al (2008) observed that mangoes destined for the domestic market were sorted by size, maturity, and desired market destination.

Mangoes targeted at processing industry do not have strict quality standards as those targeting high end fresh markets or the export market. Specifically, processors judge quality along the following criteria: maturity, ripeness (within two days of ripening), size (large are preferred as they have more pulp), bruising, and spots or pest/insect damage. Processors also sort mango by type, with Ngowe being the variety of choice in the coastal region, and Apple the variety of choice in Nairobi. Following delivery at the factory, mangoes are sorted to take out those that are immature, damaged or heavily bruised. Losses at this stage are estimated at 10-31 percent. Consignments of mango delivered directly by the farmer tend to have higher proportions of rejects than those delivered by brokers, who tend to pre-sort their consignments to remove sub-par fruit (Mbwika, 2012).

Standards are even more stringent for the export market, relying on codified norms concerning marketing and quality control (i.e., UNECE FFV-45). The UNECE minimum requirements state that all classes, subject



to the special provisions for each class, and the tolerances allowed mangoes must: be intact; without damage signs or deterioration; clean and free of any foreign matter; have a fresh appearance; be free from pests and pest damage, bruises, and black stains; be free from damage caused by temperature; and be able to withstand transportation and handling. Within the European market fruits with damage such as those caused by fruitfly or having weevils are strictly prohibited.

To ensure compliance to export standards, exporters have to ensure only suitable fruits are picked from the farm, either by doing it themselves or by using experienced agents. Fruits are picked on the basis of variety, color, and level of maturity (the fruit must be mature but not ripe). The fruits are then sorted by size<sup>7</sup> on the farm and packed in standard boxes ready for transportation. For the exporters who have collection centers, the fruits will be transported using smaller pick-ups, and off-loaded and then loaded on bigger trucks (approx. 3 ton) in the evening (to minimize heat damage) for transportation to Nairobi.

- *Size:* For mangoes sized by count, the difference in size in the package should be consistent. Size is determined by weight of the fruit or by count with a minimum weight per mango set at 150g. There are four size codes, by weight: A (150-350 grams); B (351-550 grams); C (551-800 grams); and D ( $\geq$  801 grams). There are also maximum permissible differences between fruit within each package.
- *Quality:* UNECE classifies mangoes in three classes for quality determination purposes. Extra class mangoes must be of superior quality. Class I mangos must be of good quality, with slight defects in shape and skin allowed. Class II mangoes do not qualify for inclusion in the higher classes but satisfy the minimum requirements specified above. Allowed defects include shape, skin defects due to rubbing or sunburn, scattered rusty, black of white lenticels

Additional standards are required if the exports are to European markets, which is currently limited. EU and U.S. markets require compliance with international standards of quality and food safety, including HACCP compliance at the processing plant level, and traceability between processing firms and the farms from which they source raw materials. Moreover, Kenyan mango tends not to be price competitive in either of these highly competitive markets where full traceability and GAP compliance are merely the basic requirements to gain market access.

## 2.5 Summary of Key Findings

Domestic demand for mangoes will be driven largely by growth across the fresh, processing, and export markets. Both processors and exporters noted they can only currently meet 40 percent and 50 percent of demand, respectively, and demand is expected to continue to grow. The fresh market demand is projected to grow from 610,000 MT in 2014 to 955,000 MT in 2022, mainly driven by income and population growth. The demand for mangoes in the processing industry is also projected to grow from 50,000 MT in 2014 to an estimated 250,000 MT in 2022, driven by increased demand for juice in the local and regional markets. Additionally, export demand is expected to grow from 13.9 MT in 2014 to 51 MT in 2022. Exports to the European markets will continue to be tricky due to strict sanitary requirements, expensive freight costs and the fact that Kenya is not a major producer of the varieties preferred in the European market (Kent, Keitt and Tommy Atkins). Varietal shift will require take time and will need to be done in strict GlobalGap adherence if we are to tap the European market.

---

<sup>7</sup> Preferred fruit sizes are sizes 8 – 12. Any fruits smaller than size 12 or bigger than size 8 is not picked.

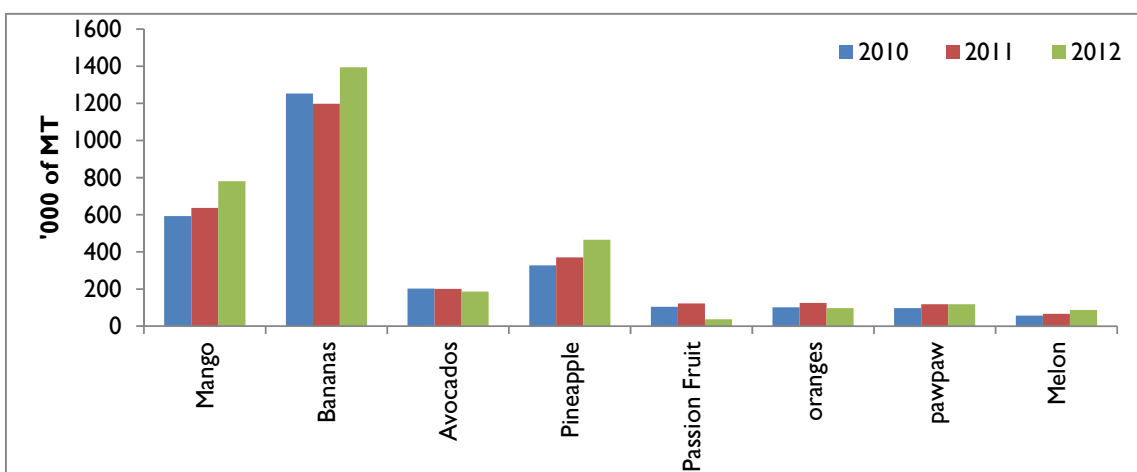
### 3. SUPPLY ANALYSIS AND PRODUCTION POTENTIAL

This section examines the determinants of supply growth and expected changes over the near and medium term. We build supply and production scenarios to evaluate the future of the mango industry in Kenya, including key drivers, trade patterns and supply constraints to project Kenya's mango supply into 2022.

#### 3.1 OVERVIEW OF PRODUCTION AREAS AND VARIETIES

Mango production constituted 19.6 percent of the total value of fruits produced and 5.6 percent of the total value of domestic horticulture in 2011 (HCDA, 2011). It is the second most important fruit crop in Kenya in terms of volume after bananas (Figure 4). Mango production increased from 593,499 MT to 781,706 MT between 2010 and 2012, while hectares under production increased from 47,051HA to 57,021HA in the same period (HCDA, 2012). The average production growth of 13.3 percent was the sixth highest growth rate in the world between 2001 and 2010.

Figure 3: Kenya's Fruit Production in '000MT 2010 - 2012



Source: HCDA (2012).

Kenyan mango production spans diverse agro-ecological zones, including almost every hot and dry area of the country. Main harvest seasons are December–March in eastern and central regions, and November–February and May–August across coast region. In all, the country has 8 months of mango harvest per year. The main production zones for improved varieties are coast region (Malindi, Kilifi, Kwale, Lamu and Tana River), eastern region (Makueni, Kitui, Machakos, Embu and Meru), and central region (Muranga and Thika) (ABD, 2009; ABD, 2011). Elgeyo Marakwet in the Rift Valley and some parts of Northern Kenya, especially Garissa, have also become important mango production areas.

Table 5 shows a comparison of production among the KAVES Counties in light green and non-Kaves Counties and the growth rate between 2009 and 2012. Kisii County recorded the highest growth in area under mango, although it was starting from a modest base. Other counties that recorded impressive growth area under mango cultivation include Machakos (356 percent), Makueni (317 percent) and Kitui (194 percent). Three counties, Meru, Taita Taveta, and Tharaka Nithi recorded a negative growth rate within the same period. USAID-KAVES counties that experienced declining production based on HDCA data (2011, 2012) are marked orange, while those which experienced substantial production gains are marked green (Table 5).

**Table 5: Mangoes Production in KAVES and Other Main Mango Producing Counties**

County	2009		2012		% Change in Area
	Area (Ha)	Production (MT)	Area (Ha)	Production (MT)	
Homa Bay	81	923	232	1,603	186%
Kitui	625	5,699	1,837	18,370	194%
Machakos	2,537	14,115	11,569	138,827	356%
Kisumu	149	1,989	168	543	13%
Nyamira	0	0	0	0	0%
Bomet	23	230	29	234	26%
Busia	216	3,607	275	1,738	27%
Vihiga	3	3	5*	12*	67%
Siaya	113	1,349	250	2,421	121%
Meru	4,526	70,883	2,193	26,310	-52%
Taita Taveta	159	2,947	89	1,780	-44%
Makueni	2,777	38,377	11,573	138,887	317%
Kisii	4	49	371	6,678	9,175%
Tharaka Nithi	1,361	6,281	1,229	14,748	-10%
Kakamega	57	226	74*	347*	30%
Bungoma	53	403	77	625	45%
Migori	328	1,107	507	4,872	55%
Kericho	15	114	28	168	87%
Nandi	13	224	13	205	0%
Trans-Nzoia	25	409	29	279	16%
Elgeyo Marakwet	581	30,396	413	15,954	-29%
Uasin Gishu	8	71	7	73	-13%
Non-KAVES Counties					
Baringo	56	618	160	1,641	185%
Embu	1,389	18,838	3,744	42,995	170%
Garissa	353	3,970	430	5,289	21.8%
Kiambu	141	1,427	226	4,036	68.2%
Kilifi	7,670	112,302	7,772	113,841	1.3%
Kirinyanga	160	3,815	74	1,179	-54%
Kwale	6,807	109,990	8,917	170,393	31%
Lamu	1,897	32,188	1,997	29,955	0%
Mombasa	321	5,049	255	3,389	-20.6%
Murang'a	486	7,091	804	6,390	65.4%
Tana River	2,981	51,506	1,211	22,054	-59.4%

Source: HCDA (2011, 2012). \* 2011~ data for 2012 missing

Looking at the analysis in Table 13 and 14 in Section 5.1, the average returns from mangoes in a typical farm are modest, but provide important source of incomes in areas with limited alternative sources of income. This could explain the decline in areas under the crop in Meru where there are alternative cash crops for income generation. USAID-KAVES could therefore concentrate in promoting mango production in Machakos, Makueni, Kitui, Migori, and Siaya where significant growth in area under mango has been recorded in the last five years. In order to improve returns on mango investment, focus should be on improved orchard management through application of appropriate chemicals including timing to check on mango weevil, fruit flies and anthracnose diseases, application of soil fertility management practices and supplementary irrigation to induce early flowering in order to cash on early season prices which are much higher. This will guarantee higher yields per tree and less losses.

Almost 60 mango varieties of local and improved varieties exist in Kenya. However, only about seven varieties (Apple, Ngowe, Haden, Kent, Sabine, Tommy Atkins and Van Dyke) are commonly offered in nurseries and are commercially produced. Apple and Ngowe varieties are suitable for hot and humid areas

up to an altitude of about 800m, while the rest can do well in both low and mid altitude areas up to 1600m. Table 6 below shows the distribution of mango varieties and their proportions on farms in coast and eastern provinces. The prominent mango variety in coast province is Ngowe at 49 percent of the mango count, while Apple is the leading variety in eastern province accounting for 49 percent. Apple is the principal export variety, while Ngowe is more popular with processors. Nationally, Apple mango constitutes an estimated 39 percent and Ngowe 17 percent (GoK/FPEAK/ITC, 2012).

**Table 6: Varieties of Mangoes Grown in Eastern and Coast Provinces**

Province	Number of surveyed farms	Numbers of trees counted	Proportion of the varieties
Coast	80,975	1,322,414	48.9% Ngowe, 18.9% Small-fruited local varieties, 17.0% Apple, 12.6% Boribo, 2.2% Batawi, 0.4% others (mainly improved varieties)
Eastern	92,650	3,049,141	49.1% Apple, 19.3% Small-fruited local varieties, 8.5% Sabre and Peach (partly cultivated for rootstock production), 7.9% Tommy Atkins, 5.6% Kent, 4.4% Ngowe, 2.9% Van Dyke, 2.5% others (improved and large-fruited local varieties)

Source: ABD and DANIDA mango surveys performed in 2009 and 2010

### 3.2 PRODUCTION TRENDS AND KEY DRIVERS OF PRODUCTION

The national average mango yield in Kenya is 13.10 MT/Ha. These yields compare favorably with other leading producers of mango, such as Brazil (15.8 MT/Ha), Pakistan (10.7 MT/Ha) and India (6.3 MT/Ha) (GoK, May 2012). Mango production in Kenya has been increasing as a result of both increasing yields and area under production (Table 7). Since 2006, mango production has increased at an average of 22 percent per year, while yield increased by 8 percent. Combined, this accounted for an overall increase in production of 15 percent. Within the KAVES Counties, there has been notable increase in area under mango production between 2009 and 2012, with Kisii leading at about 9175 percent, Machakos at 356 percent, and Makueni 317 percent (see Table 5, column 6).

**Table 7: Kenya Mango Production**

Year	Area (Ha)	Area growth rate	Production (MT)	Production growth rate	Yield (MT/Ha)	Yield Growth rate
2006	25,271		248,531		9.8	
2007	26,409	5%	396,461	60%	15	53%
2008	28,794	9%	448,631	13%	15.6	4%
2009	36,304	26%	528,815	18%	14.6	-7%
2010	47,051	30%	593,499	12%	12.6	-13%
2011	59,260	26%	636,585	7%	10.7	-15%
2012*	57,021	-4%	781,706	23%	13.7	28%
Average	40,015	15%	519,175	22%	13.1	8%

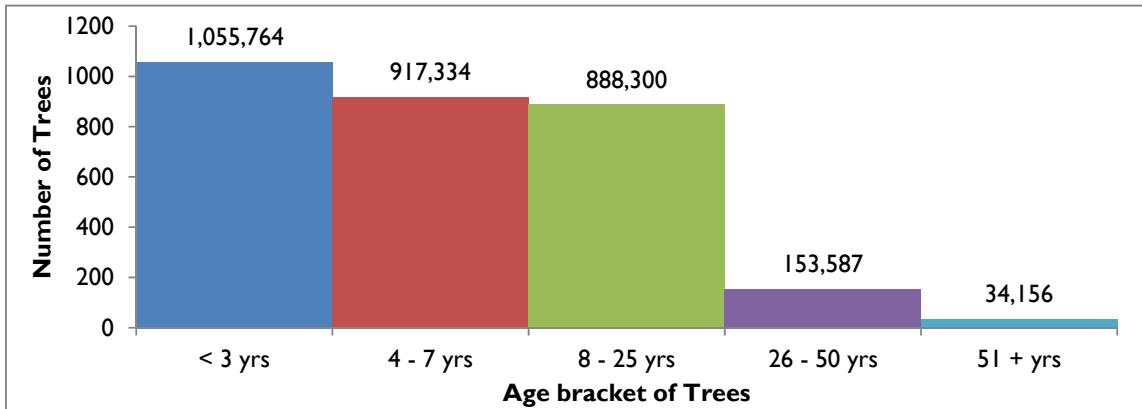
Source: HCDA 2011/2012. \* Production data adjusted from 2,781,706MT reported in HCDA 2012 Validated Report, which was noted as a typo by the HDCA

In 2010, a mango census by the ABD (2010) in eastern province showed a growing establishment of new orchards in the region, with over 34.6 percent (over one million) of the surveyed mango trees being less than three years old and only 6.2 percent more than 26 years old (Figure 4).<sup>8</sup> A similar census in coast

<sup>8</sup> Mango trees reach maturity in the third and fourth year and attain maximum yields from the seventh year.

province (ABD, 2009) found that 13.3 percent (178,391 trees) of the trees were less than three years old, 15.9 percent (206,168 trees) were between four and six years old, and 39.2 percent (500,013 trees) were between seven and twenty five years old (Figure 6).

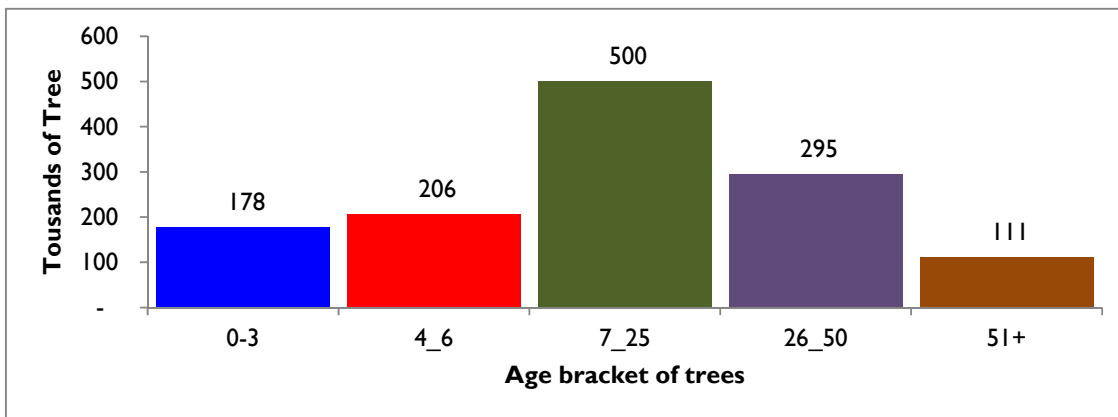
Figure 4: Age Distribution of Mango Trees in Eastern Province



Source: ADB, 2010

Within the Coast Province, the ABD/MOA/IDM mango census found the area had a total of 1,322,414 mango trees and 80,975 farmers involved in mango farming (ABD/MOA/IDM, April 2009) Msambweni, Malindi and Kilifi districts were the leading accounting for more than half of the number of trees. As in Eastern Province the census at the coast found that only 0.3 percent of the farmers owned more than 200 trees each. Coast mango trees are however much older than eastern region, with only 29 percent of established trees below full maturity and 39 percent of trees fully mature. Instructively, about 31 percent of coastal region trees are older than 25 years.

Figure 5: Age Distribution of Mango Trees in Coast Province



Source: Source: ABD/ IDM Baseline Survey, April 2009

These surveys of Kenya’s leading mango producing regions imply that there will be a significant boost to national production over the next five to ten years from eastern and coast regions. With over one million trees reaching peak production in 2016, at a conservative 300 fruits per tree, this will translate to 300 million fruits or 100,000 MT. Despite high yields, these regions also have very high postharvest losses, currently estimated at 40 percent of production; due to widespread pest and disease damage, poor postharvest handling and poor infrastructure.

### 3.3 SUPPLY PROJECTIONS

Kenya’s mango production is conservatively forecast to grow at 10 percent per year over the next ten years (GoK/FPEAK/ITC, 2012; GoK, May 2012), while postharvest losses are forecast to decline from the

current 40 percent to 25 percent in 2022. Increased supply will also come from the establishment of new mango orchards as demonstrated by the ABD (2009, 2010) survey in eastern and coast provinces, where a number of newly established orchards were documented (Figure 5 & 6). Mango orchards aged up to 25 years in the two provinces were approximately 4million. If each tree was well managed and produced a conservative figure of 300 fruits per tree, this will translate to about 400,000 MT of mangoes or 68 per cent of volume of mangoes produced nationally in 2010. Additional supplies are also likely to come from emerging mango production areas in Nyanza, Western, North Eastern and Rift Valley provinces. Based on these calculations, Kenya will produce 878,000 MT of mangoes in 2017 and 1,415,000 MT in 2022 (Table 8). Accounting for decreased postharvest losses, available supply will be 616,000 MT in 2017 and 865,000 MT in 2022.

**Table 8: Mango Supply Projections 2013-2022**

Year	2006-2012	2013	2014	2015	2017	2020	2022
Production Growth Rate	22%	15%	10%	10%	10%	10%	10%
Production ('000 MT)	519	600	660	726	878	1,169	1,415
Estimated Postharvest Loss (%)	40	40	37	34	30	26	25
Available Supply ('000 MT)		360	415	478	614	865	1,057

Source: Author Projections

The Government plans to promote investment in nucleus mango production (of Ngowe variety) along the Tana Delta/LAPSSET Corridor. Mango will be one of three value chains promoted in the area, along with beef and sugar cane. The initiative proposes to support an additional capacity of 190,000 MT Ngowe mangoes through a mango production company supported by an out grower scheme. If this scheme is realized an additional 200,000 MT of mangoes will be available on top of the projected 1,415,000 MT in 2022.

## 3.4 SUPPLY CONSTRAINTS AND THREATS

### 3.4.1 Productivity Constraints

The majority of small-scale farmers have limited knowledge about improved production technologies and orchard management, and rarely apply optimal inputs to boost production and quality of fruits. Farmers also have limited harvesting and postharvest management skills leading to high postharvest losses. For example, very few small-scale farmers have knowledge on the maturity index<sup>9</sup> that guides harvest decisions. A study by Gathambiri et al (KARI Biennial Conference), for example found that 49.4 percent of farmers determined maturity of mango fruits by hand feeling, while 41.6 percent determined by size of the fruit and only 5.2 percent considered mango shoulders. This is one of the reasons exporters have to use their own trained personnel to harvest mangoes in order to ensure quality fruit and appropriate harvest and postharvest handling.

Mango farming is also highly affected by pests and disease (including fruits fly, mango weevil, and anthracnose). Farmers have limited knowledge on application of pesticides for pest and disease control. Farmers also face problems of access to quality seedling due to a limited number of registered and certified fruit tree nurseries. Lack of water for supplementary irrigation is also a major constraint considering most of the mango farming is conducted within water deficient areas.

### 3.4.2 Marketing and Postharvest Constraints

A lack of organized mango farmer groups has been cited as a major contributor to market inefficiencies, particularly considering that individual farmers only cultivate few small quantities of different varieties by

<sup>9</sup> University of Florida (National Mango Board, USA, 2010) has argued that: When to harvest is one of the most important decisions a grower faces when it comes to providing the marketplace with superior-quality fruit. Mangos picked before their optimum maturity may eventually ripen, but will develop inferior flavor and aroma, show increased susceptibility to chilling injury caused by low temperatures during transport, and have shortened shelf life. This is an area that is not well understood by Kenya mango farmers and that needs consideration in capacity building.

small-scale farmers making aggregation by traders and exporters expensive. In many areas, mango farmers have to individually deal with traders and mango brokers, who offer low prices especially during the peak season of production. Indeed some farmers in Meru are already cutting down their mango trees because of a lack of suitable market (Nation Media Group, February 25<sup>th</sup> 2014; Standard Media, Feb 16<sup>th</sup> 2014)<sup>10</sup>. Marketing is also affected by an insufficient amount of aggregation centres where traders and exporters can easily collect sufficient mango quantities. A lack of appropriate storage facilities also makes the supply chain extremely inefficient. The establishment and strengthening of existing mango farming and marketing groups, as well as the establishment of mango collection centres will enhance marketing efficiencies and provide opportunities for strengthening farmers capacities in production and marketing.

Smallholder farmers produce a multiplicity of mango varieties complicating aggregation by buyers who require specific types of varieties such as exporters and processors.

### 3.4.3 Poor Transportation and Marketing Infrastructure

Poor rural infrastructure, inappropriate packaging, and inadequate transportation technologies make marketing expensive and inefficient. Processors face stiff competition from fresh and export markets because they are able to pay a higher price compared to what processors can offer and stay competitive in the processed mango business. Exporters on the other hand rely on expensive airfreight to ship mangoes to the Middle East, which makes Kenyan mangoes uncompetitive (as discussed earlier in this section) (GoK, May 2012; Mango Working Group, 2011).

### 3.4.4 High Cost of Transportation

Due to poor road infrastructure, high cost of fuel and insurance, mango transportation like other agriculture produce tends to be expensive. For example, transporting mangoes from Hola in Tana River to Mombasa costs about KSh70,000 per 20-ton truck (KSh3.50 per kilogram).

## 3.5 SUMMARY OF KEY FINDINGS

Mango production grew by an impressive 22 percent between 2006 and 2011 (HCDA, 2010, 2012), and is expected to continue to record impressive growth rates through 2022. This growth is being driven by an increase in area under production, increasing yields from newly established orchards, and investment in good orchard management technologies. Additional growth will come from non-traditional production areas in North Eastern, Nyanza, Western and Rift Valley regions. Production is expected to reach 878,000 MT in 2017 and 1,415,000 MT in 2022. Accounting for postharvest losses (which are forecast to drop from 40 percent in 2013 to 25 percent in 2022), available supply is expected to be 614,000 MT in 2017 and 1,057,000 MT in 2022. Given these forecasts, Kenya will struggle to meet demand in 2017, with a potential supply deficit of 154,600 MT. However, by 2022, supply will outpace demand by 51,000 MT, which will likely open up further opportunities for processing and export.

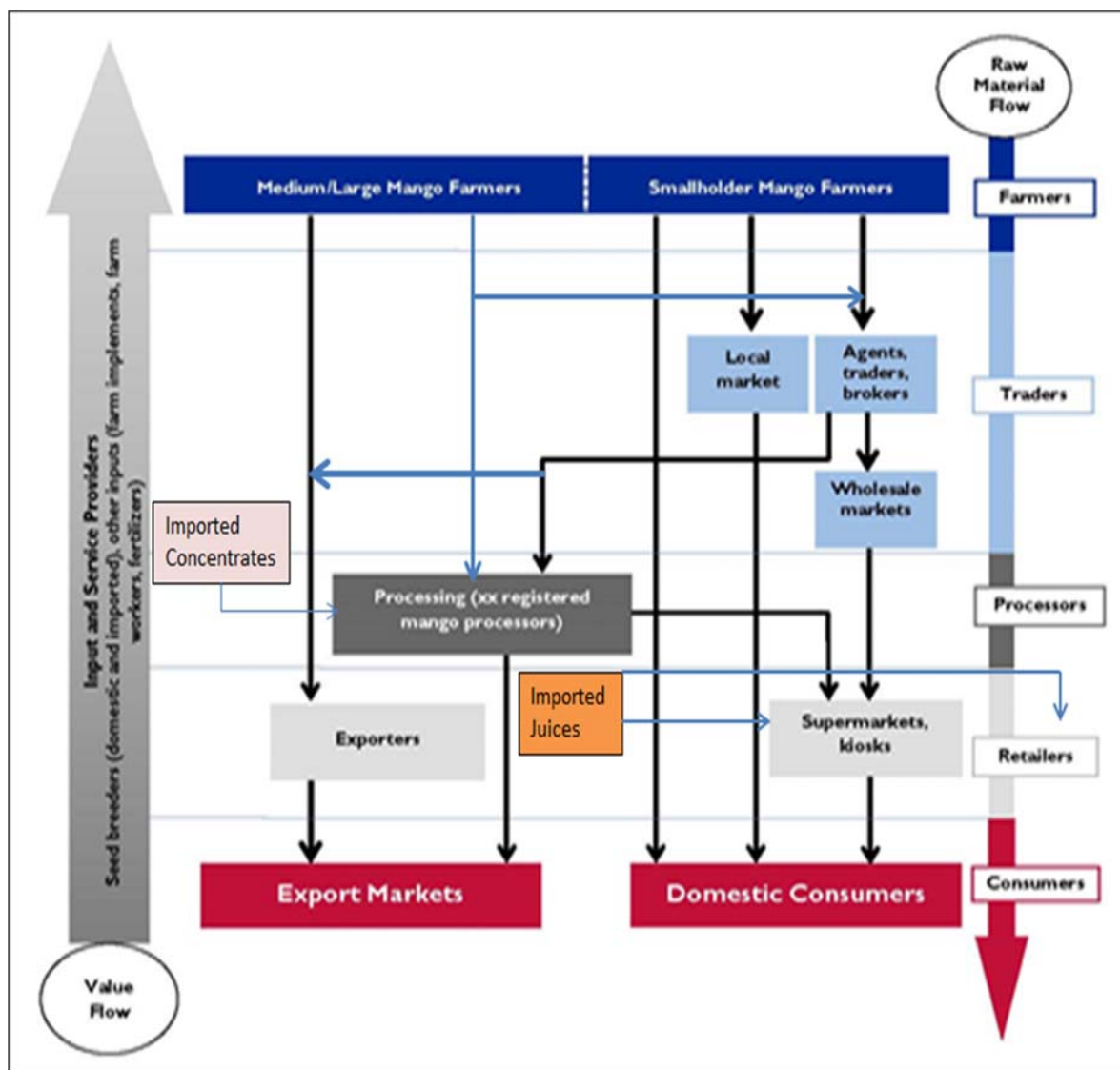
---

<sup>10</sup> <http://ntv.nation.co.ke/news2/topheadlines/mango-farmers-in-meru-complain-due-to-lack-of-market-and-cut-down-trees/>

# 4. THE MANGO VALUE CHAIN MAP

In this section, we look at the mango value chain in detail, highlighting key actors, their interactions and critical constraints and gaps, as well as opportunities for USAID-KAVES interventions. For ease of reference, Figure 6 provides a simplified diagram of the Kenyan mango value chain, showing the basic flow of mango from farmers through marketing agents, and processors to the end consumer.

Figure 6: Kenya Mango Value Chain Map



## 4.1 INPUT SUPPLIERS

Mango tree nurseries, small agro-dealers and stockists are the primary sources of inputs for smallholder mango farmers. The number of agro-dealers has increased substantially over the last decade from 8,000 to 10,000 nationwide. According to HCDA records, there are 208 registered nurseries distributed all over the country, which produce about 576,000 mango seedlings (Njuguna, 2012). Although these nurseries have improved access to primary inputs, and although there has been improvement over the last ten years, the



average distance to the nearest fertilizer retailer in low potential areas was estimated at 4.1 km in 2007, while in high potential areas it was 2.9 km (see Mathenge et al., 2012; Barnnet et al, 2011).

#### 4.1.1 Seedlings Suppliers

Mango seeds range from poly-embryonic varieties (mostly traditional local varieties) that can be propagated by seeds, and mono-embryonic types (mostly improved varieties) that need to be vegetatively propagated. The vegetatively propagated seedlings are found in tree nurseries, some of which are registered with HCDA and provide high quality seedlings. However, there are many more nurseries operating on the side of roads and selling seedlings of unknown quality. As a result, a lack of quality seedlings is consistently cited as one of the main impediments to the establishment of quality orchards (GoK/FPEAK/ITC, 2012; Mango Commodity Working Group, 2011). Gitonga et al (2010) in a study in Embu and Mbeere districts found that 37.7 percent of mango farmers sourced planting material from neighbors, 10.4 percent from their own farm, while the rest were sourced from group nurseries, KARI and MOA.

Seedling nurseries are registered by HCDA and certified by Kenya Plant Health Inspectorate Services (KEPHIS), which is responsible for certification of domestically produced seed and providing permits for seed imports. It also provides training and registration of seed stockists and registers authorized seed sellers. KARI is the main research institution producing and releasing improved varieties in Kenya and has mango seedling nurseries at its Thika and Katumani centres, where a number of certified mango seedlings can be purchased. Seven varieties (Apple, Ngowe, Haden, Kent, Sabine, Tommy Atkins and Van Dyke) are commonly offered in nurseries and are commercially produced (Njuguna, 2012). The seedlings retail at KSh 100 a piece irrespective of the variety. Recent USAID-KHCP buyer surveys<sup>11</sup> in the Middle East report that varietal selection might be limiting Kenya's ability to penetrate regional markets where sweeter Indian and Pakistani varieties tend to dominate.

#### 4.1.2 Fertilizer Suppliers

There is very little use of fertilizer in mango production, especially among small-scale mango producers, and the volumes used are not currently documented (Njuguna, 2012). A small case study in Eastern Kenya revealed that 95 percent of the surveyed mango farmers did not apply any mineral fertilizer and more than 60 percent did not even use manure (Gitonga et al., 2010, cited in Njuguna, 2012). The main reason given for lack of use was the cost of fertilizer and the availability of manure (Table 9).

**Table 9: Reason for Not Using Manure/ Fertilizer in Mango Production**

Manure (n=48)	%	Fertilizer (n=73)	%
Not available	58.3	Expensive	46.6
Inadequate knowledge on use	20.9	Inadequate knowledge on use	24.7
No perceived need	20.8	Spotting on mangoes after overuse	11.0
		No perceived need	17.8
Total	100		100

Source: Gitonga et al. (2010)

Fertilizer in Kenya is mainly imported, with both state agencies and the private sector playing a major role. Out of ten fertilizer importers in Kenya, four firms control over 85 percent of the market. Public sector institutions, such as the National Cereals and Produce Board (NCPB), the Kenya Tea Development Agency (KTDA) and sugar companies/out grower schemes are also major players in the fertilizer market. An estimated 500 wholesalers/distributors, as well as 8,000 retailers and agro-dealers are involved in fertilizer supply (Mathenge, 2009).

While Kenyan fertilizer prices compare favorably against those of its East African neighbors, they are well above FOB prices from major exporters such as the US Gulf, and the price differential has increased significantly since late 2011 (from roughly \$200 to \$400 per MT) illustrating the impact of high transport costs (both sea freight and internal land) on fertilizer prices in Kenya (and throughout East Africa). To address the affordability of fertilizer, the Kenyan government initiated the National Accelerated Agricultural

<sup>11</sup> Conversation with author, March, 2014.

Input Access Program (NAAIAP) in 2008 to help farmers access subsidized fertilizer by organizing them into groups, especially in remote areas. These are areas where incentives to develop private sector distributorships are low as a result of low demand and lack of purchasing power by poor farmers (IFDC, 2012). However fertilizer subsidies are more targeted at maize production than any other crop in Kenya. For example, in 2012, the Government provided subsidized fertilizer (about 60,000 tons) to about 250,000 maize farmers.

#### 4.1.3 Other Farm Inputs

**Other farm chemicals (pesticides, herbicides, fungicides)** are widely available through stockists and all major leading manufacturers are represented in Kenya. Annual imports of pesticide products are estimated at 9,000 MT (\$50 million). Selection, safe use, and appropriate disposal remain serious issues. The Agrochemicals Association of Kenya (AAK), affiliated with CropLife International, is the umbrella organization for 48 Kenyan pesticide manufacturers, formulators, re-packers, importers, and distributors. The Pest Control Products Board (PCPB) is responsible for product registration (with about 200 products currently registered), and it also provides inspection services to identify improperly repacked, unregistered, counterfeit, mislabeled, or adulterated product.

Small agro-dealers and stockists are the primary source of inputs for smallholder farmers, many of which also carry other items (hardware, general wares, etc.). Their numbers have increased substantially over the last decade, and are estimated at between 8,000 to 10,000 nationwide (Mathenge, M. et al August, 2009). This has resulted in better access to primary inputs by farmers, although average distances for farmers to the nearest seed or fertilizer supplier remains high. Agro-dealers are required to have a license from local government authorities, as well as receive certification from the Pest Control Products Board to sell pesticides and other farm chemicals. Not all agro-dealers register with PCPB.

The use of chemicals for pest and disease control by small-scale farmers varies by region. For example a survey carried out by ABD in Coast province found that only 8 percent of the farmers used pesticides, 46 percent did nothing to safeguard their orchards from pests and diseases, and 33 percent used alternative methods such as keeping their orchards clean (ABD, 2009). Inadequate control of diseases and insects can be attributed to lack of awareness, high cost of pesticides and sometimes due to lack of appropriate equipment (Njuguna, 2012).

## 4.2 FARMERS

### 4.2.1 Smallholder Farmers

Mango production is predominantly a smallholder affair in Kenya. FPEAK (2012) estimates there are more than 200,000 smallholder farmers involved in mango production in the country. The small-scale farmers grow multiple varieties, use no irrigation, and rarely use any fertilizers on their orchards. Because of the low production by individual farmers, coupled with the mixed growing of varieties, aggregation for marketing is a challenge and was cited by exporters and processors interviewed as one of the primary factors contributing to market inefficiencies. The majority of the small-scale mango farmers are not organized in any form of marketing group, instead relying on village assemblers, export agents, and local traders to access markets. This tends to result in low farmgate prices for farmers. Numerous studies (Msabeni et al, 2010; Chain Partners, 2014) have identified the lack of market organization as a major constraint to the development of the mango industry.

In a mango census conducted in Eastern Province by ABD (2010) among 92,650 farmers, researchers found that 56.6 percent of the farmers owned ten mango trees or fewer. Only 2.4 percent of the farmers owned more than 200 mango trees, but these farmers owned 39.8 percent of the trees (Table 10). Another interesting finding was that 23.3 percent of the trees were owned by farmers who had 501 trees and above. Under a mono cropping system, each acre will carry approximately 50 trees, meaning that there were about 570 farmers who cultivated more than 10 acres of mangoes each.

**Table 10: Distribution of Mango Trees in Eastern Province**

Farm size	Number of farms/farmers		Population of trees	
	Number	Percent	Number	Percent
Up to 10 trees	52,442	56.6%	240,678	7.9%
11 – 20 trees	14,994	16.2%	231,502	7.6%
21 – 50 trees	13,670	14.7%	456,317	15.0%
51 – 100 trees	6,079	6.6%	443,423	14.5%
101 – 200 trees	3,228	3.5%	461,964	15.2%
201 – 500 trees	1,667	1.8%	501,694	16.5%
501 + trees	570	0.6%	713,563	23.3%
Total	92,650	100%	3,049,141	100%

Source: ABD/IDM Baseline Survey, April – June 2010

A similar census in Coast province (ABD, 2009) found that there were 80,975 farmers involved in mango production and owning 1,309,922 mango trees. As in Eastern province, majority of the farmers owned less than 50 mango trees, representing more than 95.7 percent of the farmers interviewed (Table 11). The survey further found 85.3 percent of trees were owned by farmers who had between one and 100 trees each, while only 5.1 percent were owned by farmers who had more than 500 trees each (81 of the surveyed farmers). These findings show a more commercial orientation of mango farming in Eastern compared to Coast province.

In terms of ownership of mango trees, a census conducted in Eastern Province (ABD, 2010) found that most of the mango trees were owned by men (78.7 percent), while women owned only 20.7 percent of the mango. In Coast Province, ABD found that men owned 84.1 percent of the trees and women owned 15.8 percent. These results show that mango farming is predominantly a male affair. This is a reflection of the general land ownership in the country, where men dominate land ownership. In Kenya only 1 percent of titled land is owned by women (Saturday Nation, 2014).

**Table 11: Distribution of Mango Trees in Coast Province**

Farm size (number trees)	Number of farms/farmers		Population of trees	
	Number	Percent	Number	Percent
Up to 5	23,564	29.1	71,410	5.4
6 – 10	21,215	26.2	166,624	12.6
11 – 20	19,515	24.1	293,576	22.2
21 – 50	13,199	16.3	411,271	31.1
51 – 100	2,753	3.4	185,138	14
101 – 200	567	0.7	80,667	6.1
201 – 500	162	0.2	46,285	3.5
501 +	81	0.1	67,443	5.1
Total	80,975	100	1,309,922	100

Source: ABD/IDM, April 2009

#### 4.2.2 Medium and Large Scale Farmers

Although there is no official definition of farmer size, the ABD (2009, 2010) provided classification of farmers by the number of mango trees they have planted. Farmers with over 50 trees were considered commercial farmers, growing mangoes for commercial purposes and therefore falling with the classification of medium to large scale farmers. These farmers constituted 13 percent of the surveyed farmers and owned 69.5 percent of the surveyed mango trees in Eastern Province (ABD Mango Census, 2010). Farmers in the same region cultivating more than 500 trees constituted only about 0.6 percent of the farmers surveyed. KENFAP estimates medium and large-scale farmers produce between 25 – 35 percent of mangoes in Kenya (KENFAP, 2010).

Large and medium scale mango farmers have the ability to negotiate and sell directly to exporters, wholesalers, supermarkets and agents. They grow specific varieties of mangoes for commercial purposes, unlike small-scale farmers who grow a mix of mango varieties. They are also well capitalized and are able to apply necessary inputs to control pests, diseases and soil fertility. Some large scale mango farmers along River Athi in lower eastern Kenya have direct links with the main export companies in the country who offer premium price because of the good quality of the mangoes in these farms. Others supply their mangoes direct to Uchumi supermarket. Large scale farmers are able to stimulate flowering and, using supplementary irrigation, are able to produce an early September crop, when there is a shortage of mangoes for export and they are able to command higher prices.

## 4.3 MARKETING ACTORS

The actors involved in mango marketing in Kenya include farmers, brokers, village assemblers, wholesalers, retailers and exporters. Village assemblers/brokers are the main link between farmers and the rest of the value chain. They purchase and sell either direct to retailers, wholesalers, processors or to contracted agents. Wholesalers purchase direct from farmers or through brokers and supply urban markets, where they sell to retailers or agents acting for supermarkets. Retailers are the final link, bringing mangos directly to consumers. Exporters purchase directly from large-scale farmers or use appointed and trained agents to purchase mangoes on their behalf.

### 4.3.1 Small-Scale Rural Assemblers/Brokers

Rural mango assemblers and brokers are an important link to markets given their ability to penetrate remote areas in search of mangoes. They purchase direct from farmers and transport to urban centers, where they sell to retailers in wholesale markets or agents that supply supermarket chains. In some cases they also sell directly to consumers in main urban centers. They tend to operate with little capital and therefore sell their purchases as soon as possible. Rural assemblers are affected by the seasonality of mango production as their business is more localized, while brokers have the ability to move from region to region and also broker in other commodities.

Tegemeo (2008) found that nearly 80 percent of fresh fruits and vegetables, including mangoes, are assembled by assembler/wholesalers in rural areas. In the study, the rural assembly activities were quite dispersed, with only 2 percent of all produce flowing through formal rural assembly markets. Tana Delta Ndungu et al (2008), observed that 95 percent of the mangoes were harvested by brokers/ middlemen.

A study conducted in Mbeere district (Msabeni et al, 2010) found that traders who purchased mangoes in the district were selling them to wholesale markets in urban areas (for example in Wakulima market in Nairobi), while others sold direct to retailers including supermarkets, hotels, institutions like prisons, hospitals, schools, and kiosks. The agents tended to operate in a climate of uncertainty and encounter all manner of risk. They had little working capital, relying mainly on their own funds except when working on commission basis. The poor infrastructure generally made their trips long and arduous, jeopardizing the quality of the mangoes and translating into heavy losses.

### 4.3.2 Wholesalers

Mango wholesalers either source mangoes directly from farmers in rural areas or use local assemblers/agents to purchase mangoes from farmers on their behalf. Others operate in urban wholesale markets where they purchase directly from rural assemblers or transporters and then sell to retailers. Wholesalers are an important link between rural assemblers and retailers, although some of the rural assemblers also sell directly to retailers. Tegemeo (2008) observed that 63 percent of mangoes entering Nairobi wholesale markets were sourced from Machakos. Other sources were Kitui (11 percent), Makueni (8 percent), Embu (6 percent), Transmara (4 percent) and Meru (3 percent). Mango wholesalers were interviewed in four wholesale markets in Nairobi (Wakulima, Kangemi, Eastleigh and Kawangware) and in Kongoa in Mombasa.<sup>12</sup> Three varieties of mangoes were observed in the market: Ngowe, Apple and the traditional mangoes (green small high fibre varieties). All the Apple and Ngowe mangoes sold in Nairobi were sourced from Makueni County, but the traditional varieties came from Makueni, Machakos, Embu, Meru and Kitui.

---

<sup>12</sup> Although Gikomba market in Nairobi was visited, it did not have a wholesale market for mangoes.

According to the Rapid Rural Appraisal survey conducted in Nairobi and Mombasa by KAVES in January 2014, wholesalers pack their mangoes in bags, boxes or pakachas. The weight per bag is between 100 kg and 130 kg, while the boxes weigh between 22 kg and 50 kg. Pakacha's were observed in the Kongoea wholesale market in Mombasa and weight about 14 kg.

### 4.3.3 Transporters

Mangoes are mainly transported with hired or trader owned trucks (ranging from 3-ton to 30-ton) or pickups. In rural areas donkey carts and motorcycles are used to move the mangoes from the farm to market centers or roadsides where large trucks can pick them up. In Coast Province, Mbwika (2012) found that agents for mango processors and organized farmer groups were hiring 20-ton trucks for KSh35000 to transport mangoes from Tana River to Mombasa per trip. Mangoes destined for the local market are packed in bags, boxes or just loaded on to trucks unbagged for transportation to various markets. However, exporters pack their mangoes in special cartons before loading them into 3-ton trucks for transportation to their pack houses.

## 4.4 PROCESSORS

There are four main mango processors in Kenya who transform mangoes into pulp, juice and concentrates, including Milly, Sunny Mango, Kevian and Allfruits. Milly and Allfruits are based in Coast Province, while Kevian and Sunny are based in Central Kenya near Thika. Milly and Allfruits take advantage of their proximity to the Coast production zone, which is a major producer of Ngowe mangoes, which is preferred for juice processing. Sunny Mango owns a nucleus farm and also gets supplies from Muranga, Embu, and Machakos counties. Milly is the only firm that processes concentrates. Allfruits is located at the Miritini Export Processing Zone premises and by law is required to export most of its produce. The processing firms operate around 40 percent of installed capacity because of supply shortages that are the result of significant postharvest losses, fluctuating seasonal production and competition with local fresh fruit and export markets, which offer better prices (Mango Working Group, 2011).

The processing firms operate at approximately 40 percent of installed capacity because of supply shortages created by significant postharvest losses, seasonality of production and competition with local fresh fruit and export markets, which offer better prices

Processors rely on brokers and in some cases organized farmer groups for delivery of mangoes. Rarely do they venture into production zones to purchase mangoes. Harvesting and handling of mangoes for the processing industry is not as stringent as it is for the export markets. Farmers may harvest and deliver their mangoes directly to the processing firm, or through brokers and traders. Once the mangoes are delivered at the factory, they are weighed, inspected, and sorted to meet the general requirements. Losses at this stage are estimated at 10-31 percent (Mbwika, 2012). Higher losses are recorded for those delivered by the farmer, with lower end losses for those delivered by brokers as they will have already done pre-selection. Major reasons for rejection include immature fruit, insect/pest damage, over ripeness and bruising.

## 4.5 EXPORTERS

There are about 20 mango exporting companies in Kenya.<sup>13</sup> According to interviews with FPEAK, the leading mango exporters include: Keitt Exporters Ltd, Mackay Import and Export Agents, Kankma Exporters Ltd, Zenith, Global Exporters, Jakal Services Ltd, Vegmon International, Kankam Exporters Ltd. These are responsible for about 90 percent of mango exports. Due to the seasonality of mango production, the exporters also deal in other fruits and vegetables to ensure continuous business operations.

Export markets demand a level of quality that is much higher than that demanded by domestic fresh markets or processors. To ensure quality fruit, exporters rely more on their own staff to supervise harvesting, sorting, packaging and transportation. This guarantees minimal waste as only the right mangoes are harvested and transported in ideal packages to minimize damage. Fruits are picked on the basis of variety, color, and level of maturity, lack of spots and insect damage, and size (quality characteristics for export are explained further in Section 2.4).

<sup>13</sup> <http://www.alibaba.com/countryserach/KE/mango-fruits-exports.html>.

Once the fruits reach the company premises in Nairobi/Mombasa, they are inspected and resorted again to ensure no damaged fruit is packed for export. Minor losses of 1-2 percent may be experienced at this stage, but these are offloaded in the local market and therefore constitute loss only as far as the export market is concerned. Saudi Arabian customs officials randomly select and test mango shipments for the mango seed weevil. If the pest is detected inside a seed, the entire consignment is destroyed as has been the case with at least one Kenyan shipment over the last year. Saudi officials do not currently test mango consignments for pesticide residues. Exporters interviewed for this report noted that Saudi Arabia enforces quality standards more regularly and more completely than officials in the UAE, another major export market. For the UAE market, interviewees noted that mangoes are even purchased from wholesale markets in Nairobi, usually outside the range of export quality.

## 4.6 RETAILERS

Mango retailers source their mangoes directly from farmers for those located in rural urban centers and from brokers and traders/transporters for those located in large urban centers such as Nairobi, Mombasa and Kisumu. The retailers also get mangoes from wholesale markets in the urban centers such as Kongoa in Mombasa, and Wakulima in Nairobi. According to Tegemeo (2008), 19 percent of retail traders in Nairobi sourced their fresh fruits and vegetables directly from farmers, while the rest were sourced from wholesale markets in the city.

A USAID-KHCP survey (January 2012) showed that hawkers and green grocers transacted 58 percent of the total volume of fruits at the retail level, while supermarket and large duka's had a market share of 1 and 4 percent respectively. The rest were sold in open air market stalls. In the same period, retailers transacted 15,629 MT of mangoes worth KSh1 billion (\$12 million), or 19.7 percent of the volume of fruits transacted (KHCP, 2012). Hawkers and green grocers dominated the retail transactions on overall fruits and vegetables with 170,457 MT, representing 58 percent of the cumulative volumes, priced at KSh8.9 billion (\$103 million). The implication is that most of the fruits and especially mangoes are transacted under conditions that are not ideal for fruit preservation.

Most retailers in rural urban centers and road sites have little to no infrastructure for storing and/or displaying their product, which tends to further damage the sensitive fruit (see Fig. 11). For the supermarkets, mango suppliers come from contracted agents and face high risk because the mangoes can ripen rapidly and deteriorate before being purchased.<sup>14</sup>

---

<sup>14</sup> Some of the supermarkets do not assume the risk of spoilage as they only pay suppliers based on actual sales of the mango supplied or spoiled mangoes before they are purchased are returned to the supplier.

### MARKETING STRUCTURE CONSTRAINTS

The mango value chain is a product of complex marketing channels and fragmented sales by small numbers of farmers. It faces significant constraints related to skills required, investment needs, costs, taxation, collusion, intimidation, and uncompetitive practices, among others. Some of the key organizational and structural constraints include:

- Small scale mango farmers own a few orchards of different varieties making aggregation for marketing a difficult and costly task;
- Small scale farmers lack knowledge of the harvesting index, leading to high levels of immature fruit, which are rejected by buyers, especially processors;
- Farmers tend not to be organized into groups and there is no existing mechanism for aggregation of produce;
- The perishable nature of mangoes, a lack of market information and organized marketing groups puts the producer in a weak bargaining position;
- There is substantial cost of assembly, handling and grading, and rural-based traders suffer low margins and poor access to credit;
- At the rural aggregation level mango grades and standards are limited to variety, ripeness and visual appearance.
- High cost of transportation due to poor roads, high cost of fuel and maintenance costs affecting returns along the value chain

### MARKETING EFFICIENCY GAPS

Mango marketing in Kenya tends to be very inefficient. The small-scale nature of production with numerous varieties within each farm, lack of organized collection/ aggregation system, poor rural access roads, inappropriate packaging and transportation, and general lack of quality and measurement standards characterize the many aspects of inefficiency.

- The gap between producer price and consumer price is high largely due to poor information flow and influence of brokers and marketing agents in the industry;
- Small-scale farmers are not organized into marketing groups and usually lack information on prevailing market conditions;
- Farmer-village assembler relationships tend to favor the village assembler in terms of price and purchasing conditions. Interventions to promote weight and standards will help ensure farmers get fair prices.

## 4.7 SUMMARY OF FINDINGS

The mango value chain is a complex network of actors starting from research to the final consumer. There are an array of opportunities and challenges facing the sector; industry consensus remains optimistic owing to the country's tremendous potential for growth in this sector.

**Input Suppliers:** Although a recent increase in nurseries has improved access to primary inputs, average distances to the nearest seed or fertilizer stockist remains high. KAVES should work with HCDA and other stakeholders to improve access to quality planting materials through establishment and registration of more nursery operators, training of existing nursery operators and providing information and linkages between nursery operators and mango farmers. Additionally, the appropriate use of chemicals and good orchard management would address most of the pests and diseases affecting mango production.

**Farmers:** There are about 200,000 smallholder farmers involved in mango production in Kenya producing about 65 percent of mango supply in the country. The high cost of fertilizer and poor access to seedlings continues to stifle the growth in input adoption by smallholders, leading to low yields. Farmers also have limited technical knowhow related to orchard management and control of various pests and diseases. The general lack of organization in the industry, with farmers growing many different mango varieties, continues to hamper the efficient aggregation of mango en route to urban centers.

**Marketing Agents:** These include village assemblers, brokers and wholesalers. They face numerous challenges as a result of poor rural infrastructure, which contributes to the high cost of aggregation. Lack

of appropriate transport and packaging technologies also add to the challenge, contributing to high costs and high losses.

**Processors:** There are four main mango processors in Kenya, two located in Mombasa and two in Central Kenya (Thika and Muranga). Other small processors have emerged such as Malindi and CDA Hola. Most of the processors specialize in pulp and juice making, with only one processor processing fruit concentrates which are sold both locally as well as exported. There is a total 88,000 metric tons of installed capacity in Kenya. They operate at 40 percent capacity due to low supply of mangoes as a result of seasonality and competition in the market with players that are able to pay higher prices such as domestic fresh and export markets.

**Exporters:** have a consistently hard time procuring quality fruit due to poor agronomic and post-harvest practices. Kenyan exports tend to be priced substantially higher than the 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.



## 5 MARGINS ANALYSIS

**This section looks at gross margins along the value chain. As part of this assessment, we conducted Rapid Rural Appraisal (RRA) surveys of producers, assemblers, wholesalers, and retailers, and used data from farmer surveys and USAID-KAVES crop budgets data. Interviews with wholesalers in Nairobi and Mombasa markets provided information on marketing costs including transport, county levies, prices at sources, losses, market commissions and wholesale prices. Additional information was collected through telephone interviews with farmers in Machakos and Makeni counties.**

The mango producer in Kenya has three main market channels, including domestic fresh produce market, which takes the bulk of mangoes, and the processing and export markets. Farmer returns in the mango value chain are determined by price differentials across the different markets, varieties, time of the season, the levels of postharvest losses (PHL), and the region of production (volumes and proximity to major markets). The export market prices are significantly higher than those paid by processing and domestic fresh market, because of higher quality requirements of exporters. The export market also tends to start purchasing much earlier in the season when supply is much lower than demand. Exporter prices range from KSh80 to KSh400 per box (4 kilograms) through the production cycle, with prices determined by season and region. Processors enter the market at peak production to capitalize on low prices—they pay an average KSh13 per kilogram of mangoes. Domestic fresh fruit buyers get into the market toward the peak and pay prices ranging from as low as KSh3 per piece (farm gate) to KSh10, depending on variety, region and time of the season. The margins of the major value chain actors are analyzed in sections that follow.

### 5.1 FARMERS

We use the RRA data collected through interviews with farmers in Nzau and Kibwezi in Makeni County and Ithanga in Machakos bordering Muranga county to derive crop budgets and conduct margins analysis for mango farmers. Additional data from KAVES surveys for various crops budgets is also used to complement information on production costs and farm gate prices for mangoes. We also consulted industry actors and experts to establish the most appropriate production systems and expected yields.

In calculating the gross margins for mango producers we consider the establishment costs, costs of maintenance and stream of revenues over a period of 25 years, our estimate for the average productive life of an orchard. The calculation is done on a per acre basis assuming a representative farmer adopting improved production systems where each acre has 50 trees. Trees are assumed to start producing in the third year after planting at 150 fruits per tree by the third year, 450 fruits per tree in year 4, 600 fruits in Years 5 & 6, before peaking at 700 fruits per tree from Years 7 to 25. To cater for postharvest losses (PHL), we have assumed three scenarios—40%, 25% and 15%.

All the interviews indicate the price of mango seedling is KSh100 per piece. Land preparation costs include clearing, ploughing, harrowing and digging of planting holes and are calculated on a per acre basis. Farm gate prices are based on prices prevailing in December 2013/January 2014 and have been averaged for prices paid for apple mangoes (by exporters and brokers) and ngowe mangoes. Other cost considerations include chemicals and pesticides, farm labour (spraying, weeding, pruning and harvesting) and fertilizer/manure costs. Other assumptions are:

- Fixed Establishment Cost:
  - Land preparation (clearing, ploughing and harrowing) is KSh20000 per acre
  - Price of seedling at KSh100 a piece (KSh5000 per acre);
  - Labor cost for digging planting holes at KSh40 per hole (KSh2000/acre) and KSh15 for planting per seedling (KSh1000/acre)
  - Transport of seedlings to the farm is estimated at KSh3000

- Variable Cost: Farmers apply fertilizer and manure, weed per year, spray against insects and pests, and prune the trees from Year 4. Through interviews with farmers in Embu and Mbeere, Krain et al. (2008) estimated mango farming required 60 person labor days per year.
- All trees reach full maturity.
- Farm gate prices per fruit of KSh4, KSh5, KSh6, and KSh12 (for export mangoes) are used sensitivity analysis (each kilogram is equivalent to approximately three mangoes). Fresh produce and processing markets pay an average KSh4 per mango, rising to KSh6.

Calculations of the cost of production for the first 7 years are contained in Table 12, which contains the establishment cost, subsequent cost of maintaining the trees, and unit costs. Based on our assumptions, the farmer spends KSh31000 in fixed costs and another KSh7500 in variable costs to establish an acre of mangoes, for a total investment cost of KSh38500. The farmer then incurs annual variable costs through the life of the orchard—ranging from KSh7500 in Year 2 to KSh16000 in Year 7. In situations where the cost of production is 10 percent higher, the farmer would need KSh39250 for establishment and KSh17600 per year from Year 7. From Year 1 to 3, the unit cost of production is calculated from the sum of fixed and variable costs for the three years; Year 4-7 uses only the latter.

**Table 12: Cost of Investment and Production per Acre of Newly-established Orchard**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
<b>Cost:</b>							
Fixed establishment cost	31,000	-	-	-	-	-	-
Manure/fertilizer	2,500	2,500	2,500	3,500	3,750	3,750	3,750
Pesticides and chemicals	1,500	1,500	3,000	3,000	4,500	4,500	7,500
Weeding	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Pruning	-	-	-	250	250	250	250
Spraying labour	500	500	800	800	1,200	1,200	1,500
<b>Variable cost</b>	<b>7,500</b>	<b>7,500</b>	<b>9,300</b>	<b>10,550</b>	<b>12,700</b>	<b>12,700</b>	<b>16,000</b>
<b>Total cost</b>	<b>38,500</b>	<b>7,500</b>	<b>9,300</b>	<b>10,550</b>	<b>12,700</b>	<b>12,700</b>	<b>16,000</b>
<i>If Variable costs increase 10%</i>	<i>8,250</i>	<i>8,250</i>	<i>10,230</i>	<i>11,605</i>	<i>13,970</i>	<i>13,970</i>	<i>17,600</i>
<b>Total cost</b>	<b>39,250</b>	<b>8,250</b>	<b>10,230</b>	<b>11,605</b>	<b>13,970</b>	<b>13,970</b>	<b>17,600</b>
Number of trees	50	50	50	50	50	50	50
Yields (fruits per tree)			150	450	600	650	700
Yields (kg per tree)			50	150	200	217	233
Yields (fruits per acre)			7,500	22,500	30,000	32,500	35,000
Yield (kg/acre)			2,500	7,500	10,000	10,833	11,667
Cost per fruit			7.37	0.47	0.42	0.39	0.46
Cost per kg, given:							
0% PHL			22.12	1.41	1.27	1.17	1.37
40% PHL			36.87	2.34	2.12	1.95	2.29
25% PHL			29.49	1.88	1.69	1.56	1.83
15% PHL			26.02	1.65	1.49	1.38	1.61

Source: USAID-KAVES calculations

From the aforementioned assumptions, the unit cost of producing one mango in Year 3 is KSh7.37 (allocates all costs incurred over the first three years), which translates to KSh22.12 per kg. When postharvest losses are accounted for, the average cost per kg is KSh36.87 at 40% PHL, KSh29.49 at 25%, and KSh26.02 at 15%. The unit cost significantly from Year 4—starting at KSh1.41 before stabilizing at KSh1.37 from Year 7 onwards. At the higher PHL of 40%, the average cost per kg starts at KSh36.87 in Year 3 and then drops to KSh2.34 by Year 4 and stabilizes at KSh2.29 from Year 7. The unit cost of production declines by 20 percent and 30 percent at 25% and 15% PHL, respectively, which makes PHL levels a critical determinant of returns. If farmers limited PHL to 15%, they can produce a kilogram at a cost as low as KSh1.38 by Year 6.

To calculate mango producers' revenues and gross margins, we use the three price regimes set out above. At KSh6 per fruit (KSh18 per kilogram), Table 13 contains estimates of revenues and gross

margins for our representative farmer. It shows the farmer would earn KSh45000 in revenues per acre in the third year, before accounting for losses. At 40% PHL, the farmer income would be KSh27000 per acre and KSh38250 at 15% PHL. At full maturity in the 7<sup>th</sup> year, the farmer would realize gross revenues of KSh210000 per acre, assuming no losses. The gross margin in year 3 is KSh35700 per acre before factoring in losses; when 40% PHL is considered, it declines to KSh17700 and KSh28950 if 15% PHL is assumed. In the 7<sup>th</sup> year, the gross margin is KSh194000 per acre, and ranges from KSh110000 at 40% PHL to KSh162500 at 15% PHL.

**Table 13: Producer Gross Margins at Higher Price**

	PHL	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Price (KSh per fruit)	6	6	6	6	6	6	6	6
Revenue per acre:	0%			45,000	135,000	180,000	195,000	210,000
	40%			27,000	81,000	108,000	117,000	126,000
	25%			33,750	101,250	135,000	146,250	157,500
	15%			38,250	114,750	153,000	165,750	178,500
Gross margin per acre:	0%	(38,500)	(7,500)	35,700	124,450	167,300	182,300	194,000
	40%	(38,500)	(7,500)	17,700	70,450	95,300	104,300	110,000
	25%	(38,500)	(7,500)	24,450	90,700	122,300	133,550	141,500
	15%	(38,500)	(7,500)	28,950	104,200	140,300	153,050	162,500
Gross margin per kg:	0%			14.28	16.59	16.73	16.83	16.63
	40%			7.08	9.39	9.53	9.63	9.43
	25%			9.78	12.09	12.23	12.33	12.13
	15%			11.58	13.89	14.03	14.13	13.93

Source: USAID-KAVES calculations

At the average price of KSh6 per fruit, a kg of mangoes would earn the farmer between KSh7.08 and KSh11.58 in Year 3, and KSh9.43-13.93 by Year 7. The analysis also shows that for every shilling invested farmers earn 80 cents in the third year and four shillings in the seventh year assuming losses of 15%. This shows that mango farming, despite numerous constraints, can be a highly profitable and secure business. Assuming 25% PHL, the KSh141500 in gross margins per acre in the 7<sup>th</sup> year is a significant annual return in Counties with few or no alternative uses of land and sources of income, and is substantially higher than the minimum KSh114000 required to sustain a typical rural household. Krain et al (2008) found that the income per acre is much higher when one considers the entire farm enterprise as most farmers practice intercropping.

Farmers producing mangoes for the processing market obtain lower prices, estimated at KSh4 per fruit (KSh12 per kg). Results of the analysis of gross margins for this market channel are contained in Table 14—only revenues and gross margins are shown. The Table indicates lower returns but the mango enterprise remains profitable. Specifically, the gross margins in Year 3 are only 58 percent those obtained at KSh6. At the 15% PHL level, the gross margin at KSh4 in Year 7 is 62 percent that at KSh6. By implication therefore, while the unit price is lower by only 33 percent, the impact on gross margins is much greater (a decline of 38-46 percent). At the lower price, an acre mangoes, even at a much lower PHL level, would barely satisfy the minimum rural household annual expenditure requirements. However, mango enterprise would still meet more than 50 percent of household expenditure requirements. Compared to alternative enterprises in the targeted marginal regions, this amounts to substantial household income and can lift the living standards of most farming households.

**Table 14: Producer Gross Margins at Lower Price**

	PHL	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Price (KSh4 per fruit)		4	4	4	4	4	4	4
Revenue per acre:	0%			30,000	90,000	120,000	130,000	140,000
	40%			18,000	54,000	72,000	78,000	84,000
	25%			22,500	67,500	90,000	97,500	105,000
	15%			25,500	76,500	102,000	110,500	119,000
Gross margin per acre:	0%	(38,500)	(7,500)	20,700	79,450	107,300	117,300	124,000
	40%	(38,500)	(7,500)	8,700	43,450	59,300	65,300	68,000
	25%	(38,500)	(7,500)	13,200	56,950	77,300	84,800	89,000
	15%	(38,500)	(7,500)	16,200	65,950	89,300	97,800	103,000

Source: USAID-KAVES calculations

Producing mangoes for the export markets could be even more lucrative for farmers. Exporters pay an average KSh12 per fruit through the production cycle. Since the quality requirements of exporters are much more stringent, and thus requiring additional inputs and the best quality fruit, our analysis of gross margins assumes the average cost of production is 10% higher. The results are presented in Table 15. It indicates that farmers targeting the export market can earn between KSh234000 and KSh402400 from an acre by Year 7. Assuming the PHL is 40%, given the higher quality requirements, an average farmer would be making KSh234400 per acre per year from Year 7, which is a significant income by Kenyan standards. If losses are kept at a minimum of 15%, the average farmer can earn KSh340000 annually from an acre of mangoes. The gross margin per fruit would be as high as KSh9.70.

Targeting the export markets therefore presents the most profitable opportunity to improve farmer returns and household living standards in the SA2 regions targeted by USAID-KAVES. To benefit from these higher returns, farmers would need technical and financial assistance to meet the high quality requirements of exporters.

**Table 15: Producer Gross Margins from Export Mangoes\***

	PHL	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Total Cost		39,250	8,250	10,230	11,605	13,970	13,970	17,600
Revenues:	0%			90,000	270,000	360,000	390,000	420,000
	40%			54,000	162,000	216,000	234,000	252,000
	25%			67,500	202,500	270,000	292,500	315,000
	15%			76,500	229,500	306,000	331,500	357,000
GM per acre	0%	(39,250)	(8,250)	79,770	258,395	346,030	376,030	402,400
	40%	(39,250)	(8,250)	43,770	150,395	202,030	220,030	234,400
	25%	(39,250)	(8,250)	57,270	190,895	256,030	278,530	297,400
	15%	(39,250)	(8,250)	66,270	217,895	292,030	317,530	339,400
GM per fruit	0%			10.64	11.48	11.53	11.57	11.50
	40%			5.84	6.68	6.73	6.77	6.70
	25%			7.64	8.48	8.53	8.57	8.50
	15%			8.84	9.68	9.73	9.77	9.70

Source: USAID-KAVES calculations. \* Assumes KSh12 per fruit

The returns from 25 years investment in a mango orchard are relatively high. The Internal Rate of Return (IRR) over the period is presented in Table 16; it is evaluated at a price of KSh18 per kg and KSh12, with 40% PHL. It indicates a robust 71% IRR at the higher price and 57% at the lower price. These findings are in line with Krain et al. (2008) who found that farmers realized an IRR of 47 percent under intercropped mangoes in Mbeere and 23 percent under mono-cropping system. Mango investment is therefore a financially viable proposition for farmers.

**Table 16: Investment Analysis (Internal Rate of Return, IRR) for Improved System**

<i>If price of mango is fixed at KSh6 a piece (KSh18/kg)</i>	
40% PHL	71%
25% PHL	82%
15% PHL	89%
<i>If price of mango is fixed at KSh4 a piece (KSh12/kg)</i>	
40% PHL	57%
25% PHL	67%
15% PHL	73%

Source: USAID-KAVES calculations

## 5.2 RURAL ASSEMBLERS/BROKERS

Rural assemblers/brokers purchased mangoes at KSh6-10 in Makueni County and KSh4-6 in Machakos/Muranga area (with higher prices paid at the beginning and end of the season). The higher prices in Makueni are due to competition from exporters and traders from both Nairobi and Mombasa, for the perceived high quality mangoes from the area. The farmers in Nzau were also organized into a group and were able to broker better prices for their fruits. Despite the challenges facing rural brokers/assemblers, gross margin analysis shows they make between KSh0.80 and KSh1.80 per fruit (10 to 22.5 percent gross margin) in the three areas where RRA was conducted (Table 17). It is important to note that rural assemblers/brokers handle large quantities of mangoes and hence earn highly from relatively low margins.

**Table 17: Gross Margin Analysis for Rural-level Assemblers/Brokers, in KSh per Fruit**

	<b>Nzau</b>	<b>Machakos</b>	<b>Mtito Andei</b>
Transport bulking	0.20	0.20	0.20
Purchase price	6.00	5.00	6.00
Total cost	6.20	5.20	6.20
<b>Sale price</b>	<b>8.00</b>	<b>8.00</b>	<b>8.00</b>
<b>Gross margin</b>	<b>1.80</b>	<b>2.80</b>	<b>1.80</b>
<b>Gross margin, as % of sale price</b>	<b>22.5</b>	<b>35.0</b>	<b>22.5</b>

Source: USAID-KAVES RRA Survey Jan 2014

## 5.3 WHOLESALERS

The costs incurred by wholesalers include county levies at source and end market, loading and off-loading, transport, losses and commission charges at private markets. Eastleigh is a private market, which also charges a commission of KSh25 per box or KSh2000 per pickup truck for trading in the premises. This is in addition to KSh10 per box or KSh800 per pickup levy charged by the County Government. Interestingly the County Government has different levies for different markets, with Wakulima having the highest at KSh15.50 per box or KSh3500 per 7-ton truck (carrying 231 boxes). Kangemi has the lowest levy of KSh5.20 per box, but it is also a private market attracting a commission fee of KSh500 per truck for trading in the market. Kangemi is the busiest market in terms of volume of mangoes traded; with an estimated 3,636 boxes traded per day according to the RRA findings. This could imply that traders are attracted by the low levies charged at the market.

These costs along with mango purchase price at source and wholesale price at the end market are used in calculating the gross margins enjoyed by the wholesalers, as contained in Table 18. The highest cost on business transaction in mango wholesaling is the cost of the fruit, representing about 71.4 percent of the total cost in Nairobi markets and 68 percent in Mombasa. Wholesalers spend an additional KSh9.60-9.90 to move a kg of mangoes to the market, which is 40-47 percent over the cost of mangoes. Transport cost and losses are the major cost items, constituting 22 percent of the total landed cost in Nairobi. Wholesalers make identical margins of about 22 percent in both Mombasa and Nairobi markets, with average absolute margins of KSh9 per kg.

**Table 18: Mango Wholesale Gross Margins, per Kilogram**

	Nairobi	Mombasa
Purchase price	24.00	21.00
Loading cost	0.30	0.30
Transport Cost	4.50	4.50
Offloading	0.30	0.90
County levy	1.20	0.90
Losses	2.40	3.00
Commission	0.90	0.90
Total cost	33.60	30.90
<b>Sales Price</b>	<b>43.20</b>	<b>39.60</b>
<b>Gross margin</b>	<b>9.60</b>	<b>8.70</b>
<b>Gross margin as % of sales price</b>	<b>22%</b>	<b>22%</b>

Source: USAID-KAVES RRA surveys (January 2014)

## 5.4 TRANSPORTERS

The USAID-KAVES RRA surveys conducted in Nairobi wholesale markets in 2014 found that the transport cost per box of mangoes ranged from KSh71 (KSh18000 per truck) to KSh78 (KSh16500 per truck), when transported by 7-ton a truck from Makueni and KSh150 per box when transported by a pickup (this applied only to Ngowe mangoes traded at Eastleigh market). This finding indicates that wholesale traders can increase their average returns by using high-capacity transport trucks.

## 5.5 RETAILERS

From the USAID-KAVES RRA surveys data, mango prices at retail level vary depending on point of sale. For example while a piece of standard apple mango was retailing at KSh25 on roadside kiosks and dukas in Nairobi and its suburbs, it was selling at KSh132 per kilogram (KSh44 a piece) at Nakumat Galleria, a difference of about KSh20 (76 percent) per fruit. The average purchase price of mangoes by retailers was KSh14 a piece (KSh42 per kilogram). Retailers incur other expenses, such as storage, county levies, labor (off-loading and security) and losses. Losses are estimated at KSh2 per kg due to poor condition of which the retailers sell and store unsold mangoes leading to high losses. Despite the high costs of operation, our gross margin analysis results in Table 19 show that retailers make on average KSh6 per fruit (KSh18 per kilogram) or 24 percent gross margin.

**Table 19: Mango retailer gross margin analysis (KSh per fruit)**

Cost Item	Kitengela & Langata	Supermarket
Purchase price	14.00	15.00
County levy	1.00	
Storage & labor	2.00	
Losses per unit	2.00	2.00
Other costs	0	2.00
<b>Total cost</b>	<b>19.00</b>	<b>19.00</b>
<b>Sale Price</b>	<b>25.00</b>	<b>44.00</b>
<b>Gross margin</b>	<b>6.00</b>	<b>25.00</b>
<b>Gross margin, as % of sales price</b>	<b>24%</b>	<b>57%</b>

Source: USAID-KAVES RRA surveys (January 2014)

## 5.6 EXPORTERS

Interviews with exporters indicated that they are the first to get into the market at the beginning of the season in late September to late October. At this time most of the mangoes will be found in Lower Eastern parts of the Country (Makueni and Machakos). They also indicated that the most preferred

varieties for export in the Middle East are apple and ngowe varieties. Apple accounts for about 88 percent of the fresh mangoes exported from Kenya. Stringent sanitary requirements and high freight costs make the European market uneconomical. The European market also prefers Kent, Keitt and Tomy Atkins varieties, which are not widely produced in Kenya.

Exporters also demand high quality fruits, free from pests and disease infestation, mature but not ripe and high post harvest handling to ensure the fruits reach the market destinations without blemishes. Prices start as high as KSh400 per box of 4kgs in the beginning of the season and drop to as low as KSh80 per box in December – February when production is at peak, and then steadily increase towards KSh400 per box in May/June.

Most exporters prefer to purchase directly from farmers using trained harvesters and packers to ensure only fruits that meet export standards are picked. Export cost and margin analysis for exports to the Middle East are presented in Table 20. We have estimated purchase price by exporters at KSh35.75 (\$0.40) per kg and airfreight to Middle East at KSh72 (\$0.80) per kg. Local transport and harvesting labour are the other major costs incurred by exporters. Airfreight is therefore the most expensive item in the export business, costing more than double the local average purchase price of mangoes. Total costs are equivalent to \$1.25 (KSh112.50) per kg, while FoB prices is assumed to be \$1.68 per kg (KSh151.20). Despite the high cost of exporting, exporters earn average gross margins of KSh39.00 (\$0.43) per kg of mangoes; this is nearly three times the gross margins earned by processors.

**Table 20: Analysis Costs and Margins for Direct Purchase from Farmers and Exporting the Middle East, per Kilogram**

<b>Cost (KSh):</b>	
Average purchase price	35.75
Transport	1.70
Harvesting labour	0.53
aggregation cost	1.00
Loading	0.17
cleaning and packing	0.50
County levy (cess)	0.17
HCDA fees	0.30
Airfreight	72.00
<i>Total cost (KSh)</i>	<i>112.12</i>
<i>Total cost (US\$)</i>	<i>1.25</i>
<i>Selling price (US\$)</i>	<i>1.68</i>
<i>Exporter gross margin (US\$)</i>	<i>0.43</i>

*Source: USAID-KAVES interviews with selected exporters*

## 5.7 PROCESSORS

Processors purchase their mangoes either directly from organized farmers groups or agents. The farmers or the agents are given a supply contract which specifies the volumes to be supplied, the quality parameters, contract price (factory gate) and the varieties. Quality parameters considered include maturity, sugar content and acidity. The price range for mangoes at the factory gate is KSh13 to KSh14 in Mombasa and Malindi and KSh14 to KSh16 in Nairobi and Thika. In our analysis we use the factory gate price of KSh13 paid in Coast region. Transport cost is factored into the factory gate price. Organized farmers and agents are required to deliver mangoes at the factory gate. Losses estimate at 12 per cent are realized at the factory mainly attributed to poor packaging and transportation methods and the hot and humid weather conditions. Mangoes are packed in open trucks and because of compression and depending on the level of ripeness/ maturity those at the bottom of the heap will have spoiled by the time they are off-loaded at the factory.

The recovery rate is 50 percent and according to our industry informer, the by-product is currently discarded but there are plans to start converting it into fertilizer or biomass. Other costs considered are utilities, maintenance, licenses and management costs. These costs are USAID-KAVES estimates and are calculated on a 20 MT fresh mango basis. A 20-ton truck of mangoes converts to 8.80 MT of puree, after accounting for 50 percent recovery rate and 12 percent losses. The price of puree is FOB US\$900/MT. The costs and returns for processors are presented in Table 21. The gross revenue from 8.80 MT is KSh627264 and the value added by the processor is KSh22.64 per kg of mangoes.

**Table 21: Analysis of Costs and Returns in Processing Mangoes (every 20 MT)**

Factory gate total purchase price (KSh 13000 per MT)	260,000
Casual labor (offloading) - six casuals per day at KSh500	3,000
Mango losses, 12% (MT)	2.40
Mango available for processing (MT)	17.60
Puree recovered (rate of 50% of mangoes) (MT)	8.80
Puree recovery losses, 12% (KSh)	31,200
Cleaning labor (KSh)	429
Utilities (assume 10% of cost of mangoes) (KSh)	26,000
Management Costs (assume 5% of mango cost) (KSh)	13,000
Maintenance costs (5% of mango cost) (KSh)	13,000
Licenses (KSh)	260
Total cost of puree recovered (KSh)	346,889
Unit cost of puree (KSh/MT)	44,795
Value of puree recovered (US\$900/MT, at KSh90=1US\$) (KSh)	627,264
Gross margin (KSh/20 MT)	280,375
Gross margin (KSh/MT)	36,205
Total cost equivalent per kg mangoes (KSh)	17.20
Sales price equivalent per kg mangoes (KSh)	35.64
Gross margin equivalent per kg mangoes (KSh)	18.30
Gross margin %	51%

Source: USAID-KAVES estimates from interviews with selected processors

## 5.8 SUMMARY OF VALUE ACCUMULATED

Based on our analysis, the value accumulation along the mango value chain is illustrated in Figure 9. Assuming 40% PHL, the production cost per kilogram of mango is estimated at KSh2.30 for the first seven years of establishment. In the domestic fresh market, where mangoes sold in open-air markets, kiosks and local shops at a producer price of KSh18 per kg to the village assembler, the producer makes gross margins of KSh15.70 per kg. The Assembler in turn sells to a wholesaler at KSh27, who then sells to the retailer at KSh42. The final consumer purchases at an average of KSh75 a per kg in the fresh produce markets. Mangoes sold through supermarkets and high-class grocery stores command a higher retail price. At the time of conducting this study, a kg of Ngowe mangoes was selling for KSh132 in Uchumi and Nakumatt stores; equivalent to KSh44 a piece.

The cumulative value is calculated per kilogram, as the difference between the average retail price (KSh75), processor price (KSh36), exporter FOB price (KSh151), and the average farm-gate cost of production for a mature tree (KSh2.30). The results are summarized in Table 22. It indicates that the value of mangoes increases by KSh73 from the farm gate to retail markets, by KSh33 through processors, and by KSh149 through exporters. The analysis indicates that every KSh1 invested in producing mangoes generates KSh6.83 in value to the farmer, and KSh11.74 through the village assembler. The fresh mango value chain generates an additional KSh72.70 in value per kilogram at the retail markets—equivalent to 32.6 times the farm cost. On the supermarket or groceries store shelves, the value of mangoes would be 52 times the cost of production. Overall, a further KSh32.60 and KSh65.65 is created through the fresh fruit and export channels, respectively, for every KSh1 invested in mango production. This is a significant multiplier effect, which makes mango industry a critical creator of economic value in rural areas.

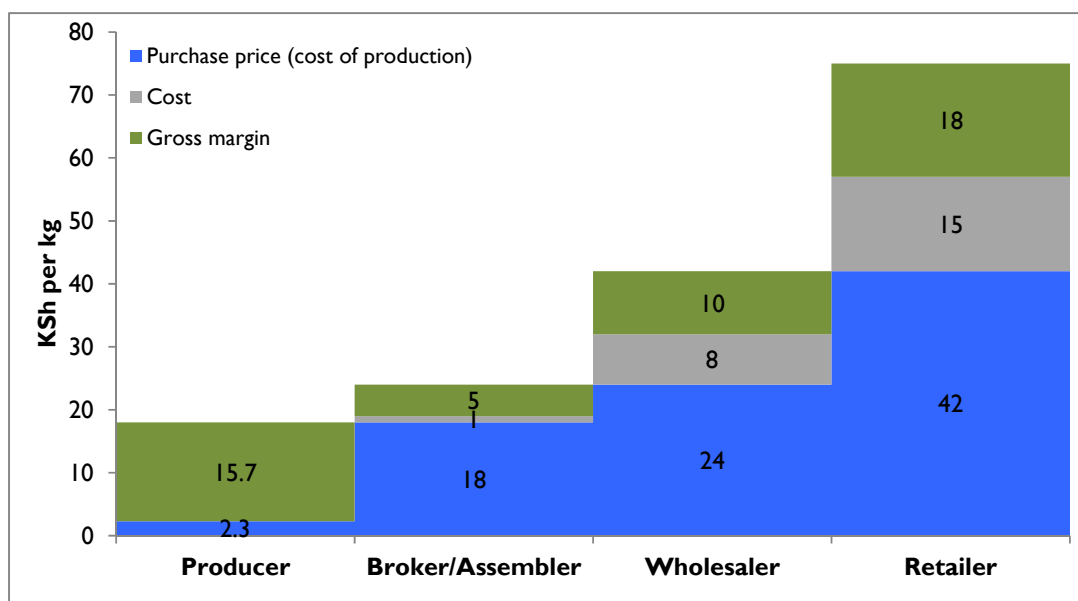


**Table 22: Summary of Cost and Gross Margins for Mango Value Chain Actors (per kg)**

Item	Producer	Assembler	Wholesaler	Retailer	Processor*	Exporter*
Purchase price	-	18	24	42	13	36
Total cost	2.30	19	32	57	17	112
Selling price	18	24	42	75	36	151
Gross margin	16	5	10	18	18	39
Gross margin %	87	22	22	24	51	26
Value added	16	6	18	33	23	115
Percent value added	22	8	25	45	68	77

Source: USAID-KAVES calculations. \* Assumes direct procurement from farmers

It is noteworthy that between KSh24 and KSh36 remains in the rural economy for every kilogram of mangoes produced. From the 360,000 MT of mangoes available in 2013, mango producing rural economies earned approximately KSh10.8 million (assuming an average KSh30 retained value per kg). The rural incomes from mangoes can more than double through improved production systems and, from our projections in Section 3.3, would more than triple by 2022.

**Figure 7: Value Accumulation and Gross Margins in the Fresh Mango Market**

Source: KAVES Rapid Assessment Survey (Jan. 2014) and Crops Budget Survey

From the value accumulation data, retailers have the highest markup of KSh33, while wholesalers get KSh9 and Assemblers KSh6. The high markups among retailers partly covers the high cost and risk they face due to poor marketing conditions and high perishability. Retailers also move relatively low volumes of mangoes. Supply agents and wholesalers on the other hand have to incur high assembly and transport costs due to remoteness of and poor infrastructure in production regions and numerous levies at different levels, especially across counties.

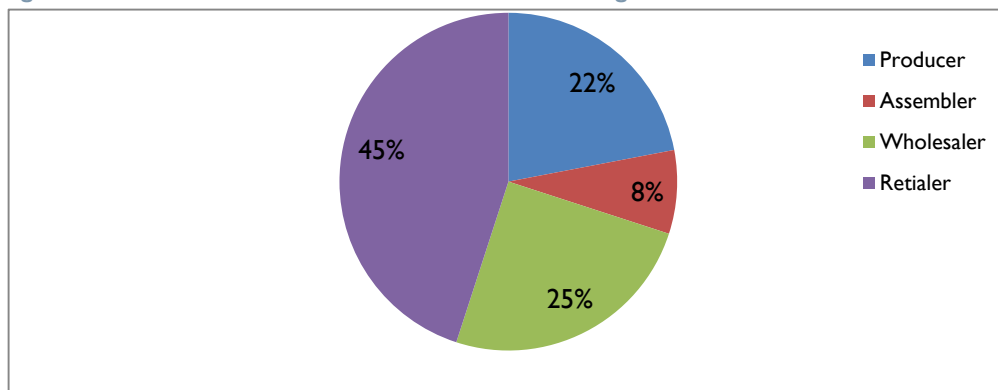
## 5.9 SUMMARY OF KEY FINDINGS

From the above analysis, farmers require about KSh38500 to establish an acre of mango orchard with 50 trees and a further KSh14500 per year to maintain it for 25 years. At full maturity (from 7<sup>th</sup> year), an acre yields 11.7 MT of mangoes per year, at unit cost of KSh1.37 per kg (KSh2.30 if we assume 40% PHL). From this cost of production, the mangoes go through either fresh produce, processing, or export market channels. We find the value of mangoes increases by KSh73 from the farm gate to retail markets, KSh33 through processors, and KSh149 through exporters. For every KSh1.00 invested in mango

production a further KSh32.60 and KSh65.65 is created through the fresh fruit and export channels, respectively.

The greatest generator of value along the fresh mango market channel is the retailer at 45 percent, followed by wholesalers at 25 percent and farmers at 22 percent (Figure 8). Among marketing actors, the analysis indicates exporters earn the highest absolute margins (KSh39 per kg) despite paying the highest prices, while processors pay the lowest prices and earn the highest percent margins (51 percent). Overall, assemblers, wholesalers, exporters and processors earn more money from high volumes traded compared to retailers and producers, who handle only small volumes per season.

**Figure 8: Percent distribution of value accumulation among the actors**



Source: KAVES Rapid Assessment Survey (Jan. 2014) and Crops Budget Survey

In terms of economic value, approximately KSh24-36 of the value created is retained in the rural economy for every kilogram of mangoes produced. From the 360,000 MT of mangoes available in 2013, mango producing rural economies earned approximately KSh10.8 million (assuming an average KSh30 retained value per kg), which makes mango production a powerful economic driver. The rural incomes from mangoes can more than double through improved production systems and, from our projections in Section 3.3, would more than triple by 2022.

## 6 BUSINESS ENABLING ENVIRONMENT

### 6.1 SUPPORTING ORGANIZATIONS

Kenya has several ministries handling agriculture-related issues, including the State Departments of Agriculture, Lands, Housing and Urban Development, Environment and Mineral Resources, and Devolution and National Planning, among others. The Agricultural Sector Coordination Unit (ASCU) and the National Stakeholder Forum play a crucial inter-ministerial role in formulating mango-related policies in consultation with various stakeholders. It is important to note that ASCU led the development of the horticulture policy with financial support from IFAD through the Smallholder Horticulture Marketing Programme (SHoMaP). The Ministry of Agriculture provides most of the extension and training services. It also generates market information through the Agricultural Information Resource Center (AIRC).

#### 6.1.1 Implementing Institutions

Kenya's institutions, especially farmers' and traders' associations and public institutions, are not adequately developed to provide effective support to the mango value chain. Institutional structures to support structured development of the mango industry remain weak. There is lack of standards and enforcement mechanisms to ensure production, handling and processing of quality mango products. Research in the mango industry remains passive and unsupportive to orderly development of the subsector.

**Horticultural Crops Development Authority (HCDA)<sup>15</sup>:** the horticulture sector regulatory body is an important player in the mango industry. It is a State Corporation established under the Agriculture Act Cap 318 through a subsidiary legislation in 1967, Legal Notice No. 190, HCDA Order 2011. HCDA is mandated to regulate the horticulture industry through licensing and application of rules as prescribed under the Agriculture Act, Cap 318. HCDA also provides advisory and marketing services to the stakeholders in the industry for planning purposes

**Kenya Plant Health Inspectorate Services (KEPHIS)** was established through the Legal Notice No. 305 of 18th October 1996 pursuant to the State Corporations Act Cap 446 to undertake quality control services of agricultural inputs, plant variety protection and plant health. The strengths of KEPHIS include: Local and internationally recognized accreditation and certification; availability of infrastructure; good corporate governance; competent and committed staff; international recognition and membership to international organizations; advanced laboratories and inspection services; decentralized services for ease of access; enhanced collaboration with all stakeholders; and an ability to form and maintain linkages with collaborators and donors. Weaknesses include: limited resources; lack of specialized capacity in specific disciplines; inadequate visibility and awareness about some institutional services; inadequate procedures for implementation of existing legal framework; inadequate internal legal capacity; and weaknesses in succession planning.

**Horticulture Competent Authority Coordinating Committee:** The Ministry of Agriculture established the Horticulture Competent Authority Coordinating Committee in November 2011.<sup>16</sup> The Committee is a mechanism for streamlining enforcement of sanitary and phytosanitary measures that were adversely affecting the horticulture industry, especially the concerns with rejection of Kenyan produce in the international market. The committee meets on an as needed basis and as frequently as once a month when tackling urgent issues. The Committee was recently audited by FVO, which assessed, among other things: the structure of the Committee and roles of the constituent institutions;

---

<sup>15</sup> Further information on the HCDA, KEPHIS and PCPB can be found in the USAID-KAVES Potato Value Chain Study (2014).

<sup>16</sup> The committee comprises KEPHIS (to serve as the central notification point and chair of the technical committee in addition to core competence on all matters phytosanitary and residue testing); PCPB (responsible for testing, registration and regulation of plant protection products); HCDA (to undertake registration and development of the horticulture sub-sector); KARI (to undertake all research issues in horticulture); FPEAK (dealing with fruits and vegetable exports); and KFC (dealing with export of flowers).

nature of training horticulture producers receive and whether some of them still use prohibited chemicals (such as dimethoate); the capacity of the KEPHIS labs to detect residues at prescribed levels; mechanisms for institutionalizing traceability in the industry; and, whether or not the proposed reforms under AFFA will compromise the functions of the Committee. The final audit report has not been released but discussions with KARI indicate that the Committee is moving in the right direction.

**National Food Safety Coordination Committee (NFSCC)** is a multi-sectoral committee initiated by various government agencies/institutions. It is responsible for coordinating all food safety activities in the country.<sup>17</sup> It was established in response to stiffer penalties/regulations on food specifications and codes set by importing countries such as the European Union (e.g. GlobalGap and EU directive 91/493/EEC). It seeks to increase awareness about the impact of food safety and quality, and to initiate the revision and harmonization of all the relevant Acts of Parliament. It is aimed at ensuring that food produced, distributed, marketed and consumed meets the standards of food safety.

### 6.1.2 Private Sector Associations

**Fresh Produce Exporters of Kenya (FPEAK)** was established in 1975 as a limited company. The association is a recognized partner in all the leading agricultural legislation consultation, certification and research bodies, and development partners in Kenya. This makes it possible to influence innovation and policy to the benefit of its members and the industry at large. It has a mission “to develop, unite and promote the Kenyan horticultural industry in the global market with due regard to safety, good agricultural practices, social, ethical and environmental responsibilities” (FPEAK, 2014). Its strategic goals are to: update and implement Kenya Gap to recognized international standards; influence enactment of a facilitative environment for the horticulture industry; create awareness in the horticulture industry on market requirements, changes and regulations; and, undertake continuous identification of market opportunities. Other activities include: provision of timely information on technical issues, trade, official regulations, and market requirements; undertaking trade enquiries from overseas buyers; conducting training programs in conjunction with specialized trainers; undertaking pre-certification appraisals; supporting small scale farmers through training programs targeted at good agricultural practices; market development through coordinating the participation in trade events of its members; and, undertaking advocacy and lobbying through continuous monitoring of domestic and international policy.

**Horticulture Council of Africa (HCA)** is a network established by major horticulture exporting countries in the Eastern, Central and Southern Africa (ECSA) region.<sup>18</sup> HCA aims to bring greater bargaining power to address common challenges and constraints, such as competition and compliance with safety and standards that these countries face, especially in the European markets. It is also active in organizing sharing of information and technical skills, as well as providing a common platform for negotiations on economic partnership agreements (EPAs) and at the WTO.

The HCA aims at complementing rather than competing with national horticulture associations, such as FPEAK and KFC in Kenya, Rwanda Flower Producers and Exporters Federation, Horticultural Exporters Association of Uganda, and Horticultural Promotion Organization of Uganda (HPOU). This, however, is easier said than done as in practice, the member countries must compete in the emerging regional markets. The fact that Kenya, for example, is concerned about increasing horticulture imports from neighboring countries like Tanzania and Uganda, means that HCA would have to play more proactive and regulatory roles for which it is ill suited, especially considering its limited human capacity.

---

<sup>17</sup> The Members are the Department of Veterinary Services, Department of Livestock Production, Department of Fisheries, Kenya Bureau of Standards, Kenya Plant Health Inspectorate Services (KEPHIS), National Public Health Laboratory Services (NPHLS), Government Chemist, Kenya Medical Research Institute (KEMRI), University of Nairobi, Tea Board of Kenya, Coffee Board of Kenya, Kenya Agricultural Research Institute (KARI), Kenya Dairy Board, Pest Control Products Board, Ministry of Local Government, and the National Biosafety Authority (NBA). Co-opted members include World Health Organization (WHO), Food and Agricultural Organization of the United Nations (FAO), and UNIDO.

<sup>18</sup> Member countries include Kenya, Uganda, Zambia, Tanzania, Zimbabwe, South Africa, Burundi, Rwanda, and Ethiopia.

**The Mango Producers and Marketing Organization:** is a farmer led organization formed in the last three years to lobby for the development of the mango value chain, especially in articulating farmers' issues. This is a newly formed organization that will require further capacity building in order to have an orderly development of the industry.

Other key industry players that have synergies with the horticulture value chains and/or promote horticultural products commercialization, marketing and technology support include The Kenya National Chamber of Commerce and Industry; The Kenya Association of Manufacturers (KAM); and, East African Business Council (EABC)

### 6.1.3 Research, Extension, and Information

Kenya has several public and donor-funded national and multinational research programs, including:

- *Kenya Agriculture Research Institute (KARI) – Thika.* Responsible for research and breeding and also tree nursery for quality planting material
- *Local universities, the University of Nairobi, and JKUAT* – research on breeding and crop protection, agronomic practices, socioeconomic studies, and training in farm management.
- *National Agricultural Research Laboratories (NARL)* – national mandate and responsibility for agriculturally related research in Natural Resource Management, including soil fertility testing
- *Private agribusiness companies*, including regional centers for multinationals and seed multipliers.

Mango research in Kenya is being conducted by a number of institutions. KARI, Thika centre for example has been conducting research on crop protection and physiological issues. ICRAF is also involved to some extent on mango research especially on diversity. Jomo Kenyatta University has been doing research on value addition, while International Centre of Insect Physiology and Ecology (ICIFE) is conducting research on fruit flies. KEFRI is establishing a database on mango varieties in the country. University of Nairobi is undertaking research on postharvest issues, while KENFAP is involved in market research. Kenya Plant Health Inspectorate (KEPHIS) coordinates response to crop pests and disease control and provides inspectorate services to all fresh produce exports.

### 6.1.4 Service Providers

Financial institutions are important players in the agriculture sector through financing of a number of activities, including farm inputs, trading and processing. The Kilimo Biashara initiative is an example of how farmers have been able to access loans for production process, despite the risk associated with rain fed agriculture. The fund is also financing small-scale farmers, farmers groups/self-help groups, and cooperatives and farming companies for purchase of farm inputs; fertilizers, chemicals and seeds (up to KSh 150,000). It is a \$5million facility financed by IFAD and AGRA to cushion banks against risks of lending to the agriculture sector (participating Banks include Equity and Family Bank). Although there is documented evidence of funding of cereals and the dairy sector, there is no documented evidence of financing of mango production or trade. One challenge is that mango production is a long term investment with a two year period of no harvest after the establishment of the orchard. This may pose challenges to financial services providers. However, financial products could be developed for producers with already producing orchards and especially for purchase of inputs.

Smallholders' access to financial services is affected by a number of factors. Some find the loan application process tedious (in the case of Kilimo Biasara facility), while others fear the consequences of defaulting as most farmers can only access loans as a group and therefore one farmer defaulting could have consequences for the others. Farmers have also indicated that loans are very risky due to the uncertain nature of rain-fed agriculture (Barnett et al, 2011). KAVES could identify potential areas for financial support to mango producers and help link farmers with service providers.

## 6.2 REGULATORY AND POLICY ENVIRONMENT

### 6.2.1 Legal and Regulatory Framework

The **Agriculture, Fisheries and Food Authority (AFFA) Act of 2013** is intended to give effect to the 4<sup>th</sup> Schedule of the Constitution of Kenya (the distribution of functions between the national

government and the county governments) and the creation of a central authority, AFFA, to consolidate all laws regulating and promoting agriculture. The functions of the Horticulture Crops Development Authority (HCDA) will be discharged within AFFA. Commercial functions will be undertaken by a company registered under the Companies Act, while non-commercial functions will be performed by AFFA. This proposal has elicited major concerns among industry players, who when interviewed, worried that delinking the highly complementary functions of the HCDA, the Pest Control Products Board (PCPB) and the Kenya Plant Health Inspectorate Services (KEPHIS) could lead to bureaucracies that would stifle horticulture development. The Act also provides for creation of Directorates within the Authority for each produce to undertake any specialized activities with respect to promotion and management of the commodity.

Mostly the regulatory framework is developed by KEBS and implemented by HCDA. Standards on production (farm standards benchmarked on international standards), food safety are well in place. For example KS 05-220-5:1981 on analysis of vitamins and KS 1560:2000 code for hygienic practice for the horticultural food industry (recommends general hygiene practices for use in handling including growing, harvesting, preparation, processing, packaging, storage, transport, distribution, and sale of horticultural food product for human consumption). For the export markets, EUREPGAP and GLOBALGAP are the main standards governing the sub sector. It is important to note that a Horticultural Policy is being developed to further direct the industry activities. The Country also operates within the UNECE standards for fresh mango exports.

### 6.2.2 Policy Regime

The policy regime in Kenya consists of support functions for the national government and the regulatory and facilitating functions of the new county governments. At the national level, policy reforms and interventions relevant to horticulture industry and mango sector include the following: Agricultural Sector Development Strategy (ASDS), 2010-2020; National Agricultural Sector Extension Policy (NASEP), 2012, National Horticulture Policy, 2012; National Agricultural Research System Policy, 2012; National Agribusiness Strategy, 2012; and the National Seed Policy, 2011. A review of these policies is covered in more details in the USAID-KAVES Maize Value Chain report (2014).

In 2010, Kenya published its first Horticulture Policy document whose main theme is to promote the growth and competitiveness of the horticulture industry including the mango subsector. Interestingly the policy does not mention the mango industry anywhere. However the policy documents capture some of the factors ailing the mango industry and potential solutions, including intentions to improve infrastructure, promote value addition, increase domestic and export trade, promote of increased production of high quality produce, and develop appropriate credit packages for small scale horticulture farmers. The policy document also highlights the need to support the formation and capacity building of common interest groups to enhance market efficiency and provision of extension services.

### 6.2.3 Devolution of Agricultural Policies

The emerging county agriculture policies and regulations will significantly reshape Kenya's agricultural policy regime. Of specific importance are production and marketing levies already being proposed across the counties. Msabeni Anita et al. (2010) in a study conducted in Mbeere district observed that local government policies in relation to levies, costs of moving goods by road within counties (poor infrastructure), and policies on land use and conservation would affect agriculture production, including mango production. It is expected that as the counties look for ways of generating revenue, agriculture and transport will be some of the sectors that will be affected. Of particular concern is the possibility of double taxation as traders move commodities across county boundaries. Interviews with mango wholesalers in Nairobi and Mombasa indicated that they were paying between KSh11 per 22kg in Nairobi and KSh15 per 14kg box in Mombasa wholesale markets. Similar levies are being levied at the counties of origin.

### 6.2.4 Price Control and Taxation

The Price Control (Essential Goods) Act No. 26 of 2011, an Act of Parliament, commenced on 19th September 2011 and aims to provide regulation of the prices of essential commodities in order to secure their availability at reasonable prices. The Minister from time to time may determine the maximum prices of the commodities with consultation with the industry. The list of the prices for the

essential commodities was never announced. In addition, the Consumer Protection Act of 2012 came into force on March 14, 2013 and provides for punishment of businesses that knowingly sell sub-standard goods and lie on pricing, prohibits the use of misleading information to sell goods and services. The mango industry is not subject to price controls as the products are not classified as part of the essential commodities.

Although the new Value Added Tax Act of 2013 (CAP 476) exempts fresh fruits including mangoes from taxation, it imposes a 16 percent VAT on processed juices. Maina (2013) analyzes the differences between exempt and zero-rated status, and concludes that the difference in the price of exempted supplies and those charged 16 percent VAT is negligible, and prices of zero-rated supplies are the lowest. This is a result of the fact that businesses supplying exempted goods/services have no mechanism to claim back input VAT, which then must be converted into a cost, while those under the 16 percent VAT category do. The 16 percent VAT on distribution will increase the cost of production inputs, transportation costs, and ultimately mango prices.

### 6.2.5 Grades and Standards

Kenya applies the UNECE fresh mango standards but for only export mangoes. Within the domestic market, the country does not have stipulated mango standards. Standards apply for processed mango products, such as juices and jams. Processors are required by law to register all processed products on offer for sale to the public and acquire the KEBS diamond mark of quality.

## 6.3 INFRASTRUCTURE

### 6.3.1 Transport Infrastructure

The mango industry is heavily affected by the state of rural infrastructure given the perishable nature of the product. Rural feeder roads, which are critical for collection of production, are in dire need of repairs and maintenance. In some areas, village assemblers and brokers are forced to use donkey and ox carts to penetrate remote areas to purchase mangoes. In addition, packaging infrastructure is important if the harvested fruits are to be kept under suitable conditions.

For export mangoes, port infrastructure and shipping lines are also critical factor for ensuring competitiveness of mango exports. At the moment there is heavy reliance on air transportation, which is expensive and makes Kenya mangoes cost more compared to imports from competing countries. As part of the national expansion of infrastructure, the Government has initiated the construction of the Lamu Port and its Corridor linking coastal Kenya with South Sudan, Ethiopia and Uganda. Within this Corridor, the Government has identified production and processing of mangoes as a key value chain along with livestock industry (GoK, 2012).

### 6.3.2 Rural and Urban Market Facilities

Rural and urban market facilities (retail and wholesale) are not specially constructed for horticulture produce. Trading takes place on open floors within wholesale markets and some of the commodities are also traded while loaded on the trucks and only off-loaded after a deal is made. Given the perishable nature of mangoes, these conditions provide the right environment for fast deterioration of the fruits leading to heavy losses. Exporters and processors have also highlighted a lack of collection and sorting facilities in the main mango producing areas as one of key logistical challenges that adds to marketing costs.

### 6.3.3 Irrigation

Although Kenya has invested in irrigation agriculture, there has been very little attention towards providing irrigation for fruit crops and especially mangoes. In areas that utilize supplementary irrigation, such as large-scale farms along river Athi, mangoes are able to produce better quality fruit. In some cases, irrigation allows the production of early season fruits, giving the farmers an opportunity to get better prices.

## 7. UPGRADING INTERVENTIONS

Based on the information and analyses provided above, this section outlines interventions for the mango sector, with a focus on small-scale producers, that will increase on-farm productivity, streamline aggregation, and improve storage and postharvest systems. These are organized into three strategic components:

1. **Increase productivity** - agronomic and pest management technologies that will increase yields, improve quality and raise productivity
2. **Aggregation and marketing** – including a national mango survey; group capacity building; and establishment of collection centers, with grading systems and the appropriate provision of rural transportation and packaging services;
3. **Postharvest handling and standards** – training and new techniques to improve quality and reduce wastage.

The three components are supported by eight specific strategic interventions and 26 objectives that will increase on-farm productivity, streamline aggregation, and improve market systems for fresh and processed mangoes. Interventions have been selected that will contribute directly to the goals and objectives of the KAVES project and are highly scalable through private sector partnerships, with varying levels of public sector support. The interventions all rely heavily on the mass adoption of new technologies, supported with specialist training and extension; new sources of investment and credit to unlock value chain constraints; and engagement of private sector partners for market development and sustainability.

Recommended interventions	Specific upgrading objectives	Challenges	Expected results
<b>Strategic intervention I: Increase Productivity</b>			
<b>1. Increase awareness and planting of varieties for processing</b>	1. More linkages established between nursery operators and mango farmers 2. Quality of certified tree nurseries improved 3. Farmers have more information on different varieties	<ul style="list-style-type: none"> <li>• Predominance of varieties unsuitable for processing</li> <li>• Time lag between planting and production</li> <li>• No national mango strategy</li> <li>• Weak regulation of nurseries</li> </ul>	<ul style="list-style-type: none"> <li>• Better distribution of varieties</li> <li>• Increase in marketing agreements</li> <li>• Increased productivity and production over the medium term</li> </ul>
<b>2. Promote integrated pest management</b>	4. Input suppliers and farmers have more information on approved agrochemicals 5. Increase in trained teams to provide spraying services 6. Reduction in mango weevil and fruit fly infestation 7. More productive orchards	<ul style="list-style-type: none"> <li>• Erroneous or lack of pesticide labelling</li> <li>• Lack of qualified trainers</li> <li>• High cost of pesticides approved for export markets relative to generics</li> <li>• Fake products</li> </ul>	<ul style="list-style-type: none"> <li>• Improved fruit quality</li> <li>• Reduced postharvest losses</li> <li>• Increased production</li> <li>• Better prices and higher income from mangoes</li> </ul>
<b>3. Increase use of custom fertilisers</b>	8. Fertility and organic content of orchards increased 9. Farmers adopt soil testing and use custom fertilizer 10. Fertilizer application systems Improved	<ul style="list-style-type: none"> <li>• Cost</li> <li>• Most farmers plant trees to avoid input costs</li> <li>• Absentee growers</li> </ul>	<ul style="list-style-type: none"> <li>• Improved yields</li> <li>• Better quality fruits</li> <li>• Time to first crop reduced</li> <li>• Higher sales and incomes</li> </ul>



<b>Strategic intervention II. Increase aggregation and collective marketing</b>			
<b>4. Support a national mango survey</b>	<p>11. Data obtained on distribution and age of varieties for market forecasting</p> <p>12. Baseline established for county level planning</p> <p>13. Greater interest in Kenyan mango products from international buyers</p>	<ul style="list-style-type: none"> <li>• High cost of satellite imaging</li> <li>• National consensus of stakeholders required</li> </ul>	<ul style="list-style-type: none"> <li>• New national mango strategy formulated and agreed</li> <li>• Export sales of fresh and processed mango increase</li> <li>• Farmers' sales and incomes increase</li> </ul>
<b>5. Build capacity of farmer groups</b>	<p>14. More marketing groups formed</p> <p>15. Availability of pruning, spraying and harvesting services increased</p> <p>16. More collection centres established</p> <p>17. Marketing agreements increased</p>	<ul style="list-style-type: none"> <li>• Large distances between farms</li> <li>• Resistance from brokers</li> </ul>	<ul style="list-style-type: none"> <li>• Increased sales and incomes</li> <li>• Orchard management improved</li> <li>• Market risk reduced</li> </ul>
<b>Strategic intervention III: Improve quality and reduce postharvest losses</b>			
<b>6. Improve postharvest handling systems</b>	<p>18. Farmers trained on harvesting indices and field handling</p> <p>19. Sorting and grading at field and collection centre levels increased</p> <p>20. Improved fruit quality</p> <p>21. Improved shelf life of the fruit</p>	<ul style="list-style-type: none"> <li>• Large size of trees</li> <li>• No price incentives</li> <li>• Investment needed</li> </ul>	<ul style="list-style-type: none"> <li>• Higher returns to farmers and first level traders</li> <li>• Exports increased</li> <li>• New markets supplied</li> </ul>
<b>7. Introduce quality standards</b>	<p>22. Farmers trained and adopting new national standard KS 1758:2005</p> <p>23. Standard weights and measures adopted</p>	<ul style="list-style-type: none"> <li>• No price incentives</li> <li>• Weak regulatory</li> </ul>	<ul style="list-style-type: none"> <li>• Increased market access</li> <li>• Safer products</li> <li>• Higher net returns</li> </ul>
<b>8. Scale up niche processing operations</b>	<p>24. KHCP-assisted microprocessors evaluated</p> <p>25. New investments in mango products obtained</p> <p>26. New products developed</p>	<ul style="list-style-type: none"> <li>• Food safety standards difficult to meet for export markets</li> <li>• Local market for dried fruit still small</li> <li>• May need new investment</li> </ul>	<ul style="list-style-type: none"> <li>• Processing industry growth</li> <li>• Reduction in postharvest wastage</li> <li>• Rural employment created</li> </ul>

## ANNEX I: REFERENCES

ABD/Danida, IDM. April 2009. The Results of the Mango Tree Census and Baseline Survey for Coast Province.

ABD/Danida, IDM. Dec. 2010. The Results of the Mango Tree Census and Baseline Survey for Eastern Province.

Barnett, C., M. Chisvo, and Y. Pinto. (2011). Country Case Studies on the Pass Value Chain Strategy/ Approach and its Impact/ Effect on Smallholder farmer yields in Africa.

Chain Partners: Developing mango market linkages through farmer field schools in Kenya. [www.kit.net/KIT\\_Publications\\_output/showfile.aspx](http://www.kit.net/KIT_Publications_output/showfile.aspx). Accessed on 5<sup>th</sup> March 2014.

CPCS Transcom Limited (June 2010). Analytical Comparative Transport Cost Study along the Northern Corridor Region. Northern Corridor Transit Transport Coordination Authority.

David Tschirley and Milton Ayieko. 2009. Assessment of Kenya's Domestic Horticultural Production and Marketing Systems and Lessons for the Future. Tegemeo Institute of Agricultural Policy and Development. WPS 32/2008.

FAO: (2004). Mango Value Chain Analysis: Case Study of Mangoes in Kenya. <http://pdfcast.org/pdf/value-chain-analysis-a-case-study-of-mangoes-in-kenya>.

FPEAK (2011). Minutes of the First Mango Commodity Working Group Meeting Held on 22nd July 2011 at Southern Sun Hotel Nairobi.

FPEAK, HCDA, EPC. Creating Sustainable Exporter Competitiveness in the Tree Fruit Sector in Kenya. A Netherlands Trust Fund II Project. Project Document KEN/47/111A. ITC, CBI.

Gathambiri C.W., J.G. Gitonga, M. Kamau, J.K. Njuguna, S.N. Kiiru, M.N. Muchui, E.K. Gatambia and D. K. Muchira: Assessment of Potential and Limitation of Post-harvest Value Addition of Mango Fruits in Eastern Province: A Case Study in Embu and Mbeere Districts. <http://www.kari.org/biennialconference/conference12/docs/>. Page 563-566.

Gitonga K. J., C. Gathambiri, M. Kamau, K. Njuguna, M. Muchui, E. Gatambia, S. Kiiru. 2010 Enhancing Small Scale Farmers' Income in Mango Production Through Agro-Processing and Improved Access to Markets. <http://www.kari.org/biennialconference/conference12/docs/enhancing-small-scale-farmers-income-in-mango-production-through-agro-processing.pdf>

GoK (May 2012). Agriculture Investor Roundtable on Investment Opportunities in the LAPSET Corridor. Investor Presentation.

ITC. (April 2012): Mango Global Market Report: A Kenyan Perspective. Prepared for NTF II Program. Kenya Competitive Tree Project.

Juergen Griesbach. 2003. Mango Growing in Kenya. [http://www.icraf.com/downloads/publications/PDFs/97\\_mango\\_growing\\_in\\_Kenya\\_.pdf](http://www.icraf.com/downloads/publications/PDFs/97_mango_growing_in_Kenya_.pdf)

Kehlenbeck, K., E. Rohde, J.K. Njuguna, F. Omari, L. Wasilwa and R. Jamnadass: (2010). Mango cultivar diversity and its potential for improving mango productivity in Kenya (KARI and ICRAF).

Kenya Competitive Tree Fruit Project. April 2012. Mango World Market Report. A Kenya Perspective. Prepared for NTF II Programme.

KHCP. January 2012. Horticulture Retail Audit Report.

Krain, E., Ngugi, A., Ndegwa, N., N, J. (2008). Enterprise Budgets for Market-Oriented Mango Farming: The Case of Embu and Mbeere Districts: Main Report. GTZ/GoK PSDA.

Maina, Betty. 2013. "Let's Face It, VAT Act Is Killing Firms — but It's Not Too Late to Correct It." *The East African Standard*, November 4, Standard Digital News edition, sec. Business Beat.  
[http://www.standardmedia.co.ke/mobile/?articleID=2000096911&story\\_title=let-s-face-it-vat-act-is-killing-firms](http://www.standardmedia.co.ke/mobile/?articleID=2000096911&story_title=let-s-face-it-vat-act-is-killing-firms).

Match Maker Associates Ltd. (Jan 2011): Mango Value Chain Analysis in Tanzania- Final Report. AMAGRO- The Association of Mango Growers/ Cluster Competitiveness Programme.

Msabeni, A. Muchai, D., Masinde, G., Matoke, S., and Gathaara., V. (2010). Sweetening the Mango: Strengthening The Value Chain an Analysis of The Organizational Linkages along and within the Mango Value Chain in Mbeere District, Eastern Province, Kenya. ICRA/MoA&LD/ PSDA/ KARI/KENFAP. WPS 136.

Mutunga, John. (Feb 2010). Organization of Mango Value Chain. Presentation at the National Mango Conference. 11TH -12TH February 2010 at Kenyatta International Conference Centre, Nairobi, Kenya.

Ndungu J. M., Pole F. N. and Katama C. K. Value chain Analysis: A case study of Mangoes in Tana delta. [www.kari.org/fileadmin/publications/conference11/value\\_chain\\_analysis\\_acase.pdf](http://www.kari.org/fileadmin/publications/conference11/value_chain_analysis_acase.pdf)

Njuguna, J. K. May 2012. Mango production and standards in Kenya. Project No: 1929-KEN/47/111a. International Trade Centre/FPEAK

Republic of Kenya, FPEAK, ITC, CBI (Ministry of Foreign Affairs of the Netherlands): Mango Commodity Business Plan 2012 – 2022

Republic of Kenya. June 2012. National Horticulture Policy.

Republic of Kenya. 2010. Agricultural Sector Development Strategy 2010 – 2020.

Saturday Nation. 8<sup>th</sup> March 2014. This is your life if you're a Kenya Woman, pg 3.

Standard Media group: Feb, 16<sup>th</sup> 2014. Meru Mango Farmers Seek Alternative Crops.  
[http://www.standardmedia.co.ke/ktn/?videoID=2000075126&video\\_title=meru-mango-farmers-seeking-alternative-crops](http://www.standardmedia.co.ke/ktn/?videoID=2000075126&video_title=meru-mango-farmers-seeking-alternative-crops);

Steve New (2010). Market Opportunities for Mango Growers. Presentation at the National Mango Conference. 11TH -12TH February 2010 at Kenyatta International Conference Centre, Nairobi, Kenya.

Tanzania Agriculture Productivity programme (TAPP). June 2013. Fresh Produce Market in Dubai.

University of Florida, IFAS Extension/ National Mango Board. (2010). Mango Postharvest Best Management Practices Manual. HSI 185

## ANNEX II: LIST OF ACRONYMS

AAK	Agrochemicals Association of Kenya
ABD	Agricultural Business Development
ADSP	Agribusiness Development Support Project
AFFA	Agriculture, Fisheries and Food Authority
AIRC	Agricultural Information Resource Center
ASAL	Arid and Semi-Arid Lands
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Kenya
ASCU	Agricultural Sector Coordination Unit
AU	African Union
CAGR	Compounded Annual Growth Rate
CIF	Cost Insurance and Freight
CL	Coastal Lowlands
COMESA	Common Market for Eastern and Southern Africa
DAP	Diammonium Phosphate
DSL	Dryland Seed Company Limited
EAC	East African Community
EAGA	East African Growers Agriculture
EASEED	East African Seed Company Limited
EL	Eastern Lowlands
FAK	Fertilizer Association of Kenya
FAO	Food and Agriculture Organization
FCI	Farm Concern International
FEWSNET	Famine Early Warning Systems Network
FPEAK	Fresh Produce Exporters Association of Kenya
FTF	Feed the Future
GCI	Global Competitiveness Index
GoK	Government of Kenya
ha	Hectare
HCDA	Horticultural Crops Development Authority
HP	High Potential
HQCF	High Quality Cassava Flour
HRI	High Rainfall I
ICBT	Informal Cross-Border Trade
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDM	Institution Development and Management Services
IFPRI	International Food Policy Research Institute
IPM	Integrated Pest Management
IPDM	Integrated Pest and Disease Management
ITC	International Trade Centre
JKUAT	Jomo Kenyatta University of Agriculture and Technology

---

KAINet	Kenya Agricultural Information Network
KARI	Kenya Agricultural Research Institute
KEBS	Kenya Bureau of Standards
KEFRI	Kenya Forestry Research Institute
KEPHIS	Kenya Plant Health Inspectorate Services
kg	Kilogram
KHCP	Kenya Horticultural Competitiveness Project
KHE	Kenya Horticultural Exporters
KSh	Kenyan Shilling
KSU	KARI Seed Unit
KTDA	Kenya Tea Development Agency
KVC	KAVES Value Chain
LPI	Logistics Performance Index
MoA	Ministry of Agriculture
MT	Metric Ton
NAAIAP	National Accelerated Agriculture Input Access Programme
NCPB	National Cereals and Produce Board
NEPAD	The New Partnership for Africa's Development
NGO	Non-governmental organizations
OPV	Open Pollinated Varieties
PCPB	Pest Control Products Board
PHL	Post Harvest Losses
PMG	Producer Marketing Group
PSDA	Promotion of Private Sector Development in Agriculture
RRA	Rapid Rural Appraisal
SACCO	Savings and Credit Cooperative Society
SSA	Sub-Saharan Africa
TMT	Thousand Metric Tons
USAID	United States Agency for International Development
USAID-KAVES	Kenya Agricultural Value Chain Enterprises
USAID-KHCP	Kenya Horticulture Competitiveness Project
VAT	Value Added Tax
WH	Western Highlands
WHSL	Wholesale
WL	Western Lowlands
WSC	Western Seed Company Ltd.
WT	Western Transitional