Rural Logistics for Smallholder Farmers to Meet New Agricultural Market Demands: *Analysis of various Horticultural Value Chains*

Project AFCAP/GEN/060: Work Package 2 (Deliverable 4) Report

Kenya Network for Dissemination of Agricultural Technologies [KENDAT]

In Partnership with:

International Forum for Rural Transport and Development (IFRTD)

and

TCP International GmbH

This project was funded by the Africa Community Access Programme (AFCAP) which promotes safe and sustainable access to markets, healthcare, education, employment and social and political networks for rural communities in Africa.

Launched in June 2008 and managed by Crown Agents, the five year-long, UK government (DFID) funded project, supports research and knowledge sharing between participating countries to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources.

The programme is currently active in Ethiopia, Kenya, Ghana, Malawi, Mozambique, Tanzania, Zambia, South Africa, Democratic Republic of Congo and South Sudan and is developing relationships with a number of other countries and regional organisations across Africa.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

CP:	Collection Point
CV:	Commercial Village
CVM:	Commercial Villages' Models
FCI:	Farm Concern International
FWG:	Farmers Welfare Groups
GAP:	Good Agricultural Practice
GDP:	Gross Domestic Product
HCDA:	Horticultural Crops Development Authority
HGV:	Heavy Goods Vehicle
ICTs:	Information Communication Technologies
IMT:	Intermediate Means of Transport
KHE:	Kenya Horticultural Exporters
KShs:	Kenya Shillings (***1US$ = KShs 85 Nov 2012***)
LGV:	Light Goods Vehicle
NGO:	Non-Governmental Organization
SF:	Small Farmers
WDR:	World Development Report

1 INTRODUCTION

Three quarters of the poor live in rural areas of Developing Countries and 70% of the population in Least Developed Countries is engaged in agriculture. About 60% of the Kenyan population lives in rural areas, with 70% of rural households dependent on agriculture as the main livelihood pillar. Agriculture contributes 24% of the National Gross Domestic Product (GDP) and it also supports 27% of the GDP through forward and backward linkages with other sectors of the economy. Agriculture also accounts for 60% of all exports. The agriculture sector holds an important key to poverty reduction through increased productivity, value addition and improved marketing.

Rapid urbanisation in Kenya and demand for fresh, high quality, agricultural products in international markets has opened new income opportunities for farmers, rural food processing industries and transport companies. New markets for high value agricultural produce driven by rising incomes, liberalised trade, advanced logistical systems and use of ICTs have proliferated in many developing countries.

In Kenya, three quarters of the fruit and vegetable export production is coming from smallholders. About 95% of all horticultural produce is marketed locally[1]. Participation in modern markets can increase farmer income by 10 to 100% (WDR 2008, p.127).

The smallholder farmer is, however, increasingly being asked to compete in markets that demand much more in terms of quality and food safety which have significant cost implications. The upcoming and enlightened farmers find themselves increasingly under the sway of supermarkets, processors and large export traders; hence more international competition. As small farms struggle to diversify into higher value products, they must increasingly meet the requirements of these demanding markets, both at home and overseas. These changes offer new opportunities and pose serious threats to small farmers.

Among the serious threats to the farmers at the farm level, is the issue of transport. Undeveloped and disorganized rural transport logistical system provide a major challenge for farmers to deliver produce to the market efficiently, cost effectively, while maintaining quality and standards. This research project focuses on logistic chains for high value products in Kenya with the main focus being to improve marketing and incomes smallholder farmers.

[1] Henry Kinyua. 2012. Project Nurture. Paper presented at the AFCAP Project Kickoff Workshop, 28-29 February, 2012.

This report covers Work Package 2 (WP2) of this project under Deliverable 4 as shown on the project contract documents. The previous report was composed of the analysis of the existing transport services and logistics in a variety of value chains for high value commercial horticultural products for Kenyan and international markets. Work Package 1 (WP1) focused on an analysis of the logistics and transport systems including but not limited to:

- Organisation of transport as part of the value chain logistics system.
- Market segments and how they influence infrastructure of the logistics chain,
- Transport in small holder versus large holder systems.

Smallholder marketing organisational structures

Figure 1 shows the coverage of the project areas studied. The areas cut across the country's fertile lands on the slopes of Mt. Kenya, Aberdares Range, the Rift Valley and Yatta Plateau.

In WP2, four primary value chains were identified, categorised and analysed. This Deliverable 4 is a description of the logistics chains including transport services in the selected value chains and a comparative analysis of their main transport and economic features.

Each value-chain is reported by its various operational stages from farm to market namely: farm level production systems, the attendant logistical and transport services, socio-economic structures and across all these aspects, the challenges and interventions taking place and those that can be recommended.

2 OVERVIEW OF VALUE CHAINS

This study carries out an analysis of seven horticultural and agricultural value chains that target mainly the national as well as the international consumer markets. The crops involved are French Beans, Bananas, Potatoes and Onions. Some of this produce ends up in the immediate local (within 10km) and regional market centres or towns (within 50-200km). It is not unusual for some of the produce to find its way to distances over 500km, and even into neighbouring countries like Uganda, Tanzania and Southern Sudan. Four chains focus on French Beans and the remaining three on Bananas, Potatoes and Onions. In five chains small scale farmers are the key producers and these are compared respectively to a medium sized and a large scale farm, which are all located within the Central Province and Rift Valley as depicted in Figure 1.

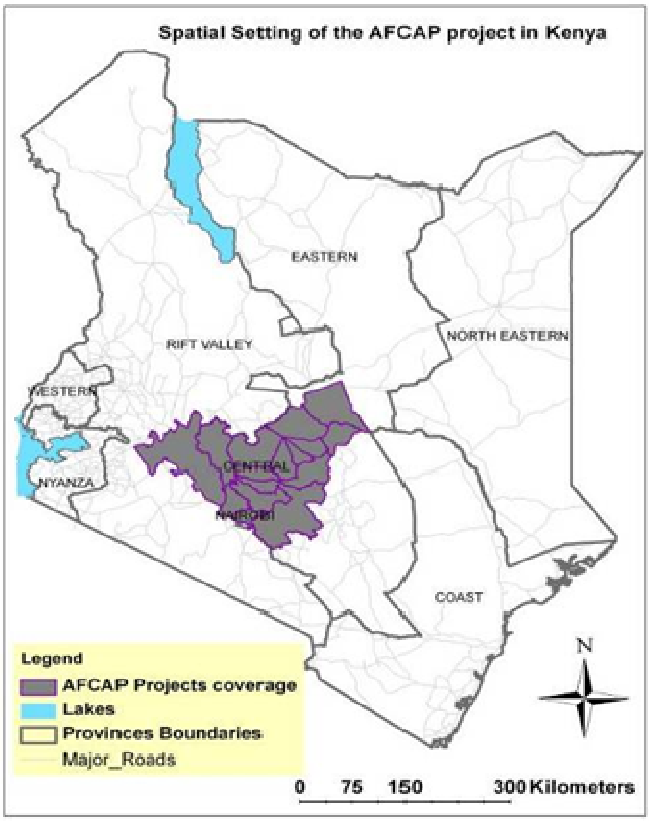


Figure 1: National spatial setting of the AFCAP project

Figure 2 shows the generalised value-chain that traders fall into, each participating in selected selected components of the chain. In terms of logistical and transport set-ups, these choices will determine the volumes of material flows, distances involved, choice of transport mode and capacities and other operational as well as business structures. Figure 2 depicts the reality that significant volumes of produce are lost along the chain, hence the decreasing thickness of the arrows from left to right.

Table 1: Logistic chains studied

	Marketer	Destination	Region	Product	Farm scale
1	Meru Greens Ltd	National Canning Factory for export	Meru	French Beans	Smallscale
2	Kangai Tisa	Export Market	Mwea	French Beans	Smallscale
3	Goshen Farm	Export Market	Mwala	French Beans	Mediumscale
4	SUNRIPE Ltd	Export Market	Naivasha	French Beans	Largescale
5	Mt Kenya Gardens Ltd	National Niche Market (Supermarket)	Meru	Banana	Smallscale
6	Commercial Villages: Farm Concern International	National Market	Nyeri	Onions	Smallscale
7	Uncoordinated brokerage market	Local, Regional and National Market	Kinangop	Potatoes	Smallscale

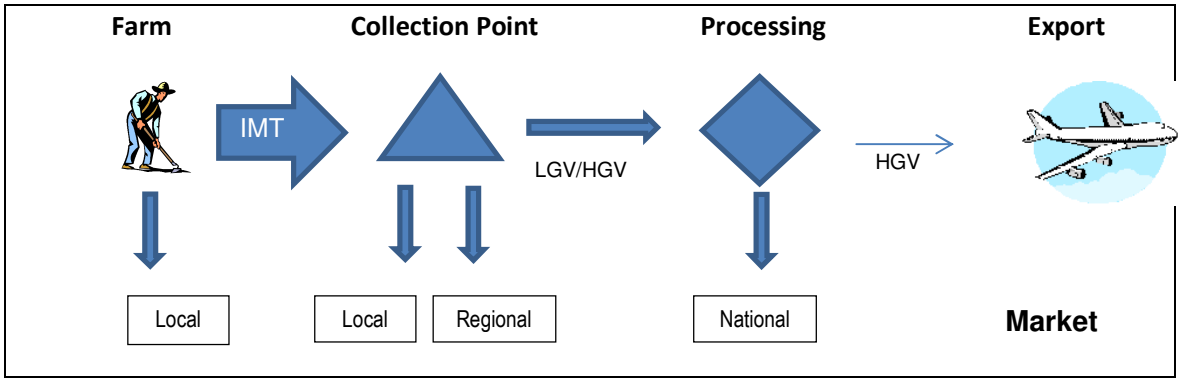


Figure 2: General layout of logistic chains

Six regions were chosen for this study in Kenya. These regions include; Kirinyaga, Meru, Nyeri, Nakuru, Kiambu, Machakos and Nairobi. Most of the regions fall within the high and medium potential agricultural lands, of which Kenya has only 20% of the total national land. Figure 3 below shows the spatial setting of the study areas. Meru and Kirinyaga regions are located on the windward Eastern slopes of Mt Kenya. The region spreads from the humid upper to the lower flatter zone neighbouring semi-arid Isiolo to Tharaka. Rainfall varies from 500mm to 1400 mm a year. Generally, the region has high potential area with tea, coffee and maize systems in the humid upper parts on Southern Slopes of Mt. Kenya (1200m above sea level and higher). Lower

altitude zones (800-1200m above sea level) are irrigated from the reliable but vulnerable rivers flowing from Mt. Kenya.

Nyeri region (covering Mweiga, Kiawara) is a generally humid area (averaging 1200mm rainfall per year) and a high potential area located between Mt. Kenya and the Aberdare's.. Kiawara region is famous for potato and onion farming practiced by small scale farmers. Nakuru region is located in the core of the Rift Valley. Farming activities span the Green House farming zone of Naivasha to the potato zones of both the Eastern (highly productive Kinangop area) and Western Escarpments of the Valley (highly productive Njoro and Molo areas. Average rainfall in the Nakuru region is 1200 - 1400mm annually. The Machakos region is mostly semi-arid. Average rainfall in Machakos is around 700mm spread over relatively short rain seasons. Machakos is hot with vulnerable shallow soils of poor natural fertility, (generally rocky). Machakos can however be very productive under irrigation systems which are grossly absent.

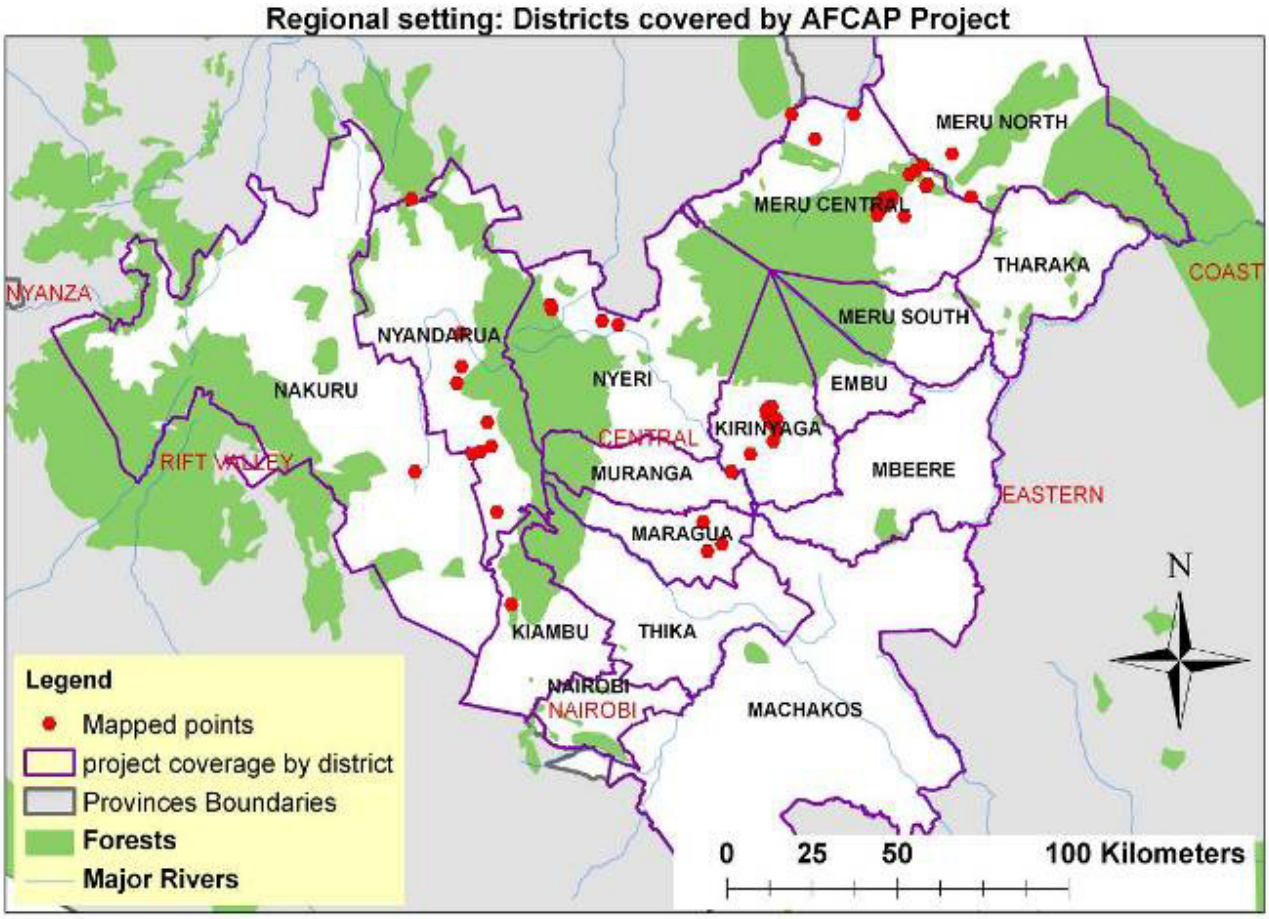


Figure 3: The regional setting of the AFCAP project

3 ANALYSIS OF TRANSPORT CHAINS

3.1 Meru Greens and Mt. Kenya Gardens system

Meru Greens and Mt. Kenya Gardens are two sister companies trading in separate product lines. Meru Greens specialises in French Beans, while Mt Kenya Gardens specialises in fruits, mainly bananas and and pawpaws.

Meru Greens has contracted about 1,500 small scale French bean farmers scattered in about 50 Km radius from its operational base.

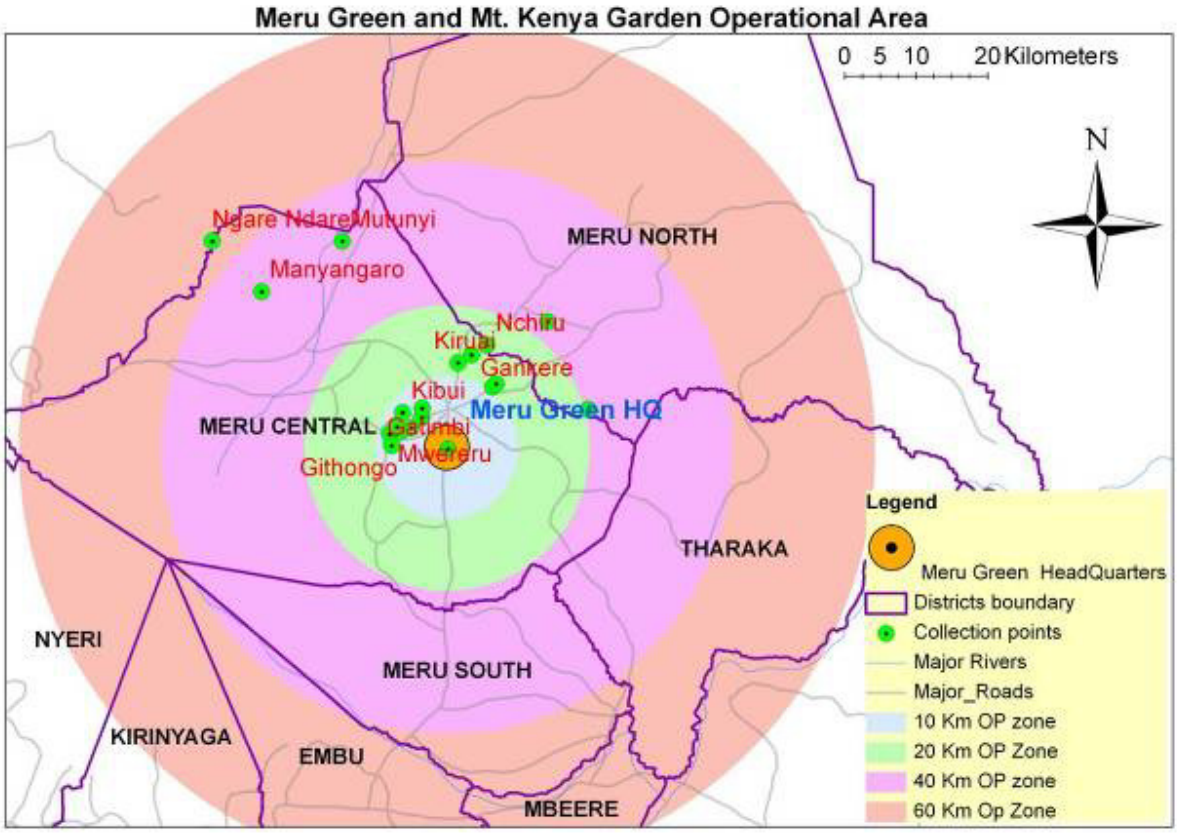
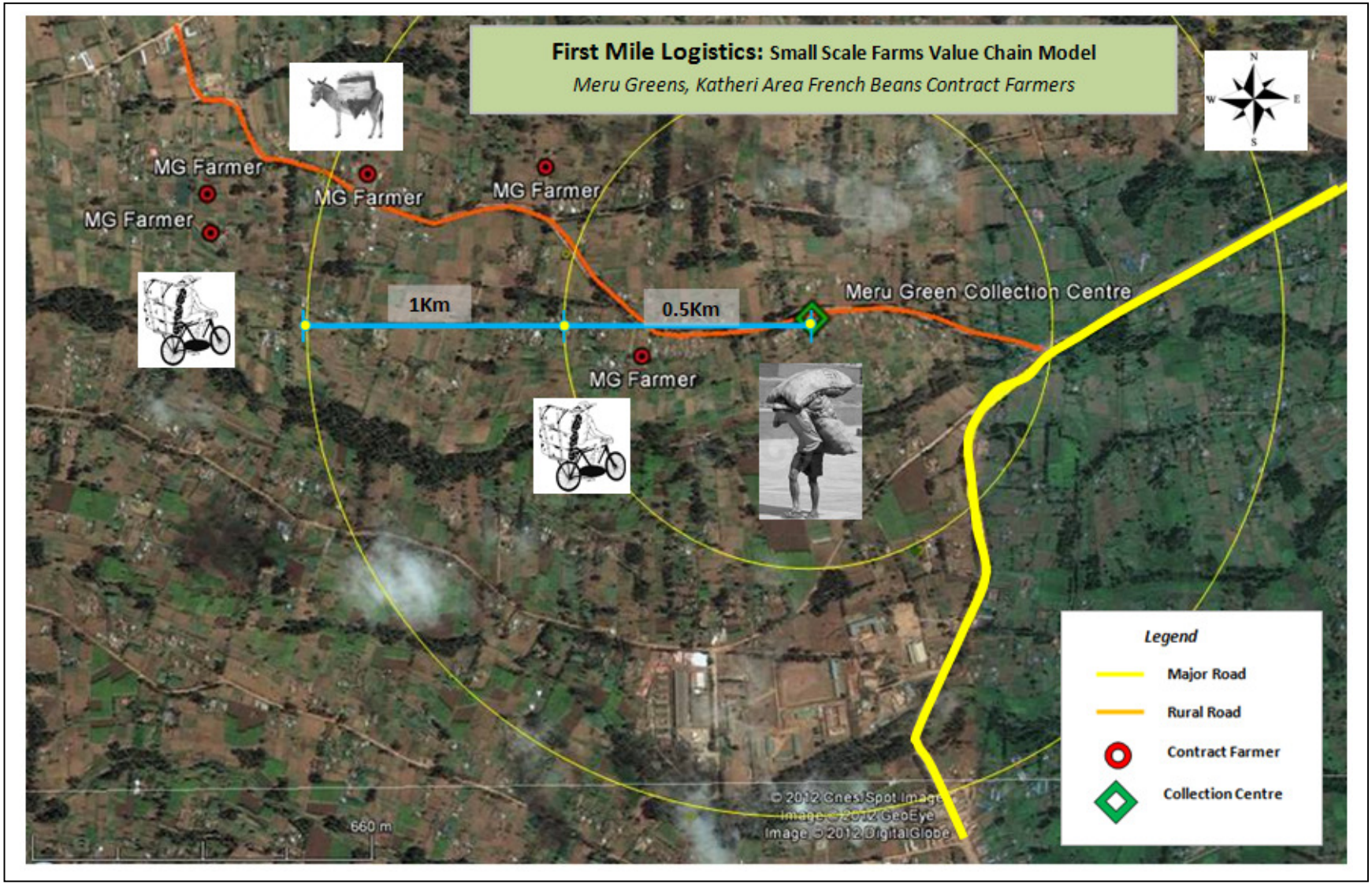


Figure 4: Operational zone coverage of Meru Greens and Mt. Kenya Gardens

The company organises farmers into production zones that enables joint access of inputs, and consolidation of produce in order to improve on economies of scale. Through the groups, seeds, agrochemicals, and fertilizers are distributed to the farmers. Each group owns a collection and sorting shed. Here farmers bring their produce to sort, grade, weigh and consolidate before delivery to the buyer's premises. These groups also act as focal points for agricultural knowledge dissemination.

From Farm to Market women have a primary role to play in horticultural value chains. This study showed clearly that women definitely have a dominion. Men appear to come in only when IMTs (wheelbarrows, bicycles, motorbikes, hand and donkey carts,); light and heavy goods vehicles, equipment operation (like animal drawn ploughs, sprayers and water application equipment) need an operator. While men were observed to be more prominent in the handling of heavy and bulky bagged produce like potatoes and onions, women featured upto 95% in the case of French Beans and Bananas. Men simply do not have the strength, the patience the delicacy to, bend all day, sort delicate produce, wait long for the next customer while chatting with a business competitor etc. etc. To the surprise of the study team, urban markets for horticultural produce had some deeply engraved women traders attached to them. Indeed even where fruit and vegetable businesses were run by married couples, men often were good mostly for their networking for business growth if not for their management of muscles and logistics. One bean picker had the serious accusation about men, saying, “These days it is we women who sleep on the side nearer the door. Yes, these days we are the last ones into the bed and the first ones out (in the morning). Often you just leave him snoring because you cannot afford to miss the early morning wholesale market of the day.”


First Mile Logistics: Small Scale Farms Value Chain Model
Meru Greens, Katheri Area French Beans Contract Farmers
MG Farmer
MG Farmer
MG Farmer
MG Farmer
MG Farmer
1Km
0.5Km
Meru Green Collection Centre
N
W
E
S
Legend
Major Road
Rural Road
Contract Farmer
Collection Centre
660 m
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First Mile Logistics: Small Scale Farms Value Chain Model

Meru Greens, Katheri Area French Beans Contract Farmers

Farmers located within a radius of 0.5km from the collection and processing centres used human labour and or farm hands to deliver their produce. In this case farmers were able to save on transport and production costs. Other modes used by farmers within the 0.5km radius include wheelbarrows, bicycles and motor cycles.

For distances more than 0.5km farmers used donkeys and motorcycles to transport produce to the collection and processing shed. The availability / reliability of motorcycles depended on season and road condition.

Other socio-economic dimensions: **Gender dimensions**: Women pick and transport produce to the processing centre. Men operated / owned the motorcycles within the area.

ICTs: Farmers located more than 0.5km from the collection centre used mobile phones to contact motorcycle operators. Transport charges by motorcycle depend on distance and load

Value Chain	Production and Marketing	Transport Cost Assessment	Socio-Economic Dimensions	Challenges
Value Chain 1: ***The Case of Meru Greens Ltd*** who are coordinating farmers as individuals and groups to grow **French Beans** for a Nairobi-based canning factory under a coordinated smallholder farmer service establishment.	• Farmers access inputs directly from local agro-shops but there are special inputs like soil-drenchers, organic manures and foliar feed fertilizers which may only be available from the Meru Greens shop located between zero and 50km from the farmers. • Farmers are producing on average ½ acre plots, receiving 800-1500mm of rain annually, using traditional hoe-based farming methods. Irrigation is by flood or sprinkler methods and farmer obtain average yields of 4 tonnes/acre. • The company employs agronomic officers to scout crops and ensure that any disease or pest infestation is detected early and cured. These officers also help track production volumes. • Farmers tend to produce Julia seed which are of the superfine category and specifically for canning. This may mean farmers can get away with a situation of fewer rejects, unlike the cases for fresh bean shipment. • There is much scope for technology advancement into no-till agriculture and use of drip	• Farmers and Meru Greens enjoy the use of bean collection and sorting sheds conveniently located within 4 km from farmers' farms. This brings order and efficiency of logistic operations. • 1st mile operations to get beans to the sheds is carried out by humans and IMTs, depending on the volumes and distances involved. This is the most expensive section of transport chain in terms of cost per tonne-km. • Some sheds were observed to have charcoal coolers in-built. However these were rarely used as beans tend to be picked by the afternoon of the same day they are picked. • From the shed beans are carried directly to the Nairobi market where they are sold to a canning factory. • Meru Greens like many others visited tend to transport beans long distance to Nairobi in the night when it is cooler. This helps transporters get away with not using refrigerated trucks. The trucks however have special ventilation ducts. • Meru Greens operates a system where they may hire transport to	• **ICTs:** There is visible application of advancing technologies such as organic foliar feeds, mobile phones for marketing and price tracking, charcoal coolers for produce preservation, motorbikes for faster rural transport etc. • There are established business enterprises with local and foreign marketing networks. Farmers are aware they are growing for an international market. They have seen enough audit visitors from the buyers' countries. • **Gender:** At household level, men tend to play a bigger role in preparation of land for planting, using oxen or hoes, up to the stage of planting. Women tend to do the seeding of the farms and weeding, men coming in later to lay irrigation lines and to do spraying. Depending on the dynamics of a given family it is not unusual in this region to see a man or 2 assisting the wife with seeding or weeding. • Use of Global GAP traceability regulations help track source of	• Poor road systems which make transport costs high and especially during the rainy season. • Contract system which prevents farmers from selling to other potential buyers sometimes offering better prices. • Use of sorting sheds at farm level reduces the volumes of rejects that farmers may be charged with later. • Farmers with small holdings grow only one crop a year due to lack of land for rotation • French Beans easily grow in areas with good rainfall. However they prefer warm climate with well-mineralized, irrigated soils. Irrigated because excessive rain can dampen the environment and increase the prevalence of fungal diseases and unique pests. • HCDA has standardized penalties for brokers that approach contracted farmers and offer shorter-term high prices. • There are innovations like mobile telephony and GIS mapping which would help

	irrigation kits. This may be a way to go as ongoing negative climate change happenings take the toll on farm agribusiness.	back-up their own. When they hire such they make sure they travel full.	produce by farmer and farm location. This practice has advanced the practice of ethical trade as well as eliminating use of poisonous chemicals.	companies like Meru Greens track where the bean volumes are and how to programme and plan pick-ups, each coming week.

Table 2: Overview Meru Greens Logistic Chain

French Bean sorting shed In Meru and a Potato store in Nyeri

Examples of such farmers' group which Meru Greens Company works with include Kitharene and Mwereru groups in Meru. Kitharene group has about 200 farmers while Mwereru has 250 famers. However, only about 100 famers are active in both groups while others operate seasonally. They deliver their produce 3 times a week in the high season and 2 times weekly on low crop season. These farmers grow French Beans in their individual farms but market collectively.

Operations as a group enable farmers to capitalize on economies of scale in a number of ways:

- they carry out load consolidation in their group shed where the company truck comes to pick their produce thereby minimizing transport costs,
- the famers order their seeds and chemicals as a group,
- famers ensure high quality standard are met so that their produce fetches higher market prices,
- farmers carry out sorting, grading and storage in the sheds owned by the groups.
- Group approach gives farmers an upper hand in bargaining for the costs of chemicals and seeds.

A weakness observed in the groups is the occasional lack of group cohesiveness. The famers expressed the need for the company to build group harmony through training. These groups play a pivotal role in rural farming development and act as focal points for agribusiness growth.

1.1.1 Meru Greens' Logistic Chain for French Beans

Meru Greens Company offers a good example of a "Three stage logistics chain", depicted in Figure 7. The company organizes growth of produce among smallholder farmers and markets for local processing and canning for export.

Some preliminary value addition like sorting, grading, washing and weighing is carried at the farm level before the produce is transported to the processing centre. To improve assurance of product's quality throughout the entire value chain, farmers are mandated and trained on how to carry out preliminary grading and sorting at the farms. At the collection points sorting is further carried out to eliminate defects and remove those spoiled during transport within the first mile.

For the "first mile" a variety of IMT modes - typically humans, wheelbarrows, bicycles, donkey and ox carts and motorbikes- are used to transport the produce from the farm to the collection sheds.. Some of the sheds have charcoal coolers, and in case of unforeseen or projected delays in the arrival of transport vehicles, beans may be stored in the coolers after grading. The cooler takes away most of the farm heat, awaiting arrival of transport. Depending on the total amount collected in the sheds in one area, the company uses either pickups for loads smaller than two tons or 5-7 ton LG Vehicles for larger loads.

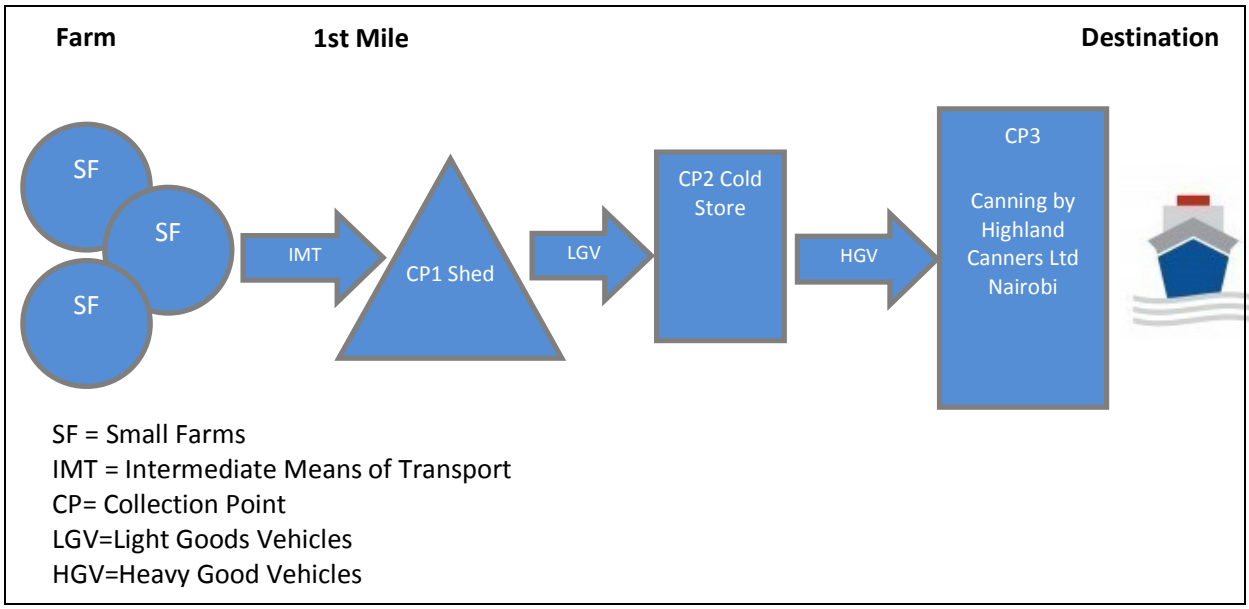


Figure 5: Four-stage transport chain for French Beans with Meru Greens

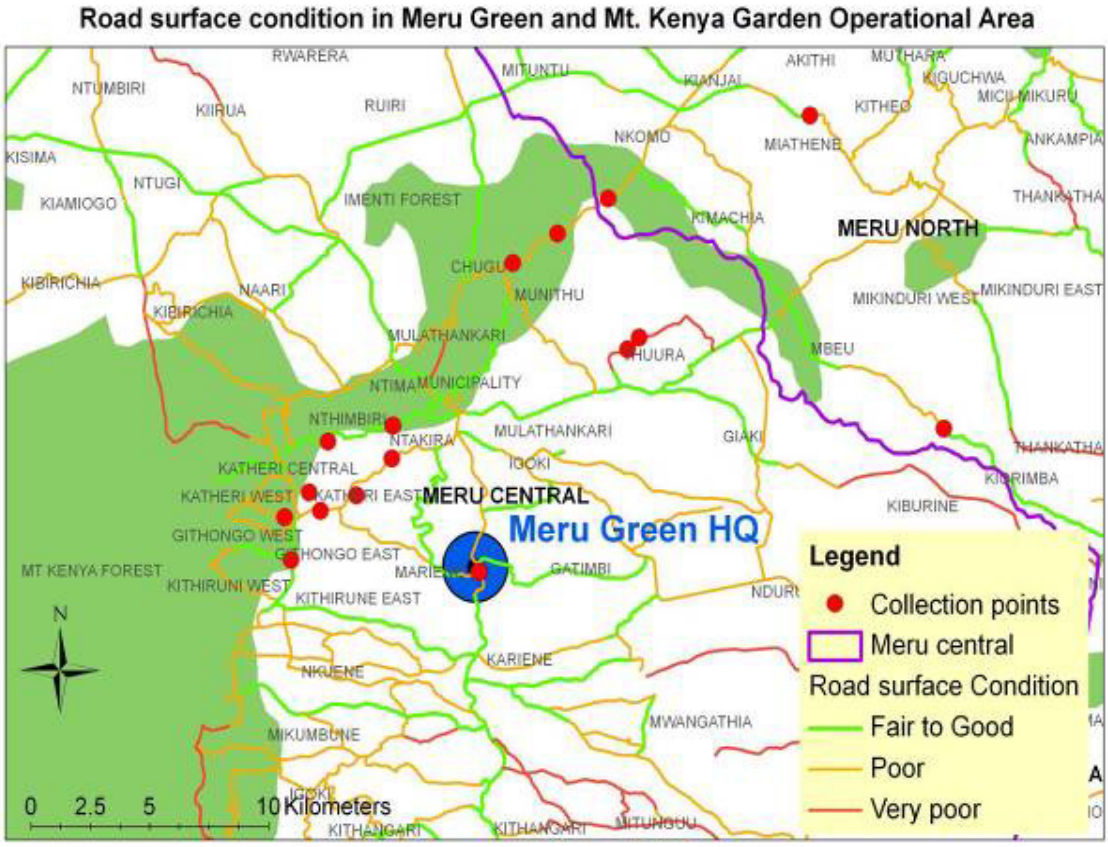


Figure 6: Collection Points for French Beans (Meru Greens) and road surface conditions

3.2 Kangai Tisa's Logistic Chain for French Beans

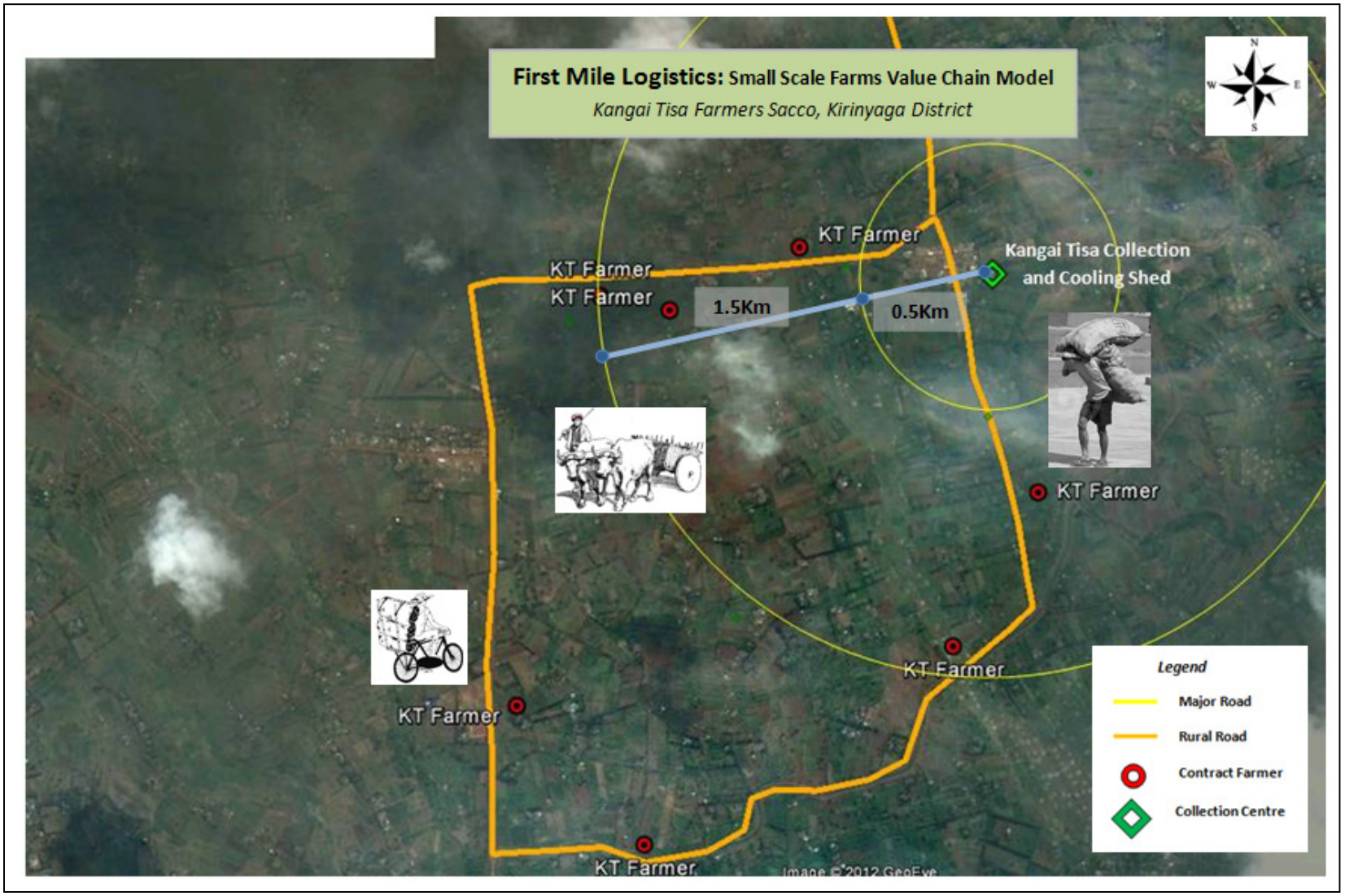
Kangai Tisa, , is an umbrella organization composed of the officials or representatives of thirteen groups (previously nine) of French Bean growing farmers in Mwea area. The individual groups have memberships of 30 to 45 members each with an assembly and sorting shed located within a distance of an average 2.5 kilometres from the farms. The farms are irrigated under the Mwea irrigation settlement water-supply scheme.

All the farmers sell their French Beans to Kenya Horticultural Exporters (KHE), a company for which they have grown beans for about 5 years. KHE supplies the farmers with seed and agronomic support, including training and crop scouting. Any seed costs incurred are deducted from the sales of French Beans, of which deliveries are paid for, once in a fortnight.

Kangai Tisa farmers manage the sorting sheds from which KHE collects their produce. They manage deliveries records in parallel to the records kept by KHE officers. After farmers coded crates of beans (which are identifiable by farmer and farm number), reach the sorting cold rooms in Nairobi, the quantities of rejects are determined and deducted from the payments made to the farmers.

From bean sales Kangai Tisa farmers have a portion of their income deducted and held by KHE. These deductions generate a bonus payment that farmers receive at the end of the calendar year to go towards Christmas festivities and school fees. A different portion saves up a fund that goes towards community development projects. Kangai Tisa officials are ever proud to show off their Maternity Hospital which was built with their donations topped up by the Directors of KHE and opened ceremoniously by the KHE UK Bean buyer. This spirit of Corporate Social Responsibility is one to be emulated by other companies in similar value-chains. They definitely leave a mark in the advancement of community livelihoods that remain needy in various ways.

The *Kangai Tisa* logistic structure is the same as for the French Beans chain described in the First Mile of the Meru Greens Chain, above (Figure 5). The farmers deliver their beans to sheds which are managed by the various member groups. The exporter, KHE, collects the produce from Kangai Tisa's sheds which have charcoal coolers for occasions when there are hiccups in the transport system. The coolers can only hold the produce fresh for a maximum of 24 hour periods. Produce is transported using 5 to 7 tons HGV, directly to Nairobi. In Nairobi the beans are packed for export by plane. KHE has a processing unit in the industrial area near the airport.


First Mile Logistics: Small Scale Farms Value Chain Model
Kangai Tisa Farmers Sacco, Kirinyaga District
KT Farmer
KT Farmer
KT Farmer
1.5Km
0.5Km
Kangai Tisa Collection and Cooling Shed
KT Farmer
KT Farmer
KT Farmer
KT Farmer
Legend
Major Road
Rural Road
Contract Farmer
Collection Centre
Image © 2012 GeoEye

First Mile Logistics: Small Scale Farms Value Chain Model

Kangai Tisa Farmers Sacco, Kirinyaga District

The use of farm hands or human labour to transport produce is common where farmers are located within short distances (approximately 0.5km) of the collection centre. Kangai Tisa farmers located more than 1km from the collection / cooling shed used ox driven carts. This mode enabled farmers to transport loads in excess of 200kg which translated to cheaper production and operational costs.

Other socio-economic dimensions: **Gender dimensions**: Women pick and transport produce to the processing centre. Men operated / owned the ox carts within the area.

ICTs: Farmers located more than 0.5km from the collection centre and did not have ox carts used mobile phones to contact transporters. The cost per ton/km using Ox carts is cheaper compared to other modes such as motorcycle and pick-up trucks.

Value Chain	Production and Marketing	Transport Cost Assessment	Socio-Economic Dimensions	Challenges
Value Chain 2: ***The Case of Kangai Tisa Umbrella Farmers Group*** who are farming and overseeing the production of **French Beans**	• On average the farm producing area is about 1 acre • Individual and family managed systems sometimes organized into groupings for collective production, marketing and economies of scale. • Organized groups are able to avoid middlemen and brokers. • Innovative technology adoption such as charcoal coolers for storing produce before collection • **Gender:** Women dominated farming systems. • Farmers are also farming tomatoes, kales, baby-corn, maize, beans, pepper etc.	• Farmers use head-loading by women for transport within 0.5 km and ox carts for longer distances for transportation of produce to the collection sheds. • Transport costs within the first mile are borne by the farmers. • Transport cost for the 2nd mile is borne by the buying company in this case Kenya Horticultural Exporters (KHE) • 1st mile transport cost Kshs 615 per ton/km • Overall transport cost for entire chain is Kshs 55 per ton/km	• Rarely receive extension services from local Government Agricultural office which claim to conduct a Demand-Led extension (service) system • **Gender:** Large percentage of workers are women. Women tend to plant weed and harvest French Beans. Men tend to participate in land preparation, crop-spraying (using knapsack sprayers) and the highly labour-intensive flood irrigation practice. • **ICTs:** Visible application of technology for example; the use of mobile phones by farmers to communicate to buyers and vice versa. • Buyer saves-up a fraction of the produce price for annual bonuses for the farmers as well as for investment into community projects like the Maternity Hospital built by the buyer and the farmers.	• Impassable roads especially during the rains which leads to high transport costs and loss of produce • Contract system which prevents farmers from selling to other potential buyers sometimes offering better prices. • Farmers with small holdings grow only one crop a year due to lack of land for rotation • Fluctuating prices of French Beans at international market. • Low levels of trust of the large buyer-exporter by the farmers who often feel trapped under one powerful enterprise and company. • Farmers can easily focus on high commercial crops which they do not eat. Food security for families can become an issue.

Table 3: Overview Kangai Tisa Logistic Chain

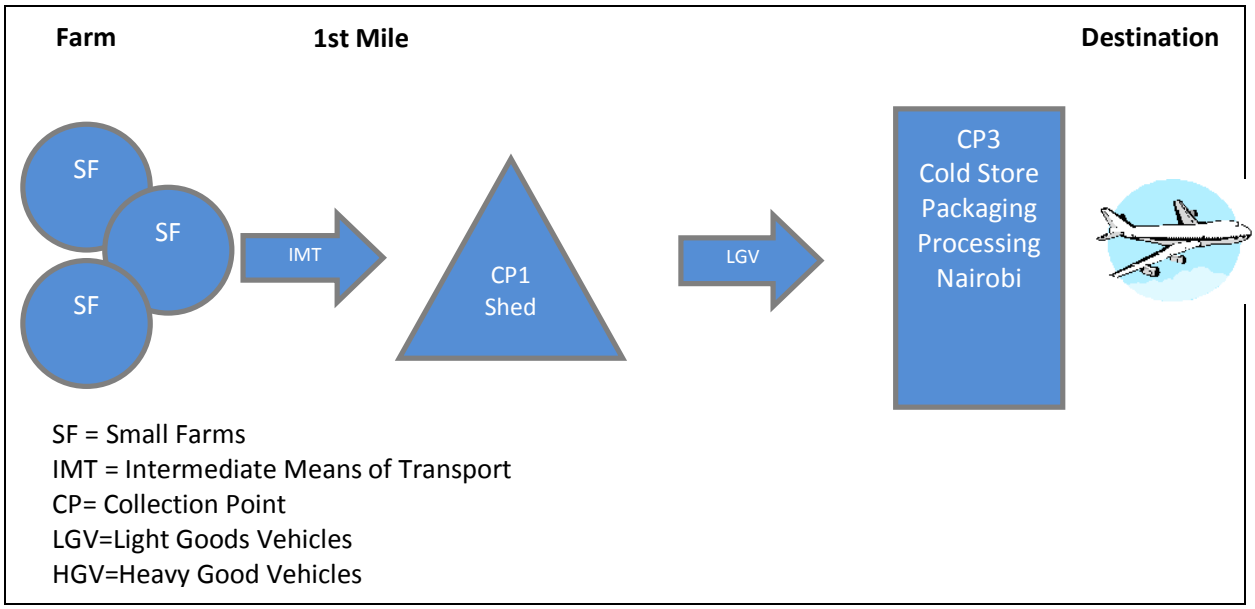


Figure 7: Three-stage transport chain for French Beans with Kangai Tisa

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Figure 8: Grading shed with Kangai Tisa, Mwea and cold store and the Exporters' processing unit in Nairobi

3.3 Goshen Farm – French Beans production on an medium sized farm

The farm is located in Kabaa sub-location within Mbiuni location in the wider Yatta region. It is owned and operated by a young entrepreneur. The farm has been in operation for one year and specializes in the production of very high quality French Beans (super fine and fine brands).

First Mile Logistics: Medium Scale Farms Value Chain Model
Goshen Outgrowers, Machakos District

Within the Goshen famr, French beans and other produce are transported to the collection point by way of human labour. The farm hands under normal circumstances will make several trips across the farm an average distance of 150m per trip. From the collection and processing centre the French beans are transported to Nairobi by light truck which is owned by the enterprise proprietor.

Other socio-economic dimensions: **Gender dimensions**: The picking of French beans within this medium sized farm is carried out by women.

ICTs: The farm owner and managers use mobile phones to coordinate picking, transport and other farm logistics. Additionally, the Goshen farm management will use mobile phones to communicate with out-grower farmers as well as various suppliers of farm inputs.

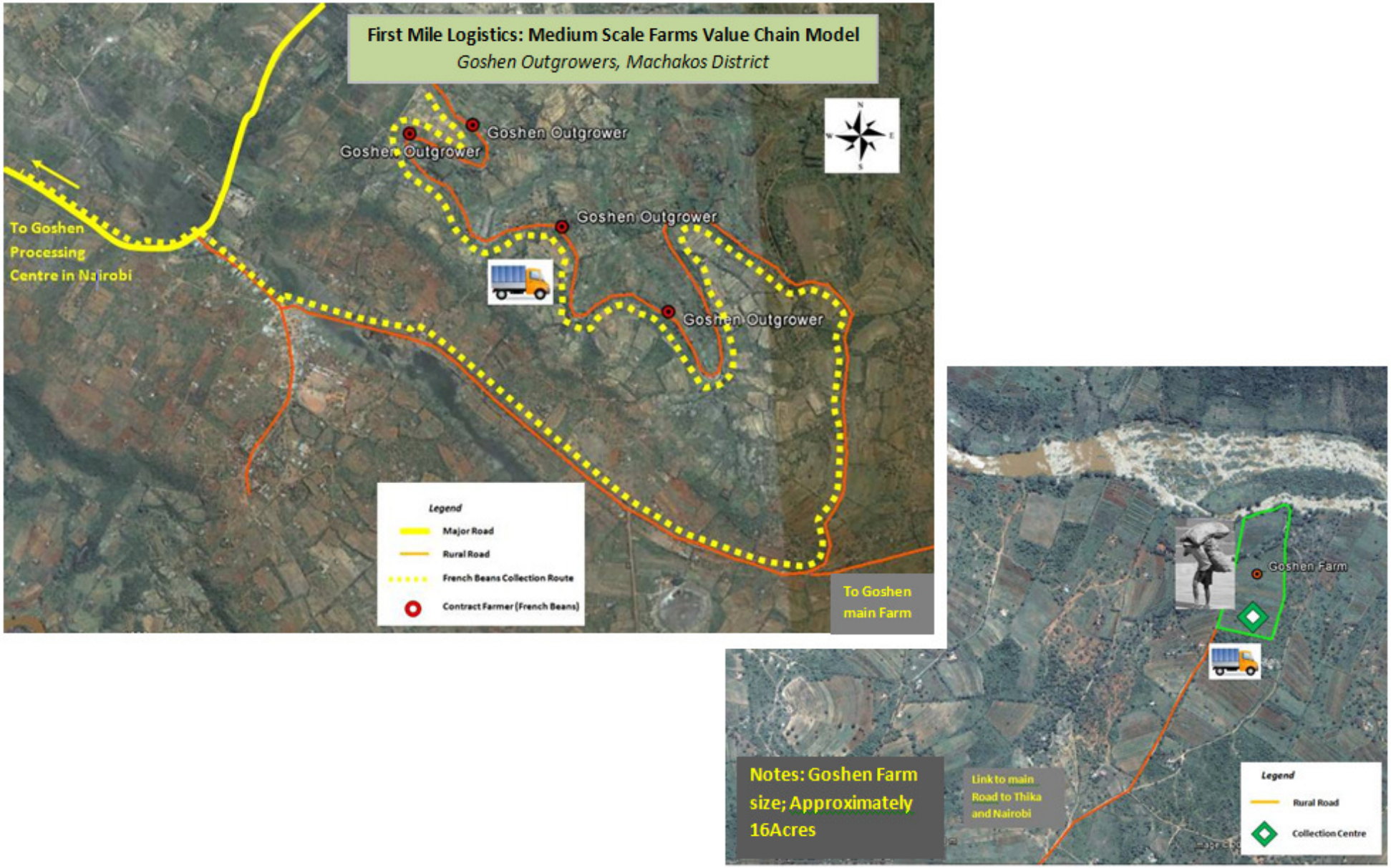

First Mile Logistics: Medium Scale Farms Value Chain Model
Goshen Outgrowers, Machakos District
Goshen Outgrower
Goshen Outgrower
Goshen Outgrower
Goshen Outgrower
To Goshen Processing Centre in Nairobi
Legend
Major Road
Rural Road
French Beans Collection Route
Contract Farmer (French Beans)
To Goshen main Farm
Goshen Farm
Notes: Goshen Farm size; Approximately 16Acres
Link to main Road to Thika and Nairobi
Legend
Rural Road
Collection Centre

Table 4: Overview Goshen Farm Logistic Chain

Value Chain	Production and Marketing	Transport Cost Assessment	Socio-Economic Dimensions	Challenges
Value Chain 3: ***The Case of Goshen Farm*** who own a medium scale (50 acre) farm are upcoming exporters of **French Beans**	• Farm size is more than 30 acres • Operates an out-grower scheme where farmers are contracted to produce crops all year round. • Operates an expensive diesel based water pumping system from Athi River into a flood irrigation system. Could benefit much savings from a tank and drip irrigation system, despite high capital cost. • On-farm sorting and processing shed. • **Gender:** Women dominated production system • Manual operational production system on semi-virgin land with an expensive land-hire price. • Has recently moved to own pack house with office space and other amenities. Previously hired and used HCDA cooler and pack house lacking independence and freedom.	• 3 stage chain 1st mile and 2nd and 3rd stage to the market (national and international) • Transport cost borne by the entrepreneur. • 1st mile consists of farm labour and light pick-up trucks for transportation. • Modern Thika highway and Eastern Bypass, recently opened have reduced transport costs in time saving.	• **Gender:** Large percentage of workers are women • **ICTs:** Use of mobile phones to coordinate picking, transport and other farm logistics. Farm owner / managers use mobile phones to communicate with out-grower farmers. • Goshen Director is computer literate and young, keeping updated on internet and on matters of the produce buyer in France. Has used these channels to learn about and get certified in Global GAP regulations.	• Poorly maintained roads especially within out-grower areas which may cause delays in delivery and transportation of produce to Nairobi • Stiff competition from other potential buyers / exporters offering better prices. • To ensure food security, farmers with small holdings occasionally grow other crops other than French Beans – leading to reduced production • Fluctuating prices of French Beans at international market which discourages contract farmers

Goshen is among Kenya's promising and upcoming exporters yielding from own farms (80-90%) and collecting from smallholder famers (10-20%) and exporting directly to France 10 to 40 tonnes a week. The young entrepreneur has recently received an export license from HCDA[2], the government body that licenses and regulates all horticultural exporters in Kenya. Tomatoes are also planted but this is mostly in the low season and is solely planted for local market consumption.

Goshen Farm has a total acreage of about 50 acres in two pieces of land in close proximity (28 acre and 24 acres farms). The farm usually operates in two seasons, the high season which is between February to April and low season that starts from May to August. The low season matches the period when European buyers are able to grow their own produce, during Spring and Summer months.

The farm employs 20 employees (10 casuals and 10 permanent staff). They are usually involved in planting, weeding, irrigation and harvesting. He buys seed from Kenya Highlands seed Company. 1 acre takes about 20 kg of seeds.

The entrepreneur has contracted about 60 other small scale farmers to grow French Beans but only about 10 are promisingly active. He supplies them with seed, fertilizers and sometimes advances them soft loans which during harvests. Each of these small farmers has a small shed where the entrepreneur comes to pick the beans after harvesting. The famers get the harvesting crates from the Goshen farm. Through mere observation on the crops in the farm, the farmers can be able to estimate the tonnages each farm is able to produce. Farmers then request for crates equivalent to the number that will be needed and these are delivered to farms in the morning of the harvest day. The crates requests determine the size of vehicle that will be hired and sent to their farms to pick the produce.

The logistic chain may be characterised as a "Three Stage Chain" where the products are collected on the farm, graded in an own shed, stored in a cooler (as and if necessary) and transported directly to Nairobi. The farm has a charcoal cooling shed although at the time of the field visit it was non-functional. However, the entrepreneur said that the farm does not truly need a charcoal cooler because the produce is transported immediately after harvest to Nairobi.

Linking the the farm to the tarmac road is approximately 20 km earthen road. The owner hires a 5 ton truck without insulation or refrigeration device which transports the produce to Nairobi. However, the vehicle can only operate a 4 tonnes load due to the steep terrain and bad roads in the area. During the high season harvesting is done three days per week. It is done two days in a day during low season.

[2] Please refer to Deliverable 1

In Nairobi the entrepreneur hires the cold store and packaging facilities of HCDA to grade and pack the beans which are exported to France. The exporter chooses to giveaway any reject and quips:" If I do not give them, where will I take it?"

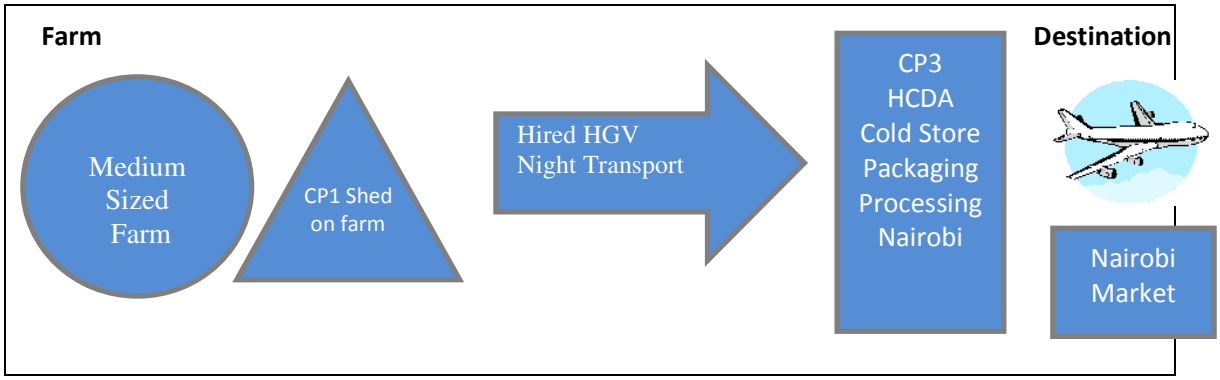


Figure 9: Medium sized Goshen Farm with exports of French Beans

Goshen's Outgrower farmers produce 20% of the French Beans. Two pickup trucks collect the produce from the farms and consolidate the load at the farm collection shed where a 5 ton truck is used to transport them to Nairobi stores for processing and packaging.

3.4 SUNRIPE Ltd- a large farm with production of French Beans

SUNRIPE is a large Kenyan owned enterprise with has four large farms in Naivasha area of the Rift Valley in Kenya. The company rents a 300 ha farmland in Naivasha where a diverse collection of horticultural crops are grown primarily for export market including Snow Peas and Sugar Snaps (20%), French Beans (20%), Runner Beans (15%), Baby Corn (10%), Garden Peas (15%) and Tender-Stem Broccoli (15%). While these products are mainly for export to Europe, Asia,M iddle East and South Africa, the company is also serving local markets with an increasing trend.

Sunripe employs 500 people of which women are 80% and men are 20%. The explanation given for the higher percent of women is because they are more patient and hence handle the delicate produce without damaging it. This reduces rejects to 15% from the farm to the table. Produce harvested is preserved in on-farm cold rooms to remove farm heat, for a few hours before it is collected for the 2 hour journey to Nairobi.

Table 5: Overview Sunripe Logistic Chain

Value Chain	Production and Marketing	Transport Cost Assessment	Socio-Economic Dimensions	Challenges
Value Chain 4: ***The case of Sunripe Ltd*** who are an established large scale **French Bean** growers, processors and Exporters.	• Large scale farm operation (more than 300acres) and growing a variety of crops. • Capital intensive / Highly mechanized system • Sunripe for example operates a 494 acre farm in Naivasha, but also has farms in other parts of Kenya and in other East African countries • Owing to the mechanized systems, they achieve a higher yield of 6.5 tonnes per acre - than the medium and small scale producers. For example, the yield is nearly four times more per acre than the 1.5 tonnes/acre achieved by small scale farmers of Kangai Tisa. • Largescale farming of some 14 crops may compromise quality of French Beans. • Have an organic French Beans section that farms with losses of 50% across the value chain. Inorganic losses amount to 30%.	• 1 stage value chain transporting from own farm to own packhouse. • Production and transport cost borne by the company across the value chain • Production is geared exclusively for the export markets. • Own transport system serving own large farm can grossly improve transport cost efficiency and logistical arrangements all round.	• Contracts several medium scale farmers as outgrowers. • Employs some 200 women daily for packhouse sorting and grading. • Trains a wide cross-section of Kenyans in horticulture and business etiquette. • International exposure has the company serving the emerging middle class and local supermarket chains. Persons sensitive to organic foods and value added (trusted) super-market mixes like Stir Fry have seen the company growing the local market services.	• Heavy mechanization for land preparation, irrigation, transport and own pack houses has high capital investment. • Staff-turnover: Highly trained staff may depart to initiate own business or to help upcoming employers. • Staff may have big institution syndrome like watching the clock by the hour. • Exposed to international trends and happenings like closure of cargo airport due to volcanic activity over Iceland, currency fluctuations etc.

The access to the SUNRIPE farms is generally good because the farms are located close to the all-weather Nairobi-Nakuru highway. The farm compounds comprise grading and packaging facilities on the farm where casual workers harvest various products on the farm, sort them and package them on trucks which offer same day delivery. The company experiences the normal tranport challenges of varying fuel prices, unpredictable traffic jams accessing cooling facilities, and general planning under undependable conditions influenced by annual international market variations.

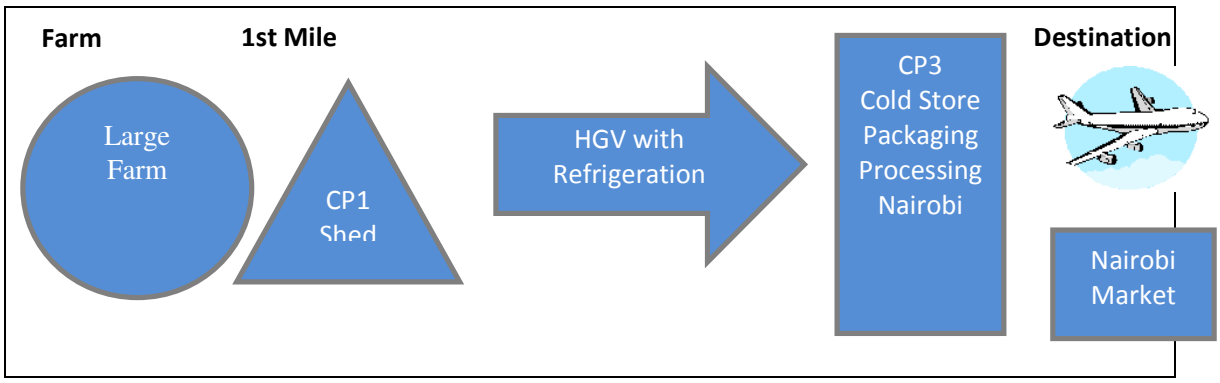


Figure 10: Large farm owned by SUNRIPE, refrigerated logistic chain for French Beans

The farm owns eight refrigerated trucks that transport the produce daily to Nairobi. Transport trucks are organized and managed centrally from Nairobi office. The vehicles are refrigrated with a capacity of 8 tons each. The company uses its own cold storage, packaging and processing facilities in the industrial area near the Nairobi airport.

Figure 11: SUNRIPE's large scale irrigation scheme

3.5 Mt Kenya Gardens' Logistic Chain for Bananas

Mt. Kenya Gardens Ltd. is a sister company of Meru Greens Ltd. The Banana chain is different from the French Beans one in that bananas are collected from homesteads and farms and not from produce assembly sheds. The logistic system is a "Three Stage Transport Chain" where the bananas are collected directly from the farm typically by a 5-ton truck or by pick-up truck where roads are bad or excessively wet.

Table 6: Overview Mt Kenya Garden Logistic Chain

Value Chain	Production and Marketing	Transport Cost Assessment	Socio-Economic Dimensions	Challenges
Value Chain 5 ***The Case of Mt Kenya Gardens Ltd*** who are established **banana** growers and marketers under a coordinated smallholder farmer service establishment.	• Average farm size is 2 acres • Individual and family managed farming system • Marketing Key role played by brokers who dictate pricing in settings where farmers are not organized into groups. • Harvests of bananas are spread over a long period of time. Small farms produce a bunch or two every 2 weeks. Harvests are rarely in bulk. • Uses ethylene ripening unit, beating the competition by being able to supply fruit at appropriate ripening stages.	• 2 stage logistics namely; first mile and 2nd section to the market. • Overall transport per/ton/km lower than French bean chains (second lowest transport compared to other chains).	• Has an elaborate farmer training and business network led by a woman. • Husbands tend to leave banana income (money) for women to enjoy. This is because it trickles in, in small bits. • Employs some 50 persons in from of qualified staff and casuals	• Fruit spoilage in transit if not packed well. • Spread-out harvesting programme requires transport vehicles to traverse long distances collecting on-farm. Collection points are highly dynamic.

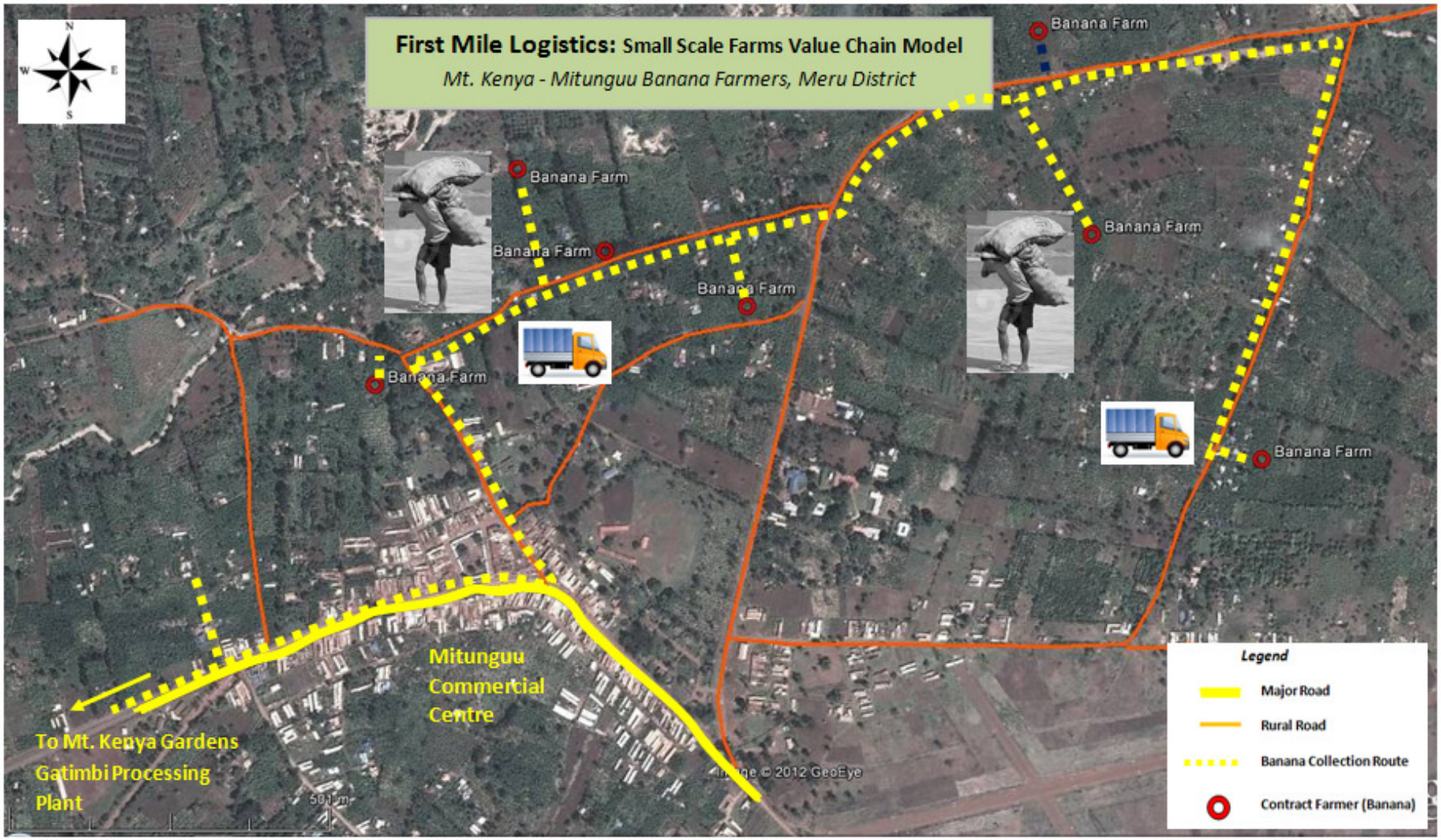
First Mile Logistics: Small Scale Farms Value Chain Model

Mt. Kenya - Mitunguu Banana Farmers, Meru District

The use of farm hands or human labour to transport produce is common where farmers are located within short distances (approximately 0.5km) of the collection centre. Kangai Tisa farmers located more than 1km from the collection / cooling shed used ox driven carts. This mode enabled farmers to transport loads in excess of 200kg which translated to cheaper production and operational costs.

Other socio-economic dimensions: **Gender dimensions**: Women pick and transport produce to the processing centre. Men operated / owned the ox carts within the area.

ICTs: Farmers located more than 0.5km from the collection centre and did not have ox carts used mobile phones to contact transporters. The cost per ton/km using Ox carts is cheaper compared to other modes such as motorcycle and pick-up trucks.


First Mile Logistics: Small Scale Farms Value Chain Model
Mt. Kenya - Mitunguu Banana Farmers, Meru District
Banana Farm
Banana Farm
Banana Farm
Banana Farm
Banana Farm
Banana Farm
Banana Farm
Mitunguu Commercial Centre
To Mt. Kenya Gardens Gatimbi Processing Plant
Legend
Major Road
Rural Road
Banana Collection Route
Contract Farmer (Banana)

Upon arrival at the company's headquarters in the outskirts of Meru,bananas are prepared for ripening/de-greening in a special unit. Some may be carried to Nairobi where a larger ripening unit is located, at this 2nd stage. Both Meru Greens and Mt. Kenya Gardens own and use appropriate technology consisting of improvised charcoal coolers that use cold charcoal pallets. The charcoal coolers have a storage capacity of around one ton of products. By using alternative energy instead of expensive power sources, the charcoal coolers help the company to save considerable refrigeration costs. Another innovative practice observed is the transport of produce to the city during the night and early- mornings when the temperatures are lower hence reducing the cost of using refrigerated vehicles.

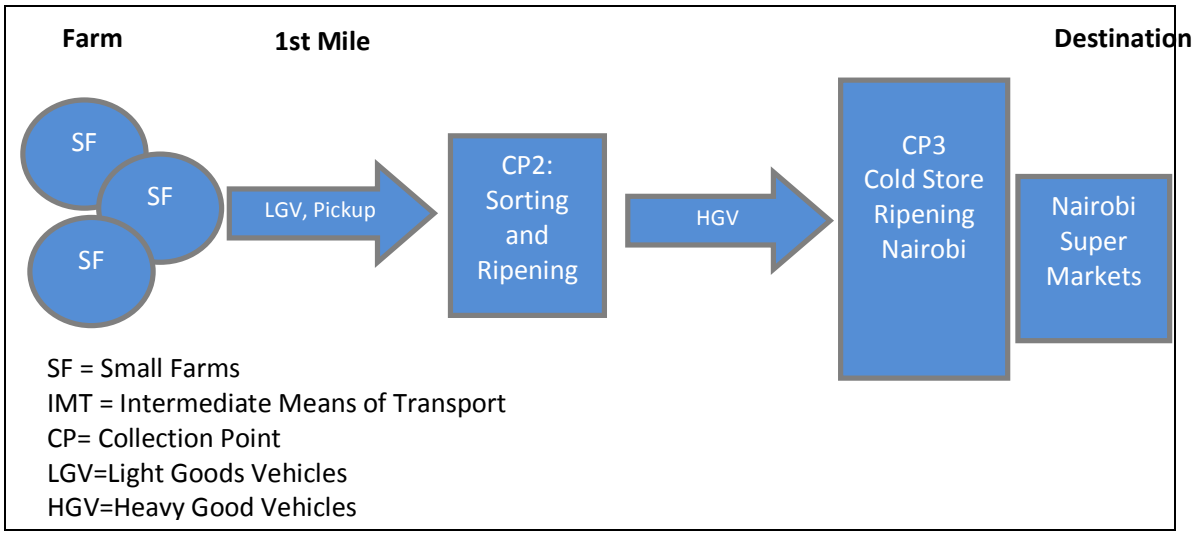


Figure 12: Three-stage transport chain

From the company's headquarters, the bananas are transported in HGVs to Nairobi. From the cold store and ripening device located in Nairobi the produce is sold in crates directly to Nairobi's Supermarkets through a contracted super-market chain distributor.

Figure 13: Grading, weighing and packing of sweet bananas in Meru Greens central collection point

3.6 Nyeri Onion Production

3.6.1 The Commercial Villages Model of Farm Concern International

The Farm Concern International (FCI) is an agricultural marketing organization that endeavours to empower vulnerable smallholder farmers across the value chain, from production to marketing. The commercialization NGO plays a facilitative role. It connects famers with different players within the agricultural market that train the famers in various production aspects. They enable famers to tour different localities and receive training including input use and the process of commercialization. Simplified and action-oriented training modules that address the commercialization, livelihood options, pre- and post-harvest management techniques and market access have been developed by FCI for various commodity chains. Market players are equipped on pro-poor supply chain management innovations and offered a platform for direct partnership with smallholders.

Commercial Village Models (CVM) are interventions designed by FCI to address various malignant farming challenges faced by small-scale farmers in Kenya. For a long time, FCI has observed that most small scale farmers lack capacity, rely on rudimentary farming methods and lack access to improved markets. This situation leads farmers to produce in small, inconsistent, quantities of poor quality, which can only fetch marginal and unsustainable returns. Brokers would normally be the main marketers, farmers unable to bargain due to small harvests. Mostly, small scale farmers

depend on rain-fed agriculture. They do not adhere to seasons making it difficult to plan for production and marketing of agricultural produce.

To address these drawbacks, FCI designed the Commercial Village Model in 2005. The model evolves typical African villages into trading blocs, branded commercial villages (CVs). The CVs are made up of a hybrid of farmer groups, farmer associations, co-operatives and agro-enterprises, who work together as trading partners. The production and marketing capacities of these blocs are systematically developed and strategic partnerships formed with buyers, input suppliers, extension service providers and other stakeholders. Under the CV model, different business units engage in market-led production and marketing of agricultural and non-agricultural commodities. This enhances collective bargaining, economies of scale and a competitive advantage over large scale producers. The model has been tested and proven across different communities, countries and commodity chains such as groundnuts, assorted vegetables, onions, Irish potatoes, cassava, sweet potatoes, nuts, pulses etc.

In Nyeri region, FCI established a pilot project in 2005 called *Farmers Welfare Groups* (FWG). When the pilot programme ended in the year 2007-2008, it changed its concept from farmer's welfare to Commercial Village Model (CVM). Initially, 5 commercial villages were established across Kieni East and Kieni West divisions in Nyeri district. More than 2000 small scale farmers were targeted and mobilized into groups which were then clustered into CVs.

Within each CVM, the famers are facilitated to form different sub committees which are tasked with various roles. There are five such sub committees dealing with Production, marketing, welfare, finance and youth affairs as illustrated in the figure below.

According to Watoro, the FCI Nyeri Coordinator, the market development strategy directly links farmers to traders and thus eliminates the influence of middlemen in the value chain. Farmers now have a growing database of onion traders in Nairobi, Mombasa, Karatina and Kisumu, accessed easily from cell phones. Onion traders are also trained in cash flow management, business development plans, transportation, customer selection and formation of traders associations. "What we want is sustainability, which is only possible if all the components are working efficiently and making profits," Watoro explained. Kieni has largely been considered developmental backwater. Yet Watoro said banking institutions were moved in and marked an increase in number of those holding accounts.

Table 7: Overview Farm Concern Logistic Chain

Value Chain	Production and Marketing	Transport Cost Assessment	Socio-Economic Dimensions	Challenges
Value Chain 6: ***The case of Farm Concern International Coordinated National Market*** under whose support farmers are growing **onions** under a coordinated marketing system that invites dependable traders to purchase their produce.	• On average the farm producing area is less than 1 acre (Farmers in high potential areas have smaller plots compared to those in low potential areas) • Individual and family managed systems sometimes organized into groupings such as commercial villages for collective production, marketing and economies of scale. • Organized groups are able to avoid middlemen and brokers by operating under Commercial Villages. • Key role played by brokers who dictate pricing in settings where farmers are not organized into groups. • Women dominated farming systems with established collection points.	• 2 stage chain 1st mile collection stage and 2nd stage to regional and national markets • Use of animal and human portage in the first mile • Farmer bears the transport in the 1st mile • Overall transport cost for the entire chain is Kshs.30 per/ton/km • Farmers able to dictate prices unlike before where traders dictated prices to farmers	• Farmer groups organized into committees to cater for marketing, production, social welfare including gender and youth • Voluntary saving and loans systems to provide farmers with access to capital and finance (farmer guaranteed) • **Gender:** Women make over 60% of farmers. Men dominate the transport scene while women tend to stay on-farm uprooting onions, careful not to hurt them. • **ICTs:** Use of mobile phones and mass media to access market prices and agricultural production information. ICT information support by FCI staff and other institutional arrangements. • Long term vision to start a farmer based / managed financial institution	• Lack of information on value addition options available • High casual labour cost who charge per hour. • Integrated cultural settings to manage agricultural activities e.g. commercial village huts where all business transactions and production matters are discussed. These can eventually grow into value-addition depots, building agro-industry

Rather than FCI marketing the farmers produce, it links farmers directly to the markets' traders. Farmers then decide on the pricing of their produce depending on the market prices and knowledge imparted on them. This gives them independence to market their produce and eliminate brokers who would most likely exploit them.

The CVM is in contrast to other market operators like Meru Greens where farmers do not access market directly. They are contracted to produce for the company and it's up to the company to look for the market. This, on the long run might have an effect on farming sustainability, for example if the company winds up or changes focus to other business, the farmers would be left without market.

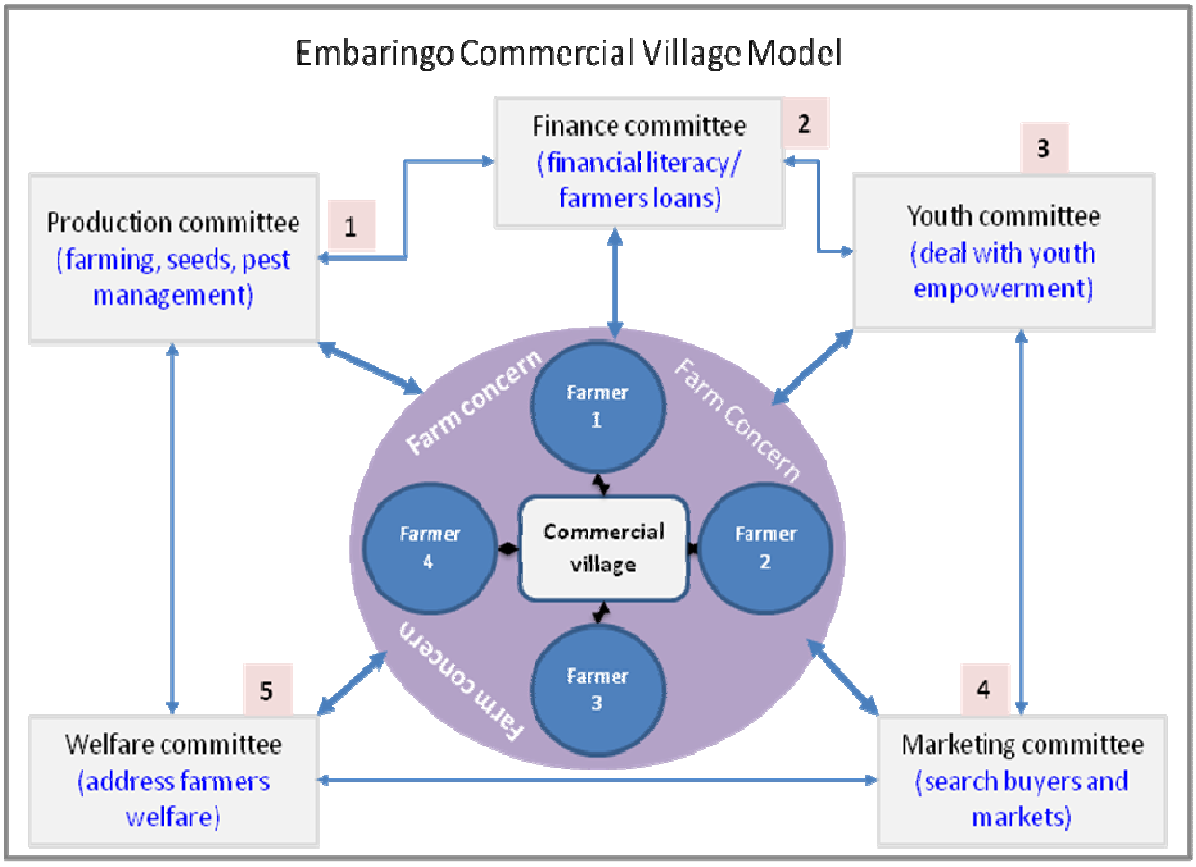


Figure 14: The Commercial village Model concept

Before FCI intervention, all the onion farmers in the Embaringo locality could only manage to produce 3 lorry loads worth of onions per season translating to about Kshs 500,000. They grew poor quality seed and marketed individually and were often exploited by brokers. After only one year of FCI entry, the same farmers produced more than 60 lorry loads of onions by mid-2011 (translating to about Kshs 10 million). In this year (2012), more than 100 Lories has gone to pick the onion in the same locality (This has translated to about Kshs 22 million Ksh)

In the CVM model, farmers produce individually but market collectively to different buyers. Initially the brokers would buy and then sell to the buyers. Nowadays, the brokers have been eliminated and have since gone back to farming as one farmer reported.

Before FCI enlightened us, I never got to know or meet any buyer. I also had no said whatsoever in fixing the price of my onion. The brokers would dictate that since they knew I do not know the prevailing market prices. Even if the market prices were high, we never enjoyed the returns and farming to me was just a loss. Nowadays, even the brokers, many of whom were our neighbours sons, have decided to go back to farming as we call the buyers once we harvest through our mobile phones since we have their contacts (Mr. Njaramba, Embaringo Farmer)

3.6.2 Transport and Market Operations within CVM

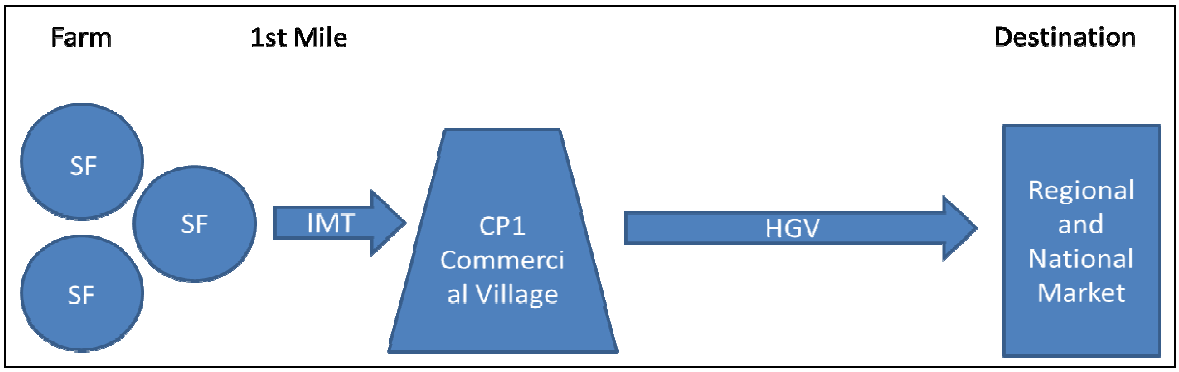


Figure 15: Logistic Chain of a Cooperative (FARMCONCERN)

The farmers harvest, weigh and package the produce into sacks. These sacks are transported to defined pick-up points within the commercial village, such as road side or the homestead of a selected member. For this purpose, various IMTs are used, such as backloading equally shared between men and women, donkeys, bicycles and motorcycles. Carts or trailers are not used in this

hilly area. Mostly, motorbikes are the most preferred means of transport from the farm to the main access roads. “Before motorbikes were introduced, it was very challenging to transport the produce to the main access roads” says a potato farmer. Mostly they would depend on either back load or donkey carts. Back loading would be used on impassable access roads and on steep slopes where all other means can’t access.

The traders simply load the bags on the heavy trucks with a payload of 5- 7 tons. No additional packaging, processing or cooling is conducted before, during or after the collection. Thus the type of logistics chain may be classified as “traditional” with low level of technology involvement and little value added by additional processes.

Figure 16: (Left:) Back loading from farm store to access road (50 – 300m) and (Right:) Motorbike ferrying onion from farm road-side to the main road or market, depending on road condition, the weather and final market destination. Motor-bikes are often used to feed trucks packed on the main road, depending on road and weather conditions.

The main factor influencing the costs are road conditions that are determined by the dominance of earth, gravel and sand roads and the steep terrain. Generally the steep terrain prevents trucks

to fully load their vehicles. Consequently, a fraction of the load may be carried up a difficult hilly road section, be unloaded, and the truck does a second or even third haulage round before filling the truck fully. This increases transport time by roughly 2-3 hours and requires additional labour. This cost difference is not carried by the trader, but charged to the farmers.

> "Many children are now able to go to school, good houses are coming up and the young are turning to farming instead of migrating to urban centres for the ever elusive promise of employment."
>
> Farmer: Embaringo CV

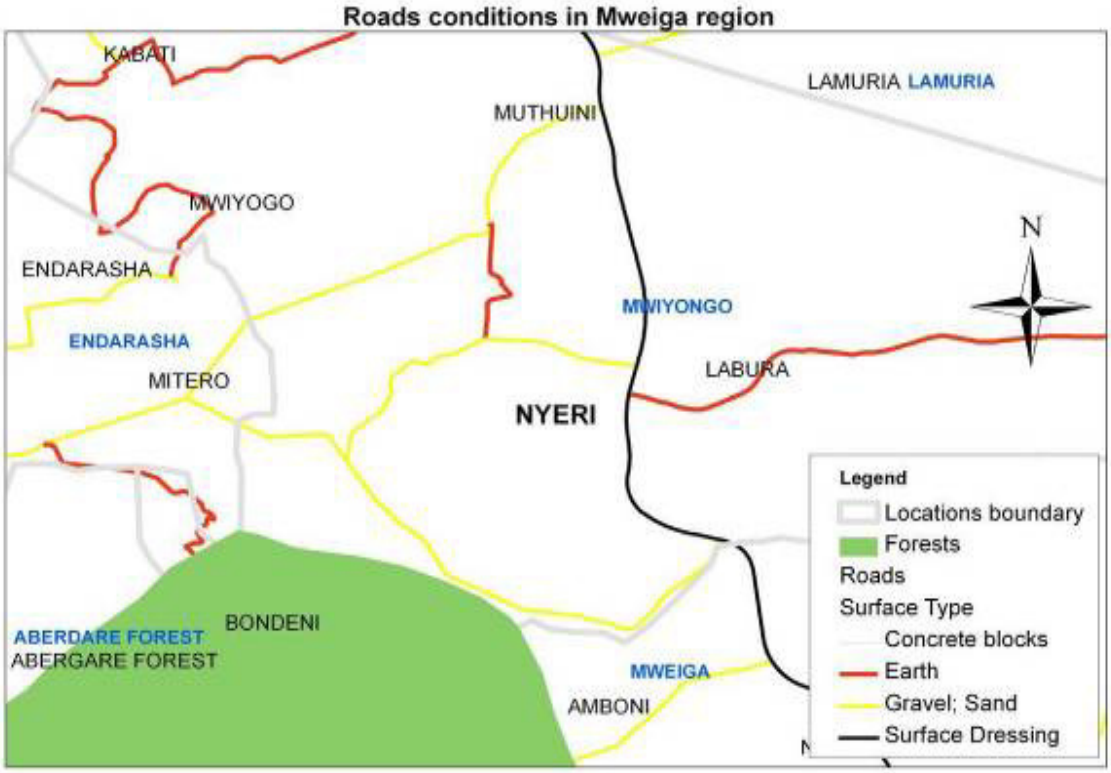


Figure 17: Road Surface types in Mweiga region

3.7 Potato production in Kinangop

Kinangop region is located in the Western slopes of Aberdare ranges in Nyadarua District. The area is at an altitude of 2600m above sea level. Kinangop has unique characteristics for high potential potato and cabbage farming. Farmers also do dairy farming. Landholdings by design are mostly largescale, averaging 80 acres per household. The region receives an average of 1000mm of rainfall in a year. Figure 18 shows the Kinangop area that was studied.

According to farmer David Kung'u, Kinangop is a highly productive area but with land that is grossly under-exploited: "*We have food in plenty but we lack money and crop diversification. Our children look healthy but they eat mostly potatoes and cabbages. With irrigation systems and better marketing structures, and ways of fighting frost and pests, we would be very rich. Famine is unknown to us*"

First Mile Logistics: Uncoordinated Small Scale Farms Value Chain Model
Potato Growers, Kinangop

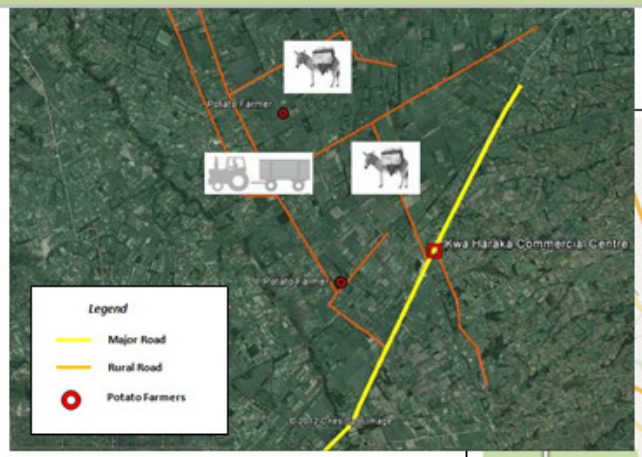
The potato farmers in Kinangop use donkeys and tractors to deliver produce to buying centres or convenient points where middlemen and transporters are located. The poor road conditions especially during the rainy season subject farmers to high transport costs, wastage and inability to get produce to the markets. Middlemen use light trucks to transport produce to regional and national markets such as Thika, Nairobi, Nakuru and Naivasha.

Other socio-economic dimensions: **Gender dimensions**: The harvesting of potatoes is done by men and women while transport logistics are principally managed by men.

ICTs: Farmers rely on mobile phones to coordinate with middlemen who organise transport logistics and purchasing of the produce. Additionally, the middlemen are able to use mobile cash payment methods to pay for produce.

First Mile Logistics: Uncoordinated Small Scale Farms Value Chain Model

Potato Growers, Kinangop



Uncoordinated Small Scale Farms Value Chain Model

National and Regional Markets for Potatoes

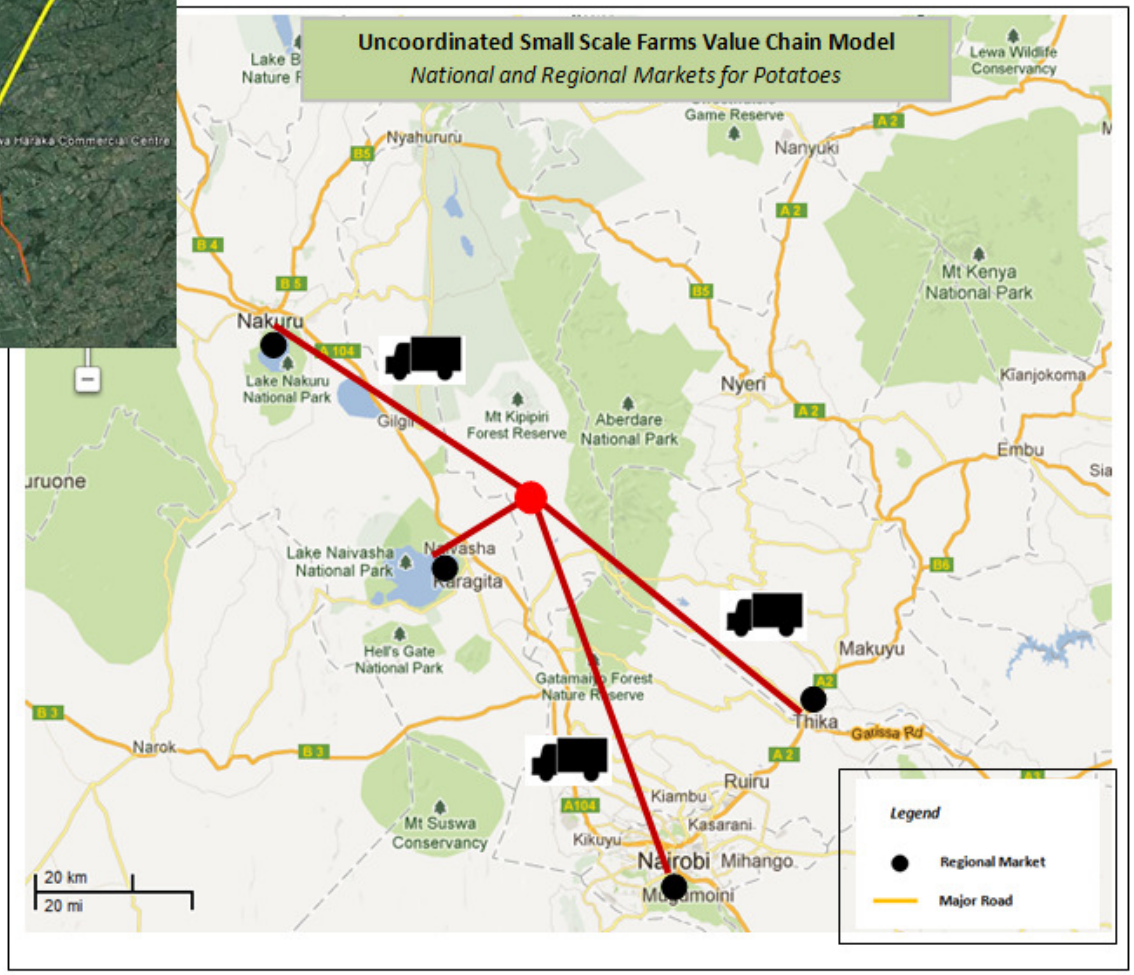


Table 8: Overview Kinangop Logistic Chain

Value Chain	Production and Marketing	Transport Cost Assessment	Socio-Economic Dimensions	Challenges
Value Chain 7: ***The case of Uncoordinated Small Scale Farms of Independent Kinangop Potato farmers*** *who do not belong to any organized farmer groups working with traders and middlemen to organize marketing and transport logistics.*	• Average farm size is 2.5acres in high agricultural potential area. • Individual and family managed farming system where farmers organize for marketing at farm level. • Marketing is organized through middlemen / traders who supply regional and National markets. • Key role played by middlemen / brokers who dictate pricing based on prevailing market conditions. • Mechanization in large farms (+ 2 acres) • Competitive market where a variety of traders buy produce to deliver to different markets • Farmers use special locally (*jua kali*) manufactured hoes with broad fingers and higher soil movement capacity than the standard digging fork.	• Two stage value chain; 1st mile (production) and 2nd to local and national markets • Majority of farmers meet the transportation costs of their produce mainly to the roadside or intermediate points where middlemen / brokers buy / pick. • Farms with access to all weather roads benefit from trader organized transport logistics • Reliance on animal drawn means or tractors depending on distance and road condition (depends on season). • First mile cost relatively low because of low use of human porterage (bulky nature of produce limits use of human porterage)	• **ICTs**: The use of mobile phones to access market information and potential buyers / traders and middlemen. • **Gender:** Women traders dominate the trading systems for potatoes. Women stay on farm (carefully uprooting potatoes without damaging them) and at the market and tend not to participate in transport due to the heavy nature of produce. Men come in with tractors, carts and motorbikes. When situations demand, practical women will break-up the heavy loads to manageable pieces and get it to the collection points. • Farmers wish for the support of Farm concern international whose Commercial Village system they have heard about from a distance.	• Impassable roads especially during the rains which leads to high transport costs and loss of produce • High supply with low or constant demand leading to produce going to waste and very low farm gate prices which discourages farmers from engaging in farming. • Exploitation by middlemen and traders. • Poor seeds leading to low yields. • Lack of access to information on improved agricultural practices and farmer networks. • Lack of value addition facilities.

Potatoes once harvested by women (and a few men!) must be bagged into heavy sucks, often with an additional sewn -on ½ bag, as the market wants it. For this reason women rarely are seen handling potatoes after harvest, only after it reaches the market. The sewn on ½ bag is as per the count goes, determining payments for the one filling the bag, the ones carrying (loading and offloading), the number per truck as well as the cost per bag when entering the town council market. Regulators are out to kill the large unit which is back-breaking and often exploited by brokers as no bag is likely to be the same weight as the other. Potato as much as onion value-chains can greatly be enhanced by capacity to store produce. Off-season, all produce can easily triple and even quadruple in a matter of a couple of months off-peak (season)

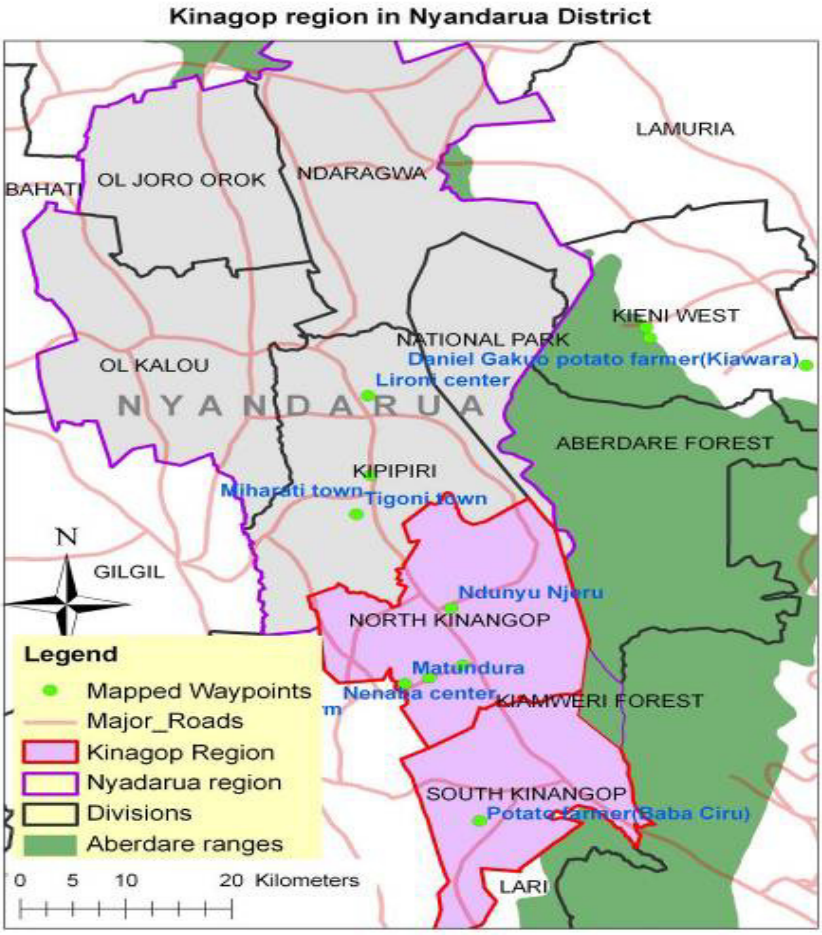


Figure 18: Kinangop study region

Market and Transport logistic for potato farmers in Kinangop

Kinangop is located 70 Km away from the *Marigiti*, one of the largest fresh produce wholesale markets in the city of Nairobi. The structure of the logistic services is comparable to that of the onion transport described above (Figure 15). No additional packaging, processing or cooling is conducted before, during or after the collection. Thus the type of logistics chain may be classified as "traditional" with low level of technology involvement and little value added by additional processes. In the dry season a 5-ton truck picks up the potatoes directly from the farms and transports them to Nairobi or to regional markets. During periods of rain, when roads are not passable human porterage is used to carry the produce to off-farm collection points, from where they are transported to regional or national markets. The truck charges Kshs 27,000 to transport them to Nairobi, but according to farmer David, brokers at the market exploit transporters, who carry home a profit of only Kshs 8000 from a 5 tonne truck load of potatoes.

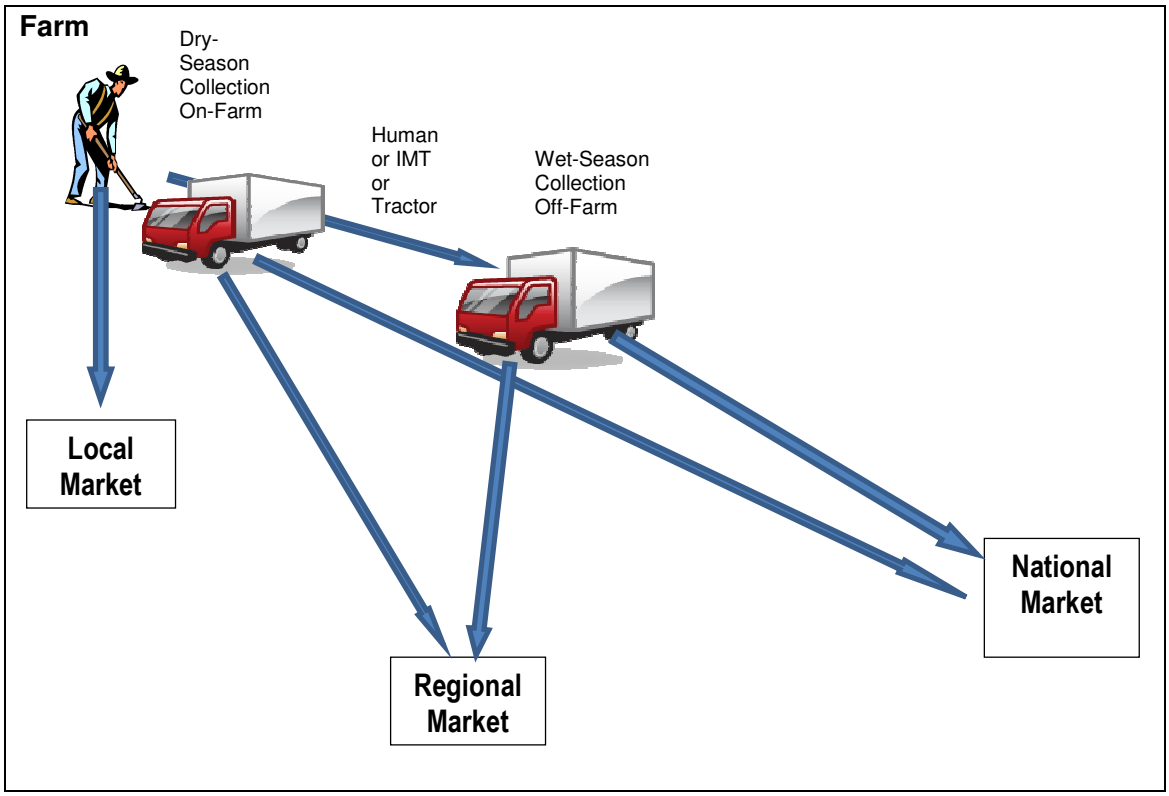


Figure 19: Kinangop Uncoordinated Broker-Dependent Market for Potatoes

David quips: "In Marigiti market, the brokers are in charge and control the market operations. Once our Lorries arrive, they immediately take charge. They pay the city council levies and taxes and sell our potatoes. Most traders arrive in the wee hours of the morning before 3 am as the brokers count the number of trucks that arrive in the market. If there are many trucks in a particular day, they will strategize how to buy the produce slowly in order to create an artificial over-supply. This lowers the market prices. (David Kung'u, Kinangop, Potato Farmer)

Figure 20 below shows the general condition of roads in the Kinagop region. It is clear from the Figure that the fair to good roads are few, making about 30% of the available road surface. This, in an area that has a relatively good distribution of roads, compared to other parts of the country. The situation of improved roads is recent, as the Government's Vision 2030 scheme has seen some primary roads like the Limuru, Ndunyu Njeru, Miharati, Ol'kalau road re-built.Local farmers appreciated that this road had greatly reduced their transport costs, although they could not quantify these.

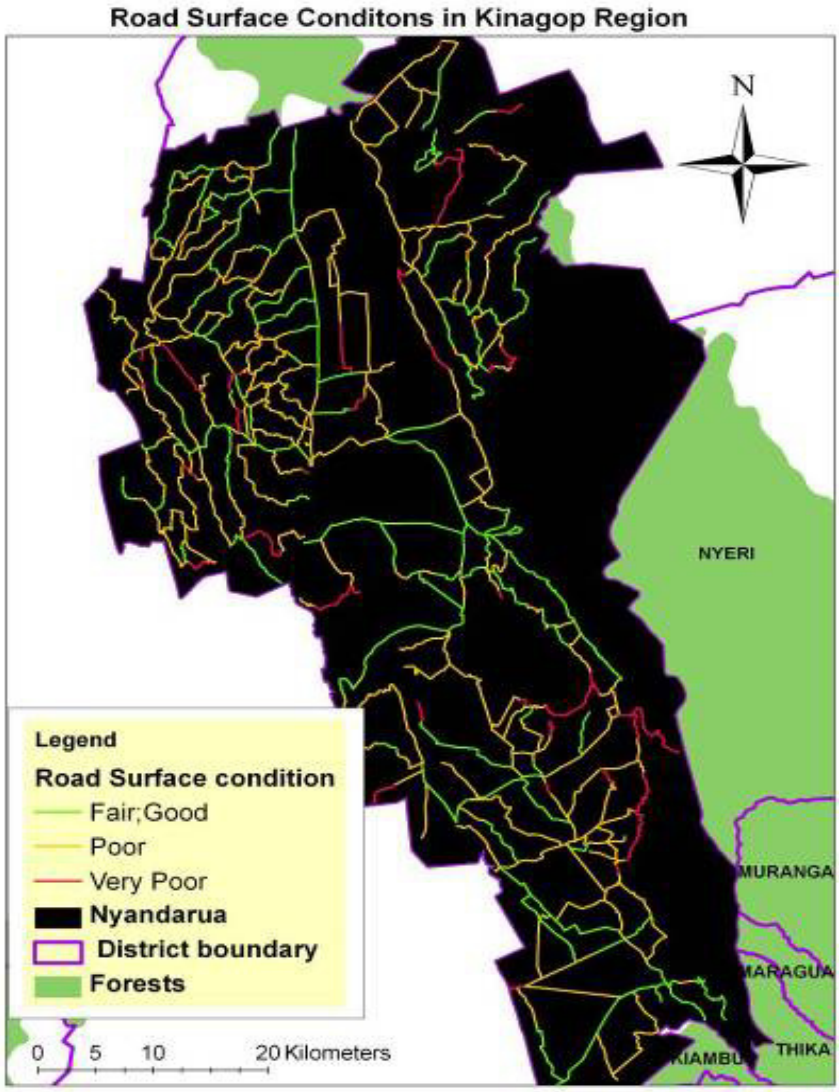


Figure 20: Road Surface condition in Kinangop region

4 PRODUCTION, MARKETING AND PRICES

4.1 Analysis of products marketed

4.1.1 French Beans

Production of French Beans in Kenya can be characterized as follows:

- Dominant large scale, capital intensive farming enterprises such as Sunripe, KHE and others. Production is geared mainly for the export markets. The farms would typically range from 5000 to 1,000 acres. Sunripe for example, operates a 494 acre farm in Naivasha, but also has farms in other parts of Kenya and in other East African countries. Sunripe has complete control over its production system. Partly because of this, and partly because of their mechanized systems, they achieve a higher yield of 6.5 tonnes per acre, way more than the medium and small scale producers. For example, the yield is nearly four times more per acre than the 1.5 tonnes/acre achieved by small scale farmers of Kangai Tisa. Sunripe farms operate as a different cost center from the transport and export enterprise. As such, they are able to fix a farm gate price at which they sell to their export enterprise.

- Medium scale producers: There are a growing number of medium scale entrepreneurs – such as Goshen, Athi Farm and Freshpak- entering the French beans export market. They typically lease medium size farms of 30-50 acres and to supplement production, they may contract a number of small scale farmers around their core farm. Goshen has 10 active small scale contact farmers, who supply 10-20% of the volume for the enterprise. The enterprise achieves a yield of 5 ton/per acre. The relatively good yields result from the much younger soils used in the Yatta Plateau, compared to the highly exploited soils of Kangai Tisa.

- Small scale production: At the other end of the scale are small scale farmers, producing on farms ranging from ½ to 1 acre. Meru Greens and Kangai Tisa farmers are examples of this model. Collectively, the small holders are able to achieve economies of scale in production, purchase of inputs, and coordinated load consolidation in a group shed. Yields for small scale holders range from 1.5 tonnes/acre to 3 tonnes/acre.

- Farm-gate prices vary according to the nature of market farmers are able to reach (See Table 2). Sunripe, with own large far may be able to fix her price throughout the year. Meru Greens, selling to a local canning factory with fixed quota may manage to hold the

price at a fixed rate all year, her buying price (Ksh 30 compared to Ksh 40 -55) being lower than others due to the longer distances involved.

Table 9: Overview of Production for French Beans Value Chain

LARGE SCALE EXPORTER		MEDIUM SCALE EXPORTER	SMALL SCALE FARMS MODEL	
SUNRIPE		GOSHEN	MERU GREENS	KANGAI TISA
Distance of Farm to Nairobi Market (km)	100	120	250	110
Total Farm Size (Acres)	494	32	100[3]	60
Yield/acre (Tonnes/ Acre)	6.5	5	3	1.5
Total Yield/Year (Tonnes)	3,600	5.6	1194	180
Farm Gate Price (Kshs/kg)	50	40	30	35 - 55
National Market Price (kg)	50 – 90			
Airport gate price/tonne (kg)	Ranges between KShs 130-210/kgs			

As Table 9 shows, most of the French Bean production is geared towards export market. In particular, the large scale producer, Sunripe gears their production, exclusively for the international market. Only a very small proportion (2%) of their total production ends up in the Kenyan market. Among the medium scale and small scale producers, a good proportion of the produce that does not meet export market standards is sold in the national market.

[3] 100 small holder farmers with land sizes between ½ - 1 acre

Table 10: Market Share for French Beans

	SUNRIPE	GOSHEN	MERU GREENS	KANGAI TISA
% of total yield for international market[4]	73%	65%	30%	60%
% of total yield for National market	2%	20%	60%	30%
% of produce going to waste	25%?	15%	10%	10%

4.1.2 Bananas

Bananas are currently a much sought after fruit in the Kenya's growing urban markets. Mt Kenya Gardens has over 200 contract farmers with an average land size of 2 acres in the area studied. On average 2 acres produce a yield of 2.5tonnes/month. Every month, the company is therefore able to collect 28 tons from the farmers. The average price for bananas at the farm gate is Kshs 19.00 per kg, while at the national market, the price ranges from Kshs 60-80 per kg.

4.1.3 Onions:

Onions is another crop whose demand continues to grow very rapidly in Kenya. It is also becoming an important source of cash income for small scale farmers as it fetches relatively higher prices than the staples that have been grown under subsistence tradition. In the study area, onions are grown on farms that are on average less than 1 acre in the area studied. The average production is 7 tonnes/per acre, with one yearly production cycle. Farm gate prices for onions average Kshs 30 per kg, while at the national level, the price ranges from Kshs 70-80 per kg

4.1.4 Potatoes:

Potatoes are produced on small holder farms with an average size of 2.5 acres for the area studied. Yields per acre range between 0.8-1.2 tons per acre. Potatoes, like the onion value chain is characterised by many buyers who come to the farm gate and transport to various national markets. Farm gate prices in Kinangop ranged between Kshs 25-30 per kg while national prices varied between Kshs 40-45 per kg.

[4] From international sources, current price for French Beans from Kenya range from US$1.3-2.6

4.2 Value Addition

The common form of value addition across all the value chains consists of: sorting and grading, packaging and transporting. For onions and potatoes, on farm value addition consists of sorting out into varieties types and sizes, bulk-packaging and transfer to on-farm or roadside collection points. Further transportation is undertaken by the traders who deliver in bulk to various national markets where separate distribution chains take over.

Value addition of bananas consists of sorting out according to various varieties and transfer to a particular location on-farm or to the roadside collection point. The bananas are then transported into a collection depot where ripening takes place. Ripening may be natural, which takes time or the process can be influenced by storing in an airtight chamber where they are exposed to ethylene gas. The exposure periods for this process can be for periods ranging from 24 to 48 hours, depending on the ripening stage sought by the range of clients. The bananas are subsequently transported to the national market for distribution to the various clients.

Value addition for French Beans consists of on-farm washing, sorting, weighing and bulk packing, according to client and farm identity, in accordance to traceability requirements of Global GAP regulation. Produce is then transported in refrigerated trucks or in ordinary trucks (but preferably at night when it is cooler) to cold rooms in Nairobi where it is packed for export. Packing at this stage is in accordance with the specifications of the importer. Some of the importers want their beans clipped at both ends, others want them left whole, probably for further processing upon arrival of the produce in the receiving country.

Meru Greens was observed to deliver her French Beans to a canning factory. Sunripe was observed to be orienting part of its production to the growing local market in the form of super-markets who want a fraction of her beans processed singly or in a mix with others (Stir Fry and other versions) for a growing middle class. Due to the stringent export quality control standards, import rejects can reach 60 per cent, much of which finds its way into the local market, some for human consumption and some as animal feed.

Production costs can be expressed through the farmgate price, which farmers receive when selling their products at the farmgate or at the grading shed. For French beans, these prices range between Kshs 30 and 55 per kg as depicted in Figure 21.

Transport cost range between Kshs 3.7 and 5.9 per kg. Thus, transport only makes up a small share of the overall costs. The price for French Beans on the national Kenya market ranges between Kshs 50 and 90 per kg. On the international markets prices of between Kshs 130 and 210 per kg may be achieved. Here an average price of Kshs 170 per kg has been assumed. Both, national and international thresholds are depicted in the graph. Profit margins vary considerably.

With low Kenyan prices some producers are not able to be competitive. Clearly, international markets are extremely profitable but only for those that can access it and manage to stick to the stringent Global GAP regulations. The restriction is mainly in the capacity of growers and marketers to satisfy the needs of consistency and volumes of the high quality produce sought by the importers. Quality is not difficult to achieve among farmers who often grow at most a quarter acre plots under mixed farming smallholder systems.

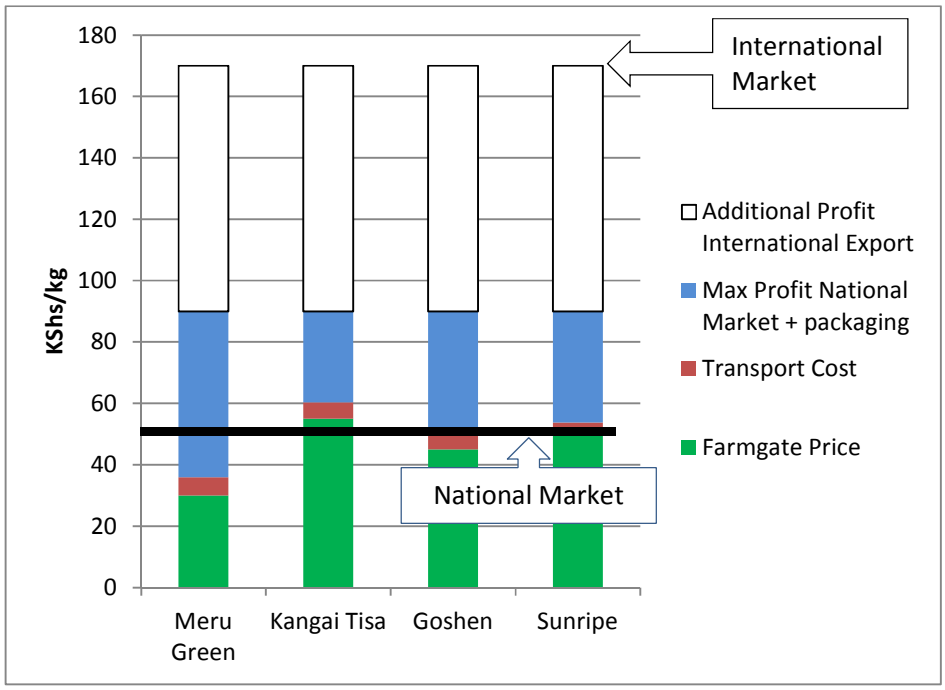


Figure 21: Value added to French Beans from farm to international market.

If export to the national market at maximum prices is assumed, the revenues for the farmers amount to between 33% and 61%. Transport cost only varies between 4 and 7%. The remaining items contain the profit margin and the costs of the processing, packaging and grading. These vary between 33% and 60%. The latter rises considerably, if international markets are targeted. Exporters reported that the international market is far from exhaustion. Thus, business growth for the French Bean commodity is only a matter of producing more high quality produce and transporting them to the export hubs.

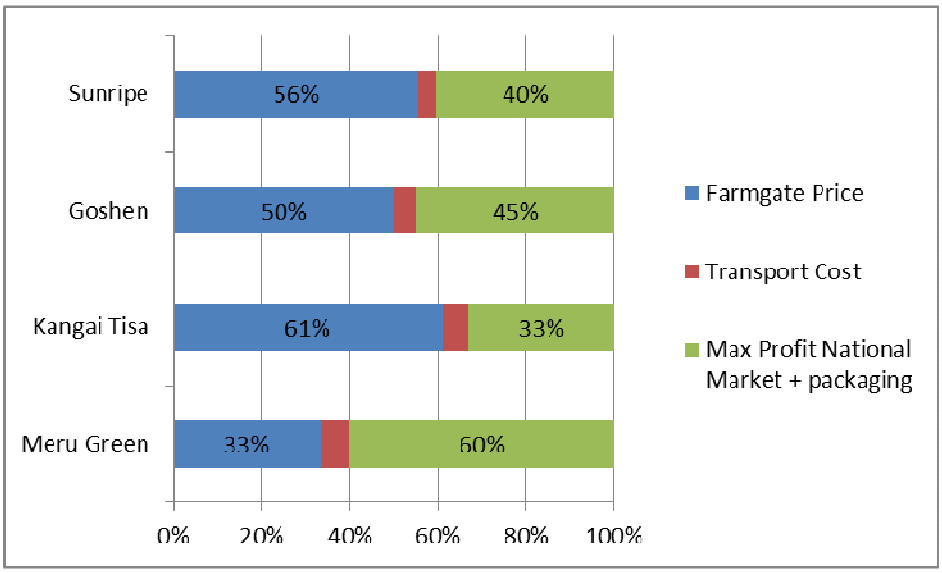


Figure 22: Share of value added for marketing of French Beans on the national market

4.3 Loss of produce

Very little loss is observed in regard to onions, banana and potato value chains as the harvests are not prone to drastic perishability. This is unlike French Beans which must be processed or eaten within weeks. Onions if appropriately dried while still on farm and into storage can last upto 6 months if kept away from contact with moisture. Potatoes can be stored up to 8 months if kept under the correct temperature and relative humidity. This is not normally possible for potato farmers in Kenya. After at most 2 months where natural night cold can be used to keep potatoes cool, potatoes in storage begin to shoot and lose moisture, becoming spongy in texture.

On losses companies interviewed reported as follows:

- **Goshen Farm**: On the core farm about 25 % of the produce does not meet the export standard criteria. Out of the 25% that is not exportable, 15% goes to the national market and 10% is "waste", given for free to animal owners who frequent the pack house. Among the small scale farmers contracted by Goshen, between 40- 50% of the produce is lost due to poor handling the by harvesters. Harvesters are paid by the kilo, against a weight received before sorting. A wasteful harvester can harvest the pods which are not ready or those that are over-mature, in the interest of raising more kilos. The harvesting process can also drop many of the flowers, sacrificing the formation of pods in future. This situation was reported by Kangai Tisa small scale farmers, as well.

- **Sunripe**: The company loses 25% of its produce as they have set themselves high standards. They only sell a very small proportion of the non-exportable quality to the local market (2%) with the rest being given away as fodder. Once produce is on the table trimming of the ends can waste another 25% of the produce before packing.

- **Meru Greens**: Only 10% of French Bean is lost. This is because they target primarily the national canning market (60%) that has less stringent market standards.

- **Mt Kenya Gardens:** The company picks fruit from farmers plots or on-farm collection points. They normally will sort produce by grade and assign different prices then leave undersize fruit to the farmer. A farmer may sell such to other buyers who may come around buying 'rejects'. These may end-up in the local or even national market with users that are not super-markets. Damages to fruit during transport may reach 30%, depending on quality of packing (usually in crates), level of maturity or ripeness or the roughness of the road condition.

5 TRANSPORT COST ASSESSMENT

5.1 Specific Transport Costs

Transport costs on the first mile depend strongly on the mode used to transport the products, as depicted in the figure below. Research from other studies is confirmed here, that human porterage is the most expensive means of transport, producing costs that range between Kshs 1000 and 2500 per tonne-kilometre. A tremendous reduction of transport costs can be achieved by the usage of IMT, such as bicycles and motorcycles, which decrease costs to Kshs 300 to 800 per tonne-km. Human porterage is the most common mode used where distances are under a kilometre or where shortcuts are worth taking due to proximity of the destination, across a valley or where the normal road would be too winding.. This could also be where roads are non-existent, or the terrain is too difficult or steep for other means.

Donkey or oxcarts are mainly used for larger loads or bulky products, such as onions and potatoes. An exception is Mwea where oxcarts are used to transport French Beans. For heavy loads donkey carts and especially oxcarts are much cheaper than motorcycles.

Pickups and tractors are the cheapest means of transport, if they are fully loaded. However, the constraint is their availability. Since investment costs for these means are high and depreciation is considerable, a constant usage is needed to justify the investments. In rural areas this is often not the case.

Another outcome is, that bulkier loads, such as bananas, onions and potatoes are more expensive per tonne-km than lighter goods. This is probably because they are more difficult to carry by humans or by cycles.

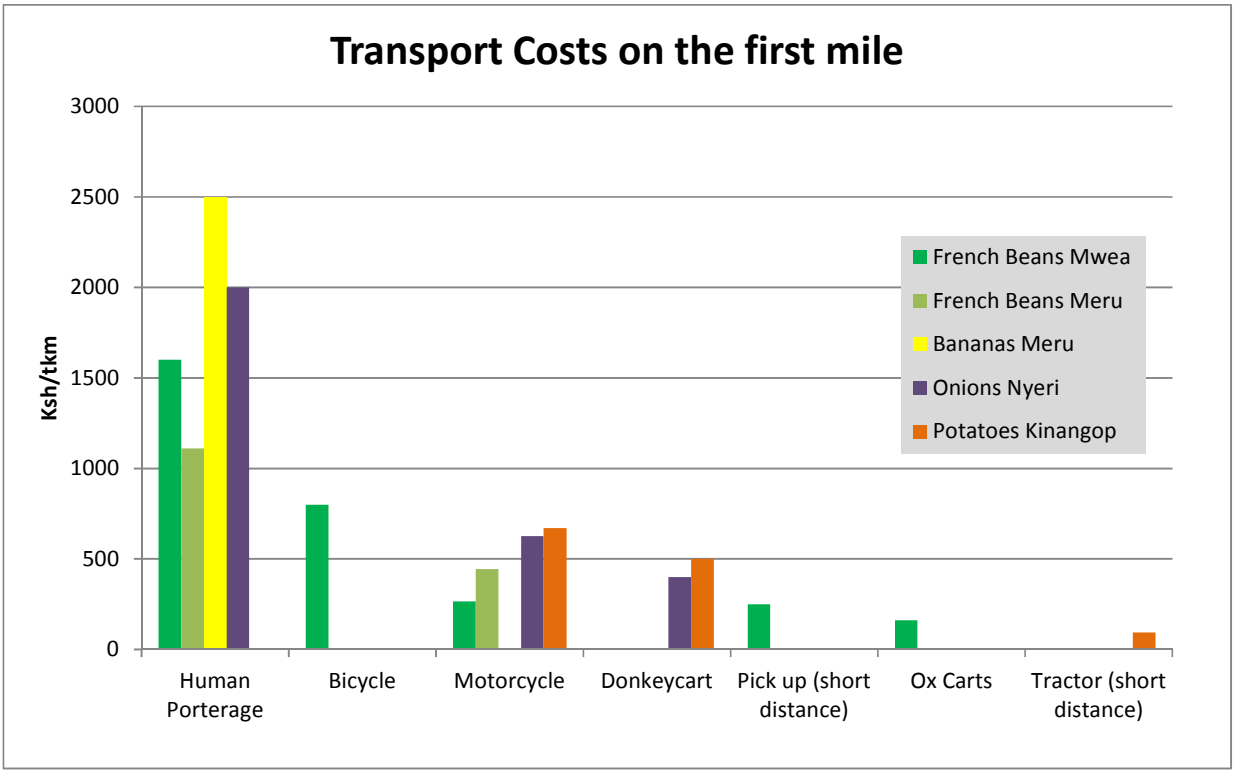


Figure 23: Transport costs on the first mile

A different picture is produced if long distance transport costs are analysed as presented on Figure 24. The graph shows that the payload of the vehicle on the horizontal axis, while the product types are presented in different colours, such as green for beans, yellow for bananas, aubergine for onions and brown for potatoes. The graph shows clearly, that with increasing payload, unit transport costs decrease. A fully loaded 8-ton HGV (High Goods Vehicle) may cost only a half of the transport on a 1 tonne pick-up. This entails some deliberations:

- During rains when HGV are not able to reach the farm on bad roads, transport costs increase significantly, as will be shown in the following chapter.
- A full load in a large truck traversing longer distances reduces transport costs. This is for example the case for the large farm SUNRIPE in Naivasha and Meru Greens compared to Machakos (Goshen) and Mwea (Kangai Tisa, 1st Mile case). However, Sunripe has an 8-ton refrigerated truck bound to have higher unit costs compared to the 5 ton trucks from Nyeri and Meru.

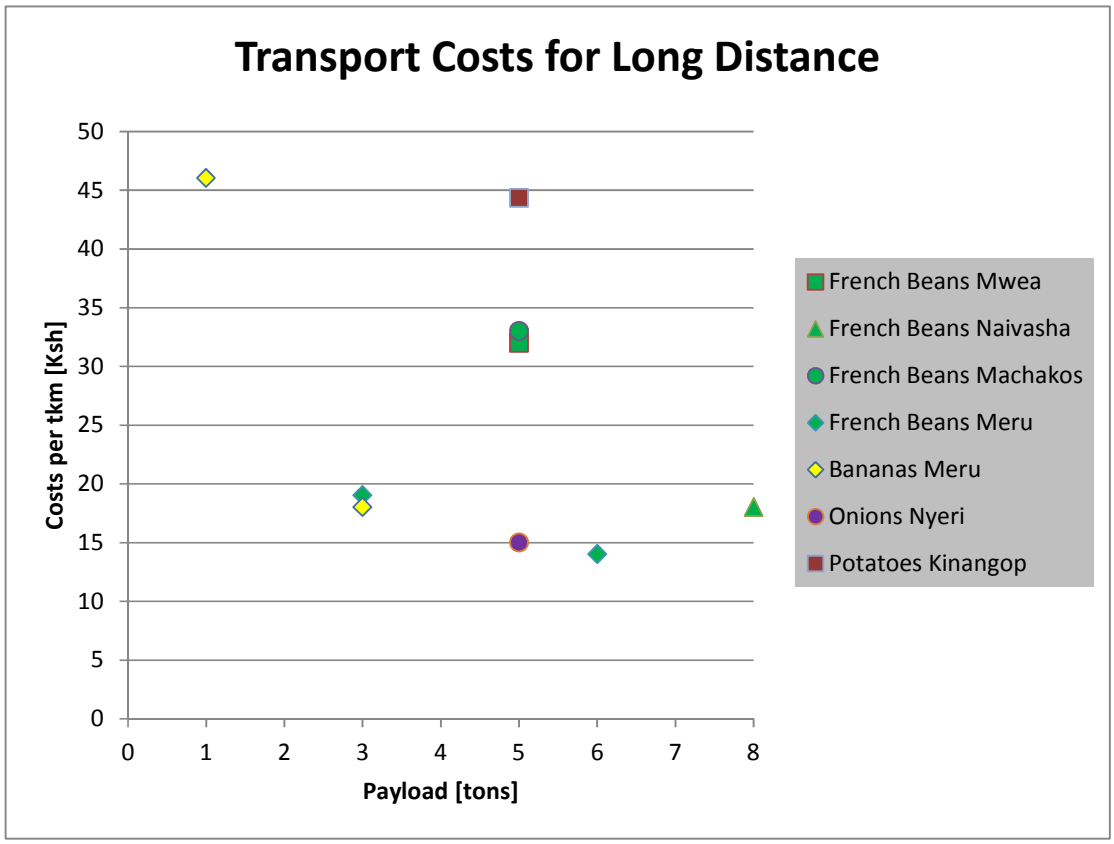


Figure 24: Transport costs for long distance transport

Even though a larger vehicle is used to transport the potatoes from Kinangop, transport costs reported are high. Three reasons may be attributed to this:

- firstly, the roads are generally in a bad condition,
- secondly, transport is conducted by private brokers that charge excessive transport rates to cover often excessive local running and uncertainty of destination and
- due to their quasi monopoly position.

The case of Nyeri shows that even in a steep terrain a good organisation of the marketing system, saves heavy local running and this can drastically reduce the transport cost.

5.2 Total Transport Costs

Transport costs are determined by the distance the products have to be carried from the producers to the final consumers, which is listed in Figure 25. The length of the chain ranges between 65 and 380 kilometres .

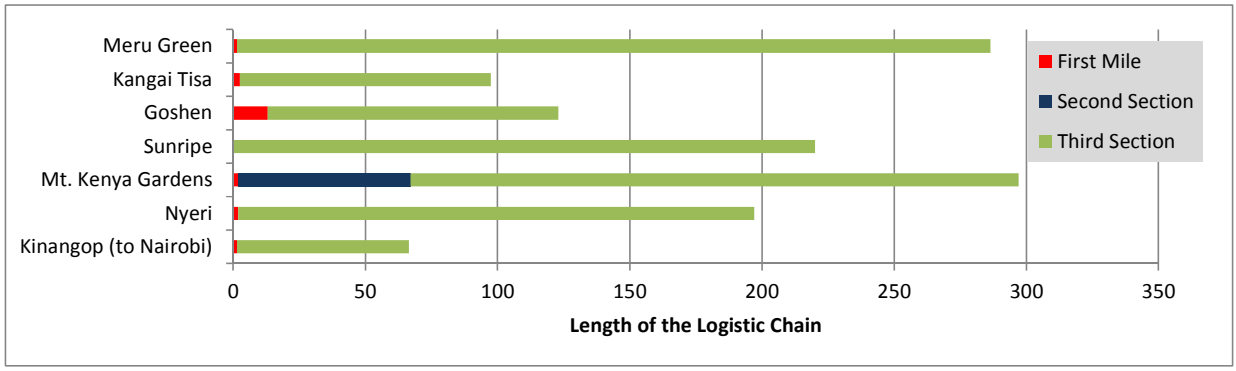


Figure 25: Total Length of the Logistic Chains

If the transport costs of the chains are compared, a completely different picture emerges, as given in Figure 25. To a minor extent this graph exemplifies the distances involved without reflecting on the costs described in the section above. By focusing on distances, the graph is not able to bring out the drastic unit costs involved, especially with the 1st mile, which are significant. Figure 25 leads to the observation that the cost-efficiency of the transport is a more weighty decision factor than distance or geographical location.

The length of the first mile transport segment ranges between 1.5 to 13 km, which makes up only 0.4% to 10.6% of the distance of the entire chain. However, this picture changes, if the transport costs are assessed: the first mile can make up to 37% of the total transport costs of the chain as depicted in Figure 27. This is one of the most important findings of the study: Even if distances of the first mile are short, its transport costs can make up a considerable share of the overall transport costs.

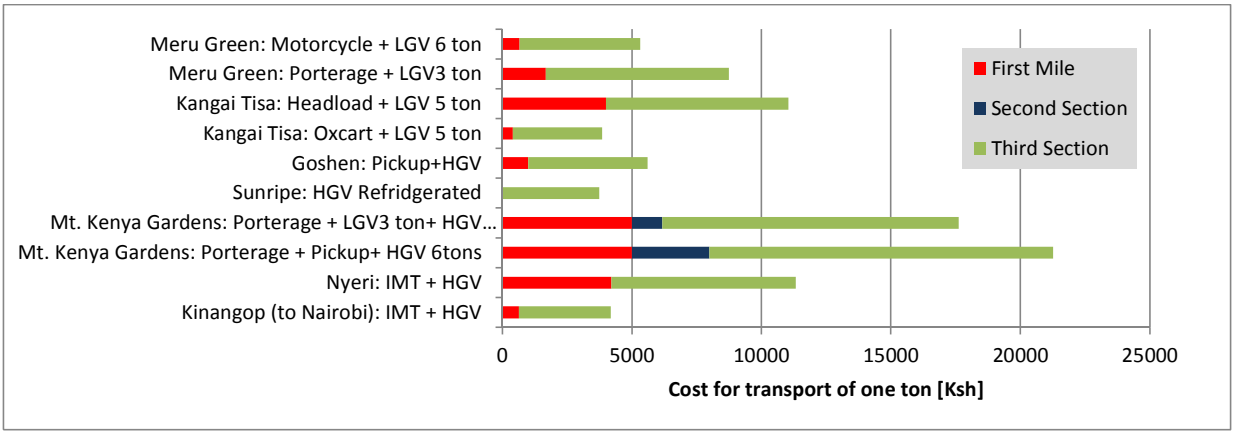


Figure 26: Costs to transport one ton on the logistic chains

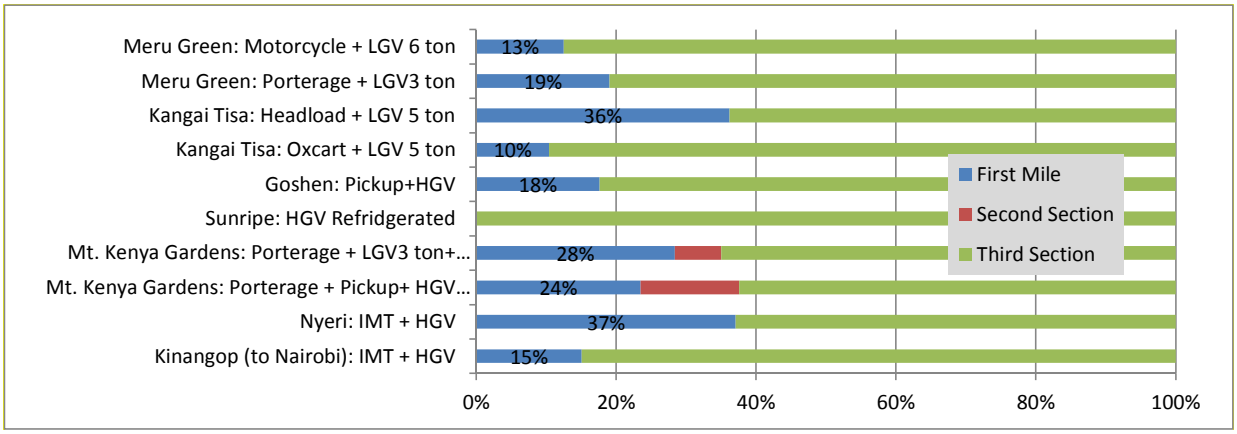


Figure 27: Cost share of transport sections of the logistic chains

The cost efficiency of the whole chain, depicted in Figure 28, ranges between 17 and 72 Ksh/t-km. The graph shows as well, that the choice of the mode on the first mile has a considerable impact on overall costs. For example in Meru the change from porterage to motorcycle can reduce overall costs by roughly one third; in Mwea (Kangai Tisa) the shift from porterage to oxcart can half overall transport costs.

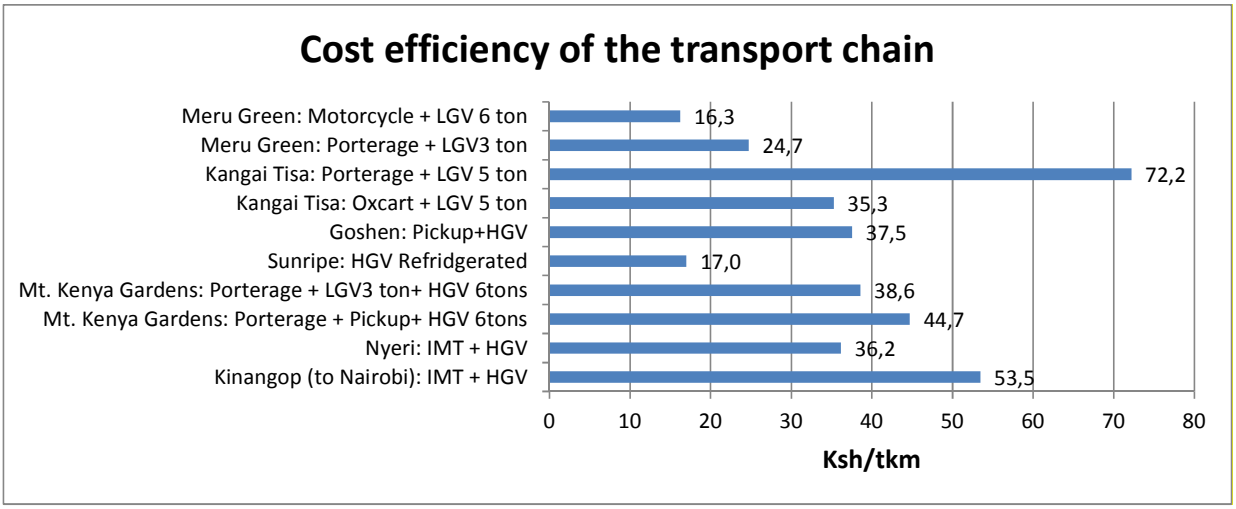


Figure 28: Overall cost efficiency of the chains

The conventional approach would only analyse the costs of the motorised chain and try to improve its cost efficiency. A wider approach taking into account the first mile, finds that costs to transport products to collection points can make up a considerable share and thus influence overall costs considerably. These costs are mainly carried by the producers and thus reduce farmer's income significantly.

5.3 Road conditions and accessibility

Road conditions determine the cost of transport in various ways, from efficiency of access to wear and tear of transport equipment, people or animal hauliers and goods alike. Road conditions contribute directly to the scot of transport. Appendix 2 has tables that aided the computation of costs across the various value-chains in the study areas.

Several aspects regarding field operations are worth noting:

- If roads are in a bad condition, forbidding HGV to enter, pick-ups and IMTs, or even human porterage have to be used. This can more than double transport costs. For example where a 1 tonne pickup-has to undertake 8 trips to fill one 8-ton HGV, costs rise significantly. As a rough estimate: double transport cost * 8 times trip + trans-shipment = 17 fold costs. This is an extreme increase in costs, most likely passed on freely to the farmer by the transporter.

- Additional costs can be attributed for transhipping the loads on large vehicles after tarmacked sections are reached.

Field reports received regarding transport costs impacts were such as follows:

Goshen Farm: The farmer suffers great losses in the rainy season as many rural roads become impassable. It costs about 18,000 Kenya shillings per trip to transport the produce to Nairobi on a hired truck. This is calculated on an assumption that it cost Kshs 10 to transport one kg of French Beans from the farm to the pack house in Nairobi. However, due to high petrol prices, transport costs have increased drastically.

In other details the entrepreneur reported: It costs Kshs 11 to harvest one kg of French Beans. Packing and grading costs Kshs 15 per crate (crate is 20kg) at the Nairobi pack house. Farm gate price for a kg of French Beans is Kshs 50. Net profit according to the entrepreneur is Kshs 30 per carton (a Carton is 3kg). The rejects are sold to local supermarkets at Kshs 4 per kg.

Nyeri, Onions: A big challenge facing onion and potato farmers in the region is the poor and deplorable state of access roads. Only the main road from Nyeri to Nyahururu is tarmacked. All other roads are earthen with a few having been converted to all-weather roads by placement of murram.

Figure 29: Motorbike carrying potatoes on a muddy road and right, poor state of the access road on which farmers have placed some stones in desperation.

Road conditions are essential for the transport costs. Appendix 2 lists the road conditions in the study areas. The road conditions were assessed through on-site inspections and by expert judgement. Between 60% and 90% of the roads were in a good condition. The worst conditions were observed in Kinangop area, which has strong impacts on the costs of the transport chain as described above.

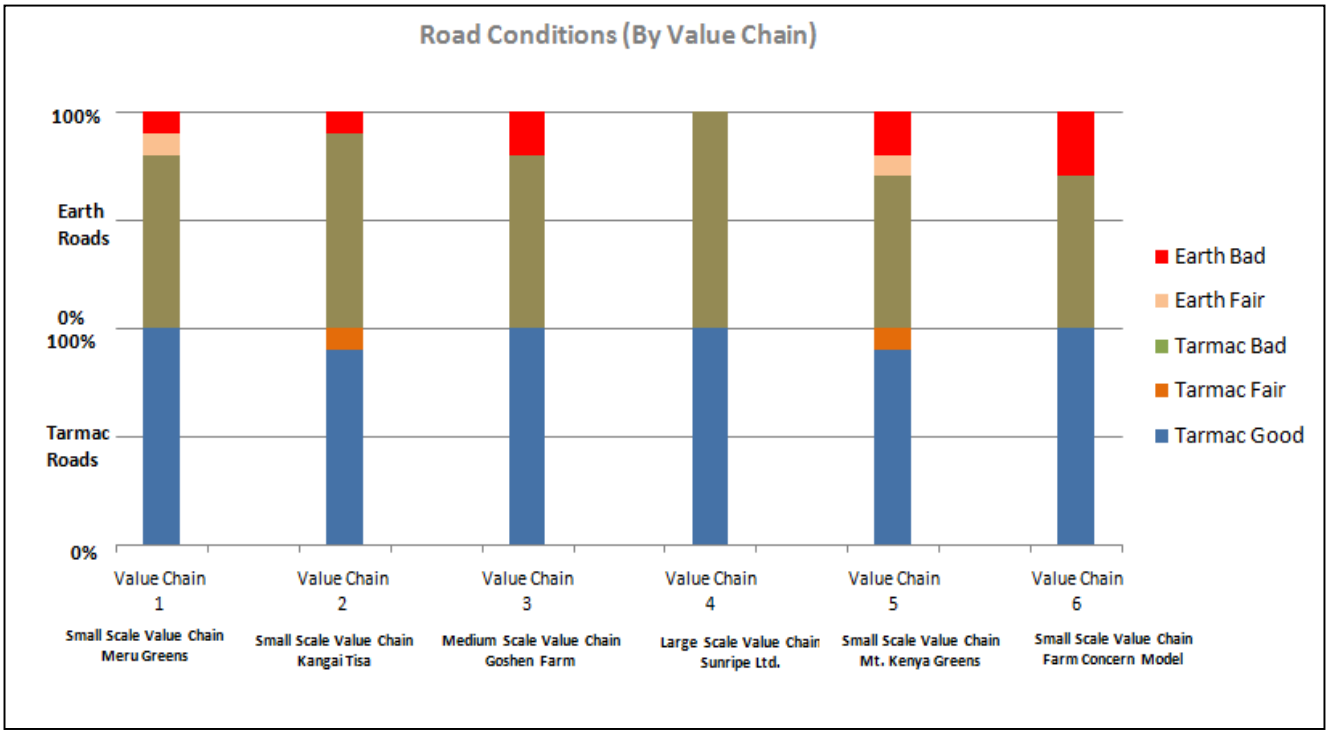


Figure 30: Rough expert assessment of road conditions in the study area

6 Quality of the Value Chains

The Chart below is an exemplification of the extent to which various activities are actualised in the various value-chains studied. It provides a snapshot of the extent to which various value-chain components expected of such are put into practice. It is clear from this chart that operational attention like for cooling of produce at various stages between leaving the farm and reaching the market can be considered luxuries when it comes to putting smallholder farmers to farm high value and quality-sensitive crops. For example comparing Sunripe to others it is clear that business size, hence economies of scale play a major role in operational and logistical etiquette. This is why smallholder farmers need the intervention of medium and large scale entrepreneurs to see the light of day, in business sense. Only with the assistance of collector-trucks, sorting sheds, agronomic input support etc. can smallholders participate in this journey from subsistence to business farming. Unfortunately, as reported in the previous Chapter, the smallholders may participate but not necessarily leap the profits expected of venturing into farming higher value crops.

Notes for the Chart below:

Small scale value-chains such as the Kinangop Potato and Onion farmers under Farm Concern continue to face challenges in production, marketing and handling of produce. All value chains with the exception of Sunripe (large scale value chain) face transportation challenges owing to poor roads, high transport cost and exploitation by middlemen and traders. Improved agricultural practices and intervention by stakeholders has resulted in better post storage and transportation practice. Owing to high cost of acquiring refrigerated trucks and storage facilities, only large scale operators who also enjoy economies of production are able to install these facilities at farm level.

Operational Aspect	*Detail Aspect*	*Meru Greens beans*	*Kangai Tisa*	*Goshen Farm*	*Sunripe*	*Mt Kenya Gardens-Banana*	*Farm Concern Model*	*Kinangop Potato*
Harvest	• Minimise delays before cooling							
	• Cool the product thoroughly as soon as possible							
Cooling	• Store the produce at optimum temperature							
Temporary storage	• Practice 'First in First out' rotation storage							
	• Ship to market as soon as possible							
Transport to market	• Use refrigerated loading area							
	• Cool truck before loading							
	• Avoid delays during transport							
	• Monitor product temperature during transport							
Handling at destination	• Use a refrigerated unloading area							
	• Measure produce temperature							
	• Move produce quickly to the proper storage area							
	• Transport to retail markets in refrigerated trucks							
	• Display at proper temperature range							
Handling at home or food service outlet	• Store produce at proper temperature							
	• Use the produce as soon as possible							

Legend:

	Carrying out practice
	Shortcoming or limitations observed

7 CONCLUSIONS AND FURTHER STEPS

7.1 Conclusions

This work package has analyzed the logistics of selected value-chains that Kenyan smallholder farmers participate in as they meet the challenges of new agricultural market demands. Preliminary findings of the study depict determined farmers and trading entrepreneurs building agribusiness partnerships that are of great development potential but which remain relatively unstructured and lacking of central and local government support. These value-chains, as operationalized by farmers who have journeyed from subsistence to business farming need to be understood and supported in ways that yield the greatest possible impacts. This is indeed the objective of this study.

This study toured and reported on the French Beans, Potato and Onion farming areas of the country. The study scope of a very wide and complex development arena covered the:

- Typical uncoordinated, individual or family supported farmer, exposed to many shortcomings, including lack of information about improving yields, access to advancing technologies and even markets. This farmer remains vulnerable and exposed to marketing brokers who are more likely to make higher profits than farmers that have poured the sweat and more, to bring about a sellable product.

- Supported farmers with growing structure, coordinated under commercial villages, able to receive training and information, participate in exposure visits and sell as a group to national markets, all coordinated under donor-supported projects.

- Supported farmer outgrowers with growing but buyer-dependent structures run by ambitious home-grown entrepreneurs who are also medium scale farmers, targeting international markets.

- Largescale independent farmers who may or may not contract outgrowers, or do so under own terms of business with structure of input and market support, targeting international market under stringent regulations.

The logistical analysis covered:

- Operational production of the crop up to the farm gate, where it may be sold to various traders (hence transporters), markets, from local to national and even international destinations.

- Logistical operations in terms of mapping routes, transport material flow volumes, wastage along the way and costing, including the possible incomes that can be derived.

- Understanding of organizational and logistical adjustments that make business sense, hence further steps that will build-up more knowledge of status and possibilities in this important development and economic growth path for Kenya and beyond.

- Cross-cutting aspects of livelihood influences of organization and institutionalization of business and development from natural, social, human, physical and financial capitals perspective, are alluded at if not particularly highlighted throughout the report.

The analysis revealed many aspects that are reported across the Chapters of this report. In conclusion, we report that the analyses revealed that:

- Farmers may gain considerable income from marketing high value products to national or international markets. Farmgate prices make up 33% to over 60% of the national market price and generate sufficient income for farmers to escape the poverty trap.

- Additional income is generated through processing and transporting the products. The value added through French Beans by these processes amounts to 39% to 77% of the national market price. Transport cost only makes up between 4% and 7%.

- However, much higher profit margins may be achieved by selling the beans to the international market. The national market price amounts to 55 Ksh/kg while on international markets prices range between 130 and 210 Ksh/kg. Selling to international market is a very lucrative undertaking.

- Exporters report, that the international markets are far away from being satisfied. Clearly, international markets are extremely profitable but only for those that can access it and manage to stick to the stringent Global GAP regulations. The restriction is mainly in the capacity of growers and marketers to satisfy the needs of consistency and volumes of the high quality produce sought by the importers. Quality is not difficult to achieve among farmers who often grow at most a quarter acre plots under mixed farming smallholder systems.

- Smallholder farmers may never be able to tap into the benefits of farming higher value crops until they have more knowledge and exposure to improved farming systems, technologies and practices that improve their yields while accessing improvement inputs, market information and markets as well as protecting their vulnerable soils.

- There is much for farmers to gain by carrying out group-centred and coordinated farming, training and marketing of produce that meets the critical mass of volumes and consistency sought by many a trader. The group approach creates tangible

commercialization safety nets such as for access to information, markets and voice to seek appropriate price, cutting out the auction of produce, under the whims of exploitative brokers.

- There is adequate market for farmers who can consistently supply volumes of high value produce of good quality, be it for local, regional, national or international markets. To be able to produce this way, farmers need much by way of mechanization for effective labour utilization, irrigation to be able to be weather independent and dependable transport services serving markets of known produce prices.

- There are many logistical and transport factors and parameters to be further assessed in future studies such as this one. This study already showed the importance of various value-chain components such as the following, many of which were not easy to quantify due to complexity of the sector under study, types of records kept by the companies studied or the time available to gather adequate data for scientific analysis:

    - The situation of the transport chain, the total volumes ferried by what type of means, quality of loads and load efficiency of transport equipment and means available.

    - Quality of roads and impacts of cost shocks to the system like rainy season, accidents, new roads that have opened, business growth trends etc.

    - The way logistical chains are organized and their capacity to cause the least damage to the crop produce re: the quality of harvesting carried out and procedural protection of the produce, the roads traversed, vehicle quality: anti-shock, sanitation and coolness of the load in transit, placement and efficiency of cooling facilities (on-farm and beyond), value-addition capacities and quality, timeliness of chain component activities etc.

- Transport costs of marketing high value crops must not be averaged out in units of overall distance. Such costs must take into consideration the high impact on total cost of difficult sections of the journey, such as the 1st Mile section, before the grading shed or the all-weather road. Modes of transport used in this or other difficult section of the journey, including head-loading, wheel-barrows, bicycles and motorbikes can contribute significantly to the overall unit cost and cost efficiency (per tonne-kilometre) of the trip (see Section 5.2).

- The length of the first mile transport segment makes up only 0.4% to 10.6% of the distance of the entire chain. However, this picture changes, if the transport costs are assessed: the first mile can make up to 37% of the total transport costs of the chain. This is one of the most important findings of the study: Even if distances of the first mile are short, its transport costs can make up a considerable share of the overall transport costs.

- The cost efficiency of the whole chain, ranges between 17 and 72 Ksh/t-km. The study shows as well, that the choice of the mode on the first mile has a considerable impact on overall costs. The conventional approach would only analyse the costs of the motorised chain and try to improve its cost efficiency. A wider approach taking into account the first mile, finds that costs to transport products to collection points can make up a considerable share and thus influence overall costs considerably. These costs are mainly carried by the producers and thus reduce farmer's income significantly.

7.2 Further steps

Then next steps in this project, as previously planned, will be to:

- Define key success factors of an efficient value chain by way of modeling the same. This process will carry the leanings we have achieved forward with a view to contributing expert knowledge useable by planners, investors and policy makers and other stakeholders of the value chains of high value crops. This process will look at examples from other studies, exchange with other operators in other value chains like the highly successful milk industry in Kenya.

- Define an ideal scheme for a new value chain. We will set a scene for recommended agribusiness organizational and institutional best practice, sellable to stakeholders. We will visit key stakeholders, including companies studied and receive their unbiased opinions regarding best practices for Kenya's horticultural value chains. Their position and input will be guided against what we will have observed, analyzed and reported in form of key ingredients of a strategic plan for sustained positive change to the horticulture agribusiness arena in Kenya.

- Invite key stakeholders to a 2-day workshop and exchange with them at one sitting. Before this workshop (to be held in February, 2013), key stakeholder representatives will be engaged to help close any apparent information or experience gaps (operational, costs, etc) during the workshop.

- Following the workshop and building on production, logistical, transport operational and marketing (timing, cost efficiency, sustainability, partnerships for trust etc.), adjustments agreed, we will produce a booklet titled "Planning and Investing in Horticultural Value-Chains of Kenya"[5] .Tthis will be the final product of this project.

[5] This title is tentative may vary with time

Appendices

Appendix 1:

Farm Concern International Commercial Village Model Application (An Abstract by G. Watoro, Nyeri Coordinator)

Winning markets for smallholders and enhancing cross border trade through Commercial Village Model (CVM) : A case of bulb onions in Kenya and Tanzania

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Although African economies are by and large agrarian they have a future, only if agricultural strategies and policies are implemented after their design and development. Commercialization and market development of staple foods offers an enormous potential for food, income and nutritional security. However, most of these crops have largely been promoted for subsistent production with very little focus on sustainable commercialization. Over the last five years, Farm Concern International (FCI) has implemented several market development and commercialization initiatives across Sub-Saharan Africa some of these supported by MATF-Farm Africa and other donor agencies.

FCI developed the Commercial village Model as innovative private sector approaches that are market driven to trigger a sustainable commercial production of bulb onions in Mang'ola basin Karatu District Tanzania and Kieni West in Nyeri County of Kenya. Objectives of the interventions were:

- To assess the onion management practices, analyze livelihoods, market opportunities and threats within the target sites;
- Establish Commercial Villages and governance structures for enhanced trading and market linkages;
- Enhance the capacity of Commercial Villages and Community Based Technical Experts;
- build partnership with private sector players;
- Develop sustainable and gender sensitive access to markets;
- Monitor and evaluate bulb onions commercialization, trade alliances, and household incomes.

Strategic value chain strengthening was carried out directly and through partnership with public and private sector players. The model achieved its commercialization objectives through establishment of collective marketing systems, increased participation of small scale actors either farmers or traders along value chains, collective access to business development such as transportation and increased small holder's competitiveness in the market place. This commercialization intervention targeted over 3000 households

organized into 3 Commercial Villages as direct beneficiaries and over 50,000 others that have enjoyed improved access to markets, quality inputs as well as improved access to Business Development Systams (BDS). Price for the bulbs onions improved due to FCI interventions that reduced the number of market players through various strategic interventions from a paltry Kshs 5 (USD 0.06) and average of Ksh 45 (USD 0.5) a whooping over 500% having factored inflation and other factors. Women participation has come alive. In this year 2012 average farmgate prices have been sustained at Ksh 50 per kg.

Smallholder farmers have used these incomes to educate their children, buy nutritious food, buy dairy cattle, and hire more land for food crop and red bulb onions transforming livelihoods in both short term and long term thanks to the support by MATF – Farm Africa. Main challenges have been scaling up these great intervention to reach more farmers and other countries but FCI has sourced support and are now working with over 10000 new farmers in these districts. The target scope has been extended to neighbouring Kieni East District and Laikipia Districts as well. Of the above target in the current programme DoHoMa (Domestic Horticultural and Market programme) funded by Bill and Melinda Gates Foundation. Of the targeted 10000 farmers so far 4389 have been registered by FCI in the past one year alone.

Appendix 2: Transport Cost Assessment Tables

Table A1: Transport Costs Assessment - Small Scale Farm model

	MERU GREENS (FRENCH BEANS)					KANGAI TISA (FRENCH BEANS)					MT. KENYA GARDENS (BANANAS)				
Section of Chain	**Avg Distanc**	**Transport Means**	**Payload/ trip(kg)**	**Cost (Kshs)**	**Cost/ton (Ksh)**	**Distance (km)**	**Transport Means**	**Payload/ trip**	**Cost (Kshs)**	**Cost/ tkm**	**Distance (km)**	**Transport Means**	**Payload/ trip(kg)**	**Cost**	**Cost/tkm**
First mile	**1.5 Kms**	Motorcycle	150kg	Kshs100	444	**2.5km**	Boda boda	150kg	100	267	**2km**	N/A	N/A	N/A	
		Human	30kg	Kshs 50	1,110		Human	25kg	100	1600		Human	50kg	250	**2500**
							Bicycle	50kg	100	800					
							Ox-cart	500kg	200	160					
						12	Pick-up	1000kg	3000	250		N/A	N/A	N/A	**N/A**
2nd Section	**N/A**	N/A	N/A	N/A	N/A	**N/A**	N/A	N/A	N/A	**N/A**	**130**	Light truck	3 tonnes	7000	**18**
		N/A	N/A	N/A	N/A	**N/A**	N/A	N/A	N/A	N/A		Light truck	1 tonne	6000	**46**
3rd Section	**380 Kms**	Medium size Truck (not cooled	6tonne	Kshs31000	14	**95**	Small truck	5 tonne	15,000	32	**230 Kms**	Medium Truck	6 Tonne	31,000	**23**
		Small Truck (not cooled	3tonne	Khs22,000	19										
Whole Chain	**381.5**	N/A				**109.5**					**362km**				

Table A2: Small Scale Farm model: Coordinated CV onion system and Uncoordinated broker managed potato system.

KIENI (NYERI) ONION FARMERS						KINANGOP POTATO FARMERS				
Section of Chain	**Average Distance**	**Transport Means**	**Payload/trip**	**Cost/trip**	**Cost/ton Kshs**	**Distance**	**Transport Means**	**Payload/trip**	**Cost/trip**	**Cost/tonKm**
First mile		Donkeycart	250	Kshs200		1.5kms	Motorcycle	200kgs	Kshs200	**670**
	2.0km	Motorcycle	150	Kshs200	625		Donkeycart	.400kgs	Kshs300	**500**
	0.5km	Human	60kgs	Ksh 60.00	2000	3kms	Tractor	2500kgs	Kshs700	**94**
2nd Section	**195**	Light truck	5000	Kshs 15,000	15	65km(Nairobi)	Light truck	5000kgs	Kshs14,000	**43**
						80km(Thika)	Light truck	5000kgs	Kshs17,000	**43**
Whole Chain	195.5					35km (Nakuru)	Light Truck	5000kgs	Kshs 10,000	**47**

Table A3: Transport Costs Assessment: Large Scale and Medium Scale Exporter

LARGE SCALE EXPORTER						MEDIUM SIZE EXPORTER				
SUNRIPE						GOSHEN FARM				
Section of Chain	**Average Distance**	**Transport Means**	**Payload/trip**	**Cost/trip**	**Cost/ton Km**	**Distance**	**Transport Means**	**Payload/trip**	**Cost/trip**	**Cost/tonKm**
First mile	N/A	N/A	N/A	N/A	N/A	13Kms	Light Pick-up	1000Kgs	KShs. 1000	**76**
		N/A	N/A	N/A	N/A	1Kms	Human	30Kgs	Kshs40.00	**1,333**
		N/A	N/A	N/A	N/A					
2nd Section	120Kms	Heavy Truck (cooled)	8000Kgs	Kshs17,000	KShs17	110	Light Truck	5000Kgs	18,000	**33**
Whole Chain	120kms					124kms				

Notes: No first mile for SUNRIPE. Produce is collected directly from the farm

Appendix 3:

Case study of Stephen Muriithi (Thika Wholesale Marketer): Accessing Onions from the Nyeri (Kieni East), Western Kenya (Olotum and Chwele) and Northern Tanzania (Singida and Mang'la) farming sources:

Stephen Murithi and his Camera-shy wife Anastasia (in apron) at their wholesale and retail outlet in Makongeni Market Thika. Stephen tends to handle produce acquisition from farms and the wholesale section while Anastasia handles retail business of the trade. The family business has grown in leaps and Stephen hope that one day he will have his own truck, to freely build links with farmers. "That is when I will consider that we have arrived...". He quips.

One of the market stops studied in depth was that of Stephen. Stephen is a long-time onion trader in Thika town, a wholesale market where some of the onions grown in Kieni in Nyeri come. Stephen helped the research team learn how onions from the field arrive at the market and how they are marketed with a retail outlay as well.

In Thika, specifically Madaraka section of popularly known Makongeni Market, Stephen Muriithi, a local trader of Red Onions had a story far from typical. He buys produce from three main localities at different times of the year, which determine his profit margins. Depending on supply by transporters Stephen may buy from the arriving trucks or rent a truck himself (or teaming-up with colleagues) to travel and collect onions from various locations, including far away locations in Northern Tanzania (Mang'ola and Sigida). Stephen asserted that the best Onions and for most of the year (May to December) are found here. He reiterated that Kenya has poorer quality onions mostly because of a practice of early harvesting and poor curing by Kenyan farmers. Stephen reported that the Tanzanians traditionally uproot the Onion when it has fully matured and even store them to cure to the best marketing moisture level.

What Stephen buys from Kenyan Farmers is from Nyeri (Kieni), Chwele and Olotum in Western Kenya. However these places seem to yield the most crop only four months in a year; January to April. In Kieni, Stephen buys his Onions for about Ksh 53/= to 58/= per kilogram; he sells his Onions at Ksh 85/- per kg. Initially his profit margin is outstanding, but there are various other costs he must contend with. Stephen hires Transport to deliver his Onions at Ksh 16,000/=, which are packaged in Nets carrying an average of 25-30 Kg of Onions at Ksh 25/= to 30/=.These are packed and sewn at a total cost of Ksh 600/= . Stephen transports 7 to 8 tons of Onions, equivalent to 300 nets, on Trucks from Kieni to Thika. He pays 1200/= Market Entry Fee on arrival at Thika and Ksh 600/- Cess. He also pays Ksh 1500/= KES to have the truck load off-loaded.

In Olotum and Chiwele, Stephen buys at Ksh 75/= and sells at Ksh 85-90/=. Here, Stephen buys 12 tons of Onions. His costs are thus more expensive. He pays 35,000/= for transport, 1600/= goes to Thika Town Council, 1000/= for CES and 2100/= to offload his Onions once in Thika. All other costs remain the same as for Kieni.

In Tanzania, Stephen travels to the border and pays 1000/=, has his Passport stamped and travels further to places like Mangola and Sigida to purchase his Onions. In these places he meets up with Brokers who do the work of connecting the Farm to the Purchaser, in this case Stephen, by making produce readily available. Here Stephen doesn't bring his own trucks to transport the Onions back to Thika; instead he rents Trucks once across the Tanzanian border, a tactic that saves him both time and money. He pays roughly 50,000/= KES for transporting his 12 tons (130 bags) of Onions back to Thika and pays roughly 3800/= for loading and offloading the Onions. He then pays 3600/= at the border on his return; a cost that is split evenly between him and the owner of the truck. Stephen also pays 1100/= for Cess. In Tanzania, Stephen buys one bag of

Onions, which is equivalent to 115-120Kg, for 5800/=. He brings it across the border to sell at 7800/= per bag..

Stephen and his wife Anastasia Wangari Munene, are entirely involved in the business. Whilst Wangari does more of the retail work, Stephen is concerned with attaining the produce from the farmers, and wholesale business. 'A Dynamic Duo' they seem. Stephen operates on a high profit margin, and his life reflects that. His only Daughter who is 14 years of age, is currently in her first year of high school and as Stephen puts it; "Onions have given me everything".

Every morning Stephen leaves home at 6:00am to work whilst his wife delivers breakfast to him a couple of hours later. He works until 7:00pm whilst his wife heads home at 6:00pm; pleasant working hours for an occupation that 'changed their lives'.

How did Stephen become an Onion Trader? Stephen began as a factory worker, but only worked three months at a time (renewable contracts) so his company could avoid paying statutory fees as 'payee' taxes. In the time when he was laid off, Stephen noticed that his colleagues would head to the market and sell vegetables in small quantities for some extra money. Stephen got involved. And as he worked he observed and he learnt and adapted to his surroundings. He switched to selling Onions because of the short 'shelf life' of the vegetables. He realized that he could sell Onions for more hours than his colleagues were selling vegetables. With time he grew more proficient at his trade which has helped him grow a business to this date. Eight years on and Stephen is now 38 years old, running a profitable business and happily married with a daughter. Not bad, for a man who never attended High school.

The Table below shows the gross-margins of Stephen's business by source of produce. Stephen is able to generate a gross margin of 38.35% per kg with onions from Kieni (about 200km away) nowhere comparable to the 13.41% achievable from Olotum and Chwele (about 350-450km away). Apparently onions from far-away Tanzania (about 500-600 km) locations at (34.5% margin) compete in profit margin with Kieni onions. This is especially considering that the onions from Tanzania may be able to last as much as 3-4 months after arriving at the market, as long as they are kept dry.

Table A4: Impact on consumer price of Alternative sources of onions marketed in Thika town by Stephen Murithi, an established wholesale and retail trader.

Source of Onions	**Kieni (Nyeri) 150 km Journey**		**Olotum & Chwele (Western Kenya) 420 km Journey**		**(Mang'ola and Singida) Tanzania 480 km Journey**	
	Ksh* /Kg	**Totals (Ksh)**	**Ksh /Kg**	**Total (Ksh)**	**Ksh /Kg**	**Total (Ksh)**
Amount Bought/Ferried	8000 kg (8 tonnes ferried)		12000 kg (12 tonnes ferried)		12000 kg (12 tonnes ferried)	
Buying Price	58.00	464,000.00	75.00		48.30	5,800.00
Transport	2.00	16,000.00	2.92	35,000.00	4.17	50,000.00
Netting/packaging	1.00	7,600.00	1.00	12,000.00	Bagged transport	
Council Fee	0.15	1,200.00	0.13	1,600.00	0.15	1,800.00
CESS	0.08	600.00	0.08	1,000.00	0.09	1,100.00
Onloading/Offloading fee	0.19	1,500.00	0.18	2,100.00	0.32	3,800.00
Other Expenses	Ksh 2.00 per Net	Ksh 600.00 per (Sewing)	Ksh 2.00 per Net	Ksh 600.00 per (Sewing)	Border Expenses; Ksh 1000.00	
Selling Price (per Kg)	Ksh 85.00		Ksh 90.00		Ksh 65.00	
Profit Margin		38.35%		13.41%		34.50%

**1 US$ = 85 Kenya Shillings*

Appendix 4:

Persons and Institutions Visited

Name & Position	Institutional Affiliation	Contact
Janet Maigoya – Marketing Officer	Farm Concern International	0722386335
David Ruchiu – Regional Manager & Director	Farm Concern International	0726440600
Stephen Munene and Anastasia Wangari Munene	Wholesale and retail trader Thika Makongeni Market	0727955983
Carol Kimathi - Technical Advisor	Meru Greens Horticulture Ltd	0712391398
Joseph Nderitu - Chairman	Ketharani Horticulture self-help group	0703507879
Gerald and Rosemary Muthomi - Directors	Meru Greens Ltd and Mt. Kenya Gardens Ltd	0722783045
Morris Gatobu - Transport Manager	Meru Greens Ltd	0726883419
Dianah Nkirote – IT Manager	Mt. Kenya Gardens	071803403 2
Anthony Mbwiri - Agronomist & production manager	Meru Greens Horticulture Ltd	072187069
Harrison Ndung'u	Nyahururu Wholesale and Retail Onion Trader	0720363035
Mary Njoki Kihocia	Nairobi Wakulima Onion Trader	0723467663
Mr. Kamau	Potato Trader Kangemi Market	0722421564
Peter Mwangi	Potato Trader Korogocho Market	0727177414
Peter Muriuki	Githurai Market Potato Trader	0710390648

John Njoroge	Githurai Potato Trader	0777317624
Murungi Cyprian Mburugu	Contracted Coordinator and Produce Assembly Farmer Fresh-Pak	0724759589
John Ngigi - Proprietor	Fresh Pak	0721-360463
Alex Mutu - Proprietor	Goshen Farm	0722927819
Amos Agronomist	Goshen Farm	0715364156
Mr & Mrs Mulinge – Directors, Proprietors	Athi Farm	0722815652
Charles Mutinda – Farm Manger	Athi Farm	0725079804
Daniel Gakuo – Kieni East	Leading onion farmer	0723535696
Mr. Peter-Kieni East	Onion Farmer Farm concern commercial village	0710106462
Mr. Kingo'ri	Onion Farmer Farm concern commercial village	O727815790
Gerald Watoro Technical Advisor	Farm Concern International	watoro@farmconcern.org geraldwatoro@yahoo.com 0715408751
David Kung'u	Farmer, Kinangop	0720651049
Thomas (Field Coordinator) and Irene Wambui -Secretary	Farm Concern International Kimende and Rukuma Area Commercial Village	0722252908
Silas Mbaabu - Farm Manager	Sunripe: Naivasha Farms	0738900274
Elizabeth Kamau - General Manager	Kinangop Dairy Cooperative	0725991064
Dr. Maiteri James – Extension and Milk Collection Manager	Kinagop Dairy Cooperative	0723884802
Anold Micheni - Potato Trader Embu	Transporter & Trader	0720821397]
Embaringo area Potato growers group	Farm Concern International	0710106462
Transport Manager Sunripe Nairobi Elijah Ng'ang'a	Sunripe – Nairobi Offices	0738900771

Margaret Mutinda - Operational Manager	Sunripe – Nairobi Offices	0738900134
Farmers & Traders	Numerous officers, farmers and traders (at least 300), both male, female and youth, without formal contacts were met and interviewed as individuals or as group members, at their farms or in market places	