Catalysing food safety in the domestic horticulture sector in Kenya

The potential link between export production and evolving domestic supply chains

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Contents

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List of abbreviations and acronyms

CBD	Central Business District
EU	European Union
FAO	Food and Agriculture Organization
FFV	Fresh Fruit and Vegetables
HCD	Horticultural Crops Directorate (of the Agriculture and Food Authority of Kenya)
HTS	Horticulture Traceability System
KEPHIS	Kenya Plant Health Inspectorate Service
KES	Kenya Shilling
KHCP	Kenya Horticulture Competitiveness Project
MRL	Maximum Residue Level
MT	Metric Ton
PCPB	Pest Control Products Board
PHI	Pre-harvest interval
USAID	United States Agency for International Development
WCDI	Wageningen Centre for Development Innovation, Wageningen University & Research
WUR	Wageningen University & Research

Executive Summary

Background of the fresh fruit and vegetables sector in Kenya

In 2016, the total value of fresh fruit and vegetables (FFV) marketed in Kenya was US$ 1.46 billion, of which US$ 310 million (21%) was from the export sector and US$ 1.15 billion (79%) from the domestic sector (HCD, 2016). The domestic market presents significant opportunity for growth, but a recent quick scan of the horticulture sector (Matui *et al.*, 2016) suggests the fragmentation of the domestic FFV sector to be the most limiting factor. However, shifts are happening in this market through differentiation of various segments as well as through new regulations on traceability (National Horticulture Traceability System) and food safety (KS1758-2:2016 standard) due to increased awareness about food safety and quality. For example, a study by Onyango and Kunyanga (2013) found high levels of agrochemical residues, heavy metals from use of contaminated irrigation water and microbial contamination in kale, tomatoes, mangoes and amaranth from samples collected in wet markets and supermarkets in Nairobi, Nakuru and Machakos.

FFV that meets food safety and quality standards is in high demand by the export market and some segments of the domestic markets, mainly the formal segments within supermarkets; institutions like hotels, schools and hospitals; and middle to high-end grocery stores. The wet markets account for over 85% of volume of FFV traded in the city (Tsichery and Ayieko, 2009) with supermarkets accounting for 5% of trade and 10% being traded through contracted suppliers to different market segments. With increasing demand as a result of increased awareness of and concern about food safety in the domestic market segment, there is need to invest in FFV that meets minimum safety and quality standards.

The export segment has already significantly contributed to knowledge about how to produce FFV that meets high food safety standards, as evidenced by the over 20,000 farmers who are certified under the GlobalGAP scheme for FFV export production (GlobalGAP website, 2017). Previous research has shown that export markets diffuse good practices to domestic chains through spillover effects and strategic positioning of export products redirected to domestic markets export products (Hammoudi and Hamza, 2015; Khrishnan, 2018). This study confirms that good practices from knowledge and standards in export production are diffused to production destined for the domestic market.

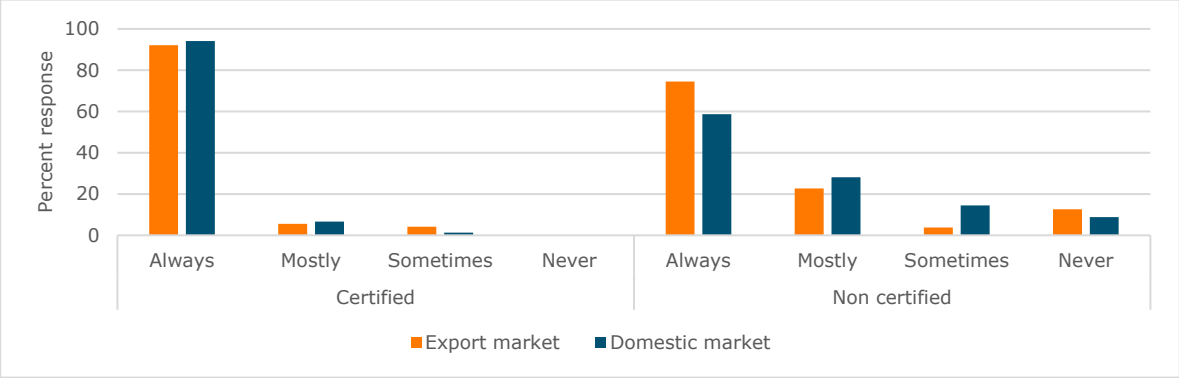
However, despite there being domestic demand for FFV that meets high safety standards, the produce grown by certified and non-certified farmers that meets these standards is mixed and traded with produce that does not. Farmers miss the opportunity to realize the full value of this FFV, and the attributes of the produce that relate to safety and quality are lost and/or compromised through trading practices in the dominant wet market chain. This presents opportunities for strategic positioning to catalyse investment, by matching this produce to market segments that demand food safety. This study was guided by this proposition and generated some key insights based on interviews with certified and non-certified FFV farmers and markets actors in the City of Nairobi. The main findings are summarized below.

Key findings

a) Supply side (production)

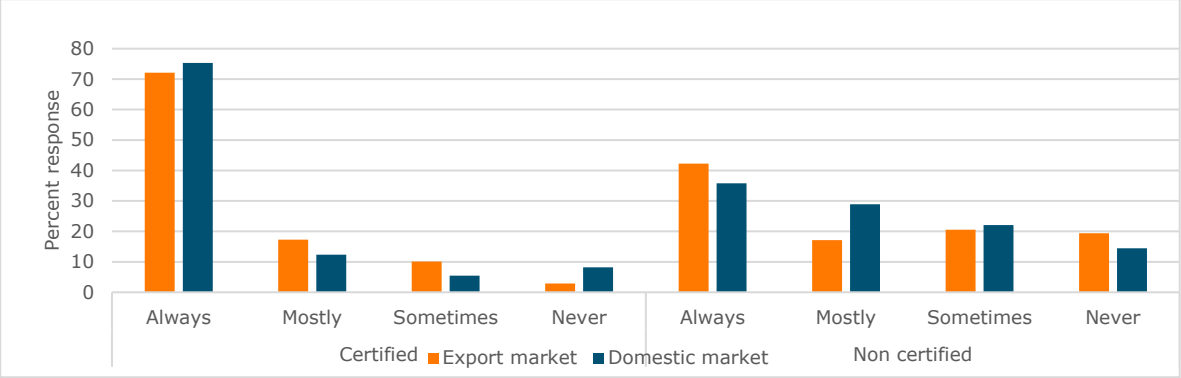
Key finding 1: Good production practices are diffused from the export platform, which is guided by GlobalGAP certification, by small- and medium-scale farmers who are producing FFV for both export and domestic markets.
GlobalGAP standards provide farmers with guidelines on good agricultural practices for effectively managing pests and diseases. To be certified, farmers need to comply with standards that include record keeping, risk assessment, scouting for pest and diseases, training in safe use of agrochemicals and hygiene. This study found clear diffusion of these good practices from export production to domestic production by certified farmers compared to those without certification. This is because through certification, farmers learn procedures and practices that become embedded in the way they manage their farms. Training for certification covers all aspects of production, including cultivation practices, harvesting, handling and knowledge about the facilities that a farmer needs to meet the standards.

It was found, for example, that all the certified farmers almost always respect the pre-harvest interval (PHI) for their crops, be they for the export or domestic market. Of the non-certified producers, 13% (export) and 9% (domestic) admitted never observing the PHI, as they did not know about it. It is important that farmers adhere to the PHI, because it is only after the lapse of this period that residue levels of pesticide are below the maximum residue level (MRL) and the harvested product is safe for consumption.



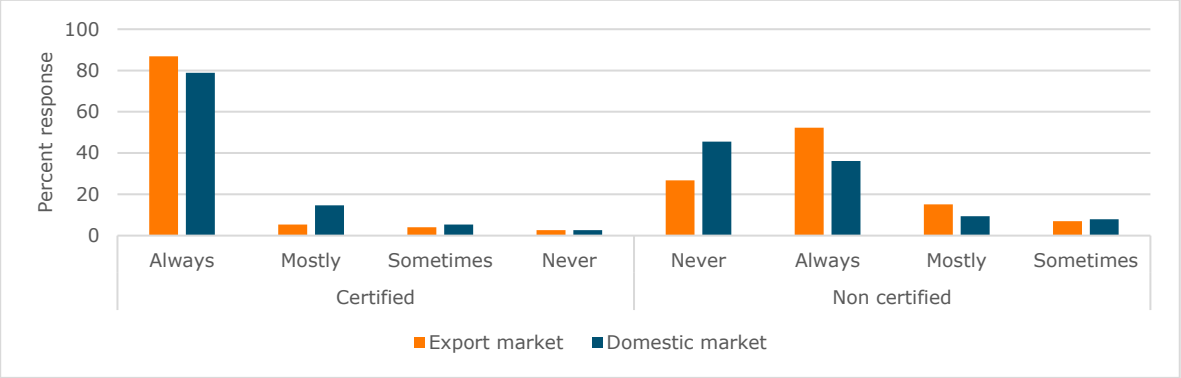
Percentage of farmers adhering to the pre-harvest interval

Key finding 2: Certified farmers are more likely to invest as much in quality inputs for domestic production as they do for export production. Investment facilitates management practices that promote product safety and quality.
The appropriate use of inputs like compost manure, fertilizer and pesticides was found to be significantly higher among certified as compared to non-certified farmers.



Percentage of farmers applying compost

While certified farmers were found to analyse soil and irrigation water and scout for pests and diseases when making input decisions, non-certified farmers did not undertake these tests that allow quality and food safety considerations to influence their input selection. Farmers with certification were more likely to use pesticides from the official Pest Control Products Board (PCPB) list, ensure they are registered for the crop and observe PHI after applications.

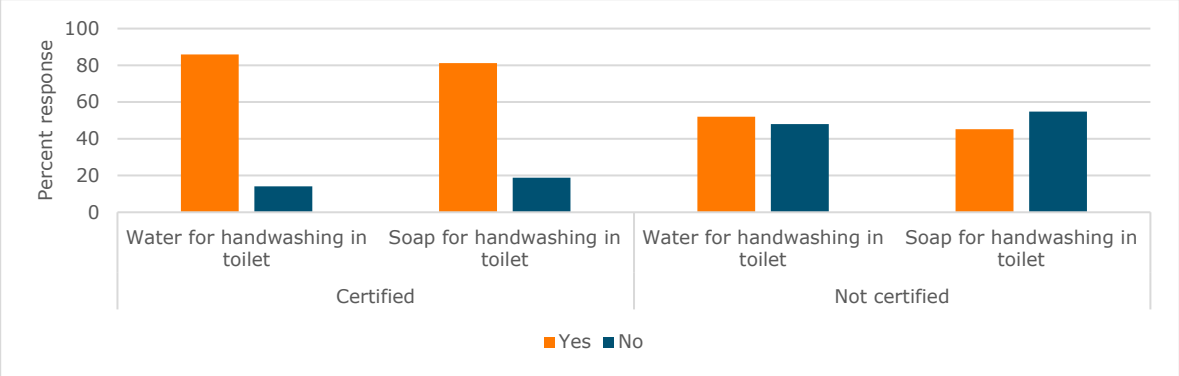


Percentage of farmers applying registered pesticides as per list of the Pest Control Products Board

The majority of the interviewed farmers are engaged in contract farming with companies that buy their produce. The companies supply the seed for the commodities both to certified (52%) and non-certified (34%) farmers. Having access to certified seeds is important because quality seeds influence crop health, and crop resistance to pests and diseases affects pesticide use in the crop cycle.

Key finding 3: Microbial and heavy metal contamination is less likely to happen to produce of certified farmers compared to non-certified farmers.

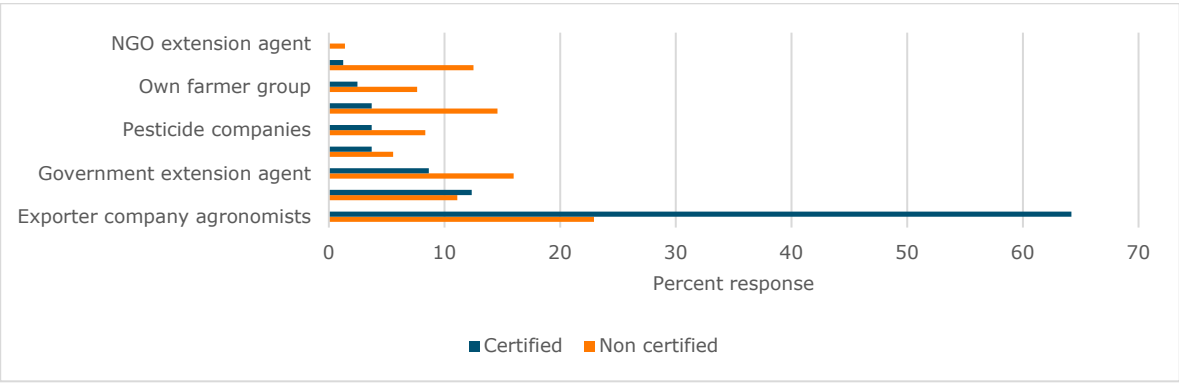
Microbial and heavy metal contamination result from not following good hygiene practices and from using irrigation water that is contaminated with biological hazards and heavy metals. Certified farmers were found to be aware of and to follow good hygiene practices during harvest, to use clean harvesting equipment, to wash hands before and after visiting the toilets as to have a toilet facility accessible to those working in the fields. To be certified, farmers need to have had training about hygiene, have personal protective equipment available and routinely cleaned, have harvesting and holding facilities and have toilets with water and soap. Additionally, certified farmers are required to have irrigation water and water used for produce handling tested in an accredited laboratory to ensure it is of good quality. The analysis showed that certified farmers adhere to good hygiene practices to a much larger extent than non-certified farmers.



Handwashing after visiting the toilet

Key finding 4: Farmers that produce for export have a higher likelihood of receiving training and extension services from technical assistants, agrovets and agricultural extension officers.

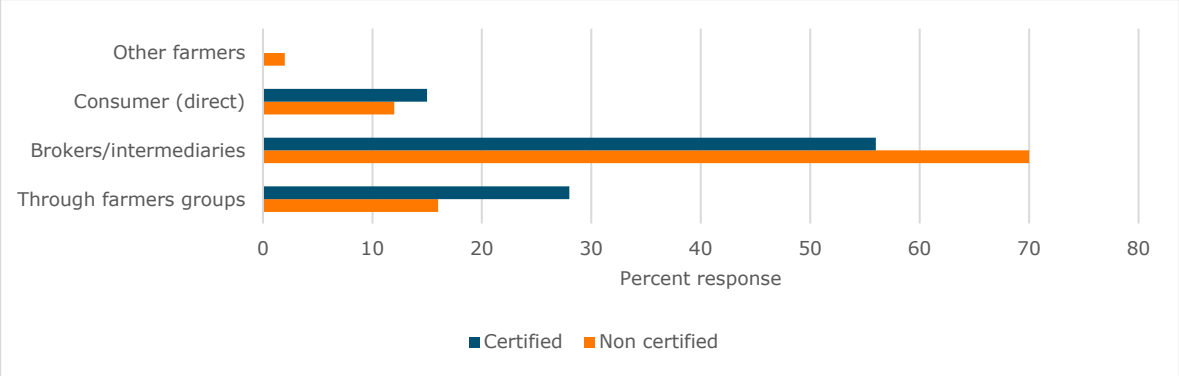
Certified farmers were found to receive information about and training in FFV production from technical assistants employed by exporting companies (64%), agrovets (12%) and agricultural extension officers (9%); farmers growing without certification received training from technical assistants (23%), agrovets (11%) and agricultural extension officers (16%). The training received by certified farmers was found to range broadly, from production methods for both export and domestic crops, to appropriate rational use of agrochemicals, to harvesting and post-harvest handling as well as compliance with export standards. Visit and train was the most common method through which certified farmers accessed extension. Non-certified farmers mainly relied on mass media and field days for training where they were less likely to gain practical skills. It was also observed that the government extension services offer little training for farmers on the topic of food safety.



Sources of information and training for farmers

Key finding 5: FFV produced by certified farmers are mixed and traded in the domestic market with other FFV that are not grown according to high standards, exposing them to contamination and leading to loss of their value.

While certified export farmers were found to produce FFV in line with safety and quality standards, the value of their domestic produce is lost as it is traded through brokers (70%), marketed through farmer groups to traders (16%) and sold direct to consumers (12%) and to other farmers (2%). The brokers mix the produce with other products that are not produced to meet the high standards, and it can also be contaminated through poor handling in transit to markets as well as within markets. As a result, traceability is lost once the product leaves the farm gate, and the product cannot be recognized for its higher quality.



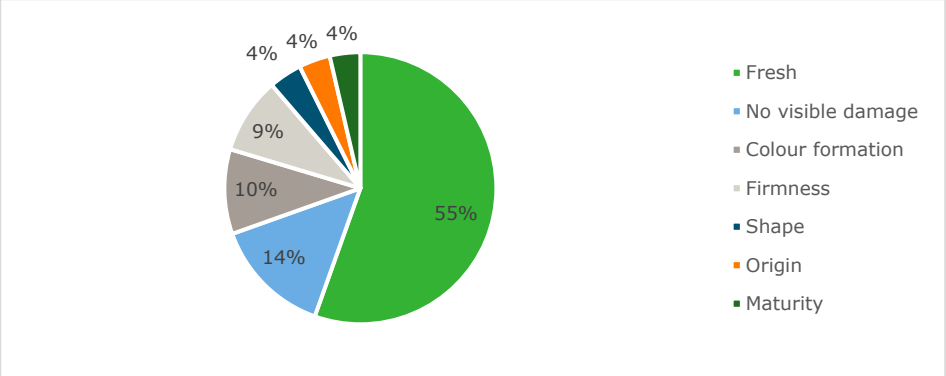
Channels used by farmers to market their produce

b) Demand side (markets)

Key finding 6: There is clear segmentation of markets that recognize the importance of food safety and those that have no concern for food safety and do not feel responsible for its assurance.
Four market segments were identified through this study: wet retail and wholesale markets within the official City of Nairobi infrastructure; unregulated spill-over of traders outside this infrastructure into roadsides and kiosks within city environs; grocery stores with investments in display, storage and packaging who are licensed and operate in permanent addresses within the city environs and residential areas; and supermarkets and high-end grocers in upmarket malls. The first two segments have no concern for food safety, as a result of the fast, impersonal nature of transactions and the low levels of awareness (only 2% of market actors were aware of food safety). The grocery stores and supermarkets recognize the importance of food safety but do not have a pull-factor to influence food safety due to lack of direct control over the value chain.

Key finding 7: No attention is paid to food safety in wet markets, but they dominate trade – over 80% of volume and value flows through the main wholesale markets.
The traders at the wet markets were both unaware of (98%) and unconcerned about food safety. Traders – especially those in Gikomba and Wakulima, the main wholesale markets – do not believe food safety is their responsibility and see no business value in investing in it. These traders have limited willingness to change the nature of transactions and roles of actors as they rely on information gatekeeping to maintain their dominant position in the market (e.g. they resist new market entrants who have tertiary education). Yet these markets contribute to food contamination as they lack sanitation facilities, have poor hygiene practices such as using contaminated water to sprinkle vegetables, and allow consumers to touch the produce while buying.

The wet markets reported that customers value the FFV characteristics of freshness (55%), followed by lack of visible damage (14%), colour formation (10%), firmness (9%), and shape, origin and maturity (4% each). Traders' perceptions of what consumers demand contributes to the disinterest in the wet markets about food safety, as these parameters are related to visual quality and physical characteristics rather than how safe the food is to consume.



Quality indicators that consumers value as reported by traders in the wet markets

Key finding 8: Grocery stores and their consumers consider food safety to some extent; however, consumers' purchase decisions are ruled by the visible characteristics of a product. Additionally, traders give consumers misleading positioning statements about the safety and origins of produce traded through these outlets.
Grocery stores recognize to a certain extent the importance of food safety, as they perceive it to be of concern to their customers. However, they rely mainly on supplies from wet markets directly (72%) and from suppliers (6%) who most likely source from wet markets. Only 22% of grocers were found to be involved in direct sourcing, including own production.

Grocers were found to misrepresent their sourcing programmes to consumers, with terms such as 'natural' and 'organic' being used loosely without evidence.

Key finding 9: Consumers and regulators use visual quality to monitor food safety contamination in FFV, despite contaminants being invisible to the eye. Reliable testing regimes are needed to provide assurance to consumers.
Consumers were reported to use visual quality as an indicator of contamination. For example, they believe incorrectly that agrochemical contamination leaves visible residue. With the lack of a reliable monitoring and testing regime, including clear sampling protocols, consumers have no decision support mechanisms. Neither city regulators nor the federal agencies have a routine food safety monitoring regime for the domestic market. They visit the markets to inspect for poor hygiene, which can be an indirect indicator of contaminants. Only in cases of serious outbreaks are tests undertaken by government agencies to determine contaminant sources. Without a good monitoring regime, there is a high likelihood that the majority of incidents are missed.

Recommendations

Supply side (production)
Targeted training and extension services by private actors for farmers should be provided by both public and private extension providers to improve food safety and quality. The government extension service should be revitalized to be more active in training about and awareness of food safety, as this should not be the responsibility of exporters or their agents.

Examining the roles of men and women will help identify knowledge gaps. Training given to men about pest management, PHIs and MRLs should also be given to women who are responsible for harvesting. In general, the non-certified farmers who form the majority of FFV producers for the domestic market should be targeted for the relevant training. FFV produced according to GAP standards should be labelled accordingly for sale, and farmers should be rewarded, either as preferred suppliers or through higher prices.

Demand side (markets)

We recommend a two-step process. The first is to run a pilot action research project that investigates how to link grocery stores directly with farmers that meet high quality standards. This needs to be accompanied by a testing regime to assure consumers of the intrinsic value of products in this market.

The second is to scale up the action research to market segments within the wet markets or other city infrastructure that exclusively trade products that are fully traceable and regulated through a testing and monitoring regime. This may necessitate investment in new public or private wholesale infrastructure and consumer branding that allows consumers to identify products that have undergone assurance of quality, safety and full traceability.

This can be done by:

1. Focusing first on the main products traded in the wet market so that practices leading to a good traceability system can be implemented slowly. For example, the focus could begin with tomatoes and leafy vegetables, and other products could be progressively added. A risk-based monitoring and surveillance system should be set up and implemented.
2. Having the national and county governments invest in the wet markets to improve hygiene: clean toilets and handwashing facilities, clean display and measuring equipment, food-grade benches for displaying produce, and minimizing the touching of produce that can easily be contaminated by customers through packaging. Improving training and awareness among all players – including traders, consumers and market officials – about food management and their responsibilities to increase food safety.
3. Educating consumers about FFV safety/quality criteria, for example visible versus non-visible attributes, and creating awareness about food safety and negative effects on human health. This can be done through the existing popular TV and radio programmes.
4. During the action research, identify possibilities to position the National Horticulture Traceability System and the national standard (KS1758-2:2016, code of practice for fruits and vegetables) as important for Kenyan consumers, so grocers and wholesalers see the value of it. The following questions also need to be answered:
   - How can food quality specifications be integrated in the domestic market?
   - If there are first movers within the domestic market that are interested in joining this initiative, how can they be engaged?
   - What mechanisms would trigger behavioural change at the level of brokers and traders in the middle of the chain to keep product separation and traceability?
   - What mechanisms can be used to engage the grocery segment and the consumers who would be willing to pay higher prices for products with higher assurance of food safety?

Policy recommendations

1. The Government of Kenya should prioritize and make funds available for the implementation of a national monitoring plan for FFV destined for the domestic market and should publish results of the testing.
2. The County of Nairobi can better resource the Food Safety Unit of the Public Health Department so that it can work the Kenya Plant Health Inspectorate Service (or other laboratory with relevant capacity) to routinely test for MRLs, heavy metals and microbes and assess how and where they are entering the supply chain in order to improve knowledge and compliance.
3. In addition, the Food Safety Unit can work more collaboratively with the national authorities charged with various aspects of food safety. Coordinated efforts should identify strategies to increase the awareness of food safety that the different actors in the horticulture sector have and to empower the Food Safety Unit to properly monitor and implement sanctions for non-compliance with food safety procedures and regulations.
4. The County of Nairobi can work with key counties supplying horticultural products into the City of Nairobi to improve compliance with food safety and access to extension, aggregation and traceability.
5. The County Government of Nairobi can use a traceability system to monitor food origins and flow into the City of Nairobi in order to manage any challenges that are identified by the city during routine monitoring.

6. Development actors can identify mechanisms to incentivize brokers and traders to properly identify and keep records of the products grown to export standard (even without certification) so that markets that will pay for produce that meets higher food safety standards can be assured of its traceability, for example the grocery markets.
7. Increase the availability of appropriate facilities to guarantee food safety. These can be in the form of collection centres and transportation infrastructure that ensure produce does not get contaminated while in transit. At farm household level, hygiene facilities and clean harvesting equipment are needed to enhance produce safety. This can also be achieved through the implementation of a traceability system along the domestic chain to change behaviour and ensure delivery of safer food to the consumer.

Explore the possibility of enabling a more organized and less congested wet market by separating retail activities from the wholesale markets and scheduling days exclusively for cleaning and maintenance of the infrastructure, instead of the current intensive weekly schedule without intervals for proper cleaning and maintenance.

1 Introduction

1.1 An overview of the horticulture sector in Kenya

Since the early 2000s, the fresh fruit and vegetables (FFV) sector in Kenya has received a great deal of attention due to the rapid and sustained growth of its exports to Europe (Muendo *et al.,* 2004). Yet, despite this growth, exports remain a small fraction of the overall horticultural sector. Most smallholder farmers in all but the arid regions of Kenya produce horticultural products, but only about 2% of these engage in the export segment. Over 90% of all FFV production is consumed domestically, with continuous growth in volumes and varieties of FFV in the domestic segment. The value of domestic horticulture clearly surpasses that of the export segment. In 2016, the total value of FFV marketed in Kenya was US $1.46 billion, of which US$ 310 million (21%) was export revenue and US$ 1.15 billion (79%) domestic revenue (HCD, 2016).

Since the beginning of this century would be best, shifts in the domestic FFV supply chains include differentiation in various market segments, increase in food safety and quality awareness, new regulations that require the domestic market to follow traceability (National Horticulture Traceability System [HTS]) and food safety standards (KS1758-2:2016). There is huge potential to catalyse a vibrant domestic market in which quality and safety are offered to consumers. An example is the emerging urban middle class market that demands safer and better quality horticultural produce and is willing to pay a premium price for it (Ngigi *et al.,* 2011; Okello *et al.*, 2012). However, the poorly organized market structure makes it difficult for farmers to benefit from these emerging market opportunities and to assure safety and quality to more consumers. Over 90% of FFV in the domestic markets is still traded through wet markets that are highly informal and therefore subject to inefficiencies that cause wastage and contamination and deterioration of the value of horticultural commodities. A recent scan of the Kenyan horticulture sector (Matui *et al.*, 2016) suggested that the fragmented nature[1] of the domestic FFV sector is one of the most limiting factors to its development. The horticulture supply chain has very weak relations where the numerous market players compete with each other, leading to suboptimal producer–market coordination, high price fluctuations and food wastage. The quick scan also pointed to the lack of reliable mechanisms to support traceability and food safety in the domestic market.

Fresh produce that complies with food safety and quality standards is highly demanded by the export market but needs to be promoted in the domestic market in Kenya (Karki *et al.*, 2016). A study by Onyango and Kunyanga (2013) tested *sukumawiki* (kale)*,* tomatoes, mangoes and amaranth from open-air markets and supermarkets in Nairobi, Nakuru and Machakos and found that samples contained pesticide residues that were above the acceptable maximum residue levels (MRLs as per *Codex Alimentarius*[2]). This was attributed to excessive and wrongful use of pesticides in vegetable production and non-adherence to specified pre-harvest intervals (PHI). Contamination with biotic agents was found to result from the use of unprocessed manure (slurry), transportation of fresh produce in open trucks (sometimes with non-food products), sprinkling harvested produce (to keep it fresh) with contaminated water, and unhygienic conditions in the market, including customers touching produce. Addressing these issues through improved supply chain coordination and marketplaces that are more organized with higher hygiene standards can reduce risks of contamination. Through awareness-raising via media and research, the domestic market is gradually becoming informed about food safety issues related to the consumption of fresh produce, and interest

[1] Defined as a marketplace where there is no one company that can exert enough influence to move the **industry** in a particular direction. The market consists of several small to medium-sized companies that compete with each other and with large enterprises.

[2] http://www.fao.org/fao-who-codexalimentarius/codex-texts/maximum-residue-limits/en/

in safer and more hygienic food is growing. There may be opportunities to enhance safety and quality in the domestic FFV market if the produce of farmers who currently produce for the export market and also apply those high standards to produce for the domestic market segment, is valued accordingly. This will create options for consumers and grow a quality and safety-oriented domestic horticulture sector.

1.2 Developments in the production of domestic fresh fruit and vegetables: The export market link

FFV that meets food safety and quality standards is currently being produced in Kenya but primarily for the export market. More than 20,000 producers are certified under the GlobalGAP standard to produce for the export market (Lenné *et al.,* 2005). These farmers also grow several other horticultural crops for the domestic markets alongside their export production. These crops are produced at more or less similar standards as the export crops because the good agricultural practices apply across the production system. Lenné *et al.* (2005) describe how the export supply chain of Kenyan horticulture might be a useful role model to overcome constraints in the development of a robust domestic sector through the use of improved and adaptive vegetable varieties and quality seed, enhanced by sustainable seed-delivery systems as well as organized technical assistance, reduced use of pesticides, better control over pests and diseases, and efficient marketing systems.

Hammoudi and Hamza (2015) noted that good agricultural practice in export sectors could spill over to domestic supply chains. This represents an opportunity to enhance the availability of safer and better quality FFV in the domestic markets. Most export fruit and vegetable crops are also consumed locally, so improvement of domestic markets can benefit local consumers (Basler, 1986; PIP Magazine, 2011). One example of the positive relationship between domestic food crops and export crops was studied by Chaléard (2003) in the south of Togo and the Ivory Coast, where an increase in export production generated an increase in domestic food production.

In the Kenyan context, there are spillover effects when excess or rejected produce which was initially destined for export is channelled to domestic markets, as well as when export-grade products are supplied to premium domestic markets (Krishnan, 2018). The excess produce usually does not meet export quality and cosmetic grades but is safe. The recent establishment of the HTS to complement the national standard (KS1758-2:2016, code of practice for fruits and vegetables) offers new market opportunities for farmers and buyers to create better organized supply chains that support relationship building and information flow up and down the chain to enhance quality and safety.

1.3 Developments in the domestic fresh fruit and vegetables market segment

According to Tschirley and Ayieko (2008), the Kenyan urban wholesaling and retailing system has spilled over from organized county markets into roadsides and other unregulated areas because there has been a lack of investment in public market places. In the current system, all participants are subjected to high transaction costs and poor quality FFV, and many traders, especially but not only those in kiosks, are vulnerable, subject to theft and even bodily injury. Collaborative planning for new investment between city officials and farmer and trader organizations is badly needed; positive signs of movement in this direction include a more constructive approach to kiosks and joint public/private planning for a new wholesale market outside Nairobi central business district (CBD).

Most of the produce for the local market is marketed through the informal sector, such as wet markets and kiosks, and only 5% is sold through supermarkets (Tschirley *et al.,* 2004). So far, production is not governed by standards or enforcement of MRLs, and tests related to food safety issues are rarely carried out. Monitoring mechanisms in place rely on visual quality, which is not indicative of the presence of contaminants.

Further, Tschirley and Ayieko (2008) noted that by 2030 the urban population in Kenya is expected to nearly triple, while rural populations will rise by only 50%. The urban share of the population during that time will rise from 21% to 33%. Several implications follow. For one, farm productivity will need to increase dramatically. Today, 10 farming households have to feed about 2.5 non-farming households; in 25 years' time, those same 10 farming households will have to feed about 5 non-farming households. To achieve this, marketed food production per rural household will have to grow by nearly 3% per year, a major challenge even under the best of circumstances. A second implication of these demographic trends is that marketing infrastructure in rural and urban areas and their linkages will have to be strengthened. Over the past two decades, this infrastructure has received very little investment. In many cases it has deteriorated. This report shows that urban marketing activities have, as a result, spread widely into unplanned – and subserviced – informal markets, with major negative effects for farmers, consumers and urban residents. This undesirable situation is well recognized in Kenya Vision 2030, which accords a high priority to improving food marketing infrastructure and rural–urban marketing links.

USAID-KHCP (2012) estimated domestic trade for FFV in Kenya to be approximately 2.72 million metric tons (MT) worth KES[3] 137.1 billion, or US$ 1.5 billion. Fruit constituted 27% of the volume and approx. 30% of the value; vegetables constituted 73% of the volume and 70% of the value. Tschirley and Ayieko (2008) found that the volume of FFV entering Nairobi City every day is 700 MT, worth KES 10 million (US$100,000) or KES 36.5 billion (US$ 36.5 million) per year.

The Nairobi market consistently has the largest market share by volume of fruit (30%), followed by Eastern (19%), Nyanza (14%), Central (14%), Rift Valley (11%), and Coast (9%). The Western region has the least volume (2%), possibly due to availability at household levels (USAID-KHCP, 2012). For vegetables, the Eastern region recorded the highest volume (31%) followed by Nairobi (20%) (USAID-KHCP, 2012). This was attributed to the Eastern region being a net importer of vegetables, even in the rural areas of Machakos, Kitui, Mwingi and Makueni, due to the dry climate associated with the region. While Nairobi has a high population density, urban agriculture contributes 25% of vegetables consumed in the city (County Government of Nairobi, 2017). The Western region had the lowest amount of vegetable trade (5.2%) at mainly attributed to domestic production of vegetables consumed by households.

Tschirley and Ayieko (2008) estimated that over 80% of all FFV traded in Kenya is consumed in urban markets, with vegetables making up 85% of the volume and 79% of the value of fresh produce entering the Nairobi market. The study also identified Wakulima and Gikomba markets as the two main wholesale markets in Nairobi for FFV. The study also identified Wakulima and Gikomba markets as the two main wholesale markets in Nairobi for FFV. Wakulima accounts for 29% of the total value of wholesale trade compared to 56% of total value of produce entering the city; indicating that wholesale segments in the retail markets by small intra-urban wholesalers is also a significant segment (Van der Lans *et al.*, 2012).

1.4 Market segmentation[4]

This study identified four distinct market segments with interconnected supply chains; segments here refer to distribution or marketing channels:

The main segment is the wet wholesale and retail markets, accounting for over 85% of volume of FFV traded in the city. The market infrastructure is owned, managed and controlled by the County Government of Nairobi, which leases space in the market on a day-to-day basis to traders. While all a trade needs to pay is the daily cess, entering the wholesale market is difficult as informal consent of existing wholesalers is needed. Gikomba and Wakulima, the main wholesale markets, have connected retail markets at Ngara, Muthurwa, City Park, Kangemi, Toi, Woodley and City Market. Small groups of

[3] 2018 rate is 1 USD = 101 KES

[4] Segments here refer to distribution or marketing channels

intra-urban wholesalers source from Gikomba and Wakulima and sell to retailers in these markets. According to Jalang'o *et al.* (2016) wet markets are dominated by traders who transact buy and sell on cash basis. The wet traders find this convenience as it saves them time and transaction costs because the buyers mostly collect the vegetables for themselves. According to Lenné and Ward (2010), urban open-air wholesale markets such as Wakulima and Gikomba in Nairobi are critical to the functioning of the fruit and vegetable market chains.

The second segment identified involves retail traders, commonly referred to as hawkers, who operate on the roadsides from small informal kiosks close to residential estates but outside the precincts of the official city market infrastructure. Traders outside the Nairobi CBD pay cess to the County in the form of a human carrier licence, although the County does not recognize them as operating within the legal FFV retailing environment. However, those within the CBD are considered to be engaged in illegal trade and are often prosecuted for hawking without a valid licence within the CBD precincts. This segment of the market, though important in reaching consumers, was not studied as its characteristics were found to be similar to those of the retail traders operating within the official city market infrastructure. No additional insights were foreseen by studying this segment in relation to food safety and quality. Furthermore, as the wet market segment is the most unregulated and without formal infrastructure, it was viewed as posing the greatest risk to food safety and quality compared to the formal retail markets.

The third market segment was found to consist of specialized traders / FFV businesses that operate within the formal economy[5]), pay annual licences to the County Government and operate in leased/owned permanent or semi-permanent business premises. That is, they are mainly small, medium and large grocery stores supplying both middle income individuals and high value institutional consumers such as schools, restaurants, hospitals and hotels. In a study by Jalang'o *et al.* (2016), this market segment was found to demand consistent volumes of supplies and better presented, high quality and 'safer' FFV, notwithstanding that this judgement is based on visual quality. The segment has short procurement processes, in most cases requiring 14–30 days credit terms. Grocery stores were found to be located either in high-end shopping malls or conveniently in close proximity to middle income residential estates. Grocery stores were sensitive to food safety and quality and are making efforts to meet the demand of consumers by investing in display, storage and training so the produce appeals to their customers.

Supermarkets are the fourth market segment identified. They have a more complex procurement system, with suppliers being paid only two to three months after delivery. Supermarkets were found to insist on contractual agreements that do not allow traders the flexibility of benefiting from temporary price premiums in alternative channels (Jalang'o *et al.*, 2016). Tschirley and Ayieko (2008) estimated that supermarkets on their own account for 4–5% of the FFV trade in Nairobi. This study did not investigate this market segment, as Krishnan (2018) had already identified diffusion from global value chains to domestic retail through spillover effects and strategic diversification. This study did, however, note relations between supermarkets and their suppliers to be based on trading dynamics, with three out of four supermarkets interviewed reporting that they lease space in the fresh department to their suppliers and have no interest or capacity to build business relationships up to the production level. Another factor that would prevent these business relationships developing is that farmers who grow for the export market and could re-channel high quality produce to the domestic market reported that payment turnaround time of under 14 days is the most important parameter regardless of the market segment. This is in direct conflict with the supermarket business model described above. However, due to the increase in competition, supermarkets are paying more attention to revenue streams such as FFV products and becoming more sensitive to food safety to attract more consumers. Supermarkets are starting to look at business models that will allow them to source high quality produce directly from export farmers.

This study therefore focused on the first and third market segments.

[5] An economic system where money is the primary means of making financial transaction (Fisher, 2006)

1.5 Research questions

1.5.1 Catalysing investment in quality and safety in the domestic fresh fruit and vegetables sector

The context described above informed the design of an action research initiative that examined the leverage points catalysing investment opportunities for enhancing quality and safety in the domestic FFV sector.

This research sought to answer the following questions:

1. Is the export market a potential catalyst for supply of domestic FFV products that meet good production standards from among farmers engaged in parallel production for export and domestic markets?
2. Which factors and aspects of the domestic horticulture supply chain can be acted upon to catalyse the production and marketing of food in a safe manner that ensures best quality?
3. How is the current domestic market for FFV organized and are there opportunities for connecting farmers who meet good agricultural practices to traders and consumers who are responsive to food safety?

1.5.2 Key assumptions informing the action research

Underpinning the action research were the following assumptions and theory of change:

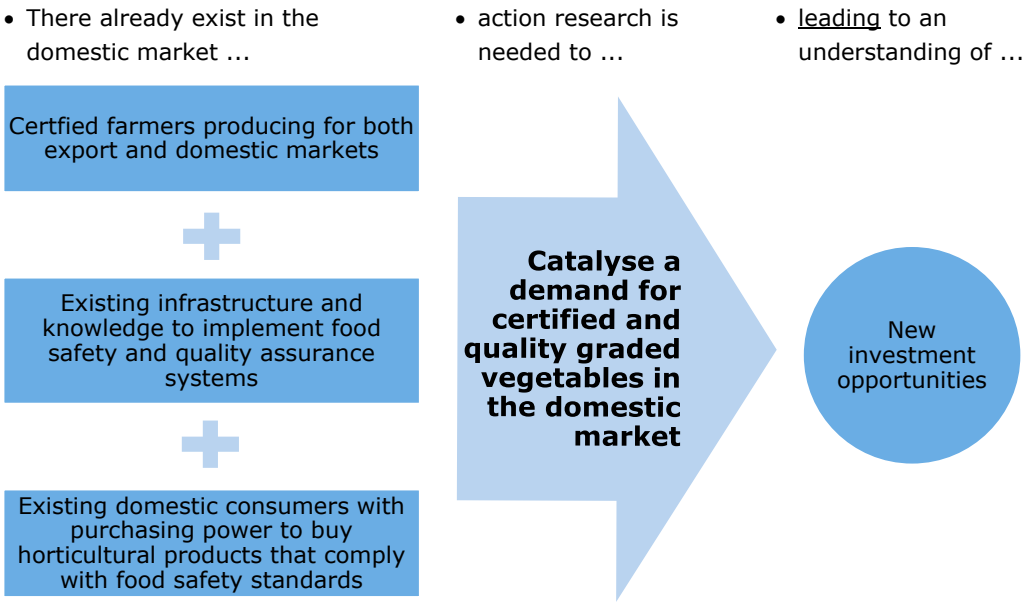


Figure 1 *An illustration of how action research can promote new investment opportunities for formal businesses to grow by linking the producers to domestic markets and defragmenting the domestic sector*

1.5.3 Purpose of the study

As an entry point of the action research, the team conducted a study whose objective was twofold:

1. to investigate whether (and how) practices among export farmers are being diffused towards production for the domestic market in relation to quality and safety (supply side).
2. to understand practices in the domestic markets (that are predominantly within the cash economy in relation to safety and quality and how different market segments perceive and respond to demand by consumers (demand side).

2 Research methodology

The methodology followed a two-step process linked to the two objectives.

2.1 Research method for objective 'a' (supply side): a two-step process to survey farmers

The study began with making an inventory of small- and medium-scale farmers producing FFV for export and domestic markets within a three-hour drive of Nairobi, as the main market (Figure 2), focusing on regions with small scale farmers growing for the export market with the exception of Narok where farmers were found to lease land seasonally. The inventory of farmers across key regions was developed through liaison and interviews with key regulators, exporters, the Horticultural Crops Directorate (HCD) and the Horticulture Division of the Ministry of Agriculture.

The inventory was done through liaising with exporters, Horticultural Crops Directorate (HCD) and Ministry of Agriculture. The key regions were identified through interviews with key regulators including three key exporters, HCD and the Horticulture division of the Ministry of Agriculture.

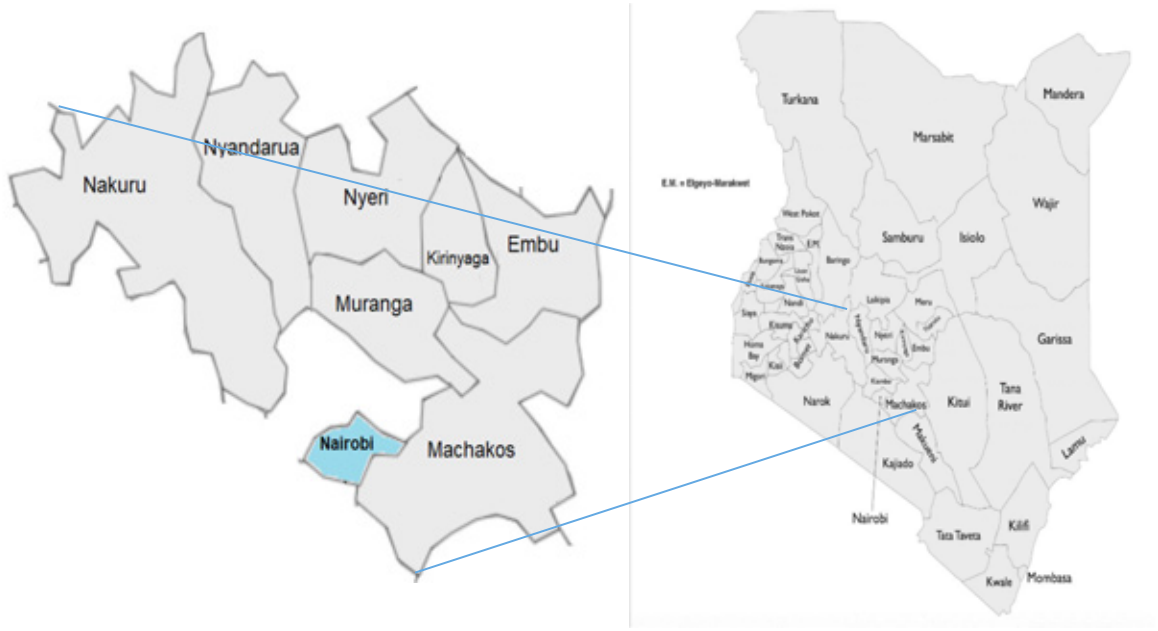


Figure 2 *Source counties around Nairobi of the FFV producers in this study*

Once the production regions had been mapped out, we then identified farmers with GlobalGAP certification as well as farmers without GlobalGAP certification but in close proximity to certified farmers. The certified farmers were identified through the GlobalGAP database, and the farmers that were growing for export without GlobalGAP certification were identified through the inventory Table 1).

Table 1 *Inventory of GlobalGAP certified and non-certified farmers*

Actors	Number identified	Method of identification
GlobalGAP-certified farmers	At least 10,000 farmers in the identified regions	GlobalGAP website and discussions with key actors including HCD, three export companies and Ministry of Agriculture representatives in selected regions
Non-GlobalGAP-certified farmers	More than 50,000	By extrapolation (there were no reliable sources on this)

From this inventory, purposive[6] and snowball[7] sampling methods were used to select farmers to be surveyed. A sample size of 218 farmers was drawn from the different subregions within three hours driving radius of Nairobi. This sample size is made up of 78 certified farmers and 140 non-certified farmers, as summarized in Table 2 below.

Table 2 *Number of surveyed farmers*

County	# Certified farmers (%)	# Non-certified farmers	# Total sample (%)
Embu	12 (15%)	38 (27%)	50 (23%)
Kirinyaga	6 (8%)	10 (7%)	16 (7%)
Machakos	25 (32%)	20 (14%)	45 (21%)
Muranga	15 (19%)	19 (14%)	34 (16%)
Nakuru	8 (10%)	24 (17%)	32 (15%)
Nyandarua	6 (8%)	19 (14%)	25 (11%)
Nyeri	6 (8%)	10 (7%)	16 (7%)
Total	**78**	**140**	**218**

2.2 Research method for objective 'b' (demand side)

For the market end of the study, sampling was undertaken jointly with the County Government market-in-chargers and the traders' association. Nairobi County was selected as a case study because it is the largest and most visible market, also serving as a transit point for other neighbouring regions in Eastern Kenya. The study aimed to investigate practices and perceptions regarding food safety and traceability, focusing on two market segments:

a. Traders in the mainstream wholesale and retail markets who trade in key FFV. A sample of 165 traders was drawn from three wholesale markets (Muthurwa, Wakulima [Marikiti] and Quarry Road [Gikomba]) and six retail markets (Kangemi, Ngara, City Park, Toi, City Market and Woodley Market).

The sample was drawn from traders who are regularly present in the markets and were considered to understand the dynamics of FFV trade (Table 3). A purposive sample was drawn from traders to include different gender, age, product types and duration in the market as the key parameters. Traders were informed of the purpose and voluntary nature of the study.

[6] In purposive sampling (non-probability), the researcher relies on his/her own judgment when choosing members of population to participate in the study (https://research-methodology.net/sampling-in-primary-data-collection/purposive-sampling/).

[7] Snowball sampling involves primary data sources nominating other potential primary data sources (referral) to be used in the research (https://research-methodology.net/sampling-in-primary-data-collection/snowball-sampling/).

Table 3 *Number of traders in the main markets and number of traders interviewed*

Market	Estimated # traders/day	# traders sampled	% of total sample
Gikomba	1,925	24	1
Wakulima	1,700	29	2
Ngara	1,396	24	2
Muthurwa	1,198	14	1
City Park	1,105	19	2
Kangemi	972	21	2
Toi	838	15	2
Woodley Market	522	10	2
City Market	220	9	4
Total	**9,876**	**165**	**2**

b. Traders (grocers) in middle income estates in Nairobi

Grocery stores were mapped on Google Maps using location marketing online tools (Figure 3). An inventory was made of the grocery stores, their locations and contact details. Geographic spread and level of investments were used as parameters for sampling. Those grocery stores that were found to have a permanent address, display their products in crates, have workers who wear uniforms and have display infrastructure like shelves were purposively selected. Willingness of the grocers to participate in the study was also a key parameter.

Figure 3 *Location of wet markets and grocery stores sampled*

The minimum investment criterion led to three categories of grocery stores: high, medium and low end (Table 4).

Table 4 *Number of grocery stores interviewed*

Grocery category	Estimated average investment (KES)	Estimate of # of grocery stores	# grocery stores sampled	% of total sample
High end	>300,000	30	8	27
Medium end	>100,000	40	17	43
Low end	50,000	60	11	18
Total		**130**	**36**	**28**

In this study, the high-end grocery stores are those with electronic point of sales, air conditioning for products, uniforms for employees, parking space, signage and branding of the outlet. The medium end grocery stores are those with uniforms for employees, parking space, signage and branding of the outlet. The low-end grocery stores have only signage and branding of the outlet.

The inventory of key actors was undertaken from review of secondary data and key informants in order to inform the sample size and methodology.

2.3 Data collection methodology

This study used a mix methods approach to collect quantitative and qualitative data. Quantitative data was gathered through a survey of the farmers, and qualitative data was collected through interviews with market traders, Nairobi County officials and selected grocery stores (see Annex 1 for the survey tools).

Data collection tools were prepared and uploaded in Survey CTO (https://www.surveycto.com), which enables online data collection. This was followed by a process of data cleaning to facilitate analysis. Quotes were recorded by the interviewers in notebooks during the interview process and used to draw insights from the data.

2.4 Data analysis

The factors and aspects of the domestic market that can be acted upon to catalyse production and marketing of FFV in a safe manner were analysed. Data was analysed using SPSS and Excel spreadsheets. The results of the analysis were critically analysed for key areas of investment required to bring about positive transformation in the FFV sector and potential first movers.

2.5 Limitations to the methodology

It was challenging to sample farmers who grow for the export market but do not participate in any certification, because their data is not readily available since they enter and leave the market at different times. Another challenge was that certification was used as an indicator of good production stewardship, attention to quality and food safety as well as good resource management. However, the study could not validate this to be the case, as farmers with certification may not necessarily follow the correct practices.

In general, the sample is not nationally representative but is fairly representative for the sampled counties. Since the sampled counties are the main horticultural producers that supply the Nairobi County markets, they are a valid sample to derive conclusions from.

3 Findings

3.1 Overview of fresh fruit and vegetable production for farmers in the sampled regions

3.1.1 Land size

In this study, the average landholding that is dedicated to crop production was found to be 3.4 acres[8] under non-certified production and 3.6 acres under certified production (Table 5).

Table 5 *Landholding in acres by certification*

	Non-certified			Certified		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
Total owned cultivated land	3.4	57.0	0.2	3.6	35.0	0.1
Total owned uncultivated land	1.3	7.0	1.0	5.0	20.0	1.3

There were limited differences in terms of land size and types of vegetables produced by farmers who were growing under certification and those who were not. The main difference was in how the contractual arrangements between farmers and buyers were structured. Farmers producing under certification were found to have contractual arrangements with buyers, which enabled them to produce throughout the year as well as access training, extension services and some inputs, especially seed from the buyers. These buyers supply the main retail markets in Europe. However, farmers growing without certification supply under quasi-contractual arrangements with brokers and buyers who do not require evidence of certification. These buyers sometime enter the market during the high season and exit during the low season. The market for this category was reportedly the wholesale markets in Europe, the Middle East and regionally in Eastern and Southern Africa, where certification is not necessarily demanded.

3.1.2 Fresh fruit and vegetable production

The study found that farmers in the surveyed regions grow vegetables for both the domestic and export markets. Export FFV production in most households was found to average 20–30% of the total volume of FFV grown by the farmers, and the remaining 70–80% was for the domestic market (Figure 4).

[8] 1 acre = 0.405 hectare

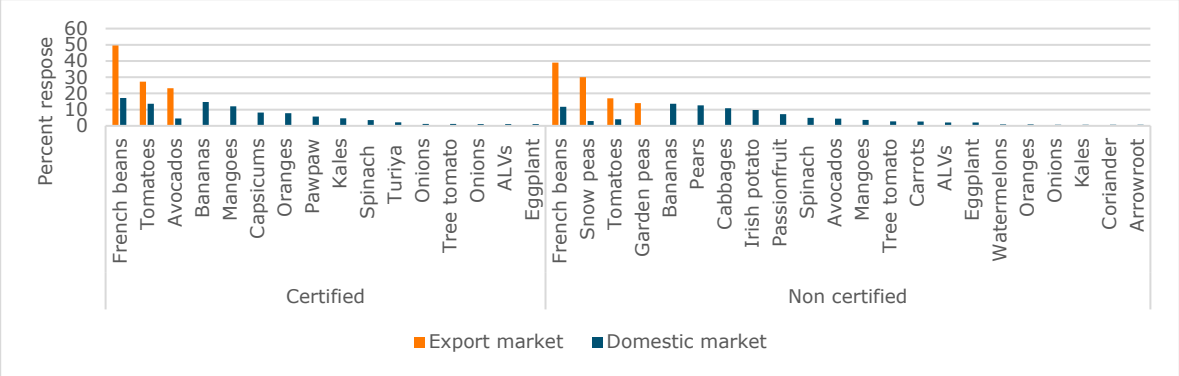


Figure 4 *Overview of products grown for domestic markets and export markets by certification*

a) Overview of main fresh fruit and vegetable products grown by interviewed farmers for domestic markets and export markets

The export market for Kenyan FFV involves both certified and non-certified produce. The main certified products destined for export are French beans (50%), tomatoes (27%) and avocados (23%). The main non-certified products are French beans (39%), snow peas (30%), tomatoes (17%) and garden peas (14%). Tomatoes were mainly exported to regional markets in Eastern Africa.

Our findings agree with those of Ota and Lenné (2003) that the most important export vegetable crops include French beans, garden peas, sugar snaps, snow peas and baby corn, while the dominant domestic vegetables are tomatoes, cabbages, kale and onions.

All commodities exported were found to also be traded in the domestic market within wet markets and grocery stores. Most of the certified produce that was not exported probably had non-compliance issues or was produced in surplus and was sold in the domestic market through spillover and strategic marketing.

Dannenberg and Nduru (2013) found that there was also entry of non-certified FFV from Kenya into the EU market, made possible through made possible through farmers supplying other farmers. They gave two reasons for the low rates of certification: prohibitive cost and complexity of the GlobalGAP standards.

b) Contribution of on-farm and off-farm income to household livelihoods

Crop farming is the main activity for the majority (51.8% certified and 53.4% non-certified) of the respondents, with livestock farming following closely. This shows that crop farming contributes greatly to the livelihoods of the respondents (Figure 5).

Figure 5 *On-farm and off-farm income contribution to respondents' livelihoods*

According to Lenné *et al.* (2005), vegetable production generates and diversifies farm income for smallholder farmers and provides rural employment. It therefore contributes to reducing poverty and enhancing the livelihoods of the poor. In addition, vegetable production supports private sector development through agribusiness and service industries.

c) Roles played by different members of the family

We sought to establish who undertakes the different crop production activities, distinguishing between male and female and between adult and youth. 'Youth' here means someone below the age of 30 who still lives with their parents. The analysed results show that planting, weeding, fertilizer application, harvesting and post-harvest handling are mainly done by women and female youth, whereas land preparation, pest/disease control and harvesting are mainly done by males, including male youth. The analysed results show that planting, weeding, fertilizer application and post-harvest handling are mainly done by women and female youth, whereas land preparation and pest/disease control are mainly done by males, including male youth. This allocation of roles is crucial to the organisation of training, as women and men are equally involved in harvesting both need to understand the importance of PHIs (Figure 6).

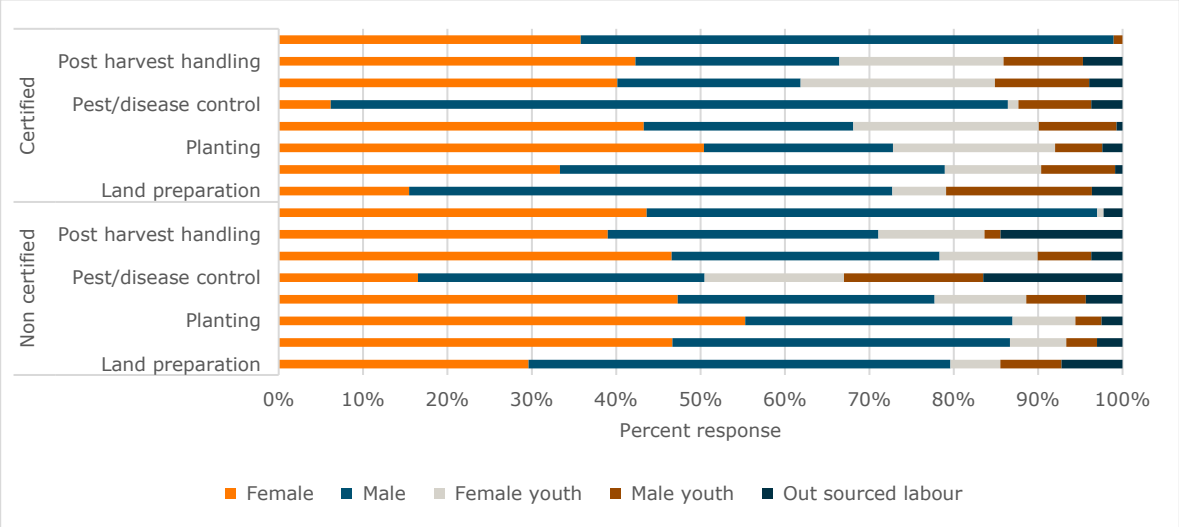


Figure 6 *Roles played by different members of the family*

McCulloch and Ota (2002) found that small-scale farmers mainly rely on family labour. This saves them supervision costs, and the additional care taken by family members means that small-scale farmers get higher yields and therefore higher returns from their small plots.

d) Availability and affordability of hired labour

As seen in most of the respondents work on the farm, growing crops. Some of them also work off-farm in their own businesses or are employed either formally or as casual labourers, and use mostly family and hired labour for their own farm production. When asked about the availability and affordability of hired labour, 89.3% of the non-certified respondents said that it is readily available and 72.9% said that it is affordable. These figures were higher for the certified respondents (Table 6).

Table 6 *Availability and affordability of hired labour by certification*

		Non-certified		Certified	
		#	%	#	%
Availability of labour	Readily available	125	89.3	76	97.4
	Unavailable	15	10.7	2	2.6
Affordability of labour	Affordable	102	72.9	72	92.3
	Not affordable	38	27.1	6	7.7

Labour outsourcing (Table 6) was found to be less than 5% across most of the different farm activities, except for pest and disease control (17% of non-certified farmers) and post-harvest handling (14% of non-certified farmers and 5% of certified farmers). This indicates that horticulture has not contributed much to employment in the rural economies of the sampled counties, despite the fact that most of the respondents said that labour is both available and affordable.

3.1.3 Differences in practice between certified and non-certified export and domestic farmers

We analysed the production practices of the certified and non-certified sampled farmers to understand if there were differences, particularly in practices that have a direct link to food safety and quality.

3.1.3.1 Crop production practices

Crop production practices are important parameters not only for yield improvement but also for quality and safety assurance. Record keeping, risk assessment, scouting for pests and diseases and access to training were used as indicators of good practices.

Statistical analysis was undertaken to determine whether the practices for domestic and export crops are influenced by certification. Chi-squared testing was done for each practice against the type of certification for the four qualitative responses (never, sometimes, mostly and not applicable) to test how significant the relationship is between record keeping and type of certification for both export and domestic crop at 1% significance level.

Record keeping is the basis of traceability and accountability. As shown in Figure 7, there is a significant relationship between record keeping and certification for both export and domestic crops. The majority (74%) of certified farmers always keep crop production records for export crops, but 5% of farmers never do. The certified farmers are diffusing good agricultural practices, as is evident by 57% of them keeping records for crops grown for the domestic market. On the other hand, the two largest groups of the non-certified farmers never keep any records (46% for the export market and 55% for domestic market). A positive observation is that 26% of the non-certified farmers kept records for produce destined for the domestic market, and even more (32%) kept records for export crops. The observed differences can be attributed to the fact that certified farmers are required to keep good records to meet certification standards, and the non-certified farmers are not. This implies that the certified farmers apply the good production practices they use to grow export crops to their domestic market crops.

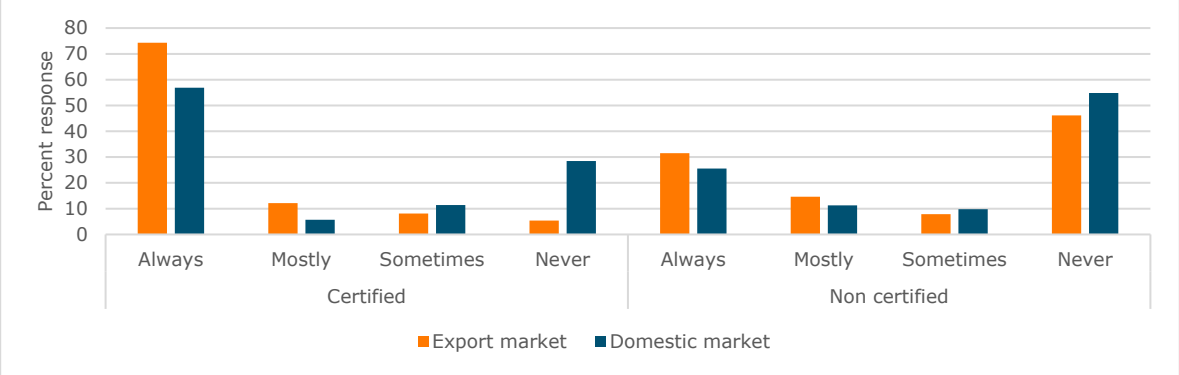


Figure 7 *Record keeping*
(Pearson chi-squared *Export market =49.273,* P =0.01; Pearson chi-squared *Domestic market = 27.230*, P =0.01)

It is of great importance for compliance that farmers conduct risk assessment to identify, manage and control potential hazards to products, health and safety and the environment, including identifying residual risks and their management. From the chi-squared test shown in Figure 8. it is clear that there is a significant relationship between risk assessment and certification for both export and domestic crops at the 1% significance level. The certified farmers were aware of and undertook risk assessment for both

export (62%) and domestic (73%) crops, but of the non-certified farmers only 33% farmers undertook risk assessments for export crops and only 21% for domestic crops. The largest groups of non-certified farmers (45% export and 57% domestic) did not undertake any risk assessments.

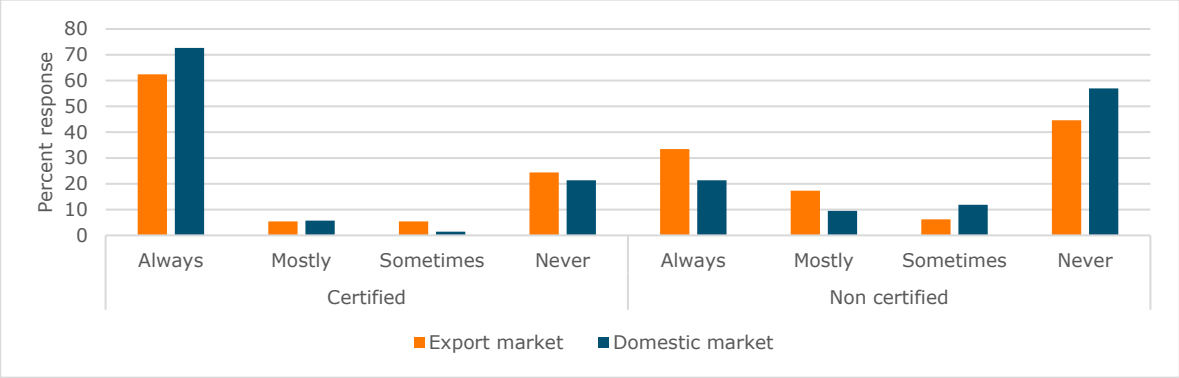


Figure 8 *Risk assessment*
(Pearson chi-squared *Export market =19.132,* P =0.01; Pearson chi-squared *Domestic market = 30.651*, P =0.01)

Scouting for pests and diseases was reported as one of the key production management practices necessary to monitor, prevent and manage outbreaks and to enable farmers to use integrated crop management practices. Chi-squared testing shows a significant difference between scouting and certification for both export and domestic crops at the 1% significance level. Certified farmers reported that they always scout for pests and diseases (78% for export production and 90% for domestic production). Fewer non-certified farmers did so (44% for export production and 36% for domestic production) (Figure 9). Farmers who regularly scout for pests and diseases are better able to adapt good management measures compared to those who do not.

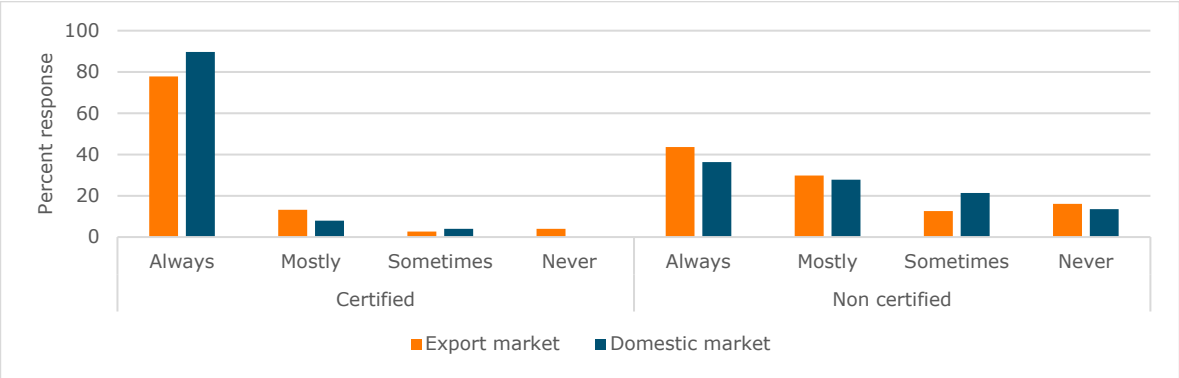


Figure 9 *Scouting for pest and diseases*
(Pearson chi-squared *Export market =31.373,* P =0.01; Pearson chi-squared *Domestic market = 53.612*, P =0.01)

Training farmers in production methods heightens their awareness about aspects of production that affect product quality and safety. The chi-squared values show that training in production practices has a significant relationship with certification for both export and domestic crops. Significantly more certified farmers (66%) than non-certified (41%) always receive crop production-related training for their export crops Figure 10. Training for the domestic crops always happen; possibly at the same time as export crops as reported by 70% of certified and 30% of non-certified farmer respondents. Dinham (2003) noted that without training, farmers are unable to make good crop decisions: recognition of pests and their predators is generally low, leading to decisions to spray to kill any insect. Knowledge of pesticide product selection, application rates and timing is poor; different products are often combined in the belief

that the effect will be greater; re-entry periods after spraying and essential PHIs are not known; and without knowledge of alternatives, farmers will often assume that the only solution to pest problems is to spray more frequently.

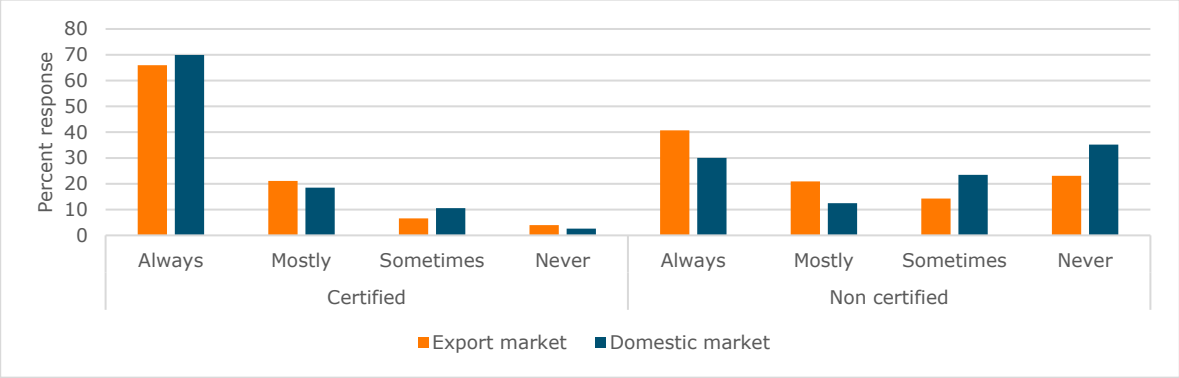


Figure 10 *Training in production practices*
(Pearson chi-squared *Export market =26.784,* P =0.01; Pearson chi-squared *Domestic market = 40.943*, P =0.01)

3.1.3.2 Inputs use

Inputs are a key feature in any horticulture value chain. They include seeds, fertilizer (organic, inorganic, liquid/foliar), pesticides (herbicides, insecticides, fungicides) and machinery. In this study, we analysed the selected farmers' practices around input use.

Crop nutrition plays an important role not only in reaching attainable yield but also in quality improvement. One of the sustainable methods of improving crop nutrition is by applying compost manure, an organic fertilizer that is prepared through the process of composting. The chi-squared values show that there is a significant relationship between composting and certification for domestic crop at the 1% significance level, but there is no significant relationship between composting and certification for export crop at the 1% significance level. This can be attributed to the fact that due to ready availability of compost manure, both certified and non-certified farmers are likely to use it. The majority of the certified farmers apply compost for both export (72%) and domestic (75%) crops 42%) and domestic (36%) crops.

A smaller percentage of non-certified farmers indicated that they always use compost manure for export (42%) and domestic (36%) crops.

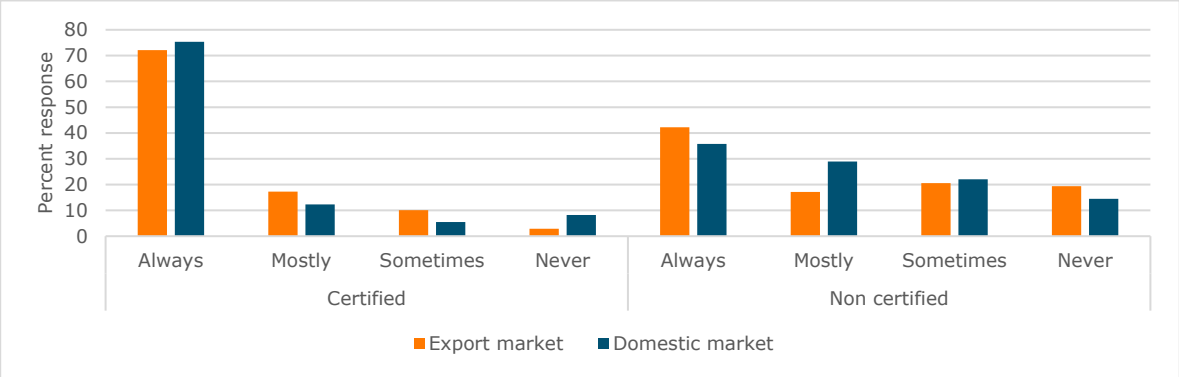


Figure 11 *Composting*
(Pearson Chi-Square *Export market = 2.4,* P.v =0.494; Pearson Chi-Square *Domestic market = 35.628*, P.v =0.000)

The use of fertilizers is a very common practice among both certified and non-certified farmers (Figure 12). The chi-squared values show that there is a significant relationship between fertilizer application and certification for both export and domestic crops at the 1% significance level. Of the certified farmers, 75% always use fertilizer for export crops and 78% for domestic crops. A smaller proportion of the non-certified farmers reported that they always use fertilizer, with 47% always using it for export crops and 36% for domestic crops. It can be deduced that certified farmers are more confident to invest in inputs than non-certified farmers because they already have a market through their contracts.

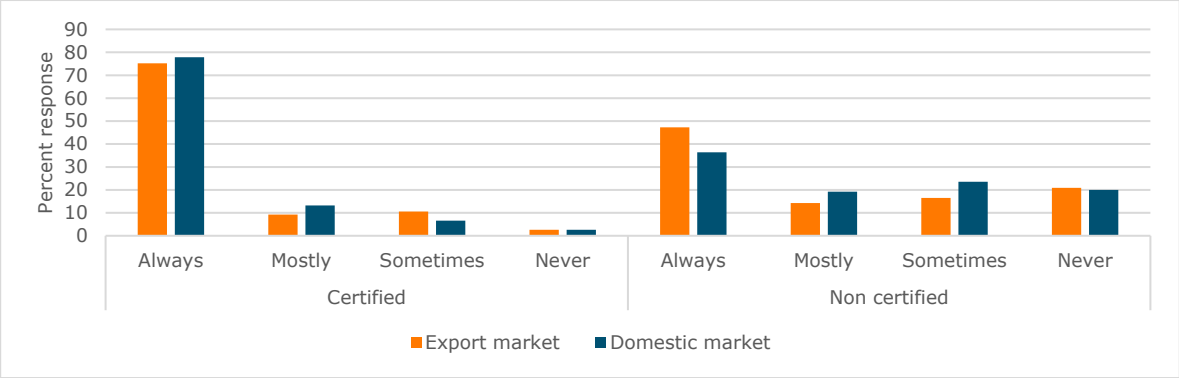


Figure 12 *Fertilizer application*
(Pearson chi-squared *Export market = 26.203,* P =0.01; Pearson chi-squared *Domestic market = 31.34*, P =0.01)

The Pest Control Products Board (PCPB) is the government agency that regulates pest control products in Kenya. Each year, the agency publishes an official list[9] of all the registered products that are approved for pest control, including those meant for agricultural use. The list also includes products that are restricted to specific applications as well as those that have been banned for use. Export standards require crop producers to have this list as a reference point for any crop protection product they use for pest and disease management and control.

In this study, the certified farmers were aware of the PCPB list, referred to it and actually applied only the approved pesticides on their crops. The majority (87%) of certified farmers always refer to this list for their export crops and 79% always use the list for the domestic market crops. For the non-certified farmers, 52% always use approved pesticides as guided by the PCPB list for the export crops, whereas for the domestic crops the largest response (46%) was from those who said they never followed the list. It is also important that farmers use the chemicals that are specifically for particular crops as part of responsible pesticide use. Figure 13 shows that the majority of certified farmers follow correct pesticide use for particular export (78%) and domestic (82%) crops. A smaller majority (53%) of non-certified farmers use the correct pesticide for particular export crops, but 40% of the certified farmers do not use the approved pesticide for particular domestic crops. The observed difference can be attributed to the fact that certification requires farmers to have the PCPB.

[9] http://www.pcpb.or.ke/listofregproducts/Full%20List%20of%20Registered%20Products%20Version%201_2018.pdf

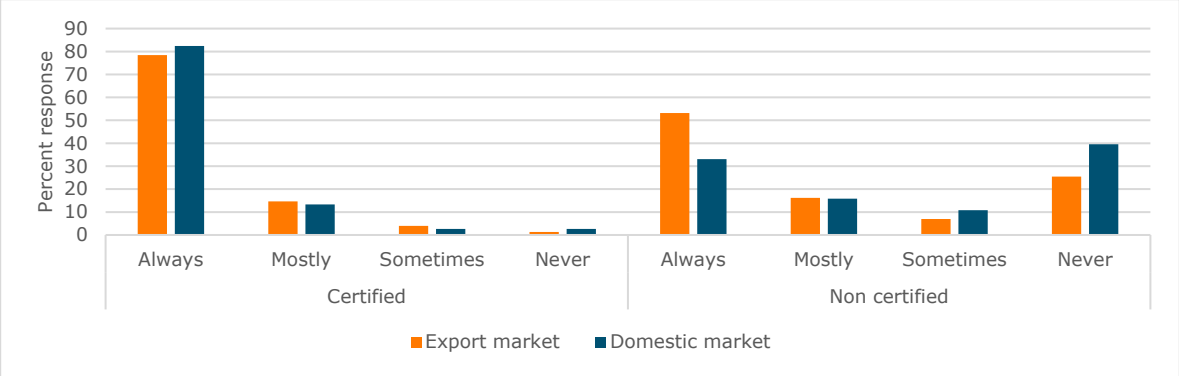


Figure 13 *Use of correct pesticide for particular crop registered with PCPB*
(Pearson chi-squared *Export market =32.513,* P =0.01; Pearson chi-squared *Domestic market = 46.068*, P =0.01)

How FFV is harvested can directly affect the quality and safety of the produce. The PHI is the minimum period (usually in days) between pesticide application and harvesting of the crop. After the lapse of this period, the residue levels of the pesticide should have fallen below the MRL. Therefore, the PHI is directly related to the amount of pesticide residue in the harvested product. The chi-squared test values show that there is a significant relationship between observation of PHI and certification at the 1% significance level. Figure 14 shows that all the certified farmers said they almost always observe the PHI for their crops, be they for the export or domestic market. Of the non-certified producers, 13% (export) and 9% (domestic) admitted never observing the PHI, as they did not know about it.

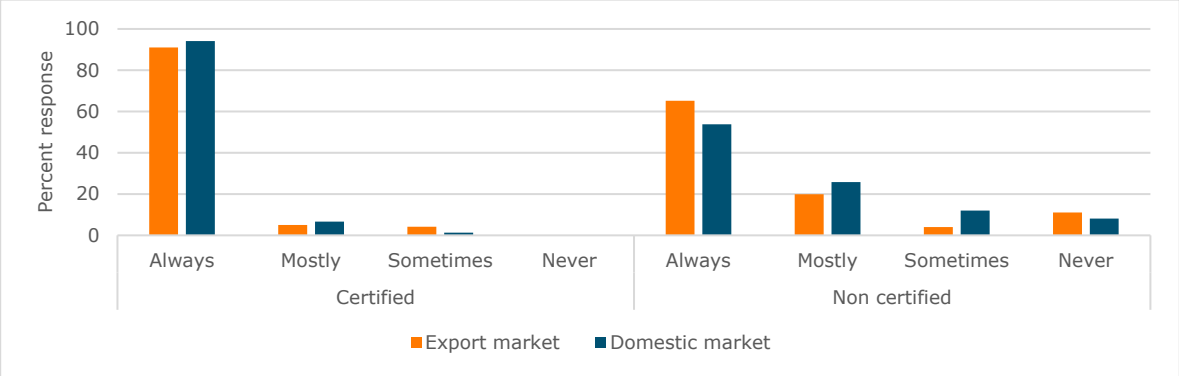


Figure 14 *Observed the pre-harvest interval*
(Pearson chi-squared *Export market = 27.626*, P =0.01; Pearson chi-squared *Domestic market = 42.462*, P =0.01)

3.1.3.3 Hygiene practices

This study sought to find out whether the producers observed hygienic practices such as ensuring they have clean sanitary facilities, observing personal hygiene after using these facilities, using personal protective clothing (aprons, head cover) and using clean harvesting equipment during the harvesting of FFV. The chi-squared values show that there is a significant relationship between observation of hygiene during harvesting and certification for both export and domestic crops at the 1% significance level. As seen in Figure 15, all of the certified farmers reported almost always observing hygienic practices during the harvesting of export crops. A few (4%) of the certified farmers admitted never observing hygienic practices during harvesting of domestic crops, as compared to 29% of their uncertified counterparts. For the export crops, 17% of the non-certified farmers reported never observing hygienic practices during harvest. It is notable that hygienic practices are followed for produce destined for both export and domestic markets, albeit by fewer farmers in the domestic market and less often by non-certified farmers.

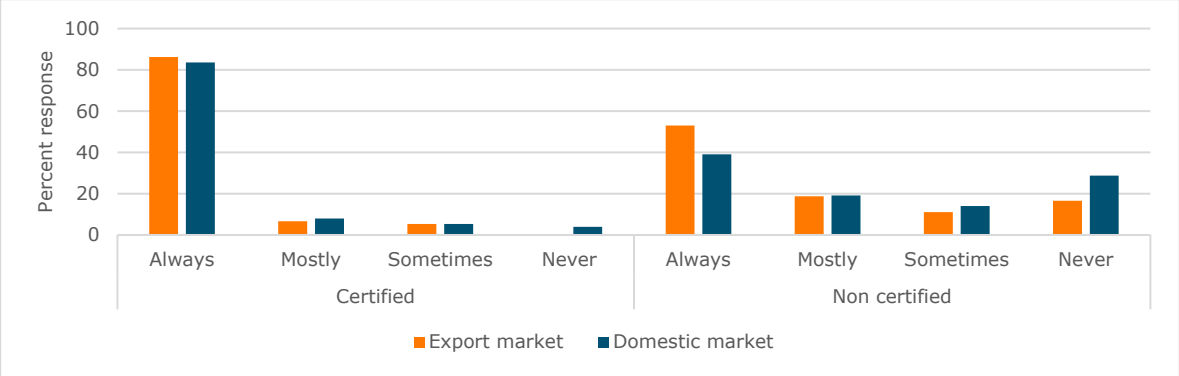


Figure 15 *Observed hygiene during harvesting*
(Pearson chi-squared *Export market = 33.713,* P =0.01; Pearson chi-squared *Domestic market = 35.684*, P =0.01)

Harvesting equipment includes tools, harvesters' clothing (apron, head cover) and containers (crates, buckets, gunny bags) just to mention a few. The cleanliness of such equipment is directly linked to the hygiene qualities of the produce being harvested. Chi-squared testing showed that there is a significant relationship between use of clean harvesting equipment and certification for both export and domestic crops. As an indicator for the diffusion of good agricultural practices, a significant majority (84%) of the certified respondents always used clean harvesting equipment for all their crops, whether destined for export or domestic market (Figure 16). Among the non-certified farmers, 49% of those growing for export and 59% for the domestic market always used clean harvesting equipment; 14% of those growing for export and 37% for the domestic market never used clean harvesting equipment.

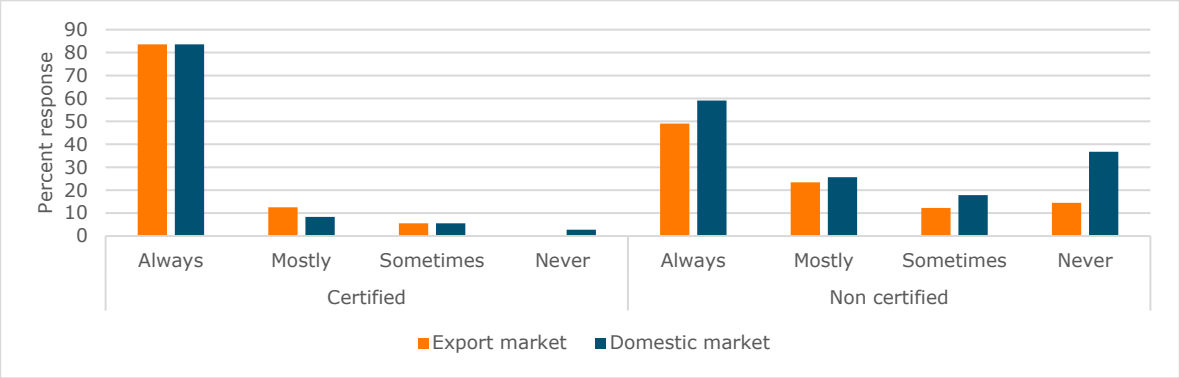


Figure 16 *Use of clean harvesting equipment*
(Pearson chi-squared *Export market = 30.271,* P =0.01; Pearson chi-squared *Domestic market = 30.577*, P =0.01)

The majority of the certified farmers have handwashing facilities (86%) in (or near) the toilet as well as soap (81%) to use when washing hands after visiting the toilet. This good hygiene practice is linked to the requirements for certification and to the hygiene-related training that certified farmers receive. As can be seen in Figure 17, 48% of the non-certified farmers said they did not have a handwashing facility near their toilets of which just over half provide soap.

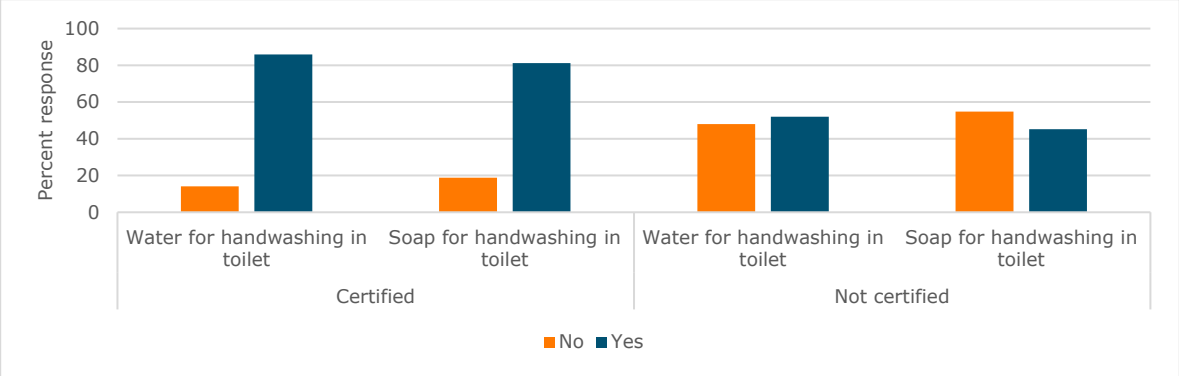


Figure 17 *Use of clean harvesting equipment*

Having access to a toilet facility within 500 m (or 7 minutes' walk) of the farm is a requirement of the GlobalGAP standards that certified farmers comply with. The majority (67%) of the respondents have pit latrines on their own farm, and more than 30% have access to pit latrines shared with other farms (Figure 18). The remaining 3.5% of certified and 4% of non-certified farmers have flush toilets on their own farm.

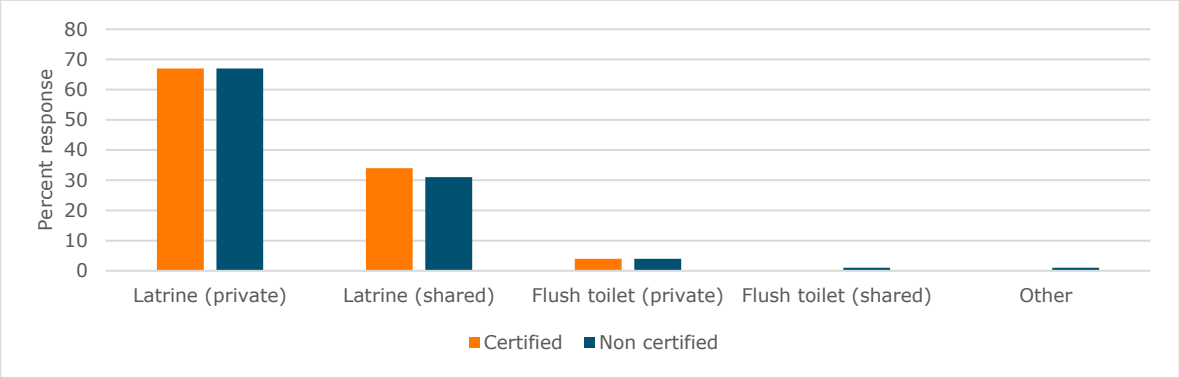


Figure 18 *Use of clean harvesting equipment*

The material used to make the toilet floor directly affects the cleanliness of the toilet. Earth/mud or wooden floors are difficult to clean and maintain, whereas cement and ceramic are much easier. A majority (more than 55%) of the interviewed certified and non-certified farmers have access to toilet facilities that should be easy to keep clean (Figure 19).

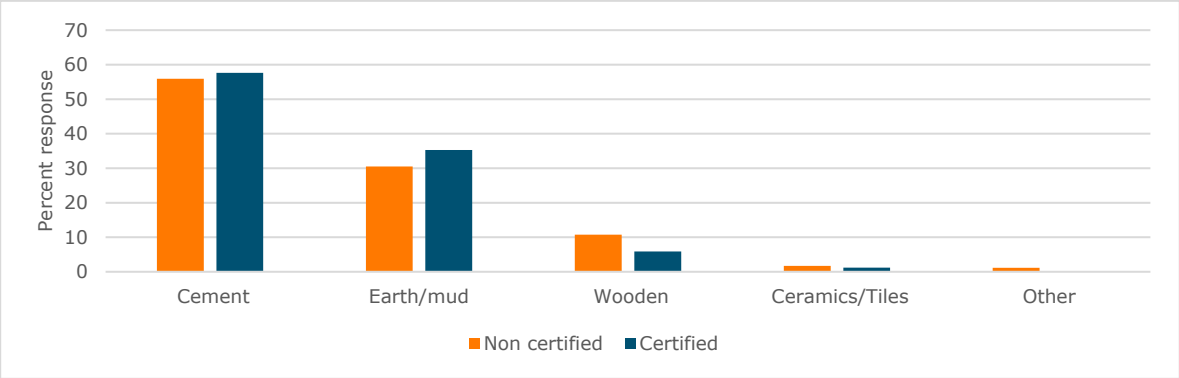


Figure 19 *Toilet floor materials*

3.1.4 Investments in production

3.1.4.1 Purchase of seed

The farmers were asked about the accessibility of seeds for FFV production. The majority (74%) of certified farmers use certified seeds, whereas the majority (60%) of non-certified farmers use farm saved seed (Figure 20).

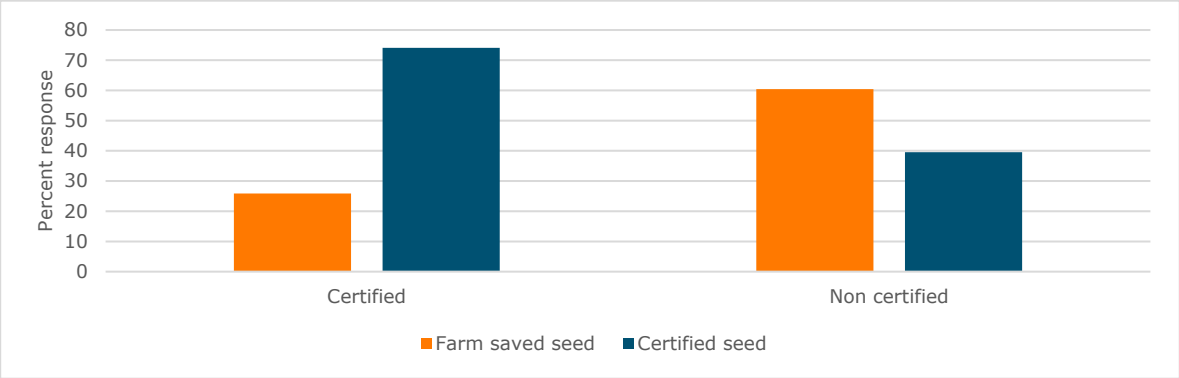


Figure 20 *Purchase of seeds*

3.1.4.2 Main sources of seed in the last 12 months

Farm saved seed by farmers themselves is an important source of seed, as reflected by the 15% of certified and 19% of uncertified farmers who rely on it (Figure 21). However, most of the interviewed farmers are engaged in contract farming with companies that buy their produce. These companies supply seed for the commodities they buy both to certified (52%) and non-certified (34%) farmers. Other main sources of seed are input stores (agrovets), direct purchase from seed companies through field agents, farmer exchange and even farmer groups.

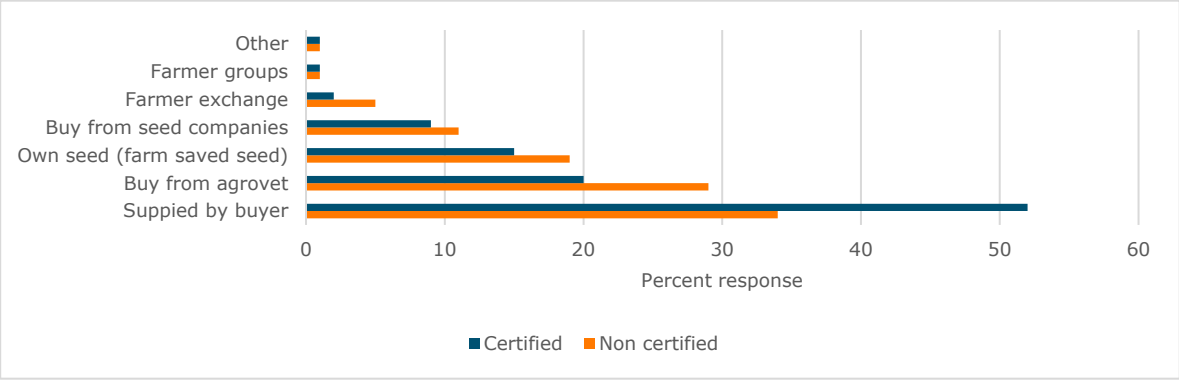


Figure 21 *Main sources of seeds*

3.1.4.3 Access to fertilizers and pesticides

In general terms, all categories of fertilizer were accessible to the farmers, regardless of certification status. However, organic fertilizers are the least accessible to farmers, as reported by 26% of certified and 14% of the non-certified farmers. The most accessible fertilizers are those used in planting, mainly diammonium phosphate and NPK (nitrogen, phosphorus and potassium) (Figure 22).

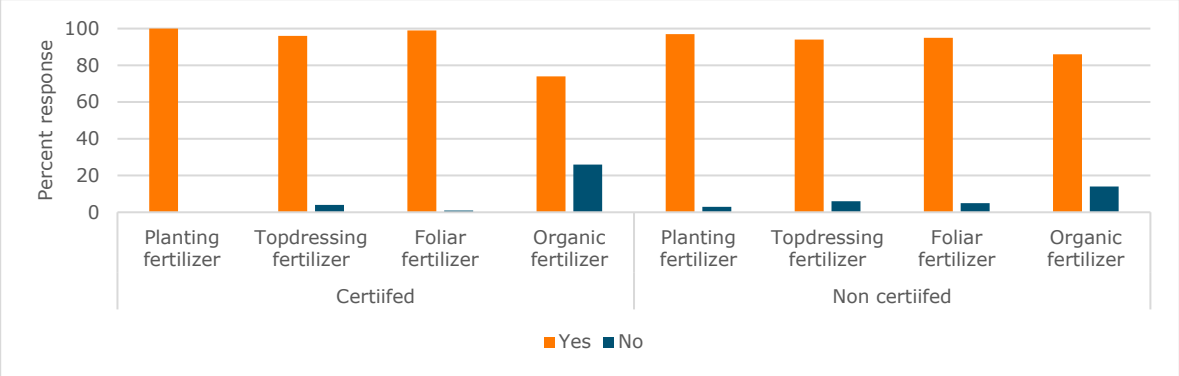


Figure 22 *Fertilizer accessibility*

Insecticides and fungicides were either more accessible or there was a greater need to apply them than to apply herbicides (Figure 23). Almost all the certified and non-certified farmers reported that they could easily access organic and inorganic insecticides from their local input stores, contracting companies and field agents of the agrochemical companies. A similar trend was reported for fungicides.

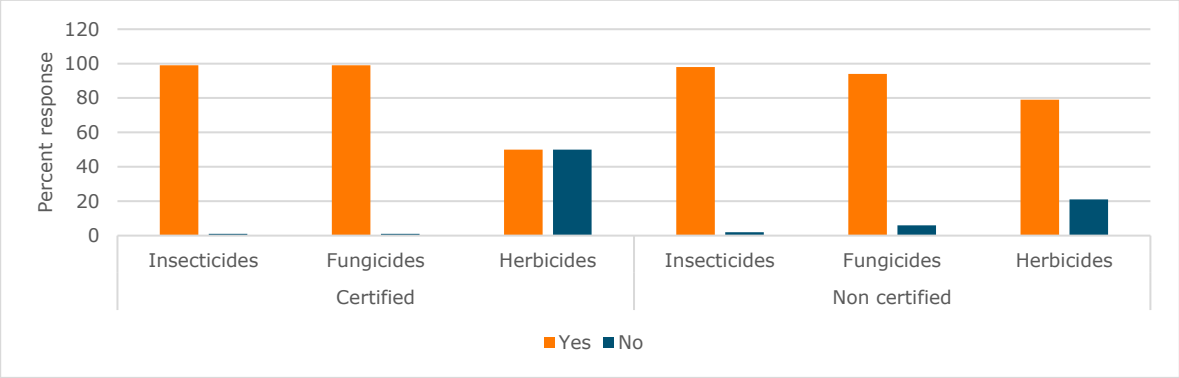


Figure 23 *Pesticide accessibility*

3.1.4.4 Pesticide storage facilities

In this study, 80% of certified farmers said they have a pesticide storage facility as compared to 54% of the non-certified counterparts (Figure 24). As expected, it is a much higher percentage of non-certified farmers (45%) than certified farmers (21%) who do not have pesticide storage facilities.

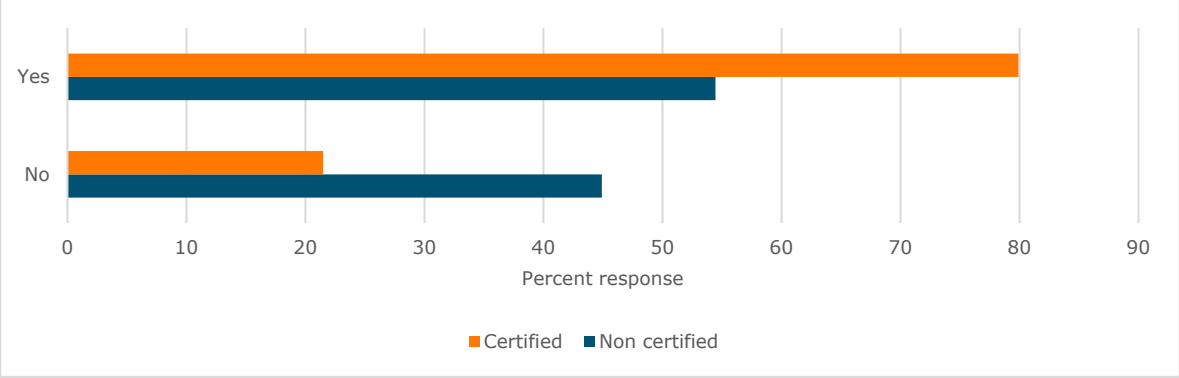


Figure 24 *Ownership of pesticide storage facility by certification*

3.1.4.5 Access to credit

This study sought to understand who makes farmers' decisions to invest in horticultural production and how these are made. Amon g the certified farmers, 50% of the respondents reported that the decision was made by their spouses while 41% making the decision themselves (Figure 25). Joint investment decisions were reported by 9% of the certified and 30% of the non-certified respondents.

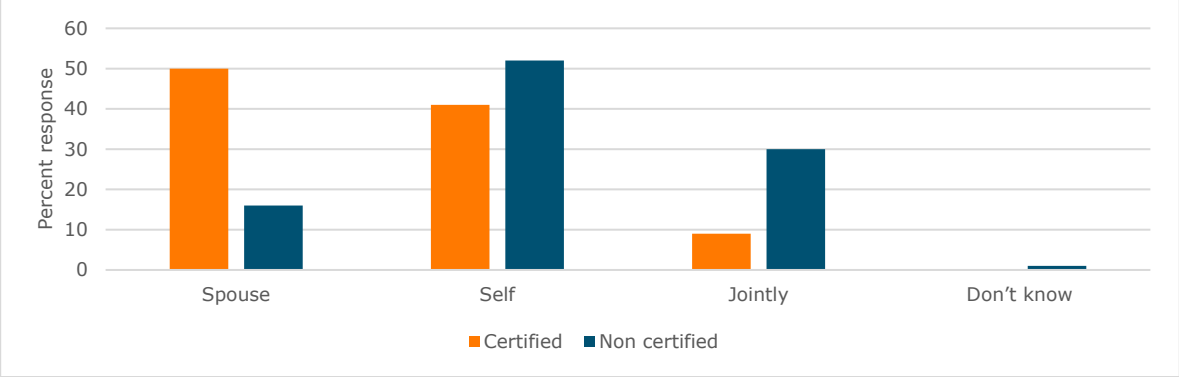


Figure 25 *Decision-making about investments by the household by certification*

When asked about access to credit, 48% of the non-certified respondents indicated that they needed credit facilities; of these, 68% sought (applied) to lenders with 79% of them receiving it (Figure 26). More (67%) of the certified respondents needed credit facilities with 78% of them applying for it and 74% of them receiving. Production under certification requires higher investment, and this may explain why more of the certified farmers need credit facilities, include lending from the exporting companies, to support their systems (Dolan and Humphrey, 2000).

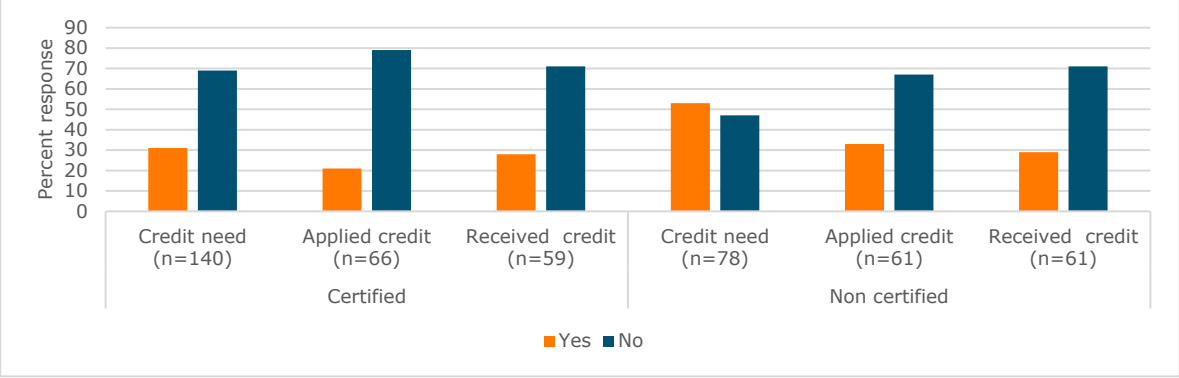


Figure 26 *Access to credit*

When the non-certified farmers were asked why they did not need credit, the majority (51%) said that they were not cash constrained and 23% cited high interest rates as a hindrance; the certified farmers gave similar responses. It was interesting to note that 8% of the non-certified farmers did not know where they can get credit compared to only 3% of the certified respondents (Figure 27).

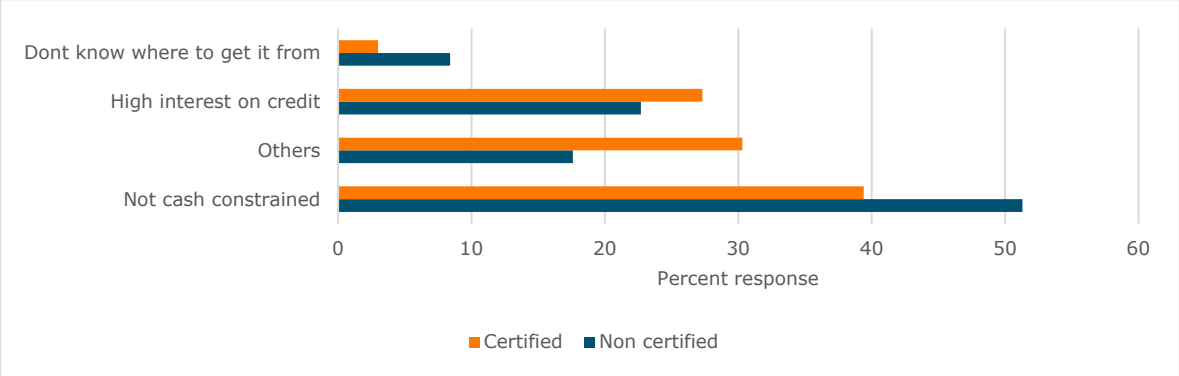


Figure 27 *Reasons for not requiring credit by certification*

The main sources of credit facilities for the certified respondents are merry-go-rounds[10] (social groups) (39%), banks (31%), and others (mainly neighbours and family; borrowing inputs from, for example, local agro-vets) (Figure 28). The non-certified farmers said their credit comes from several sources, including farmer groups, merry-go-rounds, banks, and others (borrowing from neighbours and family; borrowing inputs from, for example, local agro-vets).

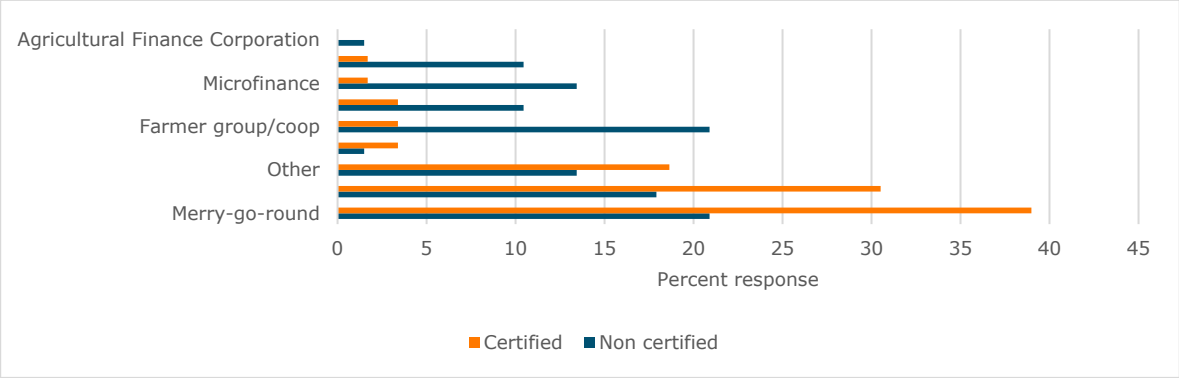


Figure 28 *Sources of credit by certification*

The respondents were asked about the nature and/or type of transaction used when selling their farm produce. A large majority of the certified farmers used mobile money platforms (93%) complemented by banks (90%) for vegetable crops. These percentages were lower for the non-certified farmers and for crops other than FFVs (Figure 29).

[10] A "merry-go-round" is a small social organization where members contribute a small sum of money on a regular basis, often every week. Each time money is collected, the full sum is paid out to one of the members. The members take turns receiving the pay-out, so that after one full cycle, every member of the group has had a turn (www.techxlab.org)

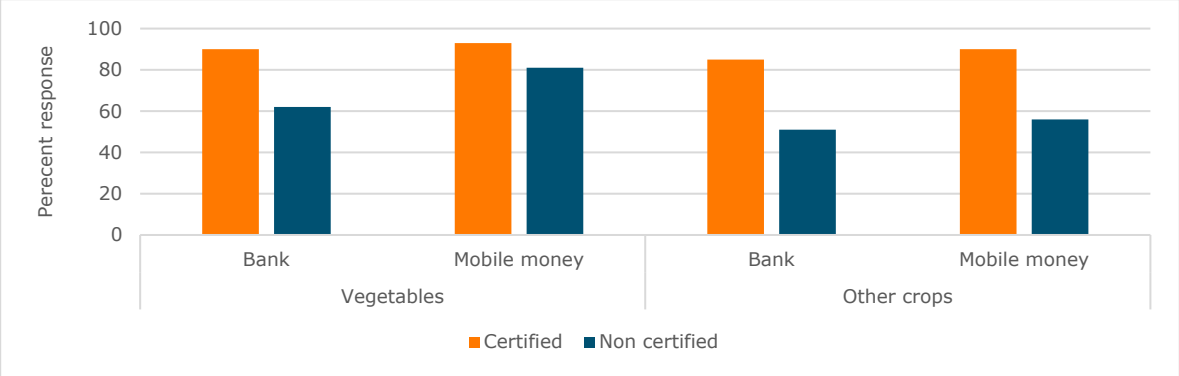


Figure 29 *Mode of transaction by certification*

3.1.5 Access to knowledge and facilitation

3.1.5.1 How farmers access knowledge and training

The majority of the farmers (both certified and non-certified) in all the studied counties reported that they had received information and training about farming, especially about good agricultural practices. For this study, 'information' means any packaged form of communication that is related to farming, and 'training' means a structured way of passing information to farmers, for example, field days or organized forums.

All of the certified farmers in Nyeri and Nakuru counties had received this training within a year of the interview. In Nakuru, 47% of the non-certified farmers reported they had received no training or information within the previous year. Other counties with high rates of uncertified farmers who have received no training/information were Machakos (67%), Kirinyaga (31%) and Nyandarua (30%) (Figure 30). This highlights the extent of skewed attention that certified farmers receive, especially from the exporting companies/buyers. The counties with the highest number of certified farmers who had not received any training are Embu (25%) and Machakos (23%).

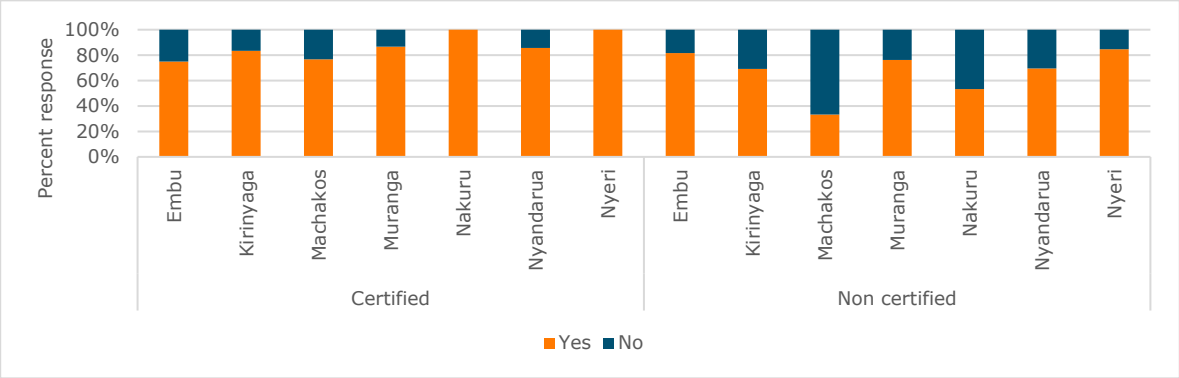


Figure 30 *Farmers received information and training*

The certified respondents who had received training and information said that agronomists from the exporter companies who buy from them are the main source of this training (64%) followed, at a distance, by agrovet stores (12%) and government extension agents (9%) (Figure 31). The non-certified farmers who grow export crops receive training from the export companies (23%), whereas the rest rely on government extension agents (16%), mass media (15%) and other farmers (13%).

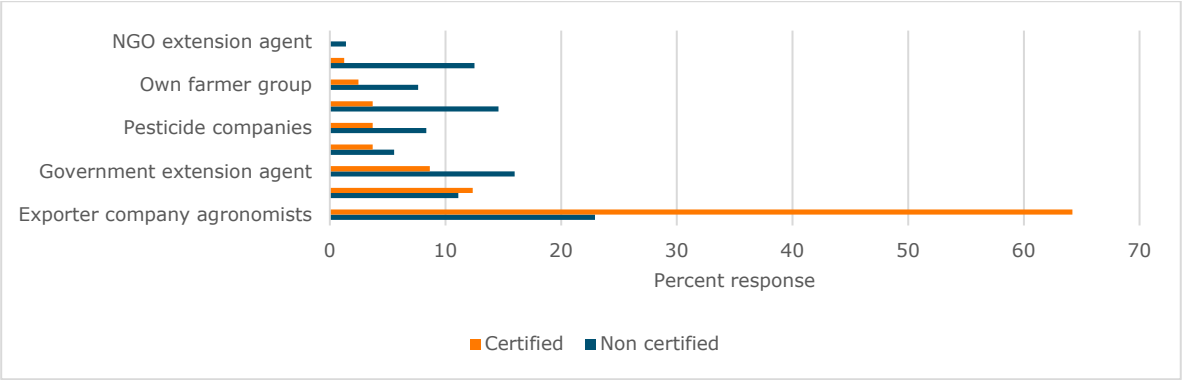


Figure 31 *Sources of information and training*

Figure 32 relates to the mode by which farmers received information and training about production. Certified farmers receive information and training mainly through extension visits paid for by the exporting companies (87%) and farmers' field days (39%). This is significant because it indicates personalized practical advice about production. For the non-certified farmers, extension visits (37%), farmer-to-farmer personal visits and discussions (32%), field days (30%) and phone call & SMS services (26%) are the main modes of information sharing and training.

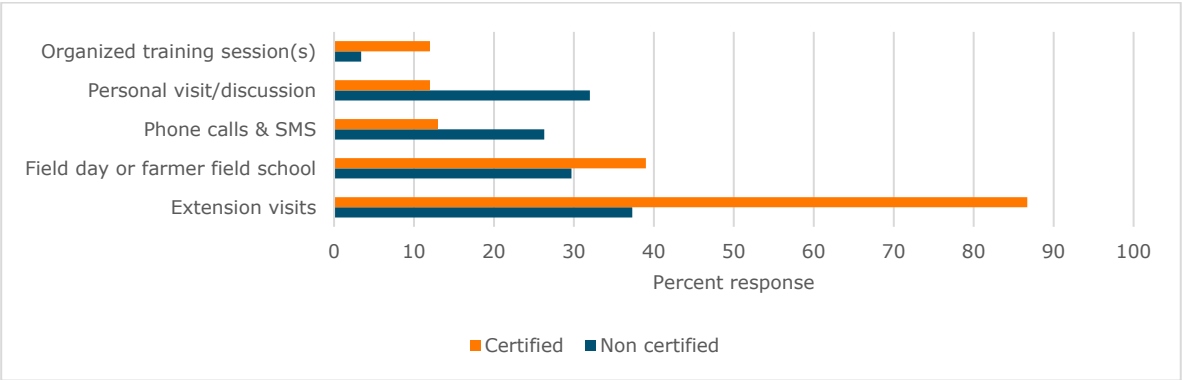


Figure 32 *Mode of training*

The farmers had generally received a wide range of training and related information, with the certified farmers receiving more training across a wider spectrum of topics than the non-certified farmers. More than 70% of the certified farmers received training in pesticide usage (safe use, PHIs and MRLs), crop production for the domestic and exports markets, pest and disease control, good harvesting practices, vegetable grades and standards and hygiene principles (including Hazard Analysis and Critical Control Points). The non-certified farmers had received training in pest and disease control (71%), pesticide PHIs and MRLs (62%), safe use of pesticides (51%) and domestic vegetable production (50%) (Figure 33). The training in domestic vegetable information covered market access and how to increase productivity in general.

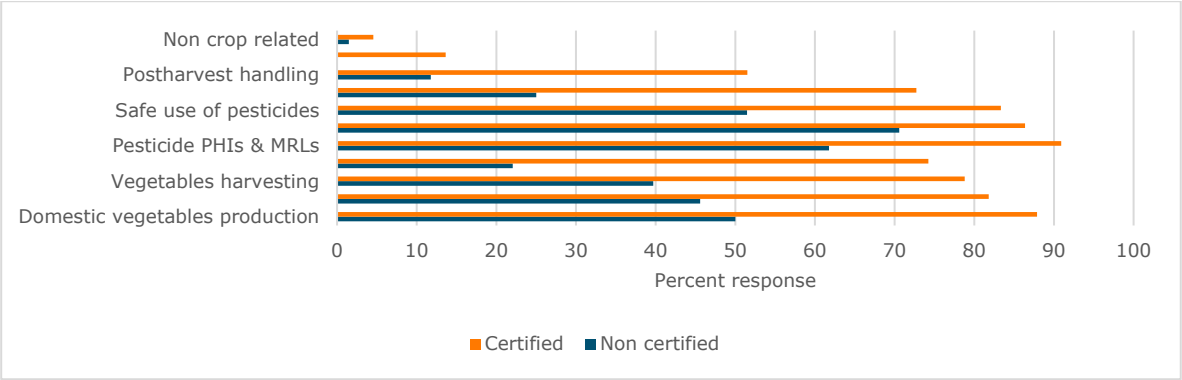


Figure 33 *Type of information and training received*

According to Dinham (2003), training farmers in integrated pest management can help them become better decision makers and greatly reduce pesticide use while reducing risks to their own health and environment. Improving the access farmers have to information and knowledge through extension, interactions among farmers and other supply chain partners is of great importance, not only for increased productivity (Goyal, 2010) but also to improve food safety and quality.

3.1.5.2 Knowledge of traceability

The recent developments in the horticulture industry in Kenya have seen the launch of the National Horticulture Traceability System (HTS) as well as a national code of practice for fruit and vegetables (KS1758-2:2016). The majority (94%) of the interviewed certified farmers reported that they know about traceability and only 6% said they were not aware of it; over half (55%) of the non-certified respondents were not aware of traceability and only 45% were (Figure 34).

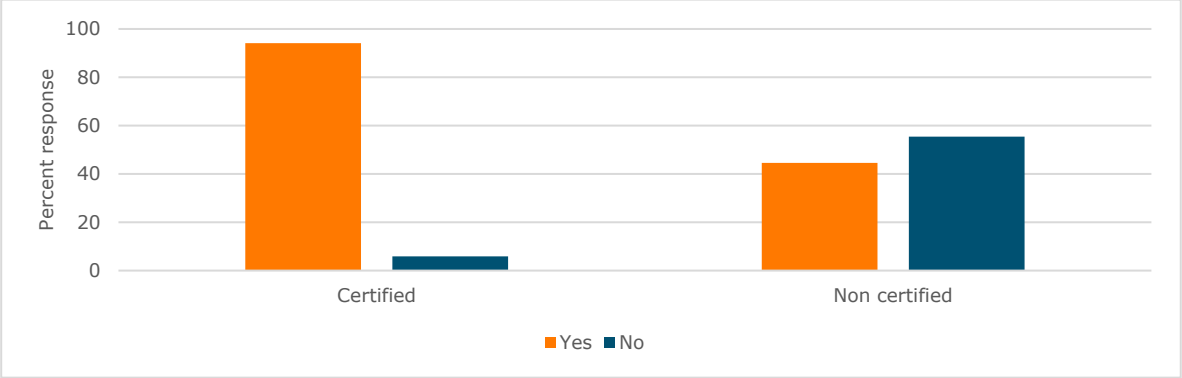


Figure 34 *Knowledge of traceability by certification*

Of those who indicated that they did know about traceability, 96% of the certified farmers and 72% of the non-certified farmers cited quality assurance to consumers as the main benefit. The fact that traceability systems help identify sources of non-compliance (as a risk assessment tool) and thus assist in implementing corrective actions was also cited as an important benefit by 74% of the certified and 49% of non-certified respondents (Figure 35). Other cited benefits include facilitation of certification (73% of certified and 41% non-certified) and supply chain management (65% certified and 45% non-certified).

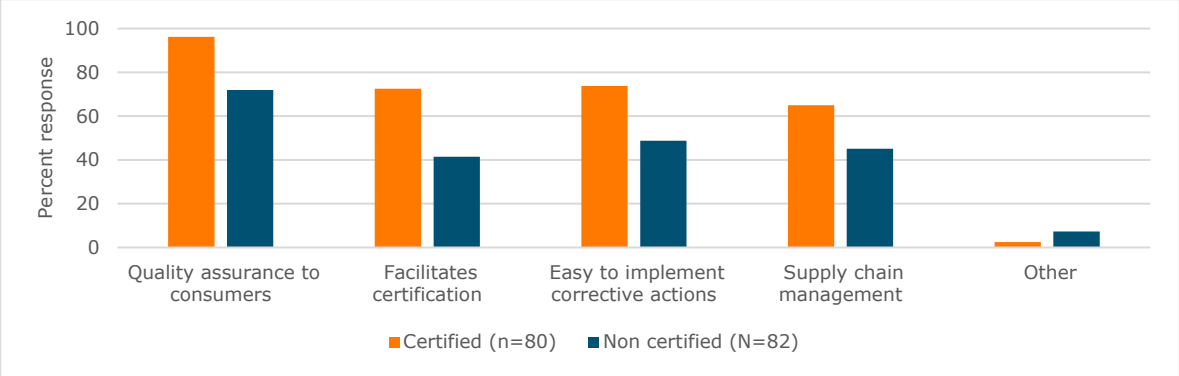


Figure 35 *Benefits of traceability by certification*

3.1.5.3 Awareness of quality assurance

In general, all the farmers were aware of quality assurance and the parameters used to ensure quality of the marketed FFV products. When asked about the factors that affect FFV quality, more than 80% of the certified and non-certified farmers said that the pests and diseases are the most important factors. The crop variety or choice of seed (planting materials) was given as the third most important factor of quality (79% of certified and 47% of non-certified farmers; Figure 36). The harvesting timing and technique/method was also reported as critical.

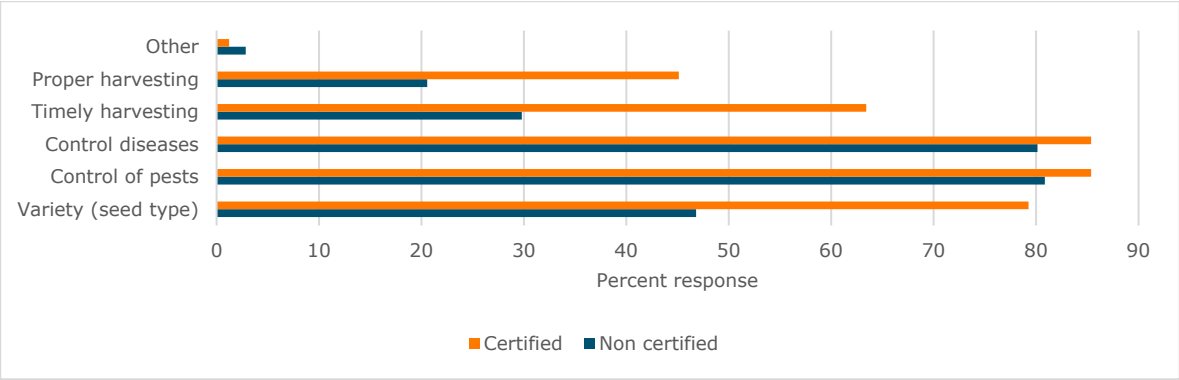


Figure 36 *Perceived importance of factors affecting vegetable quality by certification*

3.1.5.4 Organization and marketing in groups

The study found that farmers were more likely to join farmers groups they already knew about, and knew the benefits of, than to form new farmers groups where none existed. Group membership was found in certified and non-certified farmers, although at a lower rate among the non-certified farmers; 62% of non-certified farmers were aware of the existence of farmer groups and only 46% were members (Figure 37).

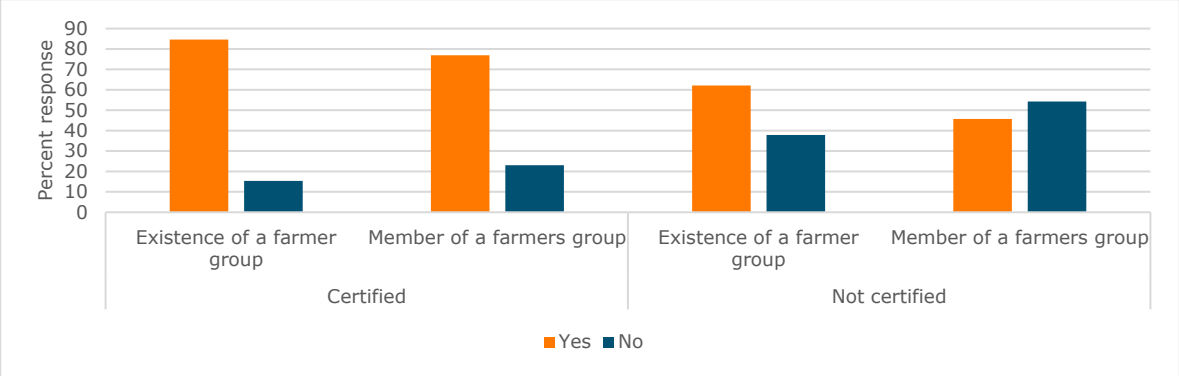


Figure 37 *Awareness and membership of farmers groups*

These findings agree with other literature, with Saint Ville *et al.* (2016) noting that strong interpersonal agricultural knowledge networks facilitate farmer-to-farmer knowledge exchange, increase farmer access to information and connect farmers to sources of support.

The study asked respondents what they expected to get by being a member of a farmers group. The majority of certified respondents cited access to improved technology and trainings to be the reasons to join a group, whereas majority of the non-certified respondents expect access to reliable markets and finance. Both certified and non-certified respondents expect groups to help them get stable prices for their produce (Figure 38).

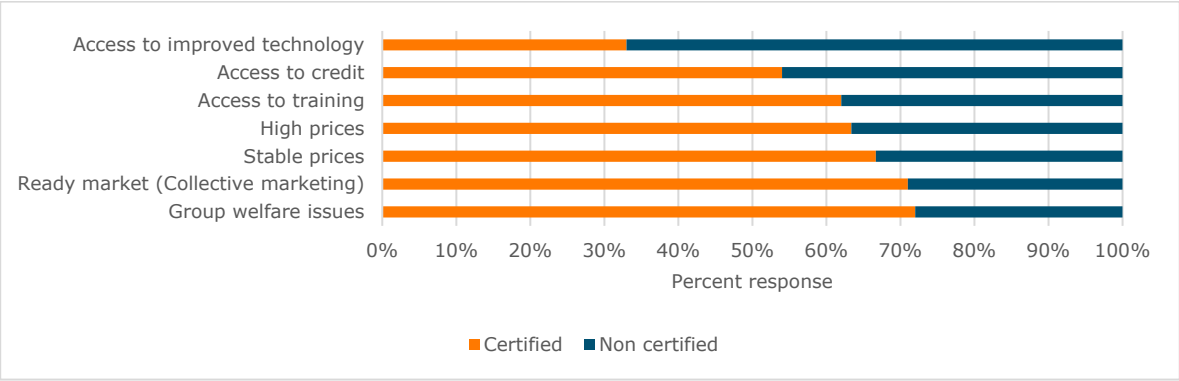


Figure 38 *Expectations of joining farmer group by certification*

The majority of farmers (56% of certified and 70% of non-certified farmers) sell their domestic market produce predominantly through brokers, who have no awareness or sensitivity to food safety or quality assurance. Farmers who sell through organized groups produce high value crops destined for export markets and high value domestic markets (Figure 39).

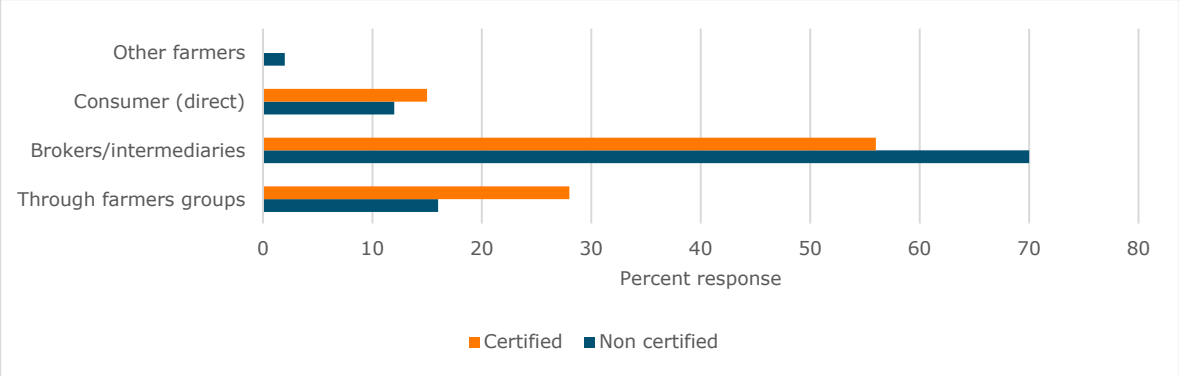


Figure 39 *Channels used by farmers to market their products*

Groups are formed for marketing specific crops, with most of the farmers interviewed belonged to French beans marketing groups (87% of certified farmers and 48% of non-certified farmers). Other farmer groups that had certification collectively marketed snow peas (11%), tomatoes (5%), kale (5%), watermelons and capsicums (3.2%) and cabbages, bananas, cucumbers and courgettes (Figure 40). French beans and snow peas are export crops, and the rest of the commodities from certified groups are sold to the domestic market. Collective marketing allows farmers to negotiate prices and secure supply contracts at known prices.

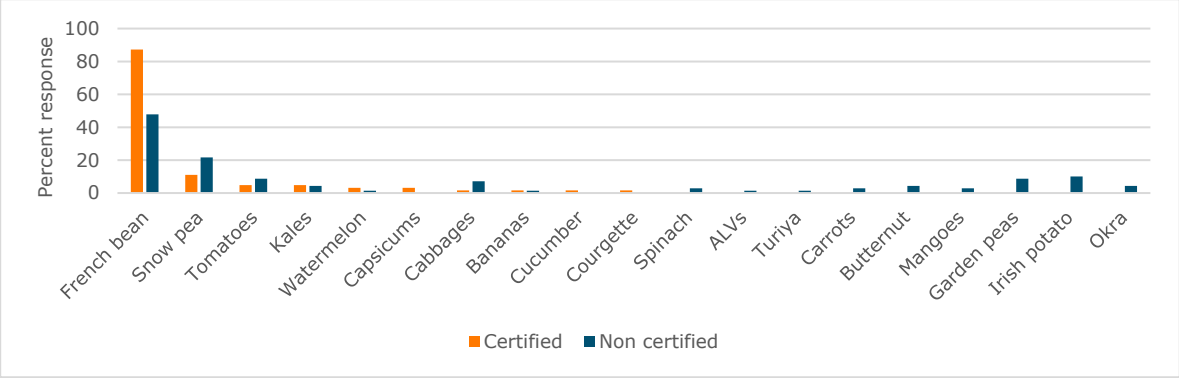


Figure 40 *Major crops marketed by farmer groups*

3.2 The market for fresh fruit and vegetables

3.2.1 Demographics of traders in the selected market segments

3.2.1.1 Respondents by age, gender and education level in wet markets

Traders in the wet markets are predominantly male (70%). The females work predominantly in the retail segment, as the level of investment required to operate as a wholesaler was found to be significant, with women lacking the finance needed for inventory. The largest group of traders are aged 36–45 (38%) followed by those aged 26–30 (30%) (Figure 41).

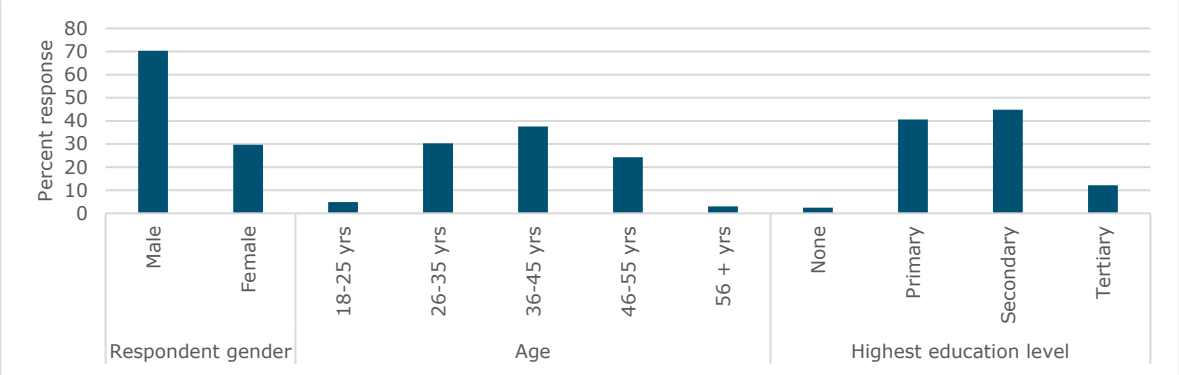


Figure 41 *Wet market demographics*

Most markets operate seven days a week, with intense operations very early in the morning between 3 a.m. and 9 a.m. for wholesalers and late afternoon/evening between 3.30 p.m. and 8.30 p.m. for retailers. The nature of transactions was found to be fast and impersonal, with price negotiation and volumes being the main topic of interest for traders and their customers.

Almost half (45%) the traders have secondary education, and the next biggest group (41%) have some level of primary education. Numeracy was found to be a basic skill needed by a trader to operate in the market, as most numbers are calculated mentally with minimal use of electronic tools. Only 2% of traders have no education, and 12% have some form of tertiary education. Older traders who have been in the wholesale markets for a long time viewed it as a domain for traders without tertiary education. Their negative view of entrants with tertiary education was reported to be because these entrants introduce new procedures and paperwork that was a new layer of unnecessary complications. Those with tertiary education, however, were found to provide specialized services to other traders, including supply of packaging materials and combining trading and distribution.

3.2.1.2 Respondents by age, gender and education level in grocery markets

Among the grocers interviewed there was a balance of male and female owners and/or family members working in the stores (Figure 42). Grocery stores are registered businesses that pay annual licences and operate in the formal economy. Half the grocers were found to be aged 36–45 and the next biggest group was in the age bracket 26–35 (29%). Grocers were found to have higher levels of education with 43% having secondary education and 12% tertiary education accounting to over 50% of those interviewed. The younger grocers aged 18–25 mainly operated low-end grocery stores, which require lower capital outlay. Importantly, the County Government of Nairobi has supported this demographic to construct and operate semi-permanent grocery stores within its jurisdiction as part of promoting youth employment.

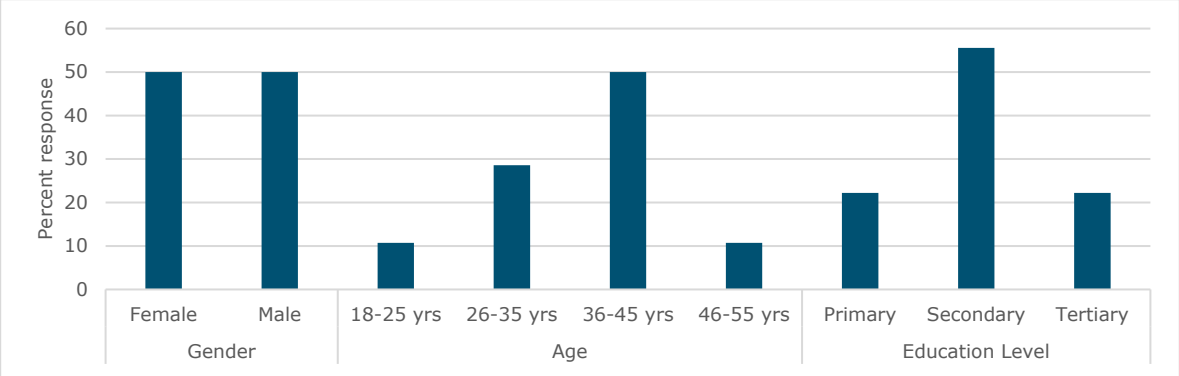


Figure 42 *Groceries market demographics*

3.2.2 Main commodities per market segment

This study sought to find out which products were traded in which market segments. Traders in both wholesale and retail wet markets were found to trade similar commodities, while grocery stores traded a wider range of products. This latter segment is a more recent development, with over 83% of grocers sampled opening shop in the last five years.

3.2.2.1 Main products traded by wet markets

The two products most traded by respondents are tomatoes (by 34% of retailers and 21% of wholesalers) and onions (42% of retailers and 15% of wholesales; Figure 43). High value fruits and vegetables were found to be traded by more specialized wholesalers and retailers. These were mainly chilli peppers, kale, spinach, oranges and garden peas by an average 4.5% of wholesalers and 4%–9% of interviewed retailers. The most popular fruit was banana, which is traded by 29% of retailers and 12% of wholesalers. Avocados followed closely second at 24% of retailers and 6% of wholesalers. Trade in fruits is seasonal, and apparent trends depend on the time of the year data is collected. Some wholesalers do not diversify and prefer to follow one commodity throughout the year, exiting the market during periods of scarcity.

In general, there is a higher level of specialization among wholesalers which is expected as wholesale trade is segmented per commodity by the County Government allowing participation of traders in either one or a few related commodities (e.g. different types of leafy vegetables in the brassica family). Retailers, on the other hand, carry a mixed assortment of FFV in smaller quantities because of proximity to the wholesale markets and can therefore manage their stocking by buying small quantities. Yet retailers are still subject to some limitation on the number of commodities they can carry, because crop managers in the market demarcate different retail sections for some products to avoid quality deterioration as a result of mixing. For example, ethylene-emitting fruit is less likely to be retailed in close proximity to those whose ripening is accelerated by ethylene.

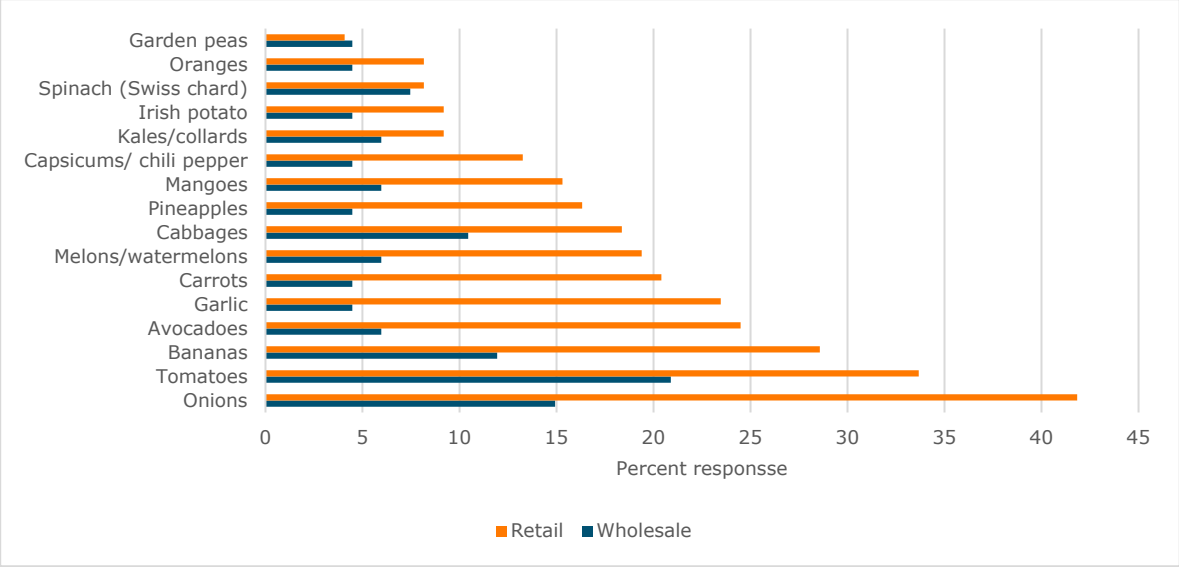


Figure 43 *Likelihood of products to be traded by retailers and wholesalers*

3.2.2.2 Main products traded by grocery stores

The most important products traded by more than 50% of grocers are those shown in Figure 44. While volume of trade seems to be a driving factor for retailers in wet markets, the commodities traded by grocery stores indicate that value of trade is more important in this segment.

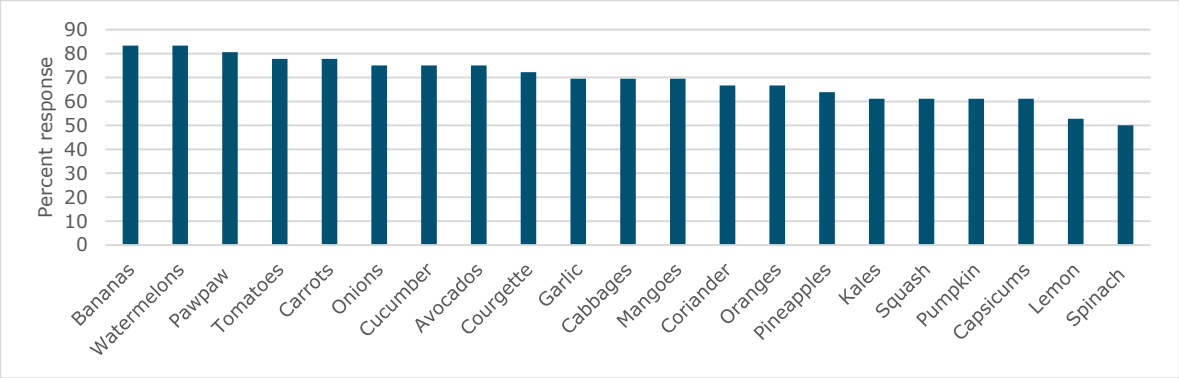


Figure 44 *Likelihood of products to be traded in grocery stores*

3.2.3 Flow of fresh fruit and vegetables to the selected market segments

This study mapped and analysed the flow of different FFV products from farms to retailers in the wet markets and grocers as well as the various actors and their roles.

The wet markets (Figure 45) have a long chain, especially in bulk commodities like Irish potatoes, oranges and cabbages which often require participation of up to ten actors to reach retail wet markets. While this might be necessary to improve efficiency and streamline trade, the many actors in the chain make it difficult to improve relations, chain governance, and visibility of trading and product-handling practices. The shortest route to the retail wet market involves five actors: the farmer, market broker, transporter to wholesaler and then retailer for tomatoes, kale and carrots (Figure 45). These products were reported to have higher and more active involvement of farmers in the chain by avoiding the need for harvesters and village level brokers (aggregating broker), the market level brokers also act as off loaders that is the market level broker organises on how the products will be offloaded.

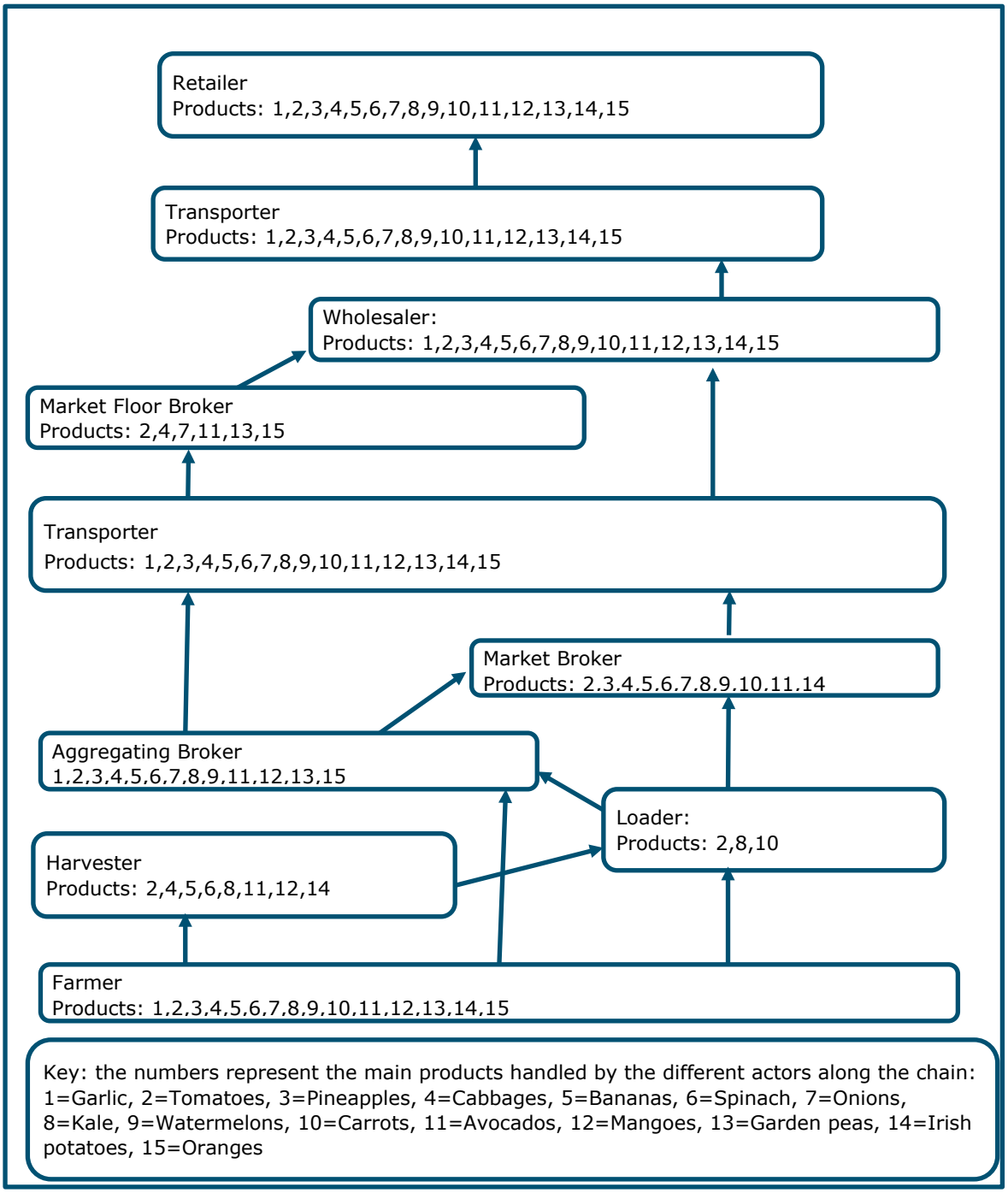


Figure 45 *Main products flow in wet markets*

Our findings reinforce available literature on flow of FFV to domestic markets. For example, Lenné and Ward (2010) found vegetables to be purchased at the farm gate by intermediaries or brokers and passed through multiple traders on their journey to major urban wholesale markets. They estimated that over 80% of smallholder production is sold in informal markets. Some smallholder farmers were found to sell vegetables directly in village markets, but powerful traders control larger markets. Constraints that hinder chain actors' activities throughout the product flow were found by Pichop and Weinberger (2009) to include lack of adequate transport and market infrastructure, especially lack of cold chain facilities; considerable fluctuation in prices and no price information systems; limited value addition as produce is mainly unprocessed; and the extremely low level of communication and cooperation among chain actors.

The supply path to grocery stores is less complex and shorter as it goes from farmers to grocers or wet wholesale markets to grocers. The grocers interviewed said that 22% of their produce is sourced

directly from production; some of the grocers are involved in production themselves and actively source from neighbours (Figure 46). However, they source 72% of their supply from wet markets directly, and 6% goes through shortlisted suppliers. Grocers who use shortlisted suppliers do not require disclosure of produce source.

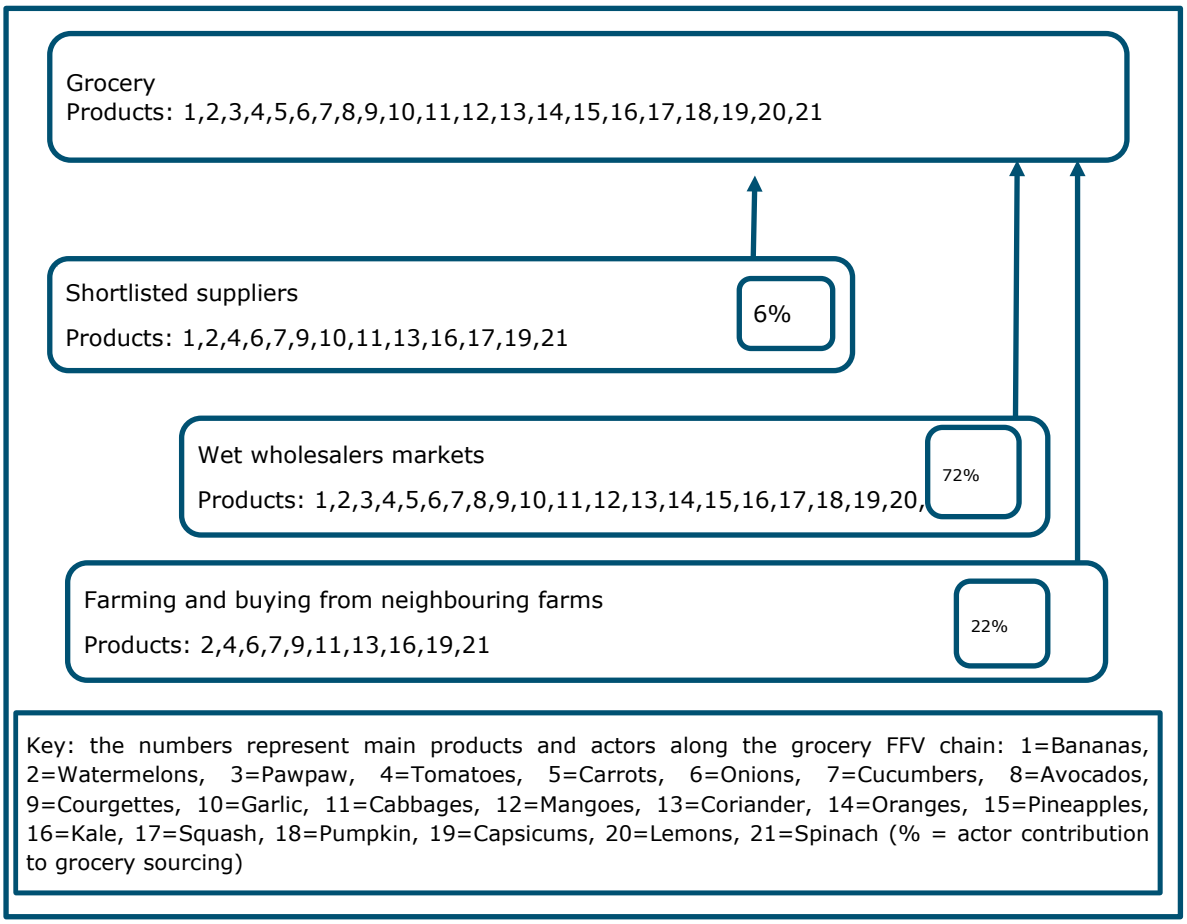


Figure 46 *Main products flow in grocery stores*

The supply chain to grocery stores shows the important role wholesale markets play in the FFV trade. While grocers are interested in investigating options to improve quality and food safety, their efforts have to be directly linked to those of wholesalers within the wet markets because it is these markets that continue to dominate FFV trade.

3.2.3.1 Market segmentation in wet markets and grocery stores

This part of the study sought market actors' perceptions about whether and how consumers are expressing demand for food safety and quality. Consumers in the two segments were found to be differentiated. Retail wet markets mainly target individual consumers, while wholesale wet markets have a more diversified customer base (Figure 47) that includes other intracity wholesalers, retailers, individual end consumers and institutions, as indicated by the eight selected top products.

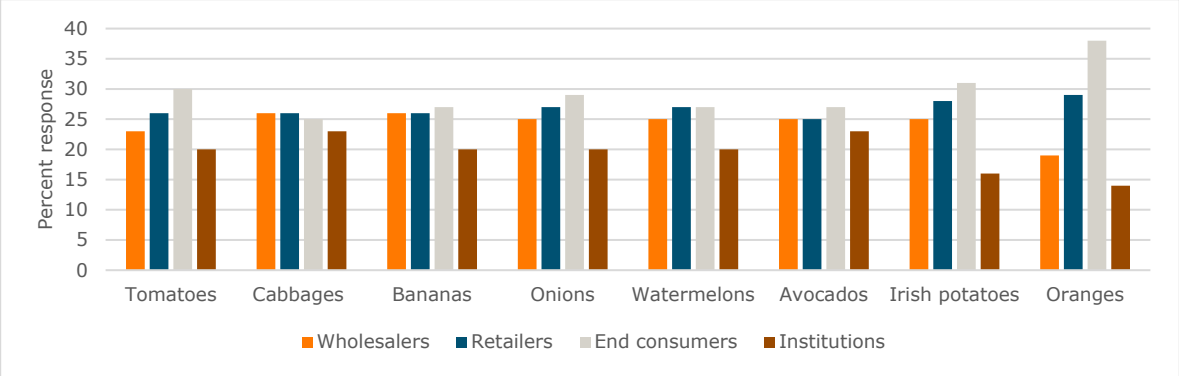


Figure 47 *Major products purchased from wet wholesale markets and by whom*

While wholesaling may be seen as a bulk produce handling role, the wholesalers break bulk and often sell to end consumers either as bulk or as retail commodity, especially towards the end of the day to clear inventory.

The mix of products purchased from grocery stores by end consumers and institutions differs in order of priority and volumes as evidenced by Figure 48 and Figure 49. Institutions such as hotels, schools and hospitals demand more diverse and better quality products compared to end consumers. However, spillover of high value products is purchased by end consumers in small quantities. Traders in the grocery stores said that they stock products that meet some minimum criteria such as being unbruised, having natural colour formations and being fresh, as this is what informs their consumers' choices while purchasing FFV products.

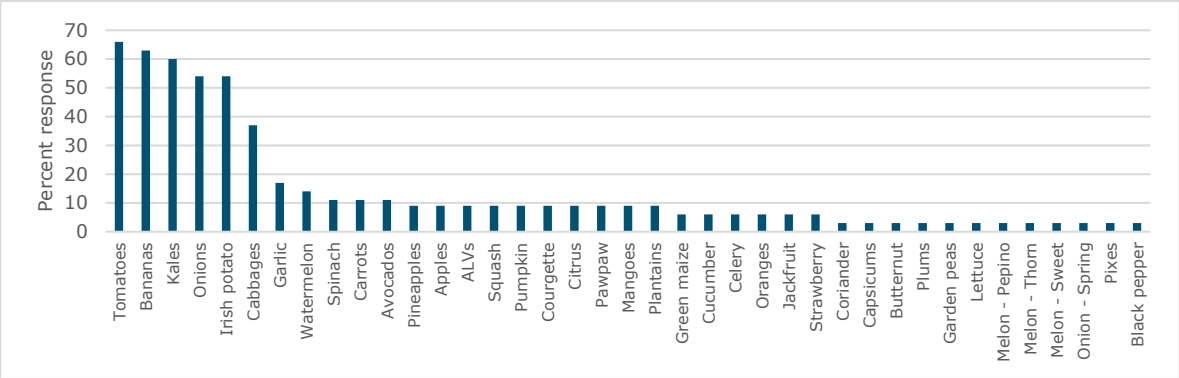


Figure 48 *Major FFV purchased by institutions from grocery stores*

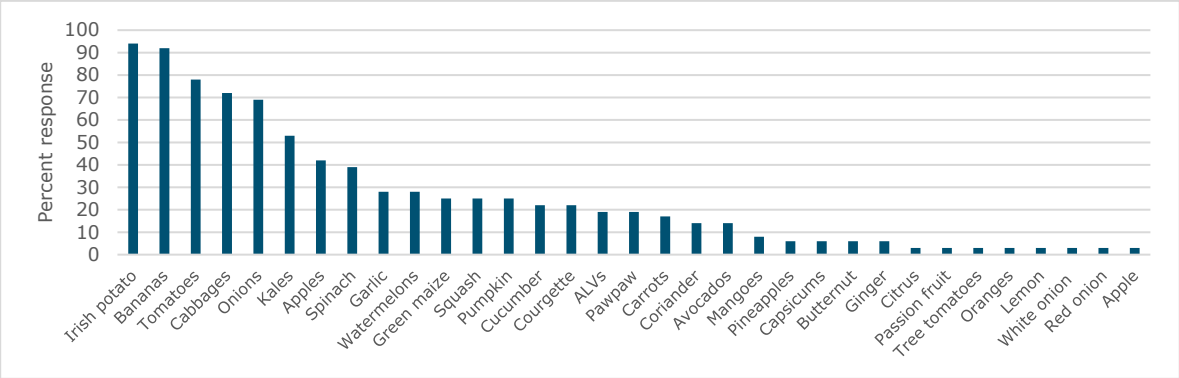


Figure 49 *Major products purchased by end consumers from grocery stores*

3.2.3.2 How market actors perceive consumer demand for quality

The wet markets reported that customers are most concerned with visual quality. Freshness was the most important quality required (55%), followed by lack of visible damage (14%), colour formation (10%), firmness (9%) and shape, origin and maturity (4% each; Figure 50). While firmness and physiological maturity may be interrelated, firmness was viewed as more important than maturity and was in most cases considered in isolation, as some mature products may not necessarily have a firm presentation.

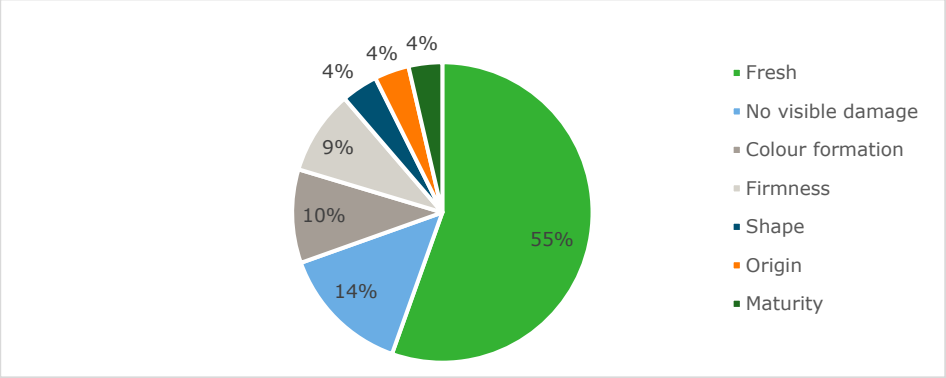


Figure 50 *Consumers' quality requirements as reported by traders in the wet markets*

Wholesalers reported that price reduces with age of products, hence the practice of retailing produce to end consumers towards the end of the day. Notably, traders do not deal with intrinsic product quality and safety issues. This study attributed this to both a lack of awareness and interest by the retailers as well as the fast, impersonal nature of transactions, which do not allow for personalized relations.

Grocery stores reported that the two main characteristics consumers equate with quality are freshness (78%) and no visible damage (22%; Figure 51). This can be attributed to the fact that grocers already have some formal or informal specifications that they use while making purchasing decisions, which include their idea of what consumers expect when they are making their own purchasing decisions.

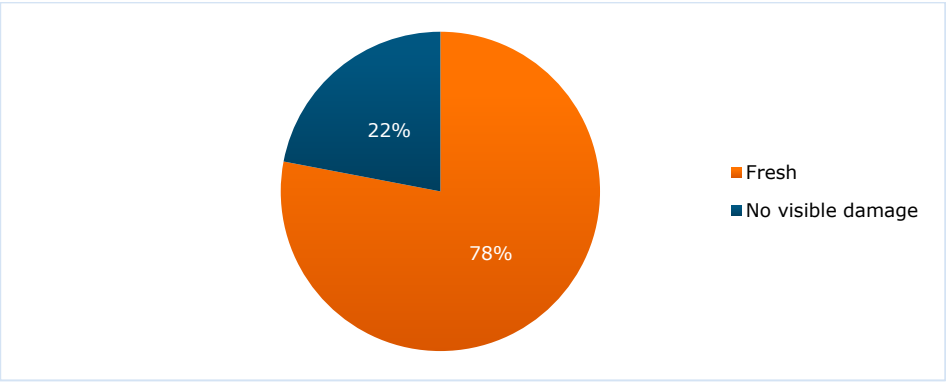


Figure 51 *Consumers' quality requirements as reported by grocery stores*

3.2.3.3 Market actors' perception of consumer demand for food safety

The perception of consumer demand can indicate the level of awareness of the sources and types of contamination. The following data (Figures 52 and 53) shows that in general, grocers are more concerned about contamination than actors in the wet markets. This is supported by the fact that only 2% of traders in the wet markets had undergone any form of training in food management, while the grocers have learned about food safety as they have to obtain food handler's licences and certificates.

Most traders (94%) in the wet market reported that consumers are unconcerned about agrochemical contamination, and 11% reported that consumers understand that wholesalers have no way to act on this issue. A very small number (2%) reported that they tell consumers that there is no contamination, while 3% acknowledged minimal use of agrochemicals. Less than 1% of traders reported ever having heard consumers enquire about PHIs and MRLs.

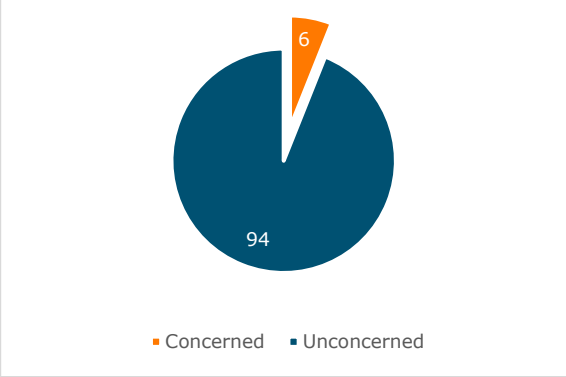


Figure 52 *Perception of consumers' sensitivity to agrochemicals in wet markets*

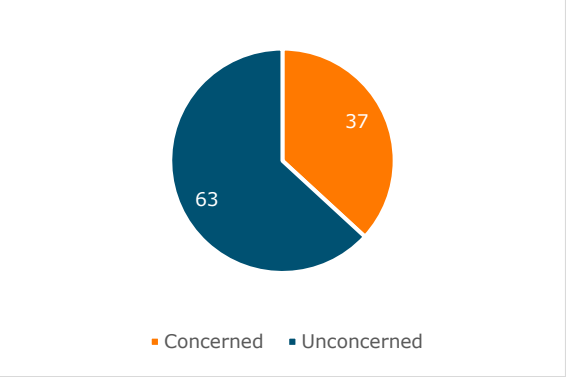


Figure 53 *Perception of consumers' sensitivity to agrochemicals in grocery stores*

Of the grocers interviewed, 63% reported that when customers ask about agrochemical contamination they are unconcerned; 31% of the grocers reported that they are concerned but not taking any action, which may be linked to the lack of traceability and thus there being no way to raise the issue with a particular producer. Only 6% of grocers reported that they ask about and inform consumers of PHIs and MRLs related to produce. These grocers were found to be involved in production and to have relations with their other suppliers.

Almost all (97%) the interviewed traders in the wet markets were not concerned about heavy metals contamination (Figure 54) and reported their consumers to be equally unconcerned, while 100% of grocers were concerned about food safety (Figure 55), mainly with regard to contaminated irrigation water as this would harm the health of the consumer over time. More than half (56%) of grocers and their consumers express the concern by avoiding produce grown along sewers, especially close to the Nairobi metropolis while 44% of grocers expressed that they are unconcerned about effects of heavy metal contamination but noted that heavy metals would lead to long-term harmful effects on consumers' health.

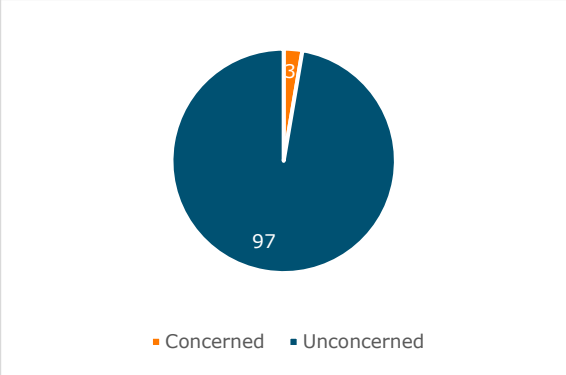


Figure 54 *Traders' perceptions about heavy metals in the wet markets*

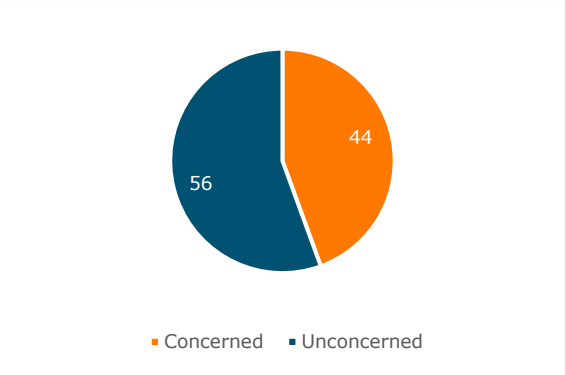


Figure 55 *Traders' perception about heavy metals in grocery stores*

While 17% of the traders in wet markets expressed concern about product and personal hygiene (Figure 56), the markets lack appropriate hygiene facilities and require traders to pay for these facilities and use purchased water. The facilities themselves lack infrastructure for product handling, making it difficult for the traders to safeguard produce from microbial contamination. The 72% of grocers who reported being concerned about hygiene (Figure 57) have some form of infrastructure but inadequate standard operating procedures to guard against contamination Figures 58 & 59). Moreover, produce in grocery stores is sourced predominantly from wet markets, where hygiene practices are already compromised.

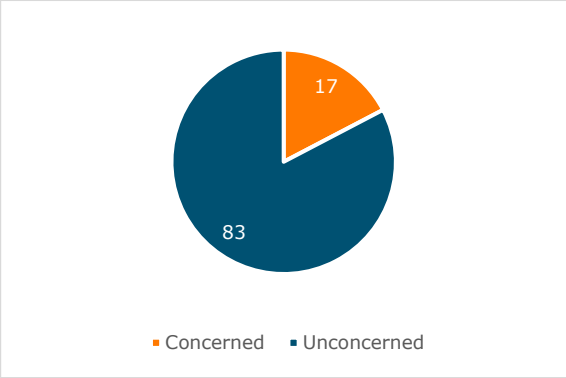


Figure 56 *Traders' perceptions about hygiene in wet markets*

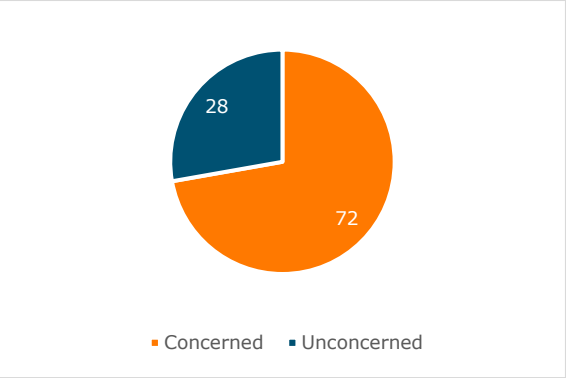


Figure 57 *Traders' perceptions about hygiene in grocery stores*

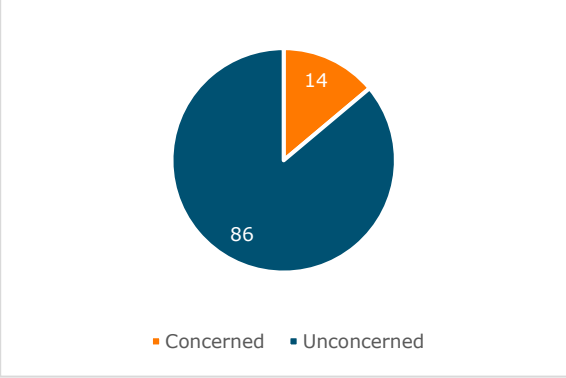


Figure 58 *Traders' perceptions about microbial contamination in wet markets*

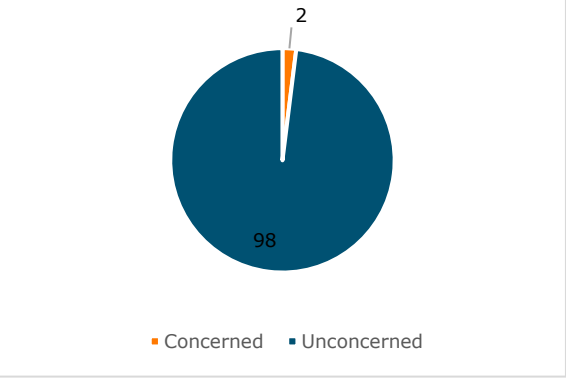


Figure 59 *Traders' perceptions about microbial contamination in groceries*

When asked about actual microbial contamination, most of the traders said they did not believe that produce can be contaminated by microbes while in the market. When interviewed traders indicated that they believe microbes to result from the process of product decomposition, rather than product handling. This aspect informs the high number of grocers who have no concern for microbial contamination; the 14% who are concerned supply market segments that require food handlers to have appropriate training against microbial contamination.

3.2.4 How the market segments facilitate food safety and quality

There is limited awareness among traders, both in the wet markets and grocery stores, of their responsibilities to consumers. However, this study sought to understand if traders' desires to meet consumer demand are facilitating food safety and quality. It did this by evaluating traders' investments and the underlying rationale for them.

3.2.4.1 Display infrastructure

Within the wet markets, traders were found to be upgrading their display infrastructure to appeal to consumers. However, this infrastructure was found to serve a more functional purpose rather than contributing to food safety and/or quality. The main investments noted are shown in Table 7.

Table 7 *Display infrastructure in wet markets*

Market category	Display infrastructure	Main products displayed
Wholesale	Open trucks	Oranges, Irish potatoes, cabbages, mangoes
	Market floor	Irish potatoes, carrots, kale, tomatoes
Retail	Market floor	Pumpkins, squash, onions
	Raised tables	Onions, kale, tomatoes
	Hand cart	Kale, African green leafy vegetables
	Crates	Tomatoes

Grocery stores were found to have a number of levels of investment in display infrastructure, as shown in Table 8.

Table 8 *Display infrastructure investment in grocery stores*

Grocery category	Investment
High end (n=8)	• Permanent building with dedicated parking and other amenities (including seating space) for customers • Separate storage / warehouse facility from retailing area • Colour-coded plastic crates for different commodities • Shelves (wooden and/or metallic) that have racks for display of different products • Automated point-of-sale system connected to digital weighting scales • Nets and food-grade containers for consumer packaging
Medium end (n=17)	• Located in permanent building but no dedicated parking or amenities for customers • Plastic crates for different commodities • Wooden display infrastructure for different commodities • Digital weighing scales and manual receipt system for customers • Nets and food-grade containers for consumer packaging
Low end (n=11)	• Semi-permanent stall • Display shelves • Crates and buckets • Minimal level of consumer packaging

High-end grocery stores were more likely to serve upper-middle-class and middle-class consumers, while low-end grocers were found to be more likely to serve lower-middle-class consumers. The volume and value of trade differed relative to location and the duration in business.

Figure 60 *Product presentation for consumers in high-end, medium-end and low-end grocery stores*

Grocers were asked about the cost of investing in infrastructure (excluding the cost of inventory and premises lease). The average investment ranged from KES 401,500 for high-end grocers to KES 57,516 for low-end grocers (Table 9). However, some high-end grocers reported the cost of infrastructure to average KES 1,500,000 for reasonable infrastructure to handle trade and maintain quality and product safety. Figure 60 shows some different types of infrastructure for displaying FFV.

Table 9 *Estimated investment in groceries*

Grocery category	Estimated average investment (KES)
High end	401,500
Medium end	136,792
Low end	57,516

3.2.4.2 Investment in packaging for transportation and presentation to consumers

Wet markets and grocery stores did not report much difference in packaging for transportation purposes. When asked about specifically what investments were made for packaging of tomatoes the following were noted investments:

Carton boxes: To prevent bruising of products like tomatoes by wooden crates, and to enable vehicles to travel at speed as the carton boxes protect the tomatoes during transportation.

Crates: To avoid mechanical damage and improve ease of transportation by enabling stacking of products.

Net: Aeration that increases shelf life when products like oranges and onions are on display. Products packaged in nets are less likely to be squeezed as consumers try to determine ripeness or firmness, which further erodes quality.

Sack: For transportation, unit of measure and neatness of the products when presented to traders and consumers. Sacks can be used to pad the inner walls of carton boxes and between layers of unripe tomatoes. This means more products can be stacked in a given space and makes the transportation cheaper per unit cost.

Spread sawdust on the floor of the pick-up and stack the tomatoes: If tomatoes are unripe, they are firmer and can be easily stacked without much damage. Sawdust absorbs shock to prevent squashing of tomatoes.

Wooden boxes: Easy to transport; avoids physical damage and allows produce to maintain shape. Wooden crates are easy to line with cartons, which increases their useful life.

In the wet markets, packaging is used to prevent physical damage of produce. However, most wholesalers break the bulk packages at the market and, due to the fast mode of transactions, FFV products may be contaminated during repackaging. Market actors, however, are not sensitive to food quality and are not concerned about this potential contamination point.

Grocery stores were found to be more likely to pre-pack produce for consumers. In all stores visited, however, consumers still had access to loose products with nets and bag packaging available. The notable exception was lettuce, which was pre-packed in polybags that prevented wilting and contamination by consumers.

3.2.4.3 Storage

The type of storage infrastructure was also used as an indicator of traders' level of investment. The study noted similarities between wholesalers and retailers. The vast majority of traders stored their produce on the ground and on benches in the market. Only 39% of wholesalers and 60% of retailers had access to any form of lockable storage facilities (Figure 61). In the wet markets, most products

are stored by either wrapping with tarpaulin or returning into sacks, which led to wilting, rotting and discoloration. This resulted in food waste and filth that is dumped in the market, creating bad odour and attracting insects and other vermin.

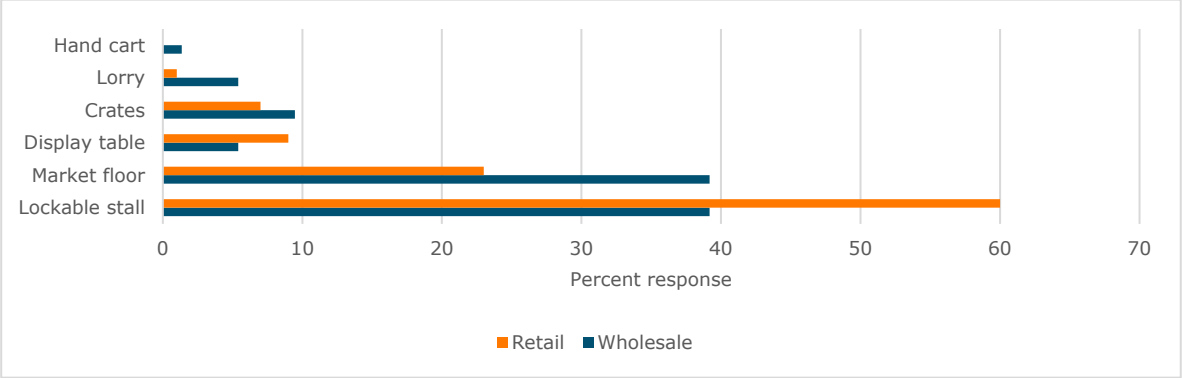


Figure 61 *Storage infrastructure by market category*

Produce in grocery stores is stored within the store by 69% of grocers, annexed stores by 28% and in warehouses by 3% (Figure 62). Cold storage infrastructure was found to be available in only 5% of the grocery stores sampled. As FFV is highly perishable, grocery stores limit their inventory to what they can sell in a day or two with daily sourcing of produce. High-end stores can prolong shelf life as they have access to climate-controlled facilities, enabling better planning and management of inventory.

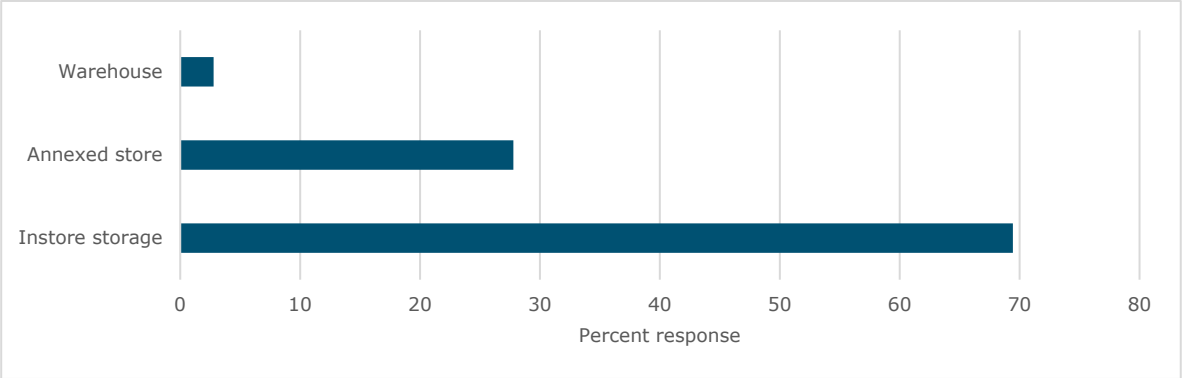


Figure 62 *Storage infrastructure for groceries*

3.2.4.4 Investment in product hygiene practices

Product hygiene is an important control point to manage food safety. Wet markets use visual quality to monitor produce hygiene, only removing dirty and damaged produce. Sprinkling of FFV with water is common, although some of the water is from contaminated sources including storm drains (Figure 63). Onyango and Kunyanga (2013) noted that sprinkling of produce with water contributes to microbial contamination rather than improving product hygiene due to this contamination. Traders dust display tables, but do not clean mats and tarpaulins on which they display produce.

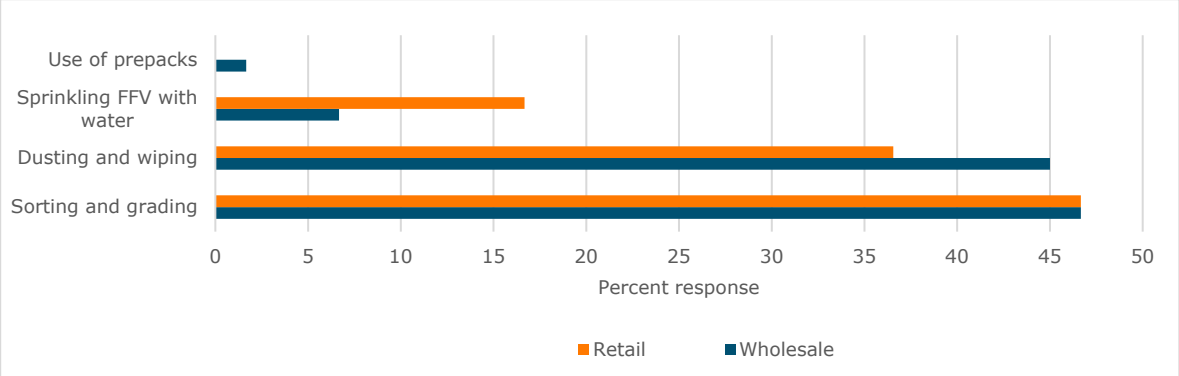


Figure 63 *Product hygiene practices in wet markets*

Grocery stores were found to follow similar practices as wet markets (Figure 64), including sorting and grading to remove damaged and yellowing parts of the FFV (e.g. cabbage leaves), damaged Irish potatoes, visibly damaged tomatoes among others. Use of prepacks in the segment is 14% compared to 2% in the wet markets. Washing FFV with water instead of sprinkling was reported by 6% of grocers. However, with over 72% of produce being sourced from wholesale markets where limited interest in food safety was noted, it is likely that the produce is already from a contaminated source before being packaged.

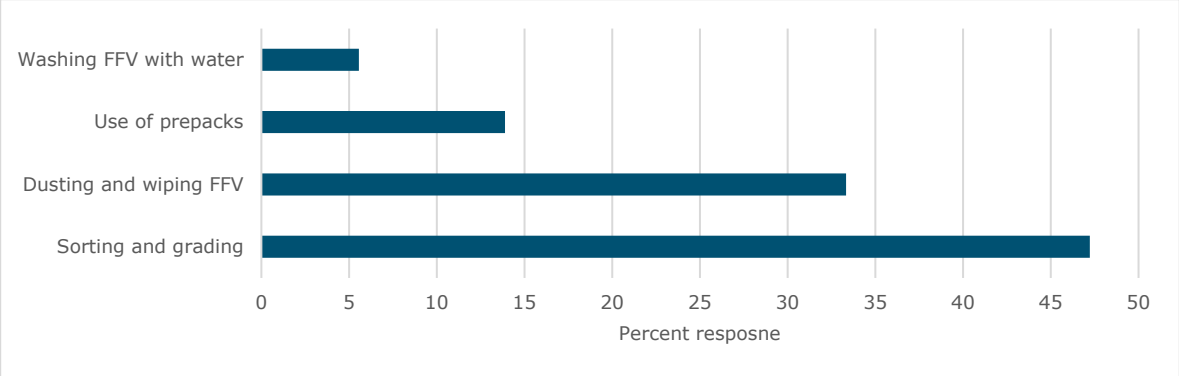


Figure 64 *Product hygiene practices in grocery stores*

3.2.4.5 Investment in personal hygiene

Investment in personal hygiene was used as an indicator of how traders are meeting consumer demand. None of the traders or their employees in the wet markets were found to have food handling certificates or licenses. Although this is not a regulatory requirement, food handlers have been encouraged to seek the licenses. While 45% of wholesaler reported to be having handwashing facilities, 66% of the retail segment reported that they have handwashing facilities although some sanitary facilities in the markets were found to lack basic handwashing facilities (Figures 65 and 66).

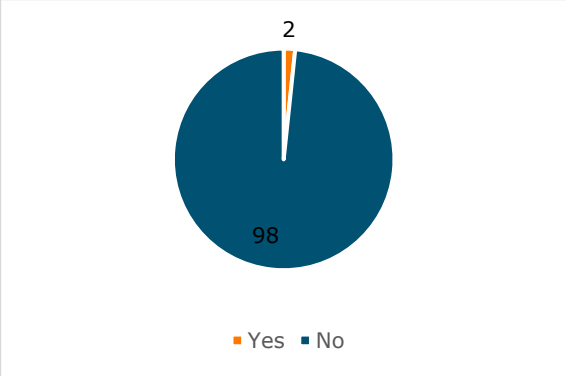


Figure 65 *Availability of handwashing equipment for retailers*

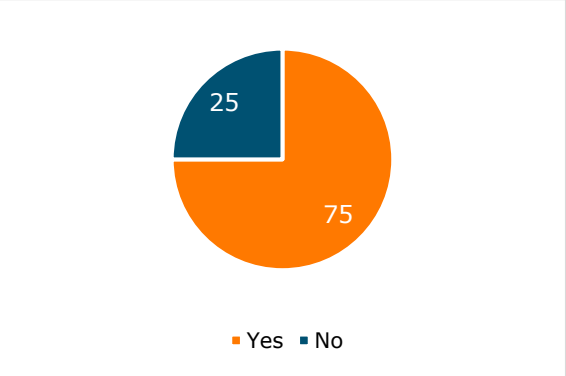


Figure 66 *Availability of handwashing equipment for wholesalers*

Only a small minority (2.8%) of grocery stores reported good practices such as requiring employees to have medical certificates and regular training and provision of personal protective equipment and detergents. On personal hygiene, only 13.9% reported that they require employees to wash their hands every time they need to handle food after visiting a toilet facility. A large majority (80%) reported that they provide facilities for handwashing but have no procedure in place to ensure hygiene practices among employees.

3.2.4.6 Investment in training

The vast majority (98%) of traders in wet markets have not had any food handling training (Figure 67). The 2% who have had training covered topics related to production such as pest and disease control, safe use of pesticide and post-harvest handling. No training programme has supported traders with work they need to do in wet markets. On the other hand, the majority (75%) of traders in grocery stores have had training in food handling (Figure 68). Topics covered include grading and sorting, post-harvest handling, customer relations and vegetable harvesting. Training was also given to grocery stores by Kiva in collaboration with agro-dealers to help them prepare to apply for finance.

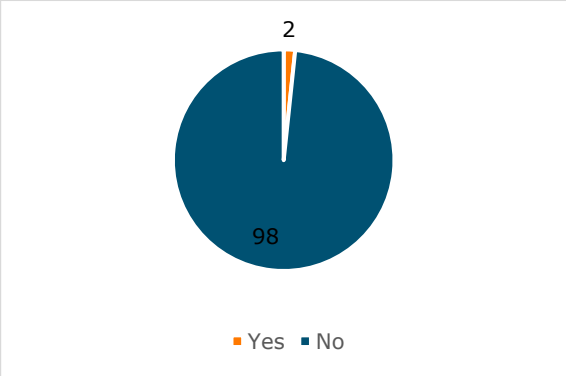


Figure 67 *Training in any issue about fresh fruit and vegetables in wet markets*

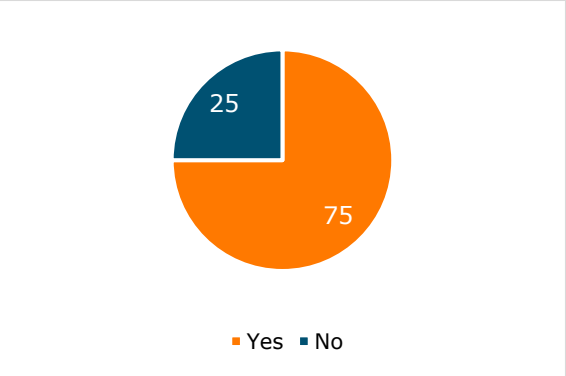


Figure 68 *Training in any issue on fresh fruit and vegetables in grocery stores*

3.2.5 Constraints of dealing with food safety in the selected market segments

The study evaluated the opportunities and challenges of addressing food safety in wet markets and grocery stores. Wet markets were found to present the best opportunity of dealing with food safety as they are owned, managed and controlled by the County Government of Nairobi. The County Public Health Department is already actively engaged in a process of drafting relevant regulations and

interventions to manage food safety in the markets. The County has a dedicated department that monitors food safety issues in the market to track compliance with public health regulations.

However, the monitoring unit uses visual quality as the main method of monitoring, with suspected contaminated samples taken to the government chemist for analysis and advice about relevant remedial action. The study found the monitoring method to be inadequate, as food contamination with pesticides, microbial and heavy metals cannot be monitored by visual checks. The Food and Agriculture Organization (FAO) is strengthening the capacity of the County to identify and implement interventions that will improve food safety surveillance. There is limited connectivity between the County of Nairobi and the Kenya Plant Health Inspectorate Service (KEPHIS), which was found to have better capacity and facilities for food safety surveillance. Improving collaboration between county and national government authorities such as KEPHIS would go a long way towards strengthening policies, planning and monitoring operations.

In terms of infrastructure, the markets are designed to deal with physical waste generated during trade; they have created display platforms, although these are inadequate for the high number of traders operating in the different markets; and there is some level of sanitary infrastructure. However, facilities to secure product quality and safety are lacking. These include storage, sorting and grading infrastructure and produce-cleaning facilities. Waste management is another key opportunity for the County to deal with food safety and hygiene. These investments are a public good that would need to be addressed by the county and national governments and be accompanied by regulation and promotion.

There are significant opportunities for traders themselves to invest in food safety. However, the opportunities can only be realized if they are supported by the right level of public investment by the national and County governments. Within the markets, traders identified some achievable targets: improving hygiene, including handwashing; use of clean display and measuring equipment; displaying produce on food-grade benches; awareness about and training in food management; and minimizing the touching of produce that can easily be contaminated by customers.

However, constraints remain as transactions are fast and impersonal. Because traders do not have predictable margins and bear high risks, their priority is to complete the transaction in the shortest and cheapest form possible. Relationship building and evidence generation are viewed as barriers to trade rather than enablers.

Grocery stores, on the other hand, position themselves as more conscientious retailers that strive to meet the needs of their customers. More than half (58%) of the grocery stores visited had taken some kind of action to meet clients' demands for product quality and safety.

The characterization of grocers as selling 'organic', 'natural' and 'family-grown' produce was found to mislead consumers, as only 22% of grocers have direct sourcing programmes. The majority of grocers (63%) reported that they lack the ability to act on the concerns of customers in relation to food safety, as 72% of produce is sourced from wet markets.

Transportation was found to be another source of food contamination (Figure 69), as FFV is transported from farm to market in open trucks, sometimes mixed with other non-food items, while intra- and inter-market transport is done by cart or human portage, in most cases under unsanitary conditions.

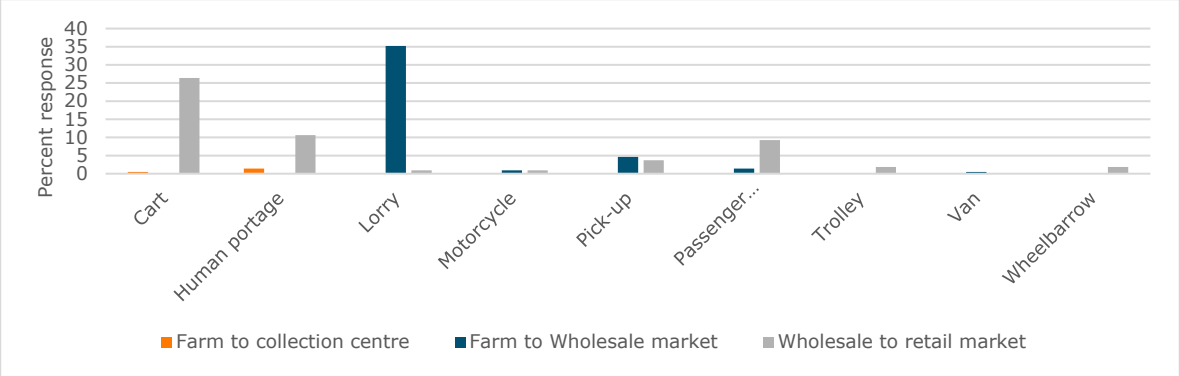


Figure 69 *Mode of transportation for wet market products*

For example, tomatoes are transported from farms to wholesale markets using pick-ups in wooden crates of about 120 kg that are tied with ropes and supported with cartons on the inside. To travel from wholesale to retail market, tomatoes are repackaged into plastic crates of 64 kg stacked together and transported on hand carts or by human portage. At the retail market, loose products are displayed on tables or on the floor.

The modes of transport from farms, suppliers and markets to the grocery stores are similar to those of the wet markets. Lorries are still the most common mode of transport (40%) followed by hand-drawn carts (30%) and passenger service vehicles (12.6%). This kind of transport infrastructure lacks the necessary mechanisms to control temperature, maintain hygiene and protect FFV products from quality deterioration.

Figure 70 *Mode of transportation for main grocery products*

4 Conclusions and recommendations

There are clear growth opportunities in the FFV domestic market in Kenya. However, assuring the safety of FFV produce in the domestic market remains a key challenge that requires action. Thus, a more active focus on addressing these constraints offers more opportunities for investment and inclusive growth. The insights from this study provide an entry point to explore how these opportunities can be catalysed and to recommend specific policy options.

4.1 Dynamics of the supply side in domestic fresh fruit and vegetables sector

The study confirms that there are many GlobalGAP-certified FFV producers who already meet stringent EU standards on food safety and quality. These farmers actively participate in parallel export and domestic FFV markets. There are also many farmers who grow for both the export and domestic markets but without following any certification. Another category is farmers who grow for the domestic market and have no exposure to food quality and safety standards. This study looked at the certified and non-certified farmers to understand whether there was knowledge spillover related to adherence to food safety production standards from the export market into the domestic market. This research sought to answer the following questions:

1. Is the export market a potential catalyst for supply of domestic FFV products that meet good production standards from among farmers engaged in parallel production for export and domestic markets?
2. Which factors and aspects of the domestic horticulture supply chain can be acted upon to catalyse the production and marketing of food in a safe manner that ensures best quality?
3. How is the current domestic market for FFV organized and are there opportunities for connecting farmers who meet good agricultural practices to traders and consumers who are responsive to food safety?

4.1.1 Certification and knowledge spillover into domestic production practices of fresh fruit and vegetables

To understand whether certified farmers transfer their production practices related to food safety for the FFV export market to their production for the domestic market, we analysed production practices, access to and use of selected inputs, hygiene practices and knowledge and facilitation.

On production practices, the study identified four key indicators for assessing safety assurance under the GlobalGAP and KS1758-2:2016 standards: record keeping, risk assessment, scouting for pests and diseases, and training in production practices. Results show that while certified and non-certified farmers followed similar production practices in domestic FFV production as they used for export, there were significant differences in how often they did so. While certified farmers almost always followed these practices, the non-certified farmers did so only irregularly. Record keeping and risk assessment were the least likely practices to be followed for domestic FFV production by the non-certified farmers, which might affect compliance with the PHI as harvesters may not know the last day of spray applications.

There is a direct correlation between access to inputs and the quality and safety of FFV. The findings show significant differences between certified and non-certified farmers in the use of fertilizer and approved pesticides from the government-authorized PCPB list. Additionally, more certified farmers indicated that they adhere to the specific pesticides approved for each crop, as well as following PHI after application of agrochemicals. The only input usage with insignificant difference was the use of compost manure.

Hygiene is an important parameter and contributor to maintaining food safety, especially in regards to contamination with microorganisms. This study compared hygiene practices recommended under GlobalGAP certification, including use of clean harvesting equipment and practice of personal hygiene during harvesting such as handwashing before and after visiting the toilets. The farmers growing under certification were found to almost always follow these hygiene practices. There is a significant difference in hygiene practices between certified and non-certified farmers, for both export and domestic crops, which can be attributed to the mandatory certification requirement on training in hygiene.

This implies that certification for export has enabled diffusion of many good practices to domestic production of FFV, mainly through certified farmers. The produce grown for domestic market can be assumed (as per research question 1) to be produced to a large extent in line with the same production standards as export FFV. Non-certified farmers have also adopted some of the good practices, but extra investment to raise their practices to the level of the certified farmers may be needed. The domestic market can therefore take advantage of certified farmers and their produce to promote FFV grown under good agricultural practices that are essential to food safety (research questions 2 and 3).

4.1.2 Access to targeted knowledge and facilitation advisory services

Training and extension services are essential to farmers being able to enhance production and use good agricultural practices. As the study found, 85% of certified farmers and 67% of non-certified farmers and/or members of their households had within the past year received information about horticultural production related to crops that they were growing. The certified farmers relied on export company technical advisers (64%), agrovet stores (12%), and government extension providers (9%) for extension advice. The non-certified farmers, on the other hand, received information from export company technical advisers (23%), government extension advisers (16%), mass media (15%) and other farmers (13%).

The certified farmers were more likely to receive more content and link directly with the providers of production training and information. Technical assistants from the exporting company visited farmers and provide tailored training on how to produce FFV that meets the necessary standards. This is in contrast to the other methods, such as field days and mass media, where contact was more impersonal and farmers had to try to apply the knowledge based on their own understanding. There were fewer farmers among those who were not certified who could articulate the diversity of the content covered through training and extension.

The findings indicate that more targeted training, inclusive of both men and women depending on their roles, and advisory support are necessary to support FFV production that meets global food safety and quality standards.

4.1.3 Farmers' ability to make investments

Horticultural production is capital-intensive, especially because the availability of the right inputs at the right time affects results. Investments were used as indicators of the economic status of farmers, as there is a direct correlation between ability to make investments and farm management practices geared towards meeting food safety and quality standards. This study identified the ability to purchase certified seed, fertilizers and pesticides and access to credit facilities as key parameters to determine how farmers are able to make investments in their production. These investments can ensure that farmers get higher yields, thus justifying efforts to implement good agricultural practices. This study found that 74% of certified farmers use certified seed, compared to only 40% of non-certified farmers. Certified farmers are more likely to use seed with characteristics like lower susceptibility to pests and diseases, matched to market demand and that has potential for higher yield and less demand for pesticides.

There was no significant difference noted between certified and non-certified farmers when it comes to use of fertilizers. However, the difference noted was with regard to following recommended dosage.

The study also found that both certified and non-certified farmers used insecticides, fungicides and herbicides. Herbicide usage was the lowest as both certified and non-certified farmers use mechanical weeding as the main method of controlling weeds.

Farmers are often constrained by availability of finance for inputs, which can lead to compromises in productivity, quality and safety. There is a reluctance among farmers to take on financial debt, as most do not want to use their land as collateral and farmers using low-cost production methods have no market guarantee. This is evident by 47% of certified farmers and 69% of non-certified farmers who reported no need for credit. However, of those who applied for credit (53% of certified and 21% of non-certified) only 29% of certified and 28% of non-certified accessed credit. Both categories of farmers rely on informal credit sources with the main source of credit being merry-go-rounds, farmer groups. Formal sources include banks and mobile money platforms.

We can infer that farmers growing under certification are more likely to seek credit as they have formal contract terms with buyers who link them to credit providers, therefore increasing their confidence to make investments as they have assured markets The domestic market can benefit from considering such arrangements, because agreements between buyers and producers reduces uncertainty related to marketing of products, and easier access to credit helps stimulate farmer investments, improving quality and safety of FFV.

4.1.4 Certified produce enters the domestic market but the farmer gains no added value

The insights above show that there is clearly diffusion of good practices from the export platform to the domestic platform through farmers who grow under certification. Even farmers who grow for the export market without certification were found to follow good practices in some key parameters, as they have to produce in line with export standards on quality and phytosanitary regulations.

Overall, the export platform in Kenya is a latent provider of safer and higher quality FFV for the domestic market. We have already identified that 70–80% of production volume by farmers participating in both export and domestic markets is produced for the domestic market. However, the analysis of these producers and how they are linked to domestic markets indicates that that their potentially safer produce is not valued as such and so they do not get a higher price for their products. The produce is mixed and traded with produce that does not meet high standards and is handled through the chain by brokers and traders who do not see any value in separating it.

However, there are potential opportunities for the domestic market to harness this value and channel it to consumers who are sensitive to food safety, for example the grocery segment and institutions (hospitals, hotels, etc.) that want to source high quality food. The investment opportunity here can be summed up as:

Supply chain governance and coordination can ensure the quality of the product by improving awareness of market players (especially brokers) about the need to trace produce from certified farms and use that as a tool to get higher value when selling to grocers or wholesalers who have market outlets for such produce.

However, further research needs to identify mechanisms to engage the grocery segment and the consumers who would be willing to pay higher prices for products with higher assurance of food safety.

4.2 Dynamics of the demand side

4.2.1 Understanding market segments

Understanding domestic market segmentation is crucial when considering entry points for catalysing investment to create a market for FFV that meets required food safety and quality standards. The study found four main market segments. The first is the domestic wholesale and retail wet markets within infrastructure provided by the County Government of Nairobi. This segment is the most significant in market share, as it is where over 85% of all FFV that enters the city is traded. The segment involves FFV traders who may specialize in one, two to three related FFV commodities, while retailers carry a wider variety of products. The second market segment mimics the wet markets but can be considered as spillover from the county market infrastructure, which is inadequate for all the trade necessary to meet the needs of emerging and expanding city residences and populations. Traders in this segment typically sell FFV on the ground, mats or in small shanty kiosks by the roadsides in close proximity to residential areas. The third segment is the grocery stores. This segment is a more recent development, with over 83% of grocers sampled opening shop in the last five years. Grocery stores were further categorized into high, medium and low end, depending on their investments and location. The fourth market segment (which this study excluded from primary data collection) is the supermarket segment and grocery stores in high-end malls. Other literature describes significant growth in this segment.

These markets can be better understood by examining the type of infrastructure, ease of entry and nature of investments that businesses make towards practices that maintain and enhance produce safety and quality standards. The wet market is characterized by limited infrastructure, informal trading practices and lack of appropriate facilities to adequately manage hygiene-related safety risks. There is no requirement for traceability; city inspectors use visual quality for monitoring, and they lack facilities for routine testing except where serious disease outbreaks are reported. The second segment is mainly dominated by retailers and is easy to enter, as very low capital is needed to start operations. This segment lacks any facilities for produce handling due to limitations in capital and capabilities of traders.

In the grocery segment, high-end grocery stores have higher investments; target high to middle income consumers; and invest in cooling facilities, proper display infrastructure, packaging and some level of FFV grading and quality control. Medium end grocery stores target lower-middle-income and middle-income consumers; invest in display, cooling and packaging facilities; employ workers who wear uniforms; and have handling facilities such as crates that are easy to clean and can therefore maintain product hygiene. The low-end grocers were differentiated from kiosks that are classified under the second market segment above. These grocers operate in semi-permanent infrastructure that is dedicated to FFV and have proper display infrastructure and presentation of their FFV to consumers. They use plastic crates; their staff wear uniforms; and hygiene facilities are available. This infrastructure means it is possible to deliver safe food to consumers within this market segment. The stores are located in lower-middle-income and upper-middle-income estates, mainly by the roadside. The grocers are mainly young and are participating in the Nairobi County employment programme for youth, which supports them to own FFV kiosks. The classification of the grocery stores, is based on their level of investments and not the volume or value of trade. The grocery segment has many characteristics that may offer opportunities to catalyse markets for produce that meets food safety standards. This can be done by promoting higher quality products at grocery stores, as they have better infrastructure than wet markets.

The supermarkets often have formal and complex relationships with suppliers, requiring price guarantees and 60–90 day payment terms. This makes entry for many small- and medium-scale producers to this segment particularly challenging, as they are operating in the cash economy. For this reason, the study excluded this segment from an in-depth analysis. However, there is already evidence that some diffusion of produce targeted at the export market is occurring in this segment through spillover and strategic positioning of redirected produce.

4.2.2 Attention to food safety in the wet market segment

Food safety assurance is a value system that has to be ingrained in the people participating in trade and transactions. It needs to be of intrinsic value to the transaction, otherwise it is only viewed as a cost to business. With the primary consideration of trade in the wet markets being lowest prices and costs, most traders were found to have very low levels of awareness of food safety risks. Additionally, when the concept of food safety and traceability was introduced to them, most were disinterested or felt that it was not their responsibility. This is linked to the fact that consumers focus on the visual characteristics of produce, leading the whole chain to pay particular attention to this value rather than to food safety, which is more difficult for consumers to verify.

Transactions in this market segment are fast and impersonal, requiring minimal interaction between traders and buyers. This discourages relationship formation and facilitates information gate keeping as a currency for traders, especially in the wholesale market. These traders are resistant to any changes to how the trade is organized, as they have already entrenched their positions in the market. The traders in this segment are opposed to new ideas, innovations or change, as the status quo benefits them at the expense of farmers and consumers.

However, since wet markets are largest segment, any intervention in food safety intended to reach and benefit the majority of consumers has to target these markets. Therefore, the role of policy and regulators becomes essential, including in investing in the necessary infrastructure to modernize and promote the intrinsic value of food safety assurance. This is especially because, as others have argued (Grace *et al.,* 2015), the ultimate goal is to maximize market access for all consumers to safe produce.

4.2.3 Grocery stores' inaccurate positioning and attention to food safety

Grocery stores supply to both individual and institutional consumers. The traders in this segment perceive their consumers to have awareness and alertness to food safety and quality. For this reason, grocers have been able to position themselves as delivering value to consumers, including food safety assurance. The main indicator that grocers reported to be tracking is production of FFV using contaminated irrigation water, mainly around the Nairobi metropolis. The majority of grocers reported that they inform consumers that they do not source from catchments that use contaminated irrigation water.

However, grocery stores source over 72% of their volume from wet markets and a further 6% through shortlisted suppliers, who are equally likely to source from wet wholesale markets. The assurance grocers give consumers that the produce is safe, 'organic' and 'natural' can be considered inaccurate positioning, leaving consumers misinformed. Grocers may misrepresent themselves due to the increased awareness consumers have about food safety and who want this as an intrinsic value of the produce they purchase.

Individually, however, these grocers are too small in volume and value to invest in programmes that link them directly to FFV sources. While they are willing to invest in traceability, food safety and process improvements, their volume does not justify such investments. However, grocers are a unique category, as aggregated they form a significant market that presents a formidable investment proposition which would help catalyse the marketing of produce that meets good FFV production standards.

4.2.4 Improving methods used to determine food safety

While food safety was expressed as a concern that consumers in both wet markets and grocery stores are demanding, visual quality is the main monitoring method used. This is also the method adopted by the County officials in their monitoring programme. There is no testing regime that has been adopted by any of the segments or regulators that provide consumers with reliable information to make informed decisions.

However, FFV contaminants cannot be detected by using visual quality as the guide. Contamination can be from microbes, from heavy metals found in irrigation water that does not meet the right quality standards, from use of pesticides that are not registered for the crop and from non-observance of PHIs. There is need for investment in a testing regime (research question 2) that allows for reliable data and statistics that can be used by consumers to make informed purchasing decisions.

4.3 Recommendations

4.3.1 Supply side (production)

Targeted training and extension services by market actors should be provided to improve food safety and quality. The government extension service should be revitalized to be more active in training about and awareness of food safety, as this should not be the responsibility of exporters or their agents.

Examining the roles of men and women will help identify knowledge gaps. Training given to men about pest management, PHIs and MRLs should also be given to women who are responsible for harvesting. In general, the non-certified farmers who form the majority of FFV producers for the domestic market should be targeted for the relevant training.

4.3.2 Demand side (markets)

We recommend a two-step process. The first is to pilot action research by aggregating demand from grocery stores and institutions within the cash economy and creating linkages to farmers already meeting higher standards to make available options for consumers of FFV that meets minimum safety standards. This needs to be accompanied by a testing regime to assure consumers of the intrinsic value of products in this market.

The second is to scale up the action research to market segments within the wet markets or other city infrastructure that exclusively trade products that are fully traceable and regulated through a testing and monitoring regime. This may necessitate investment in new public or private wholesale infrastructure and consumer branding that allows consumers to identify products that have undergone assurance of quality, safety and full traceability.

This can be done by:

1. Focusing first on the main products traded in the wet market so that practices leading to a good traceability system can be implemented slowly. For example, the focus could begin with tomatoes and leafy vegetables (identified in this report), and other products could be progressively added. A risk-based monitoring and surveillance system should be set up and implemented.
2. Having the national and county governments invest in the wet markets to improve hygiene: clean toilets and handwashing facilities, clean display and measuring equipment, food-grade benches for displaying produce, and minimizing the touching of produce that can easily be contaminated by customers.
3. Improving training and awareness among all players – including traders, consumers and market officials – about food management and their responsibilities to increase food safety.
4. Educating consumers about FFV safety/quality criteria, for example visible versus non-visible attributes, and creating awareness about food safety and negative effects on human health. This can be done through the existing (popular) TV and radio programmes.
5. During the action research, identify possibilities to position the National Horticulture Traceability System and the national standard (KS1758-2:2016, code of practice for fruits and vegetables) as important for Kenyan consumers, so groceries and wholesalers see the value of it. The following questions also need to be answered:
   - How can food quality specifications be integrated in the domestic market?
   - If there are first movers within the domestic market that are interested in joining this initiative, how can they be engaged?

- What mechanisms would trigger behavioural change at the level of brokers and traders in the middle of the chain to keep product separation and traceability?
- What mechanisms can be used to engage the grocery segment and the consumers who would be willing to pay higher prices for products with higher assurance of food safety?

4.3.3 Policy recommendations

Policy recommendations

1. The Government of Kenya should prioritize and make funds available for the implementation of a national monitoring plan for FFV destined for the domestic market and should publish results of the testing.
2. The County of Nairobi can better resource the Food Safety Unit of the Public Health Department so that it can work the Kenya Plant Health Inspectorate Service (or other laboratory with relevant capacity) to routinely test for MRLs, heavy metals and microbes and assess how and where they are entering the supply chain in order to improve knowledge and compliance.
3. In addition, the Food Safety Unit can work more collaboratively with the national authorities charged with various aspects of food safety. Coordinated efforts should identify strategies to increase the awareness of food safety that the different actors in the horticulture sector have and to empower the Food Safety Unit to properly monitor and implement sanctions for non-compliance with food safety procedures and regulations.
4. The County of Nairobi can work with key counties supplying horticultural products into the City of Nairobi to improve compliance with food safety and access to extension, aggregation and traceability.
5. The County Government of Nairobi can use a traceability system to monitor food origins and flow into the City of Nairobi in order to manage any challenges that are identified by the city during routine monitoring.
6. Development actors can identify mechanisms to incentivize brokers and traders to properly identify and keep records of the products grown to export standard (even without certification) so that markets that will pay for produce that meets higher food safety standards can be assured of its traceability, for example the grocery markets.
7. Increase the availability of appropriate facilities to guarantee food safety. These can be in the form of collection centres and transportation infrastructure that ensure produce does not get contaminated while in transit. At farm level, hygiene facilities and clean harvesting equipment are needed to enhance produce safety. This can also be achieved through the implementation of a traceability system along the domestic chain to change behaviour and ensure delivery of safer food to the consumer.
8. Explore the possibility of enabling a more organized and less congested wet market by separating retail activities from the wholesale markets and scheduling days exclusively for cleaning and maintenance of the infrastructure, instead of the current intensive weekly schedule without intervals for proper cleaning and maintenance.

The next phase of this action research is a proof of concept, working with first movers among the grocers and export farmers, using traceability as a tool to test how the domestic market can be catalysed to invest in food safety in a better governed chain, providing options for consumers.

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Appendix 1 Production data collection tool

To be completed by interviewer (enumerator) before interview			
1a. Date of interview (dd/mm/yyyy)	_ _ / _ _ / 2 0 1 7	1b.Time Interview Starts/ends (*24 hour system*):	
1d. Name of the enumerator (interviewer):		Enumerator (interviewer) signature:	
2a. Name of the household head:	Sex: [ ] 1=Male; 0= Female	Phone:	
2b. Name of the respondent:	Sex: [ ] 1=Male; 0= Female	Phone:	
2c. Where does the household head currently reside? (village/city)			
2d. County:	2f. Location:		
2e. Sub-County:	2g. Sub-Location: 2h. Village:		

Vegetable crops grown by the household for sale	Size of land	Season Planted	HH ownership of crop (Husband/Wife/Both)	. Vegetable crops grown by the household for domestic use	Size of land	Season Planted	HH ownership of crop (Husband/Wife/Both)

.Productive fruit trees grown by the household for sale	Number of trees	HH ownership of trees (Husband/Wife/Both)	. Productive fruit trees grown by the household for domestic use	Number of trees	HH ownership of trees (Husband/Wife/Both)

To be completed by supervisor after checking completed questionnaire thoroughly		
5a. Name of the supervisor:		ID:
5b. Date questionnaire checked by supervisor (dd/mm/yyyy)	_ _ / _ _ / 2 0 1 7	Supervisor signature:

PART 2A: LAND HOLDING (ACRES) DURING LAST 12 MONTHS

Land category	Mar - Sept 2016 crop season		Oct 2016 - Feb 2017 crop season	
	Cultivated land (annual + permanent crops)	Uncultivated (E.g. grazing, homestead etc.)	Cultivated land (annual + permanent crops)	Uncultivated (E.g. grazing, homestead etc.)
1	**2**	**3**	**4**	**5**
1. Own land used (acre): **A**				
2. Rented/borrowed in land (acre): **B**				
3. Rented/borrowed out land (acre): **C**				
4. Total owned land (acre): **D = A + C**				

PART 2B: LAND BUYING AND SELLING

Question	Responses
1	**2**
1. Did you buy land last year? **Codes R**	
2. If YES how many acres	
3. What is the value of the land bought (KSh)	
4. Did you sell land last year? **Codes R**	
5. What is the value of the land sold (KSh)	

SECTION 3: PRODUCTION EQUIPMENT AND MAJOR HOUSEHOLD ASSETS

Asset	Current Number (none=zero)	Average Unit Value (KSh)	Asset	Current Number (none=zero)	Average Unit Value (KSh)
1	**2**	**3**	**1**	**2**	**3**
1. Wheel barrow			12. Bicycle		
2. Sprayer			13. Grain mill		
3. Jembes/hoes			14. Water pump		
4. Tractor			15. Water storage tank (*holding capacity)*		
5. Panga			16. Radio, cassette or CD player		
6. Axe			17. Cellphone (mobile phone)		
7. Spade or shovel			18. Non-fruit trees (mature)		
8. Ox/donkey-cart			19. TV		
9. Pick-ups/lorries			20. Chaff cutter		
10. Cars			21. Other, specify……..		
11. Motorbike					

SECTION 4: HOUSING CONDITIONS

Question	Response
1	2
1. How many houses do you have?	
2. Number of rooms in the main house?	
3. For how many years has this household been living in this house?	
4. Where has the household been living before? **Code H**	
5. What is the household tenure status of main residence? **Codes I**	
6. How did the household acquire/build the main house? **Codes J**	
7. What is the style of floor of your main house? **Codes K**	
8. What is the type of wall of your house? **Codes L**	
9. What is the type of window of your house? **Codes M**	
10. What is the type of roof of your house? **Codes N**	
11. What is the main source of drinking water? **Codes O**	
12. What is the main kind of toilet facilities this household uses? **Codes P**	
13. What is the type of floor of toilet/latrine? **Codes K**	
14. Is there water for hand washing next to toilet/latrine facility? **Codes R**	
15. Is there soap for hand washing next to toilet/latrine facility? **Codes R**	
16. What is the main source of lighting energy in your household? **Codes Q**	
17. What is the main source of cooking energy in your household? **Codes Q**	
18. Does the family use bed nets? **Codes R**	
19. Who are using the bed nets multiple answer is possible? **Codes S**	
20. Does the household have a pesticide storage facility? **Codes R**	

CODES H	CODES I	CODES J	CODES K	CODES L	CODES M
1= In the same village/sub location 2= In the same sub county(rural area) 3= In the same sub county(urban area) 4= In the same county (rural area) 5= In the same county (urban area) 6= In another county (rural area) 7= In another county (urban area) 8=Other country	1=Owner 2=Rented 3=Other, specify…	1=Purchased 2=Constructed 3=Inherited 4=Gift 5=Other, specify...	1=Earth/mud 2=Wooden 3=Cement 4=Ceramics/ Tiles 5=Other, specify….	1=Wood 2=Bricks/Cement 3=Metal/corrugated iron sheets 4=Clay 5=Canvas 6=Bamboo mat 7= Mud 8=Stones 9=Other specify…..	1=Glass 2=Bamboo 3=Wood 4=Metal 5=No window 6=Other specify……

CODES N	CODES O	CODES P	CODES Q	CODES R	CODES S
1=Straw/grass 2=Tin/Corrugated iron sheets 3=Wood 4=Tiles 5=Other specify...	1=Pipe water 2=Protected well 3=Open, unprotected well 4=Mountain source 5=Rain water 6=River, pond 7=Other specify…..	1=Flush toilet (private) 2=Flush toilet (shared) 3=Latrine (private) 4=Latrine (shared) 5=None (outside) 6=Other specify….	1=Firewood 2=Charcoal 3=Kerosene 4=Gas (bottle) 5=Electricity (grid) 6=Electricity (generator) 7=Electricity (batteries) 8=Candle 9=Other, specify….	1= Yes 0= No	1= Children below 14 years old 2= Adults above 14 years old 3= Both 4=Pregnant women 5= Other, specify…

SECTION 5: HOUSEHOLD COMPOSITION & CHARACTERISTICS & LABOUR

(Household members- Persons who live together and eat together from the same pot (share food), including hired labour, students and spouse living and working in another location but excluding visitors)

Family code	Name of household member (start with respondent)	Sex **Codes A**	Marital status **Codes B**	Age (complete years)	Education **Codes C**	Relation to HH Head-**Codes D**	Occupation **Codes E**		Labor contribution in own farm **Codes F**	How many months did you stay in the village during the past 12 months
							Main	condary		
1	**2**	**3**	**4**	**5**	**6**	**7**	**8A**	**8B**	**9**	**10**
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										

11. Is hired labour readily available (**Codes R**) _____ How many hired laborers do you have on average _____
12. What is your opinion on the availability if hired labour (**Code R1**) _____
13. What is the affordability of hired labour (**Code R2**) _____

Codes A	**Codes B**	**Codes C**	**Codes D**	**Codes E**	**Codes F**
0=Female 1=Male	1= Married living with spouse 2= Married but spouse away 3= Divorced/separated 4= Widow/widower 5= Never married	0= None 1= Adult education 2=Primary 3=Secondary 4=Tertiary	1= Household head 2= Spouse 3= Son/daughter 4= Parent 5= Son/daughter in-law 6= Grand child 7= Other relative 8= Hired worker 9= Other, specify……	1= Farming crop 2= Farming livestock 3= Salaried employment 4= Self-employed off-farm 5= Casual laborer on-farm 6= Casual laborer off-farm 7= School/college child 8= Non-school child 10= Herding 11= Household chores 12= Other, specify	1=Full time 2=Part time 3=Not a worker
	Codes R1	**Codes R2**			
	1=Readily available 2=Available 3=Unavailable	1= Affordable 2= Not affordable			

PART 5A: FARMILY FARM LABOUR ALLOCATION

Activity/Process	Vegetable Crops			Fruit crops			Food crops		
Codes R	Male	Female	Youth	Male	Female	Youth	Male	Female	Youth
1	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6A**	**6B**	**6C**
Land preparation									
Planting									
Fertilizer/manure application									
Weeding									
Pest & disease control									
Harvesting									
Post-harvest handling									
Marketing									

PART 5B: OFF-FARM LABOUR ALLOCATION

Enterprises or activity	Labour allocation (number of HH members)								
	Manual/physical labour			Management			Marketing/sales		
	Male	Female	Youth	Male	Female	Youth	Male	Female	Youth
1	**2A**	**2B**	**2C**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**
1= Family non-farm self-employment									
2= Wage employment									

SECTION 6: HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS)

[*For each of the following questions, please consider what has happened in the past 12 months****]***

No.	Question	Response codes	Response
1	2	3	4
1.	During the last 12 months, did you worry that your household would not have enough food?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	
2.	Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	
3.	Did you or any household member eat just a few kinds of food day after day due to a lack of resources?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	

4.	Did you or any household member eat food that you preferred not to eat because of a lack of resources to obtain other types of food?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	
5	Did you or any household member eat a smaller meal than you felt you needed because there was not enough food?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	
6.	Did you or any other household member eat fewer meals in a day because there was not enough food?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	
7.	Was <u>there ever no food at all</u> in your household because there were no resources to get more?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	
8.	Did you or any household member go to sleep at night hungry because there was <u>not enough food</u>?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	
9.	Did you or any household member go a whole day without eating anything because <u>there was not enough food</u>?	0 = Never 1 = Rarely (in one or two months during the last 12 months) 2 = Sometimes (in 3 to 10 months during the last 12 months) 3 = Often (in more than 10 months during the last 12 months)	
10.	What is your own assessment of the adequacy of your family's food consumption over the past 12 months?	1=It was less than adequate for your family's needs 2=It was just adequate for your family's needs 3=It was more than adequate for your family's needs 4=Not applicable ''Adequate'' means no more nor less than what the respondent considers to be the minimum consumption needs of the family	
11.	What is your own assessment of the adequacy of your family's housing over the past 12 months?		
12.	What is your own assessment of the adequacy of your family's clothing over the past 12 months		
13.	What is your own assessment of the adequacy of the health care your family gets over the past 12 months?		
14.	What is your own assessment of the adequacy of your children's schooling over the past 12 months?		

15.	Taking into consideration ALL food sources (own food production + food purchase + help from different sources + food hunted from forest and lakes, etc.), how would you assess your family's food consumption in the past 12 months	1. Food shortage throughout the year, 2. Occasional food shortage, 3. No food shortage but no surplus, 4. Food surplus.	

PART 7A: VEGETABLES FARMERS GROUP

Question	Responses
1	**2**
1. Do you know of the existence of vegetables farmer groups in your area? **Codes R**	
2. Do you (or any other household member) currently belong to a (vegetables) farmers group? **Codes R**	
3. If NO in Q2, main reason why you are not a member of the vegetables group/s? **Codes Z2**	
4. If YES in Q2, is the group legally registered? **Codes R**	
5. What is the name of the vegetables farmers group?	
6. When was the group established (year)? ***(YYYY)***	
7. What were your expectations/goals when you joined the group (multiple answers possible)? **Codes Y**	
8. Is the group GlobalGAP certified? **Codes R**	
9. Does the group promote GAPs? **Codes R**	
10. Is the group engaged in contract farming? **Codes R**	
11. What crops does the group market? **Codes Z10**	

Codes Y	**Codes Z2**		**Codes Z10**		**Codes Z11**
1=Ready market 2=High prices 3=Stable prices 4=Access to improved technology 5=Access credit 6=Access training 7=Other, specify…… 8=No answer	1=Finances problem 2=Management problem 3=Political interference 4=Lack of expert in some knowledge e.g. making the constitution 5=Trust and transparency 6=Differences in opinion 7=Other, specify……	1=Garlic 2=Tomatoes 3=Pineapples 4=Cabbages 5=Bananas 6=Apples/pears 7=Spinach 8=Onions 9=Kales 10=Green maize	11=ALVs 12=Squash 13=Pumpkin 14=Melons 15=Cucumber 16=Courgette 17=Coriander 18=Capsicums/ chili pepper 19=Carrots	20=Butternut 21=Citrus 22=Pawpaw 23=Avocadoes 24=Mangoes 25=Plums/peaches 26=Sweet potatoes 27=French beans 28=Garden peas 29=others (specify)	1=Mulching 2=Practicing IPM 3=Weed control 4=Composting of manure 5=Scouting & monitoring 6=Observing PHI 7=Observing hygiene 8=Other, specify……

PART 7B: FARMERS GROUP FOR OTHER CROPS OR SOCIAL FUNCTIONS

Groups for other crops or social functions	**Group 1**	**Group 2**	**Group 3**
1	**2**	**3**	**4**
Do you (or any other household member) belong to a non-vegetable group **Codes R** ***[If NO; go to the next section]***			
Kind of group **Codes Z4**			
Name of the group?			
Is the group legally registered? **Codes R**			
What is the size (number of households) of the group?			
When was the group established? **(YYYY)**			
How much did you pay to become a member? **(KSh)**			
When did you join the group? **(YYYY)**			
Are you part the leadership for the group? **Codes R**			
Did you vote in farmers' group organization elections? **Codes R**			
How well do you think the group was able to run its tasks or functions? **Codes Z5**			
What is the main benefit of being a group member? **Codes Z6**			
What is the main disadvantage you experienced for being a member farmer group? **Codes Z7**			

Codes R	**Codes Z4**	**Codes Z5**	**Codes Z6**	**Codes Z7**
1=Yes 0=No	1=Production 2=Marketing 3=Saving/credit 4=Funeral 5=Church	0=Not effective 1=Less effective 2=Effective 3=Very effective 4=Most effective 5=Not relevant (not member of group)	1=Better social contacts with my colleague farmers 2=Knowledge exchange between members 3=Some communal problems are now discussed during producer group meetings 4=I am proud to be a member of the farmers group 5=Other, specify ……..	1=It costs money/fees 2=It costs a lot of time 3=Record keeping (too much paperwork) 4= Other, specify

Below are a series of statements that you may agree or disagree with using the scales below indicate your agreement with each of them, please be open and honest about your response

Statement		**Responses**
1		**2**
a)	People can generally be trusted. **Codes Z17**	
b)	Nowadays you cannot rely on anyone. **Codes Z17**	
c)	Most people would use you if they have a chance. **Codes Z17**	
d)	Most people would try to be fair to you. **Codes Z17**	
e)	People usually try to be helpful. **Codes Z17**	
f)	People usually only pursue their own interests. **Codes Z17**	

SECTION 8: FARMERS KNOWLEDGE ON GAPs AND FOOD SAFETY

1. For which vegetable crops do you use certified seed? **Codes Z10:** a)…… b)…… c)…… d)…….. e)……..
2. For which vegetable crops do you use farm seed? **Codes Z10:** a)…… b)…… c)…… d)…….. e)……..
3. Which vegetables give higher prices per unit? **Codes Z10:** (multiple response possible) ***[List from high prices to low price]*** a)……b)……c)……d)……..e)…….
4. What crops do you keep farm records for? **Codes Z10:** a)…… b)…… c)…… d)…….. e)……..
5. Can you mention benefits of record keeping? **Codes Z14:** a)…… b)…… c)……
6. What are the most important crop management practices to maintain produce quality and food safety? **Codes Z11** a)…… b)…… c)…… d)…….. e)…….. f)…….. g)…… h)…….
7. Can you mention the factors that affect vegetables quality? **Codes Z15:** a)……b)……c)……
8. Do you hire labor for some activities on your vegetables farm? **Codes R:** ……
9. Do you know what traceability is? **Codes R:** ……
10. If YES, what are some benefits of traceability? **Codes Z16:** ……
11. Are you a GlobalG.A.P. certified farmer? **Codes R:** ……..
12. In your opinion, does the use of GlobalG.A.P. contribute to food safety of vegetables? **Codes Z17** ……
13. In your opinion, does grading of vegetables provide an assurance of quality? **Codes Z17** ……
14. Have you ever (or is currently) engaged in contract farming? **Codes R:** …… Contracts are respected - **Codes Z17:** ……
15. What guides your decision on what crops to grow at any given time? **Codes Z18:** a)…..….. b)……... c)…….... d)…..……
16. What guides your choice of inputs to use in vegetable production? **Codes Z19:** a)…….…. b)……. c)…….….. d)……..
17. Which of the following practices is different for domestic and export crops? **Codes Z20:** a)…….. b)……. c)…….….. d)…….. e)……. f)……

Codes Z14	**Codes Z15**	**Codes Z16**	**Codes Z17**
1=Evidence of performance of the farm 2=Decision-making 3=I know how much chemicals I have used 4=Accounting for money spent 5=Useful when seeking credit (loans) 6=Component of GAPs & certification 7=Other, specify……..	1=Using the right variety 2=Control of pests 3=Control diseases 4=Timely harvesting 5=Proper harvesting 6=Other, specify…….	1=Quality assurance to consumers 2=Facilitates certification 3=Easy to implement corrective actions 4=Supply chain management 5=Other, specify……	1=Strongly agree 2=Agree 3=Disagree 4=Strongly disagree

SECTION 9: INFORMATION AND TRAINING ON GAPs AND FOOD SAFETY

Type of information and trainings received in the last 12 months	**Information**				**Trainings**			
	Received by any HH member **Codes R**	If YES, which year?	If yes, most trusted sources **Codes U**	How it was received? **Codes V**	Received by any HH member **Codes R**	If YES, which year?	If yes; <u>most important</u> provider **Codes U**	Mode **Codes V**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Export vegetables production								
2. Domestic vegetables production								
3. Pest and disease control								
4. Vegetables harvesting								
5. Pesticide PHIs & MRLs								
6. Safe use of pesticides								
7. Vegetables grades & standards								
8. HACCP and hygiene principles								
9. Postharvest handling								
10. Value addition								
11. Other specify……								

Codes Z18	Codes Z19	Codes Z20	Code U: Most trusted		Codes V
1=Ready market 2=High prices 3=Stable prices 4=Access to improved technology 5=Access credit 6=Readily available inputs 7=Favorable climate 8=Other, specify……	1=Availability 2=Affordability 3=Quality of inputs 4=Recommendations 5=Routine inputs 6=Other specify….	1=Record keeping 2=Approved pesticides 3=Trainings 4=PHIs 5=Ready market 6=Hygiene practices 7=Crop maturity 8=Other specify….	1= Brokers/ local traders 2= Government extension agent 3= Exporter company agronomists 4= Pesticide companies 5= Agrochemical stores 6= NGO extension agent	7= Radio 8= Newspapers 9=TV 10=Internet & social media 11= Own Farmer group 12= Other farmer groups 13= Other, please specify	1= Field day or farmer field school 2= Extension visitors 3= Phone call 4= Personal visit/discussion 5= Public rallies (barazas) 6=Other specify…….

SECTION 10: AVAILABILITY OF MAIN INPUTS FOR DOMESTIC VEGETABLES OVER THE LAST 12 MONTHS

Vegetables grown **Codes Z10**	Main source of seeds **Codes Z17**	Are the following inputs easily available? **Codes R**												
		Farm Machinery	Seeds	Planting fertilizer	Topdressing fertilizer	Foliar fertilizer	Organic fertilizer	Insecticides	Fungicides	Herbicides	Irrigation equipment	Pesticide application equipment	Harvesting equipment	Postharvest equipment & facilities
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

SECTION 11: COST OF PRODUCTION

Vegetables grown **Codes Z10**	Area (Acres)	Total cost of seeds (KSh)	Inorganic fertilizers including foliar feeds (If not used, put zero)		Total cost of pesticides/ herbicides used (KSh)	Manure (dry equivalent)			Cost of hired labor			
						Own	Bought					
			Amount (kg/liters)	Total cost (KSh)		Amount (kg)	Amount (kg)	Total cost (KSh)	Land preparation & planting (KSh)	Weed and pest control (KSh)	Harvesting (KSh)	Marketing (grading packaging on- farm transport etc.)
1	**2**	**3**	**4A**	**4B**	**5**	**6A**	**6B**	**6C**	**7A**	**7B**	**7C**	**7D**

SECTION 12: YIELD OF VEGETABLES

Vegetables grown **Codes Z10**	How seasons in last 12 months	Total harvested (Kgs) over the last 12 months	Total quantity sold (Kgs)	Total quantity consumed at home (Kgs)	Total quantity rejected by the buyer/s (Kgs)	Average price per kg or pieces
1	**2**	**3**	**4**	**5**	**6**	**7**

SECTION 13: MARKETING OF DOMESTIC VEGETABLES: OVER LAST 12 MONTHS

Varieties of vegetables **Codes Z10**	Who bought your vegetables **Codes Z18**	Quantity sold (Kgs)	Quality grades **Codes Z20**	Did you have a contract with buyer **Codes R**	Did you negotiate the sale price of with this buyer **Codes R**	If yes, when did you negotiate the sale price? **Codes Z21**	How often did you sell to this buyer in past 12 months	Where did you sell? **Codes Z22**	Who sold the harvest **Codes Z23**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Codes Z17	**Codes Z18**	**Codes Z20:**	**Codes Z21:**	**Codes Z22**	**Codes Z23**
1= Own Seed (farm seed) 2= Supplied by buyer 3= Farmer exchange 4= Farmer Groups 5= Buy from seed companies 6= Buy from Agrovet 7= Free By NGOs/Govt 8= Govt Subsidy Program 9= Other, specify…	1=Farmer group 2=Broker/middlemen 3=Consumer 4=Other farmer to resale it 5=Supermarket 6=Other, specify…….	1=High 2=Medium/normal 3=Low 4=No grades	1= Before the harvest season 2= During the harvest season 3= Right after the harvest 4= After washing and drying vegetables 5=Other, specify……	1= Farm gate 2= Village market 3= Main/district market 4= Local collection centers	1=Female 2= Male 3=Female youth 4=Male youth

SECTION 14: VEGETABLES INCOME UTILIZATION

Vegetable types **Codes Z10**	How was income from vegetables used **Codes Z27**			Percent of vegetables income spent by the wife (%)	Percent of vegetables income spent by husband (%)	Percent of vegetables income spent by youth (%)	Does your household plan to expand vegetables farming in future? **Codes R**
1	**2A**	**2B**	**2C**	**3**	**4**	**5**	**6**

8. In your household, who decided on the most recent investment in vegetables production? If multiple answers, please indicate them in order of decision making. **Codes Z28;** a)……..b)……c)……

9. How would you rate the stability of income from vegetables farming compared to the income from other crops? **Codes Z29**…….

10. How would you rate the working conditions in vegetables production compared to the working conditions in other crops production? **Codes Z30**……..

11. Overall, how satisfied are you with vegetables farming compared to cultivating the other crops? **Codes Z31**…….

Codes Z27:	**Codes Z28**	**Codes Z29:**	**Codes 30:**	**Codes Z31**
1= Pay for education 2= Pay for health care 3= Pay for food 4= Buy animals 5= Buy land 6= Plant more vegetables, 7= Entertainment (social) 8=Other, specify……	1=Self 2=Spouse 3=Jointly 4=Youth 5=Other, specify…..	1=Much stable 2=Little stable 3=Same 4=A little instable 5=Much instable	1=More strenuous 2=Less strenuous 3=Same 4=More pleasant 5=Less pleasant	1=Much more pleasant 2=More pleasant 3=Same 4=Less pleasant 5=Much less pleasant

SECTION 15: AGRICULTURAL CROP PRODUCTION AND MARKETING (LAST 12 MONTHS)

Crop produced **Codes G**	Season	Area planted (acres)	Total harvested GREEN **Kg**	Total harvested DRY 2015 (**kg**)	Quantity sold (kg)	Average per unit price (KSh/kg)	Total Cost of Production (KSh)				
							Fertilizer	Seed	Pesticides/ Herbicides	Cost of hired machinery/ oxen	Cost of hired labor
1	**2**	**3**	**4**	**5**	**6**	**7**	**8A**	**8B**	**8C**	**8D**	**8E**

Codes G		
1=Maize 2=Haricot bean	6=Cowpea	11=Pigeon pea
3=Soybean 4=Cassava	7=Wheat	12=Sweet potatoes
5=Groundnut	8=Sorghum	13=Coffee
	9=Millet	14=Tea
	10=Rice	15= Other crops, specify …..

SECTION 16: LIVESTOCK PRODUCTION AND MARKETING (LAST 12 MONTHS)

Total annual cost of livestock production (fodder + labor + veterinary care + artificial insemination +salt + others) (KSh) ……

Livestock type	Number of Animals currently	Current average market value of each animal	Total days milked per animal in the last 12 month	Daily milk yield per animal (liters)	Total production of milk (liters) or eggs or honey	Total livestock products sold (unit)	Average per unit price (KSh/unit)	Unit of livestock product sold (kg, liter, number)	Total number of live animals sold	Average per unit price (KSh/unit)
1	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1=Indigenous milking cows										
2=Cross-bred milking cows										
3=Exotic milking cows										
4=Non milking cows (mature)										
5=Trained oxen for ploughing										
6=Bulls										
7=Heifers										
8=Calves										
9=Goats										
10=Sheep										
11=Mature trained donkeys										
12=Young donkeys										
13=Horses										
14=Mules										
15=Mature chicken										
16=Local Bee hives										
17=Modern Bee hives										
18=Pigs, mature										
19=Pigs, young										
20=Other livestock, specify….										

SECTION 17: OTHER SOURCES OF INCOME OVER THE LAST 12 MONTHS

Sources	Who earned/ received? **Codes D**			Total income (cash & in-kind)		Total income (KSh)
				Cash (KSh)	Payment in kind Cash equivalent	
1	**2A**	**2B**	**2C**	**3A**	**3B**	**4**
1=Rented/sharecropped out land						
2=Salaried employment						
3=Farm labor wages						
4=Non-farm labor wages						
5=Non-farm business NET income (restaurant, shop, trade, tailor, sale of beverages etc.)						
6=Pension income						
7=Drought/flood relief						
8=Safety net or food for work						
9=Remittances (sent from non-resident family and relatives living elsewhere)						
10=Gifts (marriage/dowry etc.)						
11=Sale of firewood, brick making, charcoal making, poles etc.						
12=Sale of crop residues						
13=Sale of other fodder or hay						
14=Sale of organic manure						
15=Rented property (e.g. house or store or warehouse, etc.)						
16=Interest from bank deposit or loans given to others						
17= Selling of seedlings						

PART 18A: ACCESS TO CREDIT

Reason for loan	Did you need credit? **Codes R**	If **NO**, Why not? **Codes Z32**	If **Yes**, then did you get it? **Codes R**	If needed credit and did not have it, then why not? Rank 3 **Codes Z33**			If **Yes**	
				$_1$st	$_2$nd	$_3$rd	Source of Credit **Codes Z34**	Did you get the amount you requested **Codes R**
1	**2**	**3**	**4**	**5A**	**5B**	**5C**	**6A**	**6B**
1. Invest in vegetables production								
2. Buying inputs for other crops								
3. Buy farm equipment/implements								
4. Invest in transport (bicycle etc.)								
5. Build storage or processing unit/shade								
6. Buy other livestock								
7. Invest in irrigation system								
8. Invest in toilet or other sanitary practices								

9. Non-farm business or trade								
10. To pay land rent								
11. Buy food staples								
12. Other basic consumption needs (health/education/travel/tax,)								

PART 18B: ACCESS TO BANKING SERVICES

Question	Responses		
1	2		
1. If you would somehow and unexpectedly receive KSh. 1,000 what would you use it for? If multiple uses, please indicate them in order of amounts. **Codes Z35**			
2. Does the household have active bank account? **Codes R**			
3. If YES in Q2, then does the household use of bank account for selling avocado? **Codes R**			
4. If YES in Q2, doe the household use of the bank account for selling other crops/livestock? **Codes R**			
5. Does the household use MPESA or Airtel mobile banking system **Codes R**			
6. If YES in Q5, does the household use of MPESA or Airtel mobile banks system for selling avocado? **Codes R**			
7. If YES in Q5, does the household use of MPESA or Airtel mobile is banking for selling other crops or animals? **Codes R**			

Codes R	Codes Z32	Codes Z33	Codes Z34	Codes Z 35
0=No 1=Yes	1= Not cash constrained 2= Other, specify…..	1=Borrowing is risky 2=Interest rate is high 3=Too much paper work/ procedures 4=Expected to be rejected, so did not try it 5=I have no asset for collateral 6=No money lenders in this area for this purpose 7=Lenders don't provide the amount needed 8= No credit association available 9=Other, specify……	1=Money lender 2=Farmer group/coop 3=Merry-go-round 4=Microfinance 5=Bank 6=SACCO 7=Relative 8=AFC 9=Other, specify……	1=Vegetables production 2=Other crops production 3=Livestock. 4=Non-farm business. 5=Savings 6=Buy food 7=Other, specify….

Appendix 2 Data collection for wholesalers and retailers

1.0 Demographic characteristics

Name of the market outlet …….. Date:……./……/ 2017

Name of the respondent	
Age of respondent (**0= 18-25 yrs, 1= 26-35 yrs, 2= 36-45yrs, 3=46-55**; 4= **above 56yrs)**	
Gender of respondent	(**0=Female; 1=Male)**
Telephone number	
Highest level of education	**(0= None, 1= Adult education, 2=Primary, 3=Secondary, 4=Tertiary)**
Marital status	**(0=Single. 1= married, 2= divorced/separated 4= widowed)**
Duration respondent has been in the market outlet	
Do you have employees Y/N,	
How many employees do you have	
How many days of the week are market days	
Of the market days how many days to you trade in this market per week	
In this market, estimate the number of traders who attend the market day	

2.0 Products traded (Code Z10)

Which products do you trade in:

Key:

Codes Z10		
1=Garlic	11=ALVs	20=Butternut
2=Tomatoes	12=Squash	21=Citrus
3=Pineapples	13=Pumpkin	22=Pawpaw
4=Cabbages	14=Melons	23=Avocadoes
5=Bananas	15=Cucumber	24=Mangoes
6=Apples/pears	16=Courgette	25=Plums/peaches
7=Spinach	17=Coriander	26=Sweet potatoes
8=Onions	18=Capsicums/ chili pepper	27=French beans
9=Kales	19=Carrots	28=Garden peas

3.0 Supply chain mapping

3.1 Description of actors in the supply chain, their roles and associated costs

Product 1

S/N	Actor	Role	Associated cost
1			
2			
3			
4			
5			
6			
7			

Product 2

S/N	Actor	Role	Associated cost
1			
2			
3			
4			
5			
6			
7			

Product 3

S/N	Actor	Role	Associated cost
1			
2			
3			
4			
5			
6			
7			

3.2 Packaging and repacking:

How is product packed at the different supply chain levels? (Farm to aggregation point to market to next level/consumer)

Product 1

S/N	Supply chain level	Packaging used	Reason for packing	Associated cost
1	Farm to			
2				
3				
4				
5				
6				
7				

Product 2

S/N	Supply chain level	Packaging used	Reason for packing	Associated cost
1	Farm to			
2				
3				
4				
5				
6				
7				

Product 3

S/N	Supply chain level	Packaging used	Reason for packing	Associated cost
1	Farm to			
2				
3				
4				
5				
6				
7				

3.3 Description of product handling procedure and infrastructure from farm to consumer or next level

S/N	Supply chain level	Handling infrastructure used	Purpose of the infrastructure	Associated cost
1	Farm to			
2				
3				
4				
5				
6				
7				

3.4 Description of transportation from the farm to the next level or consumer

S/N	Supply chain level	Transportation facility (Lorry, cart, trolleys)	Purpose of the infrastructure	Associated cost
1	Farm to			
2				
3				
4				
5				
6				
7				

4.0 Sourcing calendar

4.1 Describe the geographic supply chain calendar for the regions where you source from

S/N	Product	Region	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
1														
Average price														
2														
Average price														
3														
Average price														
4														
Average price														
5														
Average price														
6														
Average price														

5.0 Marketing and sales

5.1 What packaging material do you use for different fresh fruits and vegetables (FFV)?

S/N	FFV products	Packaging material	Associated cost
1			
2			
3			
4			
5			
6			
7			

5.2 From your experience what time do consumers come to buy from this market outlet?
Not multiple

Consumer segments	Major products purchased	Time of the day	Frequency of purchase within a week
Wholesalers			
Individual retailers			
End consumers			
Institutions			
Other specify ……...			

5.3 How do you store produces that remain by the end of the day?

Storage infrastructure	Owned/leased	Available equipment in the storage example temperature controllers, shelves	Associated cost

5.4 What are the taxes that you pay?

Type of tax	**How much**	**Frequency**

6.0 Food Safety

6.1 What is your perception about agrochemicals in relation to food safety of fresh fruits and vegetables in the domestic market?

……

……

6.2 What is your perception about heavy metals in relation to food safety of fresh fruits and vegetables in the domestic market?

……

……

6.3 What is your perception about microbial in relation to food safety of fresh fruits and vegetables in the domestic market?

……

6.4 How do you handle the following?

Item	**Wholesalers**
Hygiene for the products	
Personal Hygiene	
Waste disposal	

7.0 Quality Grades

7.1 How do you facilitate communication of produce weights and measures between the farmers, yourself and the buyers?

Fresh fruit and vegetable product	Instrument/equipment used for weight and measures (Tins Weighting balance, cooking fat buckets)	How this is communicated

7.2 From your experience what are the generally accepted grading standards for different fruits and vegetables

Fresh fruit and vegetable product	Color	size	Appearance

7.3 How do you manage quality deterioration of the products you deal with?

Actor	Farm level (Harvesting)	Next actor ……	Next actor ……	Next actor ……
Time it takes to move to next level (In days)				
Indicator of quality deterioration				
How are products handled to reduce quality deterioration				

8.0 Food waste

8.1 At an individual level how do you manage fruits and vegetable waste?

……

……

8.2 On average what is the percentage of waste?

……

……

……

8.3 How do you manage waste?

……

……

……

8.4 How can wastage be reduced?

……

……

……

9.0 Training

9.1 In the last 12 months have you received training on fruits and vegetables? **Y/N**

9.2 What was the topic/content of the training? (More than one answer allowed)

Training topics	**If YES, which year?**	**If yes; <u>most important</u> provider Codes U**	**Mode Codes V**
1	**2**	**3**	**4**
12. Export vegetables production			
13. Domestic vegetables production			
14. Pest and disease control			
15. Vegetables harvesting			
16. Pesticide PHIs & MRLs			
17. Safe use of pesticides			
18. Vegetables grades & standards			
19. HACCP and hygiene principles			
20. Postharvest handling			
21. Value addition			
22. Sales and marketing			
23. Customer relations			
24. Other specify……			

Code U: Most trusted		**Codes V**
1= Brokers/ local traders 2= Government extension agent 3= Exporter company agronomists 4= Pesticide companies 5= Agrochemical stores 6= NGO extension agent 7= Radio	8= Newspapers 9=TV 10=Internet & social media 11= Own traders group 12= Other traders groups 13= Other, specify.....	1= Field day or farmer field school 2= Traders meetings 3= Enrolled in a course 4= Personal visit/discussion 5= Public rallies(barazas) 6= Sponsored training by my employer 7= Other specify……

10.0 Investment

10.1 If you had a significant amount of money what would you invest in?

.....

.....

.....

.....

11.0 Challenges in the market place

In your own view what are the major challenges that traders face in this market?

.....

Appendix 3 Grocery Stores

1.0 Demographic characteristics

1.1 Name of the market outlet ……..

Name of the respondent	
Age of respondent	
Gender of respondent	
Telephone number	
Duration the market outlet has traded FFVs	

2.0 What are the FFV products that you trade in?

Product	Estimated Volume per day

Codes Z10		
1=Garlic	11=ALVs	20=Butternut
2=Tomatoes	12=Squash	21=Citrus
3=Pineapples	13=Pumpkin	22=Pawpaw
4=Cabbages	14=Melons	23=Avocadoes
5=Bananas	15=Cucumber	24=Mangoes
6=Apples/pears	16=Courgette	25=Plums/peaches
7=Spinach	17=Coriander	26=Sweet potatoes
8=Onions	18=Capsicums/ chili pepper	27=French beans
9=Kales	19=Carrots	28=Garden peas
10=Green maize		29=others (specify)

3.0 Supply chain mapping

3.1 Description of actors in the supply chain, their roles and associated costs

S/N	Actor	Role	Associated cost
1			
2			
3			
4			
5			

3.2 Packaging and repacking:

How is product packed at the different supply chain levels? (Farm to aggregation point to market to consumer)

S/N	Supply chain level	Packaging used	Reason for packing	Associated cost
1	Farm to			
2				
3				
4				
5				
6				
7				

3.3 Description of product handling procedure and infrastructure from farm to consumer

S/N	Supply chain level	Handling infrastructure used	Purpose of the infrastructure	Associated cost
1	Farm to			
2				
3				
4				
5				
6				
7				

3.4 Description of transportation from the farm to consumer

S/N	Supply chain level	Transportation facility (Lorry, cart, trolleys)	Purpose of the infrastructure	Associated cost
1	Farm to			
2				
3				
4				
5				
6				
7				

4.0 Sourcing calendar

4.1 Which market(s) do you source your product from around the year?

S/N	Product	Market	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
1														
Average price														
2														
Average price														
3														
Average price														
4														
Average price														

5.0 Marketing and sales

5.1 What packaging material do you use for different fresh fruits and vegetables (FFV)?

S/N	FFV products	Packaging material	Associated cost
1			
2			
3			
4			

5.2 From your experience what time do consumers come to buy from this market outlet?

Consumer segments	**Major products purchased**	**Time of the day**	**Frequency of purchase within a week**
End consumers			
Institutions			

5.3 How do you store produces that remain by the end of the day?

Storage infrastructure	Owned/leased	Available equipment in the storage example temperature controllers, shelves	Associated cost

5.4 What are the taxes that you pay?

Type of tax	How much	Frequency
Transit receipt per county		
Market cess receipt		
Human carrier receipt		
Any other specify ……..		
Business permit license		

6.0 Food Safety

6.1 What is your perception about agrochemicals in relation to food safety of fresh fruits and vegetables in the domestic market?

……
……
……
……

6.2 What is your perception about heavy metals in relation to food safety of fresh fruits and vegetables in the domestic market?

……
……
……
……

6.3 What is your perception about microbial' in relation to food safety of fresh fruits and vegetables in the domestic market?

……
……
……
……

6.4 How do you handle the following?

Item	**Retailer**
Hygiene for the products	
Personal Hygiene	
Waste disposal	

7.0 Quality Grades

7.1 How do you facilitate communication of produce weights and measures between the farmers, yourself and the buyers?

Fresh fruit and vegetable product	Instrument/equipment used for weight and measures (Tins Weighting balance, cooking fat buckets)	How this is communicated

7.2 From your experience what are the generally accepted grading standards for different fruits and vegetables

Fresh fruit and vegetable product	Color	size	Appearance

8.0 Food waste

8.1 At an individual level how do you manage fruits and vegetable waste?

……

……

……

……

8.2 In your own opinion what can be done so that the county can collect all the waste in the market?

……

……

……

……

9.0 Training

9.1 In the last 12 months have you received training on fruits and vegetables? **Y/N**

9.2 What was the topic/content of the training? (More than one answer allowed)

Training topics	**If YES, which year?**	**If yes; <u>most important</u> provider Codes U**	**Mode Codes V**
1	**2**	**3**	**4**
25. Export vegetables production			
26. Domestic vegetables production			
27. Pest and disease control			
28. Vegetables harvesting			
29. Pesticide PHIs & MRLs			
30. Safe use of pesticides			
31. Vegetables grades & standards			
32. HACCP and hygiene principles			
33. Postharvest handling			
34. Value addition			
35. Sales and marketing			
36. Customer relations			
37. Other specify……			

Code U: Most trusted		**Codes V**
1= Brokers/ local traders 2= Government extension agent 3= Exporter company agronomists 4= Pesticide companies 5= Agrochemical stores 6= NGO extension agent 7= Radio	8= Newspapers 9=TV 10=Internet & social media 11= Own traders group 12= Other traders groups 13= Other, specify.....	1= Field day or farmer field school 2= Traders meetings 3= Enrolled in a course 4= Personal visit/discussion 5= Public rallies(barazas) 6= =Sponsored training by my employer 7= Other specify…… ……

10.0 Investment

10.1 If you had a significant amount of money what would you invest in?

.....
.....
.....
.....

Wageningen Centre for Development Innovation
Wageningen University & Research
P.O. Box 88
6700 AB Wageningen
The Netherlands
T +31 (0)317 48 68 00
www.wur.eu/cdi

Report WCDI-18-051

Wageningen Centre for Development Innovation supports value creation by strengthening capacities for sustainable development. As the international expertise and capacity building institute of Wageningen University & Research we bring knowledge into action, with the aim to explore the potential of nature to improve the quality of life. With approximately 30 locations, 5,000 members of staff and 10,000 students, Wageningen University & Research is a world leader in its domain. An integral way of working, and cooperation between the exact sciences and the technological and social disciplines are key to its approach.

To explore the potential of nature to improve the quality of life

Wageningen Centre for Development Innovation
Wageningen University & Research
P.O. Box 88
6700 AB Wageningen
The Netherlands
T +31 (0)317 48 68 00
www.wur.eu/cdi

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