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Innovative solutions to address food loss and increase access

Mango Value Chain Deep-Dive

May 2023



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Background and overview of Kenya's mango sector

\sum	Country Production	 In 2020, Kenya produced 800k MT of mangoes, making it the third largest fruit in the country by production volumes ~200k SHFs are involved in production, supplying 65% of the country's volumes; the remainder is grown by a mix of medium and large scale farms Mangoes are primarily grown in Kenya's central and coastal counties, led by Makueni, Machakos, and Kilifi Only 3% of mangoes is exported as fresh produce, primarily to the Middle East, Uganda and Rwanda. The remaining 97% is sold domestically as fresh produce (87%) or processed products (10%), most commonly via informal retailers
	Critical Loss Points	 35% of production volumes is lost along the supply chain, equating to ~283k MT of waste annually <u>Production (13%)</u>: Mainly driven by lack of buyers, improper harvesting techniques, and lack of cold storage <u>Aggregation level (14%)</u>: Mainly driven by improper handling during transport and storage <u>Offtake level (8%)</u>: Mainly driven by inability to forecast demand and improper storage
-	Other Insights	 Due to its highly seasonal production cycle, retail prices vary dramatically from 8 KSH* in peak season to 16 KSH* in the off season, making mangoes less affordable to low-income consumers in certain parts of the year Mangoes are high in key micronutrients including folate, vitamin C, and vitamin A Women are highly involved in horticultural supply chains, including mango, particularly at the production, wholesale, and informal retail levels

*Average price per mango based on Jan. – March 2023 field interviews Note: Unlike tomato and ILG, mango has one primary season that lasts from December - March Source: Kenya Horticulture Crop Directorate, FAOSTAT, Expert interviews

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Mango is the third largest fruit in Kenya by both production volumes and farm-gate value



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*Exotic leafy greens (includes kale and spinach) **Indigenous leafy greens (e.g., cowpea, spider plant, African nightshade, amaranthus)

Note: Fruits and vegetables defined using FAO guidelines, which exclude roots and tubers, pulses

Source: Kenya Horticulture Crop Directorate, FAOSTAT

Kenyan mango production occurs primarily in the southeastern and central areas, led by Makueni (18%), Machakos (17%), and Kilifi (16%)



Mangoes are grown by both SHFs and commercial farms for domestic fresh (87%), processing (10%), and export (3%) markets

Value chain visualization



Description

 Production ~200k SHFs are involved in mango production and account for 65% of Kenya's total mango supply The remaining 35% of mangoes are grown by mid- and large-scale farms, who typically specialize in certain varieties and have direct relationships with exporters and formal retailers
 Aggregation Most SHFs rely on informal aggregators for offtake. These local aggregators harvest and transport produce to a range of actors including wholesalers, formal aggregators, and processors SHFs and commercial farms may also sell to formal aggregators, who aggregate produce for domestic formal retailers
 Processing ~10% of mangoes in Kenya are processed for domestic markets Pulp, concentrate, and juice are the most common forms of processing, although there is a small market for leather and powder Processors typically source mangoes through farmer groups or aggregating agents, who transport mangoes directly to processors
 Offtake Only 3% of mangoes are exported as fresh produce, primarily to the Middle East, Uganda and Rwanda The remaining 97% is sold domestically as fresh produce (87%) or processed products (10%), most commonly via informal retailers



Source: Konva

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Mango

35% of mangoes is lost along the supply chain, representing a total volume of 283k MT annually

Smallholder farmers	Commercial farms	Informal aggregators*	Formal aggregators	Processors	Formal retailers	Informal reta	ilers
Key takeaways Farmers struggle to find buyers during peak season due to a market-wide oversupply of mangoes Improper harvesting and storage techniques lead to product damage and quality deterioration	Commercial farms experience lower loss rates vs. SHFs due to improved agricultural practices and formal offtake agreements	Improper handling and transportation practices result in high losses during travel from farm to markets	Formal aggregators are more likely to employ proper handling practices and use temperature- controlled trucks	Processors have low rates of rejection due to the low quality grade required for pulping and juicing activities	While interviewees cited in-store rejection rates of up to 30%, retailers often use rejects for juices and fruit salads	Informal retailers appropriate storad protect produce for damage Oversupply during season combined retailer forecasting capabilities result buyers	lack ge to rom weather g mango I with limited g s in lack of
100%	2%	14%			<mark>1%</mark> -	5%	65%
Total SHFs volume *Ptsochuced/gregators sold directly to retain Note: Exports excluded from analysis as the	Commercial farms ilers based on Yieldwise d	Informal aggregators ata f volumes	Formal aggregators	Processors	Formal retailers I	nformal retailers	Total volume sold to consumers

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~18% of SHF's mangoes are lost at farm-gate due to market access limitations, poor harvesting practices, and improper storage

Prod	uction (SHFs)	Aggregation	Offtake	
Loss volumes and r	rates	Key challenges	Existing solutions	Adoption*
R	ejections 📃 Sales	Market access		
526K MT 92K MT	100% 18%	 Lack of buyers during peak season due to oversupply of mangoes as rain-fed production matures Lack of adequate transportation precludes SHEs 	 Processors, who have lower quality standards than domestic fresh and export markets, purchase surplus and blemished produce for pulping and juicing activities 	
434K MT	82%	from bringing large volumes of produce to markets directly and increases reliance on aggregators for offtake	 Digital marketplace platforms (e.g., Kwik Basket, Taimba) connect farmers directly to offtake markets 	\bigcirc
Annual	Volume	Knowledge		
volumes	breakdown	 Lack of knowledge on proper prevention practices for pest and disease (e.g., fruit fly, mango weevil) 	 Agronomy training conducted through government agents, NGOs, and other 	\bigcirc
 Unsold mangoes are primarily used on- farm as animal feed or compost Quality requirements vary by output market; exporters have the most stringent product requirements, followed by domestic fresh markets and processors respectively 		 Poor harvesting practices (e.g., shaking trees, pre- mature harvesting) can cause bruises and other 	organizations (e.g., proper pesticide application, fruit fly traps)	
		quality issues		
		Equipment		
		 Lack of cold storage results in accelerated quality deterioration and spoilage. Current storage practices include use of closed, ambient rooms or leaving produce on the open field 	 Solar cold storage and similar alternative cold storage products (e.g., Solar Freeze, Tanager) offer practical, lower cost storage solutions for SHFs with limited financing and unreliable access to electricity 	

*Est. proportion of actors currently using solution in Kenya Source:TNS Yieldwise study (2020), USAID-KAVES (2015), EU MARKUP (2022). Expert interviews, TechnoServe analysis

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Informal aggregators losses are driven by poor road infrastructure and improper handling practices

F	Production (SHFs)	Aggregation (informal aggregat	tors) Offtake	
Loss volumes	and rates	Key challenges	Existing solutions	Adoption*
	Rejections Sales	Market access		
568K MT	100%	 Lack of buyers during peak season due to oversupply of mangoes in the market 	 Processors purchase surplus and blemished produce from traders for pulping and juicing 	
113K MT	20%		 Recycling organizations take market waste for use as insect feed (e.g., Insectipro) 	\bigcirc
455K MT	80%	Knowledge		
Annual volumes	Volume breakdown	 Improper handling practices (e.g., underuse of protective containers, overstuffing trucks) compresses mangoes at the bottom of piles and causes them to bruise or burst 	 Transporting fruit earlier in the ripening process provides natural protection against rough handling and roads as skin is tougher and more durable 	
The key drive	ers of loss among informal		 Wooden crates limit compression damages and improve air circulation during transit 	
quality losses	s and market-level surplus	Equipment		
Unsold produ animal feed, a	ice may be used as compost or disposed of as	 Lack of temperature-controlled transportation accelerates spoiling process 	• Did not identify existing solutions in Kenya	
trash		Infrastructure		
		 Poor road quality results in quality damages as produce is bruised from shaking 	 Did not identify existing solutions in Kenya 	

*Est. proportion of actors currently using solution in Kenya Source: TNS Yieldwise study (2020), Expert interviews, TechnoServe analysis

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Informal retail losses are driven by lack of buyers during peak season and inadequate market storage

Production (SHFs)		Aggregation (informal aggregators) Offtake (informal retailers)		
Loss volumes a	and rates	Key challenges	Existing solutions	Adoption*
	Rejections Sales	Market access		
453K MT 38K MT	100%	 Lack of buyers during peak season due to oversupply of mangoes in the market 	 Digital platforms connecting mama mbogas to consumers provide an additional offtake opportunity for retailers 	
415K MT	92%	 Knowledge Inability to accurately forecast demand results in overstocking inventory 	 Did not identify existing solutions in Kenya 	
Annual volumes	Volume breakdown , farmers operate their	 Equipment Mangoes exposed to heat and weather due to lack of cold storage in open-air markets 	 Subscription-based cold-storage (e.g., Fresh Box) and other refrigeration services provide more affordable storage options for retailers 	\bigcirc

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- centers, informal retailers typically rely on intermediaries to source mangoes on an as-needed basis
- Unsold mangoes may be used as animal feed, thrown away, or consumed domestically

 Digital platforms connecting mama mbogas to consumers provide an additional offtake opportunity for retailers
 Did not identify existing solutions in Kenya
 Subscription-based cold-storage (e.g., Fresh Box) and other refrigeration services provide more affordable storage options for retailers

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Activities related to production, wholesale, and informal retail present the largest opportunity for female engagement

Gender breakdown by activity in horticulture sector



" Women would not survive the transportation business due to the long hours and manual labor __ required. Men are hard-wired to endure hardship. - Male Director, industry association ⁴⁴ Cultural barriers make it difficult for women to take on leadership positions. Women are often forced to choose between their family or their job. - Female CEO, solution provider Women are more patient and detail-oriented, which makes them well suited for aggregation " and retail activities. -Male CEO, exporter

Note: Data should be interpreted as directionally representative of Kenya's horticulture sector Source: Expert interviews, TechnoServe analysis

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We aligned on three value chain archetypes for preliminary solution design







Value chain archetype	 Leafy greens 	Affordable and accessible fruits	Less affordable seasonal fruits
Scalable chains	 Indigenous leafy greens (e.g., spider plant, cow pea leaves, nightshade) Exotic leafy greens (e.g., spinach, kale) 	TomatoBanana	 Mango Pineapple Avocado
Shared characteristics	 Lower seasonality High perishability (< 48 hours) Tender leaves susceptible to handling injuries during transportation Limited processing sector 	 High production volumes Low seasonality Medium / high perishability Highly affordable Limited processing sector 	 High seasonality Significant export market Established processing sector



Mango

Sankey diagram: mango





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