Fast-tracking adoption of food safety and standards in the domestic fresh mango value chain: A case study of Makueni County, Kenya

By

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Dedication

This research is dedicated to all value chain actors in the mango value chain who strive to ensure food safety and standards are adopted. Guided by intrinsic motivation to deliver safe and quality food to all consumers, may you be motivated to scale to higher echelons of success in your ventures.

Abstract

Food safety is rapidly emerging as a serious concern in the domestic markets of many developing countries. Not a single country is exempt from its effects. The objective of this research is to analyse the role played by value chain actors in fast tracking the adoption of food safety and standards in Makueni County. This research used a wide range of methodological approaches including interviews with key informants, FGDs, stakeholder meeting, observations and survey with traders and consumers. The analysis was done using the Grounded theory for qualitative data and IBM SPSS version 25 for quantitative data. Results from the analysis show that majority of consumers are aware of food safety and that transport means contributes to fruits contamination. Further, consumers prefer to buy fruits from the open-air markets despite the food safety awareness. Research also show regulatory agencies face numerous constraints in delivering their mandate on food safety enforcement. There are many agencies and institutions with overlapping mandate leading to duplication of roles. Sometimes the roles among government agencies are not very well defined. The implementation of food safety and standards is hampered by the existence of fragmented legislation, multiple jurisdictions, weaknesses in surveillance and haphazard monitoring and enforcement. Nevertheless, the current situation in Makueni County presents an array of opportunities with enormous potential for creating linkages on safe food to enhance the availability of safer and better quality mango fruits in the domestic markets.

The inclusion of Makueni County in the second phase of the NHTS program, the recent launch of e-extension platform (DigiFarm) and the new pest-free zone campaign initiative by KEPHIS by promotion of GlobalGAP compliant zones using alternative cost-effective and environment-friendly technologies is a starter pack to full implementation of food safety in Makueni County.

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List of acronyms

ACL	Analytical Chemistry Laboratory
ADI	Acceptable Daily Intake
ADP	Annual Development Plan
AP	Agricultural Policy
ARfD	Acute Reference Dose
ASALS	Arid and Semi-Arid Lands
ASDSP	Agricultural Sector Development Support Program
ASTGS	Agricultural Sector Transformation and Growth Strategy
CAC	Codex Alimentarius Commission
CECM	County Executive Committee Member
CIDP	County Integrated Development Plan
CSA	Climate Smart Agriculture
DFMVC	Domestic fresh mango value chain
EU	European Union
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FPEAK	Fresh Produce Exporters Association of Kenya
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GlobalGAP	Global Good Agricultural Practices
GLP	Good Laboratory Practices
GMO	Genetically Modified Organism
HACCP	Hazard Analysis Critical Control Point
HCAS	Horticulture Competent Authority Structure
HCD	Horticultural Crops Directorate
ICPMS	Inductively Coupled Plasma fitted with Mass Spectrometer
ISO	International Organization for Standardization
JMPR	Joint FAO/WHO Meeting on Pesticide Residues
KALRO	Kenya Agricultural and Livestock Research Organization
KAVES	Kenya Agricultural Value Chain Enterprises Project
KCDMSD	Kenya Crop and Dairy Marketing System Development
KEBS	Kenya Bureau of Standards
KEFE	Kenya Exporters of Fruits & Vegetables
KENTRADE	Kenya Trade Network Agency
KenyaGAP	Kenya Good Agricultural Practices
KEPHIS	Kenya Plant Health Inspectorate Services
KFC	Kenya Flower Council
KHC	Kenya Horticulture Council
KNBS	Kenya National Bureau of Statistics
KS1758	Kenya Standard 1758
Kshs	Kenya Shilling
MESPT	Micro Enterprises Support Program Trust
MFI	Micro Finance Institutions
MoALF	Ministry of Agriculture, Livestock and Fisheries
MRL's	Maximum Residue Levels
NFSCC	National Food Safety Coordination Committee
NFSCS	National Food Safety Control System

NGO	Non-Governmental Organization
NHTS	National Horticulture Traceability System
NPPO	National Plant Protection Organization
NPRMP	National Pesticide Residue Monitoring Plan
PCPB	Pesticides Control Product Board
PHI	Pre Harvest Interval
PMO	Produce Marketing Organization
PO	Producer organization
RASFF	Rapid Alert System for Food and Feed
SCAO	Sub County Agriculture Officer
SDGs	Sustainable Development Goals
SIVCAP	Strategic Integrated Value Chain Action Plan
SPS	Sanitary and Phytosanitary
SPSS	Statistical Package for the Social Sciences
STS	Sanitary and Phytosanitary
TBT	Technical Barriers to Trade
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
USA	United States of America
USAID	United States Agency for International Development
VC	Value Chains
VCAs	Value Chain Actors
WHO	World Health Organization
WTO	World Trade Organization

1.0 INTRODUCTION

Throughout history, many countries have independently developed laws associated with food and regulations to ensure food is safe and meets expected quality (FAO and WTO, 2017). With time, standards have developed and evolved. Currently, standards are used to promote trade between buyers and sellers and play a role to ensure public safety and environmental protection within and outside national borders (Otieno, 2016). Sadly, as noted by Lasztity et al (2004), allegiance by countries in the implementation of standards is varied. Some countries have unsatisfactory food laws; others have no food laws or worse still other countries have unsuitable laws. As identified by the World Bank Group (2016) there is growing concern that food safety issues are not among key priorities by some countries especially the developing nations.

The delineation of food safety and standards is to manage threats related to the spread of plant pests and diseases and incidences of microbial pathogens or contaminants in food (Royer & Bijman, 2012). The goal to have uniformity in standards resulted in the birth of a non-governmental organization (NGO), the International Organization for Standardization (ISO) in 1946 and a governmental organization, the Codex Alimentarius Commission (CAC) a standardization body that handles agricultural and food products (FAO, 2017).

After Kenya joined WTO in 1995, complying with Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) requirements become mandatory and producers had to comply. The introduction of the European Union regulatory framework and a consortium of EU private supermarket standards shaped the evolution of standards in the export fruits sector in Kenya. However, in the domestic fresh mango value chain (DFMVC) implementation of food safety and standards is hampered by the existence of fragmented legislation, multiple jurisdictions, and weaknesses in surveillance as well as haphazard monitoring and enforcement (FAO, 2017).

Mangoes from Kenya compete in a global market governed by very stringent standards and requirements for safety and social accountability. These standards comprise of legal requirements such as adherence to pesticides Maximum Residue Levels (MRLs) and phytosanitary certification. Other standards are imposed by buyers such as traceability, adherence to Good Agricultural Practices (GAPs) and a Hazard Analysis Critical Control Points (HACCP) system for processors (FSD Kenya, 2015). Kenyan mango in the export market fulfils both market requirements of standards and food safety. Despite this, the DFMVC suffers malpractices and reassurance on food safety is unguaranteed from production to consumption. Although standards have been developed and domesticated into KS1758, enforcement and full implementation in the DFMVC is unavailable (AFA, 2017).

According to Horticultural Crops Directorate (HCD) validated data report (AFA, 2017), Makueni county is currently the leading producer of export mango in Kenya. Notably, only 4% of the total production is exported, thus the bulk of mangoes produced are sold in the local market (Ng'ayu & Audet-Bélanger, 2014). Occasioning this scenario is Kenya's self-regulation mechanism in enforcing SPS regulations against quarantine pests (whiteflies and mango weevil) and meeting the firm standards and requirements for safety (KEPHIS, 2018). With this magnitude of production ending in the domestic market (see table 1), there is a justified need to safeguard domestic consumers against possible food safety risks and hazards.

This research intended to explore the room for maneuver of certified Makueni smallholder producers by creating linkages along the DFMVC to safe quality fruits that meet food safety standards to consumers who are food safety responsive. The research findings helped in developing and contributing to a better understanding of the weaknesses in policy and regulatory framework as well as the enabling environment for the adoption of food safety. The research not only identified the missing links in the DFMVC but also played a role in contributing to the gaps that were pin pointed by Hammoudi and Hamza (2015) and (Colbert & Stuart, 2015).

1.1 Definition of concepts

United Nations Food and Agriculture Organization (FAO) and World Health Organization (WHO) define **Food standards** as a body of rules or legislation defining certain criteria, such as composition, appearance, freshness, source, sanitation, maximum bacterial count, purity, and maximum concentration of additives which food must fulfil to be suitable for distribution or sale (FAO, 2017).

Food safety calls for reducing the presence of hazards that may make food injurious to the health of consumers. The associated activities involve production, handling, storing and preparation of food in a way that limits infection and contamination within the food production chain while maintaining wholesomeness to promote good health (FAO and WTO, 2017).

In the contexture of food safety, a **hazard** is a substance or agent present in food capable of causing negative health effects to consumers (FAO and WTO, 2017).

Hazard Analysis Critical Control Point (HACCP) system is a process control that pinpoints where hazards may occur in the food production process and put into place corrective actions to limit the occurrence of hazards. They offer preventative action against possible hazards (Otieno, 2016).

Maximum Residue Levels (MRLs) are the maximum amount of trace residues of pesticides, or their breakdown products, legally allowed in produce. MRLs are always configured below limits examined as safe for humans. They are not safe limits as a food residue can have a higher level of safety limits than MRLs and still be safe for consumption. Assessment of MRL safety limits is pegged on a comparison with Acceptable Daily Intake (ADI) for short-term exposure or Acute Reference Dose (ARfD) (Keikotlhaile & Spanoghe, 2011).

Traceability is the ability to recognize, pinpoint and link the movement of a food or substance purposed to be integrated into a food, through all stages of production, processing and distribution as defined by Food Traceability Guidance (FAO, 2017).

1.2 Horticulture production in Kenya

According to the Kenya National Bureau of Statistics (2019), horticulture is the second-largest agricultural sub-sector in Kenya making a 36% contribution to Gross Domestic Product (GDP). The domestic value of horticulture production in 2017 amounted to Ksh236 Billion compared to 213 Billion in 2016 (AFA, 2017). The leading economic indicator published in January 2019 (KNBS, 2019), fruits export volume in 2018 was 75,641 tonnes with a value of Kshs12, 831 Million. Horticultural Crops Directorate (HCD) validated report 2015-2016 identify bananas and mango as the main fruits produced in Kenya. They account for 35% and 20% of total value respectively. A World Bank Policy Working Paper published in 2015 indicated the average contribution of agriculture to GDP for the 47 counties as 51% while in Makueni County, agriculture contribution stood at 65% mainly from mango production (Bundervoet, et al., 2015). Agriculture Sector Development Support Program (ASDSP II) reaffirms that agriculture remains the main economic driver in most counties (Ministry of Agriculture, Livestock and Fisheries and the Council of Governor's secretariat, 2017).

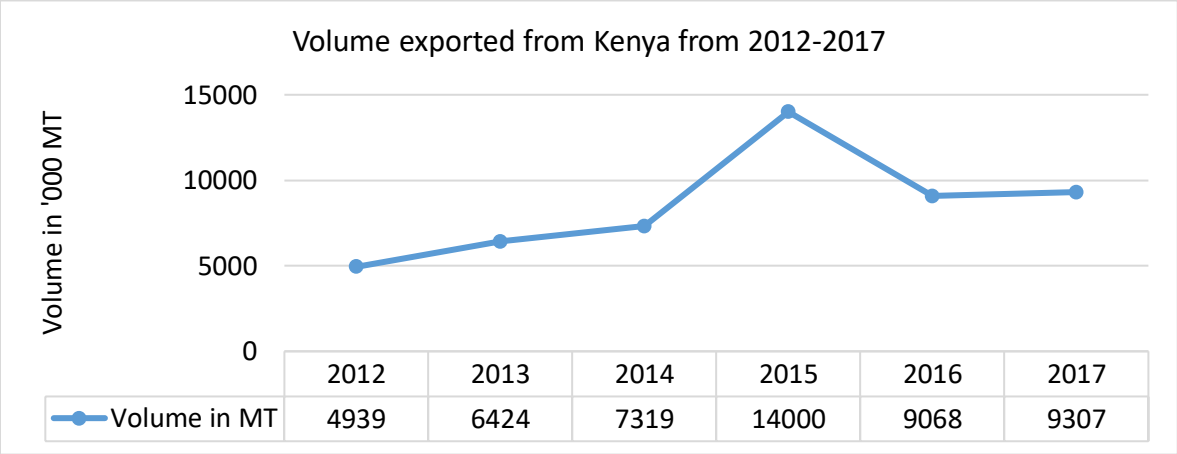
Kenya has been growing horticultural crops both for domestic and export markets. The country has a suitable climate favourable for horticulture production (USAID Trade Hub East Africa, 2013). The horticulture industry has grown steadily from small to complex businesses with vertical integration of chain actors (Match Maker Associates, 2017). Estimated to have a population of 52 million people based on current UN estimates, Kenya has the capacity to meet her dietary fruit demands and export surplus (Worldometers, 2019).

1.3 Mango production in Kenya

Kenya boasts among the leading producers of mango in the world. It ranks number 13 in the world and fourth-largest producer in Africa after Egypt, Nigeria, and Sudan. According to Ng'ayu & Audet- Bélanger (2014) the domestic market for mango remains unexploited despite the sweet-tasting varieties grown.

Figure 1 shows the mango export trends from 2012 to 2017. In 2015, after Kenya implemented strict measures to control the export of mango a larger proportion of the mango was diverted into the domestic market. Thus, a decline in mango exports from 2015.

Figure 1: Mango export trends from 2012 to 2017



Source: HCD validated data, 2018

1.4 Mango production in Makueni County

Makueni County is located in the South-Eastern part of Kenya. It borders Machakos County to the North, Kitui County to the East, Taita Taveta County to the South and Kajiado County to the West (Government of Makueni County, 2018). It covers an area of 8,008.9 km² (KNBS, 2019). Makueni County currently is the leading producer of export mango. According to HCD validated data report 2016, Makueni county contributed 30.4% of the total value of Kenyan fruit sector (Kshs11 Billion) with 12,422 Ha under mango cultivation and a production of 225,300 metric tonnes (AFA, 2017).

Figure 2 below is a map of Kenya showing the study area, Makueni County. On the map, the county is marked in red.

Figure 2: Map of Kenya showing the study area

Source: Makueni County First County Integrated Development Plan 2013-2017 *(KNBS, 2013)*.

Most county residents depend on rain-fed smallholder farming for livelihoods. Key challenges in the county include unemployment, water scarcity, recurring droughts and deforestation making poverty highly prevalent in the county. About 61% of the population lives below the poverty line. The County had a population of 884,527 according to the 2009 census KNBS (2019) with an average population density of 125 persons per Km^2. Youth constitute almost 24 per cent of the population based on estimates presented in Makueni County Annual Development Plan (2019).

As a stopgap measure to address deforestation, Makueni County sensitized smallholder farmers on mango production to mitigate climate change. Today the county leads in both production and export of mango. The fruits sector is from an economic point of view, the most important supporter to livelihood and subsequently, economic growth and development of the county (Government of Makueni County, 2018).

1.5 Mango varieties

Mango production in Makueni County is on the increase owing to increased efforts by the county government to promote production. Indigenous varieties still dominate in production but they are mainly for the domestic market (Government of Makueni County, 2018).

The mango value chain comprises of production of both local and improved varieties. The local varieties include Ngowe, Boribo, Batawi, Sabre and Dodo whilst improved varieties include Apple, Kent, Tommy Atkins, Keitt, Van Dyke, Sabine, Sensation, and Haden (Owuor, 2015) (see table 1). Apple dominates both export and fresh fruit domestic market because of its colour and aroma when ripe (Valavi, et al., 2012).

Table 1: Number of mango trees in Makueni County

No of mango trees in Makueni County					
	Year				
Variety	**2013**	**2014**	**2015**	**2016**	**2017**
Apple	1,357,918	1,577,877	1,877,877	2,016,000	2,415,974
Tommy Atkins	43,567	50,186	57,186	69,440	83,217
Kent	27,142	31,668	38,668	39,200	46,977
Ngowe	47,367	71,051	78,051	85,120	102,008
Other improved varieties	37,917	46,365	49,365	61,600	73,821
Indigenous	331,763	332,866	334,866	335,250	365,892
Total	**1,847,687**	**2,112,027**	**2,438,028**	**2,608,626**	**3,089,906**

Source: Makueni county mango production statistics (Government of Makueni County, 2018).

1.6 Mango production statistics

The last few years have witnessed an upward trend in the production of mango in Makueni County. According to unpublished data from the county department of agriculture, the production of improved varieties is on the increase with apple taking lead as shown in table 2.

Table 2: Mango production statistics from 2013-2017

Production ('000 pcs) of mango in Makueni County					
	Year				
Variety	**2013**	**2014**	**2015**	**2016**	**2017**
Apple	151,868	197,715	297,715	252,614	299,174
Tommy Atkins	2,899	3,418	3,918	32,480	13,520
Kent	3,268	3,547	4,347	33,219	5,603
Ngowe	5,990	7,683	8,083	72,800	11,005
Other improved varieties	3,717	4,444	4,723	34,720	7,452
Indigenous	89,458	90,485	93,458	91,133	98,531
Total	**259,213**	**309,306**	**414,259**	**518,982**	**437,302**

Source: Makueni county mango production statistics (Government of Makueni County, 2018).

1.7 Research justification

Research by Gogo (2017) established that qualitative losses in fruits are rampant due to perceived substandard value. Interestingly, research by Krishnan (2018), Hammoudi and Hamza (2015) identified diversification from export value chains to domestic chains through rechanneling of produce as an important base in making a significant contribution to food safety. Their research focused on producers specializing in two market segments (local and export) and concluded that given the strategic advantage of exporters, they can as well expand to supply the domestic markets with fruits.

Hammoudi and Hamza (2015) pointed out that transferring Good Agricultural Practices (GAPs) used in the production of export produce could ensure food safety in domestic supply chains. The spillover represents an opportunity to intensify the availability of safer and better quality mango fruits in the domestic markets (Canali, et al., 2016). As identified, most export fruits end up in the domestic market if not exported thus an improvement of domestic production practices can benefit local consumers (Gema, et al., 2018).

Kenyan mango in the export market fulfils both market requirements of standards and food safety. Despite this, the DFMVC suffers malpractices and assurance on food safety is unguaranteed from production to consumption. Although standards have been developed and domesticated into KS1758, enforcement and full implementation in the DFMVC is insufficient (AFA, 2017).

1.8 Problem statement

Although the export fruits value chain in Kenya has made strides in the implementation of food safety regulations and standards, the adoption of standards in the domestic mango value chain has stagnated. Propelling the urge for safe food is international and domestic food scares like *Salmonella, Escherichia coli* and *Listeria monocytogenes* contamination in fruits as well as exceedingly high levels of MRL in fruits. The hazard from heavy metals detection in fruits further compounds the issue leading to the increased need to identify strategies for fast-tracking the adoption of food safety and standards. The increase in disease outbreaks from microbial and pesticide contamination, dust and heavy metals contamination has informed domestic consumers to take a keen interest in how mango fruits are handled from production to marketing. Like never before, consumers have made an increased call for greater responsibility for food safety. In Kenya, listed among undermining factors for food safety are the existence of fragmented legislation, multiple jurisdictions and weak surveillance systems, haphazard monitoring and lack of enforcement.

1.9 The problem owner

The commissioner for this research is Horticultural Crops Directorate (HCD). Strategic plan 2017/18-2021/22 outlines HCD roles as the formulation of policies and guidelines to govern the horticulture sector, establishment and enforcement of standards, creation of awareness on food safety regulations, ensuring secure domestic food supply and forging partnerships to promote regulations particularly in the food sector through campaigns on food safety.

1.10 Research objective

To analyze the role played by domestic fresh mango value chain towards the implementation of food safety and standards in Makueni County in order to advice the Horticultural Crops Directorate (HCD) on strategies for stepping up adoption of food safety and standards in the domestic fresh mango value chain.

1.11 Research questions

1. What are the weaknesses in policy and regulatory framework that hinder the adoption of food safety and standards in the domestic fresh mango value chain DFMVC?

1.1 What are the gaps in the current food safety legislation of DFMVC?
1.2 What are the inefficiencies in the implementation of standards in the DFMVC?
1.3 What constraints regulatory bodies from performing their roles in enforcing food safety and standards in the DFMVC?

2. What is the enabling environment in the DFMVC to ensure the implementation of food safety regulations and standards?

2.1 What are the potential food safety risks and hazards in the DFMVC?
2.2 What is the motivation of different chain actors to support the implementation of food safety and standards?
2.3 What is the appropriateness of domestic market support infrastructure to enhance compliance to food safety and standards?
2.4 What is the chain governance system in the DFMVC?
2.5 What are the opportunities to create vertical linkages along the value chain from producers to consumers who are responsive to food safety?
2.6 What is the level of consumers and trader's awareness and preferences on food safety and health in the DFMVC?

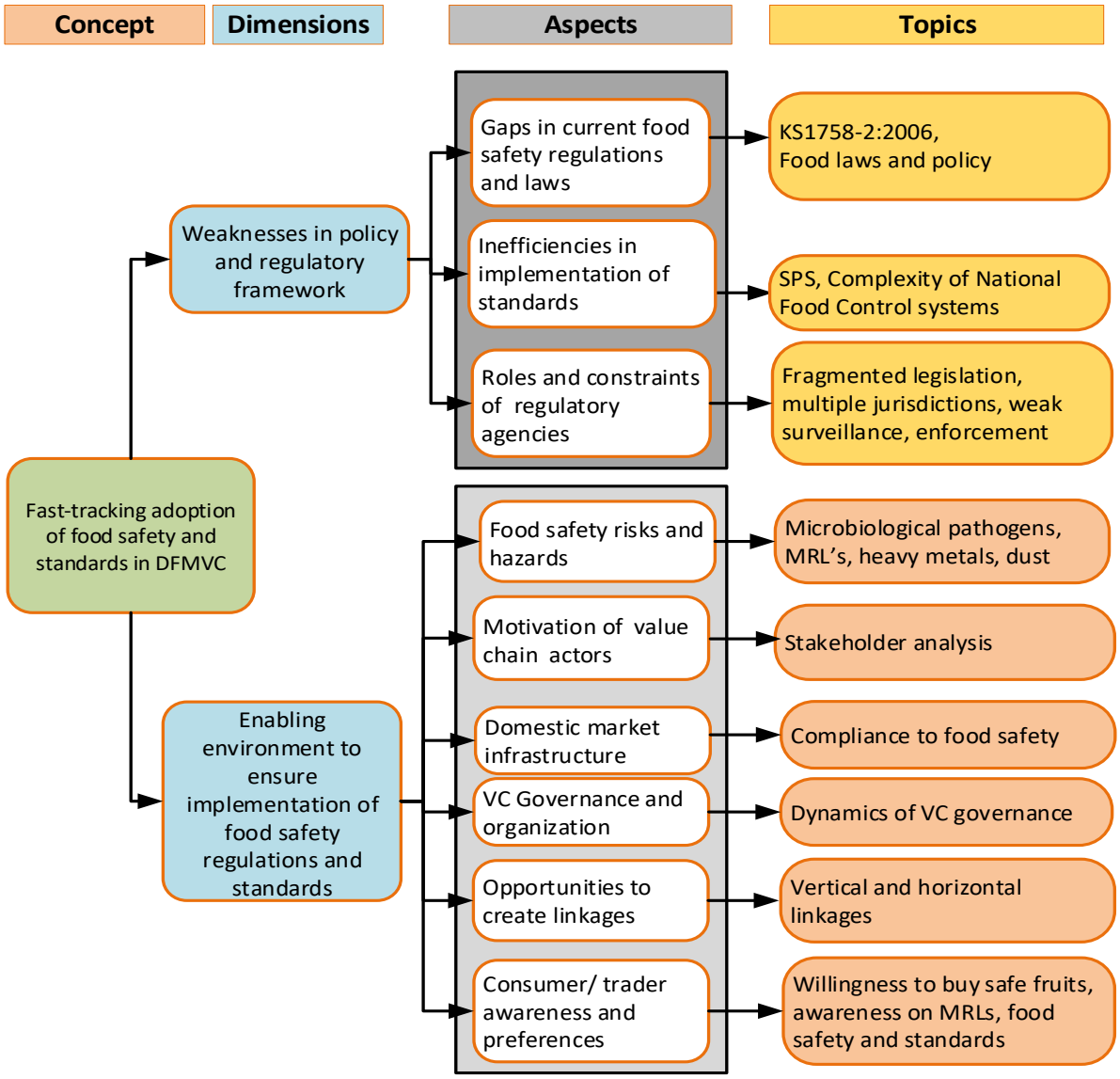
2.0 LITERATURE REVIEW AND CONCEPTUALIZATION

This chapter contains literature on the general concepts and in-depth analysis of contributions to food safety from other researchers. The fast-tracking adaption of food safety regulations and standards in the DFMVC, a well-established policy and institutional enabling environment is a necessary requirement.

2.1 Conceptual framework

The conceptual framework gives an overview of the main research aspects used in answering the research questions. It consists of fast-tracking adoption of food safety and standards in the domestic fresh mango chain with two broad dimensions (1) weaknesses in regulatory and policy framework, and (2) the enabling environment for implementation of food safety and standards as shown in figure 3 below.

Figure 3: Research Conceptual framework



Source: Author

2.2 Policy and regulatory framework in DFMVC

2.2.1 Food safety regulations in Kenya

A technical multi-stakeholder National Food Safety Coordination Committee (NFSCC) developed the Kenya Standard (KS1758-1) code of practice for the flower sector in 2015. A year later, part 2 of the standard was developed for fruits and vegetables (KS1758-2:2016) (AFA, 2017). The committee comprised stakeholders drawn from the Ministry of Agriculture, Livestock and Fisheries (MOALF), Kenya Plant Health Inspectorate Services (KEPHIS), Kenya Flower Council (KFC), Horticultural Crops Directorate (HCD), Fresh Produce Exporters Association of Kenya (FPEAK) and the Ministry of Trade. The objective was to have a national standard in which both producers and exporters would have clear and comprehensive production guidelines for the export and domestic markets. The standard encircles food safety and health, environmental concerns and workers' welfare and safety. According to the Fresh Produce Exporters Association of Kenya (2015), the code was harmonized with international agencies such as the UK's Integrated Crops Management and the United States of America's Environment Protection Agency.

Kenya established the National Horticulture Traceability System (NHTS) in September 2016 through a project of HCD supported by USAID Kenya Agricultural Value Chain Enterprises (KAVES) programme to supplement the national standard (KS1758-2:2016, code of practice for fruits and vegetables). NHTS development sought to increase transparency and accountability in horticultural value chains in the following challenges in complying with EU and international food safety requirements. The challenges include lack of a national traceability system for horticulture produce, recurrent interceptions of exports with excessive pesticide MRL and the existence of quarantine pests in export consignments. Krishnan (2018) noted that NHTS offers new market opportunities for farmers and buyers to create better-organized supply chains that support relationship building and information flow vertically along the chain to enhance quality and safety.

NHTS is still at infancy, what's more implementation and enforcement are lacking. As attributed by FAO and WTO (2017), traceability component in food safety management is of paramount importance. Used singly, the system offers no guaranteed accomplishment of food safety and quality requirements. Rather it should be employed as a highly valuable guide towards achieving quality and safety (Chemeltorit, et al., 2018). In many developing countries, Kenya inclusive, the fragmentation of value chains poses challenges to achieving traceability.

KenyaGAP was the first national scheme to consolidate both industry and smallholder farmers' concerns covering the scope of fruits, vegetables, and flowers. It benchmarked standards on GlobalGAP and engulfed guidelines of Hazard Analysis and Critical Control Points (Fresh Produce Exporters Association of Kenya, 2015).

2.2.2 Food policy framework and regulations

The institutional framework in Kenya is clear and provides guidance set out by legislative requirements. These requirements should ensure that food is safe and suitable for consumption.

2.2.3 Policies governing food safety

There are a number of policies linked to food safety in Kenya. Table 3 below gives a summary of the key policies governing the horticulture sector.

Table 3: Policies governing food safety in Kenya

Policy	Role
National Food and Nutrition Security policy (2011)	The policy aims to achieve good nutrition for the excellent health of all Kenyans, increase the quantity, quality of food available, make food accessible and affordable and protect susceptible populations using innovative and practical safety means.
National Agricultural Sector Extension Policy (2012)	Empower diverse extension patronage through knowledge and information sharing, relay skills and change attitude to enhance technology and innovation adoption.
National Horticulture Policy (2012)	Facilitate increased production of high-quality horticultural produce, enhance the provision of finances, insurance and technical advisory services, promote value addition and increase domestic and external trade, develop and improve infrastructure to support the horticultural industry particularly in major production areas, and promote horticultural investment in the Arid and Semi-Arid Lands (ASALS).
The National Seed Policy (2010)	Set out intervention measures adopted by the seed sub-sector to provide guidance to the industry to sustainability avail adequate high-quality seed planting materials.

Source: Policies under the laws of Kenya (GOK, 2019).

2.2.4 Food safety legislations

The rules governing domestic food regulations ensure risk analysis in standards. The table below outlines the major legislation under MOALF and the ministry of Health.

Table 4: Food safety legislation in Kenya

Legislation under MOALF	
2.2.2.1 Inputs related legislation	
Seed and Plant Variety Act Cap 326, revised 2012	Regulate undertakings in seeds, including provision for the testing and seed certification, indexing plant varieties names, certify restrictions on new varieties introduction, control seeds importation
Fertilizer and Animal Feedstuff Act Cap 345 revised 2012	Regulates the importation, manufacture, trade-in agricultural fertilizers and animal foodstuffs
Pest Control Products Act (Cap 346)	Regulate import, export, manufacture, distribution and use of pesticides
Agricultural Act Cap 318	Promote and maintain stable agriculture, soil and fertility conservation, to the growth of agricultural land in accordance with GAPs
Plant Protection Act Cap 324, revised 2012	Governs prevention of introduction and spread of pests and diseases destructive to plants.
Crops Act (No.16 of 2013)	Provide growth and development of agricultural crops among them horticultural crops. Led to the creation of Agriculture and Food Authority (AFA) where HCD is a directorate.
Biosafety Act 2009 (CAP 321 A)	Regulates genetically modified organisms (GMOs) and the institution of the National Biosafety Authority.
Kenya Standard 1758: Part II Fruits and Vegetables	Horticulture Code of Practice that specifies the essentials for legal compliance, sound use of inputs, secure production, handling and marketing of fresh fruits, vegetables, herbs and spices. It applies to industry value chain actors.

Legislations under the Ministry of Health	
2.2.2.2 Aggregation & Quality related	
Food Drugs Chemical Substances Act Cap 254 (Rev. 2002)	Provision for the prevention of degrading food, drugs and chemical substances.
Public Health Act Cap 242 (Rev. 2012)	Protection of public health, food hygiene and protection of foodstuffs.
Legislation under the Ministry of trade	
2.2.2.3 Marketing and Export related	
Standards Act Cap 496	Governs the standardization of the specification of commodities, development of standards for various commodities and codes of practice, and creation of the Kenya Bureau of Standards for standards management.

Source: Laws of Kenya (GOK, 2019).

2.2.5 Key chain supporters and their roles

The DFMVC has several key supporters drawn from regulatory and research organizations, banks and Micro Finance Institutions (MFI), county government and certification organizations. Based on the literature, different agencies and organizations support the value chain by implementing their mandate. Government organizations under MoALF in the national government include HCD, KALRO, KEPHIS, KEBS and PCPB while the county government departments include the Department of Agriculture and Public Health. private sector organizations include FPEAK, certification bodies and banks. Table 5 below summarizes their roles in supporting the DFMVC.

Table 5: Domestic fresh mango value chain supporters

Stakeholder	Stakeholder function	Stakeholder role in the domestic fresh mango value chain
Ministry of Agriculture, Livestock and Fisheries (MoALF).	Policy formulation, Supervise sector's performance, linkages with donors.	Provide needed support (financially, technically and enabling regulatory and legal framework). Provide an enabling environment for the development of the mango subsector.
Government of Makueni County	Provision and promotion of extension services to mango farmers.	Provision of extension service support. Support the implementation of national government policies and regulations in the counties.
Horticultural Crops Directorate (HCD)	Facilitate the development, promotion, coordination and regulation of the horticultural sub-sector.	Register horticulture nurseries, guide production, training on post-harvest handling and marketing of mango, promote development and adoption of standards in compliance with local and international standards.
Kenya Agricultural and Livestock Research Organization (KALRO)	Promote and participate in mango research by determining research priority areas.	Nursery establishment of clean planting materials, maintenance of mother blocks, carry out research on pests and disease management, disseminate information on research findings
Kenya Plant Health Inspectorate Services (KEPHIS)	Disease and pest surveillance in mango, Inspection and issuance of SPS certificates.	Consistent and timely inspection of imports, exports and certification of mango nurseries. Testing for MRL's in mango fruits and advice stakeholders on SPS and TBT agreements

Stakeholder	Stakeholder function	Stakeholder role in the domestic fresh mango value chain
Kenya Bureau of Standards (KEBS)	Standardization, Certification, Quality Control.	Enforce set standards in the domestic mango value chain. Development of the KS 1758 code of practice.
Pesticides Control Product Board (PCPB)	Regulation on safe use, disposal of pesticides to prevent harm to the environment.	Proper disposal of unsafe pesticides with adherence to MRLs, reduce environmental contamination and health risks.
Agricultural Sector Development Support Program (ASDSP)	Develop sustainable value chains for improved income, food and nutrition security.	Strengthening entrepreneurial skills of value chain actors, enhancing access to markets, coordination within the agricultural sector
Fresh Produce Exporters Association of Kenya (FPEAK)	Developed KenyaGAP, benchmarked against the GlobalGAP.	Support the horticulture industry in setting up conducive interventions and policies. Enhance compliance with market requirements among members and stakeholders.
Banks and MFIs	Monetary lending services to chain actors	Provide loans at market rates, advice stakeholders on investment plans.
Certification Bodies (Africert, SGS, Bureau Veritas)	Certification, Third-party audit checks/ Check for conformity	Enhance compliance with food standards, forge partnerships to promote regulation in the food sector through the provision of inspections and certifications.
Micro-Enterprises Support Programme Trust (MESPT)	Promote economic growth, employment creation and poverty alleviation through enterprise development	Develop value chains that make use of green growth ideologies and sustainable natural resource management

Source: adapted from Match Maker Associates (2017).

2.2.6 Gaps in policy and regulatory framework

Ineffective food safety control is attributed to the existence of shattered legislation, multiple jurisdictions, and weaknesses in surveillance, monitoring and enforcement. According to Match Maker Associates (2017), although standards have been developed and domesticated into KS1758, enforcement and full implementation in the DFMVC is lacking. FAO and WTO (2017) isolated inadequate resource base as a hindrance to realizing the plans of the national traceability system for horticulture produce in the DFMVC.

2.2.7 Hindrances in the implementation of food safety and standards

2.2.7.1 SPS requirements in mango

Kenyan mangoes compete in a global market governed by stringent standards and requirements for safety and social accountability. These standards, such as keen observance to MRLs in food and SPS certification are preconditions imposed on producers. Besides traceability, compliance to GAPs and HACCP system are a mandatory requirement by a section of buyers (FSD Kenya, 2015).

2.2.7.2 The complexity of the National Food Safety Control Systems

The DFMVC requires substantial information on the technical requirements and the capacity to implement them. As FAO and WTO (2017) pointed out that, there were no shortcuts to operate an efficient and effective food-control system. In Kenya, responsibility for food safety control is distributed among government departments across multiple ministries (Otieno, 2016). This contributes immensely to the twists and turns of the National Food Safety Control System (NFSCS). Therefore, success in the

implementation of food safety regulations requires careful planning and consistent commitment to achieve continuous improvement as envisioned by FAO and WTO (2017) and suggested by Otieno (2016).

2.3 Enabling environment to implementation of food safety and standards

The enabling environment is considered from the view of food safety risks and hazards, the value chain and the motivation of different actors, market support infrastructure, governance mechanisms within the chain, opportunities for creating linkages as well as consumers level of awareness and preferences in the mango value chain.

2.3.1 Food safety risks and hazards in the DFMVC

The World Bank Group (2016) noted that the broad purpose of food safety and standards was to manage risks associated with the spread of plant pests and diseases and reduce incidences of microbial pathogens and contaminants in food. They identified risks related to food safety and agricultural health standards to include microbial pathogens, pesticides, environmental contaminants like heavy metals and naturally occurring toxins like mycotoxins and the transmission of plant pests and animal diseases. Okello (2008) identified the key driver to safe food as a rise in consumer incomes and awareness enabling them to spend more money on safe food. Nevertheless, technological improvements have eased measurement and documentation of food contaminants together with their impacts on human health. His research noted that international food scares, such as *Salmonella, E. coli* and *Listeria* contamination of fruits have made people more aware of the dangers posed by food contamination.

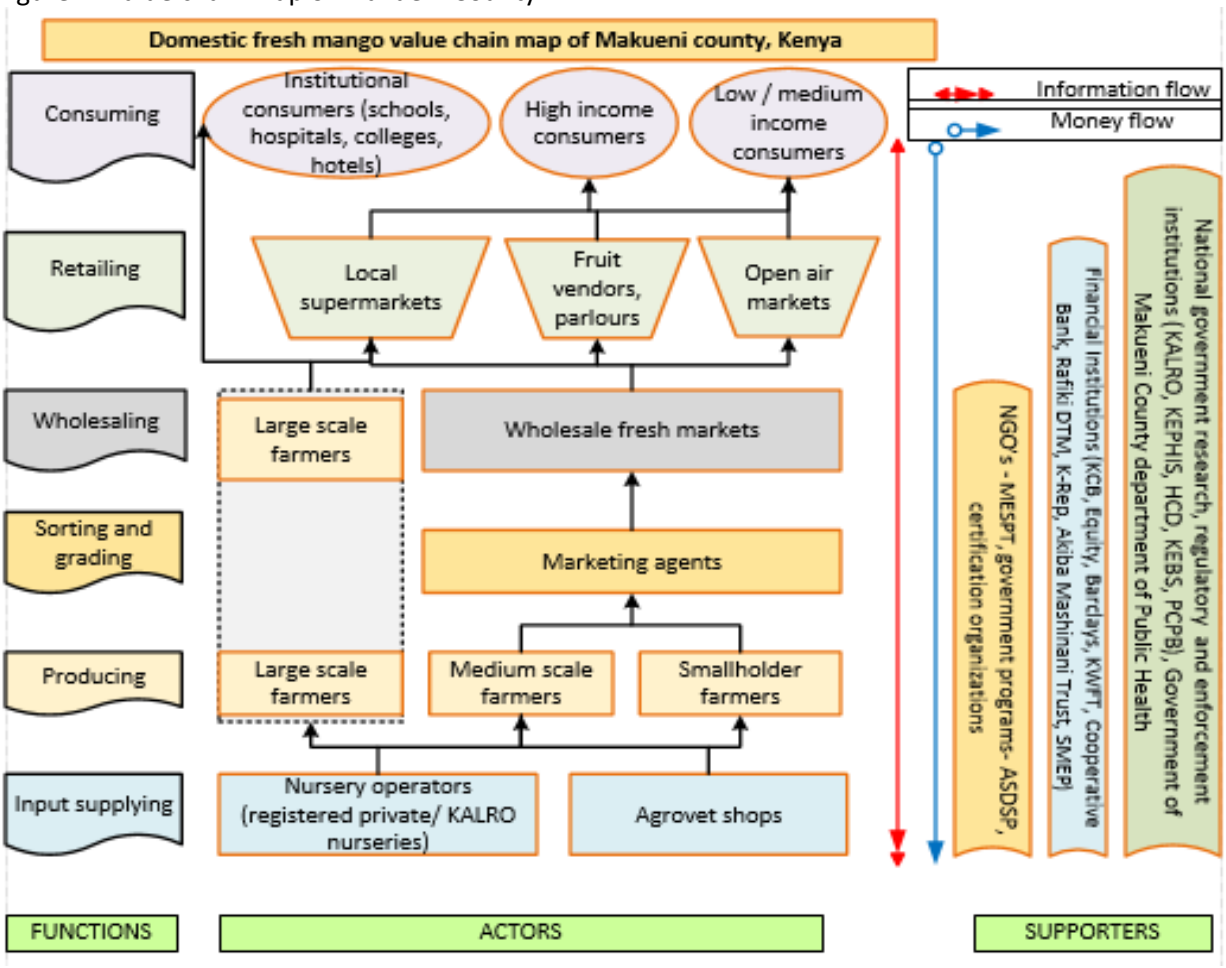
2.3.2 Domestic fresh mango value chain (DFMVC)

The fresh mango value chain comprises of several functions: inputs supply, production, collection and bulking, sorting and grading, packing and distribution and retailing to reach the end consumers.

2.3.2.1 Makueni County Mango Value Chain Map

Figure 4 below shows the organization of DFMVC. The main actors are producers, marketing agents, wholesalers and retailers. The national government regulatory institutions and county government departments support chain actors on food safety.

Figure 4: Value chain map of Makueni County



Source: Author based on County Integrated Development Programme (2019).

2.3.3 Domestic market infrastructure

Good quality infrastructure is a particularly important contributor to competitiveness and growth in agriculture (FAO, 2017). Urban infrastructure and development of rural road network is a challenge. As identified in the Annual Development Plan 2019/20 for Makueni County, the development of market infrastructure is a top priority (Government of Makueni County, 2018). The market infrastructure ranges from local supermarkets, high-end grocery shops, fruit parlours, kiosks and open-air retail and wholesale markets (Research Solutions Africa (RSA) Ltd, 2015). Developing and improving rural support infrastructure and trade-related capacities for market access is key to sustainable agricultural transformation and food safety in Kenya (Ministry of Agriculture, Livestock, Fisheries and Irrigation, 2019).

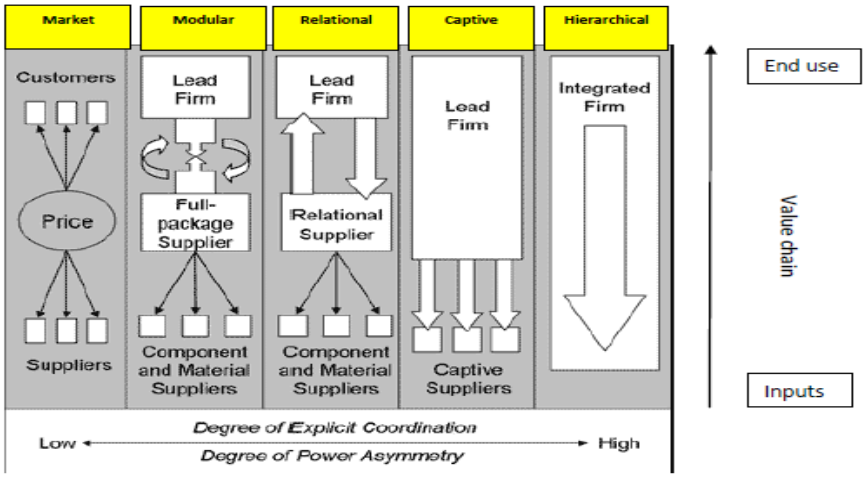
2.3.4 Domestic fresh mango chain governance

'A governance structure is an institutional framework within which the trustworthiness of a transaction is defined' as stated by Williamson (1979) in Ruben et al (2007). Ruben et al (2007) elaborate that governance structures are developed to support the execution of transactions in the most efficient way. The DFMVC is typical of a market type of governance (Gereff, et al., 2005). As described by Ruben et al (2007), the instruments of value chain governance in the domestic fresh mango chain include contracts between chain actors, standards for products and processes, a self-regulating system of the value chain, management of producer organizations and government regulatory frameworks.

As Schrader (2015) describes in market governance, transactions require very little or no formal cooperation between the chain actors. The level of complication of information exchanged is relatively low and governing transactions there is little explicit coordination of the chain. Vertical marketing channels consist of networks purposed to achieve technological, managerial and promotional economies through the integration, coordination, and synchronization of marketing flows from points of production to points of ultimate use (Ruben, et al., 2007).

Due to weaknesses in chain coordination, traders can easily switch from one buyer to another and buyers do not control production. The transactions involved are easily codified involving relatively simple product specifications (Schrader, et al., 2015). During product exchange in the market, buyers respond to specifications and prices set by sellers. The market governance in DFMVC is characterized by a low degree of direct chain coordination and power asymmetry (see figure 5).

Figure 5: Types of value chain governance in domestic fresh mango chain



Source: (Gereff, et al., 2005).

2.3.4.1 Mechanisms of governance along the DFMVC

The formal chain is characterized by contractual obligations with the market as the outcome. Buyers have formal arrangements, set goals and offer incentives to the producers who follow the laid down rules. The informal governance is relational and it is based on trust embedded among the partners as shown in table 6 below.

Table 6: Value chain governance mechanisms

Formal		**Informal**
Contractual	Organizational	
Outcome (market)	Behavioural (hierarchy)	Social (community)/ relational
Goal setting; incentive and reward systems; rules	Authority (direct supervision, standardization, monitoring and sanctions, mutual adjustment), rules	Partner selection, identity, norms, reputation/ trust, routines, embeddedness

Source: Adapted from Ruben, et al (2007).

Ruben et al (2007) distinguish relational embeddedness as an ongoing social relationship that results from repeated transactions with the same partners while structural embeddedness as the twofold relationship embedded in a community of former, current and potential exchange partners.

2.3.5 Creating value chain linkages

As stated by Krishnan (2018), creating a connection to markets for smallholder producers is essential to increase agricultural production, generate economic growth in rural areas and reduce hunger and poverty. Chemeltorit, et al (2018) presupposes the DFMVC strives to improve these links noting that it creates a virtuous circle by enhancing productivity, increasing incomes and strengthening food security. Developing accessibility to domestic markets by smallholder producers ensure they exactly sell more products at better prices. This, in turn, prompts farmers to plough money in their own businesses thus increasing both produce quantity and quality (Chemeltorit, et al., 2018). Seizing the right set of circumstances promotes agribusiness in the domestic context hence it is imperative for the prosperity and economic development of the smallholder farmers in the fresh fruits value chain (Priefer, et al., 2013). The underlying objective of Kenya Horticulture Council is to provide lobbying, advocacy and capacity building for sustained market access for Kenya horticulture products (Kenya Horticultural Council, 2017). The shift to digitalization and information technology has made a positive impact on trade and food standards in Kenya (UNECE, 2013).

2.3.6 Consumer preferences and awareness of food safety and standards

Otieno (2016) noted income growth in developed countries led to an increase in demand for high-quality health, safety and ethical standards. Findings made by Ng'ayu & Audet-Bélanger (2014) identified a growing middle class mainly localized in urban areas as the force behind the push for safe food.

The World Bank Group (2016) explains how the international trade in fresh fruits expanded enormously in the past decades, driven by changing consumer tastes and advances in production, transport, and other supply chain technologies and methods. As consumers are consistently becoming knowledgeable on food safety issues than previously done (FAO, 2018), increase in demand arising from increased awareness and concern about food safety in the domestic market segment, calls for need to concentrate on production of fresh fruits that meet minimum safety and quality standards (Gema, et al., 2018). Since chain actors with a greater level of information about the safety and quality of produce they supply are able to gain a strategic advantage over consumers or over their competitors, the results will produce differentiation based on safety and quality.

2.3.7 SDGs and improved livelihoods

According to capacity building strategy for agriculture sector 2017, (Ministry of Agriculture, Livestock and Fisheries, 2017), the sector is the key economic and social driver of development in Kenya's Vision 2030 and Sustainable Development Goals (SDGs) (Ministry of Agriculture, Livestock and Fisheries, 2017). This is anchored in 10 years transformation agenda (2019-2029) of increased agricultural output and increasing household food resilience under the Big 4 agenda (100% food and nutrition security, manufacturing to be 20% of GDP by 2022, universal health care, and affordable housing). The contribution of the domestic fresh fruits mango chain to zero hunger (SDG 2) is a top priority by both the county and national governments. (Ministry of Agriculture, Livestock, Fisheries and Irrigation, 2019). Agricultural Sector Transformation and Growth Strategy (ASTGS) notes the fact that there can be no food security without food safety, unsafe food is dangerous for health. Strengthening food safety systems enable Kenya to take measures to reduce the occurrence of foodborne disease and promote good health and well-being (SDG 3).

Standards ensure the protection of consumer health and ensure fair practices in the food trade as articulated in responsible consumption and production (SDG 12). Through the adoption of food safety standards, local traders can access markets and increase their trade by targeting consumers who are responsive to food safety issues. The resulting growth in business and job opportunities is motivation to rural residents to remain in agriculture, and not move to cities. The Ministry of Agriculture, Livestock, Fisheries and Irrigation (2019) targets ending poverty by increasing small-scale farmer income, increasing

agricultural output and value addition as well as increasing household food resilience as elaborated in ASTGS.

2.3.8 Contamination of fruits along the DFMVC

Contamination of fresh produce during the handling process is a common problem and it is usually ignored (Mathur, et al., 2014). According to FAO and WTO (2017), contamination in the DFMVC occurs from exposure to hazardous agents. Identification of hazards and estimation of the danger posed to play a key role in assuring food safety and safeguarding public health. Food hazards in mango may be biological, chemical, physical, and biotechnology-related. Hazards can happen in the food supply at any moment during production, harvesting, packaging and labelling, transportation, storage and trading.

Consumption of contaminated fruits can result in food poisoning due to the existence of intestinal infectious microbes. *Salmonella enterica, S. enterocolitis, Listeria monocytogenes and Escherichia coli O157:H7* are some of the common contaminants in mango. These microbes cause food poisoning by infecting the intestines, creating inflammation and difficulties in nutrients and water absorption. Microbes also produce toxins that are catastrophic to the digestive system of man. When ingested, the chemicals lead to nausea and vomiting, kidney failure, and sometimes death (Penteado, 2017). As noted by Mathur et al (2014) cultivation of mango in areas with injurious microbes like sewage, sludge, animal droppings, and toxic weeds can result in fruits adulteration during growth, at harvesting and during post-harvest handling.

Pre-harvest avenues of fruit spoilage include soil, contaminated irrigation water, inadequately composted animal manure, dust, insects, presence of domestic animals and contaminated human hands during handling fruits whilst post-harvest sources of contamination include handling with contaminated hands, contaminated harvesting equipment, unclean transport containers/vehicles, unsafe rinse water, improper storage and packaging (Heaton & Jones, 2007). Soil and water contamination with heavy metals and the use of pesticides indiscriminately without adherence to MRLs constitute a great risk and hazard to fruit contamination.

2.3.9 Traceability along the DFMVC

An important component of food safety is traceability. Chemeltorit, et al (2018) explains traceability advances the ability to trace a contaminated food product back to the source. The aim is to meet the needs of value chain actors operating in multifaceted circumstances; smallholder farmers, consolidators, transporters, traders, food safety-minded consumers, governments, NGOs, and other stakeholders. To provide food safety and quality assurance, all chain actor must commit to the traceability system. As noted by Chemeltorit, et al (2018), the value and meaning of traceability systems weaken as the food systems become more fragmented. In Kenya, though stringent measures exist for food products destined to export markets, the tendency converses for foodstuffs supplied to the domestic market.

Traceability system facilitates combined supply chain management to safeguard food safety and quality at any given point along the value chain. Even when produce is certified, it is difficult to ensure producers meet the requirements, as no sequence of events can confirm they exist (André & Oskar , 2017). Moreover, hardly traceability of produce in the DFMVC exist except for export producers who deliberately supply the domestic market when faced with excess production (Gema, et al., 2018). As noted by Chemeltorit, et al (2018), traceability systems are uncommon practice, since there is no demand by consumers or other chain actors to be a lawful requirement.

3.0 RESEARCH METHODOLOGY

3.1 Research area

The research was conducted in Makueni County, Nzaui Sub County, Nzaui, Kilili/ Kalamba ward. Nzaui, Kilili/ Kalamba ward is the highest producer of mango in the County. It lies 59 Km west of Wote town, the County headquarters. See figure 2 for a detailed map of Kenya showing the study area.

3.2 Study population

According to Makueni County's Annual Development Plan (ADP) for 2019/20 (Government of Makueni County, 2018). the projected population for 2018 based on the 2009 census was 1,002,979 people with an estimated 488,378 males and 514,601 females. Youth represent 24 per cent of the population.

The study population comprised 45 consumers, 45 traders and 11 key informant interviews, 23 participants for a stakeholder meeting and 16 producers for FGDs. The selection process of the survey population and FGDs were demographically representative as possible to allow broad conclusions to be drawn for the population. Each research method comprehensively describes the choice of tools and participants.

3.3 Research strategy

To meet the objectives of this research, both qualitative and quantitative research strategies were used. Qualitative research, also called exploratory research, helped in gaining an in-depth understanding of food safety and standards. Qualitative data were collected using both structured and semi-structured questionnaires, to carry out a survey among consumers on their preferences and level of awareness on food safety and standards.

On the other hand, quantitative research was used to quantify the research problem by way of generating numerical data. The collected data was analyzed statistically through IBM Statistical Package for Social Sciences (SPSS) software version 25. The results were used to quantify awareness, opinions, preferences of consumers on food safety and to generalize for the larger population.

3.4 Research methods

3.4.1 Desk study

A literature review on the research topic was done to gain an in-depth understanding of food safety and standards development in the fruits value chain. A wide range of literature from books, journals, publications and PhD theses contributed to the understanding of the research area. Value chain actors were determined and their supporters, domestication of international standards to KS1758-2:2006 and food laws and policy. Information from the desktop research helped to determine what other researchers have done on the subject and identified gaps that the current study helped to fill.

3.4.2 Observations

The observation was made using a guided checklist during a transect in the study area during the field research period. The observations targeted assessing the domestic markets support infrastructure on food safety and the level of compliance. The information was recorded in a field notebook and later transcripted into data for analysis (see appendix 19).

3.4.3 Interviews with key informants

Qualitative interviews were done using a semi-structured checklist (see appendix 7-9) at their workstations. Proceedings were recorded upon consent from interviewees and information transcripted into data. Purposive sampling of interviewees targeted institutions that are involved in policy formulation and implementation of food safety and standards. At the county level, implementation of food safety and standards is the function of the departments of Public Health and Agriculture. The interviews with key

informants from the two departments sought to delve further into performance, the capacity of individual staff, departmental capacity and the enabling environment thus use of an implementation matrix rather than a checklist (see appendix 10-11). Interviews were done with managers and heads of departments. Appendix 4 details the key informants and information they provided.

3.4.4 Survey with consumers and traders

A survey was done for this research, with traders and consumers. Both targeted 45 respondents each (45 traders and 45 consumers), 15 respondents from each of the following towns: Wote, Emali and Kibwezi. The large population of residents and ease to get respondents was the overriding factor for the choice of sampling towns. The survey sampled both male and female adult (i.e. above 18 years of age) consumers and traders.

Simple, comprehensive and relatively short questionnaires were developed (see appendix 5-6), pre-tested and validated before administration. Pre-testing of the survey questionnaire was done two days before the actual day of the survey with five respondents (5 consumers and 5 traders who were not part of the main survey). Each of the 10 respondents was requested to answer the questionnaire and a revision done based on the questionnaire feedback. Pre-testing also guided on determining the duration that each questionnaire would take (see table 7).

Table 7: Survey area for consumers and traders

Town	Consumers	Traders	Feedback
Wote	15	15	Level of consumer's awareness, preferences and understanding of food safety and standards, willingness to spend more for safe mango.
Emali	15	15	
Kibwezi	15	15	
Total	**45**	**45**	

Source: Author

3.4.5 Focus Group Discussions (FGDs)

Using the Sub County Agriculture Officer (SCAO) Nzaui, snowball sampling of participants was done from smallholder mango farmers representing different clusters to ensure full representation of the study area. Both certified and non-certified farmers were selected for the FGDs. The sampling of participants was guided by the current producer ratio of 30% females and 70% males, certified or non-certified and those with mature trees under production.

Separate FGDs were done for both certified and non-certified farmers. Information from non-certified producers enabled the triangulation of reasons for non-certification, price differences for mango, production challenges, access to markets and credit as well as management practices (see appendix 14).

3.4.6 Stakeholder meeting

Stakeholder meeting comprised of value chain actors to triangulate the information obtained during desk study, FGDs, surveys, observations and interviews with key informants (see chapter 2). Although 15 stakeholders had been invited, 23 attended the forum (see appendix 8).

3.5 Data analysis

Analysis of qualitative data was done using the grounded theory method. This research method generates theory, which is 'grounded' in data that has been intensively collected and examined (Noble & Mitchell, 2016). The data was analyzed through open coding where concepts and key phrases were identified, highlighted, and moved into subcategories and categories guided by research questions. Stage 2 involved axial coding by breaking down core themes in which relationships were identified between the categories and connections. Stage 3 of the grounded theory involved selective coding by identifying core categories and methodically relating to other categories as described by Noble &Mitchell (2016).

IBM SPSS version 25, a statistical software package for interactive statistical analysis was used to analyze quantitative data generated from survey findings (see table 8).

Table 8: Methods of data analysis

Analysis tool	Type of data	Source	Purpose
Grounded theory	Qualitative	Key informant interviews	Triangulation of information from different sources, different tools and methods
		Survey semi-structured questionnaires	
		Stakeholder meeting	
		FGDs	
		Observations	
IBM SPSS	Quantitative	Survey closed-ended questionnaires with consumers and traders.	Answers to the formulated hypothesis, find the level of significance and correlation

Source: Author

Hypothetical considerations for test

Table 9 below elaborates the hypothesis formulated and the statistical tests were done using IBM SPSS.

Table 9: Hypothetical tests

Hypothetical questions	Test
Is there a difference in consumer/ trader awareness and preferences on food safety and standards in the three towns?	Independent sample t-test
Does the level of education have an influence on consumer awareness on food safety in fruits?	One way Anova
Is there a difference in consumer preferences on the choice of mango shopping outlets in the three towns understudy?	Clustered bar chart
Is there a correlation between the trader's awareness of food safety and the sourcing of safe mango?	Pearson's correlation

Source: Author

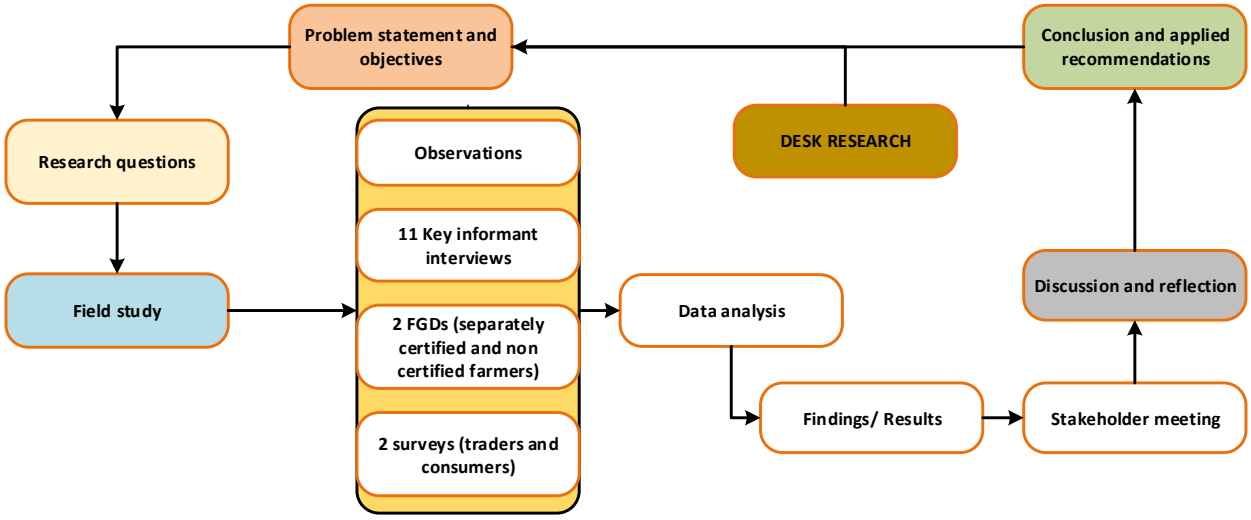
3.6 Research framework

The research process was carried out using a sequential approach by:

- Reviewing secondary information obtained from various sources including desk study research in literature, books, journals, publications and reports to understand issues surrounding food safety and standards in the DFMVC from production to consumption and find out what other researchers have developed.
- Identifying a knowledge gap and formulation of research questions
- Developing specific research methodology, tools, design for each key informant, pre-testing the tools through initial field visits, making requisite reviews, and carrying out field research (FGD, key informant interviews, stakeholder meeting and survey).
- Triangulating different sources of data, multiple research sources, multiple tools and methods.
- Analyzing the research findings, generating an initial summary of research findings and documenting key issues necessary to understand food safety and standards in DFMVC.
- Making applied recommendations to inform the commissioner of the research findings.

Figure 6 describes how the research was conducted from desk study and field study with triangulation of different methods to obtain results from which conclusions and recommendations were derived.

Figure 6: The Research Framework



Source: Author

3.7 Ethical considerations

Potential participants for FGD, stakeholder meeting and interviews were informed 4 days in advance to prepare them to find time out of their busy schedules for the research. Participants were briefed and gave oral consent to participate in the research. This was aimed to reaffirm participants that their engagement in the research was voluntary thus they had the freedom to withdraw their consent at any time, that any data that they had provided would be destroyed if they so requested and that there would be no resultant adverse consequences. No incentive was offered to participate in research and the confidentiality of participants' identities and data was assured.

4.0 RESEARCH RESULTS

This chapter consists of two sections; the first section contains quantitative results from field survey collected from mango consumers and traders in the towns of Wote, Emali and Kibwezi. The section comprises test results of consumers' level of awareness on food safety and standards as well as traders' knowledge and perception of food safety and standards in the DFMVC. The second section presents the qualitative results of the case study involving interviews with key informants in the DFMVC and actors in the fresh mango value chain. The two sections are aimed at providing answers to the research questions. Findings from the case study are presented using a chain map, stakeholders' analysis, transcription of interview results from key informants and analysis tables while findings from the survey are presented using tables, pie charts and bar graphs.

4.1 Quantitative survey results

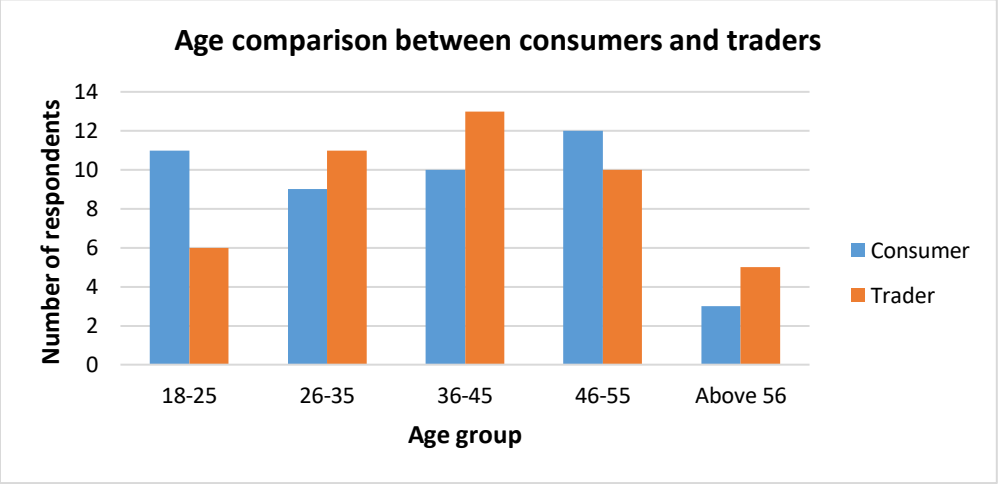
4.1.1 Demographics and socio-economic characteristics of consumers and traders

This part presents the demographic and socio-economic features of the respondents, in which factors such as age, gender, education level, number of family members, experience in trading in mango and type of business run.

4.1.1.1 Age comparison between consumers and traders

The total number of respondents (n=45) was drawn from Wote, Emali and Kibwezi in equal proportions of 33.3%. Figure 7 shows there were more young consumers (18-25 years) than young traders were.

Figure 7: Age comparison between consumers and traders

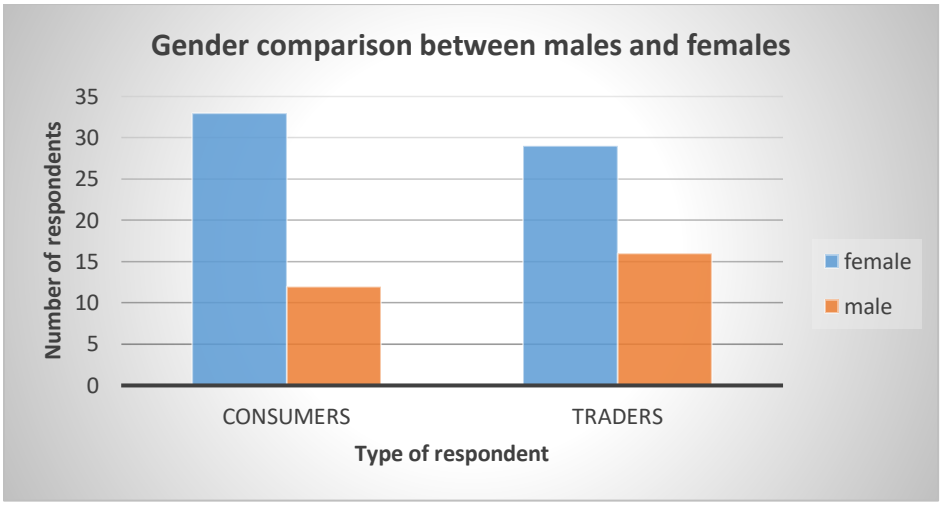


Source: Author field data, 2019

4.1.1.2 Gender comparison between males and females

The study population comprised a higher number of females than males for both consumers and traders. This finding is in line with the general population dynamics of the study area that show there are more females than males in Makueni county (see figure 9 below).

Figure 8: Gender comparison between consumers and traders

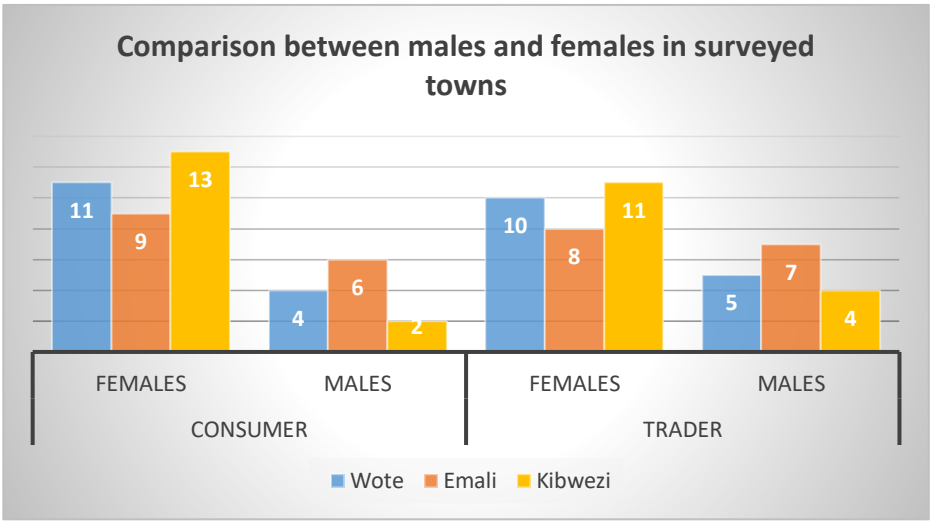


Source: Author field data, 2019

4.1.1.3 Gender relations between consumers and traders

Kibwezi town had a higher number of female consumers (13) and traders (11) compared to the other towns surveyed. Conversely, Kibwezi town had the lowest number of male consumers and traders respectively. The number of males was lower among consumers and traders as shown in figure 9 below.

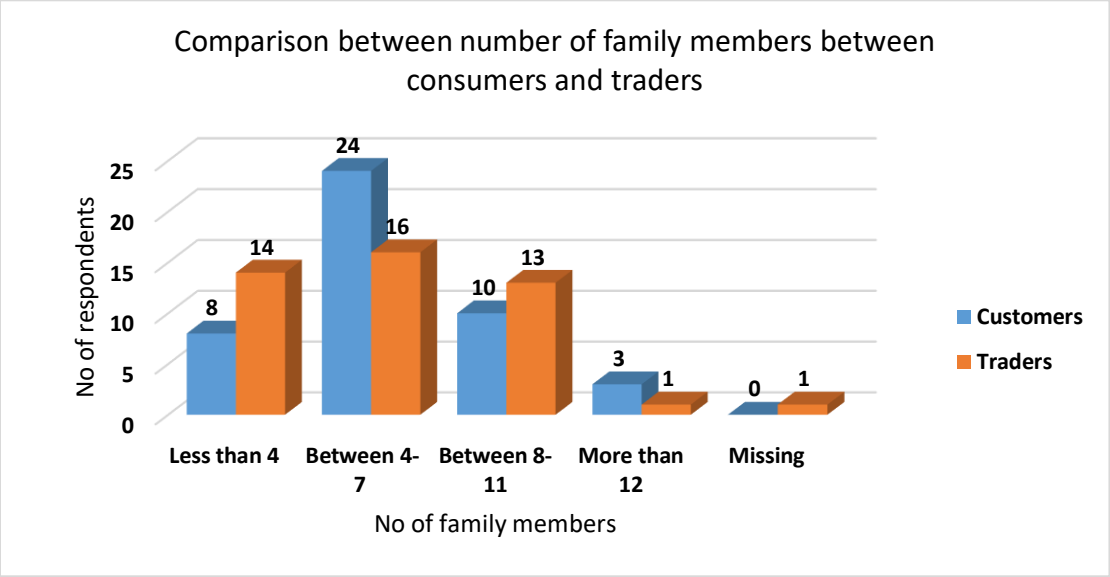
Figure 9: Comparison between gender relations among consumers and traders



Source: Author field data, 2019

Figure 10 shows both consumers and traders had a family size of between 4-7 members. One of the traders did not respond to the question hence the missing value of 1.

Figure 10: Number of family members in the study population

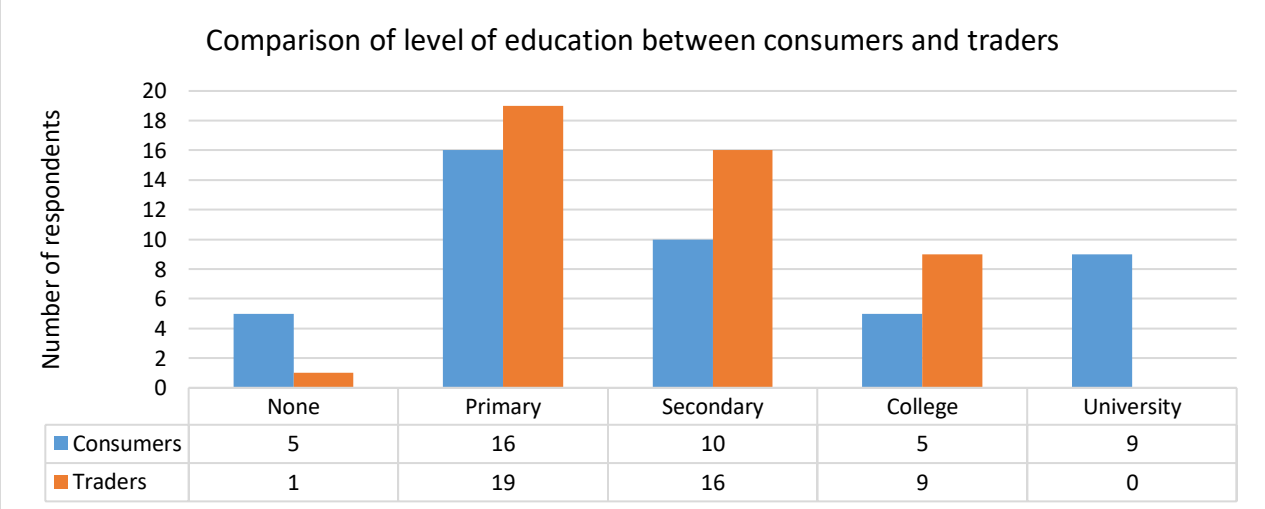


Source: Author field data, 2019

4.1.2 The education level of consumers and traders

A high number of respondents had received both primary and secondary education. Traders had a higher education level (primary, secondary and college) compared to consumers in the study population. However, none of the traders had received a university education. See figure 11 below.

Figure 11: Comparison of the level of education between consumers and traders



Source: Author field data, 2019

A one way ANOVA test on the level of education level and consumer awareness in food safety in fruits P = 0.025 showing there was a significant difference between the level of education level and consumer awareness in food safety in fruits. See appendix 3.

4.1.3 Traders market information

The table shows the weekly sales volume by traders and the number of days they open businesses per week. Nearly half of the traders (49%) sell between 100-250Kg per week and 60% open their businesses six days per week. Half of the traders (51%) do not have employees and thus operate the businesses by themselves as shown in table 11.

Table 10: Traders market information

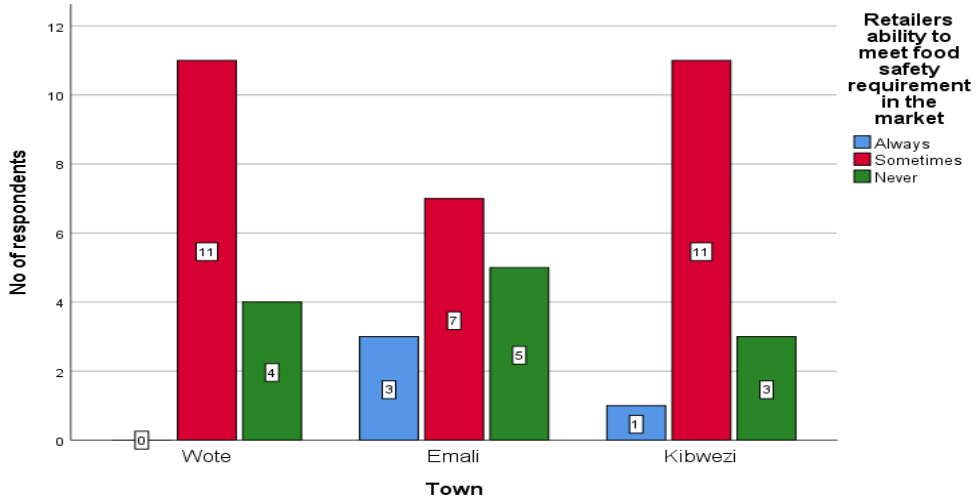
Weekly mango sales volume	**Volume sold**	**Frequency**	**Percent**	**Valid Percent**
	less than 100Kg	10	22.2	22.2
	100-250 Kg	22	48.9	48.9
	251-500 Kg	10	22.2	22.2
	more than 500 Kg	3	6.7	6.7
	Total	45	100	100
Number of days business is open in a week	**Days open**	**Frequency**	**Percent**	**Valid Percent**
	6 days	27	60	60
	7 days	18	40	40
	Total	45	100	100
Employees or no employees	**Days open**	**Frequency**	**Percent**	**Valid Percent**
	yes	22	48.9	48.9
	no	23	51.1	51.1
	Total	45	100	100

Source: Author field data, 2019

4.1.4 The ability of retailers to meet food safety requirements in the domestic market

Most consumers in the Wote, Emali and Kibwezi towns had a feeling that sometimes (64%) of retailers have the ability to meet food safety requirements in the domestic market. 27% of consumers in the 3 towns retailers never meet food safety requirements in the market as indicated in Figure 12 below.

Figure 12: Ability of retailers to meet food safety and standards



Source: Author field data, 2019

Mann- Whitney test on the consumers' view on traders' ability to meet food safety requirements in the three towns reveal P =0.000 thus there is a significant difference between the three towns in traders' ability to meet food safety requirements. Traders in Kibwezi town have a higher ability to meet food safety requirements in the domestic market compared to the other 2 towns.

4.1.5 Awareness of food safety among consumers and traders

4.1.5.1 Consumers

There was a difference between males and females on consumer-level of awareness on food safety. More males (83%) than females (64%) were aware of food safety (P = 0.011, see appendix 2). Research findings show that more males than females were aware of food safety though females constituted a larger number (33) of the study population.

Table 11: Consumer awareness of food safety

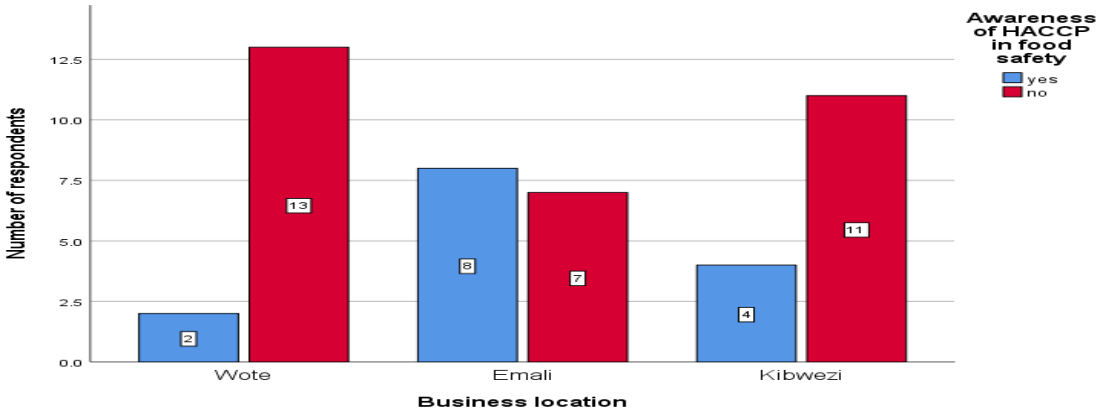
	Males			Females		
Response	No of respondents	Percent	Valid Percent	No of respondents	Percent	Valid Percent
Yes	10	83.3	83.3	21	63.6	63.6
No	2	16.7	16.7	12	36.4	36.4
Total	**12**	**100**	**100**	**33**	**100**	**100**

Source: Author field data, 2019

4.1.5.2 Traders

HACCP is relatively unknown in food safety among traders as revealed by the results in the three towns. However, in Emali town, 53% of the traders were aware of HACCP as compared to 26% of the traders in Kibwezi and 13% in Wote (see figure 13).

Figure 13: Awareness of HACCP in food safety among traders



Source: Author field data, 2019

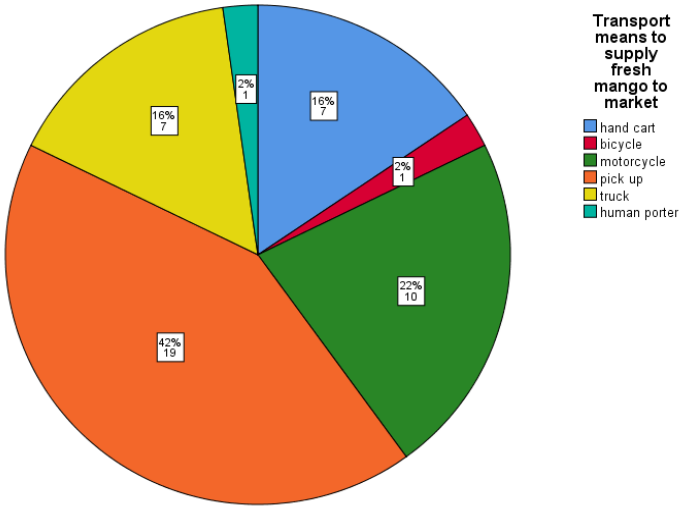
4.1.6 Correlation between traders awareness on HACCP and sourcing of fresh mango

A test carried out to find the correlation between traders awareness on HACCP and sourcing of fresh mango show a Pearson's coefficient value of r = + 0.073 which indicates a very weak positive correlation (P = 0.633). The correlation between two the variables (independent variable: traders awareness on HACCP and dependent variable: sourcing of fresh mango) shows no significant difference (see appendix 4 for analysis table).

4.1.7 Post-harvest handling and transportation of mango

Response from traders revealed that the commonly used means of transport to supply fresh mango to the market was pick up vehicles (42%). Besides, motorcycles, handcarts and trucks are common means of mango transport to the market. See figure 14 below.

Figure 14: Choice of transport means to supply mango in the domestic markets

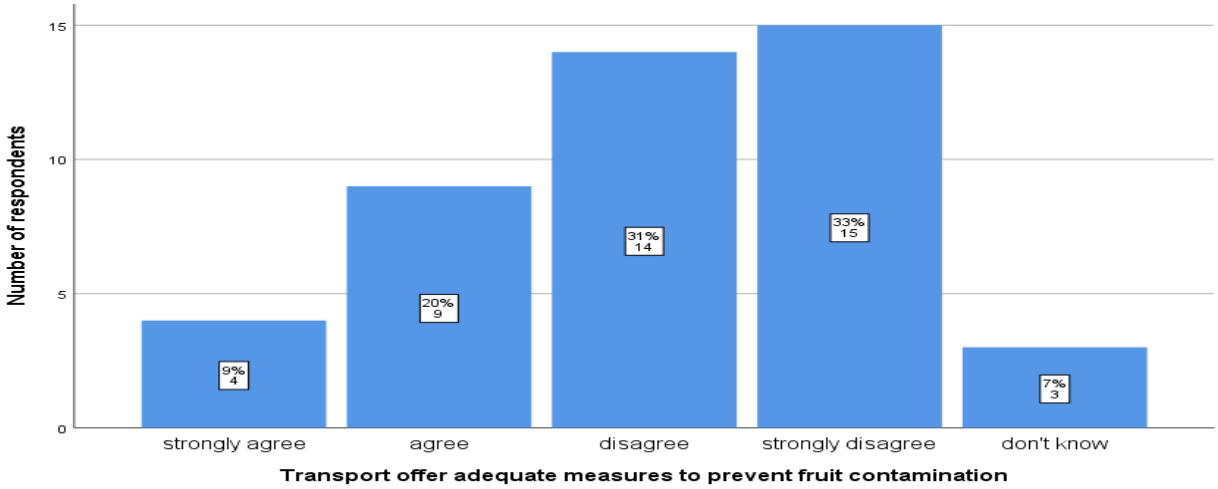


Source: Author field data, 2019

4.1.7.1 Fruit contamination during transport

Most traders (64%) felt that the transport means do not offer adequate measures to prevent contamination of mango during transport to the market. 9% of the traders strongly agreed that transport means offer adequate measures to prevent fruit contamination (figure 15).

Figure 15: Transport means offer adequate protection to prevent fruit contamination



Source: Author field data, 2019

4.1.8 Safety of packaging materials

Consumers provide 62% of mango packaging materials in the domestic market while traders provide 38% of the packaging material. Consumers use corrugated boxes, handwoven bags and gunny bags to package mango in the market. Traders, on the other hand, use plastic crates, wooden boxes, plastic nets, large corrugated boxes and direct packing into pickups as they transport produce to the market. However, regardless of the provider of packaging materials consumers expressed an opinion that the packaging materials are safe (see table 12).

Table 12: Provider and safety of packaging material

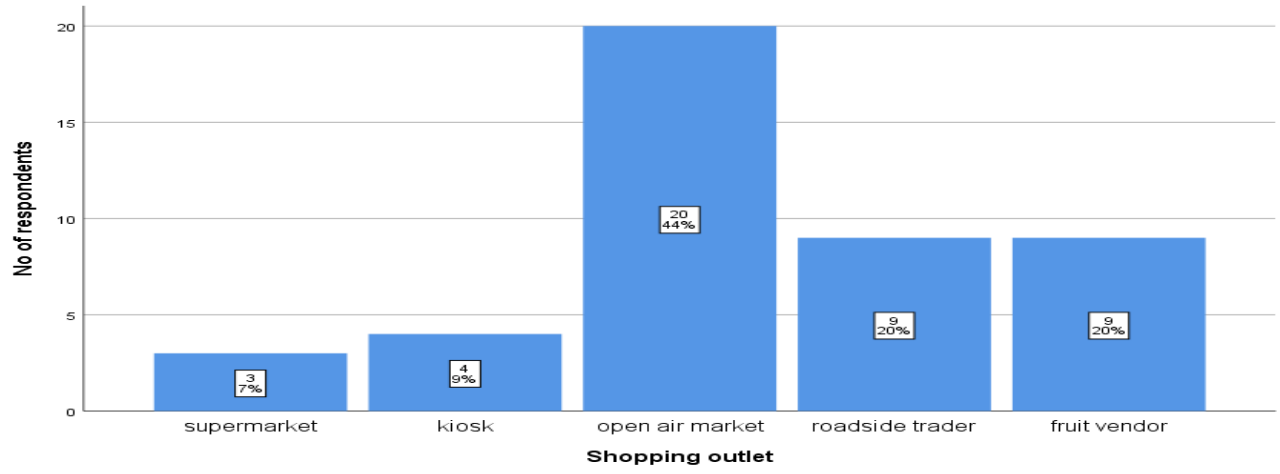
Packaging materials provider for mango			
	Frequency	Percent	Valid Percent
Trader	17	37.8	37.8
Consumer	28	62.2	62.2
Total	**45**	**100**	**100**
Safety of packaging materials			
	Frequency	Percent	Valid Percent
Very safe	13	28.9	28.9
Somewhat safe	15	33.3	33.3
Safe	15	33.3	33.3
Not safe	2	4.4	4.4
Total	**45**	**100**	**100**

Source: Author field data, 2019

4.1.9 Shopping outlets for fresh mango

Among the study population, more consumers (44%) buy their mango from the open-air market. The supermarket is the least preferred shopping outlet (7%) for mango. Roadside traders were the second preferred shopping outlet by consumers (see figure 16).

Figure 16: Shopping outlets for mango in the domestic market

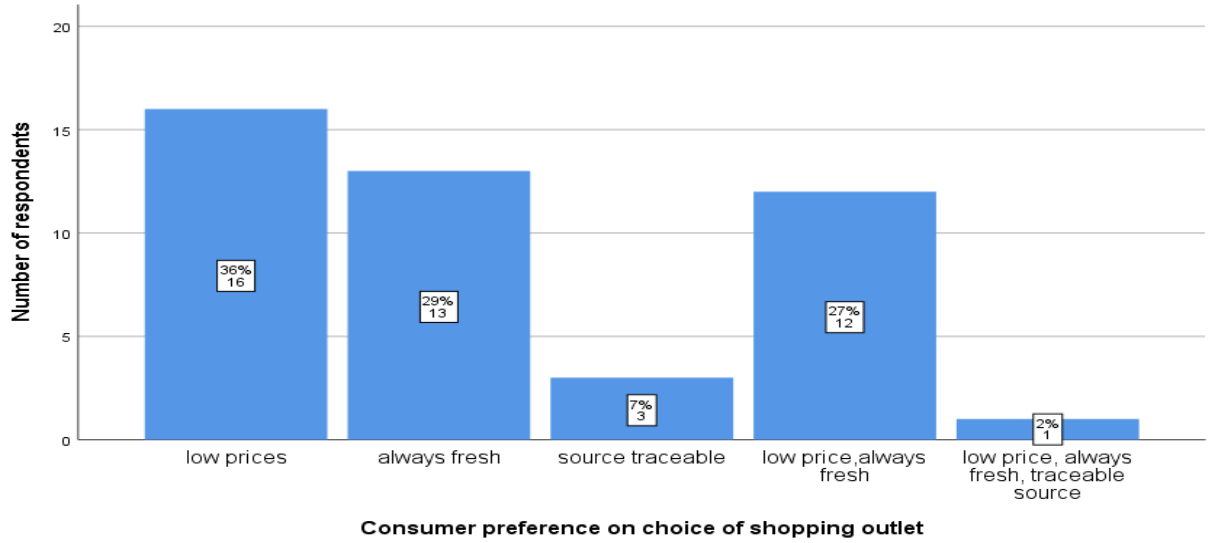


Source: Author field data, 2019

4.1.10 Consumer influence on the choice of shopping

Some consumers (36%) were guided by low prices in making a choice on where to buy fresh mango. Only 7% of consumers considered a traceable source for their mango produce as an important factor to consider while buying a mango. However, a combination of low prices and freshness of fruits (27% of consumers) was a significant choice to influence consumer choice of shopping outlets. See figure 17 below.

Figure 17: Choices for shopping outlet among domestic consumers



Source: Author field data, 2019

4.1.11 Drivers for choice for mango among traders

Profit margins, as opposed to a safety guarantee, is the key motivator for the choice of mango retail outlet among traders. Table 13 shows what motivates retailers in choosing the mango they offer to their consumers.

Table 13: Choice of mango at retail outlets

Choice of mango at retail outlets					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	consistent supply	17	37.8	37.8	37.8
	profit margin	24	53.3	53.3	91.1
	safety guarantee	4	8.9	8.9	100.0
	Total	45	100.0	100.0	

Source: Author field data, 2019

4.1.12 Consumers' willingness to invest in food safety

A majority 78% of consumers were willing to pay up to 5% of the retail prices for mango if food safety was guaranteed and assured. A small proportion of consumers (6.75%) were willing to pay in excess of 7.5% higher price for a guarantee on food safety (see table 14 below).

Table 14: Consumers' willingness to pay more for safety guarantee

The extra proportion of price consumers willing to pay					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 2.5%	20	44.4	44.4	44.4
	2.5-5%	15	33.3	33.3	77.8
	5-7.5%	7	15.6	15.6	93.3
	more than 7.5%	3	6.7	6.7	100.0
	Total	45	100.0	100.0	

Source: Author field data, 2019

4.1.13 GlobalGAP contribution to food safety in mango

Half of the consumers (53%) had knowledge of GlobalGAP requirements in food safety compared to 47% of consumers who did not have knowledge of food safety as indicated in table 16 below. The standard deviation of the responses was 0.504.

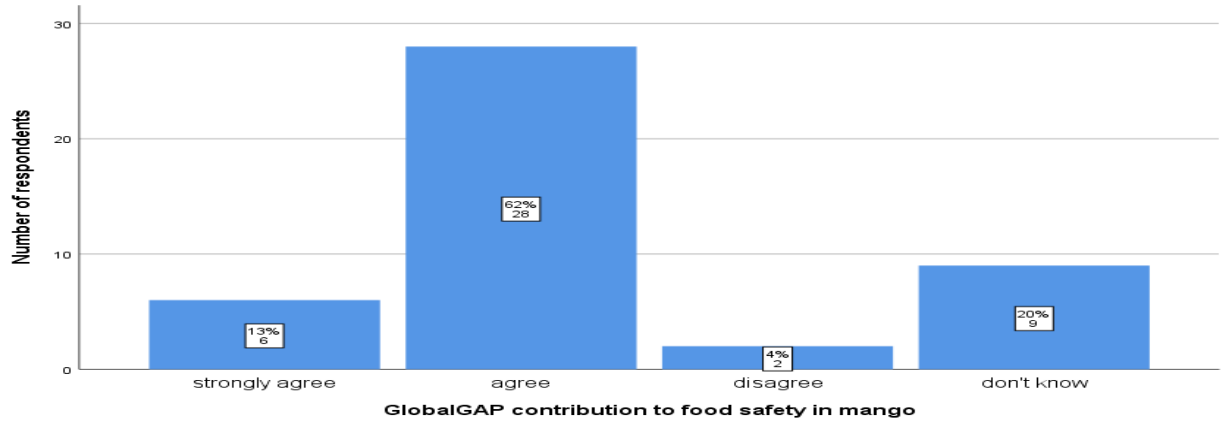
Table 15: Awareness of GlobalGAP contribution to food safety

Knowledge of GlobalGAP requirements in food safety					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	24	53.3	53.3	53.3
	no	21	46.7	46.7	100.0
	Total	45	100.0	100.0	

Source: Author field data, 2019

A majority of consumer respondents (75%) agree with the opinion that the use of GlobalGAP contributes to food safety in mango. Likewise, 20% of consumers did not know GlobalGAP contribution to food safety. A minority of consumers (4%) disagreed that GlobalGAP contributed to food safety in mango. See figure 18 below.

Figure 18: GlobalGAP contribution to food safety in mango



Source: Author field data, 2019

4.1.14 Training on food safety

Out of the 45 trader respondents, 64.4% had not received training on food safety, while 33.3% had received training. One respondent missed out in providing an answer to the question (see table 16 below).

Table 16: Training traders on food safety

Training on food safety					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	15	33.3	34.1	34.1
	no	29	64.4	65.9	100.0
	Total	44	97.8	100.0	
Missing	System	1	2.2		
Total		45	100.0		

Source: Author field data, 2019

The training was provided by different kinds of organizations: NGOs (35%), private service providers (30%), National government (23%) and County government (13%). The mean of the training providers was 2.875 with a standard deviation of 1.04 (see table 17). However, five respondents did not mention who provided their training thus no response was included.

Table 17: Training providers for traders

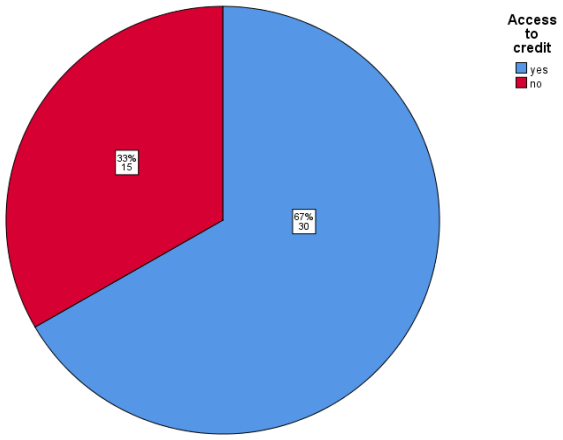
Training provider							
	Frequency	Percent	Valid Percent	Minimum	Maximum	Mean	Std. Deviation
County government	5	11.1	12.5	1	4	2.875	1.04237
National government	9	20	22.5				
Private service providers	12	26.7	30				
NGO	14	31.1	35				
Total	40	88.9	100				
Missing system	5	11.1					
	45	100					

Source: Author field data, 2019

4.1.15 Access to credit facilities and interest rate charges

The majority of traders (67%) have access to credit facilities compared to 33% who have no access to credit for their businesses (see figure 19).

Figure 19: Access to credit facilities

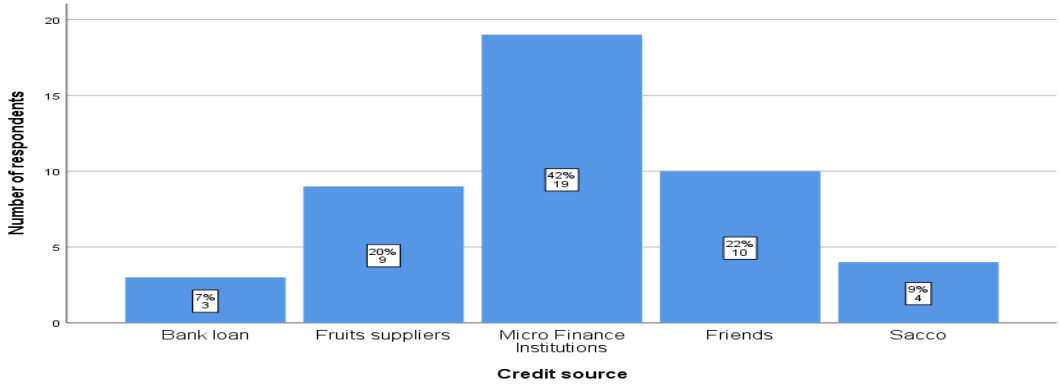


Source: Author field data, 2019

4.1.16 Source of credit for traders in the DFMVC

The largest proportion of traders (42%) operate their businesses with credit obtained from Micro Finance Institutions (MFI) (see figure 20). Friends (22%) and fruit suppliers (20%) are alternative sources for credit. Only 7% of traders obtain loans from banks.

Figure 20: Sources of credit for traders

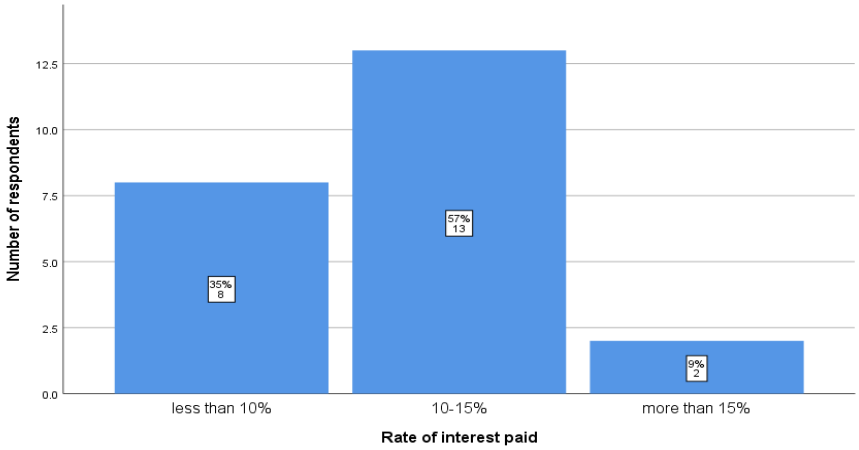


Source: Author field data, 2019

4.1.17 Interest rate charges

The rate of interest charged by financial institutions varies depending on the financial institution. Majority of traders (57%) paid an interest rate of 10-15% on their borrowed credit, while 35% paid less than 10% interest and a paltry 9% paid more than 15% interest on credit.

Figure 21: Rate of interest charged by financial institutions



Source: Author field data, 2019

A chi-square test on the link between the interest rate and the kind of financial institution P=0.011 (appendix 6) showing there is a significant difference between credit source and the rate of interest paid by traders. Fruit suppliers and friends do not charge interest. Cross tabulation results (appendix 5) show MFI are more preferred as they charge less than 15% interest rate.

4.2 Qualitative results

This section gives the results of FGDs, interviews with key informants, stakeholder meeting and observations made during field surveys (see appendix 7). FGD for certified producers had 3 women (37.5%) and 6 men (62.5%) whereas FGD for non-certified producers had 2 females (28.5%) and 5 males (71.5%).

4.2.1 Gaps in the current food safety legislation of DFMVC

The implementation of food safety in the county level is tasked with the departments of Public Health and Agriculture.

Organizational capacity: County departments clearly understand their mandate on food safety and standards though limited by resource availability. The Makueni Health Bill 2018, Vision 2025 and the County Integrated Development Programme (CIDP) 2018-2022 provides food safety and quality measures, though still at the draft stage. The distribution of tasks and responsibilities within the departments is clear. However, tasks between departments of Agriculture and Public Health are not well defined in terms of food safety and quality standards on which department is responsible. Other than a routine sampling of food at retail outlets, there are no regular and clear systems and processes to monitor food quality and safety. There are no existing County rules, procedures and guidelines on food safety and quality control. The physical work environment, office equipment and transport are inadequate.

Table 18: Organizational capacity of County departments

Priority	**Organizational capacity**				
Score	**Organizational capacity domain**	Red (0-25%)	Amber-red (26-50%)	Amber-Green (51-75%)	Green (76-100%)
	Understanding of mandate			**X**	
	County policy, legal and regulatory framework			**X**	
	Management & leadership		**X**		
	Systems and processes i.e. Management of Information Systems (MIS)		**X**		
	Rules, procedures and guidelines	**X**			
	Infrastructure and equipment	**X**			
	Learning and information sharing		**X**		

Source: Author field data, 2019

Institutional enabling environment: The Public Health Act Cap 242 and Food Drugs and Chemical substances Act Cap 254 are the legal frameworks used in ensuring food safety and quality control, though the enforcement is minimal. County has not developed a food safety policy; a draft policy has been developed but has not been submitted to the county assembly for approval. There are poor interdepartmental collaboration and lack of proper coordination and information sharing. There exist poor ICT networks and partnerships on matters of food safety, quality standards and enforcement. Community understanding of food safety and quality standards are low, the community views enforcement as a burden. There is also political interference in enforcing food safety and standards.

Table 19: The institutional enabling environment

Priority	**Institutional enabling environment**				
Score	**Institutional enabling environment capacity domain**	Red (0-25%)	Amber-red (26-50%)	Amber-Green (51-75%)	Green (76-100%)
	Policy (County/National), legal and regulatory framework		**X**		
	Coordination and information sharing	**X**			
	ICT/ logistical infrastructure		**X**		
	Formal and informal networks and partnerships		**X**		
	Attitudes, perceptions and degree of stakeholder support	**X**			

Source: Author field data, 2019

At the national level, are 20 Acts of Parliament that govern food safety and the responsibility of ensuring food safety is shared amongst 17 government ministries and regulatory agencies. This makes food safety control complex as coordination is difficult.

4.2.2 The inefficiencies in the implementation of standards

As revealed by the key informant in the department of Public Health, the key challenges faced in food safety implementation include political interference among citizenry where prosecutions are interfered with when the county government considers the prosecuted individuals as potential voters. This makes enforcement on standards a challenge. Low staffing levels and unclear roles between the departments of agriculture and public health on who is mandated to enforce standards and lack of policy on food safety.

The CECM Agriculture identified the key challenges facing the mango value VC as:

- Poor compliance to Global GAP requirements and standards
- Low uptake of credit for mango production especially by smallholder farmers
- Low access and uptake of technologies in modern farming like the use of bait and pheromone traps among producers
- Low participation by youth in the VC activities like tree nursery businesses (pointing out that none out of the 14 registered nurseries is owned by youth)
- Poor coordination of value chain players and increased incidences of adulterated pesticides and fertilizers in the agrochemical stores
- Inadequate supply of certified mango tree seedlings (current seedlings supply stands at 123,000 against a demand of 520,000 per year)

While weak coordination of regulatory organizations coupled with inadequate resources and technical capacity to manage effective surveillance has led to quality inefficiencies and exposure to food safety risks for domestic consumers as identified by HCD, the department of Public Health identified a lack of sanitation facilities in domestic market infrastructure as a key challenge. Most toilet facilities have no water, litter collection is haphazard and the markets are not big enough to accommodate all the traders.

4.2.3 Constraints hindering regulatory organizations from performing their roles

Staff shortage, reduced budgetary allocation from the exchequer and lack of stakeholder coordination deter inspections at all border and entry points into Kenya thus some produce passes into uninspected as identified by KEPHIS.

4.2.4 Food safety implementing Departments (Agriculture and Public Health)

In Makueni County, implementation and enforcement of food safety regulations and standards are tasked to the department of Public Health and the Departments of Agriculture. Noting the central role undertaken by the two departments in food safety and standards enforcement, the research study made the following findings on understanding the performance, capacity of individual staff, organizational capacity as well as the enabling environment for the implementation of food safety in the DFMVC. The results are based on the two departments' self-assessment as provided by CECM Agriculture and County Public Health Officer (CPHO).

Overall performance: The two departments' score of 26-50% shows a lack of commitment by the departments. Routine food safety checks done although not adequate due to staff shortage. Food inspections are done on a routine basis in all food outlets (wholesale fresh fruits markets, roadside traders, fruit parlours, kiosks, hotels) to ensure food safety. Limited funding, unavailability of food testing equipment and low staffing levels have been a critical hindrance (see table 20).

Table 20: Departments' overall performance

Priority	Organizations' overall performance

Score	Red (0-25%)	Amber-red (26-50%)	Amber-Green (51-75%)	Green (76-100%)
		X		

Source: Author field data, 2019

Gender mainstreaming: The research study found that the two departments do not discriminate on gender during the implementation of food safety and quality initiatives (see table 21).

Table 21: Gender mainstreaming

Priority	Organizations' gender mainstreaming			
Score	Red (0-25%)	Amber-red (26-50%)	Amber-Green (51-75%)	Green (76-100%)
			X	

Source: Author field data, 2019

The capacity of individual staff: Inadequate staff to ensure food and quality standards implementation in health and agriculture departments. Technical skills and competencies for available staff are adequate. Functional skills and competencies are adequate in planning and reporting. County departments understand their responsibilities with regard to food safety and quality standards. Interdepartmental collaboration between health and agriculture is commendable but other departments like devolution, finance, trade, Interior and coordination are left out.

Table 22: The capacity of individual staff

Priority	The capacity of individual staff				
Score	Individual capacity domain	Red (0-25%)	Amber-red (26-50%)	Amber-Green (51-75%)	Green (76-100%)
	Staffing levels		X		
	Technical skills & competence			X	
	Functional skills & competence			X	
	Performance culture			X	
	Team spirit		X		

Source: Author field data, 2019

4.2.5 Food safety development infrastructure

In an effort to provide an enabling environment for the fast-tracking adoption of food safety in the DFMVC, a number of interventions have been put in place by the national government through support infrastructure for testing pesticide residues and heavy metals. These include:

4.2.5.1 The Analytical Chemistry Laboratory (ACL)

The ACL offers a wide range of analytical and advisory services and its run by trained and skilled staff. The year 2018 saw KEPHIS acquire a new machine to expand its scope of pesticide molecules analysis using Liquid Chromatography-Mass Spectrometer and Gas Chromatography-Mass Spectrometer to 286 pesticide molecules. The scope of heavy metal analysis expanded to 20 elements using Inductively Coupled Plasma fitted with Mass Spectrometer detectors (ICPMS). In the last 3 years, the number of

samples analyzed for heavy metal grew from 85 in 2015/16 to 642 in 2017/18 thus indicating improved capacity.

The ACL conducted Good Laboratory Practices (GLP) and supervised residue trials on mango for sulfoxaflor and its metabolite for Codex MRLs setting, a process that involved field application of test substances, sampling, analysis and data submission to Joint FAO/WHO Meeting on Pesticide Residues (JMPR) for technical evaluation and adoption of MRLs (KEPHIS, 2018).

4.2.5.2 The National Pesticide Residue Monitoring Plan (NPRMP)

KEPHIS has been supported by United States Agency for International Development (USAID) FOODSCAP project, (Feed the Future Kenya Agriculture Regulatory Capacity Building Program) to monitor food safety through checking for food contaminants and setting pesticide residue limits. The ACL carry out pesticide monitoring levels for the domestic market. In 2018, 65 mango samples were taken and analyzed. From the results of the analysis, one sample (1.54%) had positive pesticide detection that exceeded the set of EU MRLs.

4.2.6 Potential food safety risks and hazards

Findings from the FGDs reveal that the uncertified farmers are not very keen on observing PHI and only use pesticides available in the shops. They, however, confirmed that they sometimes sell to exporters and supermarkets who buy mango during the peak season in November and December. On the other hand, despite compliance with GlobalGAP certification and keen observance to MRLs, the certified producers were not aware of the possibility of microbial contamination of mango during harvesting and post-harvest handling and only categorized chemical residues as the only food safety risk.

4.2.7 The motivation of chain actors to support food safety

4.2.7.1 Inputs support

Findings from CECM Agriculture, a key informant indicated that in order to boost mango production, two new tree nurseries were established in 2018 and 13,500 mango seedlings distributed to farmers by the county government. The department of agriculture distributed 3,000 fruits flytraps to help control pest infection.

4.2.7.2 Capacity building of stakeholders

Interview with CECM Agriculture revealed the county government support to smallholder producers enhance the quality of the production through which 5,055 farmers were trained on GlobalGap certification and Nzaui Farm Co. Ltd a group with about 100 farmers received GlobalGAP certification. ASDSP II supports and facilitates service providers and stakeholders mandated on implementation of food safety measures to capacity build chain actors in mango VCAs as well as sensitization of citizenry on food safety through public participation gatherings and forums.

As established during an interview with HCD (key informant), the directorate is currently doing sensitizations on KS1758 in food safety in response to the many challenges faced by stakeholders including increased cancer cases and lifestyle diseases among the Kenyan population. 5 sensitization forums were done in 2017/18 targeting organized producer groups and department of Agriculture staff in Makueni County while KEBS did 1 sensitization forum in Makueni County.

According to information from KEPHIS (key informant), ACL has trained 2 organized farmer groups (Nzaui farm co. Ltd and Kwa Kyai Irrigation Self Help group) on requirements for market compliance with respect to food safety and the adoption of standards. Stakeholder partnerships and collaboration were identified as a strong link to ensure the implementation of food safety in the DFMVC.

As reported by ASDSP II, Safaricom, (Telecommunications Company) has collaborated with the MoALF to support the establishment of digital e-extension service “Digifarm” a solution developed to provide

agricultural solutions to smallholder farmers through a digital platform. This digital platform bridge the knowledge gap among smallholder farmers through e-extension.

4.2.7.3 Sensitizations on KS 1758 and group certification

Training has also been done on contract farming, safe and effective use of pesticides and GAPs in collaboration with FPEAK. In total 500 farmers have undergone sensitization on KS 1758 in the county. Nzaui Farm Co. Ltd has undergone GlobalGAP certification while Kwakyai Irrigation Self-Help Group has undergone an audit for GlobalGAP certification. Micro Enterprises Support Program Trust (MESPT) met the certification and audit costs.

4.2.7.4 Enforcement of KS1758 and compliance

Interview with HCD established that the directorate has a code of practice, which offers guidelines on the implementation of contractual farming by highlighting the roles played by producers and dealers of horticultural produce. The law mandates HCD to enforce KS1758. The Department of Public Health observed that in the surveillance on food safety, inspections are done on premises including markets to ensure they meet minimum public health standards. Personal hygiene and medical certification also checked among food handlers.

In 2018, KEPHIS carried out 59 nursery inspections and certifications in Kenya among which two were from Makueni County. 700 seedlings were intercepted and destroyed at different entry points into Kenya, as they did not conform to standards. The presence of live pests, documentation errors and absence of import documents was the basis for rejections.

4.2.7.5 Stakeholder collaboration and networking

Findings from FGDs show that exporters provide training to producers through partnerships with MESPT (local NGO) and FAO. Producers had a group EurepGAP certification with MESPT (NGO) paying the certification costs. Interview findings from HCD show working relationships among stakeholders. For example, HCD has been working with the Kenya Horticulture Council (KHC) to ensure food safety and standards in the domestic market. Together with Horticulture Competent Authority Structure (HCAS) and National Taskforce on Horticulture, joint programs are being developed to deliver training on food safety to horticulture stakeholders. A case in point is the FOODSCAP project, (Feed the Future Kenya Agriculture Regulatory Capacity Building Program) supported by USAID to monitor food safety through checking for food contaminants and setting pesticide residue limits. The NHTS is funded in the second phase by USAID and will cover Makueni County in piloting for food safety in the domestic mango value chain. The sampling of produce for MRL testing is done in partnership with KEPHIS as revealed by findings from KEPHIS, HCD, KEBS and the department of Public Health.

4.2.8 Domestic market support infrastructure to food safety and standards compliance

4.2.8.1 Observations made on the domestic open-air markets places

During the survey, the researcher visited 3 markets in the county and made the following observations

- The county government has put up market structures across the three towns surveyed. These are Wote, Emali and Kibwezi. The markets have raised platforms with lockers for the safekeeping of produce. Electricity is provided for lighting.
- There were no litter collection bins for garbage disposal. Piles of garbage were evident in the three towns surveyed. This comprised of damaged and rotten fruits and vegetable parts. The collection of garbage is done twice weekly.
- Of the towns visited, only two had functional toilet facilities. The toilet facility in Emali was in a state of disuse as it lacked basic amenities like water and hand wash facilities. Toilets in Wote and Kibwezi markets were operational and charged a fee of 0.09 euros for single use. Most traders had a feeling the charges were high for them to afford and often most resulted in using other public amenities nearby like hotels.

- None of the markets had running water. The taps were dry and water storage tanks in Kibwezi market had been damaged. In Wote and Emali, the tanks were empty and tap dry. Traders bought water from water vendors for cleaning their fruits and vegetables. However, many expressed concern over the quality of water as the source could not be trusted.
- The market structures were not big enough to accommodate all the traders in Wote and Emali. Some traders sold their produce in the pavements of the building thus exposing them to dust contamination. A number of traders made fruit salads for their consumers. All except one lacked the basic food safety requirements. The attendant wore a headscarf, white overall and shoes, hand gloves and the processing equipment was clean.

4.2.9 The chain governance system in the DFMVC

4.2.9.1 Market segmentation

From the FGDs, it is established that both certified and non-certified producers supply the top supermarkets in the country with mango. Certified producers sell to exporters who supply the supermarkets while the uncertified producers also supply supermarkets through informal channels run by brokers. Major markets for the mango include supermarkets like Naivas, Tuskys (across the country) and local supermarkets like Mulleys and Eden Mart supermarkets (in Makueni County). Other market outlets include wholesale markets, open-air markets, fruit parlours and kiosks. Institutional consumers like schools, universities and hospitals use the open tender systems in which the lowest bidder wins the supply contract by the institution.

4.2.9.2 Contract farming

Findings from FGDs reveal GlobalGAP certified producers had written contractual agreements with their exporters. However, they do not take part in drawing and negotiations in the contract and only append their signatures on what exporters have prepared. On the other side, non-certified producers rely on oral contracts and mutual trust to sell their produce. Occasionally they are let down since traders take advantage of their disorganization to offer them low prices. Shedex Fresh World Exporters noted that *'Side selling' harms business as it's difficult to predict precisely the exact volumes to deliver to the markets thus disadvantaging traders who are keen to respect contractual obligations with producer groups'.*

4.2.9.3 Information flow and pricing mechanisms

FGD findings show both GlobalGAP certified producers and non-certified producers were aware of the domestic market requirements in mango. The producers grew mango for the export market where they sold the first grade and supply local supermarkets with second-grade mango. Second and third grade was sold to wholesale domestic markets in the country. GlobalGAP certified farmers sourced market information and quality from exporters while non-certified producers sourced market information from local traders. However, certification did not offer opportunities for better prices since the previous season, both certified and uncertified farmers sold mango at an average price of 0.15 euro/ per 450 grams piece and 0.1 euro/ 300 grams piece.

4.2.10 Creating linkages along the value chain

Formation of producer organizations as evidenced by Nzaui Farm Co. Ltd and Kwakyai Irrigation Self-Help Group provides opportunities for collaborations to advance food safety. MESPT, a local NGO met the certification costs for Nzaui Farm Co. Ltd and audit for certification for Kwakyai Irrigation Self-Help Group. Nzaui Farm Co. Ltd as found during the FGD is already pursuing avenues for the direct export market in the UAE. Likewise, through the support of MESPT, a modern collection centre is under construction that will act as a bulking centre for their produce before dispatch to the market. The domestic market offers an avenue to sell their second and third-grade mango. This transformation has seen the producer group

strive to get a share of the upmarket price segment through a negotiated contract to supply the leading supermarket chain in Kenya, Tuskys from the beginning of the season on October 2019.

The CECM Agriculture revealed during key informant interview that financial linkages have been made between producers and other actors to reputable financial service providers for financial and advisory support although financial literacy has been low. About 26-50% of VCAs have been linked to financial service providers and the County has developed initiatives to support gender such as 'Tetheka fund' for women, youth groups as well as individual farmers. About 30% of targeted beneficiaries have received funding some of whom include people with disabilities and women.

GAPs compliance in certified and non-certified farms

Table 23: Average land size and plant population in certified and uncertified farms

	Certified	Non certified
Average size of land (acre)	3.55	4.2
Average no of trees	156	130
Average no of trees/ acre	44	31

Source: Author field data, 2019

The results point out that on average certified farms have a higher plant density compared non-certified farms. Both the certified and non-certified farms grow improved varieties sourced from nursery operators within the area.

4.2.11 Consumers and trader's preferences and awareness of food safety and health

A majority of consumers (64%) held the feeling that sometimes traders met food safety requirements (see figure 12). This research found more males (83%) consumers than females (63%) were aware of food safety (table 11). However, the awareness did not translate into safety guarantee during shopping for mango. Most consumers (44%) usually buy a mango from open-air markets and are often guided by low prices (36%) rather than safety guarantee (see figure 17). Traders on the other side transport their mango using pick up (42%) and motorcycle (22%) which do not provide adequate means to prevent fruits contamination as 64% of consumers expressed their feelings against the mode of transport (see figure 14 and 15). Traders too are guided by profit margins (53%) as opposed to safety guarantee (9%) as the source for their fresh mango (see table 13).

4.2.11.1 Constraints and challenges facing smallholder producers

- Lack of adequate certified planting materials and adulteration of agro-inputs available in the markets. During the main mango season, some unscrupulous businesspersons offer adulterated products to farmers. Farmers are unable to identify genuine from adulterated products. Surveillance by PCPB is low and farmers end up making huge losses.
- Lack of adequate training on food safety requirements and standards. High GlobalGAP certification costs making smallholder farmers unable to afford unless supported by NGOs. Local consumers and markets do not demand compliance.
- Overexploitation by buyers and intermediaries by offering low prices for mango despite quality assurance. A small price difference (0.04 euro) only exists between export and domestic markets but traders are not willing to pay more for quality mango from the farmers.
- Low uptake of credit for mango production by smallholder farmers. Most financial institutions require a deposit of collateral before credit can be disbursed to farmers. Inadequate financial management skills is a major constraint.

4.2.11.2 Summary of key findings from the FGDs

- Food safety risks and hazards are unknown among the uncertified farmers' especially microbial contaminations.

- The domestic market segment handles mango from both certified and uncertified farmers. However, the mixing of produce from both certified and non-certified farmers is possible and common in the markets (including the supermarkets and high-end outlets).
- Certified farmers have a competitive edge over their uncertified counterparts in market access, production technologies and training. However, both groups suffer from low prices.
- Opportunities exist for linking certified producers to upgrade in chain activities and supply exporters with the quality grade for the domestic market.
- Enforcing contract farming in domestic markets offers price stability but most buyers are unwilling to take commitment.

4.2.11.3 Summary of findings from key informant interviews

- Many stakeholders in the DFMVC do not appreciate the importance of standards in promoting trade. Smallholder farmers do not have qualified technical people who appreciate what standards can work in developing self-regulating systems of trade.
- There are many agencies and institutions with overlapping mandate hence duplication of roles. Sometimes the roles among government agencies are not very well defined.
- The County government of Makueni has been slow in domesticating legislation and many regulations hardly exist. This creates a vacuum in implementation of food safety.
- A general mentality among stakeholders that the government is supposed to supervise the implementation of standards rather than the stakeholders themselves. Due to the shortage of staff among government agencies, full enforcement and implementation are lacking.
- Political interference of court processes when implementing food safety regulations leading to non-prosecution especially during electioneering period. The politicians sometimes protect offenders as they consider them potential voters.

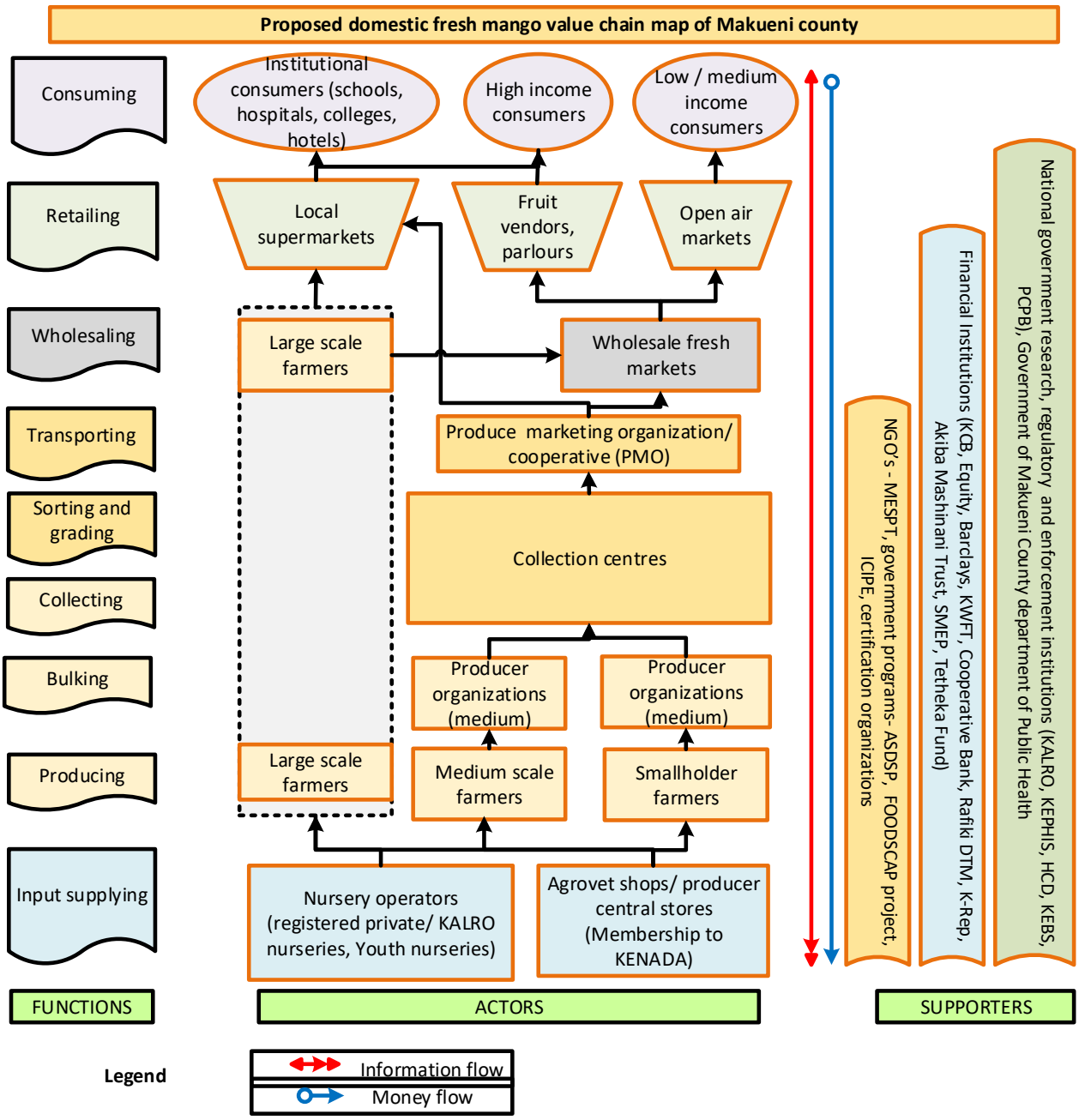
4.2.12 Proposed mango value chain map

During the stakeholders meeting held at the County Hotel, Matiliku, stakeholders proposed to bridge the gaps in food safety and standards by the inclusion of youth, women and people with disabilities (PWD). With a youthful population constituting 24% of the total population, there are opportunities that youth can exploit. Nursery operators, spray service providers, mango harvesters are strategic opportunities for youth as identified by stakeholders. 'Tetheka fund', Youth fund, from the national government through the ministry of youth and sports allows for funding investments among the youth. Also identified were opportunities to create vertical and horizontal linkages through the formation of producer groups and produce marketing organizations increase the bargaining power of producers against low prices offered by traders. Nevertheless, the ability of producer organizations to integrate chain activities in an organized manner offers the preferential possibility to enhance chain governance.

The proposed mango chain map incorporates smallholder farmers coming together to form a producer organization (PO). Several POs coalesce together to form a producer marketing organization (PMO) that will be registered as a cooperative. The cooperative was proposed to take charge of marketing, while POs do the production. POs will deliver produce to the collection centres.

The new domestic marketing system will have 3 segments. High-income consumers, institutional consumers and low/ medium income consumers with possibility of export once negotiations are completed with the buyer in UAE.

Figure 22: Proposed mango value chain map



Source: Author field data, 2019

4.2.13 Gaps and proposed interventions from the stakeholder meeting

Stakeholders raised several issues and forged a way forward towards fast-tracking adoption of food safety and standards in the DFMVC. They noted the critical role played by each chain actor and without pointing fingers agreed to launch a common front in food safety and standards. Below is a table (14) with the identified need and the proposed interventions.

Table 24: Prioritized gaps and proposed strategic interventions

Priority gaps	Existing interventions	Proposed Interventions	Lead department/ organization
Lack of awareness of food safety and standards among value chain actors (from market to smallholder producers)	None	Lead agencies (HCD and department of Public Health) in ensuring food safety stamp their authority and ensure standards are followed guided by Crops Act 2013.	Department of Public Health, HCD
KS1758 hardly unknown to many stakeholders as the standard was published only in Kenya Gazette	2 KS1758 sensitizations done to producers	More sensitizations on KS1758 to be done to all stakeholders	HCD, KEBS
Limited funding to enhance enforcement	None	Develop resource mobilization plan and forward budget proposals to the county for consideration	Public Health, Agriculture
Inadequate qualified technical staff at County	None	Staff employment	County cabinet/Public Service Board
Poor stakeholder collaboration	Food and nutrition fora	Establish a multi-stakeholder forum where issues on food safety can be addressed	KEBS, HCD, KEPHIS, Department of Public Health and Agriculture
Unclear roles and responsibilities between agriculture and public health on food safety implementation	None	Develop a clear mandate for Agriculture and Public Health	Agriculture and Public Health
Lack of clear county rules, procedures and guidelines regarding food safety and quality standards development	None	Formulation of County rules, procedures and guidelines. Currently, a draft policy in place awaiting submission to the county assembly for approval.	Public Health, Agriculture, Devolution, County assembly
Poor systems and processes to monitor food safety and quality standards	None	Establish a strong system and structure to monitor food quality and safety	Public Health, Agriculture, HCD
Minimal enforcement of food safety laws	None	Strengthening enforcement and training on KS1758. Implementation of Crops Act 2013, Public Health Act Cap 242, Food Drugs and Chemical substances Act Cap 254	Public Health, Agriculture, Devolution
Poor attitude toward food safety and standards enforcement measures	None	Behavioural change/ attitude, sensitization and training	KEBS, HCD, Public Health, Agriculture, devolution
Lack of traceability in mango among producers	NHTS	Include Makueni county in phase II of the project from October 2019 when funds are available	HCD, Department of Agriculture, KEPHIS

Source: Author field data, 2019

5.0 DISCUSSION

This research on fast-tracking the adoption of food safety and standards in the DFMVC had two research questions. One, the weaknesses in policy and regulatory framework that hinder the adoption of food safety and standards in the domestic fresh mango value chain DFMVC and two, the enabling environment in the DFMVC to ensure the implementation of food safety regulations and standards. The results from the findings as enumerated below.

Weaknesses in policy and regulatory framework

The domestication of national laws into the county laws was not expected to take long to be completed after the promulgation of the current constitution in 2010. This research, however, has established that the County government of Makueni has not domesticated the national laws into the county laws. No food laws and regulations are in place. Nevertheless, a draft policy on food safety has been developed and await submission to the county assembly for approval and adoption. The time period between now and the submission to county assembly is fundamental since the delay would envisage maintaining the status quo in a county that direly needs legislation to fast track the implementation of food safety.

This research found out that in Kenya, there exist 20 Acts of Parliament that govern food safety with a shared responsibility amongst 17 government ministries and regulatory agencies. Given the dexterity with which food safety issues should be handled, the existence of multi-governmental agencies with varying degrees of influence in the food sector further complicate implementation. The study identified from several key informant interviews charged with the mandate to implement food safety and standards that there exist many agencies and institutions with an overlapping mandate and duplicated roles. At times, the roles among government agencies are not very well defined. Significantly, this further contributes to the complexity of national food safety control systems. Similar findings were observed by FAO and WTO (2017) and Otieno (2016) pointing out this as a bottleneck to food safety implementation in developing countries. Findings by FAO (2017) supported these research findings, which established that the implementation of food safety and standards is hampered by the existence of fragmented legislation, multiple jurisdictions, and weaknesses in surveillance as well as haphazard monitoring and enforcement.

Political influence and perception of stakeholders on food safety

Nothing about food safety takes place in a political vacuum. However, the case of interference in court processes by political forces is peculiar to Kenya. Politics is supposed to build legislations on safety but not deter its implementation. This research study identified political influence and interference of court processes when prosecuting and enforcing standards to offenders as a major hindrance. This result goes contrary to many other researchers on the same field of food safety. This research identified that when Public Health department closes down food joints that do not meet food safety regulations, the local administration intervenes and prosecution does not take place. In the DFMVC, many stakeholders do not appreciate the importance of standards in promoting trade. They have a mentality that enforcement is a burden on them. The general attitude among stakeholders that the government is supposed to supervise the implementation of standards rather than the stakeholders themselves point to lack of awareness on the importance of food safety regulations and standards. This is partly due to the lack of awareness of KS1758 among value chain actors and partly due to poor attitude toward food safety and standards enforcement measures among stakeholders. Otieno (2016) made similar findings suggesting the major hurdles in food safety should be fast-tracked to ensure that domestic consumers are not exposed to food hazards.

Food safety risks, hazards and traceability

The potential food safety risks and hazards as identified in the research are biological, chemical and physical. This research found that hazards are likely to be introduced at any time and at any point in the food chain during production, harvesting, packaging and labelling, transportation, storage and trading. In

the domestic markets segment, several critical hazards exist that pose adverse risks to consumers. Rampant waste disposals methods, lack of waste disposal bins and lack of toilets with functional hand wash facilities in domestic open-air markets are critical hazards to food safety. During production, inappropriate use of pesticides without keen observance to PHI, wrong application methods of pesticides, use of expired and adulterate pesticides pose a grave danger in food safety. The sheer ignorance of the appropriate use of pesticide shutters dreams for a safe food environment. Contributing to this menace is the lack of an accountable traceability system for the domestic market. The use of water of unknown quality to clean fruits is also a potential threat as microbial pathogens could be present in water as noted by the World Bank Group (2016). These findings corroborate with Chemeltorit, et al (2018), who noted that the value and meaning of traceability systems weaken as the food systems become more fragmented and that the tendency reverses for food products supplied to the domestic market. Similar findings by André & Oskar, (2017) denoted that sometimes even when produce is certified, it is difficult to ensure producers meet the requirements, as no traceability systems exist.

This research identified glaring inefficiencies by traders in the domestic market to meet food safety. The transportation mode used, exposes fruits to contamination from dust, vehicle exhaust fumes and soil. In addition, some traders display their mango by the roadside on the ground using mats and gunny bags exposing fruits to dust contamination. This research identified nearly half of the consumers pointed out that retail outlets do not meet standards for food safety. However, the majority of consumers prefer to buy their fresh mango from the same open-air markets that have more exposure to hazards than the supermarkets as they are driven by low prices rather than traceable sources of produce. A new dimension here is exposed: could there be other factors driving consumers to behave in this manner? Research findings show consumers' views, preferences and choices, prior knowledge, risk perceptions and trust in the information around them influence attitudes towards food safety (Britwum, 2017). Thus, further research in the field of consumer behaviour is hereby recommended.

The establishment of the NHTS in September 2016 to supplement the national standard (KS1758-2:2016) as it offers new market opportunities for farmers and buyers to create better-organized supply chains that support relationship building and information flow vertically along the chain to enhance quality and safety. Though still at infancy, the implementation and enforcement are lacking. These findings complement FAO and WTO (2017), who observed that traceability component in food safety management is of paramount importance but if used singly, the system offers no guaranteed accomplishment of food safety and quality requirements.

Value chain upgrading strategies

This research observed that all chain actors are concerned with food safety because they too are consumers. Regulatory agencies too are consumers and therefore carry many of the biases and perceptions held by consumers in general on food safety. Nonetheless, regulatory agencies typically have a higher level of training in food safety than their stakeholder counterparts do.

The current situation in Makueni County presents an array of opportunities for creating linkages on safe food. Driven by the increased consumer awareness on food safety and the presence of two modern supermarkets (Mulley's and Eden Mart supermarkets) in the county, there is enormous potential to supply the consumers with safe mango. As suggested by Hammoudi and Hamza (2015) good agricultural practices (GAPs) in the export segment could overflow into domestic supply chains. This overflow represents an opportunity to enhance the availability of safer and better quality mango fruits in the domestic markets (Canali, et al., 2016). Interestingly, tapping on these linkages can create opportunities to prevent food wastage and losses by offloading safe produce to the domestic value chain. Shedex Fresh World Exporters confirmed the findings of Gema et al (2018) that fruits that are not are exported are absorbed in the domestic market and improvement of domestic production practices can benefit local consumers. Gema et al (2018) further noted that consumers are increasingly becoming more aware of food safety issues

than ever before, thus an increase in demand resulting from increased awareness and concern about food safety in the domestic market segment, calls for need to concentrate on production of fresh fruits that meet minimum safety and quality standards.

Increased awareness on food safety

This research confirms the view that there is increased consumer awareness of food safety as the driver to the adoption of standards. Though not influenced by the level of education, there is an increased knowledge of food safety. These findings support findings from Britwum, (2017) who suggested that consumers' views, preferences and their distinctive tendencies, prior knowledge, risk perceptions and trust in the information available to them, influence attitudes towards food safety (Britwum, 2017). Nevertheless, the retail market segment is not compliant with food safety regulations. More consumers are motivated by low prices and freshness of fruits as they buy. From a consumer standpoint, it is difficult to determine safety by 'looks' since safety is an intrinsic attribute. However, the desire to have quality mango, drive consumers to spend more as long as quality and safety are guaranteed as this research established. These findings are supported by FAO and WTO (2017) who also found that consumers are increasingly concerned about food-related risks, including health hazards due to microorganisms, pesticide residues and physical hazards like dust and consequently are willing to spend more for guaranteed safety.

The survey results show consumers willing to pay a higher price for a guarantee on safety assurance and quality. This growing trend is informed by increasing consumer awareness of food safety, as survey results found that majority of consumers (78%) were willing to pay up to 5% of the retail prices for mango if food safety was guaranteed and assured. However, the results of this research must not be extrapolated largely without additional studies with a larger population sample. This is because the research was limited to a small size of FGDs and survey population.

Furthermore, technological improvements in laboratory work have made it easier to measure and document food contaminants (pesticide residues, microorganisms and heavy metals) and their impacts on human health. These results corroborate findings from FAO and WTO (2017) that consumers were increasingly concerned about food-related risks. Subsequently, Okello (2008) identified the key driver to safe food as the rise in consumer incomes enabling them to pay more for safe food as identified in this research. These results match with the finding by FAO (2018) who noted that consumers were willing to offer a premium price for good quality mangoes if safety was guaranteed.

Gender mainstreaming and youth empowerment

The study recognizes that gender mainstreaming and youth empowerment are not given prominence. Though the department of Agriculture and Public Health at the county level have put emphasis on gender mainstreaming, other segments of the value chain show different results. However, the confinement of women into certain nodes of the value chain reflects the cultural stereotypes on gender roles, abilities and inequalities with respect to access to opportunities. As the research identifies, limited participation in economic activities by youths, women and persons with disability is disturbing. Noting the youthful population constitutes 24% of the total population, there is a huge opportunity to empower youth and women economically as suggested by FAO and WTO (2017), Otieno (2016). Special allocation for women in the government services like procurement, allocation for market stalls in the domestic markets and facilitating investment activities like fruit tree nurseries are avenues for promoting youth, women and people with disabilities (Ministry of Agriculture, Livestock and Fisheries and the Council of Governor's secretariat, 2017).

Domestic market governance and segmentation

This analysis adds a new dimension to the literature on value chains, food safety and standards. First, these findings are consistent with findings from previous studies. As Schrader (2015) and Ruben et al (2007) describe in market governance transactions require very little or no formal cooperation between

the chain actors and that governance structures are developed to support the execution of transactions in the most efficient way. Standards play a critical role in shaping how value chains are governed and managed, how contracts are drawn and the structure of compliance to standards. It is a pity that domestic mango value chain lacks self-governing mechanisms among producers to ensure adherence to the set code of practice. These self-regulating mechanisms would determine how group members carry out agronomic practices and avoid the problems associated with lack of GAP compliance.

From a food safety standpoint, it can be concluded that because of the development and enforcement of standards, safety-related outcomes are twofold, positive and negative. The positive outcomes include the use of safe ways to govern the mango value chain and help farmers gain access to markets and the ability of the same standards to induce information and technology transfer and hence enabling value chain upgrading. The resultant effect is the production of uniform quality and standardized product thereby elevating competitiveness amongst producers and traders. Negatively, compliance with standards may lead to an increase in transaction costs for producers and lead to the exclusion of smallholder producers from the domestic formal supply chains. Their exclusion would mean they continue supplying uncertified produce to the market.

Producer certifications and market linkages

Adherence to GlobalGAP is identified as a key requirement in sustainable food safety implementation plans. Sensitization forums on HACCP are valuable considerations as well as certifications of producer groups. Exceptionally, negotiated contractual arrangements are necessary for determining a farmer's participation in domestic production. Membership to a producer organization, on the other hand, is significant in determining smallholder involvement in production, as there are shared benefits like collective access to quality inputs, training and market access. The economies of scale in joining producer organizations are highly used for chain coordination. Along with the strengthening of producer organizations, the reformulation of contractual agreements with clear-cut defined price benefits is a more sustainable alternative for smallholders to participate fully in adopting food safety and standards in domestic chains.

Sustainability practices

Feed the Future Kenya Agriculture Regulatory Capacity Building Program, a USAID FOODSCAP project, implemented by KEPHIS from 2018, is a classic example of sustainability practise in monitoring food safety through checking for food contaminants and setting pesticide residue limits. Smallholder farmers are the beneficiaries of this project. This is because the initiative promotes the use of alternative cost-effective and environment-friendly technologies (e.g fruit fly traps, baits and other biological measures to control pests. As a result, the promotion of GlobalGAP compliant zones would offer safe assurance on MRLs which this research recognized with growing concern among uncertified smallholder producers.

It is important to point out sustainability and food safety complement each other. The reduction in the use of pesticides among producers and Food safety is an overriding factor for economic growth. Broadly, sustainable practices address risks related to production far outside what food safety covers. From a sustainability perspective, food safety is a key part that interweaves both social and environmental issues. Sustainably supporting the governments' effort to fast track adoption of food safety regulations creates a room for reinforcing regulations that enhance food safety thus ensuring greater sustainable development.

5.1 Reflection as a researcher

The long journey to the development of this thesis begun with a project proposal. Being relatively new in the field of applied research challenged me during the proposal development phase with numerous corrections on the research topic, problem statement, research questions and conceptual framework. After successful defence of the proposal, and getting a green light to proceed for data collection the intricate part begun. Doing research in my home county was imagined as a walk in the park, little did I

know that it would cost me sleepless nights during pretesting of the survey questionnaires when it dawned on me that translating the questions to the local language was an uphill task. After amendments to the survey questionnaires, and pretesting the questionnaire, I was satisfied that it would enable me collect the data in line with my research questions. However, some technical challenges occurred when some respondents could not understand some questions clearly even after pretesting the questionnaires. Looking back to a few sections that were left unanswered by some respondents, I feel there is possibility of having lost some significant information.

The research methods used were 2 FGDs with smallholder farmers (certified and uncertified farmers), 11 key informant interviews with government agencies, departments and exporter, observations, 1 stakeholder meeting as well as 2 surveys (traders and consumers). However, the sample size for the survey was small and this could have affected the validity of the results from the survey. With caution, the results of this research should not be extrapolated largely without additional studies with a larger population sample of consumers and traders. The sample size may not justify blanket recommendations for the whole county. Importantly, similar results were obtained by other authors using different population samples thus building confidence that this research made a significant contribution to fast tracking adoption of food safety in the domestic market.

During my proposal development, I had indicated to have key informant interviews with managers in specific organizations. As it turned out several changes had to be considered. First, being an offseason production for mango, minimal mango field activities were ongoing, save for pest control and a little harvesting of the off-season crop. The Makueni fruit processors being an off-season for mango had closed down for maintenance and it was impossible to get an audience with the management of the processing plant. Booking appointments with the general and senior managers was not easy as for most of the time they were very busy and unavailable for interviews. However, heads of departments provided the much-needed information. From this, I learned that patience is a virtue every researcher should develop.

During research, I found some important key informants who had not been included in my proposal. For example the ASDSP II program which has been at the forefront in value chain development of the mango subsector in the county. ASDSP II provided plenty of useful information without which this research would be incomplete. County Executive Committee Member (CECM) Agriculture provided information and data on mango following the redeployment of the County Director of Agriculture to the sub-county level. Though not initially targeted as key informant. This reorganization and readjustment did not sway the objective of the research in any way. In fact, more information was gathered and this contributed to more reliability of data.

Doing research work in my employer organization was tricky. This is because my supervisor at work was a key informant. Though I already knew most of the answers to the checklist, I had to ask to get the opinion and answers from my supervisor. The line dividing my research work and official duties had to be drawn. This helped in clearly defining my duty as a researcher. During data collection with FGDs, stakeholder meeting and surveys, I only introduced myself as a researcher and student. This was to avoid the biased information I would get if I introduced myself as working with HCD, as some respondents would give sugar coated answers and not really the situation on ground. Triangulation of research with different tools, methods and research provided for avenue to cross check the information and make data collected more concrete.

6.0 CONCLUSIONS

The research on fast-tracking the adoption of food safety and standards in the DFMVC identified the weaknesses in policy and regulatory framework that hinder the adoption of food safety and standards. The enabling environment that ensures the implementation of food safety regulations and standards spotlights different dynamics surrounding the sustained efforts to ensure the fast-tracking adoption of food safety in the domestic mango value chain. The domestication of KS1758-2:2016 for fruits and vegetables and the harmonization to global standards through the technical multi-stakeholder National Food Safety Coordination Committee (NFSCC) was the beginning point towards the development of food safety initiatives in the domestic market. Development of the KenyaGAP initiative and the KS 1758 code of practice have made an immense contribution to the upgrading of local value chains. However, as identified in this research, several loopholes still do exist in the implementation and enforcement of safety standards in the domestic mango chain.

Gaps in the current food safety legislation of DFMVC: At the county level, lack of clear county roles, procedures and guidelines regarding food safety and quality standards development hinders the full implementation of food safety regulations. However, the development of the draft policy on food safety at the county level awaiting tabling to the county cabinet for approval brings a ray of hope towards achieving a county food policy to enhance food safety regulations in the domestic market.

Inefficiencies in the implementation of standards in the DFMVC: In Kenya, the Public Health Act Cap 242 and Food Drugs and Chemical substances Act Cap 254 are the legal frameworks used in ensuring food safety and quality control. However, the existence of 20 Acts of Parliament that govern food safety and the sharing responsibility of ensuring food safety amongst 17 government ministries and regulatory agencies, contributes to the complexity of national food safety control systems. As a result, enforcement is negligible.

The formation of the National Food and Nutrition Security Policy 2011 to address issues related to food safety and quality by providing guidelines on safe high-quality food and regulations have borne little fruits. On the other hand, the NFNSCC whose secretariat is the Ministry of Public Health, has limitations in carrying out enforcement of food safety and the transformation of this committee into authority is a strategic base for sealing the gaps in food safety. Moreover, the launch of KHC is seen as an opportunity to further the agenda on food safety and the adoption of standards.

Constraints regulatory bodies face in performing their roles of enforcing food safety and standards: Regulatory agencies face numerous constraints in delivering their mandate on food safety enforcement. The capacity to carry adequate surveillance is crippled by low staffing levels and inadequate budgetary allocation from the national exchequer. Then again, the presence of many agencies and institutions with overlapping mandate leads to duplication of roles and reduced efficiency. Therefore, streamlining coordination among government agencies thus is seen as an avenue to create a pool of resources for monitoring and enforcement.

Food safety risks and hazards in the DFMVC: Hazards can be introduced at any time at any point in the food chain during production, harvesting, packaging and labelling, transportation, storage and trading. The inappropriate use of pesticides especially the exceedance of set MRL limits and the associated risk of environmental contamination, the mode of transport used to deliver mango to the market exposing fruits to vagaries of possible contamination from dust, vehicle exhaust fumes and soil affect negatively sustained efforts to food safety. Lack of waste disposal bins and lack of toilets and hand wash facilities in domestic open-air markets are critical hazards in food safety. The use of water of unknown quality to clean fruits is also a potential threat as microbial pathogens could be present in water.

The motivation of chain actors: To boost mango production establishment of new tree nurseries and their certification, distribution of mango seedlings and fruit fly traps to farmers by the county government is a

motivation for smallholder farmers to increase production and enhance the quality of the production. Capacity building farmers on GlobalGap certification is a big boost towards developing new markets to supply safe food to consumers who are food safety-sensitive. Partnership support and facilitating service provision to stakeholders mandated on implementation of food safety measures, capacity building of mango VCAs, as well as sensitization of citizenry on food safety through public participation gatherings and forums, aim at ensuring food safety is assured in the DFMVC.

Domestic market support infrastructure to enhance compliance to food safety and standards: The markets are designed with raised platforms, lockable for the safekeeping of produce. However, lack of litter collection bins for garbage disposal, functional toilet facilities, clean running water and inadequate capacity to accommodate all the traders are perceived as limitations to food safety as they pose risks to fruits contamination. Open-air markets and roadside traders though preferred by most consumers (440% and 20% respectively) are the high-risk points of food contamination.

The chain governance system in the DFMVC: Both certified and non-certified producers supply the top supermarkets in the country with mango, as well as wholesale open-air markets through formal and informal channels. Thus, the likelihood of mixing of produce in the market is high as there is no traceability system in place for the domestic market. Sadly, as the findings of this research reveal certification does not offer opportunities for better prices for producers as both certified and uncertified farmers sell mango at the same price. However, the market segmentation offers different prices for the same mango. This submits that farmers have either little or no price negotiation skills or lack horizontal and vertical linkages. The fragmented nature of farmers allows overexploitation by traders.

Opportunities to create vertical linkages along the value chain: Formation of producer groups like Nzaui Farm Co. Ltd and Kwakyai Irrigation Self-Help Group is an opportunity to get collaborators who promote food safety. Linkages to markets, extension service, certification and audit programs can be fast-tracked through organized groups. Horizontal integration broadens the pool of knowledge through sharing information thus an opportunity to expand the bargaining power of producer groups and price negotiations for better value share among producers.

Consumer and trader awareness and preferences on food safety and health: A majority of consumers (64%) have the feeling that sometimes traders meet food safety requirements with more males (83%) consumers than females (63%) being aware of food safety. However, this awareness does not translate into safety guarantee during shopping for mango. Most consumers buy a mango from open-air markets and are often guided by low prices rather than safety guarantee. Traders on the other side transport their mango using open pickups and motorcycles, which do not provide adequate means to prevent fruits contamination as contamination from dust, exhaust vehicle fumes as well as deterioration in quality. Traders too are guided by profit margins as opposed to safety guarantee as they buy fresh mango from the smallholder farmers.

6.1 Applied recommendations

Fast-tracking review of government policies on food safety: As this research identifies, some legislation is not implemented at the county level. The Makueni Health Bill 2018, vision 2025 and the CIDP 2018-2022 provides food safety and quality measures. The CECM Agriculture and Public Health have a duty to ensure the draft is presented to the county assembly the soonest for discussion and approval. Speeding up policy development can be achieved through public participation in which the two departments can initiate. On the other hand, awareness creation and promotion of policy adoption among stakeholders are prudent in stepping up the review and adoption of government policies on food safety. This can be achieved through concerted efforts by all stakeholders as this research identified all sector players are consumers and hence affected by the risks and hazards posed by unsafe food.

Sensitizations and capacity building of stakeholders: This research identified that the KS1758 unknown to many value chain actors. Thus recommends developing sensitization forums led by KEBS and HCD to publicize the KS1758 through the mass media for general awareness creation. Further sensitization forums must aim at the improvement of produce quality to meet KS1758 standards. HCD have a duty to take lead to stamp authority and ensure standards are followed as mandated by Crops Act 2013.

Innovative approaches and stakeholder collaboration: Market-driven innovations inspire chain actors to be dynamic and responsive to adoption. The recent launch of e-extension platform (DigiFarm) led by Safaricom in partnership with the MoALF and the new pest-free zone campaign initiative by KEPHIS will play a pivotal role in containing misuse of pesticides and exceedance to set MRLs. This is because the initiative promotes the use of alternative cost-effective and environment-friendly technologies (e.g. fruit fly traps, baits and other biological measures to control pests. Promotion of GlobalGAP compliant zones would offer safe assurance on MRLs, which this research recognized as a major concern among uncertified smallholder producers.

Improving domestic open-air markets: It is recommended for the county government to allocate a budget this financial year for the improvement of domestic market infrastructure as a matter of concern. Regular and routine cleaning, provision of litter collection bins and clean supply of potable water are essential in the market. Market superintendents should make provisions to ensure all to traders are accommodated in the markets. Enforcing regulation by the Department of Public Health and HCD guided by the crops Act 2013 will ensure food is sold under hygienic conditions.

Formation and strengthening of Producer Organisations: As already identified in the Makueni CIDP 2019, access to inputs, proper marketing coordination among producer organizations, transporters and traders enhance the sustainability of mango value chain. The County department of Agriculture in collaboration with the department of Devolution are duty-bound to take lead in mobilizing group formation and coordination initiatives to form strong producer organizations with negotiation power to influence chain activities. Targeting all mango smallholder farmers based on the geographical locations, producer groups can be formed at the sub-county and ward levels and members capacity build on leadership skills and group dynamics to avoid group conflicts. Promoting networking and information sharing across the producer organizations would promote an enabling environment for fast-tracking adoption of food safety and standards. Establishment and marketing produce through certified collection centres and increasing the area under production is a strategic base to enhance safety along the value chain.

Nursery registration and certification: The County acknowledges the inadequate supply of clean planting materials from certified nurseries. Youth and women should take up the opportunity to have certified nurseries supported by Youth fund, 'Tetheka fund' and MFI whose interest rates are lower than 10%. This initiative will enjoy the support of HCD and KEPHIS fast track the registration and certification processes to reassure producers of quality planting materials.

Promoting linkages among chain actors: Linkages among chain actors can influence domestic market intelligence systems and information sharing. Tapping on the findings that fresh fruits that meet food safety and quality standards are in high demand by a large segment of the domestic consumers. The increasing concern about food-related risks and health hazards due to microorganisms, pesticide residues and physical hazards; is imperative to create linkages among chain actors who can supply safe food, as consumers would be willing to buy. A premium price for safe mango would trigger compliance among producer groups. Enforcement of contract farming would ensure the code of practice in horticulture is followed. ASDSP II through the value chain approach can spearhead this initiative backed by HCD on contract enforcement.

The PCPB must improve surveillance on regular inspections of agro-input dealers and increase vigilance for adulterated products. Establishment of an agro-dealers network and affiliation to Kenya National Agro-

Dealers Association (KENADA) would ensure close surveillance on the use of inputs thus save farmers the huge losses they incur from adulterated products.

Youth and women inclusion in mango value chain activities: Youth representation in mango value chain activities is low and as identified in the draft policy on ASDSP II. By offering a dynamic workforce that is innovative the DFMVC presents a huge opportunity for the creation of employment like through entrepreneurship in the transport, service provision like spray operators, crop management, fruit consolidation and trading activities that the county acknowledges is lacking.

6.2 Limitations of the study

The focus of this study was limited to the DFMVC in Makueni County. However, the data developed was used to draw general conclusions on food safety regulations and standards in the domestic mango value chain. Due to limitation in time and resource constraints, data were collected in six weeks. This time was not enough to delve deep into all areas of food safety and the research only spotlighted a segment of value chain actors including smallholder producers, traders and consumers in the towns of Wote, Emali and Kibwezi. However, the research did not fail in emphasizing the missing links of roles played by national and county government regulatory organizations in the stepping up adoption of food safety regulations and standards especially the departments of Public Health and Agriculture at the county level.

The study did not look at the extent to which standards are known in the domestic market. Secondly, the study overlooked views concerning standards and their contribution to value chain upgrading as this research area has been widely explored by other authors. However, this study has brought up a number of gaps in policy findings and stakeholder engagement strategies along the value chain, which present important changes in fast-tracking adoption of food safety and standards implementation in the domestic market.

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Appendix 1: Retailers ability to meet food safety requirements

Test Statistics		
	Town where survey was done	Retailers ability to meet food safety requirement in the market
Chi-Square	.000[a]	21.733[a]
Df	2	2
Asymp. Sig.	1.000	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 15.0.

Source: Author field data, 2019

Appendix 2: Consumers awareness of food safety

Test Statistics		
	Gender of respondents	Consumer awareness on food safety
Chi-Square	9.800[a]	6.422[a]
Df	1	1
Asymp. Sig.	.002	.011

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 22.5.

Source: Author field data, 2019

Appendix 3: One way ANOVA test on consumer level of education and awareness in food safety

ANOVA					
Consumer education level					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.524	1	8.524	5.368	.025
Within Groups	68.276	43	1.588		
Total	76.800	44			

Source: Author field data, 2019

Appendix 4: Correlation between traders' awareness on HACCP and supply of fresh mango

Correlations

		Awareness of HACCP in food safety	Fresh mango supplier
Awareness of HACCP in food safety	Pearson Correlation	1	.073
	Sig. (2-tailed)		.633
	N	45	45
Fresh mango supplier	Pearson Correlation	.073	1
	Sig. (2-tailed)	.633	
	N	45	45

Source: Author field data, 2019

Appendix 5: Crosstabulation results for credit source and rate of interest paid

Rate of interest paid * Credit source Crosstabulation

Count

		Credit source				
		Bank loan	Fruits suppliers	Micro Finance Institutions	Sacco	Total
Rate of interest paid	less than 10%	2	1	5	0	8
	10-15%	0	2	10	2	14
	more than 15%	1	0	1	0	2
Total		3	3	16	2	24

Appendix 6: Chi -square test on source of credit and rate of interest paid

Test Statistics

	Credit source	Rate of interest paid
Chi-Square	18.000[a]	9.000[b]
df	4	2
Asymp. Sig.	.001	.011

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 9.0.

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 8.0.

Appendix 7: Interview list of key informants

Organization	Information provided
HCD Manager, Regulations and Compliance	Role of HCD in standards enforcement, regulations, challenges in the implementation of food safety and standards, gaps in policy
HCD Depot manager, Kibwezi	Training and sensitizations on KS1758, challenges in the enforcement of standards
KEPHIS- Head Laboratory Accreditation and Quality Assurance	Domestic food safety requirements, food safety regulations, risks, testing for Maximum Residue Levels (MRL's) compliance in domestic mango chain
KEPHIS- Head Phytosanitary services and Biosecurity	Surveillance and inspections at entry points, phytosanitary measures for imports and exports, SPS notification in domestic fruit chain, gaps in policy and regulatory framework
KEBS- Standards Development and Enforcement Officer	Role of KEBS, KS1758, challenges in the implementation of standards, gaps in policy
County Public Health officer, Makueni County	Enforcement mechanisms in the domestic mango value chain, challenges, the status of domestic markets, and challenges in the enforcement of standards
County Executive Committee Member (CECM) Agriculture	Overview of the mango value chain, challenges and opportunities
Shedex Fresh World Exporters	The motivation of chain actors, opportunities for linkages, challenges in the implementation of food safety and standards, domestic value chain governance
ASDSP II County coordinator (CC), Makueni County	Role of ASDSP II in the mango value chain, partnerships, linkages, collaborations in the value chain, gender in the mango value chain
ASDSP II, Value Chain Development Officer (VCDO)	Inventory of support sector policies, review of existing policies, regulations, strategies and sector action plans
Mulley's supermarket	The motivation of chain actors, opportunities for linkages, challenges in the implementation of food safety and standards
Total 11 Key informants	

Source: Author

Appendix 8: Stakeholder meeting participants

Stakeholder	Number of participants	Feedback from the meeting
Smallholder farmers (2 certified and 2 non-certified)	4	Stakeholder analysis Developed a functional chain map, opportunities to create linkages, description of hindrances to the implementation of food safety standards and possible intervention strategies.
Shedex Fresh World Exporters	1	
Traders (supermarket, kiosks, open air market)	4	
County Public Health officer (CPHO)	1	
Sub County Agriculture officer (SCAO)	1	
Ward Agricultural Officer (WAO)	2	
HCD	2	
KEPHIS	1	
ASDSP 11	2	
MESPT	1	
KEBS	1	
Market superintendents	2	
County Hotel	1	
Total	**23**	

Source: Author

Appendix 9: List of key informants

No	Name	Position	Organization	Contacts
1	Ms Mary Muteti	County Executive Committee Member (CECM) Agriculture	Department of Agriculture	www.makueni.go.ke +254700 346736
2	Ms Mary Goretti Musau	County Public Health Officer	Department of Public Health	countyhealthmkn@gmail.com +254736 212451
3	Ms Faith Ndunge	Head, Phytosanitary services and Bio-Security	KEPHIS	kephisinfo@kephis.org +254709 891000 +254 20 6618000
4	Ms Lucy Namu	Head, Laboratory accreditation and food safety		
5	Ms Josephine Simiyu	Manager, Regulations and Compliance	HCD	md@hcda.or.ke +254722 619530
6	Mr Nicodemus Ngeka	Depot Manager, Kibwezi		yavinicodemus@gmail.com +254723 987769
7	Mr Peter Mutua	Standards Development Officer	KEBS	www.kebs.org +25420 9648317 +254722 836425
8	Ms Regina Maingi	County Coordinator	ASDSP II, Makueni County	www.makueni.go.ke +254722 376987
9	Mr Martin Munyao	Value Chain Development Officer (VCDO)		+254720 951896 matomunyao@yahoo.com
10	Mr Shadrack Kaveva	Director	Shedex Fresh World Exporters	shedexfreshworld@gmail.com +254721 224597
11	Mr Dominic Mutiso	Fresh Produce Manager	Mulley's supermarket	www.mulleys.co.ke +254718 522026

Source: Author field data, 2019

Appendix 10: Research pictorials

Structures for displaying mango in the domestic market in Wote and Kibwezi towns respectively. Left: mango displayed on gunny bags on the ground. Right: a trader displays mango on a raised wooden structure in Kibwezi town.

Left: Traders display mango by the roadside in Kibwezi town and Right: neatly arranged produce at Mulley's supermarket, Emali.

Left: During survey with a consumer in Wote town. Right: Administering survey questionnaire with a trader in Emali town.

Key informant interview session with Head, Laboratory Accreditation and Quality Assurance, KEPHIS, Nairobi (left), and HCD, Depot Manager, Kibwezi (right).

Left: Mango display on a plastic basin in Emali town and Right: mango displayed on a coloured wooden structure in Wote town.


Left: A fruit juice trader waits for customers outside a shop at the Emali bus park. Right: The researcher observing the Wote domestic fresh fruits market.

Members of Nzaui farm Co. Ltd during a FGD in their office, Matiliku town

All photos courtesy of the researcher, 2019

Appendix 11: List of FGDs farmers

No	Name	Gender	Total land size (Ha)	Number of mango trees	Village
FGD 1 Certified mango growers, Members of Nzaui Farm Co. Ltd					
1	Joel Wambua	M	4	210	Kilili
2	Ruth King'oo	F	3.5	135	Kalamba
3	Mutuku Sila	M	4	190	Kawala
4	Thomas Kavita Musyoki	M	4.25	176	Ndovea
5	Daniel Mbindyo	M	2	70	Matiliku
6	Esther Mwanziu	F	4	220	Kawala
7	Mutua Kinyumu	M	3.75	160	Kilili
8	Richard Mbwete	M	3.5	108	Kalamba
9	Pauline Munyao	F	3	140	Matiliku
FGD 2 Uncertified mango producers, no membership to groups					
1	Nzeleta Muli	M	2.5	50	Ndovea
2	Benedetta Ndivo	F	4	165	Kilili
3	Simon Nzeki	M	5	180	Kalamba
4	Josephine Nzowa	M	2.5	100	Matiliku
5	Josephine Mwilu	F	5	160	Kawala
6	George Mwongela	M	4.5	135	Ndovea
7	Kisui Nganda	M	6	120	Matiliku

Source: Author field data, 2019

Appendix 12: Survey questionnaire for consumers

Survey questionnaire for mango consumers

Date of survey……/……/ 2019

County:	**Sub County:**	**Town:**
Interviewee name (optional):	**Phone number:**	**Questionnaire Number:**

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting a study on adoption of food safety standards in the domestic fresh mango value chain. You are randomly selected to participate in the study by truthfully giving information about the above subject. The answers you give will be confidential and will only contribute towards the research.

Please tick (√) the appropriate box

1. Personal information

1.1 Age of respondent 0= 18-25 yrs ☐ 1= 26-35 yrs ☐ 2= 36-45yrs ☐ 3=46-55 yrs ☐ ☐ 4=above 56yrs

1.2 Gender of respondent 0=Female ☐ 1=Male ☐

1.3 Highest level of education

0= None ☐ 1= Primary ☐ 2=Secondary ☐ 3=College ☐ 4=University ☐

1.4 Number of members in the family

0=less than 4 ☐ 1= between 4-7 ☐ 2=8-11 ☐ 4= more than 12 ☐

2. Awareness on food safety

2.1 Are you aware of food safety requirements in fruits? 1=Yes ☐ No ☐

2.2 If yes, do retailers meet food safety requirements in marketing mango?

0=Always ☐ 1=Sometimes ☐ 2=Never ☐

2.3 Do you agree with this statement ' I am concerned in knowing where my fresh mango come from and how they are produced'

1=Strongly agree ☐ 2=Agree ☐ 3=Disagree ☐ 4=Strongly disagree ☐

2.4 Where do you shop for your fresh mango?

1=Supermarket ☐ 2= Kiosks ☐ 3=Open air market ☐ 4=Roadside trader ☐

5=fruit vendors ☐ other specify…….

2.5 Why do you prefer buying fruits from your choice mentioned above? Multiple answer apply
1=prices are low ☐ 2=always fresh ☐ 3=source is traceable ☐ 4=don't know ☐

2.6 Does your preferred retail outlet meet standards for food safety?
1=Strongly agree ☐ 2= Agree ☐ 3=Disagree ☐ 4=Strongly disagree ☐

2.7 Can you please rank your awareness on food safety? Very knowledgeable ☐ Knowledgeable ☐
Somehow knowledgeable ☐ Not knowledgeable ☐

2.8 Would you be willing to pay more to buy mango fruits if quality is assured and guaranteed?
1= somewhat agree ☐ 2=agree ☐ 3=disagree ☐

2.9 What extra proportion would you be willing to pay for assurance of safe mango?

1=less than 2.5% ☐ 2=2.5-5% ☐ 3=5-7.5% ☐ 4=more than 7.5% ☐

2.10 Are you aware of the maximum amount of trace residues of pesticides, or their breakdown products (MRLs) allowed on mango?

1=Least aware ☐ 2=Aware ☐ 3=Very aware ☐

2.11 Who provides with packaging material for the mango you buy from traders?

1=Trader ☐ 2=Consumer ☐ 3=others ☐ specify……

2.12 Is the packaging material safe enough to prevent contamination of your fruits?

1=Very safe ☐ 2=somewhat safe ☐ 3=Safe ☐ 4=Not safe ☐

2.13 What grade of mango do you buy from traders?

0=grade I ☐ 1=grade II ☐ ?=grade III ☐ mixed grades ☐ thers specify……..

2.14 In your opinion, does grading of mango provide an assurance of quality?
1=Strongly agree ☐ 2=Agree ☐ 3=Disagree ☐ 4=Strongly disagree ☐
5=don't know ☐

3. Perception on standards

3.1 Do you know the domestic standards in fruits? 1=Yes ☐ No ☐

3.2 Do you know GlobalGAP requirements in food safety? 1=Yes ☐ No ☐

3.3 In your opinion, does the use of GlobalGAP contribute to food safety of mango fruits?
1=Strongly agree ☐ 2=Agree ☐ 3=Disagree ☐ 4=Strongly disagree ☐ 5= don't know ☐

3.4 What could be done to improve food safety in domestic fresh mango chain?

……

……

……

Thank you for your time

Appendix 13: Survey questionnaire for mango traders

Survey questionnaire for mango traders

Date of survey……/……/ 2019

County:	**Sub County:**	**Town:**
Interviewee name (optional):	**Phone number:**	**Questionnaire Number:**

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. Randomly you have been identified to participate in the study by truthfully giving information about the above subject. The answers you give will be confidential and will only contribute towards the research.

Please tick (√) the appropriate box

1. **Personal information**

1.1 Age of respondent 0= 18-25 yrs ☐ 1= 26-35 yrs ☐ 2= 36-45yrs ☐ 3=46-55 yrs ☐ ☐ 4=above 56yrs

1.2 Gender of respondent 0=Female ☐ 1=Male ☐

1.3 Highest level of education

0= None ☐ 1= Primary ☐ 2=Secondary ☐ 4=College ☐ 5=University ☐

1.4 Number of family members

0=less than 4 ☐ 1=4-8 ☐ 2=9-12 ☐ 4=more than 12 ☐

2. **Market environment**

2.1 Duration you have been in fresh fruits business

0=less than 2 yrs ☐ 1= 2-5 yrs ☐ 2=6-10 yrs ☐ 3= more than 10 yrs ☐

2.2 Do you have employees 0=Yes ☐ 1=No ☐

If yes,

2.3 How many employees do you have?……

2.4 What type of business do you have?

1=sole proprietor ☐ 2=partnership ☐ 3=family ☐ 4=other specify……..

2.5 If family, does your family members help you in running the business.

0=Yes ☐ 1=No ☐

2.6 In the past 12 months, have you and your employees received any training on food safety handling practices?

1=Yes ☐ No ☐

2.7 If yes, who provided the training

1=County government ☐ 2=National government ☐ 3=private service provider ☐

☐NGO 5 5=other specify……

2.8 What fresh produce do you sell in your outlet?

1=Fresh fruits ☐ 2=fresh vegetables ☐ 3=both fresh fruits and vegetables ☐

2.9 Do you sell fresh mango in your outlet? 0=Yes ☐ 1= No ☐

2.10 How many days of the week do you open your business?……

2.11 How many customers of fresh mango do you serve per day?……

2.12 What is your estimated volume of sales per week?

1=less than 100Kg ☐ 2=between 101-250Kg ☐ 3=251-500Kg ☐ 4=more than 500Kg ☐

3. Access to credit facilities

3.1 Do you have access to credit?1= Yes ☐ 2=No ☐

3.2 If yes, what type of credit? ……

3.3 Where do you get the credit? 1=Bank loan ☐ 2=supplier ☐ 3=Micro financial institution ☐

4=friends ☐ 5=others specify……

3.4 Do you pay interest on credit? 0=Yes ☐ 1= No ☐

3.5 If yes, what is the interest rate? 1= Less than 10% ☐ 2=10% -15% ☐ 3=More than 15% ☐

3.6 What is the duration of the credit? ……

3.7 Any challenges in loan repayment? Kindly explain

……

……

……

4. Knowledge on food quality and safety

4.1 Who supplies you with your fresh mango?

1=Producer organization ☐ 2=Broker ☐ 3= Farmer ☐ 4=Wholesale market ☐

☐ 5=others (specify)……..

4.2 Which grades do buyers require?

1=Grade I 2=Grade II ☐ 3=Grade II 4=Others ☐……

4.3 Do you have a contract with your supplier? 1=Yes ☐ 2=No ☐

If yes

4.4 What is the type of contract?

1=Written ☐ 2=Spoken/ oral ☐ 3=Other (specify) ☐……

4.5 What means of transportation is used to deliver fresh mango to the market?

1=Hand cart ☐ 2=Bicycle ☐ 3=Motorcycle ☐ 4=Pickup ☐ 5=Truck ☐

6=Other (specify)……

4.6 In your opinion does the transport means have adequate measures to prevent fruits contamination.

1=Strongly agree ☐ 2=Agree ☐ 3=Disagree ☐ 4=Strongly disagree ☐ 5=don't know ☐

4.7 Are you aware of Hazard Analysis Critical Control Points (HACCP) in food safety?

1=Yes ☐ 2=No ☐

If yes, what are the likely causes of food hazards in your business?

……

……

4.8 What measures have you put in place to prevent food contamination risks?

……

……

4.9 What informs you on the choice of mango to sell at your retail outlet?

1=consistent supply ☐ 2=profits margins ☐ 3= safety guarantee ☐ 4=other specify……

4.10 How do you store mango that remain by the end of the day?

……

……

……

5. Perception of traders towards food safety

5.1 What is your perception about agrochemicals in relation to food safety of fresh mango in the domestic market?

……

……

5.2 What is your perception about physical contaminants in relation to food safety of fresh mango in domestic market?

……

……

5.3 What is your perception about microbial contamination in food safety of fresh mango in the domestic market?

……

……

……

5.4 In your opinion, what are the major challenges that traders face in this market to meet food safety and standard requirements?

……

……

……

Thank you for your time

Appendix 14: Interview checklist for HCD

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date ……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

1. **HCD**

Section A: General Information

Name of Respondent (optional):		Designation:
Name of Organization:		E-mail address:
Address of Organization:		Telephone:
Type of organization:	Year established:	Website:

Section B: Mandate and Functions

- What are the core functions of your organization?
- With whom do you coordinate to fulfill your functions/core mandate?
- What standards exists within the domestic fresh market?
- What are the challenges in adoption of standards and food safety regulations?

Section C: Policy and Regulatory/Institutional Environment

- How would you describe the institutional environment for the adaption of food safety and standards in Kenya? (favorable/unfavorable) explain:
- What role (if any) do you play in assisting domestic fresh mango smallholders to comply with standards?
- What is your role in the formulation and implementation of standards?
- What are the strategies your organization has in place to ensure adoption of food safety regulations and standards?

Any other information is highly appreciated

Thank you for your time

Appendix 15: Interview checklist guide for KEPHIS

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date ……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

2. KEPHIS

Section A: General Information

Name of Respondent (optional):		Designation:
Name of Organization:		E-mail address:
Address of Organization:		Telephone:
Type of organization:	Year established:	Website:

Section B: Mandate and Functions

- What are the core functions of your organization?
- With whom do you coordinate to fulfill your functions/core mandate?
- What standards exist for the domestic fresh fruits market?
- What are the food safety regulations in the domestic fresh mango market?
- How is your organization equipped in testing for MRLs and what is the trend of MRLs exceedance in the domestic fruits market?
- What are the SPS measures in the domestic fresh fruits market?
- What are the challenges in adoption of standards and food safety regulations?
- What are the various arrangements for smallholders in order to meet these standards?

Section C: Policy and Regulatory/Institutional Environment

- How would you describe the institutional environment for the adaption of food safety and standards in Kenya? (favorable/unfavorable) explain:
- What role (if any) do you play in assisting smallholders to comply with standards?

Any other information is highly appreciated

Thank you for your time

Appendix 16: Interview checklist guide for KEBS

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date ……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

3. **KEBS**

Section A: General Information

Name of Respondent (optional):		Designation:
Name of Organization:		E-mail address:
Address of Organization:		Telephone:
Type of organization:	Year established:	Website:

Section B: Mandate and Functions

- What are the core functions of your organization?
- With whom do you coordinate to fulfill your functions/core mandate?
- What standards have complied within the domestic fresh market?
- What are the challenges in the adoption of standards and food safety regulations?

Section C: Policy and Regulatory/Institutional Environment

- How would you describe the institutional environment for the adaption of food safety and standards in Kenya? (favorable/unfavorable) explain:
- What role (if any) do you play in assisting domestic fresh mango smallholders to comply with standards?
- What is your role in the formulation and implementation of standards?
- What are the strategies your organization has in place to ensure adoption of food safety regulations and standards?

Any other information is highly appreciated

Thank you for your time

Appendix 17: Interview checklist with County Public Health

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date ……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

4. COUNTY DEPARTMENT OF PUBLIC HEALTH

Section A: General Information

Name of Respondent (optional):		Designation:
Name of Organization:		E-mail address:
Address of Organization:		Telephone:
Type of organization:	Year established:	Website:

Section B: Mandate and Functions

What are the core functions of your department?
With whom do you coordinate to fulfill your functions/core mandate?
How would you rate the organizations' overall performance and gender mainstreaming with respect to adoption of food safety and standards?
How would you rate the technical capacity of individual staff in ensuring adoption of food safety and standards?

- Staffing levels
- Technical skills and competence
- Functional skills and competence
- Performance culture
- Team spirit

How would you rate the organizational capacity in ensuring the implementation of standards in the domestic market?

- Understanding of mandate
- County policy, legal and regulatory framework
- Management and leadership
- Systems and processes including Management of Information Systems (MIS)
- Rules, procedures and guidelines
- Support infrastructure and equipment
- Learning and information sharing
- What are the challenges in the adoption of standards and food safety regulations?

Section C: Policy and Regulatory/Institutional Environment

How would you describe the institutional environment for the adaption of food safety and standards in Kenya? (favorable/unfavorable) explain:

- County/ national policy, legal and regulatory framework
- Coordination and information sharing
- ICT / logistical infrastructure
- Formal/informal networks and partnerships
- Attitudes, perceptions and degree of support of stakeholders

Any other information is highly appreciated

Thank you for your time

Appendix 18: Interview checklist with CECM, Agriculture

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date ……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

5. COUNTY EXECUTIVE COMMITTEE MEMBER, AGRICULTURE

Section A: General Information

Name of Respondent (optional):		Designation:
Name of Organization:		E-mail address:
Address of Organization:		Telephone:
Type of organization:	Year established:	Website:

Section B: Mandate and Functions

What are the core functions of your department?
With whom do you coordinate to fulfill your functions/core mandate?
How would you rate the organizations' overall performance and gender mainstreaming with respect to adoption of food safety and standards?
How would you rate the technical capacity of individual staff in ensuring adoption of food safety and standards?

- Staffing levels
- Technical skills and competence
- Functional skills and competence
- Performance culture
- Team spirit

How would you rate the organizational capacity in ensuring the implementation of standards in the domestic market?

- Understanding of mandate
- County policy, legal and regulatory framework
- Management and leadership
- Systems and processes including Management of Information Systems (MIS)
- Rules, procedures and guidelines
- Support infrastructure and equipment
- Learning and information sharing
- What are the challenges in the adoption of standards and food safety regulations?

Section C: Policy and Regulatory/Institutional Environment

How would you describe the institutional environment for the adaption of food safety and standards in Kenya? (favorable/unfavorable) explain:

- County/ national policy, legal and regulatory framework
- Coordination and information sharing
- ICT / logistical infrastructure
- Formal/informal networks and partnerships
- Attitudes, perceptions and degree of support of stakeholders

Any other information is highly appreciated

Thank you for your time

Appendix 19: Interview checklist with Exporter

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date ……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

6. EXPORTERS

Section A: General Information

Name of Respondent (optional):		Designation:
Name of Organization:		E-mail address:
Address of Organization:		Telephone:
Type of organization:	Year established:	Website:

- How are smallholder farmers organized in the export supply chain?
- What are the certification requirements of the export fresh fruits supply chain
- How do smallholder farmers comply with export requirements?
- What are the challenges in adoption of standards and food safety regulations?
- What strategies in the export sector can be copied in the domestic fresh fruits chain to ensure adoption of standards and food safety regulations?
- What is the value chain governance that exist between exporters and smallholder farmers?
- Do you offer training to smallholder farmers? If yes on what kind of training do you offer?
- Are there possibilities of the exporters supplying the domestic fresh fruits market with produce that meets food safety requirements?

Any other information is highly appreciated

Thank you for your time

Appendix 20: Interview checklist with supermarkets

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date of survey……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

7. MULLEYS' SUPERMARKET

Section A: General Information

Name of Respondent (optional):		Designation:
Name of Organization:		E-mail address:
Address of Organization:		Telephone:
Type of organization:	Year established:	Website:

- Where do you source your fresh mango?
- Do you have a contract with your suppliers? If yes, what kind of contract?
- How do smallholder farmers comply with GAP requirements?
- What are the challenges in adoption of standards and food safety regulations?
- What are the strategies in the domestic fresh fruits chain to ensure adoption of standards and food safety regulations?

Any other information is highly appreciated

Thank you for your time

Appendix 21: Interview checklist for ASDSP II

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date of survey……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

8. ASDSP II MAKUENI COUNTY

Section A: General Information

Name of Respondent (optional):		Designation:
Name of Organization:		E-mail address:
Address of Organization:		Telephone:
Type of organization:	Year established:	Website:

Section B: Mandate and Functions

- What are the core functions of your department?
- With whom do you coordinate to fulfill your functions/core mandate?
- What standards are complied with in the domestic fresh market?
- What are the challenges in adoption of standards and food safety regulations?
- What is role in ensuring implementation of food safety at the domestic markets?
- How has devolution affected implementation of food safety standards in the domestic market?
- What is the level of commitment of the department towards implementation and sensitization of stakeholders on food safety?

Section C: Policy and Regulatory/Institutional Environment

- How would you describe the institutional environment for the adaption of food safety and standards in Kenya? (favorable/unfavorable) explain:
- What role (if any) do you play in assisting domestic fresh mango smallholders to comply with standards?
- What is your role in the formulation and implementation of standards?
- What are the strategies your organization has in place to ensure adoption of food safety regulations and standards?

Any other information is highly appreciated

Thank you for your time

Appendix 22: Checklist guide for FGD

CHECKLIST GUIDE FOR INTERVIEW WITH KEY INFORMANTS

Date of survey……/……/ 2019

My name is **Benjamin Tito** a student at Van Hall Larenstein University of Applied Sciences in the Netherlands. I am conducting study on adoption of food safety standards in the domestic fresh mango value chain. You have been identified as a key informant to provide information on the above subject. The answers you give will be confidential and will only contribute towards the research.

CHECKLIST FOR FOCUS GROUP DISCUSSION WITH PRODUCERS

- Are you aware of GAPs? Do you follow them during production?
- Are you aware of MRLs and PHI? Do you follow the recommended practices during spraying?
- What are the domestic market requirements in mango production?
- Who gives you information on market requirements?
- What are the quality specifications for mango in the domestic market?
- Do you receive trainings on how to comply with food safety regulations?
- Who provides the training?
- Does your production meet the required domestic market specifications?
- Do you have collection centres? Who runs them? Do they meet food safety requirements?
- Do you know of certification requirements in the domestic market? In addition, are you certified?
- Are you certified as an individual or as a group?
- What is the cost of certification? Who pays for it?
- Does certification offer you opportunity for better prices in the mango marketing?
- How do you handle your produce after harvest?
- Do you have access to credit, source, interest paid, duration of credit?
- What difficulties/ ease do you face in accessing domestic fresh fruits market?
- What are the opportunities for scaling up adoption of standards in domestic mango value chain?
- What are the constraints / challenges do smallholder farmers in Makueni County face in meeting food safety requirements and standards for the domestic market?

Any other information is highly appreciated

Thank you for your time

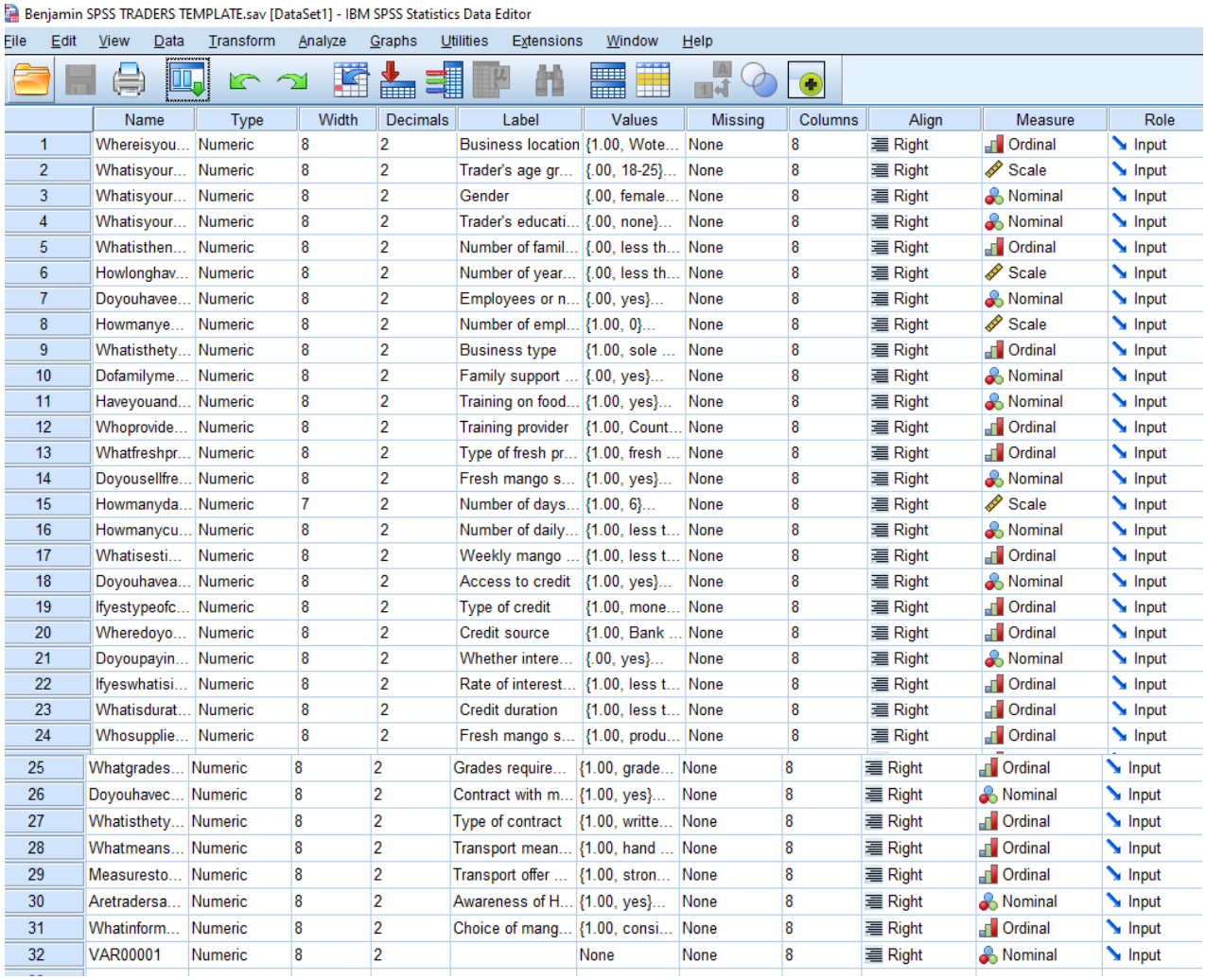
Appendix 23: Observation checklist in the domestic market place

How are the market structures build? Walls, floor-presence of cracks, peeling off, electricity
Sanitation
Cleanliness and sanitation

- Are they closed to prevent entry of rodents and birds?
- Presence/ absence of toilet facilities, water, soap
- Are they clean? Are they cleaned regularly?
- Collection of litter, presence/ absence of litter bins

Distance from the market to toilet facility
Traders mode of dressing, aprons, overals, headscaffs
Water source and quality
Handling of mango, packaging, display to customers

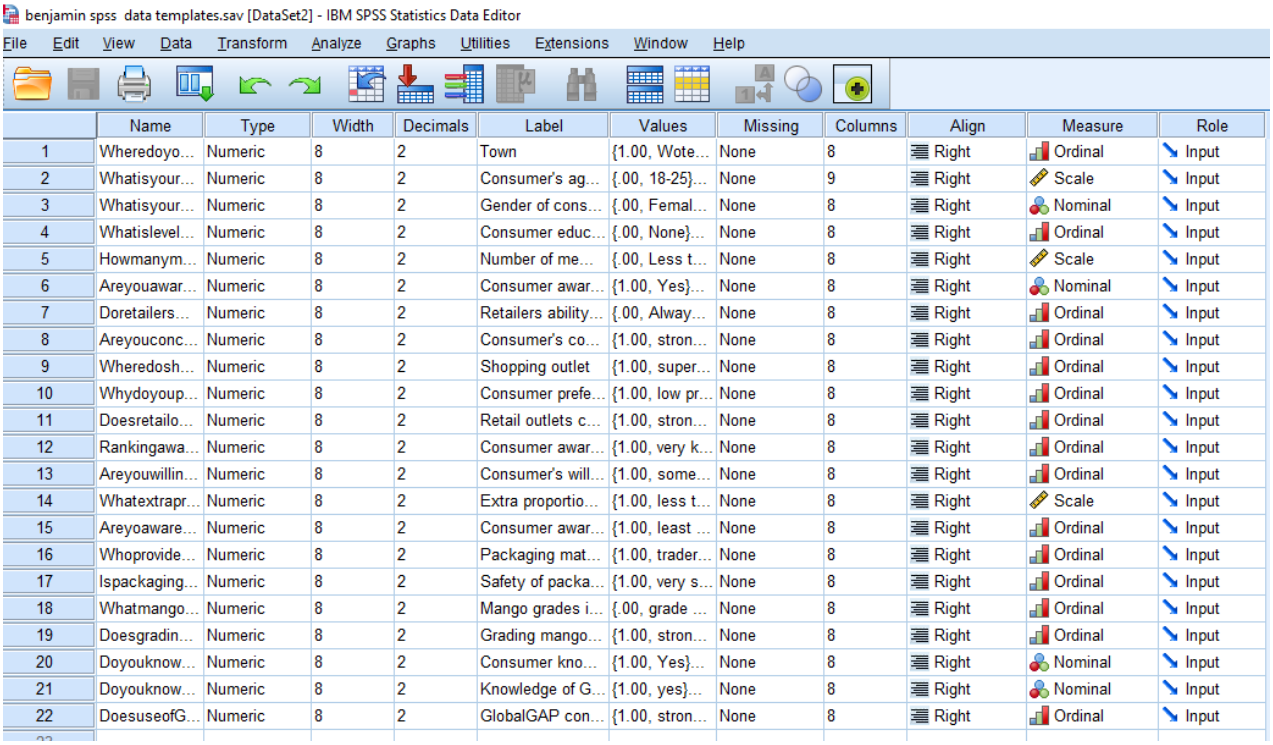
Appendix 24: SPSS data template for traders



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Whereisyou...	Numeric	8	2	Business location	{1.00, Wote...	None	8	Right	Ordinal	Input
2	Whatisyour...	Numeric	8	2	Trader's age gr...	{.00, 18-25}...	None	8	Right	Scale	Input
3	Whatisyour...	Numeric	8	2	Gender	{.00, female...	None	8	Right	Nominal	Input
4	Whatisyour...	Numeric	8	2	Trader's educati...	{.00, none}...	None	8	Right	Nominal	Input
5	Whatisthen...	Numeric	8	2	Number of famil...	{.00, less th...	None	8	Right	Ordinal	Input
6	Howlonghav...	Numeric	8	2	Number of year...	{.00, less th...	None	8	Right	Scale	Input
7	Doyouhavee...	Numeric	8	2	Employees or n...	{.00, yes}...	None	8	Right	Nominal	Input
8	Howmanye...	Numeric	8	2	Number of empl...	{1.00, 0}...	None	8	Right	Scale	Input
9	Whatisthety...	Numeric	8	2	Business type	{1.00, sole ...	None	8	Right	Ordinal	Input
10	Dofamilyme...	Numeric	8	2	Family support ...	{.00, yes}...	None	8	Right	Nominal	Input
11	Haveyouand...	Numeric	8	2	Training on food...	{1.00, yes}...	None	8	Right	Nominal	Input
12	Whoprovide...	Numeric	8	2	Training provider	{1.00, Count...	None	8	Right	Ordinal	Input
13	Whatfreshpr...	Numeric	8	2	Type of fresh pr...	{1.00, fresh ...	None	8	Right	Ordinal	Input
14	Doyousellfre...	Numeric	8	2	Fresh mango s...	{1.00, yes}...	None	8	Right	Nominal	Input
15	Howmanyda...	Numeric	7	2	Number of days...	{1.00, 6}...	None	8	Right	Scale	Input
16	Howmanycu...	Numeric	8	2	Number of daily...	{1.00, less t...	None	8	Right	Nominal	Input
17	Whatisesti...	Numeric	8	2	Weekly mango ...	{1.00, less t...	None	8	Right	Ordinal	Input
18	Doyouhavea...	Numeric	8	2	Access to credit	{1.00, yes}...	None	8	Right	Nominal	Input
19	Ifyestypeofc...	Numeric	8	2	Type of credit	{1.00, mone...	None	8	Right	Ordinal	Input
20	Wheredoyo...	Numeric	8	2	Credit source	{1.00, Bank ...	None	8	Right	Ordinal	Input
21	Doyoupayin...	Numeric	8	2	Whether intere...	{.00, yes}...	None	8	Right	Nominal	Input
22	Ifyeswhatisi...	Numeric	8	2	Rate of interest...	{1.00, less t...	None	8	Right	Ordinal	Input
23	Whatisdurat...	Numeric	8	2	Credit duration	{1.00, less t...	None	8	Right	Ordinal	Input
24	Whosupplie...	Numeric	8	2	Fresh mango s...	{1.00, produ...	None	8	Right	Ordinal	Input
25	Whatgrades...	Numeric	8	2	Grades require...	{1.00, grade...	None	8	Right	Ordinal	Input
26	Doyouhavec...	Numeric	8	2	Contract with m...	{1.00, yes}...	None	8	Right	Nominal	Input
27	Whatisthety...	Numeric	8	2	Type of contract	{1.00, writte...	None	8	Right	Ordinal	Input
28	Whatmeans...	Numeric	8	2	Transport mean...	{1.00, hand ...	None	8	Right	Ordinal	Input
29	Measuresto...	Numeric	8	2	Transport offer ...	{1.00, stron...	None	8	Right	Ordinal	Input
30	Aretradersa...	Numeric	8	2	Awareness of H...	{1.00, yes}...	None	8	Right	Nominal	Input
31	Whatinform...	Numeric	8	2	Choice of mang...	{1.00, consi...	None	8	Right	Ordinal	Input
32	VAR00001	Numeric	8	2		None	None	8	Right	Nominal	Input

Author field data, 2019

Appendix 25: SPSS data template for consumers



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Wheredoyo...	Numeric	8	2	Town	{1.00, Wote...	None	8	Right	Ordinal	Input
2	Whatisyour...	Numeric	8	2	Consumer's ag...	{.00, 18-25}...	None	9	Right	Scale	Input
3	Whatisyour...	Numeric	8	2	Gender of cons...	{.00, Femal...	None	8	Right	Nominal	Input
4	Whatislevel...	Numeric	8	2	Consumer educ...	{.00, None}...	None	8	Right	Ordinal	Input
5	Howmanym...	Numeric	8	2	Number of me...	{.00, Less t...	None	8	Right	Scale	Input
6	Areyouawar...	Numeric	8	2	Consumer awar...	{1.00, Yes}...	None	8	Right	Nominal	Input
7	Doretailers...	Numeric	8	2	Retailers ability...	{.00, Alway...	None	8	Right	Ordinal	Input
8	Areyouconc...	Numeric	8	2	Consumer's co...	{1.00, stron...	None	8	Right	Ordinal	Input
9	Wheredosh...	Numeric	8	2	Shopping outlet	{1.00, super...	None	8	Right	Ordinal	Input
10	Whydoyoup...	Numeric	8	2	Consumer prefe...	{1.00, low pr...	None	8	Right	Ordinal	Input
11	Doesretailo...	Numeric	8	2	Retail outlets c...	{1.00, stron...	None	8	Right	Ordinal	Input
12	Rankingawa...	Numeric	8	2	Consumer awar...	{1.00, very k...	None	8	Right	Ordinal	Input
13	Areyouwillin...	Numeric	8	2	Consumer's will...	{1.00, some...	None	8	Right	Ordinal	Input
14	Whatextrapr...	Numeric	8	2	Extra proportio...	{1.00, less t...	None	8	Right	Scale	Input
15	Areyoaware...	Numeric	8	2	Consumer awar...	{1.00, least ...	None	8	Right	Ordinal	Input
16	Whoprovide...	Numeric	8	2	Packaging mat...	{1.00, trader...	None	8	Right	Ordinal	Input
17	Ispackaging...	Numeric	8	2	Safety of packa...	{1.00, very s...	None	8	Right	Ordinal	Input
18	Whatmango...	Numeric	8	2	Mango grades i...	{.00, grade ...	None	8	Right	Ordinal	Input
19	Doesgradin...	Numeric	8	2	Grading mango...	{1.00, stron...	None	8	Right	Ordinal	Input
20	Doyouknow...	Numeric	8	2	Consumer kno...	{1.00, Yes}...	None	8	Right	Nominal	Input
21	Doyouknow...	Numeric	8	2	Knowledge of G...	{1.00, yes}...	None	8	Right	Nominal	Input
22	DoesuseofG...	Numeric	8	2	GlobalGAP con...	{1.00, stron...	None	8	Right	Ordinal	Input

Author field data, 2019