



**OPPORTUNITIES FOR FINANCING THE MANGO VALUE CHAIN:
A CASE STUDY OF LOWER EASTERN KENYA**

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The Kenya Financial Sector Deepening (FSD) programme was established in early 2005 to support the development of financial markets in Kenya as a means to stimulate wealth creation and reduce poverty. Working in partnership with the financial services industry, the programme's goal is to expand access to financial services among lower income households and smaller enterprises. It operates as an independent trust under the supervision of professional trustees, KPMG Kenya, with policy guidance from a Programme Investment Committee (PIC). Current funders include the UK's Department for International Development (DFID), the Swedish International Development Agency (SIDA), and the Bill and Melinda Gates Foundation.



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Abbreviations

| | | | |
|----------------|---|----------------|--|
| ABD | Agricultural Business Development | KCB | Kenya Commercial Bank |
| ACP | African, Caribbean and Pacific countries | KEPHIS | Kenya Plant Health Inspectorate Service |
| AFT | Alternative finance technologies | Kg | Kilograms |
| ASAL | Arid and semi-arid lands | Km | Kilometres |
| DANIDA | Danish International Development Agency | KSh | Kenya shillings |
| EAC | East African Community | KWFT | Kenya Women Finance Trust |
| EU | European Union | MALF | Ministry of Agriculture, Livestock and Fisheries |
| EPA | Economic partnership agreements | ME | Middle East |
| EPZ | Export processing zone | MFI | Microfinance institution |
| FAO | Food and Agriculture Organisation | MRL | Maximum residue levels |
| FAOSTAT | Food and Agriculture Organisation Statistics | NGO | Non-government organisation |
| FPEAK | Fresh Produce Exporters Association of Kenya | NPM | Net profit margin |
| FSDK | Financial Sector Deepening Kenya | ROI | Return on investment |
| GAP | Good agricultural practice | SHGPs | Self-help groups |
| GIZ | German Society for International Cooperation | SPS | Sanitary and Phytosanitary Standards |
| Ha | Hectares | SPSS | Statistical Package for Social Sciences |
| HCDA | Horticultural Crop Development Authority | TPS | Triple Super Phosphate |
| HACCP | Hazard analysis critical control point | UNICTAD | United Nations Conference on Trade and Development |
| ICRAF | International Centre for Research in Agroforestry | USAID | United States Development Agency |
| IDM | Institution for Development Management | VC | Value chain |
| KALRO | Kenya Agriculture and Livestock Research Organisation | | |

EXECUTIVE SUMMARY

Mango production in Kenya has grown rapidly over the past decade, and the volume produced between 2005 and 2012 tripled from 254,113 tonnes to 754,102 tonnes. Growth in the sector has been stimulated by the increasing demand for mangoes in domestic, regional and export markets, and the fruit is considered a major income earner for many smallholder farming households.

Despite strong growth in the mango subsector in Kenya there is scant documentation of the dynamics of the industry or the financial performance of actors along the value chain. Financial Sector Deepening Kenya (FSDK) commissioned this study in response to low access to appropriate finance in the Lower Eastern region caused by existing information asymmetries. FSDK's aim is to raise awareness of finance opportunities in existing and potential financiers and stimulate the crowding in of increased financial services. The study laid focus on the entire mango value chain, concentrating on the Lower Eastern region (Makueni, Kitui and Machakos counties), currently the leading mango-producing region in the country. The region contributes 52% of the total volume of national production and about 62,150 households rely on the sector for income. The study involved an in-depth literature review of the sector coupled with a survey of 620 value chain actors, comprised of 396 mango farmers, 80 agro dealers, 85 traders, 40 transporters, 8 exporters and 6 banks. Findings from the study showed that:

1. *The mango subsector is growing rapidly at more than 12% per annum, and the continued increase in supply of mangoes will likely exert pressure on existing market channels.*
 - a) The market for fresh mangoes currently absorbs an estimated 47% of total production, exports 2%, processing 8%, home consumption and give away 18%, with losses estimated at 25%.
 - b) There are over 3 million mango trees in the Lower Eastern region, of which 1 million are young¹ and not yet in production, signalling a potential 35% increase in production by 2015. This may exert pressure on the markets, leading to a change in current industry structures in the long term.
 - c) The processing industry has tripled its purchases of mangoes (from 21,500 tonnes in 2005 to 62,000 tonnes in 2012) to meet local demand for juice and purees, but a continued increase in supply will soon necessitate a shift to exports. Decreasing prices due to heavy supply should make processors more competitive.
2. *Exports, which provide the highest prices to producers, have also tripled in volume over the last five years from 3,160 tonnes in 2007 to 14,558 tonnes in 2012.*
3. *Small- and medium-scale farmers are the majority in the sector yet their yields are unsustainably low.*
 - a) Of the 62,150 farmers in the Lower Eastern region, 91% are small- and medium-scale farmers (<300 trees), yet they contribute about 80% of the total volume of mangoes produced in the region.
 - b) This cadre of farmers achieve lower yields (less than 80 fruits per tree) compared to the very large scale farmers who achieve average yields of 189 fruits per tree.
 - c) The low yields were found to be associated with inadequate use of inputs: small- and medium-scale farmers are cash constrained after harvest season (April to October) and, in the main, spray their mango trees only once or twice a season, rather than the recommended four rounds of application.
4. *Mango production has good returns and actors along the value chain all operate profitably.*
 - a) The net profit margins for mango farmers ranged between 49% (KSh4,950) to 92% (KSh1,386,850) for the small- and large-scale farmers respectively.
 - b) The aggregated gross earnings from mangoes in the Lower Eastern region is estimated at KSh3.6 billion.
 - c) The profit margins for input suppliers ranged between 52% (KSh7,966,343) for large operators with annual turnovers over KSh10 million to 17% (KSh105,880) for small operators with less than KSh1 million annual turnover.
 - d) Transporters earned average net profit margins of 44% even though they transport other commodities other than mangoes.
 - e) On the other hand, traders earned average net profit margins of 32% from mango sales, with wholesalers earning 26% (KSh115,812) and retailers 37% (KSh277,085), with most retailers diversifying the commodities they sell in addition to mangoes
5. *Access to finance by mango farmers is ostensibly low and more than three quarters finance their operations from meagre savings.*
 - a) The percentage of agricultural households in Kitui, Makueni and Machakos that are financially excluded (without savings, credit and money transfer services) are 30.3%, 26.8% and 15.3% respectively².
 - b) Eighty-five per cent of farmers finance their mango-related operations from savings while around 10.6% get finance from informal sources (including friends and relatives, FSAS and groups). Barely 4.4% get finance from formal sources and this

¹ ABD 2010

² FinAccess (2013)

cadre of farmers is mainly comprised of large-scale farmers (>300 trees) and constitutes less than 10% of the farmer population.

- c) Access to finance from financial institutions by small-scale farmers is minimal, mainly due to the “inability” of these farmers to service structured monthly instalments.
6. *There are opportunities for banks to extend credit to farmers and other actors along the mango value chain based on their attractive net profit margins.*
- a) Nearly all farmer categories could be creditworthy since their net profit margins are almost twice the current average lending interest rate of 18%.
 - b) Even though mango farmers operate profitably, with net profit margins ranging between 49–92%, the seasonality dynamics will require well-structured financial products to make it easy for actors to repay the credit without strain.

Therefore, there is scope for small farmers to increase their incomes if they can increase productivity and yields and reduce post-harvest losses while creating better market linkages. Processors need higher volumes of fruit at lower prices to be competitive with imports and in the export market, which is necessary for them to continue increasing sales. Exporters can continue to increase their exports by getting more fruit earlier in the season when they would still be competitive in the Middle East markets.

Based on the findings above, the study recommends the following finance-related interventions in the mango subsector, and provides estimates for the potential volume of finance required.

- i. Increasing smallholder income calls for increasing yields and reducing on-farm losses. This will require:
 - **Improved access to inputs.** Input credit can assist farmers to purchase the chemicals and applications services needed to increase the productivity and quality of their mangoes. The input credit requirement is estimated at KSh 634 million under current input usage levels, and the product can be structured for staggered disbursement with major disbursements from June to October when farmers need to intensify their spraying regimes;
 - **Savings products** to finance the initial mango-related operations such as pruning and pest control after harvesting (March to May). The savings potential is estimated at KSh2,5 billion based on estimated total net profits.
- ii. Processors often need working capital to finance purchases and hold inventory, to ease strain on their cash flow.
 - The working capital requirement for stock acquisition is estimated at KSh360 million based on total gross purchases .
 - Processors operate at between 40–60% efficiency levels, and so asset financing for machines upgrade, especially for medium-scale processors, is recommended. The loan requirement for this is KSh180 million based on stated assets needs.
- iii. Agro dealers would need working capital to stock their businesses and make the required inputs available to farmers. The working capital need for agro dealers is KSh160 million based on estimated stocks costs levels.
- iv. Spraying service providers need asset financing to replace less efficient, but traditional, knapsack sprayers with more efficient motorised pumps, to upgrade their services to farmers. The estimated cost for this is KSh20 million.

Chapter 1

INTRODUCTION

The mango (*Mangifera indica*) is a high potential fruit, suited to different agro-ecological zones ranging from sub-humid to semi-arid³. Mangoes can be grown in many parts of Kenya and have the potential to elevate many households from poverty. Over the past decade, mango farming in Kenya has expanded considerably, both in acreage and geographical spread. The exponential growth of the industry has been stimulated by increasing demand for mangoes in domestic, regional and international markets, and the fruit is considered a major income earner for many smallholder farming households in arid and semi-arid regions. Currently, the Lower Eastern region is the leading producer of mangoes in Kenya, where the subsector supports livelihoods of over 60,000 rural households⁴.

³ Griesbach (2003).

⁴ ABD (2010)

Despite strong growth in Kenya's mango subsector, there is scant documentation of the financial performance of the value chain. One major challenge for financial intervention in the sector is limited information on the financial needs of small-holder farmers, leading to low engagement by financial institutions, and a lack of optimisation of mango value chain functionalities through provision of required finance.

To respond to existing information asymmetries and low levels of access to appropriate financing, Financial Sector Deepening Kenya (FSDK) commissioned this study of the mango value chain in Kenya's Lower Eastern region. FSDK's aim was to stimulate the crowding in of finance by raising awareness of financing opportunities in existing and potential financiers, and to increase access to finance for actors within the chain.

Chapter 2

RESEARCH DESIGN AND IMPLEMENTATION

2.1 RESEARCH SITE

The mango value chain research was conducted between July and August 2013 in Kenya's Lower Eastern region, with specific focus on Kitui, Makueni and Machakos counties. The three counties contribute about 37% of national mango production, and mangoes contribute about 22% of farm household income⁵ amongst the region's mango-growing families. The percentage of agricultural households that are financially excluded in the three areas are 30.3%, 26.8% and 15.3% respectively⁶.

2.2 METHODOLOGY

The research was carried out using a sequential process by:

- Reviewing secondary information to understand production, market trends, functions and actors. It should be noted that due to the multiple sources of information, the years quoted for various data sets may vary. For instance when discussing global mango production trends the source of the data was Food and Agriculture Organisation Statistics (FAOSTAT) updated in 2011, and the Horticultural Crop Development Authority (HCDA) statistics updated in 2012 had slight variations.
- Corroborating the information with preliminary field visits to all the key actors and interaction with key informants before the actual study, mainly from the Ministry of Agriculture, Livestock and Fisheries (MALF), Livestock and Fisheries (MALF), the Horticultural Development Authority (HCDA), Agricultural Business Development (ABD), and main buyers;
- Generating an initial summary of the value chain maps and documenting key issues necessary to understand the flow of different mango value chain functions (mainly production, financing, and marketing); and
- Developing specific questionnaires for each of the value chain actors, pre-testing the tools through initial field visits, making requisite reviews, and carrying out the field survey.

2.3 SAMPLING

- Sampling was carried out at each of the functional levels of the value chain.
- A total of 620 value chain actors were interviewed, which comprised of 396 mango farmers, 80 agro dealers, 85 traders, 40 transporters, 8 exporters and 6 banks.
- Farmers were randomly sampled across 43 divisions (24 districts) within the three counties.

- The sample was proportionately distributed across the districts based on a sample frame provided by the District Agricultural Officers. The sample took into consideration only farmers who had at least some productive mango trees and were already harvesting. Using Slovin's sample size determination technique at a 5% error of tolerance, 396 farmers were sampled at household level.⁷
- Mass market retailers in Makueni, Kitui and Machakos were sampled from strategic market points provided by officials from MALF. Wholesalers, on the other hand, were sampled from the main markets in Nairobi (Eastleigh, Wakulima, Gikomba, Muthurwa and City Park markets).
- Transporters, input suppliers, processors and exporters were purposively sampled. The exporters and processors interviewed were stationed in Nairobi and Mombasa, whereas input suppliers and transporters were sampled from the three counties. Interviews in Mombasa were conducted by email and telephone.

2.4 DATA COLLECTION AND ANALYSIS

- Questionnaires for farmers, input suppliers, traders and transporters were administered by staff from the Ministry of Agriculture, Livestock and Fisheries, and graduate research assistants were drawn from the three counties. In addition, nine focus group discussions were conducted in the three counties (three per county), each comprising of 8 to 10 farmers who were considered to have a broader spectral understanding of the mango subsector in the region.
- High end interviews with exporters, processors and financial institutions were conducted by FSDK staff.
- The profit margin of each actor was computed using the following formula:

Net profit margin = ((Total revenue – Total expenses) / Total revenue) * 100%.

- For comparative purposes, farmers were segmented into four categories based on typologies of production and other common characteristics, defined primarily by the number of trees: small scale (<50 trees), medium scale (51–300 trees), large scale (301–800 trees) and very large scale (>800 trees).

⁵ ABD (2010).

⁶ FinAccess (2013), excluding North Eastern province

⁷ Sample formula: $n = N / (1 + Ne^2)$ where n = Sample population, N = Total population (60,000 mango farmers) and e = Error of tolerance (5%).

Chapter 3:

OVERVIEW OF THE MANGO SECTOR

Kenya’s mango sector has grown steadily over the past 10 years, providing a significant opportunity for stimulating rural economic growth. This section situates Kenya within world mango markets, and highlights a number of critical issues and trends which will be explored more fully in other sections.

3.1 MANGO PRODUCTION

a) Global mango production

Mangoes are produced in over 90 countries worldwide, with Asian countries accounting for approximately 77% of global production, followed by the Americas (13%) and Africa (10%)⁸. The top five mango-producing countries (FAOSTAT, 2011) are India (40.1%), China (11.5%), Thailand (6.9%), Indonesia (5.6%) and Mexico (4.8%). On a global scale, Kenya contributes about 1.7% of worldwide production, and is ranked number 15 after Vietnam (1.8%)⁹. Kenya is ranked second to Nigeria in Africa, and is the leading mango producer in East Africa, contributing about 43% of the region’s total production volume.

Kenya has two mango seasons: a main season from October to March and a low season from May to July. This production calendar gives Kenya a natural

advantage in the Middle Eastern market where, during Kenya’s main season, the key market suppliers (India and Pakistan) are out of production.

b) National mango production

Kenya’s agro-ecological conditions are well suited to mango production. The country has a wide variety of climatic and ecological conditions with altitudes ranging from sea level to over 5000 m in the highlands. Mean annual rainfall ranges from <250 mm in semi-arid and arid areas to >2000 mm in high potential areas, with most regions having suitable conditions for mango production. Mangoes do well in altitudes up to 1,500m above sea level with average temperatures ranging between 15°C and 30°C and annual rainfall of 850 to 1,000 mm.

Production overview

Mangoes are produced in nearly all Kenya’s regions. The main growing areas are Eastern and Coast regions which, combined, have 79% of national acreage (45,046 of 57,021 Ha) and volume (596,215 of 754,702 tonnes), followed by Central and Nyanza regions. Currently, Eastern region produces 204,179 tonnes, Coastal region 198,806 tonnes, Central region 43,359 tonnes, Nyanza region 37,612 tonnes, while other regions contribute less than 40,000 tonnes of total annual production (HCDA, 2010).

⁸ (UNCTAD (2011) global mango production statistics

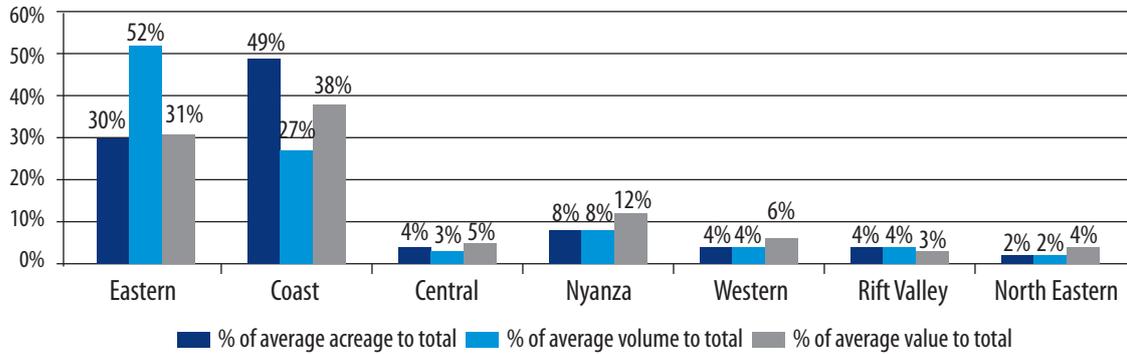
⁹ FAOSTAT (2011)

Table 1: Global mango production calendar

| Country | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec |
|------------------|-----|-----|-----|-----|-----|------|------|-----|-----|-----|-----|-----|
| 1. India | | | | | | | | | | | | |
| 2. China | | | | | | | | | | | | |
| 3. Thailand | | | | | | | | | | | | |
| 4. Pakistan | | | | | | | | | | | | |
| 5. Mexico | | | | | | | | | | | | |
| 6. Indonesia | | | | | | | | | | | | |
| 7. Brazil | | | | | | | | | | | | |
| 8. Bangladesh | | | | | | | | | | | | |
| 9. Philippines | | | | | | | | | | | | |
| 10. Nigeria | | | | | | | | | | | | |
| 11. Vietnam | | | | | | | | | | | | |
| 12. Kenya | | | | | | | | | | | | |
| 13. Egypt | | | | | | | | | | | | |
| 14. Australia | | | | | | | | | | | | |
| 15. South Africa | | | | | | | | | | | | |
| 16. Israel | | | | | | | | | | | | |
| 17. Ghana | | | | | | | | | | | | |
| 18. Mali | | | | | | | | | | | | |
| 19. Malaysia | | | | | | | | | | | | |
| 20. Tanzania | | | | | | | | | | | | |

Source: Mango Value Chain Analysis in Tanzania (Match Maker Associates, 2011)

Figure 1: Regions' contributions to national volumes, acreage and value



Source: HCDA 2010, ABD Census report 2010

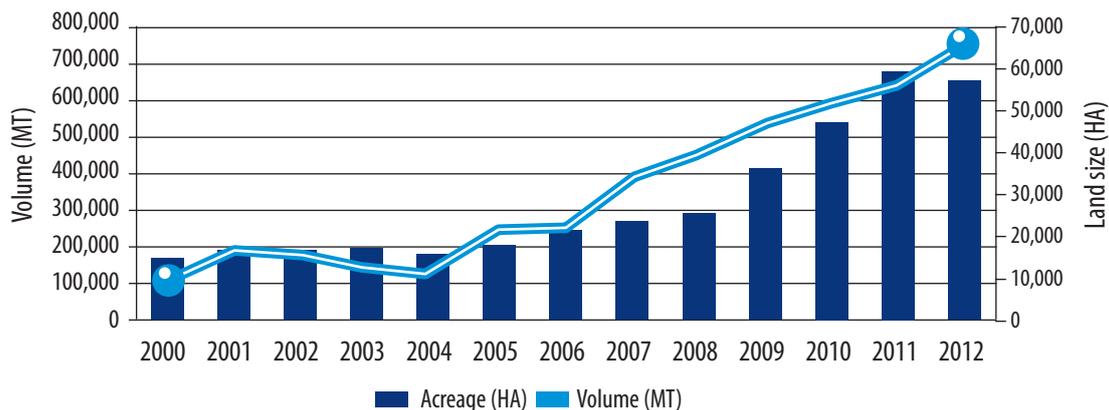
Nationally, there is a high variance in mango productivity in the different regions: among the two leading mango-producing regions, Coast region has lower productivity compared to Eastern region. In regard to productivity per unit area, North Eastern region has the highest recorded mango productivity in Kenya (though very low acreage) with a seven-year average of 5.1 tonnes per acre, followed closely by Eastern and Rift Valley regions with 4.9 tonnes per acre. Coast province has the lowest productivity of 3.2 tonnes per acre, contributing to the lowest average income of KSh37,352 per acre. The key driver of variance in productivity per unit is the level of farm management practices. Coast applies the least inputs in farm management and has a higher population of indigenous varieties, leading to lower productivity compared to Eastern region. However, Coast region has a natural advantage in being able to produce mangoes in two seasons, especially during the very low season when prices are highest; hence their improved average value per tonne of KSh11,686. The main reason for the low productivity in Coast region is poor tree maintenance, especially low input usage.

Figure 2 shows that the planted area for mango production in Kenya has risen steadily in the last few years. The high increase in the number of young trees

in this period corresponds with the recorded decline in the average yield per hectare in the same period. This underscores the fact that the very large number of young trees witnessed between 2009 and 2011 would be in the early production stage now, suggesting potentially high increases in national mango production by 2016.

There is a strong indication that the increase in mango supply has been triggered by a corresponding increase in local demand for mangoes and high farmer net profit margins of between 50 to 90% across the farmer categories. This is demonstrated by the growth of alternative mango market channels like processing (both small and large scale) and fresh fruits parlours, to meet the increase in population and growing purchasing power. There have been deliberate efforts by donor and government programmes to improve productivity of mangoes in most of the regions that have recorded remarkable growth in improved tree varieties. Farmer technical capacity building and market access programmes have been employed to raise productivity mainly in Eastern province. However, there is a possibility that the growing supply may exceed demand in the next few years, and precautions may need to be taken to avoid a future glut situation.

Figure 2: Trends analysis of mango production in Kenya 2000–2012



Data Source: FAOSTAT Database

Table 2: Kenya mango production calendar

| Region | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec |
|---------------|-----|-------------------------|-----|-----|-----|------|------|-----|-----|------------|-----|-----|
| Coast | | | | | | | | | | | | |
| Eastern | | | | | | | | | | | | |
| Central | | | | | | | | | | | | |
| North Eastern | | | | | | | | | | | | |
| Rift Valley | | | | | | | | | | | | |
| Nyanza | | | | | | | | | | | | |
| Western | | | | | | | | | | | | |
| OVERALL | | | | | | | | | | | | |
| KEY | | High to moderate supply | | | | | | | | Low supply | | |

Source: AFT report 2012

National production calendar

Kenya is able to supply mangoes throughout the year but there are two distinct major harvest seasons from October to March and from May to July, with only minimal supplies available in April, August and September. Makeni, Tana River, Garissa, Baringo, West Pokot, and Turkana counties supply mangoes in August and September while Kwale, Kilifi, Taita and Tana River counties supply in the month of April. All other counties largely supply in the months from October to March, with Coastal, Nyanza and Western counties able to supply in the two main seasons. Parts of Eastern (Meru and Embu) and North Eastern (Garissa) regions are able to supply in the months of April and May.

Mango varieties grown in Kenya

The main mango varieties grown in Kenya are Apple and Ngowe, followed by indigenous varieties Kent and Tommy Atkins. In the past, Apple has largely been used in the fresh markets whereas Ngowe has often been preferred for processing. Most processors prefer the Ngowe variety due to its availability and good processing characteristics.

Table 3: Kenya mango varieties

| Mango variety | Juice yield (%) | °Bx |
|---------------|-----------------|-----------|
| Apple | 71.34±1.59 | 23.9±0.21 |
| Ngowe | 67.64±5.70 | 23.1±0.42 |
| Tommy Atkins | 67.28±0.94 | 17.0±0.12 |
| Vandyke | 58.92±7.27 | 21.8±0.06 |
| Kent | 72.83±7.04 | 18.0±0.15 |
| Sabine | 52.93±4.93 | 17.0±0.14 |

Values are presented as mean ± SD.

Apple has better processing characteristics but is mainly consumed in the fresh market. However, there has been an increasing shift by some processors to use the Apple variety for processing if they can get it. Musyimi *et al*¹⁰ indicate that the apple variety has the highest sugar content followed by Ngowe. The volume of Kent mangoes produced is too low to sustain processing. Ngowe is sourced from the Coastal region, particularly during the May to July high season when it is less expensive. The local supply is available seven months a year.

Mango production husbandry

Optimal mango production requires good agronomical practices from orchard establishment to harvesting, which usually begins in the third year after planting. Some of the key considerations during orchard establishment are spacing (mainly 12 m x 12 m with holes of 60 cm x 60 cm and a population of around 50 trees per acre), right seedling, and proper fertilisation. Crop maintenance for orchards and producing trees is equally important and involves watering, fertilisation, weed control, pruning, and pests and disease control. The recommended spraying regime for insecticides and fungicides is four times per year for the first four years and six times per year thereafter. Foliar fertilisers can be applied four times per year.

3.2 MANGO MARKETS

The mango market comprises numerous segments: fresh fruit, processed fruit for direct consumption (juices, dried mango, pickled mangoes) or fruit used in food preparations (chutneys, pastes, purees, flour, and mango slices in brine). Globally, 97% of mango production is consumed within the country in which it's grown, with roughly 3% entering the global export market. Only a small part (in the range of 1–2%) is for commercial processing and intended for

¹⁰ Musyimi *et al*, unpublished.

international trade¹¹. Kenya's mango consumption follows a similar trend with 98% being consumed domestically and 2% exported.

Global demand for mangoes rose by 22% from 2007 to 2011 with annual growth of around 5%. Asia led during this period with an increase of 32%, followed by 25% for the US and 21% for Europe. Due to growing demand for mangoes in domestic, regional, and international markets, and the relatively high profitability to farmers, Kenya's mango industry has expanded considerably over the last six years, in both acreage and geographical spread. Acreage under production has more than doubled from 23,407 ha in 2007, to 57,021 ha in 2012, with estimated volumes growing from 384,460 tonnes to 754,702 tonnes¹² during the same time frame.

The fresh fruit market takes more than two thirds of Kenya's total mango production, with urban markets taking the largest share. This trend is anticipated to continue due to rapid urban growth in Kenya, currently estimated to be around 4% per annum.

Table 4: Estimated mango markets share in Kenya

| Market | Estimated market share | Volumes (tonnes) |
|---------------------------|------------------------|------------------|
| On-farm fresh consumption | 18% | 135,846 |
| Urban fresh markets | 39% | 294,334 |
| Rural fresh markets | 8% | 60,376 |
| Exports fresh | 2% | 15,094 |
| Processing | 8% | 60,376 |
| Post-harvest losses | 25% | 188,676 |
| TOTAL | | 754,702 |

Source: Field data

2.2.1 Domestic fresh market

Growth in domestic mango consumption has been a function of strong demand from a growing population, urbanisation at 4%, an expanding middle class at 4%, greater spending power, and the development of more organised marketing systems for fresh produce. Between 2006 and 2009 local consumption of mangoes grew at an annual rate of 24%¹³. The national market for fresh mango is estimated to be KSh6 billion in 2010, primarily in

urban areas, with a much smaller amount (and lower value) marketed in rural areas. In urban markets, mangoes are retailed at an average price of KSh45 per kg during peak season and can reach as high as KSh90 per kg during the low season. In rural markets, where most of the local varieties are sold, mangoes retail between KSh2–5 per kg¹⁴ equivalent; the improved varieties retail at KSh15–21 per kg.

These markets are characterised by over supply during the peak season and scarcity during the low season when most of the available production is sold in the larger urban areas. Devolution of central government to county governance is expected to spur economic activities within rural urban centres, leading to expansion of institutions such as schools, universities, hotels and hospitals. This will see a rise in the income levels of this population, leading to increased demand for food products and growth of the rural markets.

Supermarkets account for about 2% of the domestic fresh marketed mangoes where mangoes retail between KSh60–120 per kg. At the high end of the market, they sell high quality mangoes to upper income consumers, sourced from traders or directly from farmers. Initially, only one supermarket chain supplied mangoes but that has since grown to about 5 major supermarket chains and various mini-markets. Changing lifestyles and a demand for "convenience" drive growth in this segment.

The domestic fresh fruit market is projected to be the major driver in absorption of the mangoes in the short and medium term. However, continued growth in production – as implied by the huge number of young trees and expanding acreage – will most likely lead to an increase in supply that exceeds domestic demand.

Based on the 2012 production of 754,702 tonnes, exports of 15,094 tonnes, and post-harvest losses of 188,676 tonnes (25% of production), the amount consumed by the domestic market (domestic for the purpose of this calculation is defined to include household-level consumption, domestic fresh market, and domestic processing) is 550,932 tonnes. This translates to an annual consumption rate of 6.3 kg of fresh mangoes per person per year (current population estimate 41 million). Assuming an annual growth in production of 18%, annual mango production will be roughly 1.2 million tonnes by 2015. Assuming that post-harvest losses remain at 25% and exports grow by 10%, the supply of mangoes to the domestic market by 2015 will be roughly 900,000 tonnes. If we take a conservative approach and assume that domestic consumption will grow at the population growth rate of 3% and the per capita income growth rate of 3%, domestic demand for mangoes is estimated to be roughly 700,000 tonnes. The proposition is that domestic supply of mangoes might outstrip demand by 2015. Even at current rates of consumption (47% of mangoes being purchased fresh), per capita consumption would need to

¹¹ Jedele (2003)

¹² International Trade Centre

¹³ Estimated consumption growth rate as per ABD (2010)

¹⁴ In rural markets, mangoes are normally sold either in gunny bag (for local varieties) or by the piece for improved varieties. In supermarkets they are sold by the kilogram.

increase from 6 kg to 12 kg in order to consume the mangoes available for the fresh market.

2.2.2 Mango exports market

a) Global export market

The world's leading mango exporters are Mexico (20%), India (16%), Thailand (11%), Brazil (9%), Peru (9%), the Netherlands (8%), and Pakistan (7%) (FAOSTAT, 2013). In Africa, Senegal is the leading mango exporter, followed by Kenya. However, Kenya supplies only 1% of its mango export volume to the EU (less than 0.1% of total EU imports) due to rigorous sanitary and phytosanitary (SPS) requirements in EU accounting for 2.5% of total its export value. The leading global players supply large volumes of mangoes at comparatively lower cost as they incur lower logistics and freight charges due to their proximity to world markets. India and Pakistan in particular are able to supply mangoes at considerably lower prices than Kenya.

The world's leading importers of mangoes are North America (33%) and Europe (38%), which are competitive, dynamic and demanding in terms of quality and SPS regulations. The mango varieties demanded by these markets are Tommy Atkins, Haden, Kent and Keitt. Kenya largely trades in the Apple and Ngowe varieties, which cannot withstand long-distance shipment by sea (requiring pre-cooled conditions as low as 4°C) or the rigor of hot water and vapour treatments required by these markets. These issues (transport cost, varieties, and SPS) lock Kenya out of the US and European markets and it is not likely that Kenya will adequately supply those markets in the near future.

b) Kenya export market

Exports of mangoes more than quadrupled (426%) between 2007 and 2012,

Figure 3: Mango exports from Kenya 2007–2012

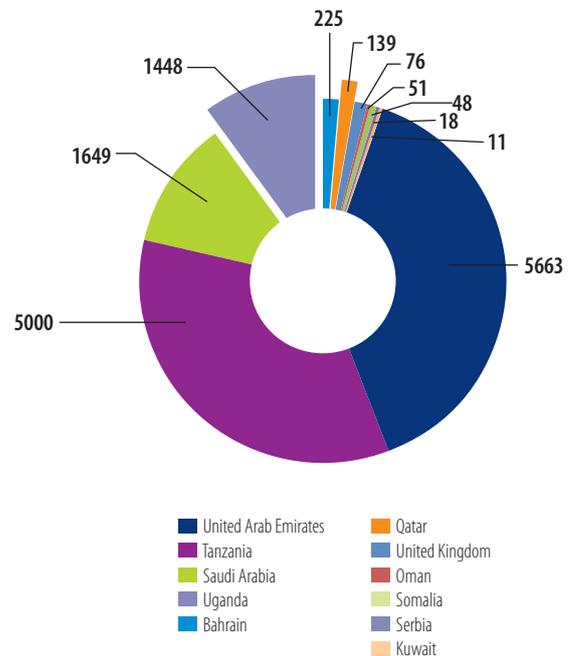


Data Source: ITC Trade Map (2012)

with an annual growth rate of 40%, to reach more than 14,500 tonnes¹⁵ valued at over KSh1.1 billion¹⁶. Mangoes are mainly exported to the Middle East as a high value product and to neighbouring Tanzania and Uganda as a lower value export. This growth has been driven by the general global increase in demand for mangoes, but assisted by concerted marketing efforts by the Fresh Produce Exporters Association of Kenya (FPEAK), the Horticultural Development Authority (HCDA), and other private stakeholders.

Kenya's exports are dominated by about 20 well-established, large-scale exporters and several seasonal spot exporters. The Eastern region that includes Makueni, Machakos and Kitui dominates the supply of mangoes for export. Kenya mainly exports fresh mangoes to the Middle East (54% of volume and 95% of value), Tanzania (34%), Uganda (10%), and others 2%. The Tanzanian market offers the minimal price of \$0.03 per kg, while the Middle East offers premium prices ranging from \$1.40–1.60 per kg.

Figure 4: Kenya Mango export volumes ('000 kg) in 2012 by key destinations



Data Source: ITC Trade Map (2012)

Kenya's export focus is the United Arab Emirates with 64% of export value, followed by Saudi Arabia at 22%. Since Saudi Arabia is the leading importer in the Middle East (ME), Kenya can explore avenues to increase exports to the Saudi market. The ME market mainly imports Apple, Ngowe,

¹⁵ Global Trade Atlas

¹⁶ International Trade Statistics (2013)

Tommy and Haden varieties (ABD, 2009/2010). The relative proximity of East African countries to the ME makes it logistically less costly and the rules and regulations are less stringent compared to Europe and the US¹⁷. Over the last five years, the ME market imported an average of 129,000 tonnes of mangoes annually. India dominates this market with 65% market share, followed by Egypt with 26%, and Kenya third with 5%. Other prominent players in the market are Indonesia and South Africa.

From the figure below, it can be observed that Kenya gets very high prices for its mangoes in the ME, double those of other exporters. Kenya is able to capture these high prices as its exports are countercyclical to everyone else, with major supplies during the months of October to March, which coincides with the low or off-season of the major exporters. The second window between May and July is smaller and coincides with the major exporters. The main opportunity for Kenya to increase its exports to the ME is in September and October (early in the Kenyan season) when demand is high, supply is low, and prices are high.

Kenya’s cost of shipment is relatively high compared to India and Egypt, making Kenya’s mangoes less competitive if they need to compete head to head. Traditionally, exports are done by sea but there has been a shift towards air shipment due to piracy in the Indian Ocean. Freight charges by sea are, on average, \$0.40 per kg compared to \$1 per kg by air. Air freight costs are around 60% of the sales price, compared to 25% by sea.

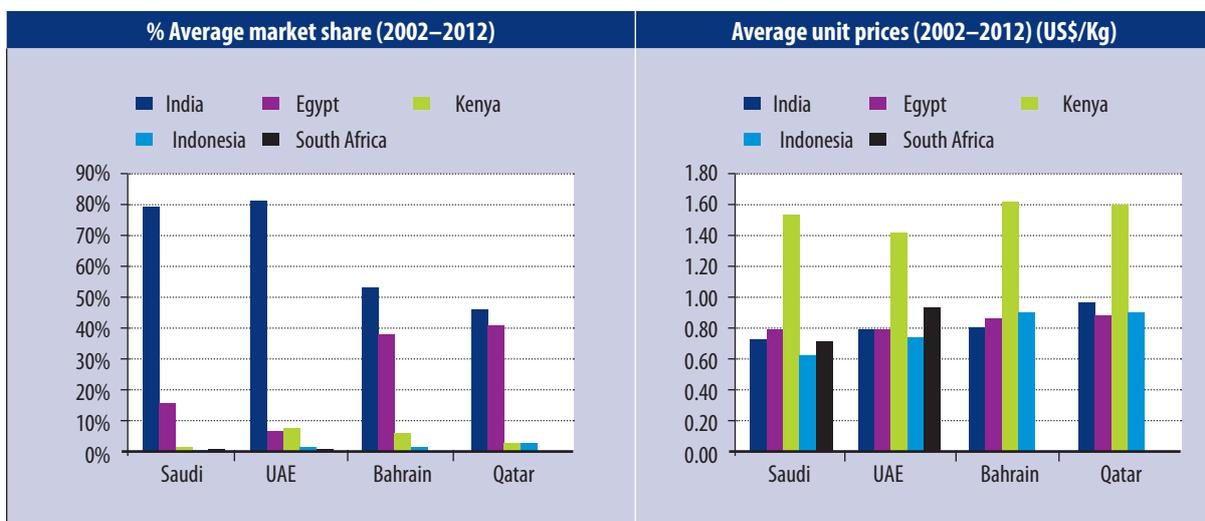
The major buyers are supermarkets and large retailers whose standards are high. To export to this market, exporters not only have to comply with the legal maximum pesticide residue levels (MRLs) and phytosanitary requirements, but also product traceability and high standards of social and environmental compliance set by the buyers. This has seen only a few long-established exporters gain entry into this market, who have invested upstream in production and downstream in import companies over time. The exporters fetch better prices in Europe (\$2 per kg) than in the Middle Eastern market (\$1.60 per kg). However the costs of compliance, certification, and shipment make the market less attractive.

2.2.3 Processing

There has been an increase in mango processing in Kenya over the years in response to demand. The growth in the processing subsector is due to two major factors: the increasing local demand for mango juice, and the projected medium-term increase in raw mango available to the processing industry at

17 Match Maker Associates (2011).

Figure 5: Average Middle East market share and prices



Data Source: International trade Map (2012)

lower cost. The availability of competitive locally processed pulp will offer incentives to substitute imported concentrate¹⁸ with locally produced pulp or juices.

The Kenyan mango processing market has four mango products out of the possible 10 that are processed worldwide. For a very long time, the Kenyan market was dominated by Mango flavoured beverages, but not mango juice. The main products are juice and pulp primarily for local use, though some quantities are exported through an agreement with Coca-Cola. The other products, produced in small quantities but mainly for export by a few processors are pickles, Indian chutneys, and jams. Delmonte and Milly Mint Ltd were the first entrants in the local market to offer mango fruit juices. There has since been a steady increase in the supply of mango juices and nectars in the Kenyan market.

Mango concentrates and juices are consumed locally with some exported to regional markets. Sunny Processors Ltd and Allfruit EPZ Ltd supply 100%

¹⁸ Large processors import pulp mainly from Egypt and other mango-producing countries within and outside of Africa. The actual amount of concentrate and pulp imported is not documented, hence it may be difficult to estimate the level of substitution possible by domestic processors.

mango purees to Minute Maid Mango (Coca-Cola) in Kenya, Uganda, Democratic Republic of Congo, Zimbabwe and South Africa, where they are further processed into juice (Jenkins and Fries, 2013)¹⁹. Milly processors export pulp to Uganda and Tanzania. The remaining processors predominantly serve the local market. The growth in this market is hindered by insufficient supply of mangoes due to uncompetitive pricing.

The urban market largely demands freshly made juice, as opposed to pre-packaged juice, due to emerging changes in lifestyles, health consciousness, convenience, and portability (pre-cut pieces and freshly squeezed juices). The cottage processors serve restaurants and hotels mainly frequented by the working class. This increased consumption of mangoes at the retail-market level is driven by local juice makers; they purchase mangoes daily from the wholesale market and, using a blender, proceed to make 20–100 litres of mango juice a day, served fresh to customers in the markets. The mango is often mixed with other fruits, particularly papaya. This channel is now consuming an estimated 2,500 tonnes of mangoes, though it is essentially captured by the urban fresh fruit channels (see fresh fruit map).

¹⁹ Jenkins and Fries (2013).

Chapter 4

STRUCTURE AND DYNAMICS OF MANGO VALUE CHAIN

The Kenyan mango value chain is made up of both fresh fruit and processed fruit industries, each of which has very different market actors, and provides different products with very different pricing structures. In each of these value chains, the markets are served by channels that are differentiated by a combination of relationships (between market actors who buy and sell the product, and which flow from production through to the end markets) and the technologies that are used at the different functional levels. By clearly identifying the differences in the channels we can determine which offer the greatest growth potential and which can provide the best prices to their participants.

4.1 FRESH MARKET VALUE CHAIN

4.1.1 Fresh market functions and actors

In the fresh market, the mangoes pass through a series of different functions that are carried out by different actors. Each of these market actors will take ownership of the product as it wends its way to one of four main market segments (rural, urban, supermarkets, and export). These start with the production of the mangoes, harvesting, aggregation, packing, storage, and export or wholesaling and, finally, the retailing of the product.

a) Production:

At the production level, we identify four types of farmers:

- 28,216 **small-scale** farmers with less than 50 trees (median 22 trees) and with low yields of 78 fruits per tree. They sell primarily to rural traders, achieve the lowest prices per piece (about KSh5–6) and are the least commercial.
- 27,609 medium-scale farmers with between 50 and 300 trees each and with low yields of 69 fruits per tree. They fetch around KSh7 per piece and are semi-commercial.
- 5,407 large-scale and very large scale farmers with more than 300 trees each and with yields of 78 and 189 fruits per tree, respectively. Largely commercial, these farmers achieve better prices of around KSh10 per fruit from exporters and supermarkets.

b) Harvesting

Harvesting is carried out either by the buyer or by agents who harvest for the trader. Farmers who sell their fruit to the traders 'on the tree' get lower prices and have less control over the quality of the product. Most of the larger farmers manage their harvests to ensure that they get the best prices, while small farmers often sell their fruit on the tree.

c) Aggregation

Traders perform the major aggregation function in the value chain but service distinct markets. The rural traders will buy directly from farmers and then take

them to the rural markets for retail sales. Many of the traders will organise the harvesting of the fruit from the producers. Brokers are often located between the farmers and the traders, identifying the product from the farmers, purchasing it, and then selling it to traders who take the fruit to wholesalers, institutions, exporters, processors and supermarkets or transport to the business premises of their buyers. Agents for the exporters will often engage directly with farmers to purchase for the export market. They buy the fruit to the specifications of the exporters, and mainly using the exporters' funds.

d) Packing and storage

Most packing takes place for the export market at organized packhouses. There is very little packing being done for the domestic market. As most fruit goes directly to the fresh retail markets, the only storage takes place for the supermarkets and the export market.

e) Exporting

There are two main types of exporters – the steady exporters and the spot exporters.

- The steady exporters have a regular presence in the market and have stronger established relationships with producers. They are usually engaged in the export of many horticultural products, not just mangoes, and have better overall infrastructure to manage the packing and storage. They usually sell directly to importers in the end markets.
- The spot exporters are often larger traders who have expanded to regional and international markets and often purchase from traders, though they will occasionally use agents to acquire fruit. The spot exporters will usually sell to commission agents in the export markets, or will export to the low-end regional markets (Tanzania and Uganda).

f) Wholesaling

Wholesalers are based in the main fruit markets in Nairobi (Eastleigh, Gikomba, City Market, Wakulima, etc.) and other urban centres in Kenya. They gather large quantities of mangoes from the different supply areas, either through orders with traders who bring the mangoes to the wholesalers' trade point or they organise a trip to the production areas where they acquire mangoes from producers or local traders. The wholesalers sell mangoes to retailers, consumers, hotels and restaurants and a few sell to exporters.

g) Retailing

Retailers are located in the local markets or in kiosks at street corners. In rural areas, they source mangoes from producers or middlemen who bring the fruit to their retailing premises. They mainly sell fresh mangoes, though some sell processed mangoes in the form of juice in urban market restaurants and cafeterias.

4.1.2 The fresh mango value chain map

The value chain map on the following page presents these different functions and their respective market actors structured into different channels. The producer participation in the channels is based on the dominant category that sells through a particular channel. However, most of the channels are served by multiple categories of producers but to varying degrees.

Channel 1, the rural market channel, is the traditional channel, selling into the least sophisticated market. Roughly 28,000 small farmers in the Lower Eastern region sell to around 5,000 rural traders and spot brokers who take the product to the market. It has the largest number of market actors, but only accounts for about 30% of total marketed production. Prices per piece are about KSh5–6. Profit margins are lowest in this channel and relationships between the farmers and the traders are very weak, characterised most often by spot market relationships.

| Channel 1 | Sales price/kg (KSh) | Value add | Net profit |
|-------------------------|----------------------|-----------|------------|
| End Market price | 30 | | |
| Retailer purchase price | Na | | |
| Wholesale | Na | | |
| Trader | 30 | 50% | 26% |
| Producer (small) | 15 | 50% | 49% |

The table above provides indicative prices along the value chain in this channel and shows that this is a short chain, with the majority of value captured by the trader.

Figure 6: Fresh mango sub-sector map for the Lower Eastern region

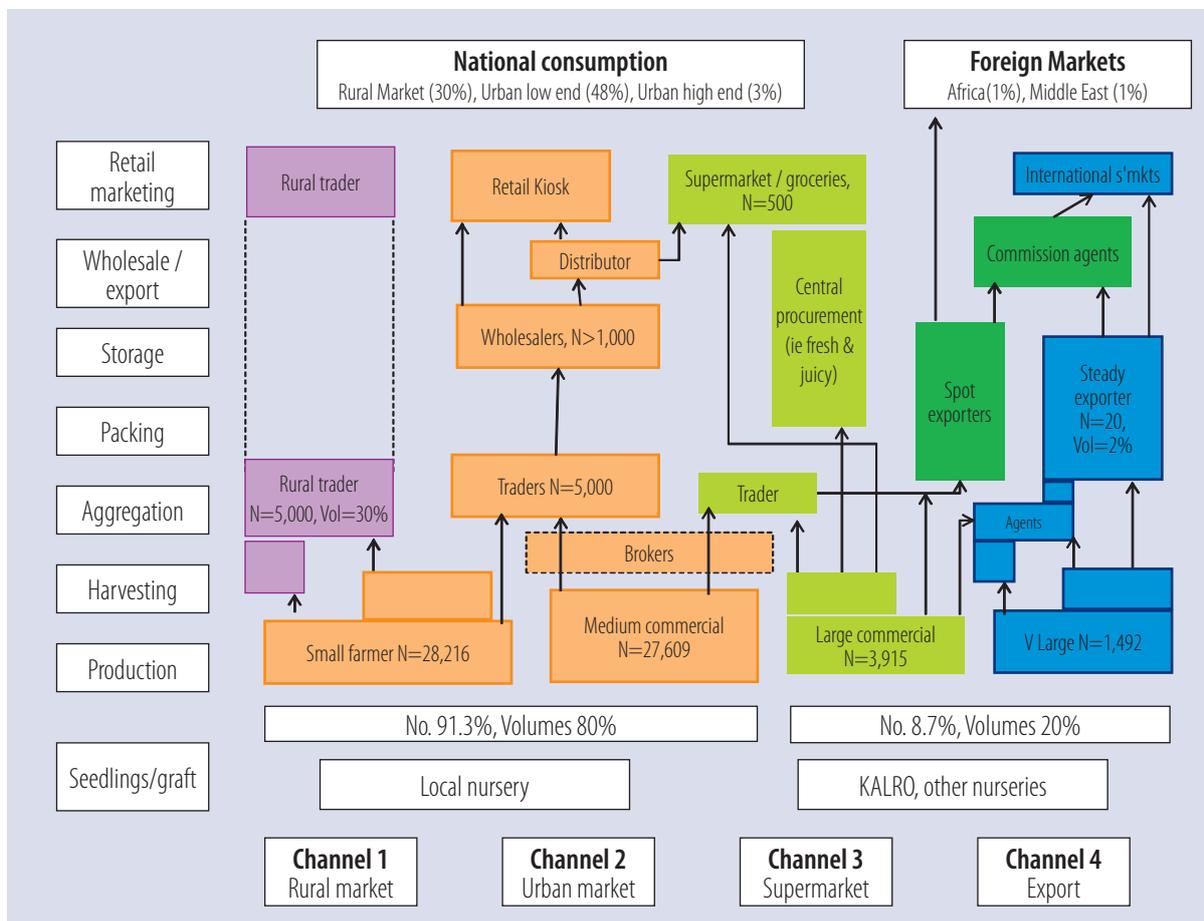


Table 5: Fresh mango subsector map for the Lower Eastern region

| Channel 2 | Sales Price/kg | Value add | Net profit |
|----------------------|----------------|-----------|------------|
| End Market price | 60 | | |
| Retailer sales price | 60 | 25% | |
| Wholesale | 45 | 25% | |
| Trader | 30 | 15% | 37% |
| Producer (medium) | 21 | 35% | 66% |

Channel 2, the urban market channel, accounts for the largest volume of marketed production (about 50%). Prices paid to the producers are slightly higher (about KSh7 per piece), but traders still dominate the trade, buying from the medium-scale and large-scale commercial farmers to take to the urban markets.

This channel is characterised by multiple sales (farmer to trader to wholesaler to retailer). While the retail prices can get quite high, the margins are split between a large numbers of market actors along the channel, as depicted in the table.

| Channel 3 | Sales Price/kg | Value add | Net profit |
|----------------------|----------------|-----------|------------|
| Market price | 90 | | |
| Retailer sales price | 90 | 33% | |
| Wholesale | n/a | | |
| Trader | 60 | 17% | |
| Producer (large) | 45 | 50% | 80% |

Channel 3, the urban high end/supermarket channel, is still fairly small (about 2% of total volume) with buyers for the supermarkets ensuring that the right quality product is delivered to the higher end stores. Centralised procurement companies like Fresh N Juici have established strong positions

as buyers and packers of fruits for the supermarkets, managing much of the supply to this higher end segment. Given their size, they will often purchase directly from larger farmers (who often deliver to them) without going through traders, ensuring a better price to both participants.

| Channel 4 | Sales Price/kg | Value add | Net profit |
|-------------------------------|----------------|-----------|------------|
| Importer sales price | 141 | 33 % | |
| Exporter sales price | 95 | 25 % | |
| Trader sales price | 60 | 14 % | |
| Producer (large & very large) | 40 | 28% | 80% & 93% |

Channel 4, the export market channel, absorbs about 2% of the total volumes of marketed mangoes. At present, the largest mango exporters in the country are East African Growers, Mofarm, Keitt Exporters, Spring Fresh Export and Fresh Home Alchemy. The established mango exporters channel involves much closer relationships between the largest farmers who produce primarily for the export market and deliver directly to the exporters, with limited outsourcing from other producers (mainly organised groups). This channel is more organised as some exporters hold contracts with producers and offer them the best price in the market. The exporters have relatively strong relationships in their targeted end markets, primarily the UAE. The spot traders account for a small percentage of the high value exports and rely on commission agents to sell their product in the end markets. The value-added table demonstrates the large margins that are available along the channel.

4.2 THE SUPPORTING SERVICES

In addition to the direct market actors who produce the fruit and take it to market, there are a wide range of service providers who do not take ownership of the product, but who play an important role in the development and management of the sector.

Table 6: Supporting services in the mango value chain

| Primary supporting services | Description of main functions of the service providers |
|-----------------------------|--|
| Input suppliers | Provide agro-inputs, extension services, training and a few provide spraying services. Most of the input suppliers are concentrated in major towns where mangoes are grown but their spread in small towns around which farmers live is minimal. |
| Nursery developers | Produce seedlings, test different varieties, trace the best rootstock and grafts. In Lower Eastern region there are few nursery operators and most farmers have learnt to graft mango seedlings on their own. |
| Brokers | Not a main actor but very crucial in the value chain. Brokers act as intermediaries between the farmer and the buyer but they are never consistent in the business. They mainly work on commission and are mobile. |

| Primary supporting services | Description of main functions of the service providers |
|---|---|
| Transporters | These are not direct actors in the value chain but they provide transport services to a range of actors in the value chain. Most of the transporters have diverse transport services and they do not rely on the mango transport business alone. |
| Researchers | Kenya Agriculture and Livestock Research Organisation (KALRO) and different universities study various aspects of fruit production. The World Agroforestry Centre (ICRAF) has also supported the introduction of improved varieties through its Tree Genetic Resources and Domestication Programme. |
| Regulators | Include different government bodies such as the HCDA and KEPHIS who regulate quality of planting materials and products for export. The Kenya Bureau of Standards (KEBS) certifies the quality of processing facilities and products. Local (district) councils develop by-laws that help establish and maintain infrastructure (markets, roads). |
| NGOs (ABD & Fintrac) | Work with farmers to optimise production and also increase the smallholder incomes from mango farming, not market driven. |
| Ministry of Agriculture, Livestock and Fisheries (MALF) | Conduct trainings on proper agronomic practices geared towards optimising productivity. Also offer extension services. |

Source: Field survey, 2013.

There are direct roles for each of the supporting services – such as the input suppliers, spraying companies, nurseries, transporters, etc. – in terms of upgrading their operations to make the value chain more efficient.

4.3 DYNAMICS OF THE FRESH MANGO VALUE CHAIN

There has been tremendous growth in all channels of the value chain, driven by high profit margins that are being captured by relatively inefficient producers. As supply continues to increase, with increased production expected from new plantings, prices will start to drop in the end markets.

While all channels are growing, the fastest growing channel is the export channel, which has quadrupled in size in the last six years, reflecting the high price margins that are captured by all actors in the channel, and rewarding their investment in the quality of the product being produced.

The relationships between the actors are a critical factor behind the increasing profitability in channels 3 and 4. With closer ties to their buyers, these farmers get the highest prices per piece. Meanwhile, in channels 1 and 2, the more fragmented relationships lead to lower prices for farmers, and often to increased post-harvest loss, due to harvesting techniques driven by the buyers.

4.4 THE PROCESSED MANGO FUNCTIONS AND ACTORS

The processed mango value chain is quite different from the fresh mango value chain, from the variety of mango used (primarily Ngowe), to the geographic concentration (mainly coastal), to the economics of the industry. The main processing season comes during the peak season of production of fresh fruit, when fruit prices are lowest across the board. Kenya's mango processing started in the Coast province due to the high availability of large

quantities of the Ngowe variety which could be cheaply harvested to supply processors. In 2013, the Kenyan processing industry consumed an estimated 8% of the annual fruit production (about 60,000 tonnes), at an average price of KSh2.50 per piece at the farm gate. The increasing demand for mangoes for the domestic fresh and export markets, which fetch on average KSh5 and KSh10, respectively, at the farm gate, has created competition for supply to the processing industry. Processors have reported shortages in supply of mangoes resulting in under-utilisation of their processing capacities, which range between 40%–80%²⁰. The main mango products processed by these industries are juice and pulp.

a) Production

Given the very low prices paid for mangoes (KSh6 per kg or KSh1–2 a piece), very few farmers produce mangoes specifically for the processing industry. Rather it is a market for the surplus production during peak production, or else for individuals who simply harvest existing trees that they do not tend or invest in. The very large farmers will deliver directly to the factories. Overall, the processing industry consumes about 8% of all mangoes produced in Kenya each year.

b) Aggregation

Aggregation is a very important aspect of the processing industry. With prices at KSh6 per kg at the farm gate, and KSh12 per kg at the factory gate, traders purchase and transport the mangoes in bulk. There are also some cooperatives that aggregate production from small farmers to enable them to transport directly to the factory and take advantage of the KShs6 per kg price differential.

²⁰ Monitor Group (2012)

While this offers an opportunity for the smaller farmers to earn larger margins, it requires better organisation and access to transport services and aggregation facilities.

c) Processing

There is both primary processing (pulp production) and secondary processing (juice or other products) of mangoes.

Currently there are around 14 suppliers of mango-related products, of which nine are locally based companies and five overseas based companies (Uganda, UAE, Egypt and South Africa). Most of the local suppliers reconstitute mango juices from imported mango concentrate with a few utilising locally processed mango pulp.

There are around six large companies in Kenya that specialise in processing raw mangoes directly into pulp or juice. The processing industry has grown from one processor Milly Mint Ltd Processors in 2003, to six main processors (Kevian Enterprises, Sunny Processors, Del Monte, Allfruit EPZ Ltd, and Malindi) and several small- to medium-scale processors in urban and rural centres. The main processors operate at Coast, Thika and Nairobi for ease of access to raw materials (fresh mangoes).

d) Large scale processors

In 2005, the Ministry of Agriculture, Livestock and Fisheries (MALF) estimated production of mango juice and concentrate by the large-scale mango processors at 15,000 tonnes. At a conversion rate of 70%, the quantity of fresh mangoes being processed into juice was 21,500 tonnes. Today, from discussions with processors, it is estimated that around 60,000 tonnes of fresh mangoes are processed into juice or pulp, indicating growth of 179% from 2005 to 2012. Even with this increase, it is estimated that only 60% of the installed production capacity of the processors is used.

Large processors offer the lowest prices compared to other buyers but present an elastic demand, currently satisfied largely by import substitution in the form of mango concentrate. They purchase mangoes at prices ranging between KSh8 to 12 per kg (KSh4 per piece at the factory gate and KSh2.5 at the farm gate) mostly during the peak season when supply of mangoes is high.

The five large local mango processors (Sunny, Kevian, Milly, Malindi and All Fruits) located in Nairobi, Coast and Central regions, process an estimated 56,000 tonnes of mangoes. Most processors make juices while a few make concentrates and pulp and sell to multinational processors within and outside of the country. The market also has two multinational processing companies, Delmonte and Coca-Cola, which convert concentrates to juice (either local or imported).

Large processors source mangoes from various regions across the country. The Coast region mainly supplies the Ngowe variety while the Central and Eastern regions supply more Apple and less Ngowe. The processing levels mainly depend on the supply of mangoes with many of the processors indicating that they are operating below capacity due to lack of supplies. The recommended brix content is about 14%.

In addition to the large processors, there has been rapid growth in the cottage processing industry that processes mangoes (among other fruits) into juices. It's estimated that the industry has over 50 cottage and small-scale processors who mainly supply fresh juice to hotels, restaurants and institutions, and the volume of mangoes absorbed by these cottage industries is estimated to be 6,000 tonnes. The industry is also characterised by hundreds of fresh fruit and juice bars that serve directly to individuals, mainly walk-in consumers. This is usually 100 per cent undiluted mango juice, sold in 5-litre jugs, and which cannot be retailed in stores.

In addition, artisanal local juice makers purchase mangoes daily from the wholesale market and, using a blender, proceed to make 20–100 litres of mango juice a day, which is served fresh to customers in the markets. The mango is often mixed with other fruits, particularly papaya. This channel is now consuming about 2,500 tonnes of fruit, though it is essentially captured by the urban fresh fruit channels (see fresh fruit map).

4.5 PROCESSED MANGO VALUE CHAIN CHANNELS

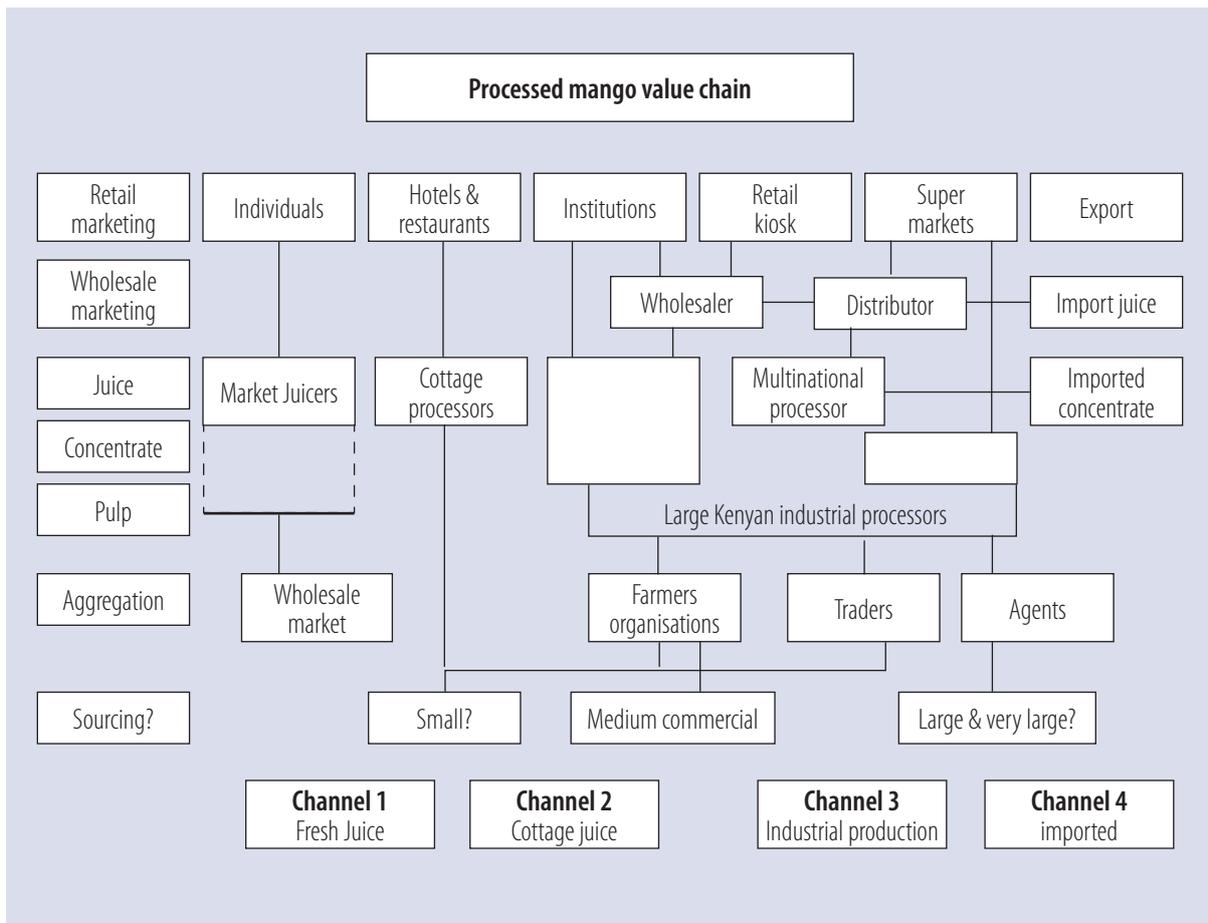
There are four main channels in the processed fruit value chain: small-scale fresh juice production, cottage industries for the food service market, industrial juice manufacturers, and the imported juice channels (see Figure 7).

Channel 1 is the fresh juice processing channel where, as noted above, small market-based processors are purchasing mangoes at retail prices, processing them as juice, and selling to end consumers the same day at an average of KSh200 per litre (usually sold in 250ml glasses). It is essentially an extension of the urban fresh fruit channel.

Channel 2 is the small- to medium-scale processing channel which serves a growing urban market that has emerged due to changing lifestyles, health consciousness, convenience, and portability (pre-cut pieces and freshly squeezed juices). These enterprises serve mass restaurants and hotels frequented by the working class but are selling a quality product. As it retails at a fairly strong price of around KSh480 per litre compared to the purchase price of KSh100 per litre, the processors are able to pay a good price directly to producers for regular supply of high quality fresh fruit.

In **Channel 3**, the industrial processing channel, large local mango processors are competing in the general juice market with juice imports and with local juice manufacturers who import pulp and concentrate. As a result, they offer

Figure 7: Processed mango value chain



the lowest prices to suppliers compared to other buyers in the fresh fruit and cottage industries. However, they represent an elastic demand, which is currently satisfied largely by import substitution in the form of mango concentrate. They purchase mangoes at prices ranging between KSh10 and KSh12 per kg, and purchase mostly during the peak season when the supply of mangoes is high and market forces have pushed prices down. As the price of mangoes comes down in the domestic market over the next few years due to the greatly increased supply, it is possible that the processors will get access to even larger quantities of fruit at prices they can afford, increasing their efficiency and competitiveness.

The low prices at the farm level are driven by the use of traders to purchase from the farmers and transport to the processors; given the low initial value, the traders are taking 50% of the value of the factory gate price. In some cases, cooperatives have successfully formed to aggregate and transport the product, recapturing that margin.

Channel 4 focuses on the imported juices which compete with the industrial fruit juices manufactured in Kenya. These products are imported directly by distributors or by the supermarket chains themselves.

4.6 DYNAMICS IN THE PROCESSED MANGO INDUSTRY

The mango processing industry has grown in response to urban demand and a more readily available supply of mangoes at a reasonable price. But with the investment in new equipment, growth in this market has been hindered by low capacity utilisation due to the inconsistent and insufficient supply of the right varieties of mangoes, uncompetitive pricing, and lack of machinery and equipment to meet required quality standards. However, the capacity utilisation is already starting to change with the supply of additional fruit.

Chapter 5

REGULATORY AND SUPPORTING ENVIRONMENT

The Kenyan government has put in place laws and regulations that govern the horticultural sector under which the mango subsector falls. The market too, driven by the demands of buyers, has developed standards over time that govern trade in the sector. Some of the key issues that enhance or hinder growth in this subsector are highlighted below.

5.1 BUSINESS ENABLING ENVIRONMENT

a) Land tenure

Much land ownership in the mango-growing areas is either ancestral, communal or jointly owned by extended family members, and is without land title. This issue particularly affects small-scale growers who constitute the majority of farmers and who would wish to use their land as collateral to raise credit to enhance the productivity of their farms. Without security of tenure, investors wishing to purchase or lease land over long periods of time are faced with difficulties accessing start-up capital from banks as well as sufficient time to guarantee returns on their investment.

b) Sanitary and phytosanitary requirements

Kenyan mangoes compete in a global market that is governed by stringent standards and requirements for safety and social accountability. Some of these standards, such as adherence to maximum residue levels (MRLs) of pesticides in food or the need of a phytosanitary certificate are legal requirements, while others such as traceability, adherence to good agricultural practice (GAP) and the possession of a hazard analysis and critical control point (HACCP) system for processors are imposed by buyers.

Kenya has developed the KenyaGap, which is benchmarked with GlobalGap, for ease of interpretation and acceptance of Kenyan produce in the world export market. Independent auditors such as Africert, SGS, KEBS and FPEAK certify for specific codes of practice. Mangoes are only supposed to be exported from farms certified by HCDA for export; equally, exporters require certification from HCDA and FPEAK to export mangoes after meeting the minimum set standards. Due to economies of scale, the costs of implementing and maintaining the high levels of compliance and certification tend to favour larger businesses over small- and medium-scale enterprises, both at producer and exporter levels.

c) Contract law (no respect, difficult enforcement)

Like other agricultural sectors, the mango value chain suffers issues to do with contract enforcement emanating from both producers and buyers. They range from produce and inputs diversion and selective picking of produce by buyers, to inefficient dispute resolution methods, largely informal relationships, and markets dynamics like price and demand volatility.

d) Interest by multinationals in formalising local supply

Over the years, the government, in partnership with several non-governmental organisations such as ABD, SNV and Technoserve, funded by development agencies such as DANIDA and USAID, has supported the development of the value chain through technical advice, financial assistance, capacity development and business linkages. For instance, through Project Nurture²¹ Coca-Cola Company brings an interesting model of partnership building to bring smallholder farmers into inclusive and sustainable value chains. The project, which began in 2010, is an alliance between Coca-Cola, the Bill & Melinda Gates Foundation, and TechnoServe, intended to bring more than 50,000 smallholder mango and passion-fruit farmers in Kenya and Uganda into the Coca-Cola's value chain – and to catalyse private initiatives by the company to sustain and replicate those linkages in Kenya, Uganda, and around the world.

5.2 TRADE REGULATIONS

Exports from Kenya enjoy preferential access to world markets under a number of special access and duty reduction programmes. Kenya is a signatory to various agreements aimed at enhancing trade amongst member states, and notable amongst these are the regional trade agreements under the East African Community (EAC), the Common Market for East and Southern Africa (COMESA), and trade agreements with the European Union. While these partnerships offer Kenya great opportunities to widen and broaden its market access for mangoes, there are various challenges that present barriers to entry into these markets.

5.3 SUPPORTING SERVICES

Production support (CPP, spraying, nurseries and grafting, extension) is critical to increasing productivity. Kenya's horticultural sector is characterised by insufficient extension services, ineffective extension messages, and a poor delivery system. The Ministry of Agriculture, Livestock and Fisheries is present in every district up to location level, providing extension and advisory services; however, the delivery is weak and sometimes not available to farmers in remote locations. A study done by the MALF in 2005 indicated that 43% of 100 randomly selected mango farmers in nine mango-producing districts in Kenya reported that there were no government extension services provided in their areas. NGOs, input stockist/dealers, input manufacturers, and buyers of the produce are augmenting the government's effort, but this has not been sufficient to fill the gap. A large number of small farmers still do not practice recommended crop husbandry. For instance in the Coastal region, only 8% of the mango farmers apply pesticides and disease-control chemicals to their orchards²².

²¹ Jenkins and Fries (2013).

²² ABD (2009).

Of great concern is the proper application of crop protection products to meet MRL requirements – especially for the export market. Due to high costs and limited accessibility, small-scale farmers are unable to switch to use of these recommended chemicals. Large-scale farms, on the other hand, have resources to purchase the right chemicals and to employ knowledgeable technical staff and thus attract the export market. Specialised spraying companies, able to meet the requirements and experienced in the preparation of the chemicals, are able to service the farmers.

5.4 PACKAGING MATERIALS

Packaging for the domestic market need not be sophisticated, however, care needs to be taken during handling and transportation to reduce waste due to damage. There is no defined standard packing for the domestic market and packaging is done in materials of varying size and quality such as plastic bags, gunny bags, extended bags (“muroro”), crates, cartons, nets, baskets and basins. For the export market, the quality, cost and availability of packaging is very important. The cost of packing materials is a real challenge especially for smaller business.

Chapter 6

KEY FINDINGS FROM LOWER EASTERN REGION

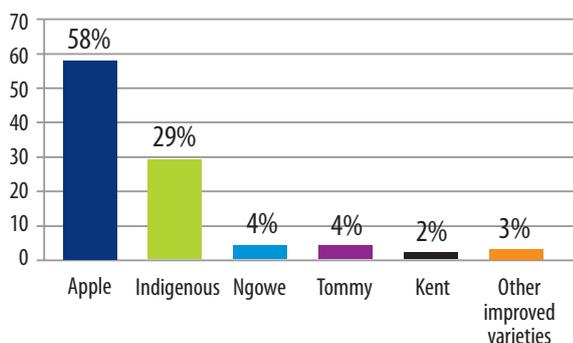
This chapter highlights some of the key findings from the mango value chain study in the Lower Eastern region. The chapter looks critically at the production of mangoes in Lower Eastern region, including dynamics, value chain structure, marketing of mangoes and the financial opportunities for upgrading the mango value chain. Detailed farm budgets and a profitability analysis are discussed in subsequent sections.

6.1 MANGO PRODUCTION IN THE LOWER EASTERN REGION

The Lower Eastern region has 2,284,099 trees and 62,150 farmers. Makueni County has 51% of all the mango trees in the three counties, followed by Machakos with 35%, and Kitui with 13%. The study revealed that the mango subsector in the region is dominated by small-scale (<50 trees) and medium-scale (51–300 trees) farmers, accounting for 45% and 46%, respectively. Large-scale (301–800 trees) and very large scale farmers (>800 trees) only accounted for 6% and 2% of the sampled farmers, respectively.

The results of the study show that farmers in the region grow multiple varieties of mangoes. The most dominant varieties grown are the Apple variety (58% of the total mango tree population) followed by indigenous varieties (29%)²³. The Apple variety has the highest local market demand among fresh mango buyers with 72% preference by traders. The main varieties for the export market are Apple (50% preference), Ngowe (30%), and others (Tommy Atkins, Kent and Keitt, 20%). Industrial processors predominantly use Ngowe. The Apple variety is gaining popularity for processing by industrial processors, however, it is largely used by smaller artisanal food processors who use blenders and other smaller machines and who can afford to pay a higher price. The local varieties have minimal maintenance costs and, being the least preferred varieties, fetch low market prices: KSh0.50 per piece at the farm gate compared to improved varieties which fetch as high as KSh10 per piece.

Figure 8: Percentage of Mango varieties grown in Lower Eastern region



Source: ABD Census report, 2010

6.1.1 Factors affecting mango productivity

Given the right agro-ecological conditions and ideal crop husbandry²⁴, a mature mango tree should produce between 500–800 fruits per season²⁵, depending on variety. But from the study, the highest recorded average yield was 189 pieces per tree among the very large scale farmers. The survey reviews three major factors influencing productivity in the Lower Eastern region.

a) Use of uncertified planting materials

Many farmers obtain planting materials from uncertified sources. The majority of farmers have learnt to graft mango trees on their own, notwithstanding the negative impact of using rudimentary technologies on the viability of the seedlings and on productivity in the long run. Only 19% of farmers obtained planting materials from certified nursery operators, mainly comprised of large- and very large scale farmers; the remaining 81% either grafted the mango trees on their own or had the seedlings germinate naturally on their farms.

b) Low input usage

The study established that many farmers do not fertilise or spray their mango trees as per the recommended standards (4–6 times a year), citing a variety of cost and accessibility reasons (see Figure 9). Mangoes are prone to powdery mildew disease and pests (mainly mango weevil and white fruit fly). The mango weevil is a major concern and farmers are making an effort to use recommended control measures. For export production, the main difficulty for farmers is to comply with the standards required by the GLOBALGAP Control Points and Compliance Criteria. The recommended spraying regime is to start immediately after harvest (April to September), but most farmers spray their mangoes either once or twice during the entire season, instead of the recommended 4–6 times.

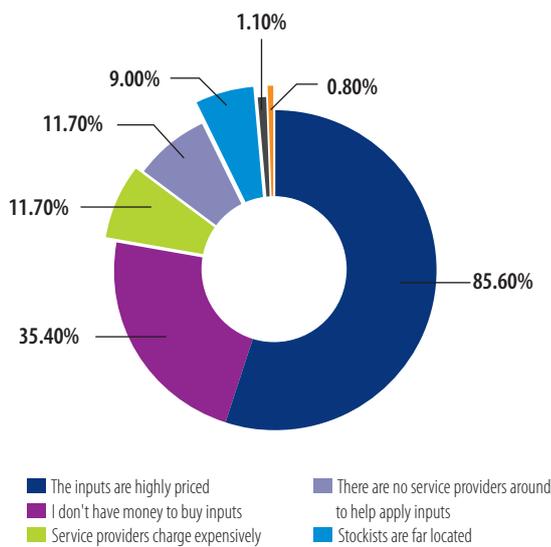
Apart from the reasons given by the farmers, further analysis of the survey data indicated an inverse relationship between the mango cash inflows and outflows, suggesting that one of the leading causes of low input usage would be lack of cash at the time of application. Whereas farmers receive their mango earnings between October and mid-April, the input application should be most intense just after harvest (mid-April to around October) when farmers are strapped for cash. The issue is further compounded by the fact that farmers do not have other sources of income during the lean period, making it difficult for them to access cash during the intensive chemical application seasons. However, most of the farmers were convinced that input usage is useful as demonstrated by the fact that only 1.1% of the farmers interviewed indicated that they don't need any inputs for mangoes.

²⁴ Ibid 21

²⁵ Some varieties like Apple, Dodo, Haden and Sensation are alternate bearing.

²³ Ibid 29

Figure 9: Factors influencing input usage as mentioned by farmers



Source: Field survey, 2013

c) Diseconomies of scale

All the categories of farmers were profitable, but the margins increased with the scale of production. The net profit margins for mango farmers in the three counties vary extensively with small-scale farmers earning 49%, medium-scale 66%, large-scale 80%, and very large scale 92%. Small-scale farmers have the highest cost per tree, averaging KSh239, compared to KSh113 for

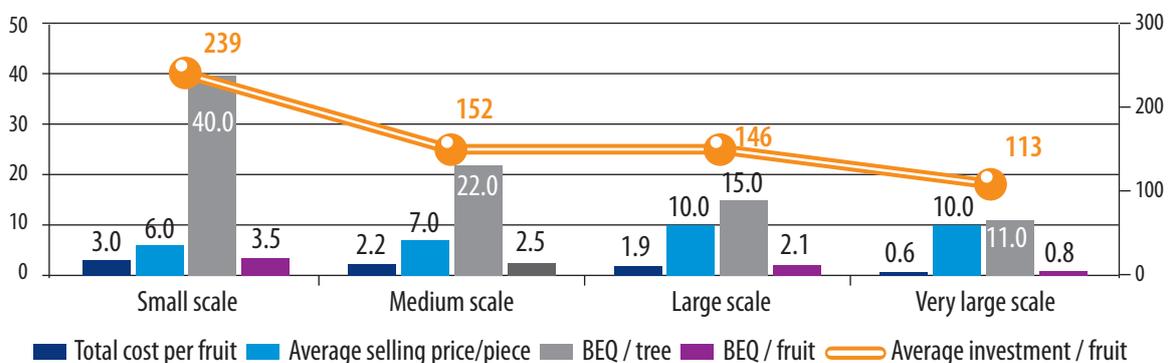
very large scale, KSh146 for large-scale and KSh152 for medium-scale farmers. The average cost per tree drops by half between the small and very large-scale farmers for several reasons, including:

- **Cheaper labour on large farms.** From the focus group discussions it was established that labour for weeding, pruning and harvesting is charged at a daily rate ranging from KSh150 to KSh300 depending on location. Farmers with large farms are able to negotiate lower labour rates compared to small-scale farmers, resulting in lower labour costs per tree.
- **Less expensive inputs for large farmers.** It was established that the small-scale farmers purchase pesticides and fungicides in small quantities at much higher unit prices due to lack of purchasing power. If purchasing in larger quantities they can save money, as do the larger farmers, who attract quantity discounts with bulk purchases.

In addition to higher costs, small-scale farmers also get the lowest prices for their produce, which negatively impacts their margins. Large- and very large scale farmers are able to attract better paying buyers like exporters, and earn an average of KSh10 per piece, compared to small- and medium-scale farmers who earn an average of KSh6 and KSh7 per piece, respectively. The break-even price per piece for small-scale farmers is KSh3.5, compared to the very large scale farmers' break-even price of KSh0.80.

Likewise, economies of scale mean the very large scale farmers' break-even quantities are as low as only 11 fruits per tree compared to the small-scale farmer who would need to produce 40 fruits per tree.

Figure 10: Break-even points and levels of investment by the various farmer categories



Source: Field survey, 2013

Table 7: Break even points and levels of investment by the various farmer categories per county

| | MAKUENI | | | | KITUI | | | | MACHAKOS | | | |
|--|---------|--------|-------|------------|-------|--------|-------|------------|----------|--------|-------------|------------|
| | Small | Medium | Large | Very large | Small | Medium | Large | Very large | Small | Medium | Large scale | Very large |
| Cost of investment/ tree | 200 | 125 | 126 | 60 | 503 | 369 | 206 | 116 | 239 | 111 | 152 | 44 |
| Cost of investment/ fruit | 3.1 | 1.8 | 1.5 | 0.4 | 4.5 | 4.8 | 3.4 | 0.8 | 3.3 | 1.9 | 2.1 | 0.5 |
| Cost/price | 44% | 23% | 15% | 4% | 91% | 69% | 34% | 8% | 55% | 23% | 26% | 5% |
| Percentage of cost items to total cost | | | | | | | | | | | | |
| Fertiliser/ Manure | 11% | 15% | 25% | 28% | 8% | 16% | 22% | 13% | 19% | 26% | 34% | 7% |
| Pesticides & Fungicides | 54% | 53% | 37% | 45% | 25% | 19% | 27% | 41% | 40% | 44% | 34% | 77% |
| Labour cost | 35% | 33% | 33% | 28% | 16% | 20% | 26% | 37% | 41% | 30% | 32% | 16% |
| Transport | 0% | 0% | 5% | 0% | 50% | 41% | 23% | 0% | 0% | 0% | 0% | 0% |
| Packaging materials | 0% | 0% | 0% | 0% | 2% | 4% | 3% | 9% | 0% | 0% | 0% | 0% |
| Cost of investment/ tree | 200 | 125 | 126 | 60 | 503 | 369 | 206 | 116 | 239 | 111 | 152 | 44 |
| Fertiliser/ Manure | 11% | 15% | 25% | 28% | 8% | 16% | 22% | 13% | 19% | 26% | 34% | 7% |

Regionally, Kitui county had the highest total cost per unit of fruit for all the categories of farmers, with small-scale farmers' total costs averaging KSh4.50 (91% of selling price) per fruit compared to KSh3.30 (55%) in Machakos and KSh3.10 (44%) in Makueni. This is largely influenced by the need for transportation (See Table 8 below), especially for the small- and medium-scale farmers who mainly deliver their produce to the local market on hired transport. In Kitui, 17% of the farmers interviewed indicated that buyers purchase their mangoes at the farm gate, compared to 77% in Machakos and 98% in Makueni. The higher transport costs in Kitui are because the county is further from the main markets,²⁶ leading to an average of 28% transport cost to total cost (55% for small scale), compared to an average of 1% in Makueni and 0% in Machakos. The other disadvantage is that the small- and medium-scale farmers of Kitui earn the lowest price (KSh5 and KSh7, respectively) compared to other counties (KSh6/7 and KSh8) as a result of their poor access to major urban markets like Nairobi and Mombasa.

²⁶ The study established that the average distance to market for farmers in Kitui is 22 km compared to 17 km for farmers in Makueni and 15.5 km for farmers in Machakos.

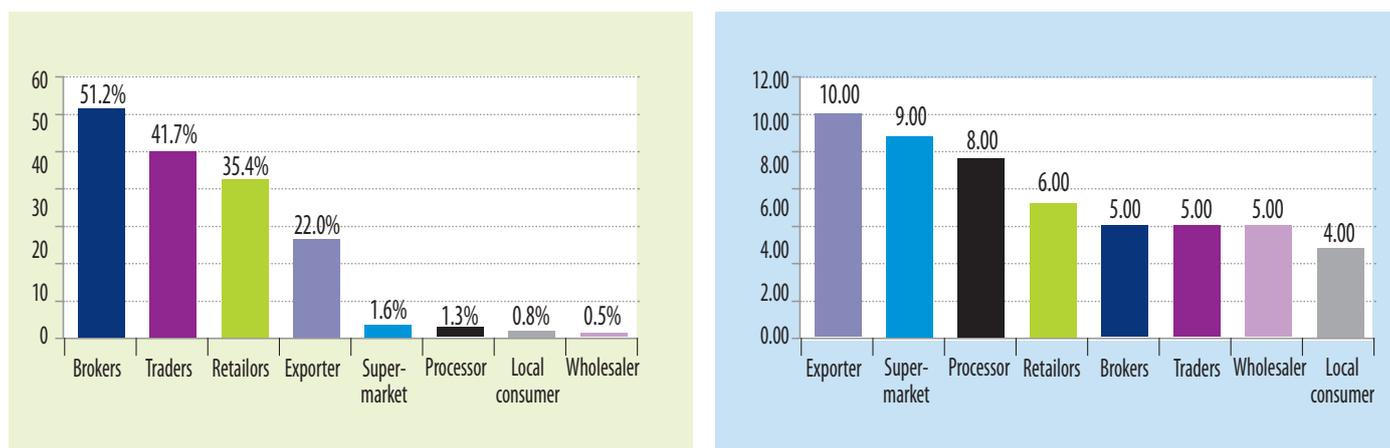
6.2 FACTORS AFFECTING MARKETING OF MANGOES IN THE LOWER EASTERN REGION

The marketing of mangoes in Lower Eastern faces two major issues: (a) spot transactions and broker dominance and (b) post-harvest losses.

a) Spot transactions and broker dominance of the fresh mango market

Despite the increasing demand for fresh mangoes, the market for mangoes in Lower Eastern has been dominated by brokers who intermediate between farmers and the buyers. The study showed that farmers sell their mangoes to multiple buyers. 51% of all the farmers interviewed sell their produce through brokers and 42%, 25% and 22% of the time directly to traders, retailers and exporters respectively. In the value chain, brokers offer farmers KSh5 per piece while exporters offer the best price of KSh10 per piece. Only one processor located within the region, a cottage processing plant, buys mangoes from the farmer. It takes 1.3% of the market share and is owned by a group of farmers who sell their mangoes to the firm at KSh8 per piece. The proportionate distribution of the buyers vis-à-vis prices offered to farmers are summarised in Figure 11.

Figure 11: Major mango buyers vs. farm gate prices (KSh) offered to farmers in Lower Eastern region



Source: Field survey, 2013

b) Post-harvest losses

The mango census survey conducted by ABD in 2010 reported annual losses of about 25% of all mangoes harvested in Kenya. However, the study revealed that the post-harvest losses in Lower Eastern are about 13%.

Discussions with farmers revealed that harvesting is mainly done by buyers who commonly use a “shaking method” of harvesting. After harvesting, the buyers only select those fruits that match their specifications and leave the rest with the farmer, which either rot or in rare circumstances are sold at very low prices (less than KSh1 per piece). This is compounded by the fact that relationships between buyers and farmers are largely informal: the study

established that 94% of farmers do not have any form of contract with their buyers. Without contracts specifying who is liable for such losses, farmers end up absorbing the losses.

6.3 FINANCIAL REVIEW OF THE MANGO SUBSECTOR IN LOWER EASTERN REGION

This chapter highlights the outcomes of financial review for both the demand and supply side of the mango value chain detailing opportunities and challenges. It highlights the actors’ profitability, cash-flow and financing options as well as the supply side products’ options, risk management and challenges.

6.4 DEMAND SIDE FINANCIALS

6.4.1 Mango farmers

a) Profit margins

Table 8: Profitability analysis of mango farmers in Lower Eastern region²⁷

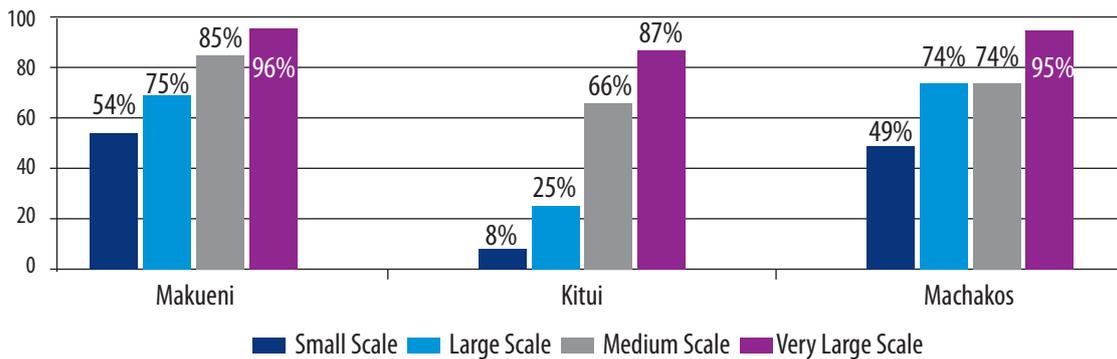
| Farmer category | Small scale | Medium scale | Large scale | Very large scale |
|------------------------------------|-------------|--------------|-------------|------------------|
| Number of sampled farmers | 173 (45%) | 175 (46 %) | 24 (6 %) | 9 (2%) |
| Average number of trees planted | 35 | 145 | 505 | 1205 |
| Average number of productive trees | 22 | 105 | 483 | 1,005 |
| Proportion of young trees | 37% | 28% | 4% | 17% |
| Average pieces harvested | 1,725.00 | 7,250.00 | 37,500.00 | 190,000.00 |

²⁷ Land size has not been factored in the computation as the number of trees planted was considered a definitive measure of outputs. Also, return on investment (ROI) was arrived at by examining the proportion of profits earned with respect to all costs incurred, which in this case was considered to be the farmer’s total investment in the enterprise.

| Farmer category | Small scale | Medium scale | Large scale | Very large scale |
|--|------------------|------------------|-------------------|---------------------|
| Yield per tree | 78.41 | 69.05 | 77.64 | 189.05 |
| Average quantities sold | 1,500.00 | 6,500.00 | 34,500.00 | 150,000.00 |
| Unsold quantities | 225.00 | 750.00 | 3,000.00 | 40,000.00 |
| % of lost quantities | 13% | 10% | 8% | 21% |
| Average selling price/piece | 6.00 | 7.00 | 10.00 | 10.00 |
| Income from improved varieties | 9,000.00 | 45,500.00 | 345,000.00 | 1,500,000.00 |
| Income from local varieties sold | 1,200.00 | 900.00 | 3,000.00 | - |
| Total Income | 10,200.00 | 46,400.00 | 348,000.00 | 1,500,000.00 |
| Less input costs | | | | |
| Fertiliser/manure | 750.00 | 3,000.00 | 19,000.00 | 19,000.00 |
| Pesticides & fungicides | 2,500.00 | 7,000.00 | 23,750.00 | 47,500.00 |
| Total input cost | 3,250.00 | 10,000.00 | 42,750.00 | 66,500.00 |
| <i>Input cost/piece</i> | <i>1.88</i> | <i>1.38</i> | <i>1.14</i> | <i>0.35</i> |
| Less labour cost | | | | |
| Weeding | - | 1,500.00 | 7,750.00 | 7,850.00 |
| Spraying | 860.00 | 1,800.00 | 14,288.00 | 17,150.00 |
| Pruning | | 1,500.00 | 4,438.00 | 15,450.00 |
| Hired integrated sprayer | 1,140.00 | 1,200.00 | | |
| Harvesting | - | - | | |
| Grading | | - | | |
| Total labour cost | 2,000.00 | 6,000.00 | 26,476.00 | 40,450.00 |
| <i>Labour cost/piece</i> | <i>1.16</i> | <i>0.83</i> | <i>0.71</i> | <i>0.21</i> |
| Less post-harvest handling cost | | | | |
| Transport | - | - | 1,500.00 | 3,400.00 |
| Packaging materials | - | - | - | 2,800.00 |
| Total post-harvest handling costs | - | - | 1,500.00 | 6,200.00 |
| TOTAL COSTS | 5,250.00 | 16,000.00 | 70,726.00 | 113,150.00 |
| PROFIT | 4,950.00 | 30,400.00 | 277,274.00 | 1,386,850.00 |
| % Margin | 49% | 66% | 80% | 92% |
| % ROI | 94% | 190% | 392% | 1226% |
| Break even price | 3.50 | 2.46 | 2.05 | 1.00 |
| Break even quantity | 875 | 2,286 | 7,073 | 11,315 |

Source: Field data 2013

Figure 12: County-level profit margins of mango farmers



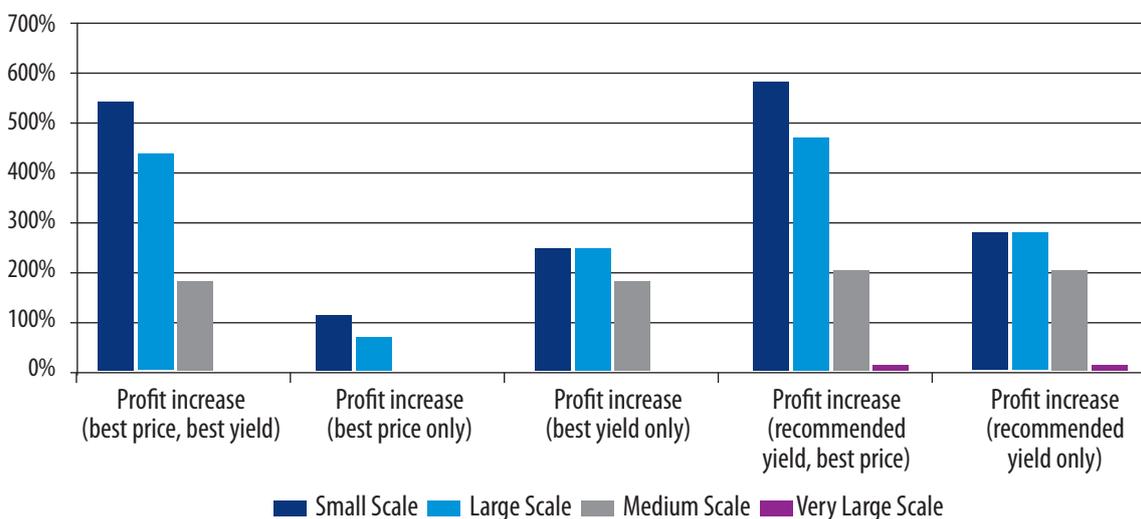
Source: Field data, 2013

The cost of production reduces with scale (economies of scale) which enables the large-scale farmers to earn higher profit margins.

Despite the fact that all the farmers seem to operate profitably, the actual profit in absolute amounts for the small-scale farmers is small – equivalent to KSh413 per month (KSh4,950 per annum) – compared to medium-, large-scale and very large scale farmers whose profits are KSh2,533, KSh23,106 and KSh115,567, respectively. Profit margins can be greatly enhanced by increasing productivity through increased input usage and better management practices. This implies that mango production for small-scale farmers is very marginal, and they are not treating the production as a business enterprise with the necessary investments, but as supplemental income. All the same, the figures show that small farmers are steadily increasing their number of trees (with around 40% not yet in production).

An increase in price for small- and medium-scale farmers to KSh10 per piece (the price earned by large-scale and very large scale farmers) would increase their profit margins by 121% and 64%, respectively, leading to profit margins of 68% and 76%, respectively. However, a combination of both price and yield increases would result in profit increases of 549% for small-scale farmers, and 436% and 188% for medium- and large-scale farmers, respectively. However, it's most likely that mango prices will not increase – at least in the short term – as reflected by the relatively flat growth of mango prices in the recent past. Two options for improving small-scale farmers' incomes may be (1) to increase the productivity of existing trees in the short term through enhanced inputs usage (to a productivity level closer to the very large-scale farmers of 189 pieces per tree), or (2) to increase the number of trees and tap into economies of scale in the long term.

Figure 13: Sensitivity analyses on changes in profit margins with increase in yield and price



Source: Field data, 2013

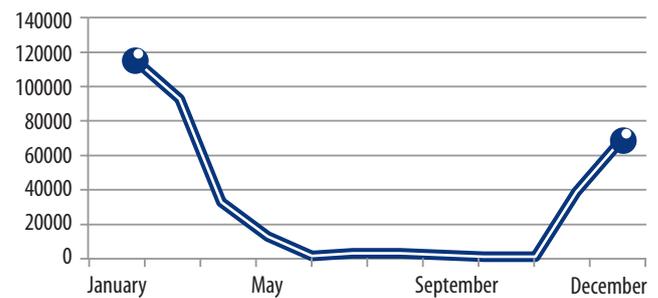
Extrapolating the current profit margins to the entire population of farmers in the three counties, the total net income for the 62,150 farmers is approximately KSh2.5 billion with a combined gross income of KSh3.6 billion. The small- and medium-scale farmers are estimated to contribute about 32% of the total net income from their 39% gross income contribution. Similarly the large-scale and very large scale farmers contribute around 68% of net income from around 61% gross income. The ABD census report indicated a gross value of KSh2.44 billion in 2010 for Lower Eastern with a projected annual growth rate of 12%.

b) Cash flows of mango farmers

Income from mango production coincides with the harvesting season in Lower Eastern region which runs from the beginning of October to April and peaks in December, January and February. During focus group discussions, mangoes were ranked as the leading cash-generating activity in most of the Lower Eastern region. However, for small-scale farmers with few trees and low productivity, the aggregate income earned from mangoes is too little to sufficiently contribute to household expenses and be spread over a period of six months when production-related expenses are incurred.

Most farmers are cash strapped in the months from April to October, when they need to spend most of their mango earnings on early crop maintenance: pruning, weeding, pest and disease control, and other family needs. The study revealed that 85% of farmers use their personal savings to partly finance their mango production activities while 7% borrow from friends/relatives, and only 1.9%, comprising mainly the large-scale producers, borrow from formal financial institutions (most mentioned financier was Universal Traders Sacco-UTS).

Figure 14: Aggregated average cash flow of mango farmers (KSh)



Source: Field survey, 2013

c) Access to finance by mango farmers.

i) General access to finance by mango farmers

A significant number (69%) of farmers access some form of financial services, which compares reasonably with the 74.6% national access rate recorded by the FinAccess 2013 survey.

The most used financial service is savings, with an average usage by 81.7% of those accessing financial services, followed by credit at 9%, remittances at 7.5%, and insurance at 1.8%. The fact that only 9% of all farmers access any form of credit, with only 7.6% accessing from formal sources (banks, MFIs and Sacco), is very telling. The dominant financial service providers are: banks (64.6%), followed by mobile money at 7.8%, SACCOs at 4.9%, other farmers at 4.6%, SHG at 4.4%, MFIs at 3.8%, ROSCAs at 3.5%, FSAs at 2.7%, and with buyers, underwriters and friends/relatives at 1.5%, 1.4% and 0.8%, respectively.

Table 9: General financial services accessed by farmers

| | Banks | Mobile money | SACCO | Other farmers | MFI | SHGPs | ROSCA | FSA | Insurer | Buyer of produce |
|---------------------|--------------|--------------|-------------|---------------|-------------|-------------|-------------|-------------|-------------|------------------|
| Insurance | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.4% | 0.0% | 1.4% | 0.0% |
| Outward remittances | 0.4% | 1.1% | 0.0% | 0.0% | 0.4% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Inward remittances | 0.0% | 5.2% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Credit | 3.8% | 0.0% | 1.5% | 0.0% | 2.3% | 0.6% | 0.4% | 0.0% | 0.0% | 0.0% |
| Savings | 60.4% | 1.5% | 3.4% | 4.6% | 1.1% | 3.8% | 2.7% | 2.7% | 0.0% | 1.5% |
| TOTAL | 64.6% | 7.8% | 4.9% | 4.6% | 3.8% | 4.4% | 3.5% | 2.7% | 1.4% | 1.5% |

Source: Field data

ii) Sources of financing for mango production

Most of the mango farmers finance their mango operations from their own savings (85%) followed by informal service providers (10.6%) and formal service providers (4.4%).

Formal financing from banks is mainly accessed by very large-scale farmers who can meet the lending criteria (mainly the collateral and regular monthly instalment requirements) of these institutions. The rest of the farmers access finance from savings and informal service providers reflecting the difficulty in accessing formal finance:

- The large-scale farmers access finance from SACCOs, friends/relatives and savings in equal measures. Large-scale and very large scale farmers generate sufficient revenues to self-finance their operations but supplement this with borrowing from formal financial institutions. They are able to access formal financing since they can demonstrate their ability to meet monthly instalments and raise the required collateral for lending.
- Small-scale farmers finance most of their mango operations from savings, followed by SHG, then friends/relatives and FSA.
- Medium-scale farmers largely finance their operation from savings, buyers, SHG, and friends and relatives, with a few accessing SACCOs.

These findings reflect the fact that when the small-, medium- and large-scale farmers access finance, they are largely accessing it from sources that leverage on their own savings. While SACCOs represent an opportunity for farmers, the outreach is largely limited to urban areas due to ease of access to clients. Farmers are also required to build at least the 30% savings required by SACCOs and MFIs and to mobilise other likeminded farmers to act as guarantors.

Access to finance by farmers from financial institutions is minimal with the main reason being the “inability” (lack of cash) of farmers to service structured monthly instalments during the input application season. Most of the products require either payments of instalments to start upfront or a bullet payment at the sixth month (ordinarily from April to September), despite the fact that most farmers could only afford repayments spread over the mango sales period of Mid-October to March.

The average credit facility accessed by the 7.6% of farmers who had some form of formal access was KSh24,000. Of these farmers, 86% accessed from either banks, SACCOs or MFIs, while the rest accessed from informal sources like groups, exporters or relatives.

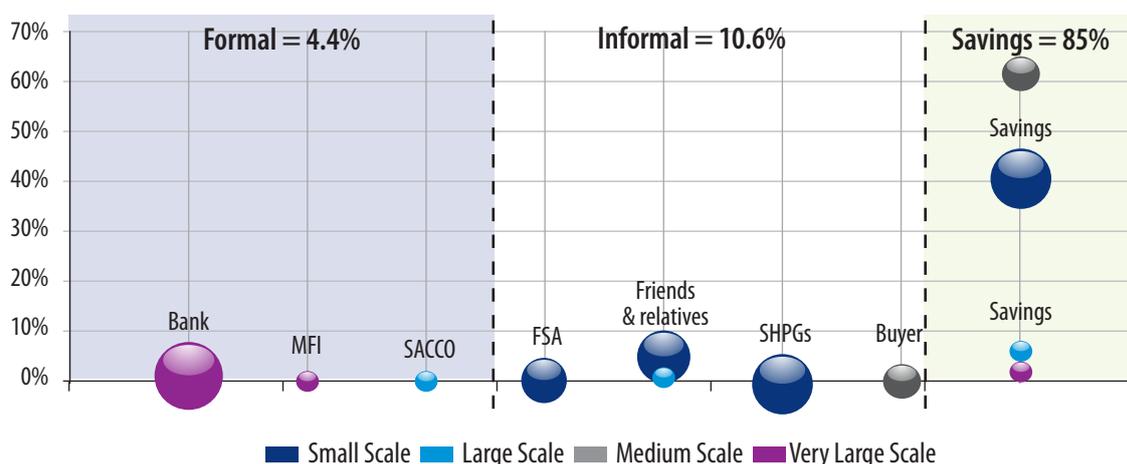
iii) Farmer organisation and access to finance

The most distinct factor that seems to influence access to finance was belonging to a formalised group. Farmers who were organised in groups had better access to finance than farmers who operated as individuals. The survey established a strong association between farmers’ organisation in groups and access to finance²⁸, underscoring the important role that organisations play in offering social collateral against character risk.

Similarly, there is a lack of proper partnership arrangements between buyers and financiers to improve loan collection hence the need to have a group lending arrangement. Most of the farmers who accessed money from banks, MFIs, SACCOs, FSA, and the produce buyers, were in farmer groups. This corresponds with the sentiments of financial institutions who prefer the group lending methodology for unsecured lending to farmers or small enterprises.

²⁸ ($\chi^2=5.569, df=1, p=0.018$)

Figure 15: Sources of finance for mango farming



Source: Field data, 2013

d) Opportunities for supporting farmers

There are three options available for enhancing farmers' incomes: (1) increasing the productivity of existing orchards, (2) expanding production by planting more trees and (3) accessing higher prices.

- Of the three options the strongest case would be to support improved productivity – to have more fruit for sale through improved utilisation of inputs.
- Opportunities for the majority (92%) of farmers – i.e. small- and medium-scale farmers – to access improved prices by selling into premium supermarkets and export markets are limited, due to the low absorption capacity of these markets.
- Activities geared towards the increased planting of new orchards may lead to an oversupply to the market, and a glut in the long term. A sustained expansion of orchards would also take time.

The processing market seems to have long-term potential for expansion if it can become internationally competitive. Systematic development of the processing market must deal with current issues like raw materials pricing, investment in modern plants, and food safety standards, in preparation for the much anticipated increase in production.

The study shows that farmers would still be profitable if they sold their mangoes to processors. At the prevailing price of KSh2 per piece at the farm gate, small-scale farmers would lose money at their current productivity rates. Small-scale farmers would lose 25%, while medium-scale farmers would lose 15.1% – compared to profits of 1.8% and 63.2% for large-scale and very large scale farmers, respectively. If small-, medium- and large-scale farmers improved productivity to 189 pieces per tree (very large scale farmers' level) they would make profit margins of 37.8%, 56.3% and 58.6%, respectively, at the prevailing price for processors at the farm gate (other factors remaining constant). This may explain why most of farmers are not currently keen to sell their mangoes to processors at the prevailing price.

6.4.2 Input suppliers

Almost all the input suppliers stock a wide variety of inputs ranging from fungicides, pesticides, herbicides, fertilisers, acaricides, veterinary drugs and farm equipment. There are a few specific chemicals that purely target mango farming. The input suppliers estimate that 27% of their business turnover is related to mango production in the Lower Eastern region. The estimates were based on the input suppliers' engagement with farmers as shown by a significant 60% provision of over-the-counter service, 23% on-field extension, and 5% spraying services. 62% of the input suppliers sell directly to individual farmers, followed by 22% to farmer groups, 6% to service providers, 4% to other stockists, and cooperatives and brokers accounting for 3% each.

a) Profitability

The 80 inputs suppliers interviewed all operated profitably. The table below highlights that:

- Large suppliers (5%), with annual turnovers of more than KSh15 million, were earning profit margins of 52%, translating to almost KSh8 million in net profits per year.
- The majority of the input suppliers (70%) were medium-scale operators whose annual business turnover ranged from KSh1–9 million and their aggregated profit margins (47%) translated to KSh1.37 million per year.
- The remaining 25% of the agro dealers were small scale (annual turnover less than KSh1 million) with profit margins of 17% (KSh105,580 per year).

The business stocks held by the inputs suppliers at the time of study constituted, on average, 56% of the annual turnover (implying only a 2x inventory turnover rate). This points to a need for intensive capital holding, especially during the high sales season for input suppliers in the region which runs from May to December.

Table 10: Average annual net profit of input suppliers

| Annual business turnover | Large scale | Medium scale | Small scale |
|---------------------------|--------------------|---------------------|-------------------|
| | > kshs. 10 million | > kshs. 1-9 million | > kshs. 1 million |
| Number sampled | 4(5%) | 56(70%) | 20 (25%) |
| Total annual sales | 15,350,000 | 2,919,917 | 615,863 |
| Less; Cost of sales | 6,375,000 | 1,247,200 | 273,714 |
| Gross profit | 8,975,000 | 1,672,712 | 342,149 |
| Variable costs | | | |
| Transport | 109,800 | 42,964 | 54,100 |
| Labour | 594,600 | 146,208 | 105,032 |
| Water | 6,120 | 3,170 | 3,162 |

| Annual business turnover | Large scale | Medium scale | Small scale |
|--------------------------|--------------------|---------------------|-------------------|
| | > kshs. 10 million | > kshs. 1-9 million | > kshs. 1 million |
| Electricity | 49,920 | 14,780 | 7,440 |
| Rent | 202,800 | 68,176 | 46,100 |
| Telephone | 20,250 | 13,528 | 12,085 |
| Trade license | 14,700 | 9,485 | 8,651 |
| Other operating costs | 10,467 | 2,914 | - |
| Total variable costs | 1,008,657 | 301,226 | 236,569 |
| Net profit | 7,966,343 | 1,371,492 | 105,580 |
| % Margin | 52% | 47% | 17% |
| % ROI | 108% | 89% | 21% |

Source: Field data, 2013

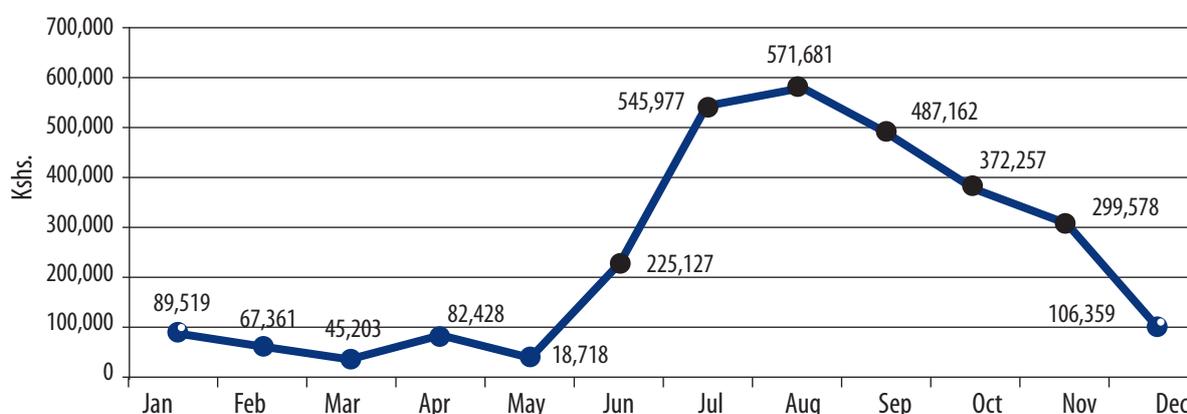
Input suppliers' cash flows

The input suppliers' cash flow is inversely related to that of the mango farmers. They sell most during the intensive input application period when the majority of the farmers have minimal cash available. For five months from mid-December to mid-May, most of the input suppliers generate only sufficient profits – just above the basic operational costs averaged at KSh20,000. An outstanding challenge for input suppliers was lack of stocking capital during the high season, since most of the net cash flow would have been utilised or diverted during the low season.

b) Business financing for input suppliers

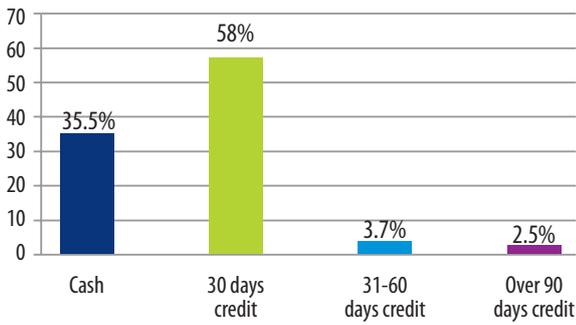
Two thirds of the input suppliers access financial services from banks, followed by 20% from mobile money; the other significant service providers are ROSCAs and SACCOs at 5% and 3%, respectively. A significant number of input suppliers (35.5%) pay cash to get stocks. While the majority of input suppliers (64.2%) are able to access credit days, on average 30 days, this makes it difficult to repay and maintain sufficient business stocks (given that their inventory turnover is much slower).

Figure 16: Input suppliers' average cash inflows (KSh)



Source: Field data, 2013

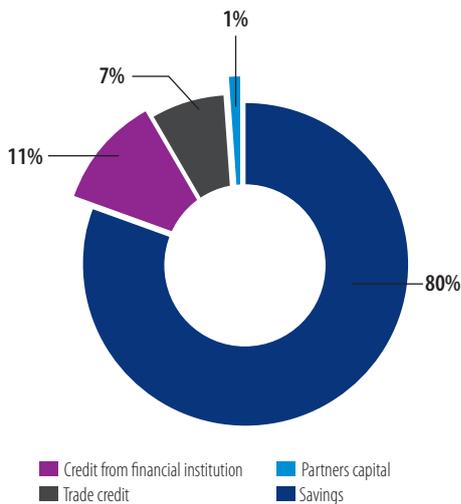
Figure 17: Terms of stock purchase



Source: Field data, 2013

Though over half of the input suppliers access trade credit, it only accounts for 7% of financing; otherwise, the largest share of financing comes from savings (80%) followed by loans from financial institutions (11%). Savings are not sufficient to cater for business needs since 37% of respondents indicated that they still needed credit to supplement the savings. Of those who access credit, the majority have used it to expand their business (76%), followed by restocking (19%) and start-up (5%).

Figure 18: Sources of business financing for input suppliers

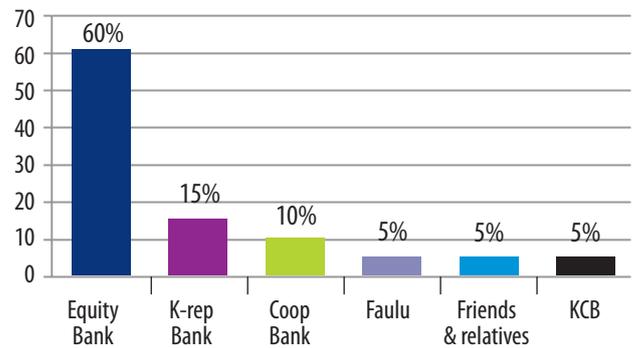


Source: Field data, 2013

Currently, the majority of the input suppliers (85%) get their supplies directly from manufacturers, with 12% from wholesalers and 3% from other stockists. Over 50% had contracts with suppliers and about 58% were able to get trade credit of 30 days from their suppliers (3% could get trade credit of up to 90 days).

Of the 11% that access loans from financial institutions, the majority use Equity bank (60%), which has a dedicated input-supplier product, followed by K-rep (15%) and Cooperative Bank (10%). Meanwhile the remaining borrowers acquire finance from friends/relatives (5%), Faulu (5%) and KCB (5%).

Figure 19: Main financiers of input suppliers



Source: Field data, 2013

c) Opportunities for supporting input suppliers

The profitability and credit demand levels of input suppliers are adequate to support potential borrowing for working capital. Any product structure must respond to the input suppliers' cash-flow peak requirements from May to November. Some simple adjustments would greatly enhance their potential, like collection of loan instalments in peak periods, as opposed to monthly instalments which require payments at times when most of the input suppliers make only sufficient profits to cover their recurrent budgets. Some finance schemes pay inputs manufacturers directly to avoid diversion by suppliers, however this model would be complicated by the number of suppliers that would require separate contracting.

6.4.3 Traders

a) Profit margin

In the mango value chain, retailers earn an average annual profit margin of 37% (KSh277,085) while wholesalers average 26% (KSh115,812). The higher net profit margins for retailers can be explained by the fact that they sell commodities other than mangoes, while most wholesalers specialise in one or two commodities.

Table 11: Profit margins for traders

| | Retailer (mangoes and other commodities) | Wholesaler |
|-----------------------------|---|----------------|
| Sales | 756,685 | 442,043 |
| Less: cost of sales | 422,963 | 269,743 |
| Gross profit | 333,722 | 172,301 |
| Variable costs | | |
| Transport | 14,335 | 19,114 |
| Labour | 6,479 | 15,308 |
| Water | 803 | 1,396 |
| Electricity | 4,578 | - |
| Rent | 1,776 | 480 |
| Telephone | 10,246 | 8,957 |
| NHIF | 149 | 168 |
| Taxes | 14,003 | 4,268 |
| Packaging materials | 4,268 | 6,797 |
| Total variable costs | 56,636 | 56,488 |
| Net profit | 277,085 | 115,812 |
| % margin | 37% | 26% |
| % ROI | 489% | 205% |

Source: Field data, 2013

b) Cash flows

Margins varied significantly based on where mangoes were sourced. Most are sourced from Makueni at the beginning, middle, and end of the season, thus traders in this region are able to fetch better prices. In order to smooth their cash flows, most traders sell other commodities to complement the mangoes. Of the traders interviewed, only 17% were able to access credit (83% had no access).

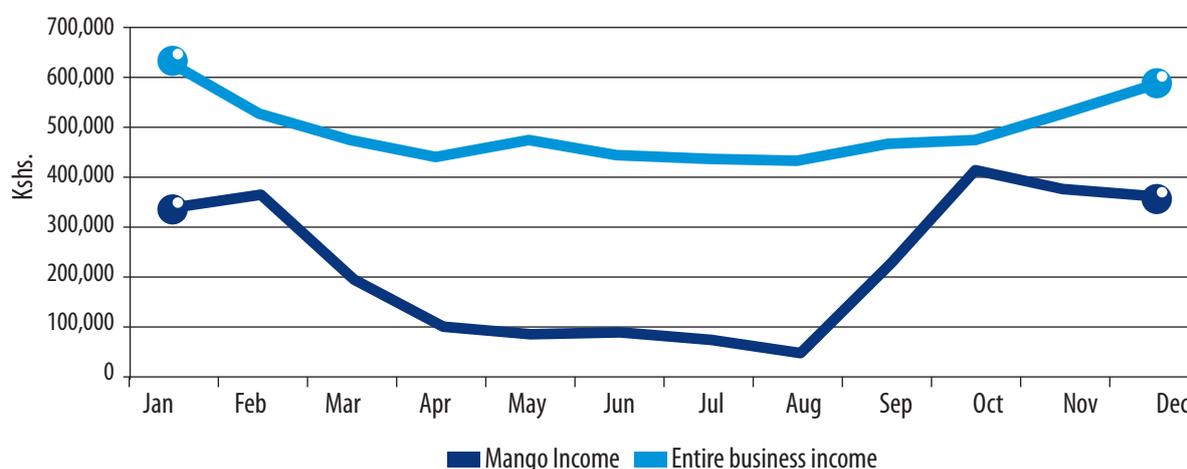
c) Opportunities for financing

There are no specific mango financing opportunities for the traders. Most of the traders have a smooth cash flow due to complimentary sales of various in-season commodities making it easy for them to operate. Furthermore most of their produce is sold for cash on a daily basis, and so cash is available for next purchases/restocking.

6.4.5 Transporters

The survey interviewed 40 transporters who had at least some mangoes as part of the goods that they transport. The majority of the transporters had, on average, one pick-up truck while a few had larger trucks (average carrying capacity 7 tonnes), and with an average vehicle value of KSh750,000. Only two transporters had refrigerated trucks, mainly used to transport perishable export produce. The main customers of the transporters were the general agricultural businesses (mainly wholesalers) and local farmers, though a few had contracts with exporters and processors. The mango business constitutes, on average, 39% of the total average income for transporters, who diversify their mango business with commodities such as oranges during the off-peak season. Others transport mangoes from as far as Garissa and Tana Delta.

Figure 20: Cash flow for mango traders (KSh)



Source: Field survey, 2013

a) Profitability

Transport businesses were found to be quite profitable with average profit margins of 44% and mango-related business contributing around 39% of total business. The major cost for transporters was fuel, on average 41% of total average costs.

Table 12: Average annual net profit of transporters

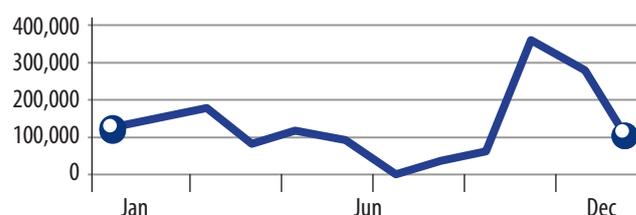
| | Kitui (32%) KShs | Machakos (28%) KShs | Makueni (40%) KShs |
|--|---------------------------------|------------------------------------|-----------------------------------|
| Income from mango transport | 412,123 | 903,091 | 475,200 |
| Income from other transport businesses | 898,877 | 1,089,091 | 781,600 |
| Total income | 1,311,000 | 1,992,182 | 1,256,800 |
| Cost items | | | |
| Fuel | 265,308 | 490,727 | 259,427 |
| Insurance | 17,346 | 29,727 | 37,433 |
| Repairs and maintenance | 110,031 | 83,600 | 80,333 |
| Labour | 106,345 | 84,275 | 83,880 |
| Salaries | 115,875 | 94,200 | 118,667 |
| Telephone | 20,508 | 28,164 | 25,720 |
| Depreciation of motor vehicles | 94,432 | 186,190 | 173,860 |
| Total Costs | 729,845 | 996,884 | 779,320 |
| Net profit | 581,155 | 995,298 | 477,480 |
| % margin | 44% | 50% | 38% |
| % ROI | 80% | 100% | 61% |

Source: Field data, 2013

b) Transporters' cash flows

Transporters are usually in business throughout the year, and transport which ever crops are in season. Most transporters are also engaged in non-agricultural business (e.g. transportation of construction materials) as well as moving produce to the counties from other regions. However, there was an increase in monthly cash inflow during the mango and orange seasons, especially in Makueni.

Figure 21: Transporters mango inflows (KSh)

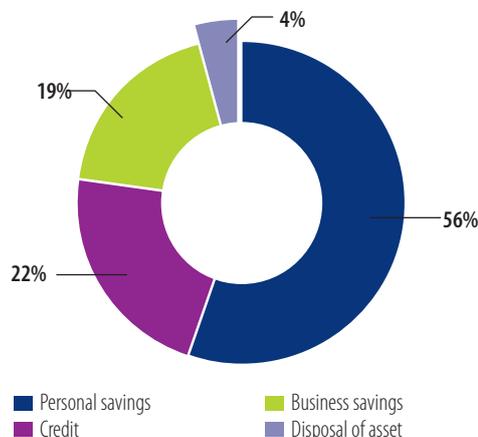


Source: Field data, 2013

c) Business financing for transporters

The most common means of financing vehicle purchases is through personal savings (56%) followed by borrowing from financial institutions (22%) and business savings (19%). Personal savings partly constitute the deposit required by financial institutions for asset financing. A few transporters finance through disposal of other assets.

Figure 22: Sources of vehicle financing



Source: Field data, 2013

As with financing of input suppliers, for the 22% of transporters who accessed credit, Equity Bank was the most common financier for vehicles (60%), with the remaining 40% shared between KCB, KWFT, Cooperative and K-rep banks. The most common challenges cited by transporters were frequent breakdown of vehicles due to bad roads (40%), seasonality of agricultural produce (33%), and a lack of guaranteed business (11%). Other minor issues included theft of produce, vehicles or money. Risk due to theft is adequately covered through insurance (Goods in transit, Cash in transit and motor vehicle insurance). A good number of transporters had old vehicles, which could explain the frequent breakdowns, and may signal a need to upgrade.

6.4.6 Processors

Different categories of processors have different financial challenges. The key challenge highlighted by all the large processors was the lack of sufficient supplies of mangoes at low prices. This is largely attributed to an average purchase price of KSh6 per kg at the farm gate for large processors compared to KSh21 and KSh30 per kg at the farm gate for the urban retail fresh and exporters, respectively.

The six large processors were indicated to have either outdated equipment or were unable to meet the stringent food safety standards. The need for an estimated KSh350 million in asset financing was identified among the medium-level processors who need to upscale their machinery. Annual expenditure on mangoes by the large processors is estimated to cost around KSh400 million²⁹, but in concentrated periods during the mango season. The working capital requirement to purchase raw mangoes by the large processors on a 90-day inventory level is estimated to be KSh200 million (active processing is mainly done in six months, but they hold the processed product over most of the year). Most of the processors purchase mangoes from farmers, brokers or through agents and pay either on the spot or within a fortnight, creating a huge cash outlay for the businesses since most of them have to hold sufficient stocks for the entire year. The survey found that some of the large processors are well established and not cash constrained as they have diversified their processing to include other seasonal fruits such as oranges and passion fruits, which smoothen their cash flows across the year. However the majority of the processors (especially the medium-scale and cottage processors in channel 2) indicated a need for working capital to purchase mangoes directly from farmers or brokers and to pay on the spot.

The major challenge facing the cottage industry is access to working capital and efficient machines. Most of them reported using commercial blenders that have limited processing capacity. Most of the cottage processors sell fresh mango juice which they stock for about a week to meet the market volumes needed. Most of the processors sell their products on a credit period of 60 days which further constrains their cash flows.

6.4.7 Exporters

The export of fresh mangoes is mainly done in the months from October to March, when mangoes are most plentiful. Kenya's mango-growing season actually gives it a natural competitive advantage, as the growing season of its leading competitors is generally from April to September.

a) Profitability

Very few exporters shared financial information, however, we were able to compute a sample income statement which is representative of the exporters. The months December to August have a more stable supply of mangoes

(especially October to April), leading to cheaper sourcing of mangoes. However, the export market prices in the same period are lower than in the low-supply months from September to November.

Table 13: Profit margins for exporters

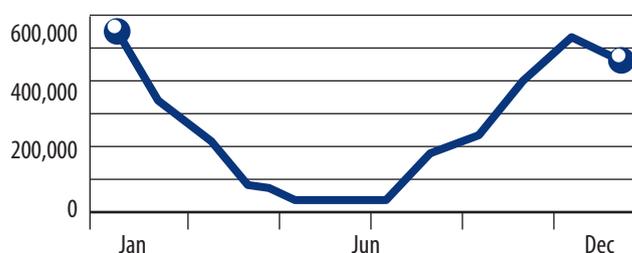
| Sample income statement | Unit value | |
|--|------------|------------|
| | Dec to Aug | Sep to Nov |
| Income per carton at export market | 631 | 783 |
| Purchase price per carton | 106 | 400 |
| GROSS | 525 | 383 |
| % Gross | 83% | 49% |
| Operating cost | | |
| Cumulative total cost per carton to pack-house | 20 | 20 |
| Cumulative total cost per carton to airport | 60 | 60 |
| Cumulative total cost per carton to CIF | 348 | 348 |
| Total operating cost | 348 | 348 |
| Net income | 177 | 35 |
| % Net profit margin | 28% | 4% |

Source: Field data, 2013

b) Cash flows

The exporters' cash flows mirror those of the farmers as the export season is dependent on the peak harvesting season between October and March. This coincides with the period when the other major suppliers to the ME are out of season.

Figure 23: Aggregated cash flow movement for mango export



Source: Field data, 2013

c) Opportunities for financing exporters

The key opportunity for financing exporters is mainly in the working capital that enables them to purchase mangoes from suppliers (farmers, brokers, agents). Most of the exporters are paid after 14 to 30 days and their purchases are largely cash.

²⁹ Most processors were quite reluctant to divulge their financials, especially revenues, and this made it impossible to compute their profit margins.

6.5 SUPPLY SIDE FINANCIALS

a) Embedded finance

Internal (embedded) financing within the mango value chain was found to be weak. There is limited integration among the value chain actors so few buyer-seller arrangements were identified; only a small proportion of farmers (4%) held contracts with the buyer. The other actors with embedded finance are the input suppliers of whom 7% have access to trade credit. Of these, 58% have 30 days credit and only 3% have up to 90 days credit. These limited contracts imply reduced trust between the value chain actors and weak organisation.

A small number of farmers (4%) have contract-farming arrangements with buyers, and these were mainly large-scale and very large scale farmers. The few small- and medium-scale farmers who sold to exporters were organised in groups. However, the primary reasons for group formation were to receive agricultural and other general training, and welfare, with a few formed for savings purposes. Buyers prefer dealing with groups due to cost-effectiveness in technical backstopping and aggregation of produce. Hence, the scale of the individual farmer didn't matter: the group aspect helped the buyer to mitigate the challenges of dealing with small-scale farmers. The contracted farmers have a price advantage over the non-contracted farmers during the peak months of mango supply, with increases of 54% in December, 18% in January, 10% in February, and 56% in March. Forty-seven per cent of contracted farmers are contracted by exporters. Since only 14.3% of farmers sell to exporters as one of their key buyers, this helps to explain why the contracted farmers have higher prices.

The contracted farmers are able to access credit advances and technical assistance from the exporters, which brings indirect financial advantages: close monitoring of farms by exporters leads to better quality export mangoes that fetch a premium price of KSh10 per piece compared to an average of KSh6 per piece for the local urban market. The arrangement also guarantees farmer

income due to agreed pricing between the farmer and buyer. However, few exporters offer crop advances to farmers because of a fear of default due to diversion of crop to other buyers; this makes it more favourable to deal with large-scale farmers or well organised groups that are more reliable.

On input supply, trader credit is largely offered between the input suppliers and their retailers with 64.2% of sales made on credit. There is minimal credit between the input retailers and the farmers. A few agents access advances from exporters as starting capital for the buying season, repayable after a few deliveries. However, due to fear of default, this only happens between agents and exporters who have a long-term relationship.

b) Formal agriculture financing

i) Overview of formal agriculture financing

There are six financial institutions with varying degrees of focus on the agricultural sector in Lower Eastern, and offering a variety of agriculture-related financial products. Only two of these institutions (Equity and Universal Traders Sacco -UTS) have mango-specific products targeted to primary producers; post-primary production financing is done through normal business loans without any specific product designed for these actors.

The most common agricultural financial products were related to working capital and asset financing. The working capital is mainly to finance farm inputs, business operation (stocks, expansion financing), and liquidity management (invoice discounting). Under asset financing, the most common products were for sprayers and water pumps (both farmers and service providers), while traders and transporters mainly borrowed to purchase motor vehicles. Funding start-ups to establish mango plantations is considered with proof of other income sources. Only one financier had a product targeting this category of farmers, with most of the other institutions offering funds as a general personal loan payable through other sources of income.

Table 14: Agriculture-related credit products

| Sub-sector | Specific products |
|--------------------|--|
| Primary production | Dairy (heifer and input), honey (hives), mango inputs, horticultural loans (inputs and equipment), farm infrastructure (e.g. fences, structures, irrigation kits, green houses, etc.), general farm inputs, commercial agro-loans, asset financing and remittances |
| Trading | Cereals traders, agro-dealers, LPO financing, asset financing, invoice discounting, general trade and investment loan |
| Processing | Agro-processors loan (working capital) and asset financing |
| Social needs | Medical, emergency and bio-gas |

Financial institutions in Wote Town, Makueni County, had the largest number of agriculture-related products, followed by Mwingi & Kitui in Kitui County and the Machakos region of Machakos County.

The current agriculture-related credit portfolio is estimated to be KSh285,790,000 with an average lending interest rate of 23%, reducing balance equivalent. The two most dominant financial institutions (Equity bank and UTS) account for 88.2% of total borrowers in the Lower Eastern region and 61.8% of the total loan portfolio³⁰. Table 15 below lays out the potential volume of credit that could be provided for production, trade finance, processing, equipment, etc.

ii) Overview of formal mango financing

Though most of the financial institutions had cross-cutting products available within all branches, some branches had not been able to activate most of the offered products. The general observation was that financial institutions were more active in regions where strong networks of vertical relationships existed between the borrowers and other sectors players (mainly the buyers, aggregators and sponsors). Strong vertical and horizontal networks are deemed to lower the risk of default and the costs of operation for financial institutions. This was particularly evident in Makueni where farmers operating in exporter-backed schemes were considered favourably by financial institutions for lending, leading to the highest mango portfolio in the region.

Four strategies stand out for increasing lending to mango farmers: (1) appropriately designed production credit products, (2) value chain linked products, (3) a decentralised approval process for small loans, and (4) providing dedicated agricultural credit staff to engage with the value chain actors.

Specific mango lending products: Two institutions had designed most of their farmers' loan products with repayment cycles tied to the production cycle and the liquidity curve of the borrower, making it easier for borrowers to repay the loans during harvesting season.

Value chain linked products: These institutions also had the greatest number of schemes arranged in conjunction with other value chain actors who work directly with the loan beneficiaries. Most the schemes revolved around farmer-buyer, farmer-aggregator, farmer-input supplier/agro-dealer relationships, and manufacturer- and public-sponsored programmes like Kilimo Biashara.

Decentralisation: The three financial institutions with the highest number of borrowers, and the lowest average loan per borrower, had decentralised approval processes, with a branch loan approval limit of between KSh100,000

and KSh300,000. The remainder required head office approval for any loan amount disbursed, which makes the process less efficient. The institutions without decentralised approval processes have to wait longer for approval (agricultural loan products are usually sensitive to timing) or applications are rejected altogether due to a lack of understanding of the business case by the head office personnel.

Dedicated agricultural credit staff: The two leading institutions in terms of number of borrowers and total portfolio size had the highest number of dedicated agricultural credit staff.

iii) Generally perceived risk and measures for agricultural lending

The financial institutions had varying degrees of agriculture-related portfolio at risk (PAR), the lowest being 1.67% (for a branch with a small portfolio of only 4.7m) and the highest 12.5%. The major risks faced by financial institutions were death of the key man (fully catered by credit life), total or partial loss/damage of productive assets, the borrower's poor character, the borrower's income fluctuation, and non-viable ventures.

The major risk mitigation strategy employed by the institutions is through partial funding of borrowers, requiring proof of other income sources, releasing loans at delayed/advanced crop stages when risk is minimal, and use of tripartite arrangements between borrowers, their buyers and the lenders (structured finance). The other strategy, though minimally applied, was risk transfer in the form of either insurance or co-guarantors. The most common types of insured risk are death (credit life cover), disability (credit life cover), and asset damage or theft (fire and burglary, and motor vehicle covers). A few institutions have dairy cow cover (mortality) and business stocks (fire and burglary) cover.

iv) Mango-specific risks and mitigation strategies

The financial institutions cited several risks associated with the mango value chain. For farmers, two business risks had the highest perceived impact: (1) pest and disease prevalence can lead to low incomes due to reduction of volumes as well as of mango quality; and (2) lack of sustained cash inflow (seasonality) to cater for repayments by instalment throughout the year. Other risks were moral or external, including diversion of funds or produce by farmers to avert recovery of credit or advances, drought, and refusal to repay the loans.

For the other value chain actors, the risks identified were income fluctuation due to seasonality, the low supply of raw materials as a result of farmers' diverting the produce, or low yields due to natural calamities like pest and diseases or drought.

There were several strategies employed by financial institutions to mitigate the perceived risks facing farmers. The most common are credit life cover, loan

³⁰ Qualitative data obtained from financial service providers, mainly banks.

guarantees, and use of the savings model (borrowers save and borrow three times their savings). Other interventions employed include reduction of loan amounts, disbursement delayed until final stages, partnership with spraying service providers and buyers, use of chattel mortgage, reducing loan amounts, selective lending to farmers with additional sources of income, and training, with a few lending via a tripartite agreement between the lender, farmer, and buyer. The most common risk mitigation methods for non-farmer actors were largely credit life and asset insurance. Most of the systemic risks that affect the flow of mangoes up the value chain were largely unaddressed.

We grouped these perceived risks into six categories and assessed the potential impact of each risk and mitigation strategy as described below:

- The risk of change of business management through death, or permanent or temporary disability was deemed to be of low intensity. The mitigation strategies employed by financiers include credit life cover, loan guarantees, and reduction in lending amounts.
- The risk of total loss of productive assets through theft, fire and drought being the key risks though of low intensity. Among the key strategies employed to mitigate these risks include asset insurance and business stocks insurance. Others include lending to farmers with irrigated farms and crop insurance (two people only).
- The risk of partial loss or damage to productive assets through pest and disease was most intense for farmers, followed by drought, while accidents and fire ranked low. The current mitigation of insurance (few),

late disbursement during flowering stage, partnership with service providers.

- Character risks – diversion of funds, diversion of produce, refusal to repay loans – are ranked in order of intensity. The key tools for mitigation are loan guarantees, group lending, reduced lending amounts, tripartite agreements with buyers/aggregators, use of credit bureau information, chattel mortgages, and tangible securities.
- The risk associated with income fluctuation (lack of sustained cash inflows to service repayments) was ranked as high impact. The mitigation strategies include loan guarantees, group lending, reduced lending amounts, incorporating other sources of income, and not lending to certain sectors.
- The risk of non-viable business venture, through business losses or margins too low to sufficiently cover repayment costs and meet other needs, ranked as of low intensity. The main mitigation strategies were loan guarantees, group lending, incorporating other sources of income, and business planning trainings.

Generally the strategies applied to mitigate the risks for various actors were more oriented to protecting the existing portfolios with external strategies. Even though some financiers apply growth-oriented strategies right from product design, business process planning and execution, the majority sold conventional loan products with little regard to sector dynamics like cash flow, profitability, linkages, etc. which would better address the risks and, at the same time, provide an opportunity for business growth.

v) Financial opportunities for upgrading mango value chain

Table 15: Key financial opportunities along the mango value chain in Lower Eastern

| Actor | Financial opportunity | Maximum possible amounts based on the current status | Purpose | Potential risks | Potential risk mitigation strategies |
|-------------------------|-------------------------------|--|--|---|--|
| Farmer | Input credit | <ul style="list-style-type: none"> • KSh634,367,712 under current input usage levels • (KSh1,035,645,446 for inputs, labour and logistics under current levels) • KSh1,163,684,615 under improved input usage • (KSh1,564,962,349 for inputs, labour and logistics under improved usage) | <ul style="list-style-type: none"> • Purchase of pesticides and fungicides | <ul style="list-style-type: none"> • Diversion of input credit funds to other competing enterprises/needs • Character risk: diversion of produce income and diversion of produce to other buyers • Low uptake / repayment due to vast distances between credit providers and borrowers • The mango seasonality can affect ability for sustained instalments repayments • Production risk resulting from poor application of inputs | <ul style="list-style-type: none"> (i) Use system-based application that would assist in getting farmers acquire earmarked inputs from designated input suppliers or service providers (ii) Enforce contracts between input suppliers and the farmers (iii) Use of agency banking and mobile platform to enhance repayments and credit uptake (iv) Enforce the tripartite agreement between the farmers, buyers and lenders (farmers' payments to be channelled through participating bank accounts) (v) Explore group lending to spread and offer social collateral (vi) Partial financing with activities such as labour financed by farmers. (vii) Staggered disbursement between April and October to avoid misuse of credit. (viii) Properly structured products to factor seasonality. Interest servicing in low seasons and accelerated repayments in high seasons. |
| | Savings | <ul style="list-style-type: none"> • KSh2,518,436,389 based on the total net profits (KSh3,554,081,883 based on gross income earned by farmers) | <ul style="list-style-type: none"> • Partially finance some of the initial mango operations • Finance their daily needs • Future emergencies • Future planned activities like education, business expansion etc. | <ul style="list-style-type: none"> • Most farmers do not have active bank accounts • Low uptake due to vast distances between the financial institutions and savers • Competing interests / needs • High transaction costs | <ul style="list-style-type: none"> (i) Mobilise savings through activation of remittance accounts (ii) Well-structured savings products with set thresholds within which a farmer can operate e.g. creating incentives for withdrawals, having specific products for specific needs etc. (iii) Use of agency banking and mobile platform to enhance savings accounts uptake (iv) Work with organised farmer groups (v) Savings with a purpose model where farmers save with particular goals like purchase of inputs. |
| Spray service providers | Asset financing | KSh20,000,000 based on an estimated need for service | <ul style="list-style-type: none"> • Purchase of motorised pumps for efficient spraying • Purchase of full spraying gear | <ul style="list-style-type: none"> • Theft/damage of equipment • Farmers may fail to pay for the serviced activities upon harvesting • The mango seasonality can affect ability for sustained instalments repayments | <ul style="list-style-type: none"> (i) The asset to be tied as collateral (ii) Insure the equipment's (iii) Enforce the tripartite agreement between the farmers, buyers, lenders and service providers (farmers' payments to be channelled through participating bank accounts where loans and service providers fees are deducted) (iv) Properly structured products to factor seasonality. Interest servicing in low seasons and accelerated repayments in high seasons. |
| | Input credit | To draw from the farmers' input financing component | <ul style="list-style-type: none"> • Purchase of pesticides and fungicides | <ul style="list-style-type: none"> • Farmers may fail to pay for the serviced activities upon harvesting • Diversion of input credit funds to other competing enterprises/needs • The mango seasonality can affect ability for sustained instalments repayments | <ul style="list-style-type: none"> (i) Enforce the tripartite agreement between the farmers, buyers, lenders and service providers (farmers' payments to be channelled through participating bank accounts where loans and service providers fees are deducted) (ii) Properly structured products to factor seasonality. Interest servicing in low seasons and accelerated repayments in high seasons. |
| Input suppliers | Working capital-general trade | <ul style="list-style-type: none"> • KSh160,000,000 estimated stocks costs levels | <ul style="list-style-type: none"> • Purchase of mango inputs | <ul style="list-style-type: none"> • Default on loan repayment • The agricultural seasonality can affect ability for sustained instalments repayments | <ul style="list-style-type: none"> (i) Use of business stocks as collateral (ii) Properly structured products to factor seasonality. Interest servicing in low seasons and accelerated repayments in high seasons. |
| | Working capital | KSh200,000,000 estimated on estimated total pay-outs to farmers | <ul style="list-style-type: none"> • Purchase of mangoes | <ul style="list-style-type: none"> • The mango seasonality can affect ability for sustained instalments repayments | <ul style="list-style-type: none"> (i) Properly structured products to factor seasonality. Interest servicing in low seasons and accelerated repayments in high seasons. |
| Processors | Asset financing | KSh180,000,000 stated assets needs | <ul style="list-style-type: none"> • Upgrading of the processing plant to meet the required phytosanitary standards for big processors • Micro-processors' equipment upgrading | <ul style="list-style-type: none"> • The mango seasonality can affect ability for sustained instalments repayments | <ul style="list-style-type: none"> (i) Properly structured products to factor seasonality. Interest servicing in low seasons and accelerated repayments in high seasons. |
| | Working capital | <ul style="list-style-type: none"> • KSh360,000,000 based on total gross purchases | <ul style="list-style-type: none"> • Purchase of mangoes | <ul style="list-style-type: none"> • The mango seasonality can affect ability for sustained instalments repayments | <ul style="list-style-type: none"> (i) Properly structured products to factor seasonality. Interest servicing in low seasons and accelerated repayments in high seasons. |

Source: Field data, 2013

Chapter 7:

CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

Mango production has grown rapidly in Kenya, tripling over the last five years. It will continue to increase as huge numbers of young trees and expanding acreage come into production, increasing supply by an estimated 250,000 tonnes by 2016. This will most likely lead to an increase beyond the absorptive capacity of the domestic fresh market, forcing prices down, and giving the processing market an opportunity to expand. This has implications on how the various value chain actors will position themselves to either cope or take advantage of the changing dynamics.

a) Perspectives for the growth of the sector

With 250,000 tonnes of extra mangoes, establishing market opportunities to keep farmers profitable will be critical. There are opportunities for market growth across the domestic fresh, fresh export, and processing sectors. Specific interventions will be required to support different categories of farmers' access different markets in a changing business landscape.

The fresh domestic market. The fresh domestic market absorbs the largest quantity of mango production and offers the greatest growth opportunity for the sector. Growth in population (particularly the middle income level), rapid urbanization, changing lifestyles, and increased economic growth in rural urban centres as a result of devolution will see this market continue to expand. But Kenyans already consume about 13.4 kg of mangoes per person per year, so demand at current prices is likely to slow below the rate of increased production. Farmers will need to increase productivity to bring down their costs of production to match an anticipated drop in market prices. With current population growth rates and a 5% per annum increase in household consumption (increasing to 15.5 kg per capita by 2016), this would still only absorb a further 150,000 tonnes.

Higher yields due to increased efficiency in production, and reduced post-harvest losses due to improved logistics and transportation can bring down prices and expand consumption. Linkages between producers and buyers can be improved to get fruit into the growing supermarket channel.

Export markets. Global trends indicate increasing demand for mangoes, and the Middle Eastern market – Kenya's leading export market – grew by 32% over the last 5 years. This implies that the volume of Kenya's exports can continue to rise but at the same time presents Kenya with an opportunity to increase its exports in the coming years to take advantage of the growing market demand. To fully take advantage of the ME market, the exporters will need to enter new markets and expand their supply season.

Kenya will have difficulty expanding its exports to major new markets (the European or US markets) as it produces low quantities of the "Floridian" varieties which these markets demand. Moreover, meeting the stringent SPS requirements of these markets is still a daunting and expensive task. Currently,

Kenya exports mainly to the UAE, and can continue focusing on the Middle Eastern market by expanding its access to the Saudi Arabian market – the leading importer in the region. Kenya will also need to expand production in the "shoulder" periods, especially September and April when demand for mangoes in the ME is high and other major producers have not yet come on line.

The export market is largely dominated by large-scale to very large scale farmers who over time have invested in good agronomical practices and supply mangoes that meet exporters' requirements for quantity and quality. Inclusion of small- to medium-scale farmers in this market can also be achieved. This will require organising farmers into groups with collective bargaining power and directly linking these groups to exporters through contracts. However, to improve productivity and quality, they will need better access to knowledge and support services. This will also facilitate the certification of their farms for export.

Processing. The processing market has seen tremendous growth over the last 8 years, increasing from 1 to 6 large processors, while consumption increased from 15,000 to 31,000 tonnes. Processor capacity is currently underutilised due to an inadequate supply of mangoes at competitive prices. With the expected increase in mango production, prices are expected to come down, and the channel has the potential to easily grow its processing capacity from the current 60,000 tonnes to 80,000 tonnes, to meet the increasing demand for processed juice that sees Kenya importing both juice and concentrate. However, there is still a window for domestic consumption of fresh juice and Kenya needs to look at expanding its export market for pulp and concentrate. For this to happen, the industry needs to increase its competitiveness on an international scale and a benchmarking exercise needs to be done to determine the competitiveness of the processing industry. The processors will have to explore access to other markets and build new export relations. Increased processing will put pressure on the processors' working capital and will require financial support. The processors will also need to be upgraded to meet international standards and this will require investment capital.

b) Integration

To serve these growing markets, integration of the value chain will play a key role. Horizontal (between actors at the same functional level) and vertical (between actors at different functional levels) relationships will enhance coordination and make the value chain more efficient. This will ensure that the buyers get access to the quantity and quality of mangoes they need and farmers will have a guaranteed market and better extension services. The study established that farmers who work together (horizontal relationships) in cooperatives have better access to finance and other services. Vertical linkages are critical to achieving higher prices for farmers and better access to services (finance, technical extension, inputs). Better coordination between

actors also makes the value chain more efficient, bringing down the end cost to the consumer.

c) Supporting services

Supporting services are critical for enhancing productivity. Most small- to medium-scale farmers produce sub-optimally due to lack of extension services, limited access to certified planting materials, and lack of adequate and timely finance to support their mango production activities.

For farmers to supply exporters, they need certification by HCDA. With increased competition and demand for quality products from all market segments, farmers will increasingly need to have certification to guarantee quality. Certification comes with good agronomical practices.

KALRO has invested to propagate quality planting materials. Subsequently, efforts have also gone into developing high-yielding, disease-and-pest-resistant varieties as well to eradicate incidences of fruit fly and mango weevil, which will hopefully bear fruit in the near term.

Many NGOs have teamed up with the MALF and other stakeholders to support extension service delivery to farmers as well as certify more private nurseries. Farmers need to be mobilised to form groups with good governance structures to enhance their access to finance, and their linkages to inputs suppliers, service providers, and to markets. Enhanced linkages to exporters and buyers through contracts can enhance farmers' access to technical information and extension services.

d) Regulatory issues

Kenya has developed KenyaGap, benchmarked with GlobalGap, for ease of interpretation and acceptance of Kenyan produce in the world export market. This has helped regulate the horticultural sector of which the mango sector is part. Observance of these rules and regulations is directly tied to Kenya meeting the stringent SPS and MRL requirements of the export markets that it serves. This has been one of the big challenges faced by the mango sector. Lax contract enforcement has also seen many producers and buyers shy away from entering contracts for fear of default. Land tenure issues have also seen many small- to medium-scale farmers fail to raise adequate collateral to finance their mango production.

Provision of adequate extension services either through improved services by MOA or enhanced capacity of agro dealers and input stockists will see many farmers begin to produce quality mangoes that meet the required standards. Vertical integration with buyers will also see buyers making an effort to ensure adherence by farmers. Formation of groups with strong good-governance structures will ensure adherence to contracts and increase access to finance.

7.2 RECOMMENDATIONS

The anticipated scenarios in the mango value chain in the Lower Eastern region are:

- i. Continued planting of new trees leading to increased supply, and possibly outstripping demand under the current market structure, leading to possible price reduction;
- ii. Reduction of prices that would render over 80% of small- and medium-scale farmers uncompetitive at their current productivity levels. If farmers cannot increase their productivity, many small farmers may fall out of the market;
- iii. Interventions to increase productivity of the small- and medium-scale farmers would lead to some consolidation under the current market structure, but offer opportunities to grow the processing industry.

The immediate response should be to support increased productivity and support the growth of promising future markets. This will require action in the areas highlighted above in order to upgrade the competitiveness of the farmers and the sector as a whole. Financial intermediation would be required to achieve the above recommendations.

Financial services recommendations:

- Even though mango farmers operate profitably, with net profit margins ranging between 50–90%, the seasonality dynamics will require well-structured financial products to make it easy for actors to repay credit without straining.
- The financial sector should be aware of the growing supply of mangoes in Kenya and implications for the future. During the past 2 years, over 1 million seedlings have been planted and this is expected to increase supply of fresh mangoes by about 35% come 2016.
- The focus should be targeted towards financing and upgrading farmers and the related services and linkages for increased productivity and improved competitiveness. The main components that will require financing are inputs and related services like expert sprayers, and support for processing and export markets that have high growth potential.
- Financial products aimed at improving coordination between market actors will make the sector more efficient, increasing quality and productivity. Emphasis on financier-induced integration through fostering of strong linkages between buyers, sellers and service providers would yield better results.
- Different financial products are needed at each level of the value chain to drive the increased competitiveness of the sector. Four actors in the value chain were identified to be in need of financial services to drive increased upgrading of the mango value chain:

- i. Farmers:** Farmers will largely require input credit to assist them in increasing the productivity and quality of mangoes. For efficient utilisation of input credit, there will be a need to tie access to input financing to related service provision. Most small-scale farmers would struggle to get the right chemical application regime if left on their own. One key challenge that financiers might face in financing small-scale farmers is diversion of funds which can be dealt with through enforced contracts and possibly a voucher system for input acquisition.
- ii. Processors:** For processors to be competitive, they often have to make spot payments when purchasing raw mangoes. This strains their cash flow severely, since they hold processed stock to sell several months after the end of the fresh mango season. An integrated financial product that targets regular payments to farmers while passing the debt on to the processor would be the most desirable in the short-run. The likelihood of successfully passing on the cost of such financing to suppliers in the short-term is low due to the uncompetitive nature of processors' prices.
- iii. Exporters:** Exporters require more working capital to purchase mangoes directly from small farmers. More often, exporters purchase directly from brokers while a few have invested in well-organised schemes with farmers. However, most of the exporters expressed a desire to purchase mangoes from farmers directly, for quality enhancement and traceability purposes. This would also increase the exporters' profit margins and their competitiveness in the global mango export market. The exporters would require a working capital of around KSh200 million to purchase mangoes from farmers. This would also open an opportunity for possible formal financing in an integrated scheme between buyer, producer and financial institution.
- iv. Traders:** The most suitable financing for traders would be a general trade credit based on the overall business performance, as opposed to mango alone, which only constitutes around 37% of traders' business. Most of the traders deal with a wide range of agricultural products making them well cushioned against cash slump during the mango low season.

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Annex 1

CHARACTERISTICS OF KENYA-GROWN MANGO VARIETIES

| Variety | Origin | Type | Fruit colour | Size (average weight) | Flesh colour | Shape | Fibre | Brix (°BX) | Juice yield % | Seed% |
|--------------|---------|------------|-------------------------------------|-----------------------|-----------------------|----------------------------------|----------|------------|---------------|-------|
| Ngowe | Kenya* | Improved | Deep yellow flushed with orange/red | 523g | Deep yellow | Oblong | None/low | 23 | 68 | 7.8 |
| Dodo | Kenya* | Indigenous | Dark green to light yellow | 453g | Yellow/orange | Oval | Moderate | ** | 33 | 8.6 |
| Apple | Kenya* | Improved | Yellow/orange to red | 397g | Yellow | Oval/oblique | Low | 24 | 71 | 9 |
| Boribo | Kenya* | Improved | Pale olive green to apricot yellow | 511g | Deep orange | Oblong | Low | ** | 45 | 8 |
| Batawi | Kenya* | Improved | Olive green to purple maroon | 523g | Pale orange | Nearly oval | Moderate | ** | | 8.1 |
| Tommy Atkins | Florida | Improved | Deep yellow with heavy red blush | 522g | Yellow | Ovate to slightly oblong | Moderate | 17 | 67 | 6.6 |
| Keit | Florida | Improved | Green/yellow with pink or red blush | 456g | Yellow | Ovate slightly oblique and plump | None | ** | ** | 7.5 |
| Kent | Florida | Improved | Greenish yellow with dark red blush | 545g | Deep yellow to orange | Ovate to slightly oblong | None | 18 | 72 | 8.5 |
| Sensation | Florida | Improved | Yellow with plum-red blush | 307g | Deep yellow | Oval/oblique | None | ** | ** | 5.8 |
| Van Dyke | Florida | Improved | Bright yellow with crimson blush | 280g | Orange/yellow | Ovate | None/low | 22 | 59 | 7.1 |
| Haden | Florida | Improved | Deep yellow with red blush | 431g | Deep yellow | Regular ovate and plump | Low | ** | ** | 7.1 |

Annex 2

FARMERS BUDGET BY COUNTY

| Farmer category | MAKUENI | | | | KITUI | | | | MACHAKOS | | | |
|----------------------------------|-------------|--------------|-------------|------------------|-------------|--------------|-------------|------------------|-------------|--------------|-------------|------------------|
| | Small Scale | Medium Scale | Large Scale | Very Large Scale | Small Scale | Medium Scale | Large Scale | Very Large Scale | Small Scale | Medium Scale | Large Scale | Very Large Scale |
| % of farmers | 43% | 49% | 6% | 8% | 41% | 47% | 8% | 3% | 52% | 41% | 6% | 2% |
| Number of trees | <50 | 51-300 | 301-800 | 801-3000 | <50 | 51-300 | 301-800 | 801-3000 | <50 | 51-300 | 301-800 | 801-3000 |
| Median number of trees | 29 | 110 | 427 | 1753 | 16 | 105 | 500 | 1005 | 22 | 103 | 544 | 1002 |
| Average pieces harvested | 1,875 | 7,500 | 37,000 | 285,000 | 1,775 | 8,000 | 30,000 | 145,000 | 1,550 | 6,100 | 40,000 | 90,000 |
| Yield per tree | 65 | 68 | 87 | 163 | 111 | 76 | 60 | 144 | 72 | 59 | 74 | 90 |
| Average quantities sold | 1,675 | 6,755 | 37,000 | 260,000 | 1,450 | 7,000 | 30,000 | 90,000 | 1,500 | 5,350 | 40,000 | 90,000 |
| Unsold quantities | 200 | 745 | - | 25,000 | 325 | 1,000 | - | 55,000 | 50 | 750 | - | - |
| % of lost quantities | 11% | 10% | 0% | 9% | 18% | 13% | 0% | 38% | 3% | 12% | 0% | 0% |
| Average selling price/piece | 7 | 8 | 10 | 10 | 5 | 7 | 10 | 10 | 6 | 8 | 8 | 10 |
| Income from improved varieties | 11725 | 54040 | 351500 | 2600000 | 7250 | 49000 | 300000 | 900000 | 9000 | 42800 | 320000 | 900000 |
| Income from Local varieties sold | 800 | 900 | | | 1500 | 2500 | 5000 | | 1100 | 550 | 3600 | |
| Total Income | 12525 | 54940 | 351500 | 2600000 | 8750 | 51500 | 305000 | 900000 | 10100 | 43350 | 323600 | 900000 |
| Less expenses | | | | | | | | | | | | |
| Fertiliser/Manure | 640 | 2,000 | 13,250 | 29,125 | 650 | 6,000 | 22,500 | 15,000 | 1,000 | 3,000 | 28,375 | 3,000 |
| Pesticides & Fungicides | 3,100 | 7,250 | 20,000 | 47,400 | 2,000 | 7,500 | 27,500 | 47,500 | 2,050 | 5,025 | 28,200 | 34,000 |
| Labour cost | 2,050 | 4,525 | 18,000 | 29,300 | 1,250 | 7,600 | 26,750 | 43,500 | 2,095 | 3,400 | 26,250 | 6,900 |
| Transport | - | - | 2,500 | - | 4,000 | 16,000 | 23,400 | - | - | - | - | - |
| Packaging materials | - | - | | | 150 | 1,600 | 3,000 | 10,800 | - | - | | |
| TOTAL VARIABLE COSTS | 5,790 | 13,775 | 53,750 | 105,825 | 8,050 | 38,700 | 103,150 | 116,800 | 5,145 | 11,425 | 82,825 | 43,900 |
| PROFIT | 6,735 | 41,165 | 297,750 | 2,494,175 | 700 | 12,800 | 201,850 | 783,200 | 4,955 | 31,925 | 240,775 | 856,100 |
| % Margin | 54% | 75% | 85% | 96% | 8% | 25% | 66% | 87% | 49% | 74% | 74% | 95% |
| % ROI | 116% | 299% | 554% | 2357% | 9% | 33% | 196% | 671% | 96% | 279% | 291% | 1950% |



