Markets and Value Chains Assessment

Kyegegwa

Development Response to Displacement Impacts Project

Ministry of Foreign Affairs of the Netherlands

WORLD BANK GROUP

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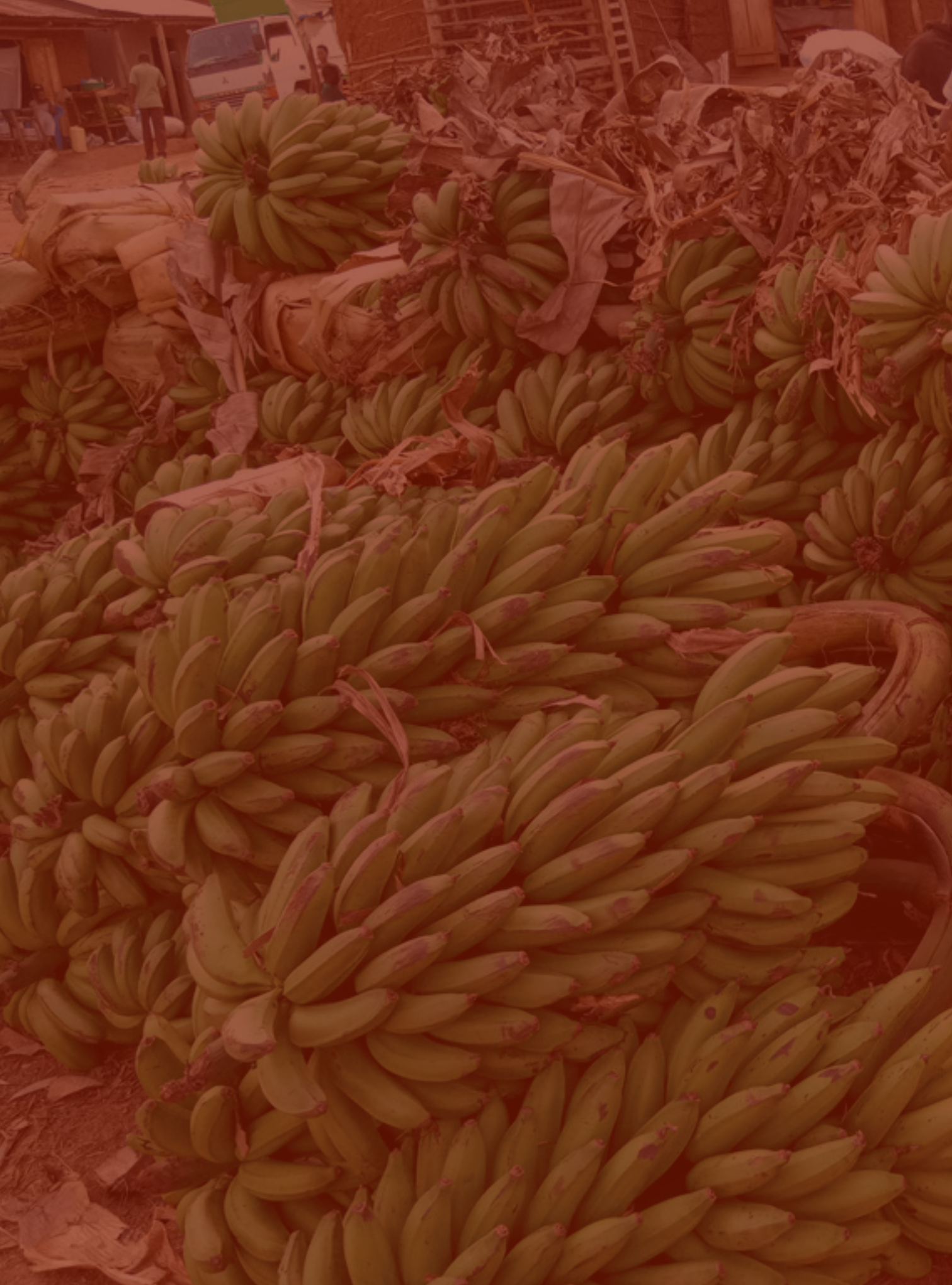

TABLE OF CONTENTS

LIST OF FIGURES iv
LIST OF TABLES v
PREFACE vi
ACKNOWLEDGEMENT vii
ACRONYMS viii
DEFINITIONS OF KEY TERMS ix
EXECUTIVE SUMMARY xi
1.INTRODUCTION 1
1.1. Background Information 2
1.2. Objectives of the Development Response to Displacement Impacts Project 3
1.3. Objectives of this Study 3
1.4. Output 3

2. STUDY METHODOLOGY 5
2.1. Study Area 6
2.2. General Approach 7
2.3. Sampling Procedure and Data 9
2.4. Value Chain Analysis 10
2.5. Measurement of Key Performance Variables 10
2.5.1. Cost benefit analysis 10
2.5.2. Share of value 11

2.6. Estimation of jobs opportunities 11

3. FINDINGS 15
3.1. Traditional Value Chains 16
3.1.1. Banana Value Chain 17
3.1.2. Dairy Value Chain 32
3.1.3. Apiary Value Chain 52
3.1.4. Tomato Value Chain 67
3.1.5. Onion Value Chain 80

3.2. Non-Traditional Value Chains 93
3.2.1. Crafts 94
3.2.2. Artisan 102
3.2.3. Trade in Agro produce 111

4. CONCLUSION 123
5. REFERENCE 126
6. APPENDICES 128
Appendix 1: Costs and Revenues for Banana Value Chain 128
Appendix 2: NPV under various scenarios of banana farming systems 129
Appendix 3: Costs and revenues for the different scenarios under dairy value chain 131
Appendix 4: NPV and PBP for the different scenarios under dairy value chain 132
Appendix 5: Costs and Gross margin of Apiary VC at farm level under different scenarios 133
Appendix 6: NPV under various scenarios of Apiary Value Chain 135
Appendix 7: Costs and Gross margin of tomato farmers under different scenarios 137
Appendix 8: Costs and Gross margin of Onion farmers under different scenarios 138
Appendix 9: Scenarios, Costs and Gross margin for craft makers 138

LIST OF FIGURES

Figure 1: A map of Kyegegwa district in Western Uganda....6
Figure 2: Approach to the assignment....8
Figure 3: Demand and supply of bananas in Uganda....18
Figure 4: Formal banana export by value (USD)....19
Figure 5: Banana flow and quantification in Kyegegwa....22
Figure 6: GM for banana farmers per acre per year....23
Figure 7: Gross Margin per Actor....23
Figure 8: NPV /year/ acre of banana....24
Figure 9: Trading channels for the banana value chain actors in Kyegegwa....24
Figure 10: Milk production and consumption in Uganda....33
Figure 11: Imports and Exports milk products from (2009 to 2018)....34
Figure 12: Milk value chain in Kyegegwa district Uganda....37
Figure 13: Farm level GM in UGX per cow per year....39
Figure 14: Gross Margins in UGX/cow/Year....39
Figure 15: GMs in UGX/Litre across the VC....40
Figure 16: Pay Back Period per cow per farming system....41
Figure 17: Milk Supply Chains in Kyegegwa....41
Figure 18: Production and consumption of honey in Uganda....54
Figure 19: Formal Honey Imports 2009-2018....54
Figure 20: Formal destinations of honey exports from Uganda....55
Figure 21: Product flow and quantification....58
Figure 22: Current GMs in UGX/ hive for beekeepers....58
Figure 23: GM for apiary VC actors in UGX /hive /year....59
Figure 24: GM for Apiary VC actors in UGX/kg:....59
Figure 25: NPV in current scenario....60
Figure 26: Share of value among Apiary value chain actors....61
Figure 27: Production and consumption of tomatoes in MT....69
Figure 28: Formal tomato products import and exports values and volumes....69
Figure 29: Fresh tomato flow and quantification in Kyegegwa....71
Figure 30: GM in UGX per acre per season at farm level....72
Figure 31: Gross Margins for different value chain actors along the Tomato value chain....72
Figure 32: Gross Margins for different value chain actors along the Tomato value chain....73
Figure 33: Trade channels in the Tomato value chain for Kyegegwa....73
Figure 34: Onion Production and Consumption in Uganda....82
Figure 35: Onion products exports....83
Figure 36: Product flow for bananas in Kyegegwa....85
Figure 37: GM for the onion farmers per season per acre....85
Figure 38: GM for the onion VC actors in UGX per season per acre....86
Figure 39: GM for the onion VC actors....86
Figure 40: Share value for different value chain actors....87
Figure 41: Share value for different actors in the Crafts value chain....97
Figure 42: Gross Margins per major craft produced....97
Figure 43: GM for traditional and KTB hive makers in UGX per hive....104
Figure 44: Gross margins for Onions, Tomatoes and Fresh Beans per Kg....113

LIST OF TABLES

Table 1: Sub counties and villages visited....7
Table 2: Sample size of various respondent categories in Kyegegwa....9
Table 3: Illustration of estimating number of FTE job units per acre....12
Table 4: Proportion of population in Kyegegwa district growing non-cooking bananas....20
Table 5: Estimated number of jobs in the Banana Value Chain in Kyegegwa district....25
Table 6: Constraints and mitigation strategies in Banana Value Chain....27
Table 7: Different Scenarios of strategic investment in Banana VC....29
Table 8: Summary of the impact of the strategic investments on GM and Jobs....30
Table 9: Specific assumptions of the Dairy Value Chain....38
Table 10: Total number of jobs at baseline under the dairy value chain....42
Table 11: Key constraints along the dairy value chain....44
Table 12: Different Scenarios of actual and strategic investment in Dairy VC....47
Table 13: Summary of the impact of strategic investments on GM and Jobs....48
Table 14: Employment along the Apiary Value Chain....61
Table 15: Constraints in the Apiary Value Chain in Kyegegwa....62
Table 16: Assumptions per of strategic investment in Apiary Value Chain....64
Table 17: Assumptions per of strategic investment in Apiary Value Chain....65
Table 18: Cost to invest per group using scenario 8....66
Table 19: Job created along the Value Chain....74
Table 20: Constraints faced by the different actors....76
Table 21: Different scenarios Tomato Value Chain in Kyegegwa....79
Table 22: Summary of the Impact of Investment scenarios....79
Table 23: Total number of jobs created and wage rate under the onion value chain....87
Table 24: Constraints at different value chain nodes....89
Table 25: Assumptions for Different scenarios for improving onions VC in Kyegegwa....92
Table 26: Summary of the Impact of Investment scenarios....92
Table 27: Common craft products, prices and price determinants....96
Table 28: Estimated number of jobs under the craft value chain within Kyegegwa district....98
Table 29: Major challenges in crafts....99
Table 30: Impact of projected scenario on jobs and GMs....101
Table 31: Employment created in the artisan sector....104
Table 32: Major constraints in artisan sector....106
Table 33: Description of scenarios....108
Table 34: Impact of the investment on a group of artisans....108
Table 35: Fixed costs per group....110
Table 36: Number of registered traders per trading center....113
Table 37: Employment along the value chain....114
Table 38: Constraints and mitigation measures....116
Table 39: Different scenarios under trade in agro produce....117
Table 40: Impact of the investment on GMs and pay back period....117
Table 41: Estimation of the market at 1% of the current market value....119
Table 42: Variable and fixed costs per group....119

PREFACE

Uganda remains the largest refugees' destination in Africa, with only Lebanon and Jordan topping the number at the world stage, owing to her open-door refugee policy. It is recorded that 1,411,794 refugees had settled in the country as of January 2018 with the majority from South Sudan and DRC. However, the presence of refugees in the country has increased competition with the host communities for resources and resulted in negative economic, social, and environmental impacts, such as rising food and commodity prices with increasing food insecurity, the depression of local wage rates, and increasing environmental degradation due to high pressure on biomass to meet energy and construction needs; and limited livelihood opportunities, among others.

These negative shocks exacerbate vulnerability for the refugee-hosting areas. Although the refugees are provided with humanitarian assistance by the UNHCR and its implementing partners, including food aid and other necessities, this is not sustainable. To the contrary, this one-sided assistance causes tension between the host and the refugee communities. Enhancing the productive capacities and coping mechanisms of the host populations is seen as an important step for safeguarding a very-much-needed asylum space for refugees among the host communities. Thus, the Development Response to Displacement Impacts Project (DRDIP), sought to embark on Markets and Value Chain Analysis in the districts hosting refugees in Uganda. The aim was to get a clear and better understanding of the appropriate economic systems and structures to build upon existing markets and businesses, thereby sustainably engaging both the host and refugee communities in each of the refugee hosting districts. This report presents the findings for Kyegegwa district.

The study took on a multipronged dimension, spanning through three phases, comprising; Inception, which teased out the scale and nature of the assignment, highlighting the expected deliverables. This was followed by the scoping study in the district that identified the existing livelihoods and value chains. The value chains were then prioritized and validated. Thereafter, a comprehensive Market and Value Chain Assessment was conducted on the highly ranked value chains.

The report presents characteristics of Value Chains Actors and statistics on current and potential markets, profitability and job creation, along the value chains. In addition, the report stresses the strategic investments under each VC and their impact on profitability and job creation. The findings in this report will help to support the project in decision making on which enterprise to fund. Besides, it will support the community facilitators and the project beneficiaries in developing community budgets for the various enterprises selected

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ACRONYMS

AGOA	African Growth and Opportunity Act
ASSP	Agriculture Sector Strategic Plan
CBA	Cost Benefit Analysis
CF	Community Facilitator
CIP	Clean in Place
CO	Community Organizations
COGS	Cost of goods sold
DDA	Dairy Development Authority
DFS	Digital Financial Services
DIG	Dairy Interest Groups
DIST	District Implementation Support Team
DRC	Danish Refuge Council
DRC	Democratic Republic of Congo
DRDIP	Development Response to Displacement Impacts Project
EA	East Africa
ECF	East Cost Figure
EU	European Union
FGDs	Focus Group Discussions
FGP	Farm Gate Prices
FMD	Foot and Mouth Disease
FR	Field Research
FTE	Full Time Employment
FTE	Full Time Equivalent
FV	Future Value
GAP	Good Agronomic Practices
GDP	Gross Domestic Products
GM	Gross Margin
GMA	Gross Margin Analysis
GoU	Government of Uganda
IFPRI	International Food Policy and Research Institute
IGAD	Inter Governmental Authority on Development
JESE	Joint Effort to Save The Environment
Kg	Kilogram
KI	Key Informant
Km	Kilometre
KRECS	Kyegegwa Rural Electrification Cooperative Society
KT	Kilimo Trust
KTB	Kenya Top Bar
LBC	Local Business Centres
LC	Local Council
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MCC	Milk Collection Centres
MS	Microsoft
MT	Metric Tonne
NDP	National Development Plan
NGO	Non-Governmental Organization
NPK	Nitrogen Phosphorus Potassium
NPV	Net Present Value
OPM	Office of the Prime Minister
OPV	Open Pollinated Variety
PHH	Post Harvest Handling
PHM	Post Harvest Management
PI	Profitability Index
PIST	Project Implementation Support Team
RMA	Rapid Market Appraisal
RMA	Rapid Market Analysis
SACCO	Savings and Credit Cooperative Organizations
SIST	Subcounty Implementation Support Team
SSA	Sub Sectorial Analysis
TV	Total Value
UDDA	Uganda Dairy Development Authority
UGX	Uganda Shillings
UHT	Ultra-High Temperature
UK	United Kingdom
UNBS	Uganda National Bureau of Standards
UNDP	United Nations Development Program
UNHCR	United Nations High Commission for Refugees
UNRA	Uganda National Roads Authority
US	United States
USD	United States Dollar
VC	Value Chain
VCA	Value Chain Analysis
VCA	Value Chain Actor
VSLA	Village Savings and Loan Association
WB	World Bank
WHO	World Health Organization

DEFINITIONS OF KEY TERMS

Full Time Employment	Number of jobs created in a year considering 8 hours per day, 26 days a month, and 12 months a year totalling 312 days per year.
Livelihood	A general set of activities or practices selected by people to earn a living e.g. crop production, livestock and brick making.
Man-day	A day regarded in terms of the amount of work that can be done by one person within a day.
Non-traditional Livelihoods	Off-farm enterprises including processing, trade (produce, Livestock & others), service enterprises e.g. saloons, food & beverages, events management, etc.
Traditional Livelihoods	On-farm primary production in crop, livestock, fisheries and bee keeping.
Strategic Investment	A catalytic investment that triggers significant growth among local enterprises, increases their profitability, creates jobs for communities and spurs local economic growth.
Supply chain	The chain of events that lead from the supply source to product consumption in a sector or subsector.
Value chain	The full range of activities that are required to bring a product or service from conception, through the intermediary phases of production and delivery to final consumers, and final disposal after use. This includes activities such as production, processing and distribution to the final consumer in national or regional or international markets.

EXECUTIVE SUMMARY

Uganda remains the largest refugees' destination in Africa, with only Lebanon and Jordan topping the number at the world stage, owing to her open-door refugee policy. It is recorded that 1,411,794 refugees had settled in the country as of January 2018 with the majority from South Sudan and DRC, yet continuing episodes of civil strife perpetuating instability in the neighborhood is a precursor for increasing influxes.

However, the presence of refugees in the country has increased competition with the host communities for resources and resulted in negative economic, social, and environmental impacts, such as rising food and commodity prices, increasing food insecurity, the depression of local wage rates, increasing environmental degradation due to high pressure on biomass to meet energy and construction needs; as well as limited livelihood opportunities, among others. These negative shocks exacerbate vulnerability for the refugee-hosting areas. Although the refugees are provided with humanitarian assistance by the UNHCR and its implementing partners, including food aid and other necessities, this is not sustainable. To the contrary, this one-sided assistance causes tension between the host and the refugee communities. Enhancing the productive capacities and coping mechanisms of the host populations is seen as an important step for safeguarding a very-much-needed asylum space for refugees among the host communities. Thus, the Development Response to Displacement Impacts Project (DRDIP), sought to embark on Markets and Value Chain Analysis in a bid to get a clear and better understanding of the appropriate economic systems and structures to build upon existing markets and businesses, thereby sustainably engaging both the host and refugees communities. Against this background, Kilimo Trust (KT) was commissioned by the World Bank and Office of the Prime Minister, to support the project team to undertake this study.

The study took on a multipronged dimension, spanning through three phases, comprising; Inception, which teased out the scale and nature of the assignment, highlighting the expected deliverables; The scoping study in the pilot district of Kyegegwa, identified the existing livelihoods and value chains that were then prioritized and validated; and the comprehensive Market and Value Chain Assessment that was conducted on the highly ranked value chains.

The objectives of this study were to: (1) Map actors and their roles along the selected value chains; (2) Determine profitability of enterprises at each level of the selected value chains; (3) Estimate the number of jobs at each level of the selected value chains; (4) Identify constraints and opportunities for each value chain; and (5) Recommend strategic areas to invest for each value chain. The study activities involved; Secondary Literature Review and Primary Data Collection through FGDs at District, Sub-counties and Community Level Meetings, coupled with Key Informant Interviews while employing participatory approaches.

Qualitative and quantitative primary data was collected for value chain actors, their characteristics, and area of operation mapped out, including costs of production and trade. The data was analyzed with NVivo 2011 and SPSS 2016 to generate frequencies, proportions and totals. Profitability was assessed at each value chain node using Gross Margins, Share of Value, Net Present Value, and Payback Periods. A value chain framework was used to estimate the jobs created in the various nodes of the chain and to analyze the impact of addressing issues and opportunities in the chain on the number of jobs. Jobs were estimated based on full-time equivalent (FTE) units with 8 hours per day, 26 days a month, and 12 months a year totaling 312 days per year - about 2,496 hours a year at 8 hours of work per day.

Key findings:

The major VCs prioritized in order of importance are dairy, banana, apiary, onion, tomato, crafts, artisan and trade in agro produce. These value chains were prioritized mainly because their respective key products are profitable, have ready market and overall, they are agro ecologically suitable for production within Kyegegwa, among others. The major Value Chain Actors and their characteristics for each of the prioritized value chain are as below.

Dairy

Input suppliers
- Capital of UGX 4M per year
- Registered at district level

Producers
- Non host with average of 8 cows/ farm
- 70% Ankole
- 3 to 5 litres of milk for Ankole
- 10 litres for improved

Middlemen/ Aggregators
- Owners of milk coolers
- Total capacity 70,600 litres

Transporters
- Use bodabodas and bicycles

Local processors
- 90% women processing ghee
- 40 litres of milk a months

Retailers
- Capital of about UGX 150,000.
- Between 15-20 litres daily

Banana

Input suppliers
- Capital of UGX 6M per year
- Registered at district level

Producers
- SHF about 0.6 acres
- Men and women equally involved
- Host and non host
- Produce 900 bunches per acre

Middlemen/ Aggregators
- Selling an average of 1,000 bunches (20 MT) per week
- Located in Katente Market

Transporters
- Use bodabodas and bicycles
- UGX 500 - 2,000 per bunch

Wholesalers/ Large traders
- Use lorries to transport 800 (16MT) and 1000 bunches (20MT)
- Buy mainly from aggregator

Retailers
- Capital : UGX 120,000
- 10 bunches per week

Onion and Tomato

Input suppliers
- Capital UGX 2M
- Registered at district level
- 60% use own savings
- 40% access credit

Producers
- Refugees, host and non-hosting communities
- O.2 to 0.5 acres
- 1MT per acre for tomato and 1.05 MT for onion

Wholesalers/ Large traders
- 65% of men and 35% of women.
- Wholesalers trade 50 – 375 kg per day.

Retailers
- Capital of UGX 100K per week
- 55% use own savings
- 45% access SACCOs

Apiary

Input suppliers
- Local hive makers
- Large companies:

Producers
- Host, non hosts and refugees
- 70% of are traditional and 30% are the KTB.

Local traders/ processors
- Small processors
- 90% men and 10%

Retailers
- Retail shops
- They buy raw honey from farmers or local

Crafts

Input suppliers
- General merchandize shops in Kampala
- Collectors of material from swamps

Craft Makers
- Individual or groups of refugees, host and non-hosting communities
- 90% are women in all communities
- Major products: School bags, hand bags, Mats, Baskets, and shoes
- Operate at 14% of their capacity

Retailers
- General merchandize shops
- They source from craft makers

Artisan

Input suppliers
- General merchandize shops
- Carpenters supplying shaped timbers

Artisan
- Traditional hive makers using local material
- Produce 24 KTB per year each Sold at UGX 90,000
- Produce 60 traditional hives per year each cost UGX 150,000

Trade in Agro produce

Input suppliers
- Small holder farmers
- Hosts, non hosts and refugees depending on the commodity

Agro produce traders
- Working capital of UGX 100,000 – 150,000
- They deal in banana: 40 bunches per Month

  Onion: 100kg per Month

  Tomatoes: 75kg per Month

  Ground Nuts: 10kg/ Month

  Beans : 20kg per Month

All the value chains prioritized are profitable, and production is mainly for commercial purposes. Dairy generates most employment in the district followed by banana. The details of employment, profitability and market size for the different value chains are as below.

Indicator	Banana	Dairy	Apiary	Tomato	Onion	Crafts	Artisan	Trade in agro produce
GM at producer level per year	3,209,850 per acre	959,000 per cow (Improved Heifer) 369,750 for Ankole	145,818 per KTB hive 58,140 for traditional hive	760,000 per acre	995,200 per acre	8,376,000 (For 240baskets, 360 pairs of shoes 240 and bags)	1,131,840 for 60 traditional and 24 KTB hives	2,608,200 (For trade in banana, Onion, Tomatoes, Ground Nuts flour, and beans)
GM at wholesale level per bunch/Kg/ Liter	6,000 (Per bunch)	300 per litre	5,000 per kg of Honey	400 per kg	200 per Kg			
GM at retail level	5,000 (Per bunch)	300 per litre	8,000 per Kg of Honey	400 per kg	800 per kg			
Pay Back Period at farm level	4 Years 4 Months	11 years 9 Months	1 year and 5 Months	–	–	–	–	1 Year 3 Months
Total FTE per year at district level	8,844	22,731	104	52.52	60.03	4.15	0.228	208.971
Current Market Value at district level in UGX	30,882,500,000	197,600,000	239,160,000	210,000,000	234,000,000	22,960,000	3,060,000	8,136,000

The banana GMs per acre are driven by the volumes dealt in by actors. Retailers deal in the least quantity - only 7% of the volume produced per acre and consequently only make UGX 310,000 from one acre. The payback period for an acre of banana enterprise at farm level is 4 years and 4 months. The FTE jobs for banana VC in the district was estimated at 8,844 with 74% of employment at farm level, while the current market size is UGX 30,882,500,000.

For dairy, local processors of ghee make the highest GMs per liter followed by large scale processors then retailers and aggregators while the farmers earn the least. The investment in an Ankole cow breaks even in 14 years and 9 months under the free-range system, and 12 years and 11 months under paddocking system. However, investment in a crossbreed under paddocking system pays back after 11 years and 9 months. With employment, improved breeds generate most jobs i.e., 16,840 followed by Ankole cows under paddocking (3914) and least is Ankole breed under free range (1,977). The current market size for the dairy VC in Kyegegwa is UGX 197,600,000

Under apiary, the farmers earn the highest GMs per Kg of honey regardless of the hive type. However, the current level of employment under apiculture is low – providing only 104 FTE jobs in a year in the entire district, with an estimated market size of UGX 239,160,000.

With tomatoes, wholesalers and retailers make GM of UGX 400 per Kg while farmers earn the least GM of UGX 380 per kg. The value chain provides 53 FTE jobs with 88% of them at farm level. The estimated market size for tomato in the district stands at UGX 210,000,000. For onions, retailers make the highest GM of UGX 800 per Kg, followed by farmers (UGX 497per Kg) and the least are wholesalers that earn UGX 200 per Kg, while the estimated market size is UGX 234,000,000 in the district. The onion VC provides FTE jobs of 60.03 at district level with 93% of it at farm level.

In Kyegegwa, the common crafts are baskets, shoes and bags. These have small market sizes in the entire district. The average GMs in UGX earned per unit by artisans are 12,000, 8,800 and UGX 9,700 respectively. For the artisanal work for beehives, the GM for the traditional hive is UGX 3,000 while for the KTB, it is UGX 27,500. In each case, an artisan makes a maximum of two hives in a day. With agro produce trade, the commonly traded produces within Kyegegwa markets are onions, tomatoes, fresh beans, ground nut flour and bananas. The traders earn GMs (UGX/Kg) of 490, 400, 580, 1,875 and 250, respectively.

The major challenges faced by the traditional VCs were pests and disease prevalence coupled with use of counterfeit agro chemicals, prolonged droughts, high post-harvest losses, inadequate skills due to weak extension system, weak farmer organizations, seasonality of the produces and poor road network. For the non-traditional VCs, the key challenges were low quality of the products due to inadequate skills, tools and equipment, resources depletion and lack of market. The opportunities are mainly existence of refuges for the market, and interest by government and development partners to invest in the prioritized VCs.

The recommended strategic investments were grouped into categories of crops, livestock, and nontraditional value chains. Capacity building for both skills and equipment, market linkages with focus on building strong producer organization and aggregation centres, post-harvest reduction and value addition, road construction and access to finance are key strategic investment options across the value chains. The details of the strategic investment areas are as below.

	Crops (Banana, Onion, Tomatoes)	Livestock (Dairy and Apiary)	Non trad (Craft, Artisan, Trade in Agro Produce)
DRDIP	• **Invest in Increasing crop production and productivity. This will involve capacity building by collaborating with:** Kawanda Banana Research Program to provide guidelines on Good Agronomic Practices for adoption by all DRDIP beneficiaries. Universities to design and implement a Volunteer Technology Transfer Scheme (VTTS). Volunteers and student interns will train farmers and reduce the burden of staff shortage-enhancing volunteers and farmers skills, create jobs and strengthen farmer-extension-research linkage. Invest in irrigation facilities • **Increase market access and reduce Post Harvest Losses** Invest in building strong farmer groups and aggregation centres. Construct the Katente market. Link farmers to functional markets and FSIs like VSLAs. Rehabilitation of rural roads and build skills of the community on feeder road maintenance	• **Invest in increased and sustainable milk production** Link project to Universities and AFRISA to design and implement a VTTS – to include pests and disease management. Rehabilitate the veterinary Centre and build the technical capacity of the staff and agro vet shop owners in animal health services provision Train Artificial Insemination technicians and equip them with relevant equipment; and link them to semen suppliers Support farmers with improved pasture seed and pasture production and conservation; and beehives • **Increase market access and reduce Post Milking Losses and Post Harvest Losses in apiary** Invest in building strong farmer groups Invest in aggregation centres with group owned cooling facilities for milk, and improved extraction and processing equipment for apiary Link farmers to large processors and FSIs like VSLAs • **Invest in PHH and Value Addition** Invest in generation of secondary products like ghee (using Ize Chan), biogas and bio slurry for dairy, and candles, etc for apiary.	Invest in Kyaka Vocational Centre and Bujubuli Vocational Secondary School and undertake capacity building of beneficiaries. Invest in modern tools and equipment for beneficiaries Invest in market linkages Build market stalls
Public Investment	• **Invest in increased and sustainable production. This involves:** Recruiting staff to fill vacant positions under the Crop Production Unit and equip them with adequate transport. Enforce regulations and by laws GAPs-bananas, and registration and use of agro chemicals. This also includes establishing functional national pesticide residue surveillance plan Construct valley dams to provide water for production • **Invest in PHH and Value Addition** Invest in research to generate appropriate Post-Harvest technologies, and competitive consumer preferred products. Construct and rehabilitate community feeder roads	• **Invest in increased and sustainable production.** Recruit staff to fill vacant positions under the Livestock Production and entomology Units and equip them with adequate transport. Construct safe water sources to provide water for animal production, and community cattle crushes for parasite management. Build the capacity of the district to undertake routine parasite and disease surveillance. Enforce regulations and by laws on registration and use of animal drugs. Construct and rehabilitate community feeder roads.	Recruit staff and build their technical capacity and facilitate them with transport. Promote programs on restoration and sustainable use of ecosystem. Invest in crafting centers. Build and equip more vocational centers.

Implementing these strategic interventions increase profitability coupled with job creation. For banana, GMs at farm level increase by 53.5% while the Pay Back Period reduces by one year. Also, it is estimated that additional 2,946 jobs are created in the district under the banana VC. For dairy, the GMs (UGX) per cow at farmer level raise from 279,625 to 4,117,600, while the Pay Back Period would reduce from 14 years 9 months to 4 years and 6 months. With apiary, these investments raise the GMs per hive per year from UGX 58,516 to UGX 244,118.

Under tomato, farmers can harvest 3 times a year, yield in MT per acre per year increase from 2 to 12 and the corresponding GM (UGX) at farmer level increase from 760,000 to 3,855,000. Besides, the FTE jobs increases from 48 to 189 at producer level and from 3 to 16 at trader level. Also, for onions, the strategic investments would enable farmers to produce for 3 seasons annually and increase the producer GM (UGX) per acre per year from 995,200 to 7,012,780. Also, the FTE jobs at farmer level would increase from 56 to 132; and from 6 to 68 at trader level.

Hapa Kazi tu!

1. INTRODUCTION

1.1. Background Information

> Uganda is the largest refugees' hosting country in Africa and the third globally. As of January 2018, Uganda was hosting 1,411,794 refugees (UNHCR, 2018).

This large number of refugees notwithstanding, Uganda faces further influx of refugees especially from South Sudan, the Democratic Republic of Congo (DRC), Burundi and Rwanda given their continued political tensions and civil unrest. Uganda is a preferred destination by refugees owing to her open-door refugee policy. The policy allows refugees to pursue education and economic activities as a means of earning a living which enables refugees to integrate with host communities almost seamlessly.

Available economic activities enable refugees and host communities to meet their immediate needs to survive as they adjust and execute long-term survival strategies such as access to quality education. Economic activities can either be traditional (on-farm) enterprises such as crop and livestock production, apiculture and fisheries or non-traditional (non-farm) enterprises including retail shops, carpentry, metalworks, brick making, embroidery, crafts, cottage industry, transport services, beauty shops, food kiosks, salaried employment, and casual labour remittances. A study by Lakwo & Enabel (2018) indicated that traditional enterprises offer better livelihoods for supporting refugees and host communities in Northern Uganda. Traditional enterprises also lead to beneficial downstream and upstream linkages like supply of inputs and processing businesses creating more job opportunities and consequently boosting local economies.

Despite the wide range of traditional and non-traditional enterprises available, more than 46% of refugees in Uganda live in abject poverty - they are unable to meet their daily food rations and non-food basic needs. Majority (54%) of refugees depend on aid for survival leading to a dependency syndrome. Donor aid is often inadequate and erratic leaving most needs of the target groups unmet. The unmet needs easily lead to resource-based conflict within and among the refugees and host communities. In case of such conflicts, refugees are the biggest losers because they are already disadvantaged by being in foreign territory. On the one hand, refugees can be a threat as they compete with the hosts for available resources that are barely adequate but on the other hand, they can contribute to the growth of local economies as consumers or by creating job opportunities through businesses.

To strengthen coexistence between refugees and host communities, there is need to implement livelihood development interventions that mitigate risks associated with refugees and at the same time tap into their potential. The interventions should not only support economic independence of the target refugees but also build resilience of refugee hosting and non-hosting communities within the target areas. In addition, the interventions should minimize negative economic and environmental impacts caused by refugee-host community interactions 7. To ensure that the impact of the interventions are sustainable, their design and implementation need to be guided by an understanding of the social, environmental and economic contexts of the target beneficiaries. Social context includes culture and religion, environmental context revolves around management of natural resources such as water while economic context include income generating activities and infrastructure like market systems.

1.2. Objectives of the Development Response to Displacement Impacts Project

Cognizant of the foregoing background information, the World Bank is funding **Development Response to Displacement Impacts Project (DRDIP)** to be implemented by the Government of Uganda in eleven refugee hosting districts. Beneficiaries of the DRDIP are refugees, host and non-host communities. The project seeks to strengthen government institutions and systems in these hitherto underserved areas by delivering three broad objectives..

1) To support development of social services infrastructure (roads, schools and health centres).
2) To support environmental restoration and access to alternative sources of energy.
3) To support livelihood projects.

1.3. Objectives of this Study

Kilimo Trust (KT) was commissioned by the World Bank to support the project team to undertake market and value chain assessments to guide the implementation of the livelihood projects component of the DRDIP among refugee hosting and non-hosting communities, and settlements. The objectives of this Markets and Value Chains Analysis study were to:

1) Map actors and their roles along the selected value chains.
2) Determine profitability of enterprises at each level of the selected value chains.
3) Estimate number of jobs at each level of the selected value chains.
4) Identify constraints and opportunities for each value chain.
5) Recommend strategic areas to invest for each value chain.
6) Test the methodology used for subsequent adoption in the remaining seven districts

1.4. Output

The final output of this study is a market and value chain assessment report. This report is structured as follows: The next chapter describes the methodology used in this study, then the findings per value chain are presented – traditional and non-traditional value chains. Each chapter on the value chains includes a map of the value chain actors, their roles, profitability, number of jobs, opportunities, constraints strategic investments and recommendations for DRDIP. The last chapter in this report ranks the value chains in order of importance and outcomes of DRDIP Livelihoods component.

KYEGEGWA
DISTRICT LOCAL
GOVERNMENT
DISTRICT
REGISTRAR
KYEGEGWA DISTRICT

2. STUDY METHODOLOGY

2.1. Study Area

Kyegegwa district is situated in the mid-western region of Uganda and borders districts of Kibaale in the north, Mubende in the east, Kiruhura in the south, Kamwenge to the southwest and Kyenjojo to the northwest. The district is one of main refugee hosts in Uganda.

Figure 1: A map of Kyegegwa district in Western Uganda

Kyegegwa district has 9 sub counties including the town council i.e. Hapuyo, Kakabara, Kyegegwa, Mpara, Ruyonza, Rwentuha, Kasule, Kigambe, and Kyegegwa Town Council. The district has been hosting refugees from the Democratic Republic of Congo (DRC), Rwanda and Burundi for over 40 years. The refugees are hosted in Kyaka II Refugee Settlement in Kyaka County. The settlement is 81Km^2, spreading through Kyegegwa, Mpara and Ruyonza sub-counties and occupying government-owned land. The district has a population of 325,240 nationals and 44,988 refugees, with the latter accounting for 11.3% of the entire population. The main source of livelihood for natives and refugees is crop farming followed by livestock production. Few people derive their livelihoods from non-traditional activities such as hairdressing, tailoring, and transport services.

The sub-counties and corresponding villages that were subject to this study are indicated in Table 1. Kakabara a non-host subcounty, and most parts of Ruyonza sub-counties have relatively lower population density and land is less degraded compared to Kyegegwa sub-county. According to district officials, Kyegegwa sub-county has the highest influx of refugees which has exacerbated land degradation and deforestation.

Table 1: Sub counties and villages visited

Sub-county	Status of the sub-county	Village	Status of village
Kakabara	Refugee Non-Hosting Sub-county	Kyabakwanga	Refugee Non-Hosting Village
Kyegegwa	Integrated Sub-county	Sweswe	Integrated Village
Ruyonza	Refugee Hosting Sub-county	Mukondo	Refugee settlement/Host Village
		Kayonza	Refugee Non-Hosting Village

2.2. General Approach

The entire markets and value chains study will be conducted in nine districts[1]. The study consists of three phases as summarized in Figure 2.

1) **Phase zero** was for inception and consultations to understand the terms of reference. The World Bank (WB) and Office of the Prime Minister of Uganda briefed Kilimo Trust on the requirements of the assignment. The outputs of this phase were two inception reports.

2) **Phase one** was to pilot the proposed methodology that had been specified in the request for proposal. The pilot study was conducted in Kyegegwa and Adjumani districts. To begin with, a scoping study was undertaken to identify the priority livelihoods and value chains in the two districts. Data were collected from the Project Implementation and Support Team (PIST), District Implementation and Support Team (DIST) and Sub-county Implementation and Support Team (SIST) to establish priority livelihoods in the districts. The scoping study was conducted between November 2019 - January 2020. The prioritized value chains were categorized into **traditional** (Banana, Dairy, Tomato, Onions, Apiary) and **non-traditional** (Crafts, Trading in agro produce and Carpentry) enterprises. The prioritised VCs were validated at the districts, sub counties and village levels beteen January and February 2020. The next stage was a detailed value chain and market assessment of the prioritised VCs. The output of this phase are VC assessment reports, one for each of the pilot district and a revised methodology to be scaled out in the remaining seven districts.

1 Kyegegwa, Adjumani, Koboko, Yumbe, Moyo, Obongi, Lamwo, Kiryandongo and Kamwenge

3) **Phase two** will involve scaling up the study using the revised methodology in the remaining seven districts. The output of this phase will be markets and value chains assessment reports for each of the seven districts (See figure 2).

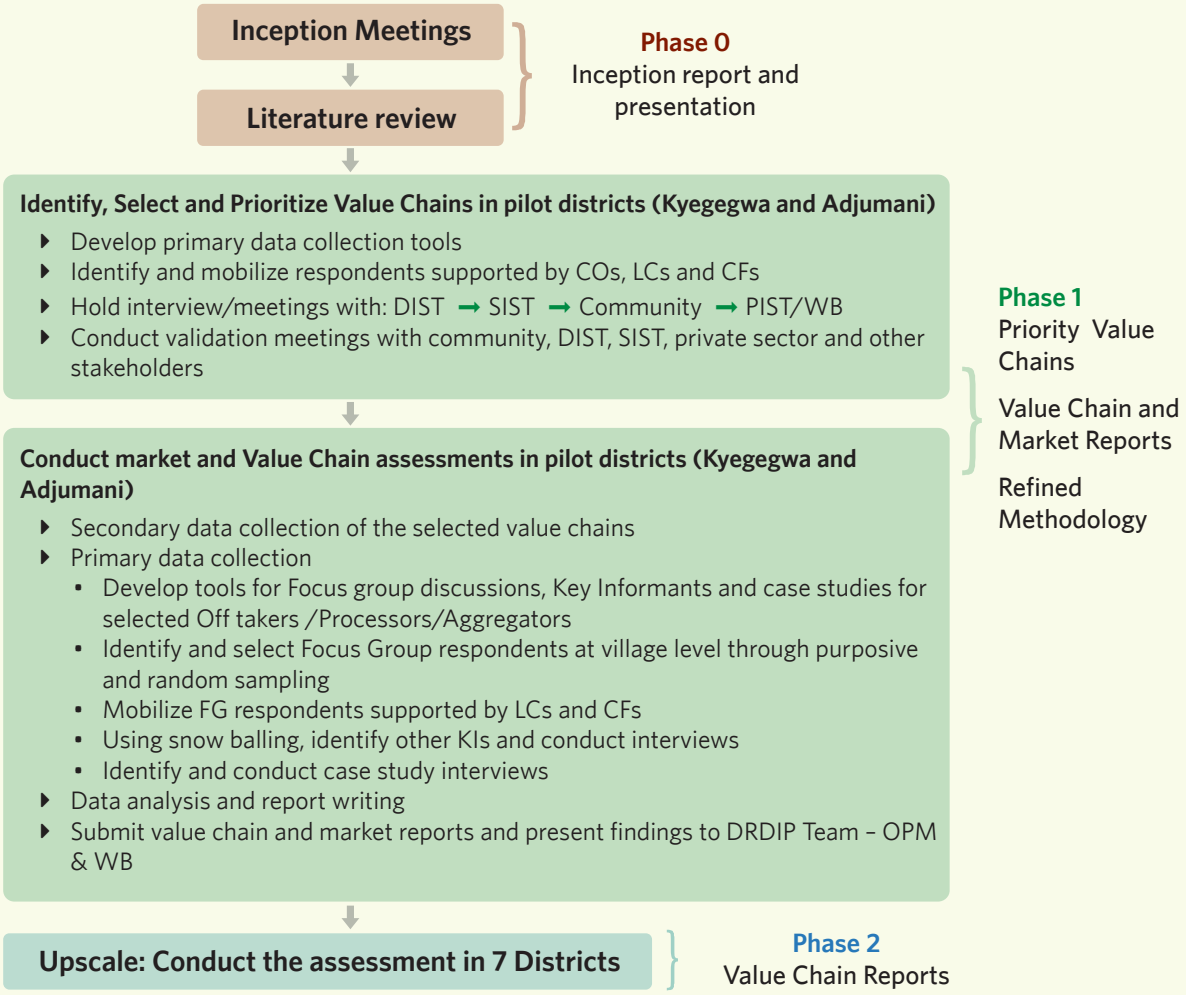

Figure 2: Approach to the assignment

2.3. Sampling Procedure and Data

Secondary information on existing VCs in the study area was collected through literature review and synthesized. Gaps in literature were filled using primary data. Quantitative primary data were analysed using MS excel 2016 and SPSS.20. Qualitative data were analysed using NVIVO.11.

Respondents were selected from both the host and non-host communities for all the VCs. The DIST were conversant of the different communities. Thus, the communities to be interviewed were purposively sampled with the help of the DIST team. In each sub-county, there were 2 focus group discussions (FGDs) per VC each including all gender categories i.e., youth, women and men. Participants of each FGD were purposively selected from refugee, host, non-host and integrated communities to ensure fair representation of the different communities. Each focus group comprised of 12 – 15 participants.

Key informants (KIs) were district technical staff, private sector actors, development partners and some lead farmers. The district staff included District Commercial Officers, District Entomologists, District Agricultural Officers, and development partners. The respondents from the private sector included farmers, traders and processors, while development partners were NGOs. The first KI interviewed was identified by the focus group discussion participants. Thereafter, other KIs were identified through snow balling by the first and subsequent interviewees. Interviewed Lead farmers were identified by participants during the FGDs. The selection process was guided by the interviewer to ensure that men, women and youth were well represented. In addition, well established enterprises and struggling ones among the selected VCs were included. The sample sizes are in Table 2. Notably, some VCs did not have actors in some nodes due to their nature.

Table 2: Sample size of various respondent categories in Kyegegwa

Actor	*Level*	*Banana*	*Dairy*	*Apiary*	*Tomato*	*Onion*	*Artisan*	*Pottery & craft*	*Agro Trade*	Total
Focus groups	Community	2	2	2	NA	NA	2	2	NA	**10**
Key Informants (District officials and Development partners)										
District staff	District	1	1	1	1		1	NA	1	**6**
Development partners	District	1	1	1	0	1	0	0	NA	**4**
Individual respondents (Value Chain Actors)										
Farmers	District	5	5	5	5	5	NA	NA	NA	**25**
Artisans	Community	NA	NA	NA	NA	NA	3	3	NA	**6**
Wholesalers/ aggregators	District	3	3	3	3	3	3	3	NA	**21**
Transporters	District	2	2	NA	NA	NA	NA	NA	2	**6**
Produce Traders/ retailers	District	NA	NA	NA	NA	NA	NA	NA	3	**3**
Processors	Community	NA	3	3	NA	NA	NA	NA	0	**6**
Total		**14**	**17**	**15**	**9**	**10**	**8**	**8**	**6**	**87**

Note: *NA= not applicable*

2.4. Value Chain Analysis

To analyse the VC, actors involved at each node were identified and mapped. Their characteristics, roles and relationships were identified and described. The supply chains, flow of products, Gross Margins (GMs) and share of value for every actor at each node were also established. Furthermore, the challenges at each node were established and mitigation measures were proposed.

2.5. Measurement of Key Performance Variables

Value chain performance was measured using the cost benefit analysis (CBA) framework, share of value (SoV), and an estimate of the number of jobs.

2.5.1. Cost benefit analysis

CBA framework compares discounted benefits that accrue after investing in an enterprise to discounted costs incurred. The decision criterion is that benefits should exceed the costs. CBA can be conducted at individual and community level. At individual level, only benefits and costs that have known market value such as farm produce and inputs are valued using market prices. This leads to financial cost benefit analysis (FCBA) (Sartori et al. 2014). At community level, social benefits and costs such as benefit of trees as carbon sinks and cost of pollution are quantified and valued using shadow prices as opposed to market prices. This leads to economic cost benefit analysis (ECBA) (Commonwealth of Australia, 2006). Based on the available resources (data, time and money), this study adopted the FCBA.

FCBA can be conducted in the short run or long run depending on the enterprise being considered. In the short run (within year), the discounting factor is one and therefore the absolute and discounted values of the benefits and costs remain the same. This is typically referred to as Gross Margin (GM). For an enterprise whose period is longer than a year, discounting is paramount to compute present value of future benefits and costs using a base year as the benchmark for comparison. This is important because a shilling in the present time is worth more than the same shilling in the future (in terms of the value of goods and services it can buy). Thus, discounting helps investors make future investment decisions in the present time. Examples of discounted FCBA proxies include net present value (NPV), benefit cost ratio (BCR), payback period (PBP), and profitability index. More than one proxy can be applied at once for robustness check. However, they all lead to the same conclusion. This study adopted the GM and NPV proxies because the enterprises assessed were selected a priori and therefore not compared with any alternatives. Rather different scenarios of the same enterprises were compared. The higher the GM or the NPV, the better is the scenario. The PBP was used to make recommendations. Interventions with a shorter PBPs were preferred as the DRDIP project has at most 3 years left for implementation.

2.5.1.1. Gross Margin (GM)

The GM was measured according to (Barnard and Nix, 1979) as the difference between revenue and variable cost for each enterprise. It is a short run measure of enterprise performance. Its limitation is that it does not control for time value of money (Lampkin and Measures, 1994). In this study, GM was used to assess performance of annual crops and non-traditional enterprises. It was computed as shown in Equation 1.

GM = (Q*p) – (TVC) ---------- (Eqn. 1)

Where, GM is the gross margin, Q is the quantity of a product sold, p is the price per unit sold and TVC is total variable cost.

2.5.1.2. Net present value

NPV is the difference between discounted cash inflow and outflow over time. The strength of NPV is that it controls for time value of money (Ardalan, 2012). In this study, the NPV technique was applied on Banana, Apiary and Dairy enterprises. As opposed to annual crops such as onions and tomatoes that require less investment, the three enterprises require high initial investment and take time to start generating revenues. The NPV was computed as illustrated in Equation 2.

$$NPV = -C_0 + \frac{C_1}{(1+i)^1} + \ldots + \frac{C_t}{(1+i)^t} \text{ ---------- (Eqn. 3)}$$

Where: C_o is the initial investment, C_1 is the net benefit in year 1, C_t is net benefit at year t, i is the market rate of borrowing, t is the year of reference.

2.5.1.3. Payback period

PBP was used to estimate the effect of alternative interventions on the number of years it takes cash inflow to offset initial capital investment. Interventions that shorten the PBP are preferred (Brigham and Ehrhardt, 2005). PBP was computed as presented in Equation 3.

$$PBP = CI - (TCF_t) \text{ ---------- (Eqn. 3)}$$

Where: CI is capital investment and TCFt is the total cash inflow over time (years) that reduce CI to zero.

2.5.2 Share of value

SoV was applied to compare GMs of actors operating at various levels for each of the VCs studied. The level with actors depicting highest GM captures the highest SoV in the VC. In this study, the SoV was computed as shown in Equation 4.

$$SoV = GMi / TGMvc * 100 \text{ ---------- (Eqn. 4)}$$

Where, GMi is the gross margin of the ith actor in a value chain, TGMvc is the sum of GMs in the entire chain.

2.6 Estimation of jobs opportunities

Existing and potential jobs in the various levels of the selected VCs were estimated following Balgos and Digal (2017). Furthermore, impact of taking advantage of existing opportunities and addressing identified constraints on the number of jobs was assessed through a mock-up process. Family labour was included in estimating labour cost. Primary data were collected ***per acre*** for crop enterprises and ***per animal*** for livestock enterprises based on the quantity of a product handled or installation capacity of equipment in a specific period. Man-days per activity were calculated. Thereafter, the current jobs per node of the chain were estimated based on Full-Time Equivalent (FTE) units following the procedure by World Bank (2015). FTE unit assumes that a man-day is equivalent to 8 working hours per day, 26 working days a month and 12 months a year. This translates to 312 days or 2,496 hours of work per year.

Table 3: Illustration of estimating number of FTE job units per acre

Activities	*# of times for an activity per year (1)*	*# of man days required per activity (2)*	*# of people undertaking the activity (3)*	*Man days per year = (1*2*3) (4)*	*FTE = (4)/312*
Land opening using a tractor	2	1	2	4	0.013
Planting	2	1	7	14	0.045
1st Weeding	2	2	10	40	0.128
2nd weeding	2	2	8	32	0.103
Harvesting	2	3	7	42	0.135
Drying	2	1	4	8	0.026
Threshing	2	2	3	12	0.038
Winnowing	2	2	4	16	0.051
Sorting and packaging	2	2	2	8	0.026
Total labour costs				**176**	**0.564**

The interpretation of the results in Table 3 is that 0.564 FTE job units exist per acre that is cultivated per year which is equivalent to 176-man days. If a farmer cultivates one acre only per year, then the job opportunities created is the product of the FTE units (0.564/acre/year) and the number of acres cultivated (1 acre/year).

3. FINDINGS

3.1. Traditional Value Chains

3.1.1 Banana Value Chain

A. Introduction

Banana is a major food and cash crop in Uganda. It is exported to several countries and in 2018, the export value from Kenya and South Sudan alone was USD 656,000 (ICT, 2020). It constitutes staple food for more than half of Ugandans with a per capita consumption of 172 Kg/person/year (Haggblade and Dewina, 2010). It is produced by 75% of farmers (Paepard, 2012). The crop is mainly grown in the western followed by the central regions of the country, with the former producing 68% of total output (UBOS, 2010). It occupies approximately 40% of the total arable land in Uganda (Dijkxhoorn et al., 2019: Ariho et al., 2015). The crop is mainly grown on small farms of about an acre (Ouma and Jagwe, 2010). There are several cultivars grown but the main one is the East African highland or the cooking type (locally known as matooke) which constitute 93% of the total banana output in Uganda. Harvesting of the crop is all year round although July - September are the peak months while November - March the lean period (Kilimo Trust & UGACOF, 2019). The average yield is 4.2 MT/Ha which is far below the potential yield of 80 MT/Ha (FAO, 2012; Dijkxhoorn et al., 2019). The main constraints to attaining the potential is pests and diseases prevalence followed by the declining soil fertility.

Nevertheless, banana is one of the twelve priority value chains for investment to increase the total export value of agricultural commodities under the Third National Development Plan (2020/21 to 20249/25). It is also one of the key commodities in Kyegegwa and within the Tooro kingdom prioritized for investment. Relatedly, the district local government and the community prioritized banana as one of the seven value chains for investment under the Development Response to Displacement Impacts Project (DRDIP) and according to MAAIF, Kyegegwa lies in a banana production zone.

B. Demand and supply

Uganda is self-sufficient in banana despite a general decrease in production due to diseases particularly banana bacterial wilt, declining soil fertility, reducing farm size and climate change (Nyombi, 2013). About 90% of the bananas produced in Uganda are locally consumed either as cooked or ripe. The remaining 10% is exported. Some varieties such as Mbidde and Musa are processed into juice and alcoholic beverages.

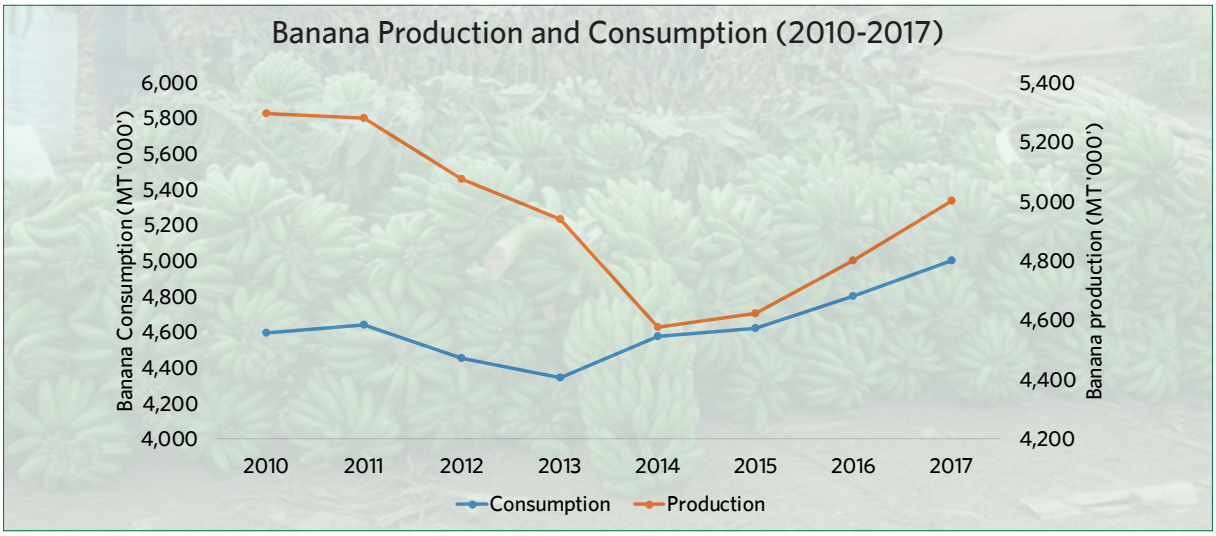

Figure 3: Demand and supply of bananas in Uganda
Source: FAOSTAT, 2020 Accessed on 31st March 2020

Formal banana exports have consistently increased in value and volume overtime. The volume of exports have been increasing at an average rate of 32% per year (ITC, 2020). The biggest export markets are Kenya and South Sudan with exports in 2018 worth US$ 210,000 and US$ 446,000. (Figure 4). The main bananas exported are the cooking type (Bogoya, Sukali Ndiizi). The high production compared to consumption coupled with low export volumes call for investment in value addition to generate high value competitive banana products.

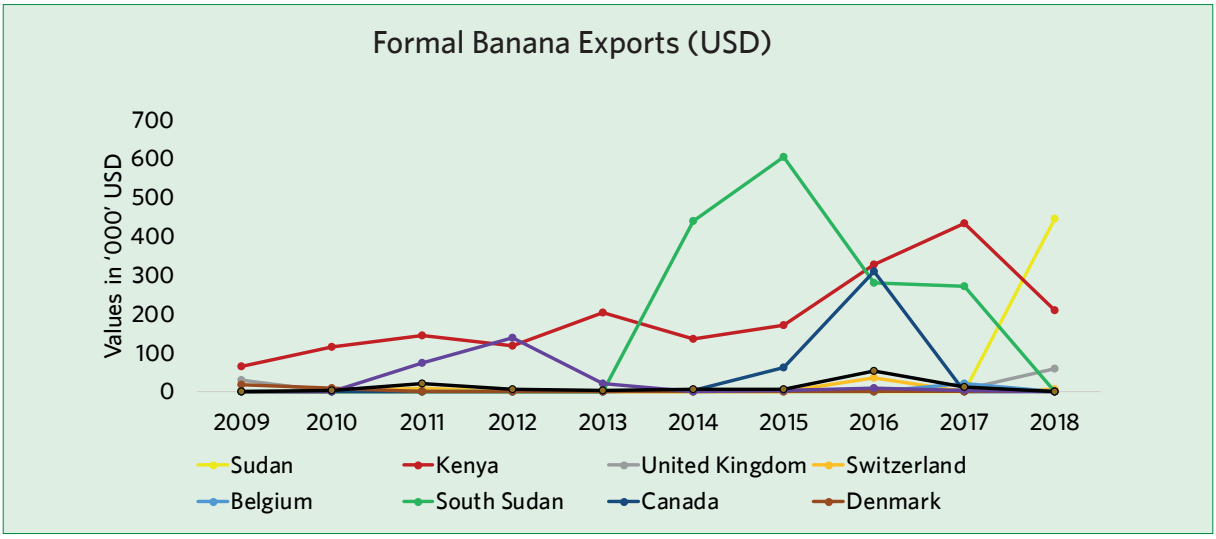

Figure 4: Formal banana export by value (USD)
Source: ITC, 2020 accessed on March 21st, 2020

C. Value Chain Actors

Bananas are grown by host and non-host communities but not refugees. Banana in Kyegegwa is a commercial crop as farmers sell 93% of their produce (Figure 5). Losses at farm level are low at 2% compared to the country's average of 15% but aggregators lose up to 10% of their bananas due to perishability of the fruit. The low level of losses at farm level is because market for fresh bananas is available thus the fruit is sold immediately after harvesting. The main business model is individualistic marketing. Small traders and transporters play an important role because they buy 83% of the bananas from farmers using motorcycles (bodabodas) and bicycles. These small traders are mostly commissioned by large traders to transport fresh bananas from farms to collection points. Traders using bodabodas sell 87.5% of their bananas to aggregators as they can transport the commodity to where the aggregators are located while traders using bicycles sell most of their bananas to retailers due to their proximity.

The average farm-gate price is UGX 5,000 for a 20Kg bunch. Seventy six percent of matooke produced in Kyegegwa end up in districts of Kampala, Wakiso, and Mukono where 93% is sold fresh at average price of UGX 15,000 per 20Kg bunch. Small traders sell the bananas at UGX 7,000 per 20Kg bunch. Notably, large traders (lorry owners) are the main drivers of the banana VC in Kyegegwa mainly because they have access to reliable means of transport which enables them access large and lucrative markets that make them enjoy economies of scale.

Input suppliers operate at a small scale with an average capital base of UGX 6 Million per year. They own agro-inputs or hardware shops. Providers of agro-inputs sell agrochemicals such as pesticides and fertilizer and offer limited extension services on inputs use to farmers, while hardware shops sell rudimentary tools like hand hoes. Forty-six input suppliers were registered with the Kyegegwa district authority and pay UGX 50,000 annually as operational fees. Majority (70%) of the input shops are operated by youth, 20% by women and the remaining 10% by men. This shows that this node of the banana VC has potential to increase youth employment.

Farmers who are about 22,723 in the entire district cultivate small farms of about 0.6 acres per farmer with men and women equally involved in managing banana plantations. Production is by host and none host communities as refugees are not allowed to grow perennial crops. The average productivity was 11 MT/acre which is 175% higher than the country's average. Farmers use rudimentary tools like hand hoes for weeding and sickles for pruning. None of the farmers used tissue culture suckers. Instead, they use suckers from mother plants in their gardens or from neighbors, while a few buy non-tissue culture suckers for UGX 1,000 per piece mostly in Kakoni parish in Mpara sub-county due to their perceived high quality. Similarly, use of good agricultural practices is rare. Only 20% of the farmers mulched their plantations using debris from maize, sorghum and beans, 30% applied manure and 10% used mineral fertilizer. None of the farmers irrigated their farms - exposing them to the negative effects of climate change. The low use of improved technologies is due to their unaffordability e.g. poor farmers may not afford manure and fertilizer at a cost of UGX 14,285 /MT and UGX 3,000/Kg respectively. As is demonstrated later in the report, using improved technologies increases cost of production but not commensurate with increase in revenue as bananas are sold per bunch not per weight.

Farmers mostly grow the East African highland (AAA-EAHB) which is a cooking type and locally called *matooke*. The *Matooke* cultivars commonly grown in Kyegegwa are *Mpologoma, Mbazirume, Kisagwa, Mutule, and Nesira* and they are tolerant to Fusarium wilt disease. Other varieties grown include FHIA hybrid; dessert banana *'Sukali ndizi'* (AAB); plantain *'Gonja'* (AAB); and the beer banana (*Mufunyankobe; and Kayinja* (ABB)). FHIA is an improved variety grown by about 30% of the farmers. FHIA is tolerant to Fusarium wilt, bacterial wilt and *sigatoka* disease as well as weevils. Besides, it is early maturing, drought tolerant and high yielding producing bunches of about 36 Kg compared to the cooking type that hardly yields 30 Kg a bunch. It is also a multipurpose variety that can be processed, roasted, fried or eaten ripe. Nevertheless, it is not popular for cooking due to its low palatability, it's difficult to peel and takes long to cook. The other none cooking banana cultivars are uncommon among farmers given their low productivity caused by their high susceptibility to pests and diseases (Table 4).

Table 4: Proportion of banana producers in Kyegegwa district growing non-cooking bananas

Banana cultivar	Percentage of population growing
Gonja	5
Sukali Ndizi	32
Kayinja	5
Kisubi	10
Mufunyankole	15

Small traders and transporters mainly use *bodabodas* and bicycles for transport. This category has many actors in the VC and competition is stiff. They operate in two ways: 1) buy produce from farmers and sell to large traders and aggregators; and 2) are hired by large traders to transport bananas from farms to designated collection centres. Ninety five percent of *bodaboda* riders are involved in banana transportation. Moreover, 50% of them are commissioned and paid by large banana traders and aggregators. Commissioned transporters are paid UGX 500 - 2,000 per bunch depending on the size of bunch and distance to destination. Transportation using *bodabodas* and bicycles is convenient for large traders and aggregators given the poor state of feeder roads and failure by farmers to aggregate. The remaining 5% of *bodaboda* riders trade banana by hawking.

Large traders use lorries to transport about 500MT of banana daily to markets out of Kyegegwa including Kampala, Wakiso, and Mukono. Approximately 27 trucks each with a capacity of between 800 (16MT) and 1,000 bunches (20MT) take matooke outside Kyegegwa district per day. On average, large traders sell a bunch of 20 Kg at UGX 15,000. Large traders interviewed said that they make three trips a week and work closely with small traders to synchronize harvest and picking times. The interviews with large traders also revealed that they make up to five trips per week if there is enough produce to buy from the farmers.

Aggregators are either medium sized traders or brokers selling an average of 1,000 bunches (20 MT) per week. Their main suppliers are the small traders. Unlike large traders, aggregators own stalls in major markets within the district but rarely own trucks. They sell mainly to large traders and on few occasions sell to markets in neighboring districts. They have a good working relationship with large traders because they can bulk volumes. In turn, this reduces the waiting time by the large traders. This is a potential pathway for structuring the banana value chain in Kyegegwa.

Retailers are small traders located in small trading centres within Kyegegwa. The main difference between them and *bodaboda/*bicycle riders is that they are semi-permanently located in markets and own business structures including shops and stalls. In addition to bananas, they sell a range of other household consumables like vegetables, flour and oil. Their operating capital is about UGX 120,000 and they sell about 10 bunches per week. They mostly sell bananas in bunches or clusters to consumers within their vicinity.

From the study, it is estimated that Kyegegwa produces 243,819 MTs of Matooke bananas annually. Approximately 5% is consumed at household level and 17% is consumed in restaurants, hotels, schools, lodges in Kyegegwa (cooked or ripened). An estimated 76% is sold to markets outside Kyegegwa like Kampala, Wakiso and Mukono. There is minimal processing of bananas in the district - usually into local brew using rudimentary methods.

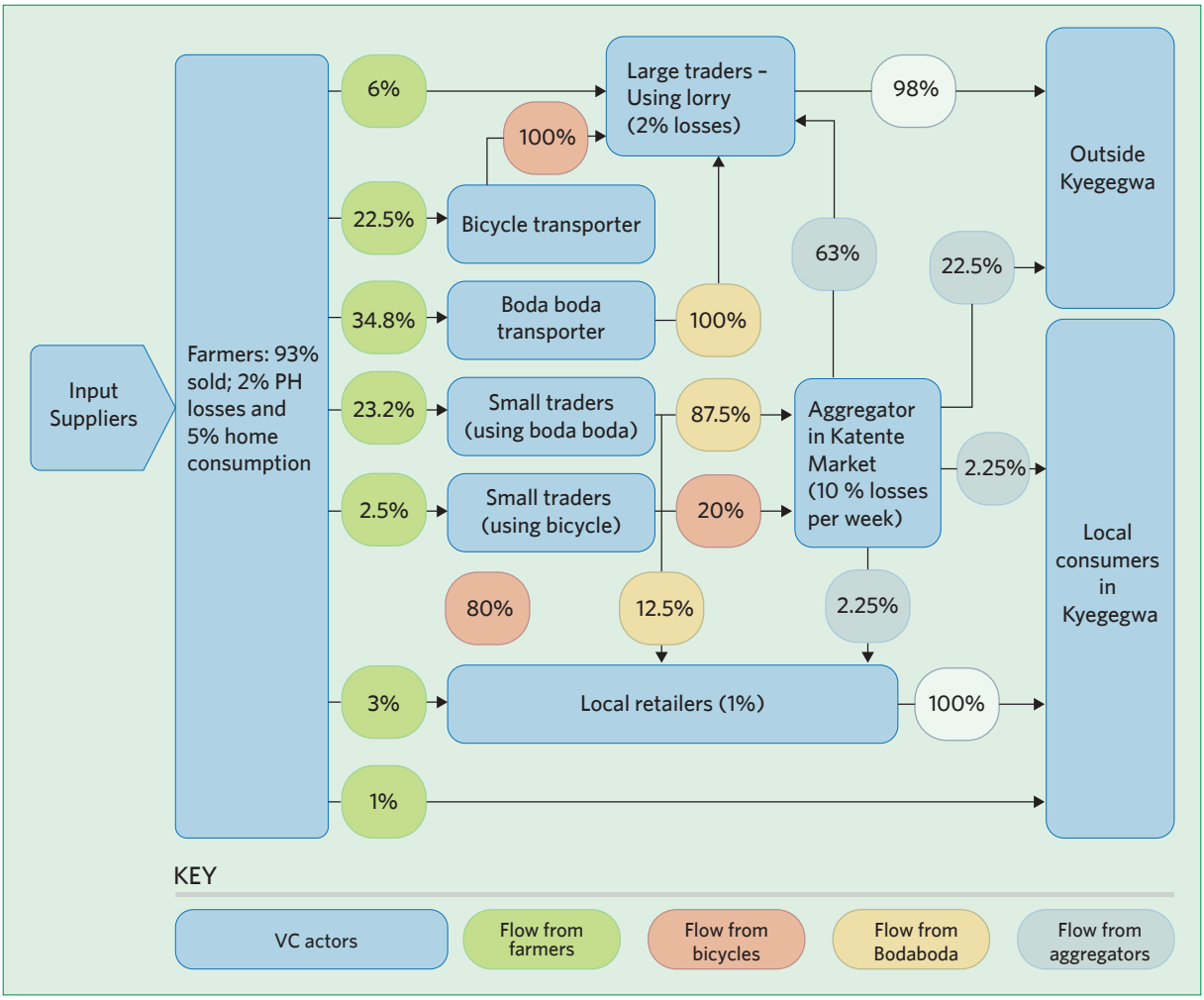

Figure 5: Banana flow and quantification in Kyegegwa
Source: Primary data, 2020

D. Profitability of the Banana value chain

Gross margin for farmers: Banana GM was computed for the second year i.e., 18 months after establishing a plantation and subsequent years (Appendix 1). This is because yield and costs differ significantly between the two periods. In the first two years, the GM was UGX 1,224,700 per acre and UGX 3,209,850 per acre for subsequent years (Figure 6). The increase in the gross margin in subsequent years is a result of doubling of output with two harvests per year. The main cost drivers are weeding and transport contributing 36% and 27% of the total cost per acre per year. The high cost of weeding is partly because most farmers do not mulch the plantations. Mulching is effective in controlling weed. Cost of transport is increased by the poor road infrastructure which reduces accessibility of farms.

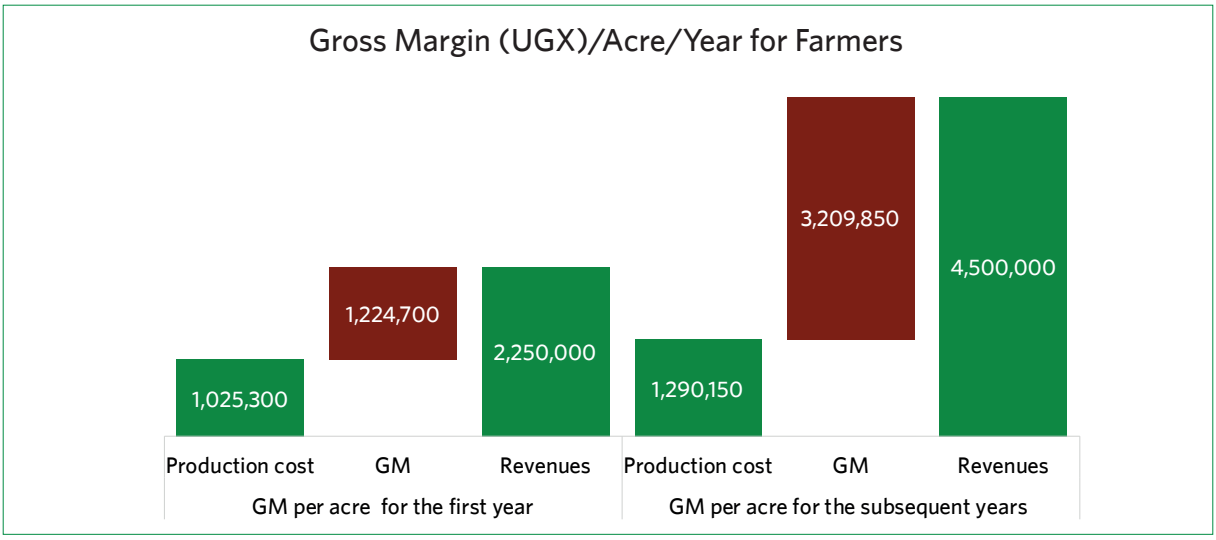

Figure 6: GM for banana farmers per acre per year
Source: Primary data, 2020

Gross margins for traders, aggregators, and retailers: Large traders earned the highest GM of UGX 6,000 per 20Kg bunch because they access more lucrative market in towns like Kampala where prices were three times higher than farm gate prices. Bodaboda traders earn the least GM given their small scale of operation coupled with relatively high cost of maintaining motorcycles compared to the cost of maintaining bicycles. Also, bananas fetch lower prices in Kyegegwa where the core markets for bodaboda traders are located.

From the product flow and quantification, it was established that 93% (837 bunches per acre) of the matooke produced was sold. About 6% (54 bunches per acre) was sold directly to large traders while 58% (533 bunches per acre) was sold to traders that use bodabodas and 25% (225 bunches per acre) was sold to traders who use bicycles. Considering the GMs per acre/ year and per bunch, large traders make the highest profit in the Kyegegwa banana VC. The retailers earn the lowest profit per acre because of the volumes they handle although they are second in profit making per bunch (Figure 7).

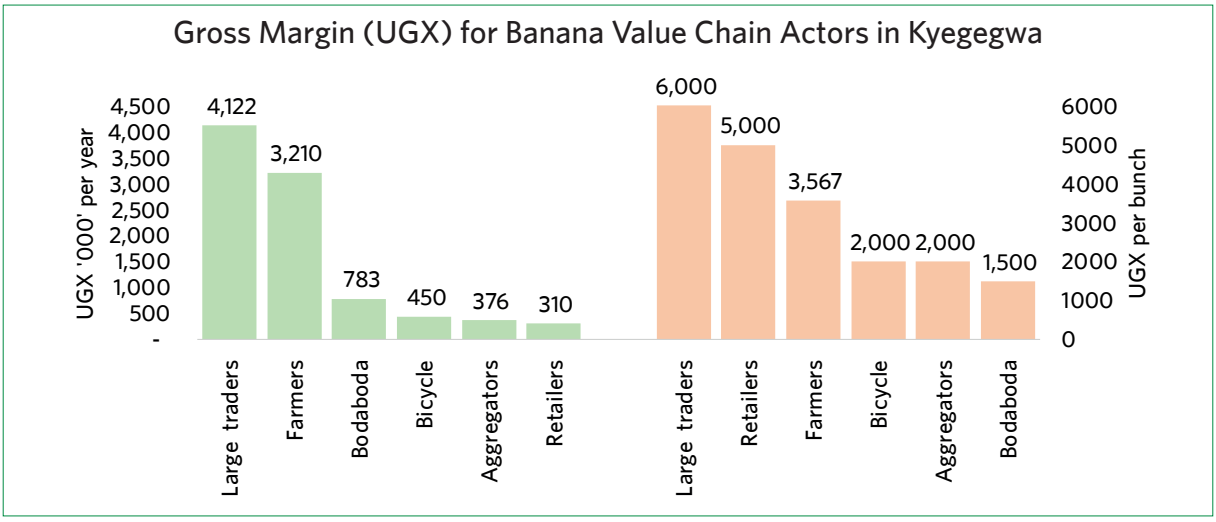

Figure 7: Gross Margin per Actor
Source: Primary data, 2020

To inform the DRDIP decision to support the banana VC, the CBA ration was calculated for one acre under the current production system with assumptions based on data collected during the survey (Fig 8). The costs and benefit were projected using a discount rate of 9%. Estimated NPV was UGX 14,112,281.00 implying that banana farming under one acre is viable in the long run. The enterprise will break even in 4 years and 4 months (see details in appendix 2).

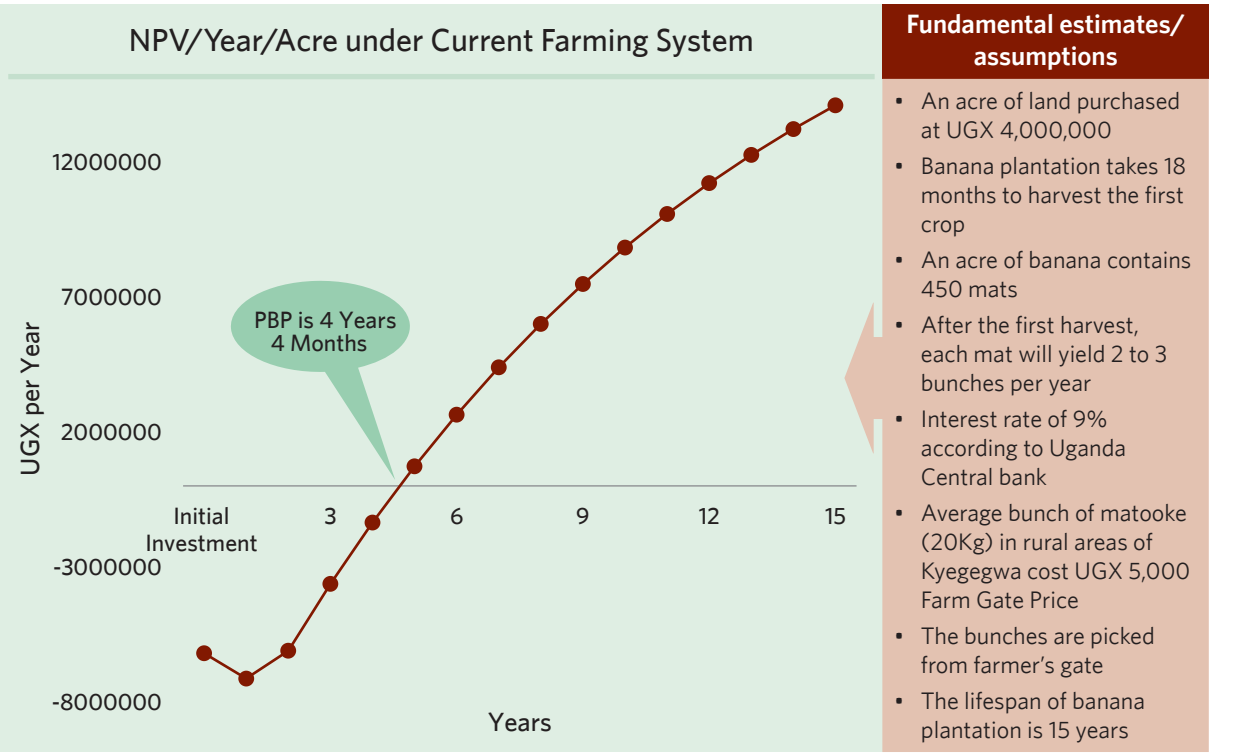

Figure 8: NPV /year/ acre of banana
Source: Primary data, 2020

Six supply channels for green bananas were identified (Figure 9). Overall, the shorter the chain and the closer an actor was to the final consumer, the higher the Share of Value (SoV). Notably, for all channels, the actor who transacts with the final consumer gets the biggest SoV. Channel 1 gives the farmer the biggest SoV followed by channel 2. However, the absorption capacity of retailers under channel 1 is limited as they cannot handle large volumes from most of the farmers. Thus, the study recommends channel 2 for the farmer as the large traders here can handle all the volumes produced by most farmers.

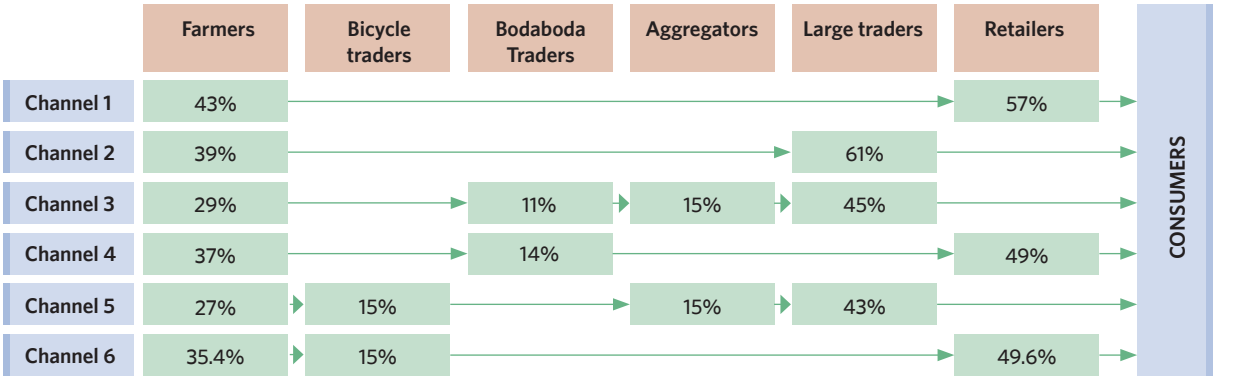

Figure 9: Trading channels for the banana value chain actors in Kyegegwa **Source:** Primary data, 2020

E. Employment generation potential and other potential impacts

The FTE job units were calculated using variable costs per acre and used as the multiplier factor to estimate the number of FTE jobs from 13,545.5 acres (total number of acres currently planted with bananas in Kyegegwa). The existing production system generates 0.65 FTE units per acre of bananas translating to 8,884 jobs in Kyegegwa with all the 13,545.5 acres cultivated (Table 5). Using the primary data collected, current wages per acre and the total wages are approximately UGX 1,017,364 and UGX 13,871,419,536 annually (Table 5).

Table 5: Estimated number of jobs in the Banana Value Chain in Kyegegwa district

Value Chain Node	FTE jobs		Total wages in UGX	
	Acre	13,545.5 acres	Acre	13,545.5 acres
Production (Variable costs)	0.48	6,560	748,800	10,233,600,000
Retailers within district	0.014	189.64	21,840	295,831,536
***Bodaboda* and bicycle transporters**	0.136	1,837	211,563	2,865,720,000
Aggregators	0.013	174.9	20,143	272,844,000
Wholesaler node	0.009	82	15,018	203,424,000
Total	**0.65**	**8,844**	**1,017,364**	**13,871,419,536**

The wages per node are cumulative wages per actor / acre/total acres.

Besides employment, banana in Uganda has several uses. It is an important income source for many households in Kyegegwa. Several products such as fresh fruits, suckers and leaves are sold by the farmers. In addition, the fruits are used in making of several drinks like juice, local brew, waragi and wine. They are also baked into products like queen cakes, pancakes (Kabalagala) and dried chips, which are highly preferred by children. The largest certified banana processing companies in Uganda include Jakana Foods Ltd, Sumz Foods Ltd, Bio Fresh Ltd as well as Kanywe Banana Wine Ltd. They make banana crisps, juice and wines. The dried banana fibres are used for thatching, decoration and for handicrafts especially baskets and mats. Furthermore, banana is a major staple food for more than half of Ugandans. The country has a per capita banana consumption of 172 Kg/person/year (Haggblade and Dewina, 2010). The fruit is prepared and consumed in various manners e.g. boiled, steamed, eaten ripe as dessert, etc. The leaves are used in cooking matooke and several other foods like cassava, sweet potato, etc. Also, in Kyegegwa and across several districts, the leaves and pseud stems are used as animal feeds and source of manure. Culturally in Kyegegwa and many parts of Uganda, local brew processed from banana is part of dowry to the bride's parents. Besides, during the giveaway of the bride, the groom is fed on chicken dish (called Luwombo) prepared using banana leaves. The banana plantation also provides a natural cooling effect to the surrounding environment and absorbs the carbon dioxide which is a major GHG.

However, banana production is escalating environment degradation in Kyegegwa as the forests are being replaced with banana plantations. Besides, banana is a heavy feeder crop and nutrient replacement is not commensurate with the high rate at which they are mined. Nevertheless, with good management practices comprising recommended spacing, construction of soil and water conservation structures stabilized with legumes like *Calliandra* sp. and use of appropriate intercrops, banana is a good candidate crop in mitigating against the negative climate variability effects through reducing water and soil erosion and leaching of nitrogen as well as boosting the yield of the intercrop for increased farm income.

F. Threats and community preparedness

The major threats to increased and sustainable banana production in Kyegegwa are pests and diseases, declining soil fertility, prolonged droughts, low banana price during bumper harvest while investment in research for production technologies and value addition is inadequate. The banana weevil is the most devastating pest followed by nematodes, while for diseases, it is the Banana Bacterial Wilt (BBW) then the Fusaruim wilt especially for the plantain types.

To manage the wilts, farmers are advised to destroy and burry the entire mat of the affected plants using heat treated or sterilized tools as well as chop off the male buds using a forked stick; avoid using suckers from infected banana fields, and movement of implements from infected to clean fields. Besides, for bacterial wilt, the central government and local communities imposed by-laws and quarantine measures to restrict movement of banana products from infected to none infected areas. At community level, if a farmer has a diseased plant and it is not removed within 24 hours, he or she can face a fine, or even prison in some cases. The control measures for the pests include use of clean disease and pests free planting materials which are either tissue culture or corm pared suckers; good husbandry practices i.e., weeding, de-suckering, pruning, manuring and mulching, to produce vigorous plants that tolerate the damage; removal and split of harvested stems into small strips and drying them to destroy breeding sites for the weevil and expose the larvae to desiccation and death; and trapping weevils using pseudo stem split pieces. In addition, for nematodes, besides corm paring, treat suckers with hot water at 500C for 30 minutes or with a nematicide using a recommended rate, and practice crop rotation with non- or less favorable hosts. For the declining soil fertility and prolonged droughts, farmers are advised to apply soil and water conservation technologies such as construction and stabilization of trenches using Nitrogen fixing plants like Calliandra and Lablab, mulching, and avoid intercropping banana plantations with heavy feeder crops like maize.

The challenge however is that the community are less prepared to address these threats. Access to extension services is limited as the district agricultural department is understaffed. The required staffing level for crop production in the district is 20 staff with two officers at the district and 18 field extension officers – 2 per sub county. However, currently, the total is 10 i.e. one officer at the district and 9 extension staff in the field. Moreover, out of the 9 extension officers, only 4 have motorcycles. There are by-laws to ensure good plantation management such as construction and stabilization of soil and water conservation structures, destruction of infected plants, etc. The LCs at village and sub county level are mandated to enforce these by-laws. However, like for the extension staff, the enforcers are few and are not facilitated to undertake the enforcement. As well, the current soil and water management practices used are labor intensive, yet the labor-saving technologies are expensive and not readily available in Kyegegwa. Besides, adoption of appropriate technologies is deterred by the low banana prices especially during bumper harvests where the average FGP for a 20Kg bunch is UGX 2,000. The existing farmer groups are characterized by inadequate organizational and bargaining skills to establish and sustain functional business linkages with large buyers to enable the farmers attain fair market prices. Moreover, the appropriate market competitive value-added banana products and associated processing technologies are not readily available.

Table 6: Constraints and mitigation strategies in Banana Value Chain

	Main constraints	Mitigation strategy
Farmers	1) Poor state of village roads resulting in increased cost of transportation, losses and ultimately reduced profits. 2) Weak management of farmer organizations limiting benefits that can accrue due to collective action like economies of scale. 3) High prevalence of pests and diseases that suppress yields. 4) Unreliable supply of effective pesticides, fungicides and other agro chemicals coupled with limited knowledge of their use, and consequently reduced yields. 5) Lack of capacity to increase the shelf life of bananas and consequently high post harvest losses.	1) Construction and rehabilitation village roads. 2) Building capacity of farmers on group management. 3) Registration and certification of suppliers who have the capacity to supply quality agro chemicals 4) Training of farmers on safe use of agro chemicals. 5) Commission NARO to undertake research on affordable technologies to increase the shelf-life of bananas.
Traders	1) Poor state of village roads resulting in increased cost of transportation and losses. 2) Roadblocks and bribes that increase the time and cost of accessing markets. 3) Weak linkage between farmers and buyers leading to untimely harvesting and post-harvest losses. 4) Inadequate working capital that suppress business growth.	6) Construction and rehabilitation of village roads. 7) Facilitation of functional business linkages between farmers and buyers to reduce information asymmetry. 8) Building/ rehabilitation of aggregation centres to reduce losses. 9) Linking traders to financial providers.

G. Public and community sector support

Banana is a very important crop in Kyegegwa for income, food and cultural purposes. However, the public and community support is limited to MAAIF, NARO and the district local government. MAAIF provides two grants i.e., production and marketing grant, and agriculture extension grant; and the district implements the interventions which include farmer trainings and market linkages. Each of these grants is cross cutting across the production departments in the districts which are: crop, veterinary, fisheries, entomology, and agriculture engineering- water for agricultural production. NARO generates relevant production and post-harvest technologies for each zone in the district. These include selection and promotion of suitable banana cultivars and appropriate ploughing technologies.

H. Recommended strategic investments for DRDIP

The banana VC in Kyegegwa is central to improving people's livelihoods through increase in incomes among various actors, food security and jobs creation. However, there are several threats that constrain achieving the potential. The key threats include a) high pests and diseases prevalence, b) declining soil fertility, c) prolonged drought, c) low banana price during bumper harvest, d) inadequate investment and availability of appropriate production and value addition technologies. Therefore, the key **strategic investment** areas recommended for DRDIP are:

1) **Invest in increasing crop production and productivity.** This will involve the following:

- Work with Kawanda Banana Research Program and district to develop guidelines on Good Agronomic Practices for adoption by all DRDIP beneficiaries; and facilitate existing staff to train farmers. The key agronomic practices will include integrated pests and disease management and integrated soil and water management.

- Link the project to Universities to design and implement a Volunteer Technology Transfer Scheme (VTTS). Volunteers and student interns will train farmers and reduce the burden of staff shortage-enhancing volunteers and farmers' skills, create jobs and strengthen farmer-extension-research linkage.

- Recruit and fill the vacant positions under the crop production department and equip them with adequate transport to enable them train farmers. Currently, there are 10 staff in crop production comprising the Production Coordinator, the District Agricultural Officer: and 9 extension staff in the field. The number of Field Extension Agents is just half of the required number of 18. Moreover, out of the 9, only 4 have motorcycles.

- Liaise with Namalere Agricultural Mechanization Resource Centre to develop affordable labour-saving technologies for the small-scale farmers. This is particularly important for equipment for ploughing and construction of soil and water conservation technologies. Currently, using the existing equipment costs over 50% of the farm labour for banana production.

- Enforce by-laws on good agronomic practices in banana plantations. The government should facilitate the LCs at the village and sub county levels to enforce the application of good agronomic practices for increased and sustainable banana production.

2) Increase market access and reduce Post-Harvest Losses

- Invest in building strong farmer groups. This should be accompanied with equipping farmer groups with knowledge and skills in leadership /governance, financial literacy, market-oriented production and farming as business. The groups should also be linked to large scale traders, and FSIs including being supported to establish their own VSLAs.

- Build aggregation centres at sub county level. These are critical in supporting collective marketing of bananas. Collective action reduces transaction costs as it is attractive for buyers to buy in bulk. Farmers can also guarantee supply from a central point and therefore can negotiate better prices for their produce. Although farmers' income would reduce by 8% because of increased losses in storage, jobs would increase by 20% and 322% at farm and aggregation levels if these centres are built. Notably, if aggregation centres are built without the road improvements, the incentive to aggregate does not exist.

- Construct the Katente market which is currently an informal roadside market but a hub for bananas sold in Kyegegwa. Constructing market infrastructure would support aggregation, ensure that bananas supplied meet set quality standards and reduce transaction costs. A positive spill over effect of constructing the Katente market would be that other commodity traders involving both host and refugees would use the same facility. The specific request from the market's management authority interviewed was to "build a standard structure for the market, equipped with water and sewerage (toilets) services, electrification and proper waste management". The Katente market is unique as described in the case below. Therefore, it is of special interest.

- Rehabilitate rural roads and build skills of the community on feeder roads maintenance. Such roads include Kyegegwa to Kyaka (19Km), Kyaka-Kakoni-Kihumuro (10Km), Kyaka-Kayonza-Kisagazi (15Km), and Kyegegwa-Hapuuyo-Kibaale (UNRA Road in the North, about 40km to the DRC Border). This will allow large traders to purchase produce which are deep within the villages. In turn, farmers will get higher prices for their bananas as the number of middlemen involved in linking farmers with buyers will be reduced. Besides, the transportation time by the traders will reduce resulting into reduced PHL on the road. The roads also have a multiplier effect on other economic activities that would improve the livelihoods of communities. The GMs of farmers, large traders and retailers will increase by 13%, 11% and 900% respectively (Table 7). Large traders will also create 25% more jobs if this recommendation is implemented.

3) **Invest in research to generate appropriate Post-Harvest technologies and competitive value-added banana products.**
   - The project can work with the Uganda Industrial Research Institute (UIRI) and Makerere University Department of Food Technology & Nutrition to develop competitive banana value added products. During bumper harvest, the average farm gate price for a 20Kg bunch is UGX 2,000. As the commodity is perishable, farmers cannot hoard it for a better price; while the transportation costs is high during the rainy season due to impassable feeder roads and delays on the road escalate perishability. Consequently, the farmers and traders register losses. Moreover, the appropriate market competitive value-added banana products and associated processing technologies are not readily available.

4) **Promote afforestation of degraded and non-agricultural fields.**
   - Kyegegwa especially the Northern side of the district is characterized by hilly rocky terrain with some fields not under cultivation. These can be planted with forests to replace those being destroyed to plant crops like banana.

The assumptions and scenarios analysed as shown in Table 7 below.

Table 7: Different Scenarios of strategic investment in Banana VC

Scenarios	Description
Scenario 0: Current scenario	Yields are unchanged, roads not improved and no aggregation centres
Scenario 1: Increase yield	Farmers are trained on GAP, invest in mulch and other GAPs. Yields increase by 25%
Scenario 2: Improving feeder roads	If all rural feeder roads[2] are rehabilitated only
Scenario 3: Building Aggregation centres	Only aggregation centres built at village level. Bunches of matooke transported from farm to aggregation centres.
Scenario 4: Improving road and yield	Farmers trained and supported in GAP and feeder roads are improved.
Scenario 5: Improving road infrastructure and building aggregation centres	Roads improved and aggregation centres at village level built and farmer groups sell directly to truck drivers.
Scenario 6: Increasing yields, improving roads and building aggregation center	Farmers trained in GAP, roads are improved and aggregation centres at village level built from where farmer groups sell directly to truck drivers.

2 Rural roads include Kyegegwa to Kyaka (19Km), Kyaka-Kakoni-Kihumuro (10Km) and Kyaka-Kayonza-Kisagazi (15Km) (All Subcounty Roads in the South) and Kyegegwa-Hapuuyo- in Kyegegwa (UNRA Road in the North, about 40k to the DRC Border

Table 8: Summary of the impact of the strategic investments on GM and Jobs at the various value chain nodes

Actor	Item	Current production system	Adopt GAPs	Improve village roads	Build aggregation centres	Scenarios 1 & 2 combined	Scenarios 2 & 3 combined	Scenarios 1, 2 & 3 combined
		Scenario 0	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Farmer	Price per bunch	5,000	6,250	5,500	5,000	6,500	6,000	7,000
	Revenue per acre per year	4,500,000	5,625,000	4,950,000	4,500,000	5,850,000	5,400,000	6,300,000
	Cost of production per acre per year	1,090,000	1,460,000	1,090,000	1,360,000	1,460,000	1,090,000	1,460,000
	GM in UGX per acre per year	3,410,000	4,165,000	3,860,000	3,140,000	4,390,000	4,310,000	4,840,000
	% change in GM	NA	22	13	- 8	29	26	42
	Jobs created	6,560	8,200	6,560	8,243	8,200	6,560	9,884
	% change in Jobs	NA	20	0	20	20	0	34
	Pay Back period in Years (Y) and Months (M)	4 Y and 4 M	4 Y and 6 M	3 Y and 10 M	4 Y and 7 M	3 Y and 11 M	3 Y and 7 M	3 Y and 8 M
Bicycle and *bodaboda* transporters	Variable costs in UGX per acre per year	261,000	261,000	13,050	261,000	13,050	13,050	13,050
	Revenue in UGX per acre per year	1,044,000	1,044,000	52,200	1,044,000	52,200	52,200	52,200
	GM in UGX per acre per year	78,3000	783,000	39,150	783,000	39,150	39,150	39,150
	% change in GM		0	-95	0	-95	-95	-95
	Job created	1,836.90	1,836.90	918.50	1,836.90	918	918	918.5
	% increase in jobs	NA	0	-50	0	-95	-95	-50
Aggregators	Variable costs in UGX per acre per year	1,316,000	1,316,000	61,100	1,316,000	61,100	61,100	61,100
	Revenue in UGX per acre per year	1,692,000	1,692,000	84,600	1,692,000	84,600	84,600	84,600
	GM in UGX per acre per year	376,000	376,000	23,500	376,000	23,500	23,500	23,500
	% change in GM		0	-94	0	-94	-94	-94
	Job created	175	175	175	736	9	736	736
	% increase in jobs	NA	0	0	322	-95	322	322
large traders	Variable costs in UGX per acre per year	6,183,000	6,526,500	6,874,500	6,183,000	6,874,375	5,719,500	6,874,375
	Revenue in UGX per acre per year	10,305,500	10,992,500	11,460,000	10,305,000	11,842,000	10,305,000	11,842,000
	GM in UGX per acre per year	4,122,000	4,465,500	4,585,500	4,122,000	4,967,625	4,585,500	4,967,625
	% change in GM		8	11	0	21	11	21
	Jobs created	82	82	61	82	61	61	61
	% increase in jobs	NA	0	25	0	25	25	25
Retailers	Variable costs in UGX per acre per year	387,500	387,500	341,000	310,000	403,000	372,000	434,000
	Revenue in UGX per acre per year	697,500	697500	651000	620000	713000	682000	744000
	GM in UGX per acre per year	31,000	310,000	310,000	310,000	310,000	310,000	310,000
	% change in GM	NA	0	0	0	0	0	0
	Jos created	189.64	189.64	189.64	189.64	189.64	189.64	189.64
	% increase in jobs	NA	0	0	0	0	0	0

A Case Study of Katente Market

Katente Market is located in Kyegegwa along Mubende road about one kilometer from the district offices. It is unique because it is the main aggregation centre of bananas from the entire Kyegegwa district. About 46 aggregators operate in the market every day comprising 10 women 5 youth males and 31 men. All the aggregators are natives but some suppliers of bananas are refuges mostly using motorcycles and bicycles. Between 20 to 50 motorcycles and 10 - 20 bicycles supply the aggregators in the market daily. The market fills about 720 MT trucks per day.

Small traders pay a daily fee of UGX 1, 000 each, while aggregators pay UGX 2,000 each. Each truck that loads from the market pays UX 5,000 per trip. If well managed, the market can generate adequate revenue for maintenance.

3.1.2 Dairy Value Chain

A. Introduction

The livestock sector in Uganda contributes 18% to the agricultural GDP with dairy contributing about 80% of the livestock GDP (CDKN-Uganda, 2018). This makes dairy the second important sector in Uganda after cereals (Kabwanga et al., 2015). It is a source of food, income and employment (UBOS, 2017). According to the Dairy Development Authority (2018), 80% of the milk produced is sold and 33% is processed while 66% is sold raw. Processed milk products include milk powder, Ultra-Heat Treated (UHT) milk, pasteurized milk, yoghurt, butter, milk-based ice cream, cheese, ghee and casein.

Small-scale dairy farmers own 90% of the milked cows (Kabwanga et al., 2015). According to the Inter-Governmental Authority on Development (IGAD), 60% of households in Uganda keep mainly indigenous cattle (IGAD, 2012). Relatedly, majority of milk production systems in Uganda are 'Low input–low output'. This explains the low productivity of 1 - 2 litres per day per cow compared to hybrids that have an average yield of 15 litres per day per cow depending on the animal and husbandry practices used. Dairy is one of the twelve priority value chains for investment to increase the total export value of agricultural commodities under the Third National Development Plan (2020/21 to 20249/25); and is also prioritized for investment by the Tooro kingdom. In Kyegegwa, the district local government and the community prioritized dairy as one of the seven VCs for investment under the Development Response to Displacement Impacts Project (DRDIP). Also, Kyegegwa lies under the Western Savana Grassland agro ecology which is zoned for cattle keeping, among other enterprises.

B. Demand and Supply of milk in Uganda

Milk demand and supply have been increasing at a rate of 3.4 % and 4.6% per year respectively (Figure 10). Increase in demand is driven by population growth of 3.2% per annum, urbanization and changing lifestyles towards consumption of animal-based food products. In 2018, milk production was estimated at 2.04 billion litres while consumption was at 2.57 billion litres (UBOS, 2019). This means that Uganda has unmet demand or deficit of 53 million litres (21%) and yet the yearly per capita consumption of 58 litres is far below the 200 litres recommended by World Health Organization (WHO). This clearly shows that there is potential for market expansion within the domestic market.

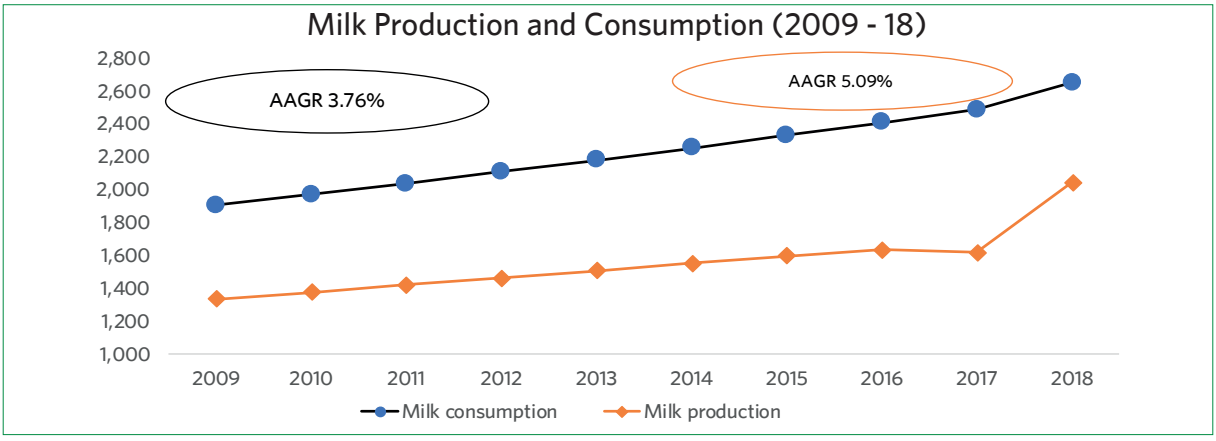

Figure 10: Milk production and consumption in Uganda
Source: FAOSTAT, 2020; UBOS, 2020

Despite the deficit, Uganda has also registered increase in milk products exports than import over years and in 2018, Uganda exported non concentrated milk valued at USD 48.8 million and 84% of it went to Kenya (ITC, 2020) while the imports were worth USD 2.9 million. On average, 91% of the milk, concentrated and not concentrated milk, is exported to Kenya and South Sudan, but there is potential market to Tanzania which has an annual deficit of at least 10 million litres. The Annual Average Growth Rate (AAGR) of exports of non-concentrated milk from 2009 to 2018 is 47.2% while for imports it is 164%. The growth in exports is a very good sign of market growth. Similarly, in 2018, the concentrated milk formal exports stood at USD 20.6 million and imports at only USD 0.8 million. While the concentrated milk exports have been increasing on AAGR of 44.6% from 2009 to 2018, the imports have been decreasing by 6.2% signaling the improvement value addition potential and import substitution. However, the export for other dairy products like butter, whey, cheese and curd is low compared to concentrated and non-concentrated milk. Nevertheless, the total value of exports is increasing on an annual average growth rate of 33.6% and the total imports at a rate of 17.3%. This indicates a potential market opportunity in Kenya and Tanzania where the annual production in litres is 4.88 bn and 2.21 bn while the respective consumption is 5.0 bn and 2.22bn litres.

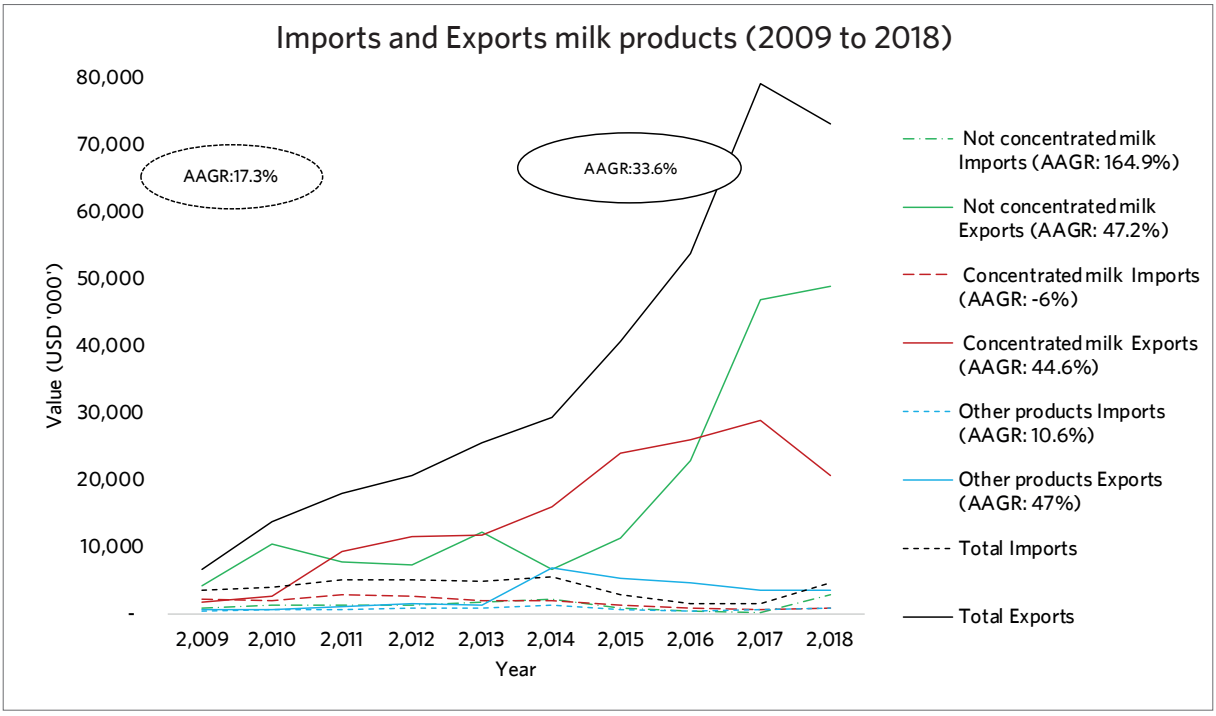

Figure 11: Imports and Exports milk products from (2009 to 2018)
Source: International Trade Centre, 2020

C. Value chain actors and potential strategic partners in the private sector

Dairy farming in Kyegegwa is a commercial enterprise, where 95% of the milk produced is sold although 25% is lost after milking due to due to spillage and spoilage attributed to poor handling practices such as the use of plastic and or leaking containers as opposed to metallic cans exacerbated by poor road infrastructure. Seventy percent of the milk is sold to cooling facilities manned by individuals while another 20% is sold to Dairy Interest Groups. These in turn sell all the collected milk to large processors including Pearl Diaries Ltd and Brookside Ltd. The rest of the milk is sold to small processors (2%), retailers (2%) and consumers (1%). The small processors mainly produce ghee while retailers sell fresh milk as shown in the figure 12.

The value chain actors in the in the dairy VC are individual households that own farms, agro-vets, farmer groups, aggregators with milk cooling facilities, retailers and small and large processors (Figure 12). There are 40 Agro Vets in Kyegegwa and are mainly found in town and other trading centers. They operate on a small-scale each with an average working capital of UGX 4,000,000 per year. They sell acaricides, de-wormers, vaccines and spraying pumps. There are several acaricides traded such as Tack tick, Milbatraz, Duodip, Alfapo, Supona Extra etc. and the price (in UGX) varies according to type and quality but it ranges between 12,000 for Tack tick and 130,000 for Supona Extra. This is also true for de-wormers which have several types like Lvemectin, Liverfa, Albafas, Albendazo, and cost per unit ranges between 25,000 for Ivemectin and 36,000 for Liverfa. One animal receives 4 dozes a year that is administered every after 3 months, and for each drenching, 100 mills are used as a recommendation. However, for vaccine, the only one reported as being traded is East Cost Fever (ECF) Vaccine which costs UGX 500,000 for one animal administered 4 times; and is purchased from Kampala. Other drugs are obtained from Kampala and Mbarara. About 15% of these dealers also process hay and silage at a small scale and sell to the farmers. The refugee communities neither use nor trade in these feed types. Operators of agrovet shops offer extension services to farmers. They should be Diploma Holders in an animal related discipline, must be licensed and are supervised by the District Veterinary Office. The agro vets have no access to refresher trainings on animal health services and they also need knowledge in business management. Complementing the agro-vets are hardware shops that supply fencing materials and silage polyethene bags.

Dairy farmers are mainly hosts and non-host communities and constitute about 38% (10,744) of all (27,720) the cattle farmers in the district, while there are only 5 refugees reported to own cattle. On average, a farmer owns eight animals and 80% of the farmers are men mainly because most women and youth do not have easy access to land, yet the dairy enterprise is land intensive. Only 10% of youth are dairy farmers. The animals are either inherited or obtained through development projects. Dairy cows constitute 34% of total cattle in the district, 70% of which are of the Ankole breed and 30% are cross breeds. Notably, farmers in the district do not keep exotic breeds due to their high susceptibility to parasites and diseases. An Ankole cow produces an average of 3 litres per day whereas a cross breed can produce an average of 10 litres per day depending on the husbandry practices used. This implies that milk productivity in the district is low as improved breeds can yield beyond 25 liters per day. The average farm gate price per litre is UGX 500.

Dairy farmers practice multiple grazing systems. About 9% of the farmers use more than one grazing system. The main grazing system is open fenced that is practiced by 65% of the dairy farmers. Zero grazing and free-range systems are practiced by 10% and 34% of the farmers respectively, while 1% of farmers tether their animals. The main pasture is a mix of several naturally growing local grasses, though in a few cases, pasture like Napier is produced for the animals. Farmers rarely supplement

cattle diets with concentrates. Grazing is predominantly (80%) conducted by men regardless of the grazing system. All the grazing systems are characterized by low nutritional pasture and of insufficient quantity. Access to safe water for the herds is also inadequate with 50% of the farmers collecting animal drinking water from wells, 20% use dams that were constructed by government and 30% use common springs. A dam is shared by about 10 farmers and most dams are poorly managed with high levels of silting and parasites like flukes.

Eighty percent of the cows are serviced by bulls at a cost of UGX 20,000 per cow. The cost of Artificial Insemination (AI) is UGX 80,000 - UGX 120,000 per cow depending on the location of the animals and the type of the breed. AI is mainly provided by the district technicians-two in number but only one has operational equipment. However, in a few cases, farmers source from private service providers in the neighboring Kyenjojo district. Lactating cows are milked twice a day mostly by men (85%). It was observed that milk handling conditions are poor. Eighty percent of the farmers do not disinfect their hands prior to milking. Although 60% of farmers wash the udder prior to milking, only 10% use warm water. Moreover, only 5% of the farmers have milking shades while the rest of the farmers milk their cows in the open. None of the farmers test their milk for quality at farm level. Eighty five percent of the farmers transport their milk to cooling plants using plastic jerrycans as opposed to the recommended metallic cans. Consequently, 25% of the milk sold is contaminated and fetches lower prices from UGX 250 to 400 per litre. The constraints affecting the farmers can strongly be associated with weak extension system. According to the district Animal Husbandry Officer, government extension officer to farmer ratio is 1: 10,000 against a recommendation of 1:500. This has left 70% of farmers receiving extension services from agro vet shops and only 20% from local government. Ten percent of farmers receive extension services from fellow farmers.

Eighty percent of dairy farmers interviewed were members of associations. Each association is linked to a milk collection centre. Although there are many farmer groups in Kyegegwa each comprising 30 - 35 members, only two are registered as cooperatives namely Mpara Dairy Farmers Cooperative in Mpara sub-county and Katwire Dairy Farmers Cooperative in Ruyonza sub-county. The main functions of all the associations include financing farmers especially to buy drugs, but also bulk and sell the milk for the members. Seventy percent of the associations do not own cooling facilities and are characterized by poor management. Some of these associations like the dairy interest groups have cooling plants. Payment of farmers mostly takes more than 15 days especially by cooling centers managed by groups although some cooling plants that are managed by individual owners pay every after 15 days from time of supply. This explains why 70% of the farmers sell to private owned cooling facilities (Figure 12). Milk is transported to the cooling plants on motorcycles and bicycles either by farmers (50%) or by individuals hired by the milk collection/cooling facility owner. In all cases, 80% of the transporters are male youth.

Aggregators buy milk from individual farmers as well as farmer groups. There are 20 aggregators in Kyegegwa district operating 23 milk coolers of various capacities in three sub–counties. Mpara sub-county alone has 21 coolers (15 coolers owned by individuals, 3 by farmer associations and 3 by processors), while Kakabara and Kyegegwa sub-counties each have one cooler. Aggregators sell to large processors namely Brookside, Pearl Dairies, Amos Dairy Processors, and Sibyangu Dairy. The total installed cooling capacity in Kyegegwa district is 70,600 litres with capacity of the cooling facilities ranging from 500 to 6,000 litres. Operational coolers hold 64,600 litres day and non-operational/ nonfunctional coolers can hold 6,000 litres per day. Approximately 34,540 litres of milk are collected during the wet season and 25,500 litres are collected in the dry season. Aggregators pay UGX 500 - UGX 1,200 per litre depending on the season and quality where the most important quality parameter is density that is measured using a lactometer. All the cooling plants are cleaned

manually. This compromises milk quality and consequently contributes to about 11% spoilage at the cooling facilities.

Small processors and retailers operate on a small scale with retailers having a working capital of about UGX 150,000. Retailers sell between 15-20 litres of milk daily. Less than 10% of them vend milk on bicycles and this activity is dominated by male youth. Generally, retailers do not have the recommended metallic cans for storing milk. Instead they use plastic jerrycans which compromise quality at times. Approximately, 90% of the small processors are women and handle about 40 litres of milk a month. They process milk into ghee using traditional technologies such as milk gourds. Five litres of fresh milk produce one kg of ghee. The ghee is sold to retailers and consumers in Kyegegwa at a cost of UGX 10,000/ Kg.

Large processors have a capacity of processing 300,000 – 1,500,000 litres per day. They process milk into powder, UHT, yoghurt, butter, ghee, flavored milk, full cream, pasteurized milk, cheese, cultured milk, butter creams and ice cream. Most of these companies have informal contracts or linkages with farmers. They pay between UGX 500 -700 per litre.

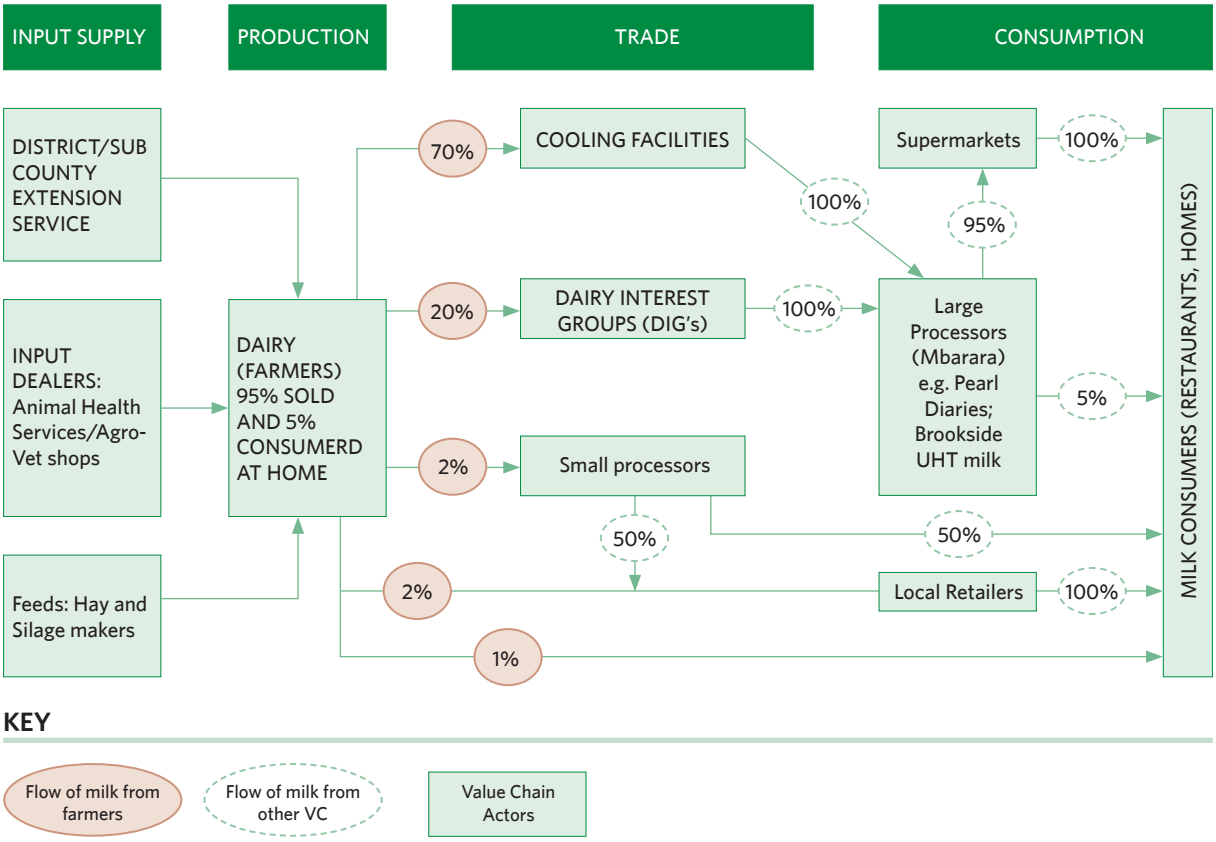

Figure 12: Milk value chain in Kyegegwa district Uganda
Source: Primary data, 2020

D. Profitability of the Dairy value chain

The profitability of the dairy VC was assessed using Gross Margins (GMs) and Net Present Values (NPVs) for the different actors while using general and specific assumptions derived from primary data under two scenarios i.e. for the local Ankole cattle and cross (75% improved heifer). The general assumptions for both scenarios are: (1) Production is open fenced grazing system - this is the commonest system in the district for both breeds; (2) A heifer starts producing milk after two years of age; and (3) A heifer produces annually. The other assumptions include: (i) Cow is serviced by a bull as is the common practice by 80% of farmers in the district; (ii) Gestation period is 9 months; (iii) Lactation period is 300 days following calving for75% improved heifers under paddocking, 221 for Ankole under free range and 234 for Ankole under paddocking; (iv) Cow is milked twice a day, (v) Post-milking loss is 25%; (vi) A litre of milk is sold by individual farmers at UGX 500 to cooling plants; (vii) Life span of a cow is 15 years; and (ix) Discount rate of 9% per year is used (Table 9).

Table 9: Specific assumptions of the Dairy Value Chain

Ankole cow under free range	Ankole cattle under paddock	Cross breed (75% pure)
Poor animal husbandry practices with no parasite and disease control; and no access to safe drinking water. Pasture not readily available and of low nutritive value throughout the year.	Poor animal husbandry practices with minimal and irregular parasite and disease control. Animals do not have access to safe drinking water. Pasture of low nutritive value and hardly available during the dry spell.	Moderate animal husbandry practices conducted with comprehensive parasite and disease control. Animals have access to safe drinking water. Pasture of low nutritive value and relatively inadequate during the dry spell.
Cow and calf raised on open grassland and roams freely	Cow and calf raised on 0.25 acre	Cow and calf raised on 0.5 acre under paddock
Cost of Heifer is UGX 700,000	Cost of Heifer is UGX 700,000	Cost of a Heifer is UGX 2,000,000
Price of calf is UGX 400,000	Price of calf is UGX 400,000	Price of a calf is UGX 1,500,000
Milk yield is 3 litres/day	Milk yield is 5 litres/ day	Milk yield is 10 litres/day
Post milking loss: 25%	Post milking loss: 25%	Post milking loss: 25%

Gross margin for farmers was based on value of milk as well as calves sold per year. The results revealed that 62%, 48% and 57% of the total revenues for the Ankole under free range, Ankole under paddocking and cross breed, respectively were from selling calves. The use of paddock for grazing the Ankole breed increased GM by 32%. The main driver of this increase in GM was due to increase in milk productivity per cow per year. For the same reason, GM of cross breeds were 2.6 times higher than those of the Ankole cow under paddocking and 3.4 times higher than for Ankole cow under free range.

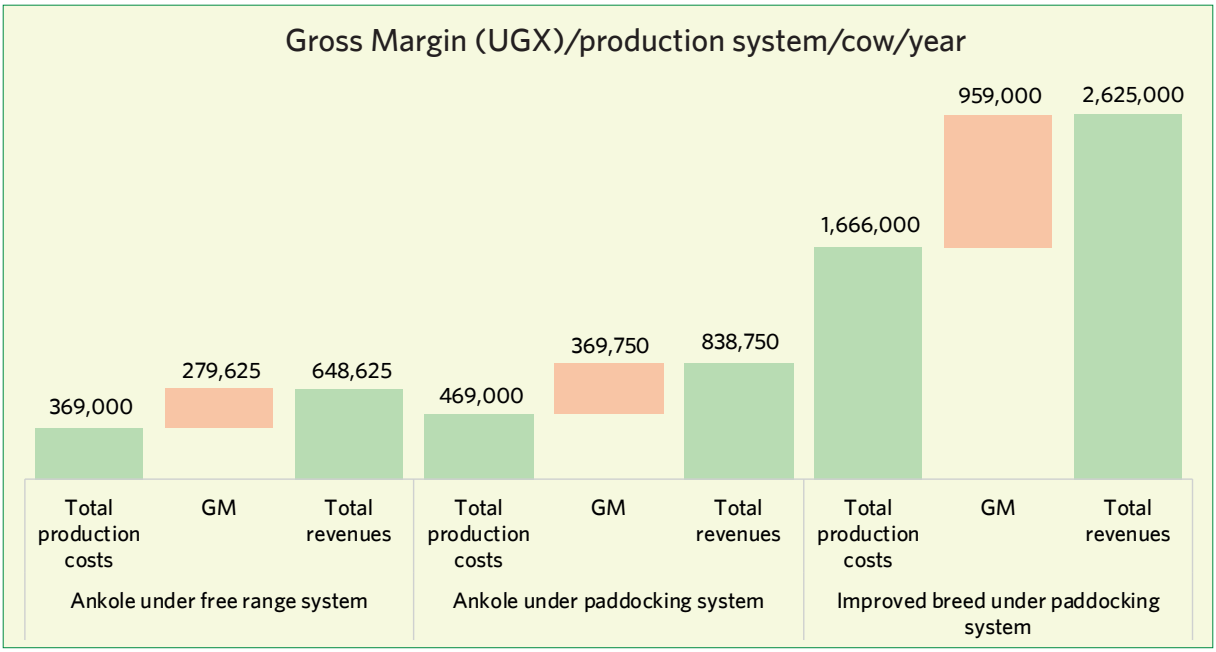

Figure 13: Farm level GM in UGX per cow per year
Source: primary data, 2020

The GMs of the other actors were based on milk traded. For large processors, UHT and powdered milk were considered. Large processors had the highest GMs regardless of the production system. The GM is driven by value addition, high volumes dealt in and low PH losses estimated at 5%. Small processors and retailers had the least profits because of the low volumes handled per cow per year.

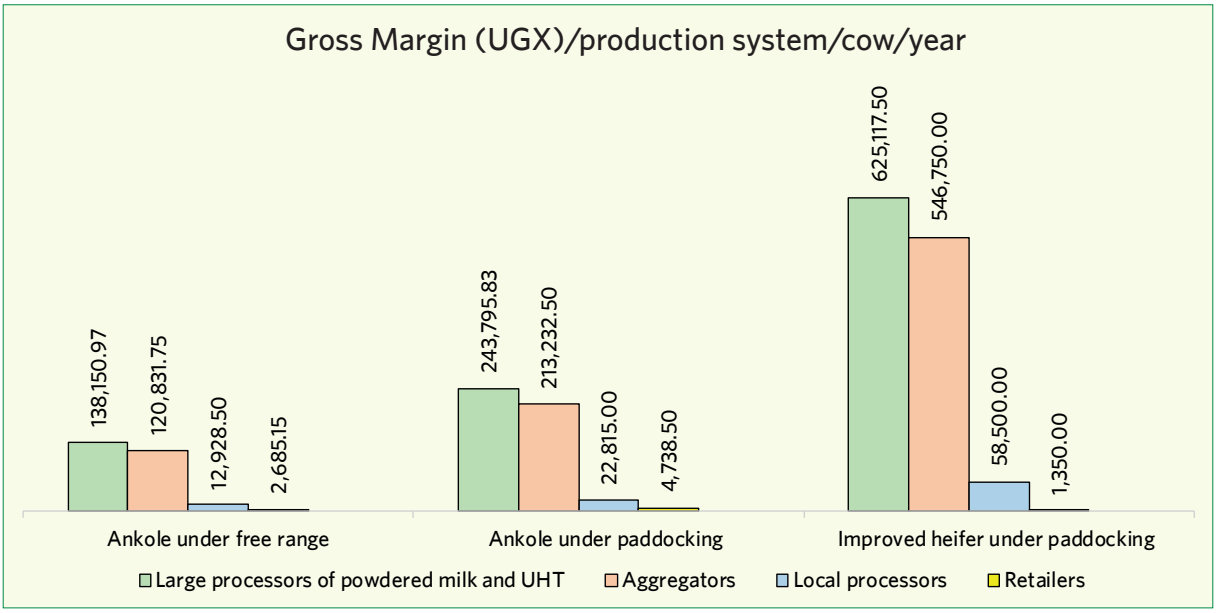

Figure 14: Gross Margins in UGX/cow/Year
Source: Primary data, 2020

Considering a litre of milk produced regardless of the breed and grazing system, ghee processors earn the most profit of UGX 1,300. These sell directly to consumers without involvement of middlemen who would increase transaction costs. In addition, their processing cost is very low owing to the rudimentary technologies they use. Aggregators and retailers have the least GMs of UGX 300 because of less value addition they undertake (Figure 15). Therefore, processing milk into ghee is a potential entry point especially for women who are the major ghee processors in Kyegegwa.

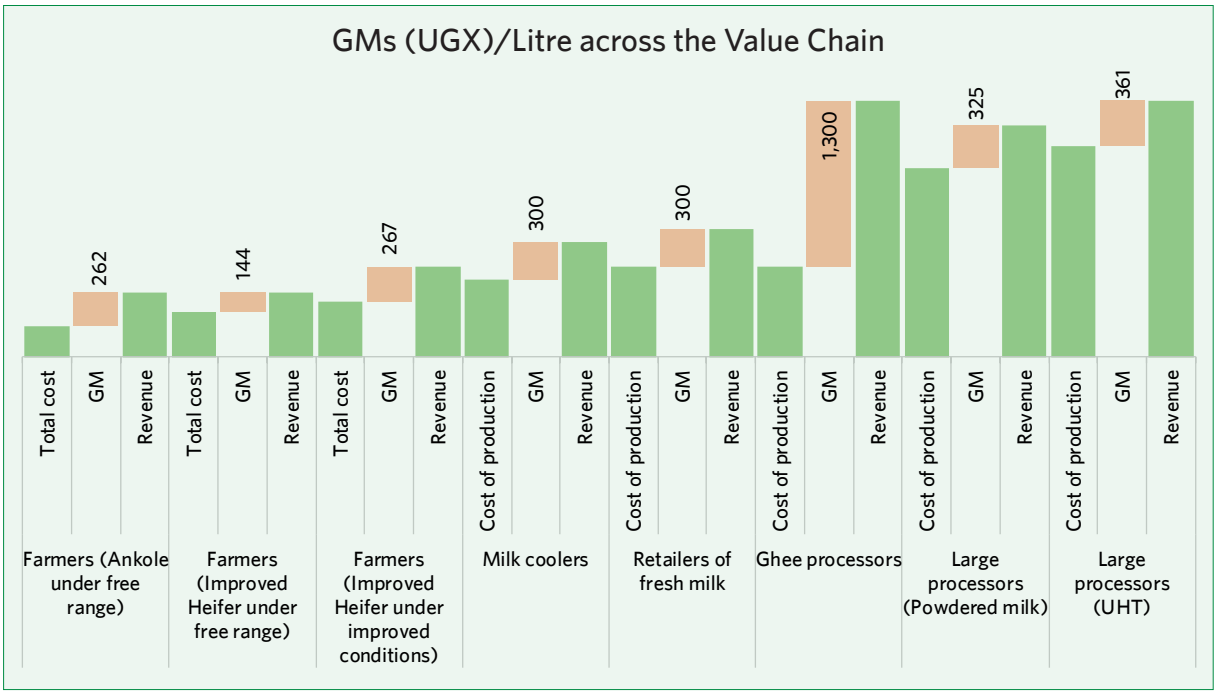

Figure 15: GMs in UGX/Litre across the VC
Source: Primary data, 2020

The NPV was calculated for one animal under the following scenarios: a) Ankole under free range system; b) Ankole under paddocking system; and c) Cross breed under paddocking using the assumptions stated in Table 9 above. The detailed revenues, variable and fixed costs are provided in Appendix 4. Figure 16 reveals that the investment in an Ankole cow breaks even in 14 years and 9 months under the free-range system, and 12 years and 11 months under paddocking system. However, investment in a crossbreed pays back after 11 years and 9 months. The payback period for the cross breed is shorter because of its high milk productivity and high price of its calves compared to Ankole breeds (See details on annex 4).

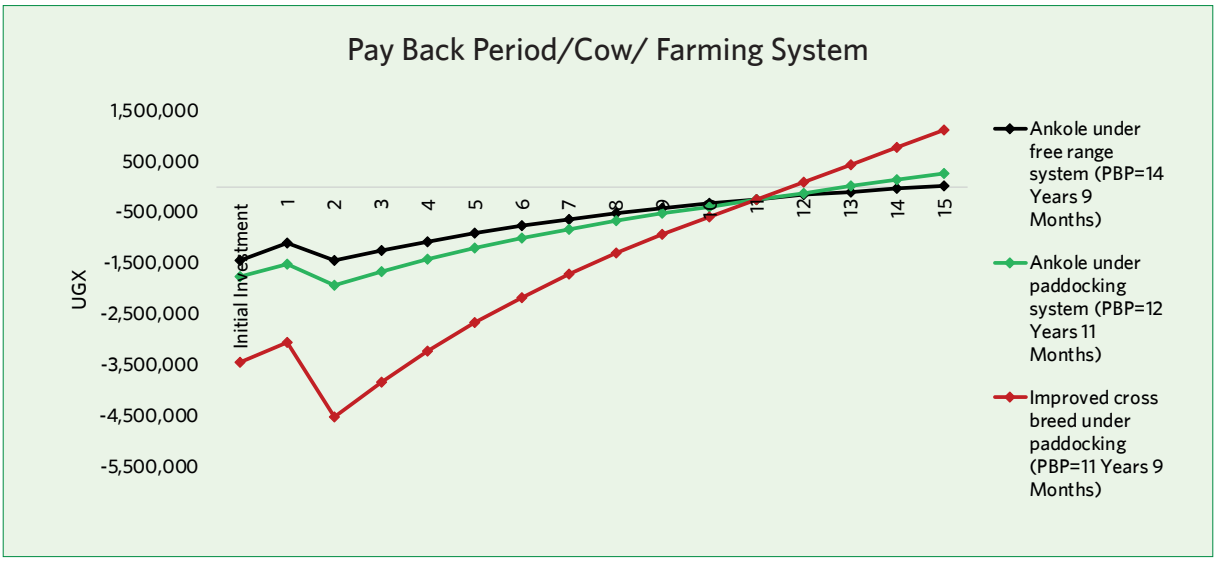

Figure 16: Pay Back Period per cow per farming system
Source: Primary data, 2020

The study also identified five supply chains of milk in Kyegegwa (Figure 17). Considering an average of UGX 220 for GMs per litre under the 3 current scenarios, farmers get the highest share of value along the value chain when they sell directly to retailers (channel 5); but get the least share when they sell to ghee processors (channel 4) as the latter incurs minimal production costs. From the commodity value that the retailer handles, the farmer gets a share value of 43% while the former receives 57%. On the other hand, considering the total milk value that the ghee processor handles, the farmer equivalent share is only 15%. The difference in value shares along the different channels is attributed to the differences in the GMs and the number of actors within a channel. The longer the supply chain, the lower the share of values for the actors. Notably however, for channel 5 where the farmers have the biggest share of value, the retailer has limited capacity to absorb fairly large quantities of milk produced. Thus, improving channel 3 by supporting farmers with cooling facilities to sell directly to large processors would be most suitable for the former.

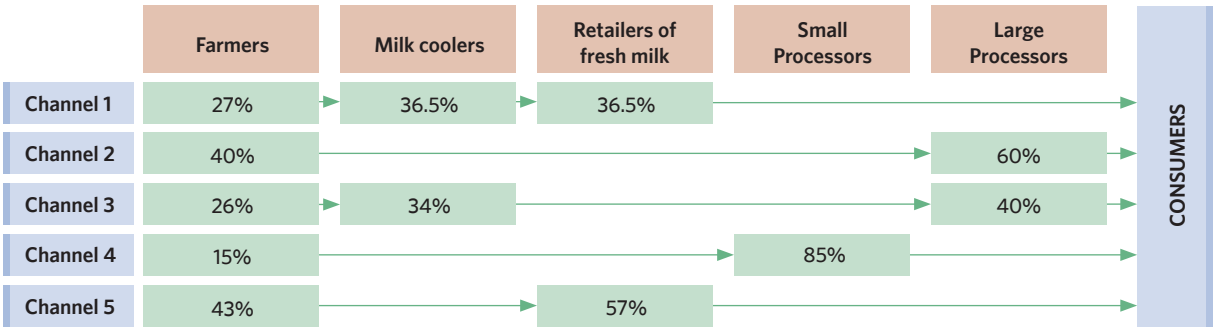

Figure 17: Milk Supply Chains in Kyegegwa
Source: Primary data, 2020

E. Employment generation potential and other potential impacts

The employment generation potential was estimated using the Full Time Equivalent approach. In addition, the wages earned were estimated in the district. The FTE jobs units per animal were used as the multiplier factor to estimate the number of FTE jobs under the existing lactating animals in the district. The estimated number of lactating dairy cows was 60,000 (12,400 for Ankole cows under free range; 23,600 for Ankole cows under paddocking system; and 24,000 for the cross breed under paddocking system). The cross breed generated the highest number of jobs per cow (0.7 units) whereas the Ankole breed under free range generated the least given the minimal labour requirement. As expected, the cross breed generates the most income (Table 10).

Table 10: Total number of jobs at baseline under the dairy value chain

Level	*FTE jobs per heifer*			*FTE jobs per lactating heifers for Kyegegwa*			*Wagers per district in UGX Billion*		
	Ankole free range	Ankole Paddocking	Cross Breed Paddocking	Ankole free range	Ankole Paddocking	Cross Breed Paddocking	Ankole free range	Ankole Paddocking	Cross Breed Paddocking
Production	0.15	0.15	0.67	1,860	3,540	16,080	2,901,600,000	5,522,400,000	25,084,800,000
Aggregation	0.002	0.003	0.007	24	79	160	4,320,000	14,220,000	28,800,000
Local retailers	0.006	0.010	0.020	74	236	480	13,320,000	42,480,000	86,400,000
Local processors	0.0015	0.0025	0.005	18.6	59	120	3,348,000	10,620,000	21,600,000
Total	0.16	0.17	0.70	1,977	3,914	16,840	2,922,588,000	5,589,720,000	25,221,600,000

FTE implies Full Time Employment and calculated without fixed costs

Production: Activities of general management such as spraying, milking etc.

Aggregator: One cooling plant unit handles maximum capacity of 6,000 litres/day; and managed by two full time staff

Local retailers: One retailer working two hours daily for one year; trading 5 litres per day

Local processor: One processor working 2 days a month for a year producing 1Kg of ghee per month from 5 litres of milk

The estimated number of heifers under lactation is 36,000 for Ankole and 24,000 for improved

Dairy farming however leads to greenhouse gas (GHG) emissions through the methane produced in cows' rumens, during manure storage and spreading, and in association with growth of crops fertilized with that manure. At the same time, the leaching nitrogen in the manure contaminates groundwater. Auspiciously, using dairy cows with efficient milk production coupled with the best feeding practices, manure handling and cropping systems significantly reduces GHG emissions.

Relatedly, efficient use of animal refuse has other benefits where dairy farming does not happen at the expense of the environment. Cow dung can generate biogas for lighting and cooking at household level. The resulting bio slurry can be used as manure in vegetable backyard gardens to enhance household nutrition but also as a strategic enterprise for the women and youth, while construction of biogas plants creates strategic business opportunities for the youth and refugees. This also implies reduction in air pollution resulting from cooking with firewood (mainly conducted by the women and girls). This also reduces a range of firewood associated health side effects such as coughing, eye irritations, difficulty in breathing, and headache (Gold Standard, 2016)

F. Threats and community preparedness

Pests and diseases are a major constraint to milk production. The major parasites are ticks, liver fluke and tapeworms but the former are the most damaging. Besides sucking blood from the animal, ticks are a vector to several diseases particularly Theileriosis (East Coast Fever or ECF), babesiosis, anaplasmosis and heart-water. The livestock parasites are controlled by the correct use and application of acaricides involving the right equipment, acaricide concentration and quality product as well as ensuring that the grazing area is well drained without stagnant water for breeding the worms. In addition, for worms, routine de-worming is recommended, while for ticks, farmers and the farming communities are encouraged to spray regularly. In the case of high infectious animal diseases like FMD, Lumpy skin disease, CBPP among others, communities are encouraged to enforce strict quarantine measures and livestock movement control for newly purchased and returning animals to avoid introduction and spread of these diseases.

The challenge however is that the community are less prepared to address the threat. Access to extension services is limited as the district veterinary unit is understaffed. Out of the 11 veterinarians and 9 para-veterinarians required, only three veterinarians and seven para-veterinarians available. The district has only one entomologist out of the 2 required and no Assistant Entomologist while each sub county is required to have one, and there are two AI technicians (but with only one having functional equipment). Worse still, there is no laboratory technician in the district. In addition, the veterinary center is dilapidated and require rehabilitation. This has also limited farm visits and follow-ups to treat sick animals as well as livestock pests and disease surveillance. The level of acaricides resistance is also going up because of imprudent use of acaricides. The funding to livestock sector is very limited thus affecting pest and disease control. In addition, the production unit had hoped to use available funds to rehabilitate the veterinary center and the slaughter slab but there is a lot of uncertainty in accessing the funds. For example, construction of slaughter slab and the veterinary center was planned in 2015/16 but till today they have not been accomplished. These challenges have resulted to frequent outbreak of infectious livestock disease leading to low milk productivity and frequent quarantines. Quarantines are very costly and exert greater impacts to district revenue collection as well as farmer national economy.

The other challenge is limited access to animal health products arising mostly from weak implementation and enforcement linked to inadequate institutional capacity, weak intersectoral coordination and inadequacies in the policy process, limited public awareness and existing policies having no specific reference to strategies for improving access among sector players. For instance, the existing regulators i.e. Uganda National Bureau of Standards (UNBS) for feeds and ingredients; National Drug Authority (NDA) for drugs and DDA for dairy equipment and milk quality only play a role in registration of new dealers as their presence on the ground is limited. There is no central registry for input suppliers in the dairy sector. Some suppliers are registered by the NDA, others by the Agricultural Chemical Board, while equipment, animal feeds and ingredient suppliers are not registered at all. The enforcement capacity of all these agencies is weak and this has instead supported a thriving business of cheap counterfeits drugs and acaricides which has partly contributed to pesticide resistance like the emergence of multi-acaricide resistant ticks.

Although the NDA proposed a central control and unification of extension messages for livestock health management, a framework to institute control and enforcement of distribution of acaricides through an acaricide zoning system based on scientific evidence and continuous monitoring of resistance, this is yet to be implemented. Furthermore, the National Animal Disease Diagnostic and

Epidemiology Center (NADDEC) which is mandated to carry out routine surveillance, monitoring and control of animal diseases is also under resourced. It is only complemented by the Central Diagnostic Laboratory (CDL), at the College of Veterinary Medicine, Animal Resources and Biosecurity at Makerere University. There are no specialized laboratories within the district to promptly identify and test acaricide resistant ticks. A combination of these factors has further contributed to multi-acaricide resistance among ticks and consequently, reduced productivity. In terms of marketing, milk adulteration with chemicals, water, and other substances is a common practice. Milk handling in unsuitable containers or equipment is illegal under the dairy (marketing and processing of milk and milk products) regulations, 2003. However, milk transportation using plastic jerry cans instead of aluminum cans is still practiced. All these have slowed the growth rate of the sector.

Table 11: Key constraints along the dairy value chain

Node	Challenge	Mitigation
Farmers	1) High pest and diseases incidences resulting in high mortality rate. 2) Scarcity of quality drinking water for animals. 3) Low nutritive value of pasture. 4) Weak farmer associations that constrains the ability to take advantage of economies of scale in accessing input and output markets. 5) Poor rural road networks.	1) Promote improved livestock management practices including access to animal health services – treatment, vaccination, judicious use of acaricides etc. 2) Construct new and rehabilitate existing dams to increase their water holding capacity. 3) Promote the production of pasture varieties that are of high nutritive value including green leaf desmodium, Calliandra, Lablab purpureus, Centrosema, etc. 4) Build the capacity of farmers on leadership, governance and faming as a business. 5) Construct and rehabilitate rural roads.
Aggregators	1) Business malpractices such as adulteration of milk. 2) Unreliable and costly electricity that is used to operate milk coolers. 3) Frequent equipment breakdown and costly repair services. 4) Poor roads and inappropriate transportation equipment resulting in high milk losses due to spillage and spoilage during transportation. 5) Scarcity of clean water for use in cleaning equipment and maintaining hygiene. 6) Impassable roads especially during rainy seasons.	1) DDA and UNBS sensitize farmers on milk regulations standards regulations on milk quality. 2) Establish linkages with Kyegegwa Rural Electricity Cooperative Society Ltd (KRECS) to prioritize rural power distribution to aggregators in the district. 3) Train local mechanics to provide good quality maintenance services. 4) Build clean water sources in rural areas. 5) Construct and rehabilitate rural roads.
Local processors	1) Adulterated milk supplied by farmers reduces the volume of ghee produced per litre. 2) Lack of affordable, time and labor-saving technologies for value addition.	1) Enforce the DDA stipulated guidelines and regulations on milk handling, transportation and preservation 2) Promote affordable, time and labor-saving technologies that processors can buy..

G. Public and community sector support

The dairy sector in Kyegegwa district is very promising and has public, private and community sector support. As presented earlier, there is greater potential for farmers to link with processors and there is underutilized processing capacity because of low milk production. The public sector support is mainly through the Dairy Development Authority (DDA) which offers capacity building on collective marketing and good governance; National Agricultural Research Organization (NARO) which supports the development of quality fodder varieties, feed formulation and breeding; and Operations Wealth Creation (OWC) which provides in calf animals and equipment for artificial insemination services. The community sector contribution is mainly through NGOs like SNV that offers training in milk quality and standards and Mt of the Moon University trains in feed formulation and marketing.

H. Recommended strategic investments for DRDIP

In Kyegegwa, the dairy VC has the potential to improve people's livelihoods through increase in incomes among various actors, and creation of jobs. It also supports sustainable environment use through generation of biogas and bio slurry especially for kitchen gardens, which also boost household nutrition and improved human health.

Nevertheless, there are several threats that constrain achieving the potential. The key threats include a) high parasites and disease prevalence with communities unprepared to manage due to inadequate animal health services such as limited number of agro vet shops, extension workers and AI service providers; b) inadequate access to productivity enhancing technologies such as improved breeds, improved pasture, cooling plants, etc; c) weak farmer groups and ineffective market arrangements; d) inadequate access to value addition technologies like for ghee processing by small scale processors; and e) inadequate skills and availability of essential services such as AI, animal health to support parasites and disease management, Agro vets to supply drugs and artisans for building biogas plants. Therefore, the key strategic investment areas are recommended are as below:

1) **Invest in increased and sustainable milk production**
   - Work with AFRISA and the district to develop guidelines on appropriate livestock production practices; and facilitate existing staff to train farmers on good animal husbandry practices (pasture production and preservation including silage and hay making, feeding and disease management).
   - Support farmers with improved pasture seeds and pasture production and conservation technologies
   - Support the district to enforce regulations and by-laws on registration and use of animal drugs
   - Link the project to Universities and AFRISA to design and implement a Volunteer Technology Transfer Scheme (VTTS) – to include pests and disease management. Volunteers and student interns will train farmers and reduce the burden of staff shortage-enhancing volunteers and farmers skills, create jobs and strengthen farmer-extension-research linkage.
   - Build capacity of the district staff and Agro vets in the district. Provide technical backstopping to the technical staff, and to the Agro vets in the district. Support government to recruit

and fill the vacant positions in the livestock and entomology units, and facilitate all technical staff with transport. This will enhance routine parasite and disease surveillance, and management. Currently, parasite and disease surveillance are only conducted by NADDEC under MAAIF, but this is rarely undertaken due to inadequate staff and limited funding. Besides, most of the parasites and disease management services are provided by the private individuals, some of whom are unqualified in animal health.

- Build the necessary infrastructure in the district to sustainably manage the production and animal health services. This will involve: a) Rehabilitation of the veterinary Centre which is dilapidated; and equipping it with equipment and materials to serve as animal health clinic; provide services for surveillance, testing and treatment of parasite and diseases, AI services, among others; b) Construct safe water sources to provide water for animal production; and c) Build community cattle crushes for livestock parasite management.
- Support farmers to invest in improved breeds through Artificial Insemination (AI): Recruit more AI technicians; and train the new and existing technicians and equip them with relevant equipment; then link them to semen suppliers. Farmers are faced with a great risk of high mortality of animals especially the improved breeds, the capacity building proposed above will adequately prepare them to manage their livestock.
- Increase market access and reduce Post Milking Losses and Post-Harvest Losses Link farmers to large processors like Brookside Ltd and Pearl Diaries Ltd and to FSIs like VSLAs.
- Invest in building strong farmer groups. This should be accompanied with equipping farmers and farmer groups with knowledge and skills in leadership /governance, financial literacy, market-oriented production and farming as business
- Invest in aggregation centres with group owned cooling facilities for milk handling
- Construct feeder roads from production units to collection centres

2) Increase market access and reduce Post Milking Losses and Post-Harvest Losses

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- Invest in building strong farmer groups. This should be accompanied with equipping farmers and farmer groups with knowledge and skills in leadership /governance, financial literacy, market-oriented production and farming as business
- Invest in aggregation centres with group owned cooling facilities for milk handling
- Construct feeder roads from production units to collection centres

3) Invest in PHH and Value Addition

- Invest in equipment and providing skills for generation of secondary products like ghee, biogas and bio slurry. Women groups processing ghee should be supported with preservation skills coupled with labour and time saving processing equipment like the Ize Chan. One Ize Chan ghee equipment costs UGX 3,000,000 and can process more than 10 Kgs of ghee in 20 minutes as opposed to the traditional system that takes over 5 days to obtain one Kg. The equipment is manually operated and can be used in rural setting without electricity. Investment in biogas will reduce environment degradation, create jobs for youth artisans, and release bio slurry for backyard vegetable gardens to improve household nutrition and income generation especially for women.

The various scenarios are described in Table 12

Table 12: Different Scenarios of actual and strategic investment in Dairy VC

Scenarios		Description
Scenario 1:	Local Ankole cow under free range system	The local cows are kept under free range system. Poor animal husbandry practices with no parasite and disease control; and no access to safe drinking water. Pasture not readily available and of low nutritive value throughout the year. Cow serviced by bull.
Scenario 2:	Local Ankole cow under paddocking system	The local cows are kept under open fenced paddocks. Poor animal husbandry practices with minimal and irregular parasite and disease control. Animals do not access safe drinking water. Pasture of low nutritive value and hardly available during the dry spell. Cow serviced by bull.
Scenario 3:	Cross breed cow under paddocking system	Improved cross breeds are kept under open fenced paddocks. Moderate animal husbandry practices conducted with comprehensive parasite and disease control. Animals access safe drinking water. Pasture of low nutritive value and relatively low during the dry spell. Cow serviced by bull.
Scenario 4:	Cross breed under paddocking system with pasture supplement	Cross breeds are kept under paddocks. Recommended animal husbandry practices conducted with comprehensive parasite and disease control. Animals access safe drinking water. Supplementary pasture of high nutritive value to supplement feeding especially during the dry spell. Cow serviced by AI. Farmers linked to large processors
Scenario 5:	Cross breed under zero grazing system	Cross breeds are kept under zero grazing system. Recommended animal husbandry practices conducted with comprehensive parasite and disease control. Animals access safe drinking water. Fodder of high nutritive value available throughout the year. Cow serviced by AI. Farmers linked to large processors

Effect of the recommendations on GM and jobs is presented on Table 13.

Table 13: Summary of the impact of strategic investments on GM and Jobs

Category	Item	Scenario 1:	Scenario2:	Scenario 3:	Scenario 4:	Scenario 5:
		Current Practices			Proposed Scenarios	
Farmer	Price (UGX) per litre	500	500	500	700	700
	Yield per cow	3	5	10	20	22
	Post milking losses (%)	25	25	25	6	6
	Volume after milking loss/cow/ year	497.25	877.5	2250	5640	6204
	Revenue from milk per year per cow	248,625	438,750	1,125,000	3,948,000	4,342,800
	Revenue from calf per cow	400,000	400,000	1,500,000	1,500,000	1,500,000
	Revenue from biogas per cow	0	0	0	600,000	600,000
	Total revenue per year per cow	648,625	838,750	2,625,000	6,048,000	6,442,800
	Cost of production per cow	369,000	469,000	1,666,000	1,930,400	2,436,400
	GM in UGX per cow	279,625	369,750	959,000	4,117,600	4,006,400
	% increase/decrease in GM/cow	NA	NA	159.4	329.4	-2.7
	GM per district (GM * current # of animals)	3,439,387,500	8,726,100,000	23,016,000,000	NA	NA
	Jobs created per cow per year	0.15	0.15	0.67	0.68	0.68
	Current Jobs created at district level	1,860	3,540	16,080		
	Pay Back period (Yrs and Mths)	14 Y and 9M	12 Y and 11 M	11 Y and 9 M	4 Y and 6 M	6 Y and 2 M
Milk cooling centres	Milk sourced from farmers (90%)	447.525	789.75	2025	5076	5583.6
	Post Milking Losses (%)	10	10	10	10	10
	Volumes sold to processors	402.7725	710.775	1822.5	4568.4	5025.24
	Variable costs in UGX per litter	241,664	426,465	1,093,500	2,741,040	3,015,144
	Revenue in UGX per cow per year	362,495.25	639,697.50	1,640,250.00	4,111,560.00	4,522,716.00
	Gross margin in UGX/ cow/year	120,831.75	213,232.50	546,750.00	1,370,520.00	1,507,572.00
	% increase/decrease in GM	NA	NA	NA	150.7	10.0
	Job created cow per year	0.002	0.003	0.007	2.675867	2.867
	% increase/decrease in jobs	NA	NA	NA	100	114
	Current Jobs created at district level	24	79	160	320	352

Category	Item	Scenario 1:	Scenario2:	Scenario 3:	Scenario 4:	Scenario 5:
Small processor	Milk sourced from farmers (2%)	9.945	17.55	45	112.8	124.08
	Volume of ghee produced		4.6	16.5	32.1	34.4
	Variable costs	6,962	12,285	31,500	32,110	34,404
	Revenue from ghee	19,890	35,100	90,000	225,600	248,160
	GM per cow per year	12,929	22,815	58,500	193,490	213,756
	% increase/decrease in GM	NA	NA	NA	230.7521368	10.4739263
	Job created cow per year	0.0015	0.0025	0.005	0.206	0.221
	% increase/decrease in jobs	NA	NA	NA	100	108
	Current Jobs created at district level	18.6	59	120	240	264
Retailers	Volume sourced from farmers	9.945	17.55	45	112.8	124.08
	Volumes after Losses (10%)	8.9505	15.795	40.5	101.52	111.672
	Variable costs	6,265	11,057	28,350	71,064	78,170
	Revenues	8,951	15,795	40,500	101,520	111,672
	GMs	2,685	4,739	12,150	30,456	33,502
	% increase/decrease in GM	NA	NA	NA	95	109
	Jobs created per cow per year	0.006	0.010	0.020	0.12	0.12
	% increase/decrease in jobs	NA	NA	NA	100	100
	Jobs created at district level	74	236	480		
Market	Market size of milk in litres					8,280,000
	# of cows to meet the market	12,066	7,239	2,011	1,031	963
	GMs from the number of cows to meet the market (At farm level)	3,416,186,250	2,981,563,125	2,861,150,250	5,587,318,920	5,002,110,900
	% increase	95.76	30.94	8.38	16.4	14.6
	Additional jobs to meet the market	1,810	1,086	1,347	701	655
	# of groups to meet the target market	804	483	335	172	160

Snapshot of processing companies purchasing milk from Kyegegwa

Pearl Dairy Company

Pearl Dairies is another milk processing company located in Mbarara. Some of its major suppliers are located in Mbarara and Kyegegwa districts. The plant has a daily processing capacity of 1,000,000 litres. However, the average utilization capacity is 800,000 litres, with a supply gap of 200,000 litres. The products from the company are UHT milk (long life milk), yoghurt, butter, ghee, flavored milk, full cream powdered milk, instant full cream powdered milk. Within Kyegegwa, Pearl Dairies has no cooling plants but is one of the major buyers. On average, the company purchases 50,000 litres of milk from Kyegegwa on a daily basis. Unlike for Brookside, Pearl Dairies does not offer suppliers with contracts though the price range is like that of Brookside.

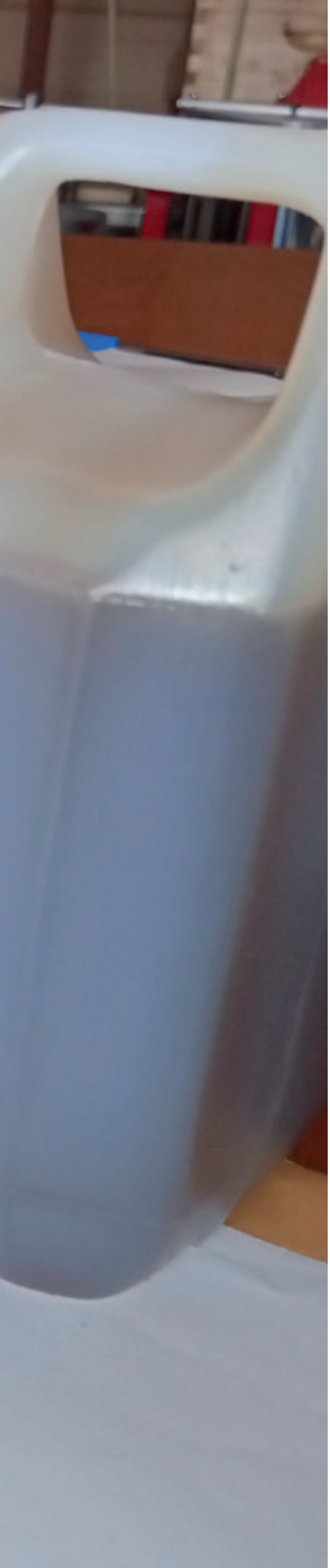
Fresh Dairy Company

Fresh Dairy commonly called Brookside is a milk processing company located in Bugoloobi, Kampala with a plant having a daily processing capacity of 330,000 litres. However, on average, the utilization capacity is 300,000 litres, which is over 90%. The products from the company are pasteurized milk, UHT milk (long life milk), cheese, yoghurt, cultured milk, butter, ghee, creams and ice cream. Brookside has many suppliers but is a major off taker of milk from Kyegegwa district, where it has 10 bulk collection centers with cold chains that are easy to access by farmers. On average the company purchases 30,000 litres of milk from Kyegegwa on a daily basis.

The farmers deliver the fresh milk on contractual arrangement either as individuals or as a group to the company's collection centers; and they are paid after every 15 days of the month through mobile money. The price per litre usually varies between UGX 700 and 1,200 depending on the season and the quality. The milk is transported from Kyegegwa to the factory in Kampala using the company's truck with cold rooms.

To ensure quality of the milk supplied by the farmers, at the collection centre, the company assesses the milk density using the lactometer test as well as the microbial levels using the clot on boiling method. In addition, the company sends quality assurance personnel to the producers' farms to inspect the milking process and provide knowledge and skills on quality assurance. However, the company does not offer any additional support such as financial services to the farmers. If the supplier fails to adhere to the company's set standards, the contract is cancelled. Indeed, on average, contracts of 10 farmers are cancelled monthly due to poor milking practices. However, such farmers can be re-contracted if they abide by the contractual terms. Notably, the company is willing to engage more suppliers but they are constrained by the low quality produced by most farmers in the district.

3.1.3 Apiary Value Chain



A. Introduction

Apiculture is an important sector in Uganda, with all the country's agro ecologies suitable for bee keeping. Although it is not prioritized under the National Development Plan III, it is a priority commodity in the Agriculture Sector Strategic Plan II 2015/16-2019/20. Apiculture produces many products such as honey, beeswax, royal jelly, pollen, propolis and bee venom. However, honey is the major product. The main honey producing areas across the country are: West Nile and Western Uganda (Kabarole, Kisoro, Mbarara, Ntungamo, Kabale, Bushenyi and Rukungiri districts) (Kilimo Trust, 2018). The sector contributes to the country's revenue mainly through export of honey. Besides, beekeeping is an important source of income especially to the economically vulnerable communities. It is also useful in pollination services, agriculture, and forestry. Additionally, apiary products like honey, bee brood, royal jelly and pollen provide nutrition and health benefits to people. Medically, honey can be used as a sedative, laxative or antiseptic (AU, 2019). Despite the benefits, beekeeping is fragmented, and mainly conducted by small-scale farmers using rudimentary production and post-harvest technologies, which consequently reduce the quality and quantity of products produced. For example, in Kyegegwa, the common production technology is the use of traditional hive with an average annual yield of 12Kg compared to the KTB that yields 18Kg. Nevertheless, Uganda is one of the few countries in Africa licensed to export honey to the EU under the Economic Partnership Agreement. To ensure quality and increase production for the EU market, the government established the National Residue Monitoring plan; developed honey standards; and formulated the Standard Operating Procedures. In addition, the World Bank in 2019, supported a strategy to improve production and quality of honey produce in Uganda. Under the strategy, there are plans to commercialize the different bee products like beeswax and venom (Business News, 2018).

In Kyegegwa, apiculture is a common livelihood source for the hosts, non-hosts and refugees' communities, with the agro ecology suitable for beekeeping. Thus, it is one of the key value chains prioritized for investment by the Tooro kingdom (Rudnitska, 2015) and it is being promoted by the District Local Government under the Department of Entomology. Also, during the scoping study, apiary was one of the value chains prioritized by all the communities for income generation by households

B. Demand and supply of bee products in Uganda

According to available data on honey, between 2003 -13, Uganda consistently had a deficit (Figure 18). Domestic consumption (8.5%) was growing faster than production at an Annual Average Growth Rate (AAGR) of 7% (Figure 18). The growth in consumption of natural honey is associated with changing preferences where consumers substitute sugar for honey in their diets due to perceived medicinal value.

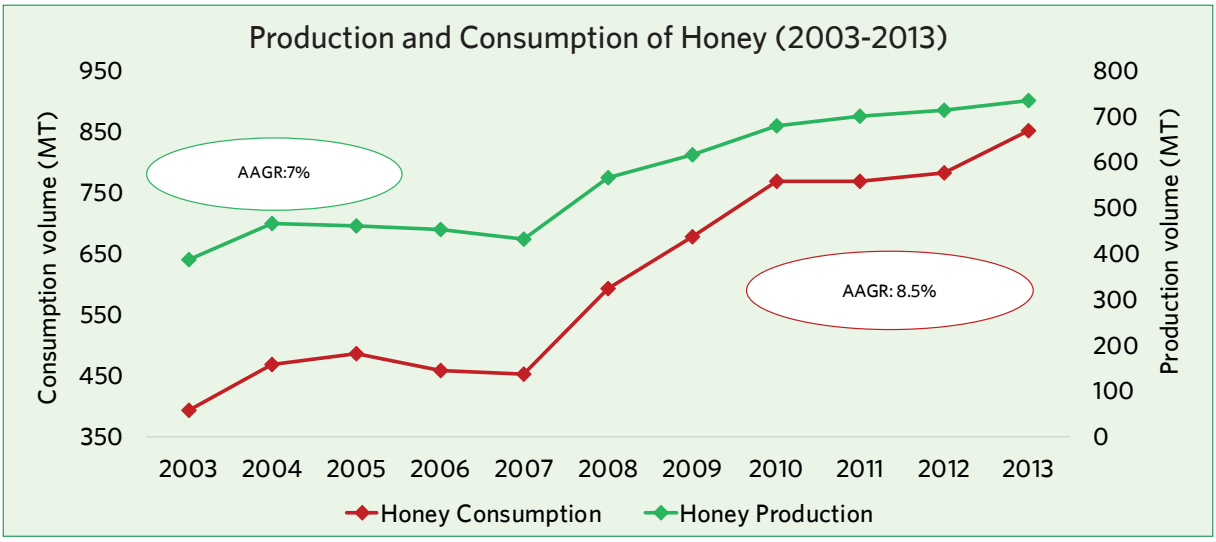


Figure 18: Production and consumption of honey in Uganda
Source: FAOSTAT, 2020

Local markets for Ugandan honey include Kampala, Jinja, Entebbe, Mbarara, Lira, Gulu, Arua and Mbale and consume 95% of the honey produced locally. Local brands dominate the market and compete favourably with imports. Kampala is a major hub where all the honey from the different regions including imports is traded. From 2009 to 2018, the annual deficit was about 45 MTs of honey and was bridged with imports from Tanzania, UAE, Kenya, United Kingdom, Pakistan and Afghanistan (Figure 19)

In 2009 – 2018, volume of honey that is imported to Uganda increased at an AAGR of 26.3% per annum. The imports provide a sizeable market opportunity for Ugandan honey through import substitution. However, there is a need to invest in productivity and quality enhancing technologies to increase competitiveness of domestically produced honey products against imports.

Despite the domestic deficit in the supply, Uganda exports natural honey. In 2009-2018, the volume of honey exports increased annually at an average rate of 142% rate.

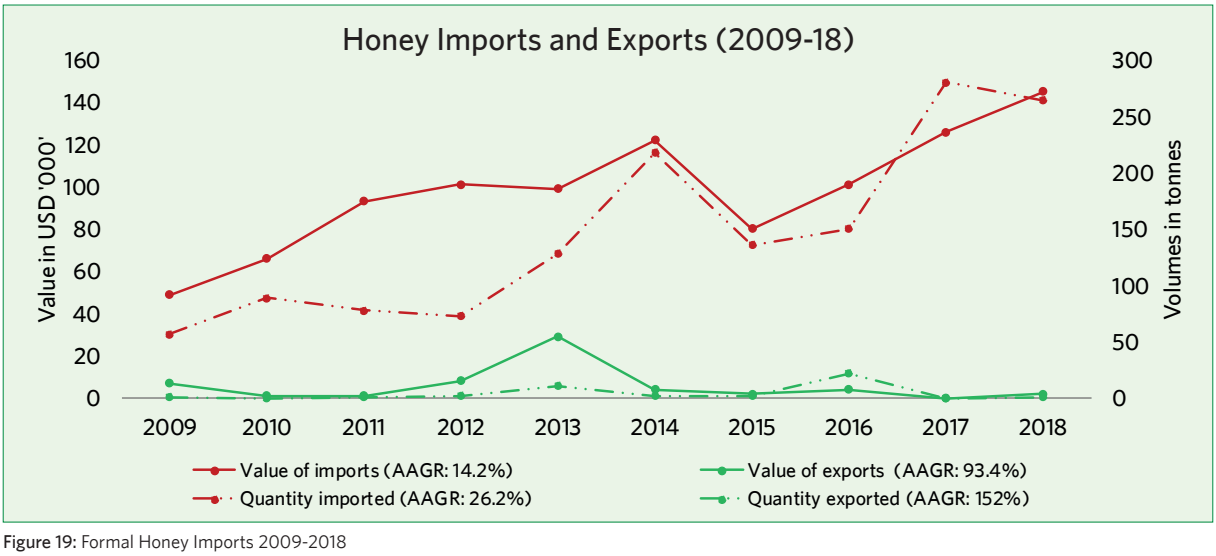


Figure 19: Formal Honey Imports 2009-2018
Source: International Trade Corporation, 2020

Rwanda (55.3%) and South Sudan (26.3%) are the largest export markets for honey from Uganda. Other markets include Oman, Tanzania, Switzerland, Sudan, Saudi Arabia and Burundi (Fig 20).

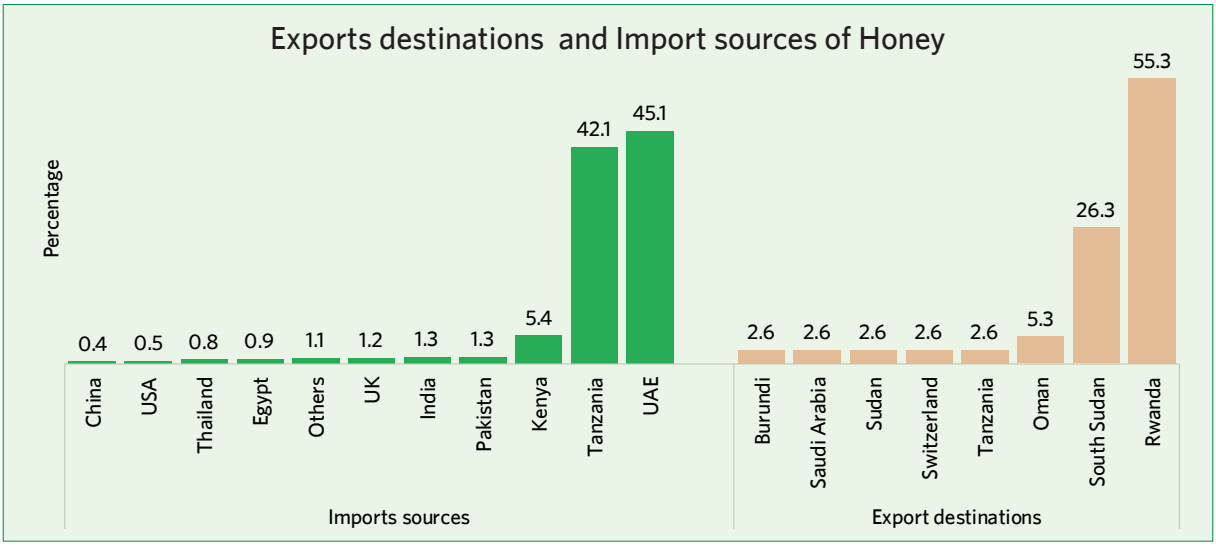


Figure 20: Formal destinations of honey exports from Uganda
Source: International Trade Corporation, 2020

C. Value chain actors and private sector strategic partnerships

The value chain actors are mainly beehives suppliers, beekeepers, processors, traders within the district and large processors. Bee keeping is a commercial enterprise in Kyegegwa with 80% of honey produced sold. The major honey buyers from the producers are small processors (35%), local retailers (25%) and large processors (15%). All the bee comb, wax and propolis produced are sold to large processors. Sixty-five percent of these products are purchased by the small-scale traders/ processors from the beekeepers. For the remaining 35%, the large-scale processors purchase it directly from the producers. The small-scale traders/ processors also sell to the large-scale processors.

Beehive suppliers include traditional beehive makers, carpenters producing KTB hives and other furniture, suppliers of ordinary equipment and tools, and large honey processing companies e.g. The Hives Ltd and Malaika Honey Company Ltd who supply modern hives (KTB and Langstroths) as well as modern honey extraction and processing equipment. Artisans of modern hives in Kyegegwa are mainly men and from host communities. The working capital for an artisan is between UGX 2,500,000 and 3,000,000 per year; and produces about 1,040 hives per year. The prices of a KTB hive varies from UGX 60,000 to UGX 90,000 depending on timber and iron sheets quality used. The common equipment sold by input suppliers within Kyegegwa include uncapping knives, hand gloves, bee brushes, protective tools, extraction equipment, airtight buckets, gumboots, nylon clothes, sieves, packaging material, papyrus, smokers, swarm, and pesticides. These inputs are supplied by different types of dealers in Kyegegwa and none of them offer extension services.

Large processors supply KTB hives at an average price of between UGX 100,000 - UGX 150,000 and Langstroth hives at UGX 350,000 per piece. The Langstroth hives cost more because one is able extract honey without destroying the combs which not only improves the quality of honey produced but shortens the time to the next harvest. This is conversely to the extraction process of honey from the KTB and traditional hives that destroys the honeycombs. This delays the next harvest because the bees have to reconstruct combs afresh. It is therefore plausible that while the KTB and traditional

hives are only harvested twice a year, the Langstroth hive can be harvested up to six times a year producing 10 to 12 Kg of honey per harvest. The Langstroth hives are not commonly manufactured in Kyegegwa while KTB hives are locally manufactured. For equipment, large scale processors supply modern extraction and processing machines imported from China and India and are tax exempt.

Beekeepers usually set hives in forests with limited supervision and operate either as individuals or in associations/groups. A group on average owns 10 beehives. In Kyegegwa, 70% of the hives are traditional and 30% are the KTB type. According to the district Entomologist, the registered beekeepers include:

- 150 individual beekeepers and 14 groups of between 10 to 30 members - in host communities.
- 8 groups each with 20 members from the refugee communities.

Most groups are not registered. Primary data showed that all the beekeepers consider the registration process cumbersome and expensive. Registration costs UGX 40,000 per year while a business certificate and license each cost UGX 20,000 annually.

The average harvest from a traditional hive is 6 kgs/season while a KTB hive is 9 Kg/ season and for each type, harvesting is conducted twice a year. Notably, a beehive takes a year to produce the first honey harvest and in the subsequent years, harvesting is undertaken after every 6 months. The average cost of a Kg of honey is UGX 10,000 while the average working capital for a beekeeper is UGX 30,000 per year. Farmers sell honey - 15% to large processors, 35% to small processors, and 25% local retailers.

Approximately 30% of the beekeepers interviewed said that they receive training on record keeping, bee colonization, value addition and marketing from the district entomologist. Forty five percent of beekeepers among refugees and 35% in host communities are women. The smaller number of women involved in beekeeping among host communities indicates that beekeeping in Kyegegwa is dominated by men. Cultural norms hinder the participation of women especially in hanging of hives and harvesting of honey. For instance, climbing of trees to site the hive, harvesting at night and wearing trousers while harvesting are culturally limiting for women. Auspiciously, women are involved in tailoring bee suits, and marketing of honey while youth are involved in harvesting, processing/ extraction, transportation, inspection and making traditional beehives. All the propolis produced is sold small processors (65%) and large processors (35%). In turn, the small processors sell their propolis to the large processors.

Small processors/traders mainly operate within the district and constitute 90% men and 10% women. While some processors operate from their homes, majority have shops and market stalls in the town. About 70% of these processors source honey from beekeepers while 30% source from other traders. The price of honey from small processors varies between UGX 13,000-18,000 per Kg. Most (80%) of the traders are also engaged in primary processing mainly using local technologies or secondary processing using improved technologies for purification. On average, a small processor/ trader has start-up capital UGX 1,500,000. For the refugees, most of their funding is in form of grants from NGOs such as the Danish Refugee Council (DRC). The DRC also supports small processors with equipment and linkages to markets.

Large processors are companies with processing facilities out of Kyegegwa. They buy and process bee products and the common ones are The Hives Ltd and Malaika Honey Company Ltd.

a) **The Hive Ltd** is a social enterprise company established in 16 African countries. It procures several apiary products including honey, propolis, pollen, wax, royal jelly and venom. In Uganda, its head office is in Luzira - Kampala and operates nationwide focusing on agro ecologically suitable areas for apiary such as Kyegegwa, Kyenjojo, Karamoja, Amudat, and Moroto. It offers markets to beekeepers, supports farmers to access equipment, and trains about 2,000 beekeepers in the country. The company has a field office with staff based in Kyenjojo district that is neighbouring Kyegegwa, and they train beekeepers on production, extraction, and processing technologies. Although the company does not have contracts with beekeepers, it offers a reliable market for honey. They purchase honey at UGX 9,000 - 12,000 per Kg of extracted honey and UGX 6,000 per Kg for honey in combs. In contrast, small traders offer UGX 10,000 per Kg for extracted honey and UGX 5,000 per Kg for honey in combs. The processing capacity for The Hive is 4,000 MT per year but is currently operating at 20 MT per season. The gap presents an opportunity for Kyegegwa beekeepers.

b) **Malaika Honey Ltd** is a business enterprise, which started with honey trading. However, due inadequate supply in existing supply chains, the company started bee farming and making of apiary inputs like KTB hives and field gear especially suits for harvesting. To complement their own supply, the company operates in a contract farming arrangement with numerous farmers. However, at the time of the interview, the company did not have any contracted farmer from Kyegegwa. Nevertheless, individuals and groups from Kyegegwa occasionally supply the company with honey. Malaika honey supplied 50 KTBs to Kyegegwa district in 2019. Across the country, besides supplying materials and offering markets for honey, Malaika honey builds capacity of VC actors. The company sells between 4 to 5 MT of honey per month; and has a maximum processing capacity of 20 MT a month but rarely processes 15 MT.

Large processors of honey prefer purchasing honey directly from the producers and not from small-scale traders/processors. The large-scale processors stated that the latter have poor handling mechanisms which reduce honey quality. Thus, they prefer collaborating directly with farmers whom they train and provide processing equipment which yield better quality honey and lower price than they would get from the local processors. The large processors sell 99% of the honey to supermarkets while 1% is sold to consumers outside the district (Fig 21).

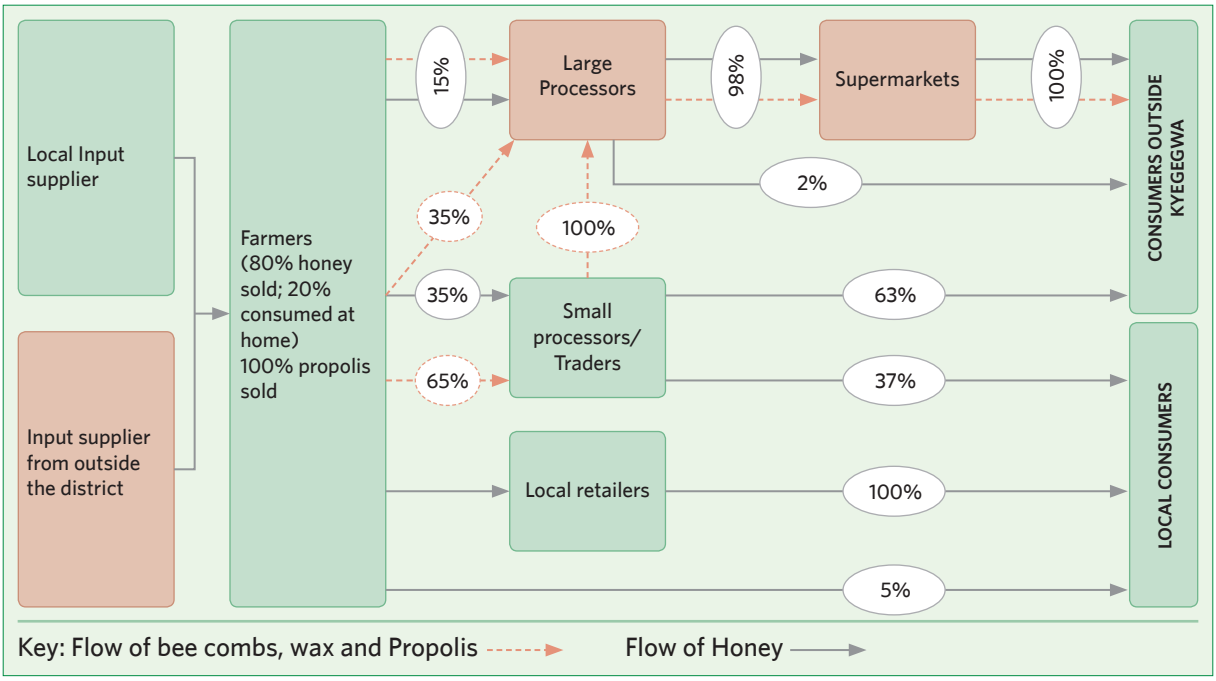


Figure 21: Product flow and quantification
Source: Primary data, 2020

D. Profitability of the Apiary value chain

The profitability of the apiculture VC was assessed for the different actors using honey with Gross Margins (GMs) and Net Present Values (NPVs) using specific assumptions derived from primary data under two production system scenarios i.e. the local and KTB hives. The assumptions for traditional hive scenarios are: (1) cost of hive is UGX 15,000; (2) Post-Harvest Loss is 12%; (3) Yield is 12Kg per year; and (4) honey price is UGX 8,000/Kg. For KTB, the assumptions are: (1) cost of hive is UGX 90,000; (2) Post-Harvest Loss is 6%; (3) Yield is 18Kg per year; and (4) honey price is UGX 10,000/Kg. Life span of the beehives is 10 years and discount rate is 9% per year.

Gross Margins for the farmers per hive per year: The KTB hive has the highest GM of UGX 145,818 per hive per year compared to the traditional hive that generates UGX 58,516. This is mainly because of the high volume of honey produced per KTB hive coupled with low post-harvest losses and without significant increase in cost of production other than the cost of purchasing the hive which is a fixed cost (Figure 22).

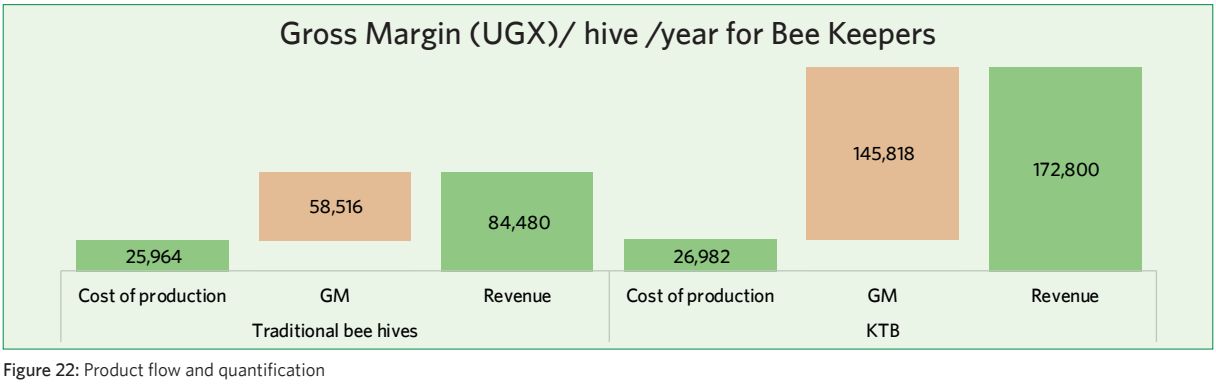


Figure 22: Product flow and quantification
Source: Primary data, 2020

Gross Margins for other actors per hive per year: The major actors assessed are small processors, large processors and retailers. Considering that large processors buy 15% of the honey from beekeepers, small processors buy 35% and retailers buy 25%, it was deduced that from a traditional hive, local retailers handle 2.6 kg, local processors 3.6 kg while large processors take 1.6 kg. From a KTB, local retailers handle 4.2 kg, small processors 5.9 kg while large processors take 2.5 kg. The above information is the basis of revenue computation from each type of hive considering that a traditional beehive produces 12 kg per year while the KTB provide 18 kg per year. The calculations of GMs also take into account the losses of 12% and 6% respectively for traditional and KTB hives, and the 20% that is retained for home consumption and handouts.

Small processors had the highest GM from both traditional and KTB hives of UGX 18,000 and UGX 29,500 per hive per year respectively, mostly driven by the large volume of honey they trade (Figure 23). Retailers had the least GM because they handle the lowest volumes in the chain.

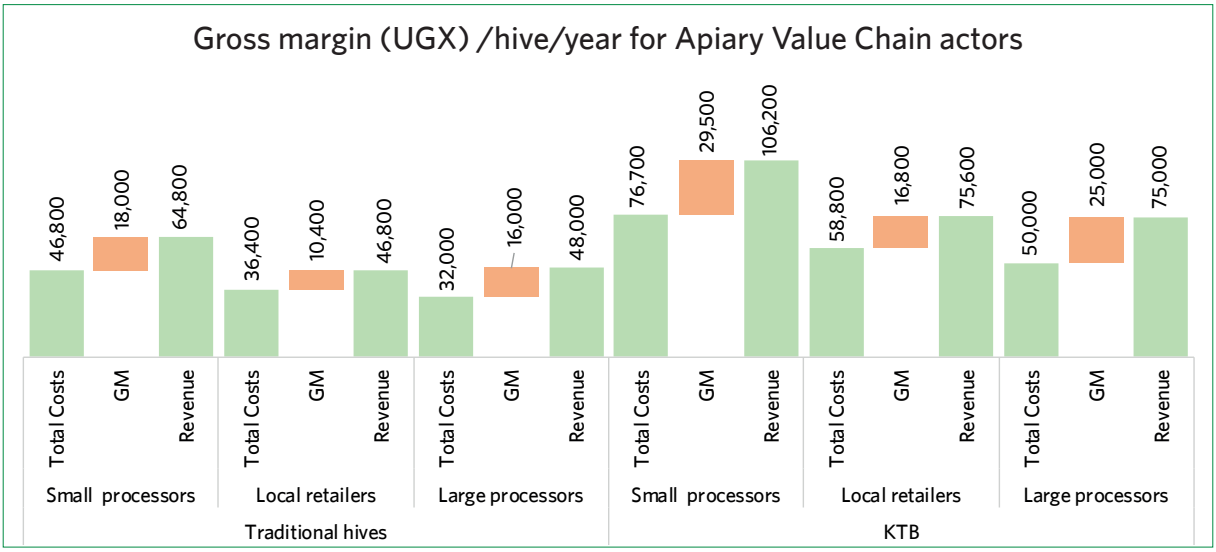


Figure 23: GM for apiary VC actors in UGX /hive /year
Source: Primary data, 2020

Gross Margins per Kg for all actors: Farmers with KTB make the highest GM/Kg (UGX 8,101) of honey harvested. This is driven by high productivity and quality of honey from KTB hive, thus high volume traded at a relatively high price (Fig 24).

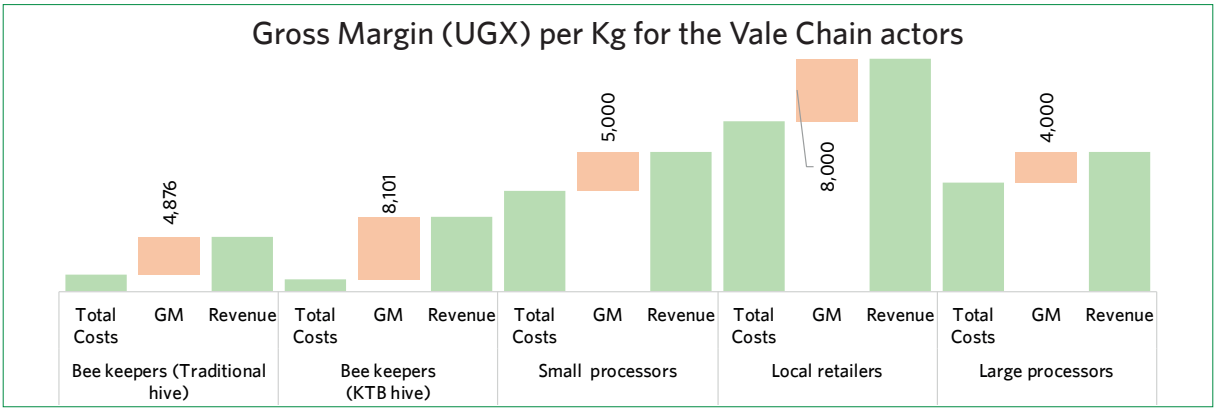


Figure 24: GM for Apiary VC actors in UGX/kg:
Source: Primary data, 2020

For DRDIP to make investment decision in apiculture VC, NPV was calculated for one traditional hive and for one KTB hive. The detailed revenues, variable and fixed costs are provided in Appendix 6. Fig 25 indicates that a beekeeper using KTB hive breaks even after 1 year and 5 months compared to 1 year and 1 month for the traditional hives. The difference is attributed to the higher initial investment cost of the KTB hives (UGX 90,000 per hive) compared to UGX 15,000 for the traditional hive.

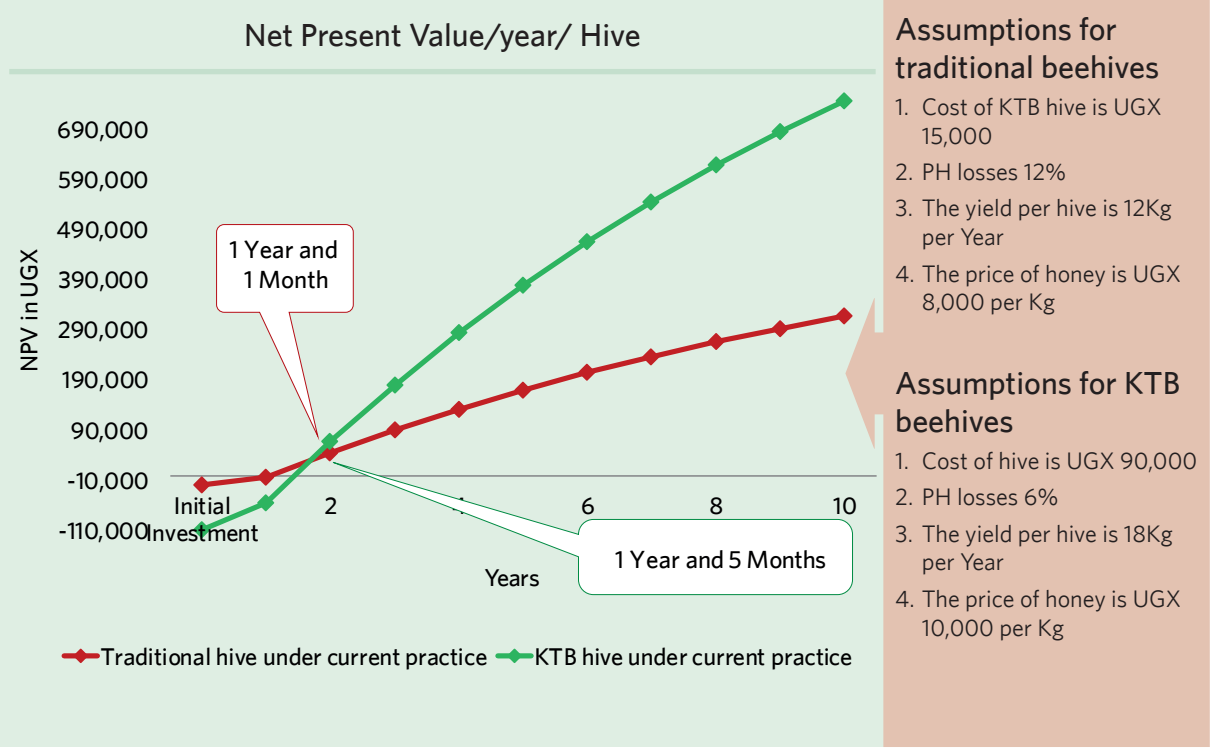
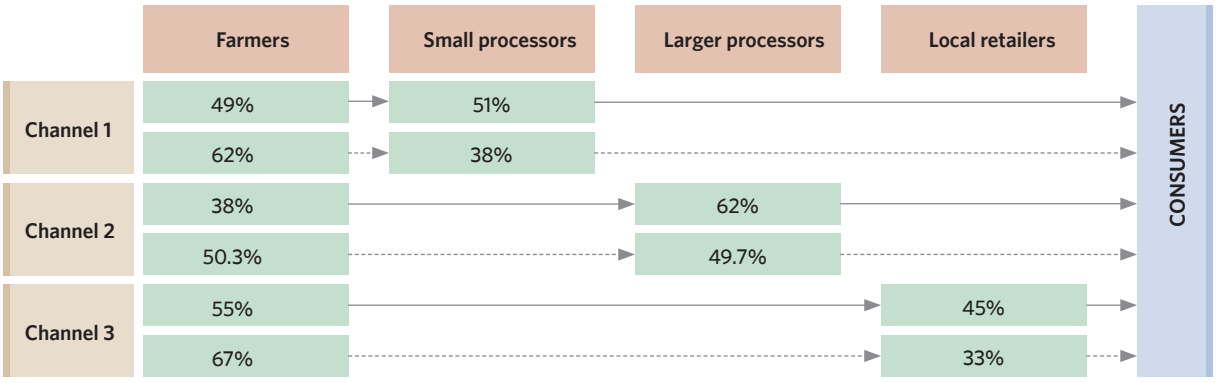


Figure 25: NPV in current scenario
Source: Primary data, 2020

The Kyegegwa honey VC is short and unstructured with three major supply chains (Fig 26). Farmers have the highest share of value where honey is extracted from KTB hives compared to that from traditional. This is because farmers generate higher GMs per Kg with KTB hives compared to other actors. Conversely, farmers' value of share is low with traditional hives compared to other actors. This is mainly due to the low-quality honey produced by traditional hives that attract low price to the farmers. This re-emphasizes the importance of processing high quality honey by the farmers. Although the farmers get the highest share while using KTB under channel 3 followed by channel 1, these channels deal with low honey volumes. Thus channel 2 using KTB hives would be the most appropriate as large processors are able to purchase all the volumes produced by the farmers. In this case, farmers' value share can raise with investment in modern extraction and processing technologies that will further improve the quality while reduce PHL at farm level.



KEY: Honey from traditional beehive ——▶ Honey from KTB hive ------▶

Figure 26: Share of value among Apiary value chain actors.
Source: Primary data, 2020

E. E. Employment generation potential and other potential impacts

The employment generation potential was estimated using the Full Time Equivalent approach. In addition, the wages earned from the different hive types were estimated in the district. The estimated number of hives in the district was 520 KTB and 1,213 traditional hives. There are currently 29.6 FTE jobs per year for 520 KTB hives in the district. The total wage for the 520 KTB hives is UGX 14,287,000 (Table 14). For the 1,213 traditional hives, there are currently 74 FTE jobs and the associated wage are UGX 34,540,175 (Table 14). The apiculture sector does not create many jobs as it does not require a lot of labour related activities during production and processing.

Table 14: Employment along the Apiary Value Chain

Actor	520 KTB hives		1,213 Traditional hives	
	Jobs	Wages (UGX)/ Year	Jobs	Wages (UGX)/ Year
Farmers	22.0	12,220,000	52.0	28,505,500
Artisans making hives	5.00	1,560,000	15.55	4,852,000
Traders	2.60	507,000	6.07	1,182,675
Total	**29.6**	**14,287,000**	**74 .0**	**34,540,175**

Despite the current low employment levels, bee keeping is a valuable and strategic economic activity especially for vulnerable households like women, youth and refugees who have inadequate access to productive resources like land. Besides, bees increase crop yields through pollination, thereby contributing to food security, household income and biodiversity conservation. Relatedly, bees wax is a valuable by-product of beekeeping that can serve as a source of income for beekeepers and can be used to produce light candle-further creating employment especially for vulnerable groups.

Furthermore, some of the bee products are used for food and medicinal purposes. It is estimated that about 100g of honey provides equivalent nutrition to 6 litres of milk or 170g of beef. It contains sugars, vitamins and minerals that are easily absorbed by the body. Medically, honey can be used as a sedative, laxative or antiseptic.

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F. Threats and community preparedness

Bees are attacked by pests and diseases. The important pests causing economic losses are the black ants, small hive beetles, wax moths and bee hornets. These coupled with pesticide use specially for emerging crop pests such as the early worm and locusts and frequent bush burning endanger not only the bee populations but also their products. Besides, there are many unscrupulous VC actors who adulterate bee products especially honey and consequently reducing the quality of the products on the market.

The community is not prepared enough to manage these threats. The district department of entomology is understaffed and underfunded. There is only one entomologist who is mandated to serve on all the entomology aspects in the district i.e., vector control and promote productive entomology (sericulture and apiculture) and this involves working across sectors of apiary, sericulture, livestock, crop and health. However, the staffing level required is for one Senior Entomologist, one Entomologist, and 8 Assistant Entomologist with one per sub county. The department also lacks funding for demonstration/training kits. With insufficient number of extension staff and lack of training kits, farmers lack skills and knowledge to diversify beyond honey production into high value products like venom, pollen, etc. Relatedly, there is limited access to technologies and equipment for production and processing of bee products. For instance, farmers are mainly using traditional hives which are cheap compared to the high yielding KTB. Similarly, the extraction and processing equipment such as the honey presser, stainless metallic tanks, and refractometer are expensive and not readily available within Kyegegwa. MAAIF is also mandated to regularly conduct national residual monitoring surveys. However, this is only conducted annually and is not comprehensive. As well, UNBS which is the quality control regulator is understaffed, underfunded and not readily available at the grassroot. A combination of these factors has contributed to reduced volumes and quality of the bee products on the market, and consequently making the value chain less competitive.

Table 15: Constraints in the Apiary Value Chain in Kyegegwa

	Constraints	Mitigation Strategy
Beekeepers	1) Limited knowledge in bee keeping and processing which affects quality and quantity of bee products produced. 2) Limited availability and affordability of modern beehives, and other equipment leading to low quality and volumes of honey produced. 3) Weak governance in farmer organizations that limits the potential of collective action. 4) Theft of honey from beehives which demotivates investment by the producers in the VC.	1) Build knowledge and skills in production, extraction, processing and packaging of different bee products like honey, venom, etc. 2) Establish a mechanism to support beekeepers acquire modern equipment. 3) Link farmers to reliable large processors e.g. The Hive and Malaika companies who also provide capacity building in production and processing of bee products. 4) Build the capacity of beekeepers on leadership, governance and financial literacy 5) Fast track the signing of the draft National Policy and enact by laws that deter theft.
Small processors/ traders	1) Unreliable quality and quantity of honey from beekeepers exacerbated by adulteration at producer and trade levels, and consequently makes the VC less competitive 2) Limited access to affordable and labour-saving equipment and packaging material	1) Establish by laws/ district ordinances to enable the enforcement of quality and safeguard against adulteration of honey. 2) Link processors to suppliers of equipment and packing material.
Large Processors	1) Inadequate supply of honey and other bee products from beekeepers making the business risky. 2) Adulteration of honey by producers and small-scale traders/processors that reduces the competitiveness of the value chain.	1) Increase production of honey and other bee products; and link processors to producers. 2) Support beekeepers to invest in beehives to increase production. 3) Establish by laws/ district ordinances to enable the enforcement of quality and safeguard against adulteration of honey.

G. Public and community sector support

The apiculture sector in Kyegegwa is promising and has multiple public and community sector institutions support. As presented earlier, there is great potential for farmers to directly link with large processors like The Hive and Malaika. However, the volumes and quality produced by the farmers are still low.

The public sector support is mainly through the department of Entomology within the directorate of animal resources under MAAIF that undertakes national residue monitoring, as well as formulation, review and implementing policies, plans and legislation in regard to productive entomology, Operations Wealth Creation (OWC) which provides farmers with KTB hives, and the District Local Government that offers training in bee production and processing. These institutions are assisted by The Uganda National Apiculture Development Organisation (TUNADO) - the apex body recognised by the public and government of Uganda to coordinate all value chain actors in the apiculture industry. In Kyegegwa, TUNADO trains beekeepers in record keeping, governance and financial literacy.

The community sector contribution is mainly through NGOs like DRC and KRC that provide beekeepers with start-up production kits and skills in production, extraction and processing of honey and JESE which offers Environment protection and livelihoods training with emphasis on bee keeping.

H. Recommended strategic investments for DRDIP

In Kyegegwa, apiculture has the potential to improve livelihoods through increase in incomes, job creation and nutritional improvement. It is also important in supporting sustainable environment use with bees pollinating crops. However, there are several threats that constrain achieving the potential. The key threats include a) rampant and indiscriminate bush burning and use of agro chemicals in agricultural fields; b) inadequate access to modern production, extraction and processing technologies; c) weak farmer groups and ineffective market arrangements; d) inadequate skills for diversification and value addition; and e) inadequate enforcements on standards and regulations within the sector. Therefore, the key strategic investment areas recommended are as below:

1) **Invest in increased and sustainable production of bee products**

- Work with TUNADO and the district to develop and disseminate guidelines on increased and sustainable production and processing of bee products and facilitate existing staff to train farmers.
- Build the capacity of beekeepers. Capacity building would be two-fold: a) Training and enabling beekeepers to access modern equipment including hives. Train beekeepers on bee keeping best practices; honey harvesting, and processing; and b) Train beekeepers on group management, negotiation skills and collective marketing.
- Build the capacity of artisans with skills and equipment to make KTB hives. Also, support farmers with the improved hives that generate more products than the traditional hives.
- Enforce judicious use of agro chemicals, by-laws against indiscriminate bush burning and adulteration of bee products. Support MAAIF and the district to enforce the Agro chemicals control act and ensure judicious agro chemical use by farmers. Also, liaise with UNBS to create awareness of the bee product standards and enforce their adoption by the actors.
- Build capacity of the district staff to offer technical backstopping to the staff. Support government to recruit and fill the vacant positions in the entomology unit and facilitate all technical staff with transport.

2) **Increase market access and reduce Post-Harvest Losses in apiary**

- Link farmers to large processors like The Hive and Malaika Ltd companies and support producers access finance by promoting VSLAs.
- Invest in building strong farmer groups. This should be accompanied by equipping farmer groups with knowledge and skills in leadership /governance, financial literacy, market-oriented production and farming as business
- Invest in aggregation centres with group owned extraction and processing facilities
- Construct feeder roads from production units to collection centres

3) **Invest in Value Addition**

- There is need to diversify and increase production of products like venom and pollen at farmer level. Also, the project should support the actors to produce secondary products such as candles, soap, etc.

Table 16: Assumptions per of strategic investment in Apiary Value Chain

Type of Hive	Scenarios	Assumptions
Traditional	**Scenario 1:** Current practice: Rudimentary extraction and processing	Rudimentary beekeeping practices i.e. using traditional beehives and manual honey extraction. Yields are low 12Kg/Year), PHH losses are high estimated at 12%, price per Kg is UGX 8,000.
	Scenario 2: Improved extraction methods	Yields are low 12Kg/Year, PHH losses are high estimated at 12%, enhanced quality of honey produced sold at UGX12,000 per Kg.
	Scenario 3: Improved extraction methods and processing	Yields are low 12Kg/Year, PHH losses are high estimated at 12%, enhanced quality of honey produced sold at UGX15,000 per Kg.
	Scenario 4: Improved extraction methods, processing and aggregation centres	Yields are low 12Kg/Year, PHH losses are high estimated at 12%, enhanced quality of honey produced sold at UGX16,000 per Kg.
KTB	**Scenario 5:** Current practice: Rudimentary extraction and processing	Yield are increased to 18Kg per year, PHH losses estimated at 4%, low quality of honey produced that is sold at UGX 10,000 per Kg
	Scenario 6: Improved extraction methods	Yield are increased to 18Kg per year, PHH losses estimated at 4%, enhanced quality of honey produced that is sold at UGX 12,000 per Kg
	Scenario 7: Improved extraction methods and processing	Yield are increased to 18Kg per year, PHH losses estimated at 6%, enhanced quality of honey produced that is sold at UGX 15,000 per Kg
	Scenario 8: Improved extraction methods, processing and aggregation centres	Yield are increased to 18 kg per year, PHH losses estimated at 6%, enhanced quality of honey produced that is sold at UGX 16,000 per Kg
Langstroth	**Scenario 9:** Modern extraction	Yield are increased to 44Kg per year, PHH losses estimated at only 2%, enhanced quality of honey produced that is sold at UGX 13,000 per Kg
	Scenario 10: Modern extraction and processing	Yield are increased to 44Kg per year, PHH losses estimated at 2%, enhanced quality of honey produced that is sold at UGX 15,000 per Kg
	Scenario 11: Modern extraction, processing and aggregation centers	Yield are increased to 18 kg per year, PHH losses estimated at 2%, enhanced quality of honey produced that is sold at UGX 16,000 per Kg

Table 17: Assumptions per strategic investment in Apiary Value Chain

		Traditional Hive				KTB Hives				Langstroth		
Category	**Item**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**	**Scenario 8**	**Scenario 9**	**Scenario 10**	**Scenario 11**
Farmer	Price per kg	8,000	12,000	15,000	16,000	10,000	12,000	15,000	16,000	13,000	15,000	16,000
	PHL	12	12	12	12	4	4	6	6	2	2	2
	Volume produced per year	12	12	12	12	18	18	18	18	44	44	44
	Volumes after PHH Losses	11	11	11	11	17	17	17	17	43	43	43
	Revenue	84,480	126,720	158,400	168,960	172,800	207,360	253,800	270,720	560,560	646,800	689,920
	Cost of production	25,964	26,589	26,589	26,245	26,982	27,607	26,882	26,602	35,026	35,026	35,007
	GMs	58,516	100,131	131,811	142,715	145,818	179,753	226,918	244,118	525,534	611,774	654,913
	% change in GM	NA	71	125	144	NA	23	56	67	260	320	349
	Jobs created per hive	0.14592	0.14993	0.14993	0.14705	0.01422	0.14620	0.14220	0.13931	0.14775	0.14775	0.14486
	Pay Back period	1Y and 1M	2Y and 9M	8Y and 11M	7Y and 12M	1Y and 5 M	2Y and 5M	5Y and 2M	4Y and 9M	4Y and 7M	4Y and 5M	4Y and 1M
Local traders	Volume handled (60%)	6	6	6	6	10	10	10	10	26	26	26
	Production cost	82,368	88,704	101,376	101,376	134,784	155,520	162,432	172,584	388,080	465,696	465,696
	Revenue	114,048	114,048	114,048	114,048	186,624	186,624	182,736	182,736	465,696	517,440	517,440
	GMs	31,680	25,344	12,672	12,672	51,840	31,104	20,304	10,152	77,616	51,744	51,744
	% change in GM		-20	-60	-60	64	-2	-36	-68	145	63	63
	Jobs created	0.146	0.150	0.150	0.147	0.014	0.146	0.142	0.139	0.148	0.148	0.145
Market	Market opportunity	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
	# hives required to meet the demand	7,576	7,576	7,576	7,576	4,630	4,630	4,728	4,728	1,855	1,855	1,855
	Number of groups required	76	76	76	76	46	46	47	47	19	19	19

Table 18: Cost to invest per group using scenario 8

Item	Unit cost	Number of item		Cost (UGX)	
		One group	47 Groups	One group	47 Groups
Hives	90,000	100	4,728	9,000,000	423,000,000
Harvesting gears	200,000	2	94	400,000	18,800,000
Honey press	1,500,000	1	47	1,500,000	70,500,000
Food grade stainless steel settling Tanks 200kgs with strainer	3,000,000	1	47	3,000,000	141,000,000
Honey Refractometer (Atago model)	2,000,000	1	47	2,000,000	94,000,000
Total				**15,900,000**	**747,300,000**

3.1.4 Tomato Value Chain

A. Introduction

Uganda's horticultural production is one of the fastest growing agricultural sub-sectors with a growth rate of 20% per year. It contributes to value addition, income diversification and foreign exchange earnings through exports. The horticulture sub-sector is dominated by small farms who produce for local and export markets. The most important horticultural crops include tomatoes, green beans, cowpea, pepper, onions, crucifers, and amarantha. Tomatoes are produced in small farms with average size of 0.2 acres. The average yield is low (1.0 MT/acre) compared to a potential of 26 MT/acre (Tusime, 2014). Use of improved technologies is minimal with 90% of the farmers using Open Pollinated Varieties (OPVs). Rarely do farmers use hybrid seed, fertilizers, irrigation or even greenhouse technologies. The crop is normally grown as a mono crop under rain-fed conditions in two seasons per year. The first growing season is April - May while the second is September - November (Dijkxhoorn et al., 2019).

Tomato is highly susceptible to pests and diseases making pesticides key inputs. The major diseases are late blight *(Phytopthora infestans)* and bacterial wilt *(Pseudomonas solanacearum)* (Atuhaire, 2016), while bollworm *(Helicoverpa armigera)* and thrips *(Thrips spp.)* are the major pests (Tumwine, 2010). The attack by late blight alone can lead to lose of the entire crop if timely application of fungicides is not undertaken (Ojiewo et al., 2010). Use of fungicides, mostly mancozeb (Dithane- M45), pesticides such as Lambda cyhalothrine, Malathion and Imidacroprid and sanitation practices are among the common ways of managing diseases. The challenge of counterfeit/ adulterated pesticides coupled with poor application skills by farmers (either poor equipment, poor dosage, non-selective application of pesticides) has led to pesticide resistance (CABI, 2017). Relatedly, Atuhaire (2016) reported high pesticide contamination of tomatoes, which is a threat to consumers' safety and the prospect of the value chain.

Tomato is not among the priority commodities under the 3rd National Development Plan (2020/21 to 2024/25). Nevertheless, Kyegegwa district local government and the community prioritized it as one of the eight value chains for investment under the Development Response to Displacement Impacts Project (DRDIP).

B. Demand and Supply

Production and consumption have been increasing steadily with an Annual Average Growth Rate (AAGR) of 4.8% and 1.2%, respectively from 2007 to 2017 - mainly driven by population growth and consumer preferences especially in urban and peri urban areas. In 2017, domestic consumption declined sharply possibly because there were more lucrative export markets that year in Kenya, the DRC, South Sudan and Burundi. Kenya was particularly affected by a long dry spell thereby increasing the demand and price of tomatoes in Uganda. In Kenya, both seasons in 2016 received reduced rains (World Weather Attribution, 2020) and production reduced by 17% (FAOSTAT,2020).

The major local markets for tomatoes are in Kampala, namely St. Balikuddembe (Owino market), Kalerwe and Nakasero. Some supermarkets in Uganda also import tomatoes from Holland and these serve a niche market for upscale restaurants in the country (Dijkxhoorn et al., 2019). Nevertheless, productivity is low at 5.5 MT/Ha compared to the potential of 56 MT/Ha (FAO, 2020).

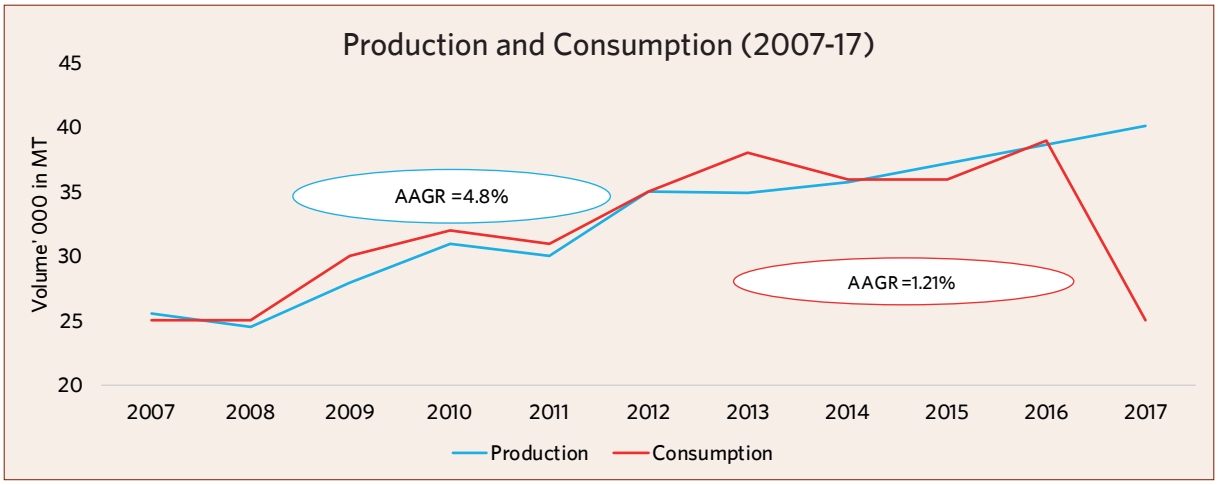

Figure 27: Production and consumption of tomatoes in MT
Source: FAOSTAT, 2020

Uganda exports fresh and prepared tomatoes (processed tomato paste) as well as tomato ketchup. In 2014 - 2018, exports of fresh and prepared tomatoes increased at an AAGR of 93% and 34%, respectively. About 81% of the fresh tomatoes and 77% of ketchup is exported to Kenya, while 77% of prepared tomatoes is exported to DRC. The other destination countries for tomato products are Burundi, Rwanda, and South Sudan.

On the other hand, Uganda imports mainly prepared tomatoes valued at an annual average of USD 2,793,000 which represents 58% of total imports. This is followed by ketchup worth USD 2,108,000 and representing 41% and fresh tomatoes constituting 1% of the total imports. Fifty one percent of the prepared tomatoes is imported from China and 31% is from Italy. For ketchup, China supplies 63% and Egypt 11% to Uganda.

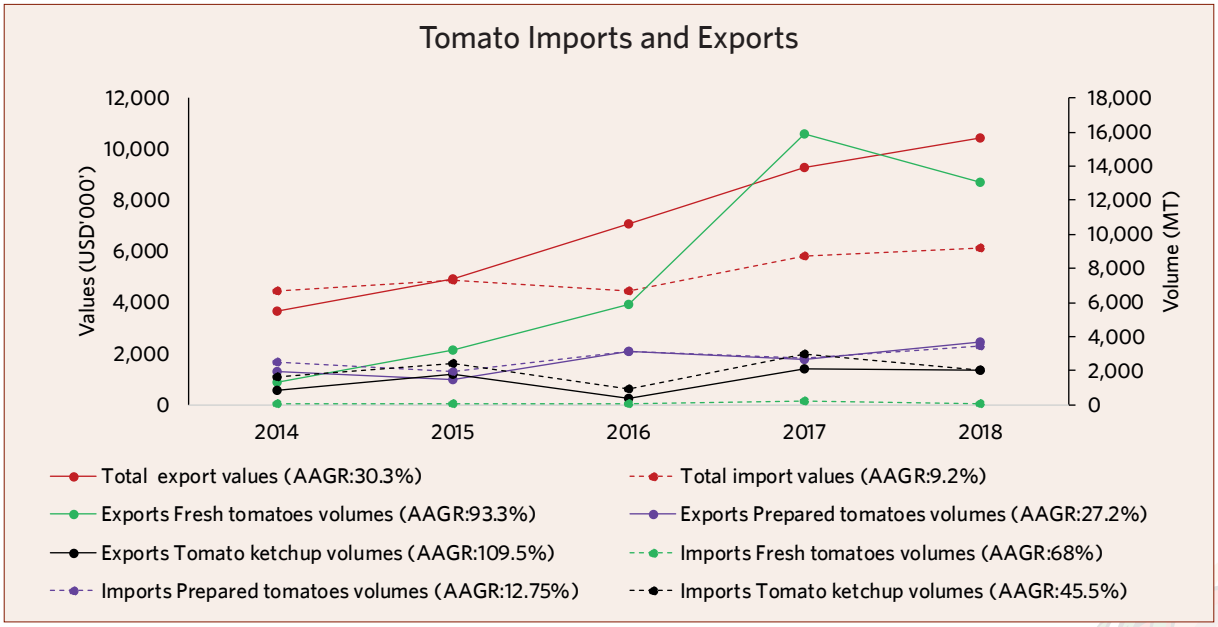

Figure 28: Formal tomato products import and exports values and volumes
Source: International Trade Cooperation, 2020

C. Value Chain actors

Kyegegwa district produces approximately 252 MTs of fresh tomatoes annually. About 7% is consumed at household level and 9.5% is consumed within Kyegegwa – restaurants, hotels, schools, lodges etc. An estimated 83% is sold to traders and transporters to markets in Kampala, Wakiso, etc. Tomato production in Kyegegwa is mainly rainfed and hence harvest is only twice a year as the area receives bimodal rainfall. Traders that source the produce from Kyegegwa normally buy from other areas during dearth season. Investment in high yielding technologies like improved varieties and fertilizer use coupled with use of irrigation facilities by farmers would raise harvested volumes even during dry season, and with an opportunity to increasingly and sustainably supply their traders. All the tomatoes produced in Kyegegwa are sold fresh. Buyers prefer large sized tomatoes that are free from physical damage. Information sharing between the different actors (farmers, middlemen and traders) in the VC is limited to price, available volumes, and harvest period.

Input suppliers are mainly located in Kyegegwa town council, which is the main town. There are 15 agro-input dealers in the district each with an average capital base of about UGX 2,000,000. Over 60% of them use own savings while less than 40% accessing credit from financial institutions mostly Centenary Bank, Equity Bank and Kyegegwa SACCO. They supply input for most crops grown in Kyegegwa.

Each input supplier pays an annual trading license of UGX 100,000. Over 85% of the input suppliers are registered at the district authority but none is certified by MAAIF. Most (80%) of the input dealers buy their stock from Kampala and the rest from Mbarara. Majority of the agro input shops in the district are owned by men (80%). The shop owners employ attendants- usually one or two youth who should at least be certificate holders. The majority (70%) of the attendants are males. The shops sell a variety of inputs including seeds, agro-chemicals, fertilizers, as well as rudimentary tools like hand hoes and watering cans. Input dealers sell 70% of their stock to farmers during the planting season but offer limited extension services on use of inputs because most of them have inadequate training.

Producers comprise refugees, host and non-hosting communities. Over 90% of the refugees grow tomatoes in backyard gardens that are less than 0.2 acres, while the hosts cultivate farms that are on average larger than 0.2 acres but less than 0.5 acres. The average yield is 1 MT/ acre. Production is mainly by individual farmers and neither the refugees nor the host communities use contract farming.

About 90% of tomato production is rain fed and irrigation is by use of rudimentary technologies mostly used mineral water bottles. About 80% of the farmers interviewed use seeds and pesticides from agro input dealers in Kyegegwa town, Kyaka, Kakabara, and Kayonza. About 40% of farmers are skilled in the use of agro-chemicals. The common seed varieties purchased by farmers are Rodade and Musununu (Asilla F1) and cost an average of UGX 40,000 per 10 g tin. Most of the agronomic practices are conducted by both men and women but spraying and marketing is dominated by men. Majority (95%) of the farmers use own savings to invest in the enterprise. Credit is mostly from VSLAs. Post - harvest losses are high, at 20 - 30% of the produce because of poor pre-harvest and harvesting practices. Selling price of tomatoes is UGX 800-1,000/ per Kg. Main buyers include wholesalers (70%), small traders (20%) and retailers (3%). Farmers harvest and sell immediately to either traders or consumers due to the perishability of the fruits.

Traders include wholesalers (10%) and retailers (90%). Men make up 33.5 % and women make up 66.5% of traders.

Wholesalers comprise 65% of men and 35% of women. Wholesalers trade between 50 – 375Kg per day. However, on market days, they sell between 250 – 375 Kg per day. The working capital is UGX 200,000 – 500,000 per week for a wholesaler. Seventy percent of wholesalers access credit from banks like Centenary Bank and Equity Bank, and SACCOs. Tomatoes are sourced from farms and farm gate price is UGX 800/Kg; and transported by motorcycles at a cost of UGX 1,000 per 100Kg to centres where wholesalers pick them. Wholesalers sell 81% of their purchase to retailers outside Kyegegwa, 2% to local consumers and 7% to local retailers (Figure 29). The selling price is UGX 1,000/Kg. All the wholesalers are registered with the district authority and pay a daily market fee of UGX 2,000. Post-harvest losses at the wholesale level are estimated at 10%.

Retailers: There are over 2,000 tomato retailers in Kyegegwa comprising 98% women. The average working capital for a retailer is UGX 100,000 per week obtained either from own savings (55%) or loans from SACCO's (45%). Retailers buy tomatoes from wholesalers at UGX 840/Kg and from farmers at UGX 800/Kg. Tomatoes bought from farms are transported using bicycles at a cost of UGX 1,000/box to the market. On average, a retailer trades 50 -100Kg per week. Their selling price is UGX 1,200 per Kg. They sell their tomatoes to final consumers. PHL under tomato retailers is over 15% as the fruits are highly perishable requiring cold chains when they are not consumed immediately. However, no retailer has such technologies. Retailers in Kyegegwa town pay a market fees of UGX 1,000 per day to the town council authority.

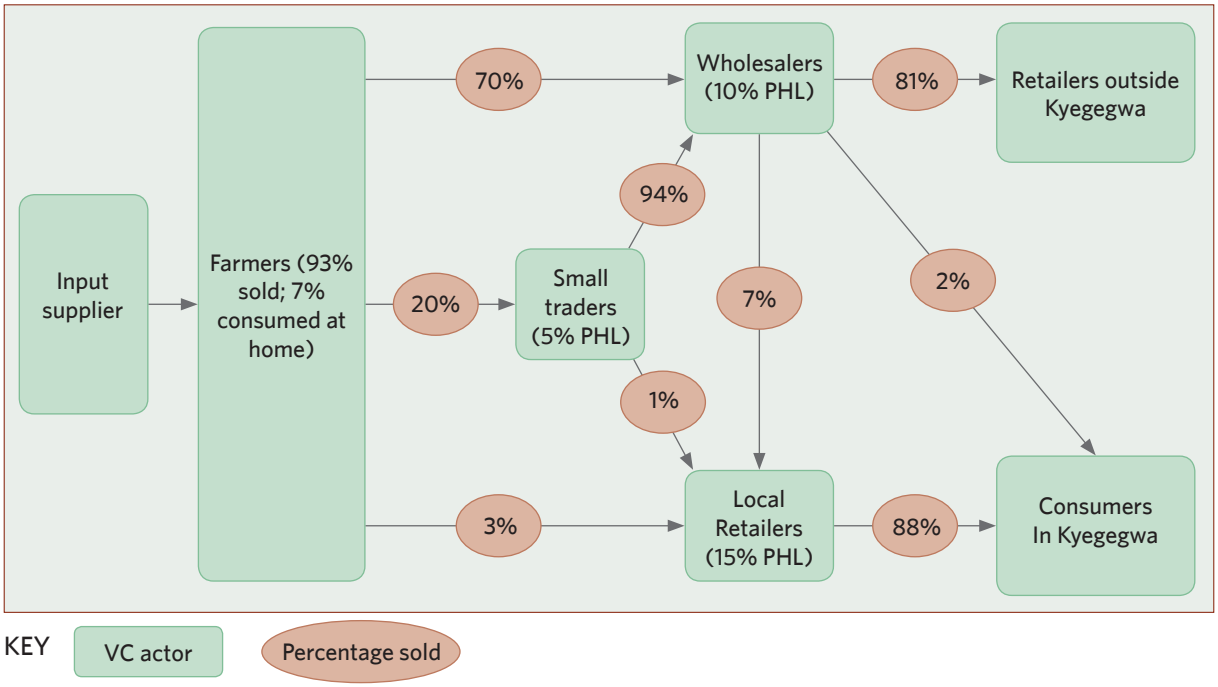

Figure 29: Fresh tomato flow and quantification in Kyegegwa
Source: Primary data, 2020

D. Profitability of the tomato value chain

The GM analysis was used to measure the profitability of tomato VC actors. The following assumptions were considered:

- Price of tomatoes per Kg is UGX 1,000 at farm level, UGX 1,700 for wholesalers and UGX 1,600 at retail level.
- Pot harvest losses are 10%, 5% and 15%, respectively for wholesalers, small traders and retailers
- Yield per acre is 2.1 MT per year.

Farmers make an average GM of UGX 380,000 per acre or UGX 380/Kg (Figure 30). The largest cost component is land opening (using a hoe) constituting 24% of the total variable costs.

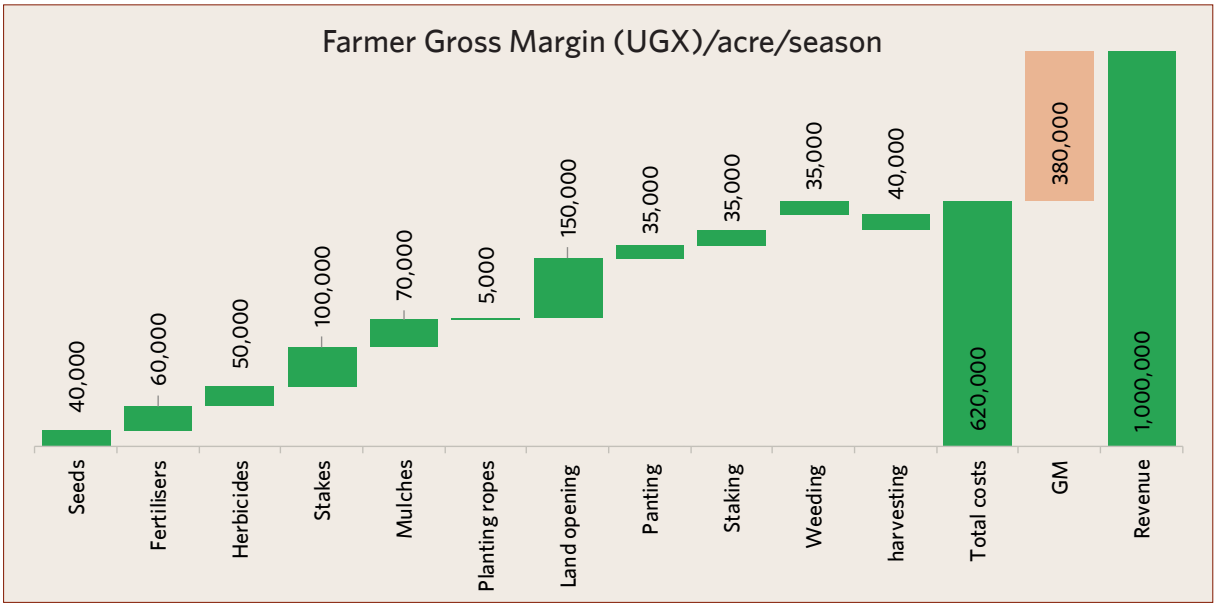

Figure 30: GM in UGX per acre per season at farm level
Source: Primary data, 2020

Wholesalers registered the highest GM of UGX 355,200 per acre because they trade in large volumes compared to retailers. Wholesalers deal in 888Kg per acre per season against 55Kg per season for retailers. The main cost driver for retailers and wholesalers is purchase of fresh tomatoes constituting 83% and 77% of the total costs, respectively.

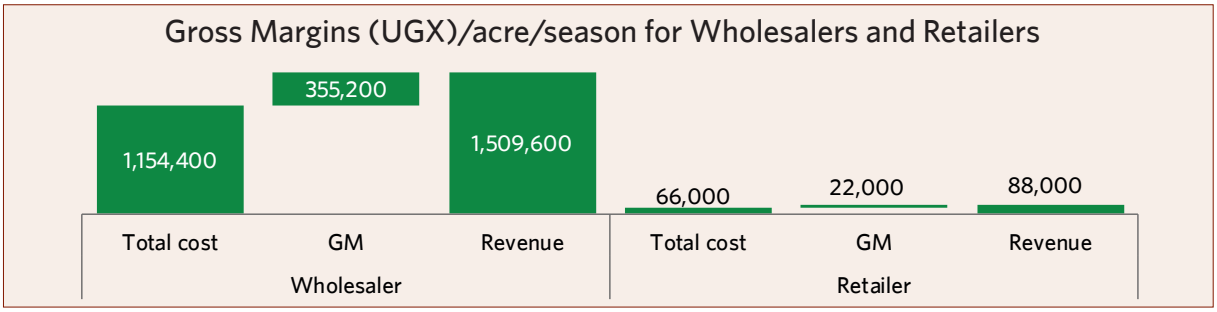

Figure 31: GM in UGX per acre per season at farm level
Source: Primary data, 2020

Both wholesalers and retailers make GM of UGX 400/Kg. Their respective buying prices are UGX 1,300 and UGX 1,200 per Kg and selling price are UGX 1,700 and 1,600, respectively (Figure 32). While wholesalers incur a high cost of transport as they sell out of Kyegegwa, they compensate by selling at higher prices. Retailers sell at relatively low prices and incur low transaction costs since they source directly from farmers and do not incur high transport costs.

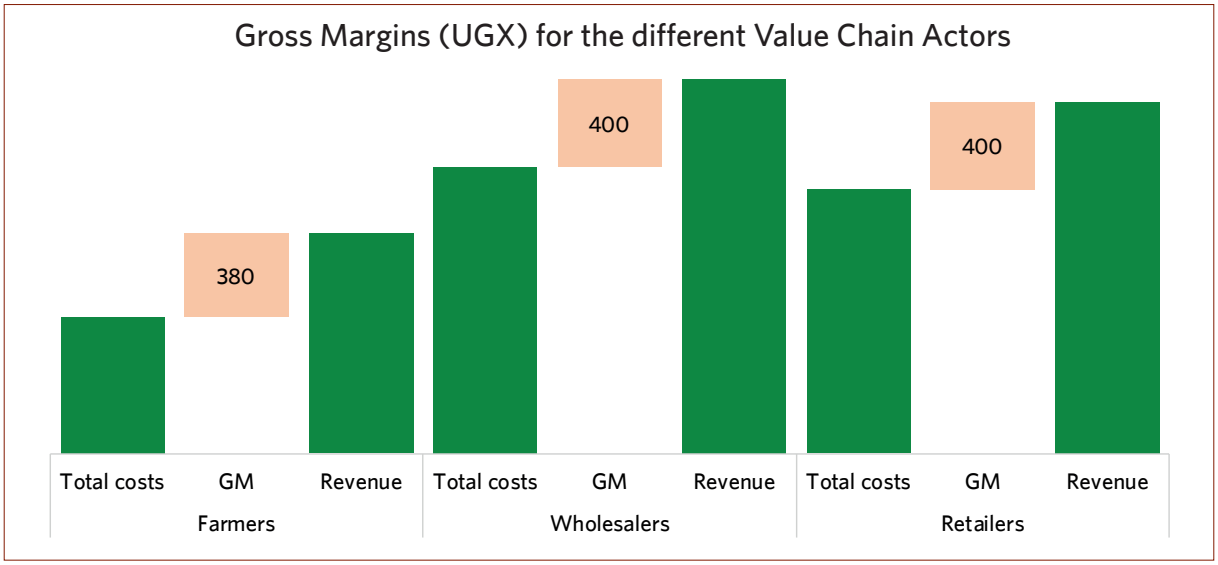

Figure 32: Gross Margins for different value chain actors along the tomato value chain
Source: Authors computation using primary data

There are four main supply chains for fresh tomato in Kyegegwa district (Figure 33). Farmers enjoy the largest share of value in channel 2 followed by channel 3 and the least share in channel 1. It is worth noting that the quantities purchased from the farmers under channel 2 by wholesalers are higher than those the retailers purchase under channel 3. Thus, channel 2 is the most suitable for investment for the benefit of the producers. However, organizing the farmers into organized groups and coordinating the picking of the tomato by the wholesalers would enhance the farmers' benefits. The data was collected during off-season and there were no small traders therefore their value share (channel 4) was not established.

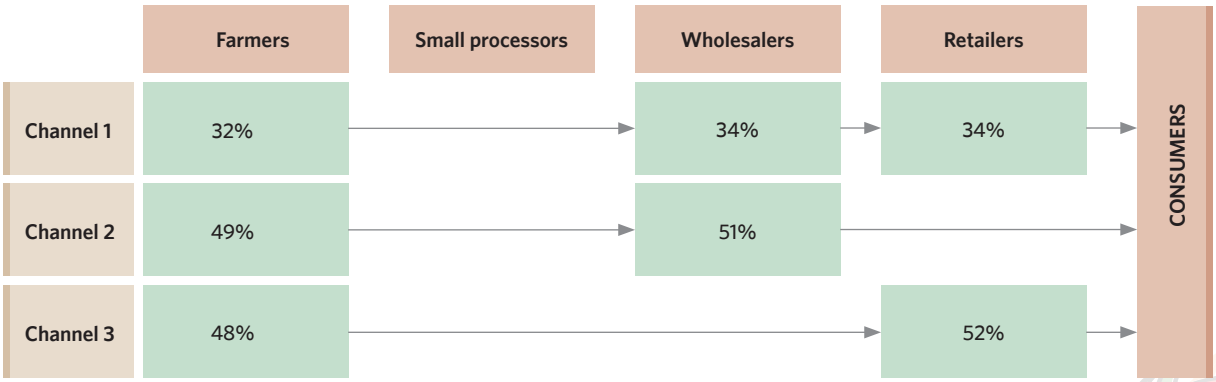

Figure 33: Trade channels in the Tomato value chain for Kyegegwa
Source: Primary data, 2020

E. Employment generation along the value chain

The employment generation potential was estimated using the Full Time Equivalent (FTE) approach. In addition, the wages earned were estimated for the entire district. The FTE jobs units per acre cultivated were used as the multiplier factor to estimate the number of FTE jobs under the existing acreage (126 acres) for tomato production in the district. At production, the major activities that require labor include land opening (30 man-days); planting (7 man-days); staking and mulching (7 man-days); weeding (7 man-days) and weeding (8 Man days). The labor activities create 59 man-days per season, 118 man-days per year and translates into 0.38 FTE jobs.

It was established that currently, a wholesaler deals in 1,776Kg per year. An acre of tomato can provide 3 days of work for a driver and a turn man; and 4 hours for loading and offloading per year. This is equivalent to 6.5-man days and translates to 0.02 FTE jobs and total wages of UGX 225,000 per acre per year.

Similarly, retailers sell on average between 50 to 100Kg per week. It was established that retailers sell 110Kg from an acre per season or 220Kg per year. Hence, an acre of tomato can make busy a retailer for 3 weeks. Since a retailer trades many agricultural commodities (on average 5), it was assumed 2 hours are spent selling tomatoes per day. Therefore, an acre provides employment for 3 weeks of 2 hours per day. This translate into 42 hours, 5.2 man-days and 0.016 FTE jobs

Table 19: Job created along the Value Chain

Value Chain Node	FTE jobs		Total Wages (UGX) in 1 year	
	1 Acre	126 acres	1 Acre	126 acres
Production	0.38	47.9	595,000	74,724,000
Wholesaler	0.0208	2.6	225,000	28,350,000
Retailer	0.016	2.02	24,960	3,151,200
Total for entire value chain	**0.4168**	**52.52**	**343,824**	**106,225,200**

F. Social benefits along the value chain

Tomato production is undertaken by both refugees and host communities because it is mostly grown on small plots which the refugees can access. A study conducted by Food and Agriculture organization (2018) on National gender profile of agriculture and rural livelihoods revealed that a higher proportion of women compared to men are involved in horticulture (58%) activities. Relatedly, a study by Atuhaire (2014) in Uganda asserted that females use smaller pieces of land to grow tomatoes. This could explain why it's grown by women as backyard/kitchen gardens for home consumption. This study corroborated the above results by establishing that more than 90% of refugees grow tomatoes in their backyard and that tomato activities at trade are dominated by women (66.5%).

Tomatoes contain beneficial nutrients and antioxidants and are a rich source of vitamins A, C and folic acid. Due to its richness in nutrients, tomatoes have various health benefits, and these are not limited to; combating the formation of free radicals known to cause cancer such as prostate, cervical, lung, and stomach. Other health benefits include; reducing a risk factor for heart disease, reduced risk of stroke, protection against loss of muscle mass, preservation of bone mineral density and reduction in the formation of kidney stones and also people with type 1 diabetes who consume high-fibre diets have lower blood glucose level.

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Environment issues

Tomatoes are highly susceptible to pests and diseases. Pesticides, especially ethylene bis-dithiocarbamates (EBDCs), are intensively used on this crop to combat different fungal diseases, such as early and late blights (Atuhaire et al., 2017). Unfortunately, the recommended pesticide usage is not followed by most of the farmers in Uganda. According to UNACOH (2019), personal protection during pesticide application is inadequate, the recommended mixing rates and pre-harvest intervals are abused, while some farmers spray tomato at or after harvest to extend shelf life during marketing (Atuhaire et al., 2016). Besides, indiscriminate disposal of empty pesticide containers and application of pesticides upstream and/or so close to water sources is a common phenomenon in farming communities across the country (UNACOH, 2019). All these practices pose a hazardous to producers and consumers of tomato as well as to the environment. For instance, a total of eight different pesticides (Mancozeb, Malathion, Metalaxyl, Profenofos, Cypermethrin, Dichlorvos, Lambda-cyhalothrin and Chlorpyrifos were found in the tomato samples collected from various vendors across the country (UNACOH, 2019). Designing and implementing a harmonized pest and disease control programs, coupled with a pesticide residual surveillance plan can reduce these risks.

Relatedly, it is a common practice to grow tomatoes in the wetlands during the dry spell. However, this favor breeding of mosquitoes; and leads to diversion of water channels, contamination of ground water with pesticides, as well as loss of biodiversity and consequently ecosystem degradation.

G. Threats and community preparedness

Tomatoes like most horticultural crops are highly susceptible to pest and disease that cause economic damage to the crop. The crop is also vulnerable to drought which is a frequent occurrence in Kyegegwa. Relatedly, during off season, tomatoes and other vegetables are grown and flourish well in swampy areas, and they attract lucrative farm gate prices which can range between UGX 1,500 and 3,500/Kg depending on the size and variety of the fruit. However, cultivation in endangers the ecosystem. Conversely, during bumper harvest, the price can be as low as UGX 600/Kg, while farmers do not have equipment and skills in value addition to the perishable commodity, which demotivates them to invest in the value chain.

The common pests are aphids, whiteflies, thrips, African bollworm, and highlands green mites that cause economic damage, while some also transmit viral diseases in tomatoes. The major diseases are late blight and bacterial wilt. Control of pests and diseases is by spraying with synthetic chemicals such as pesticides for pests and fungicides mainly Mancozeb for late blight. However, the challenge is improper chemical use that is putting both producers' and consumers' health at risk.

Presence of counterfeits coupled with the absence of harmonized pest and disease control programs, and inadequate extension services, have escalated improper use of pesticides. This has resulted in pesticide resistance and accumulation of residual in target commodities which can endanger consumer health. Moreover, measures to monitor pesticide residues in agricultural products are dismal although there are existing food laws like the Public Health Act (1935), Uganda Bureau of Standards Act (1983) and implementing authorities like Ministry of Health, Ministry of Local Government, Ministry of Trade and Industry dealing with food safety issues. Inadequate enforcement of the measures in regulating the importation and use of agro chemicals is partly because of role duplication and ineffective coordination among the mandated institutions coupled with their being understaffed and underfunded to reach the grassroots. Relatedly, the inadequate extension service is attributed to poor funding and limited technical staff at the local level. Currently within Kyegegwa, there are 10 staff in crop production comprising the Production Coordinator, the District Agricultural

Officer, and 9 field extension staff. However, the number of Field Extension Agents is just half of the required number of 18. Moreover, out of the 9, only 4 have motorcycles.

The threat of prolonged drought can be addressed through use of irrigation. However, the initial investment irrigation costs are high ranging between UGX 8M and 14M for the pump and pipes for one acre. This is not affordable by most of the small-scale farmers in Kyegegwa. Moreover, the interest rates from financial support institutions are high for farmers to access loans for investment in the irrigation system. Relatedly, financial institutions require collateral which most farmers do not have, while accessing credit through producer groups is hard as there are no existing groups for tomatoes, while those of other enterprises are weak in governance and leadership.

Another threat to tomato production and marketing is the high postharvest losses. A mitigation for this is improved handling and packaging of the product. A good packaging system should protect the commodity against pathogens, natural predators, moisture loss, temperatures extremes, crushing, deformation and bruising of the product, while allowing ample aeration of the tomatoes. The most appropriate material is the plastic crate. However, these are expensive and not readily available. Thus, farmers have adopted the use of wood crates which have higher ability to habour microorganisms responsible for spoilage unlike the plastic crates.

Poor road network leading to tomato production and marketing areas is a major hinderance hampering higher profits from the commodity. The settlements and remote areas that are far limit access to competitive markets. Table 20 below is a summary of the challenges and mitigation measures along the tomato value chain

Table 20: Constraints faced by the different actors

	Constraint	Mitigation Strategy
Farmer	1) Individual mentality of farmers that constrains their collective potential in accessing - input and output markets. 2) High prevalence of pest and diseases and low pesticide and fungicide usage that results in high losses. 3) High labor costs for land preparation and weeding that increase production cost and suppress profitability. 4) Poor state of rural roads which increases transportation costs.	1) Build the capacity of the farmer organizations in leadership, governance and financial literacy. 2) Promote good production and post-harvest practices with emphasis on Integrated Pests and Disease Management (IPM) and timely harvesting. 3) Promote the use of labor-saving technologies like use of herbicides and tractors. 4) Construction and rehabilitation of rural roads.
Traders	1) High aggregations costs due to sourcing small volumes from numerous smallholders. 2) High post-harvest losses attributed poor packaging in transportation and delays on the road due to roadblocks. 3) High transportation costs because of poor rural feeder roads.	1) Organize farmers into groups to increase volume bulked. 2) Construction and rehabilitation of rural feeder roads.

H. Public and community sector support

There is no specific policy targeting the horticulture sub-sector in Uganda. There are however various ministries and agencies that are mandated to support the horticulture sub-sector. Often, their roles are duplicated that results in ineffective utilisation of limited resources and diminished impact. For instance, the Agricultural Chemicals Control Act, 2006 mandates the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) to regulate importation, distribution and trade of agricultural pesticides. On the other hand, National Environment Management Authority (NEMA), Uganda National Bureau of Standards (UNBS), and National Drug Authority (NDA) all have an oversight role of regulating and monitoring the use of agro-chemicals in the country. Ineffective coordination coupled with limited funding and inadequate staffing negatively affects the effectiveness of these agencies in delivering their mandate. This leads to importation of illegal pesticides, proliferation of unlicensed dealers and high incidence of counterfeits in the market.

The district production sector is the main public support institution providing extension services to farmers producing tomatoes. The local government collaborates with NGOs i.e., Danish Refuge Council (DRC), Joint Effort to Save Environment (JESE) and ACTED which provide farmers especially refugees with extension services on vegetable production coupled with vegetable seeds mainly for food security. The vegetable gardens are commonly established as kitchen gardens by the farmers.

I. Recommended investments for DRDIP

Overall, tomato is a profitable VC that can generate employment opportunities for the people of Kyegegwa especially for women and youth besides boosting household nutrition. However, there is need to establish a functional pesticide residue surveillance plan to safeguard consumer safety, uphold fairness with trading partners and strengthen trade ties. To effect this, the Agricultural Chemicals Board under MAAIF should decentralize the inspection function to Local Governments and build their capacity to regulate the quality of agrochemicals distributed and traded across the country. Besides, the Ministry of Health MAAIF, Local Governments and NGOs need to undertake Health Education Programs on Safe Use of Pesticides at all levels. Also, there is need for the government to enforce existing laws as well as enact and implement a National Horticulture Policy to guide the sector activities at the national and local levels. Similarly, there is need to protect the ecosystem by enforcing the environment by-laws and safeguard the wetlands which are being destroyed by vegetable production.

Therefore, the key **strategic public investment** areas recommended for tomato in Kyegegwa are:

1) **Invest in increasing crop production and productivity.** This will involve the following:

   - ***Train farmers on GAP, GPHH, farming as a business.*** To bridge the staff gap while ensuring training of farmers, the project should work with the Horticultural Unit at National Crops Resources Research Institute (NaCRRI) and the district to develop guidelines on Good Agronomic Practices for adoption by all DRDIP beneficiaries; and facilitate existing staff to train farmers.

   - ***Recruit more staff under the crop production department and equip them with adequate transport.*** Currently, there are 10 staff in crop production comprising the Production Coordinator, the District Agricultural Officer: and 9 extension staff in the field. The number of Field Extension Agents is just half of the required number of 18. Moreover, out of the 9, only 4 have motorcycles.

- *Invest in irrigation infrastructure and associated facilities.* The government should work with DRDIP to construct structures of water for agricultural production and mitigate against the effects of prolonged drought. The project should also equip farmers with irrigation equipment. Irrigation coupled with use of GAP and GPHH as stated above can lead to three production seasons in a year. This can increase farmer GMs by 439% and increase in jobs by 290% (Scenario 2).

- *Enforce regulations on judicious use of agro chemical use.* The government should support this by streamlining and enhancing coordination as well as increasing staffing levels for the various institutions (like MAAIF, NEMA, and UNBS) that are dealing with regulation and judicious use of agro chemicals and safeguarding of the wetlands.

- *Establish a functional national pesticide residue surveillance plan.* This will safeguard consumer safety, uphold fairness with trading partners and strengthen trade ties. To effect this, the Agricultural Chemicals Board under MAAIF should decentralize the inspection function to Local Governments and build their capacity to regulate the quality of agrochemicals distributed and traded across the country. Besides. MOH, MAAIF, Local Governments and NGOs should undertake Health Education Programs on Safe Use of Pesticides at all levels. Also, the government should enact and implement a National Horticulture Policy to guide the sector activities at the national and local levels. **The central government should also empower the local government with skills, equipment** and other necessary materials for regular monitoring of pesticide residues in commodities.

2) Invest in sustainable market linkages

- There is need to link farmers to supporting services such as access to functional markets and market information, including improving road infrastructure and ultimately enable sustainable and fair prices for the tomato producers in the district. This should include building strong farmer groups which will involve equipping farmer groups with knowledge and skills in leadership /governance, financial literacy, market-oriented production and farming as business. The groups should also be linked to large scale traders, and FSIs including being supported to establish their own VSLAs and aggregation centres.

- The analysis reveals that the investment required to increase productivity to meet any market opportunity is low. Because of the perishability of tomatoes, it is critical that a guaranteed market is secured if the investment is to have impact on a large number of people in the communities.

3) Invest in value addition for competitive value-added tomato products.

- During bumper harvest (July to September), the average farm gate price for a Kg of tomato can be as low as UGX 600/Kg, and in normal season it is 1,000 while during scarcity, it is ranges between 1,500 and 3,500/Kg. As the commodity is perishable, during bumper and normal seasons, farmers cannot hoard it for a better price; consequently, they register losses. Although value added products like tomato sauce and ketchup are competitive and of high value, the processing equipment are expensive for the small-scale farmers. Thus, farmers need to be supported with skills and equipment for value addition coupled with information on market opportunities for the value added products.

The gross margins, and jobs creation at all VC levels were analysed in different scenarios to ascertain the impact of the core strategic investments. The scenarios are summarized in the following table:

Table 21: Different scenarios Tomato Value Chain in Kyegegwa

Scenarios	Description/Assumption
Current	Yields are low 1 MT/acre per season, farmers use rudimentary technologies for production; Wholesalers source directly from farmers or via middlemen and sell outside of the district; Retailers source from farmers and sell within the district.
1	Farmers are trained on GAP, investment in fertilizers/mulching/manure, high yielding varieties. Yield increases by 300% using varieties like Asilla F1, harvesting twice a year.
2	In addition to investments made in scenario 1, there is investment in irrigation equipment (e.g. drip irrigation). This will enable to harvest 3 times a year. Yield per acre per year increases by 500% using varieties like Asilla F1.

Table 22: Summary of the Impact of Investment scenarios

Category	Item	Current scenario	Yield increase with traditional irrigation	Yield increase+ With irrigation
	Scenario	0	1	2
Farmer	Price per Kg	1,000	1,000	1,000
	Yield per acre per season in Kg	1,000	4,000	4,000
	Yields per acre per year	2,000	8000	12000
	Revenue per acre per year	2,000,000	8,000,000	12,000,000
	Cost of production/ acre/year	1,240,000	4,730,000	7,095,000
	Current GM in UGX/acre/ year	760,000	3,270,000	4,905,000
	% increase /decrease of GM from scenario 1	NA	330.3	439
	Jobs created at district level	47.9	191.5	189
	% Increase / decrease in Jobs	Na	300.6	295.4
Traders	Variable costs in UGX per Kg	1,300	1,200	1,200
	Revenue in UGX per Kg	1,700	1,600	1,600
	Volume dealt in per year in Kg	1776	7,104	10,656
	Gross margin in UGX/acre/ year	710,400	2,841,600	4,262,400
	Jobs created at district level	2.6	10.4	15.6
	% Increase / decrease in Jobs	Na	391.07	637
Market	Market opportunity meet the deficit (Assuming the volumes exported out of Kyegegwa tripled: 115 MT per season*3=345 MT) The deficit will be 230 per season and hence 690 MT per year of 3 seasons			
	Yields per acre per year		8	12
	Yield increment per acre per year		6	10
	Number of acres required to meet the demand		115	69
	Number of groups to meet market opportunity (Assuming each group has 30 acres)		4	2
	Production cost per acre without labor cost		2,810,000	4,215,000
	Number of acres assuming the grant of 18.5 million		7	4
	Number of groups to meet the market gap		16	17
	Amount of grant required per group if DRDIP is to finance only 4 groups		74,000,000	78,625,000

3.1.5 Onion Value Chain

A. Introduction

Onions are commercially grown in Uganda and are the most consumed vegetable in East Africa Regardless of quantity, they are used daily in hotels, households, schools, hospitals and institutions as food seasoning and other condiments. There is a considerable export market for onions in Kenya and Rwanda. However, urban consumers prefer onions imported from Tanzania as they have superior quality characteristics such medium size and long shelf life. Auspiciously, Uganda has a suitable agro ecology for onion production and the total area under cultivation is estimated at 86,500 Ha. The total production is 344,261 MT per year (FAOSTAT, 2020). The crop thrives in areas between 1,500-2,100m above sea level, and the major producing areas are the western region and the mountainous part of the Eastern region (Dijkxhoorn *et al.,* 2019). Production is mainly rain-fed and the popular varieties are Red Bombay and Red Creole because they are high yielding and have an early maturity period. They are commonly grown by small scale farmers on plots of 0.25 - 2 acres with a few large-scale producers cultivating between 5 - 10 acres. Production is twice a year, March - June and September - December.

Productivity of onions in Uganda is very low - 1MT/acre against a potential of 20 MT/acre. This is partly because of the inadequate application of good agronomic practices (Dijkxhoorn *et al,* 2019), low soil fertility, pest and diseases, and poor storage facilities (Zziwa and Kabirizi, 2015), while production is rain-fed. The common pests are thrips, aphids, onion maggots and cut worms which destroy the leaves, while leaf blight is the major disease. Farmers often spray with chemicals such as Tata master and Ridomil to control the Leaf Blight.

Although onion is not among the priority commodities under the Third National Development Plan (2020/21 to 2024/25), the Kyegegwa District Development Plan (2015- 2020) recognizes horticulture as one of the strategic high value crops that are deliberated being promoted for commercial production and income generation. Besides, the district local government and the community prioritized onions as one of the eight VCs for investment under the Development Response to Displacement Impacts Project (DRDIP).

B. Demand and supply of onions in Uganda

Onion is consumed by almost all households in Uganda. Kampala being the highest consumption hub. In 2008 - 2013, onion production was consistently higher that consumption. Within this period, there was an average surplus of 50,603 MT. However, in 2014, there was a sharp increase in consumption by 51% and thereafter, the country consistently registered annual deficits. In 2016 and 2017, the deficit was 8,635 MTs and 6,746 MTs respectively- presenting a small market opportunity for Kyegegwa farmers.

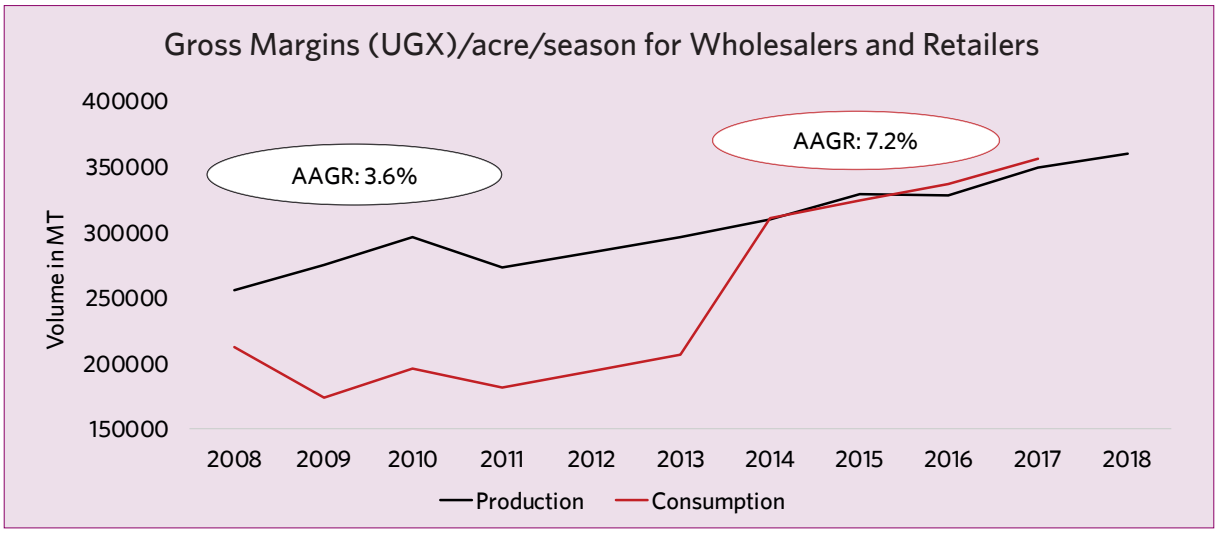

Figure 34: Onion Production and Consumption in Uganda
Source: FAOSTAT, 2020

Exports from Uganda in 2009 – 2018 comprised 97.5% of fresh onions while the rest were dried. Export of fresh onions volumes have been increasing at an annual average growth rate (AAGR) of 196% (Figure 35). In 2017 alone, the country exported 699 MT of fresh onion worth USD200,000 (Figure 35). Dried onion exports volumes have been increasing on an AAGR of 207.4%. The increasing trends in onion exports constitutes an opportunity for increasing supply.

Uganda's onions are mainly exported to Sudan with 55.9% of the exports being fresh onion and 29% being dried onion followed by South Sudan where 26.9% of the exports are of fresh onions and 29% are dried onions. Rwanda imports mainly the dried onions. Conversely, Kenya imports fresh onions only. Other destination for Uganda's onions includes Saudi Arabia and DRC(ITC,2020).

Uganda imports fresh and dried onion with the former constituting 95% of the total imports. In 2018, the country imported 20,149 MTs of fresh onion worth USD 241,600 and 51 MTs of dried onions valued at USD 22,000 (Figure 35). The fresh and dried onion imports volumes have been growing on an AAGR of 66.5% and 15.2%, respectively (Figure 35). The growth in imports is partly attributed to the growing population especially in the urban areas. This growth presents an opportunity for increasing production to supply unmet internal demand.

Imports are mainly from Tanzania and Kenya especially during the dearth season of May - June and November - December. In addition, Uganda's consumers perceive Tanzanian onions to be of better quality (medium to large size and well dried onion) compared those produced locally that are small sized and more susceptible to rotting. Besides Tanzania, Uganda imports onions from South Africa, UAE, Rwanda, China, Germany and Netherlands (ITC,2020).

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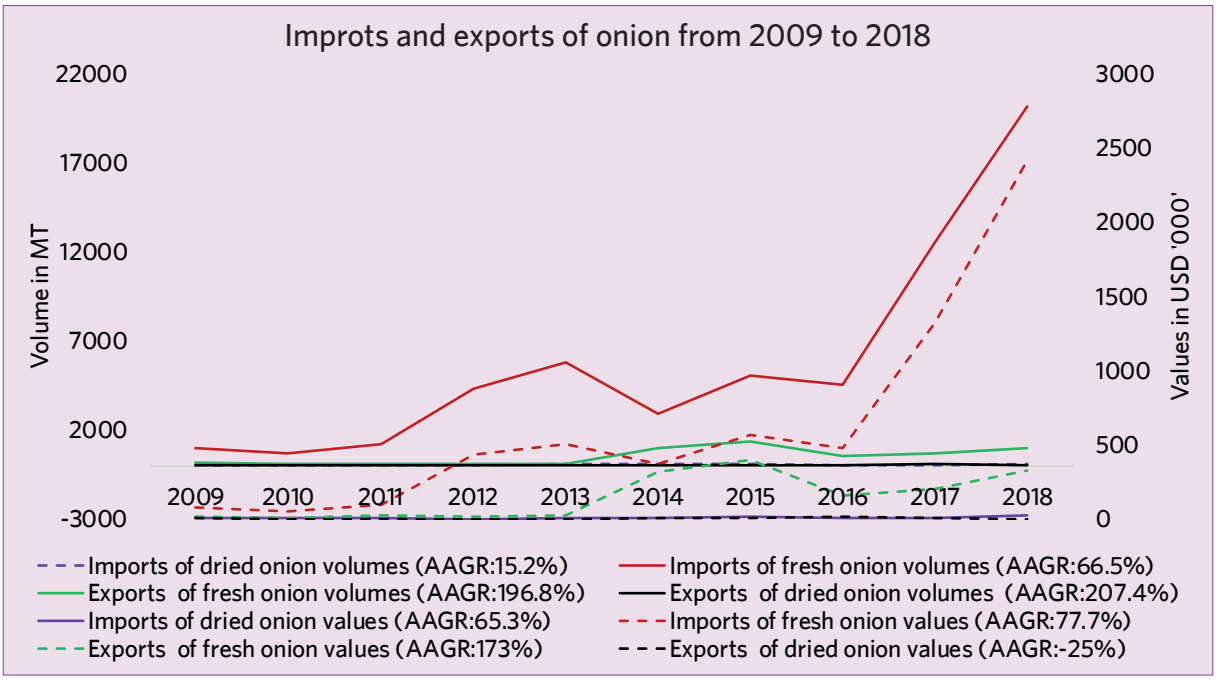


Figure 35: Onion products exports
Source: FAOSTAT, 2020

C. Value chain actors and potential strategic partners in the private sector

Kyegegwa produces approximately 260 MTs of onions per year. Production is by host, refugees and non-host communities, and grown mainly for sale. About 4% of the produced onions are consumed at household level and 7% within Kyegegwa in restaurants, hotels, schools, and lodges. An estimated 89% is sold by wholesalers in major markets in Kampala, Wakiso, etc. Possibilities of increasing yields and producing during dry season constitute an opportunity to increase the production to substitute import and to supply the increasing exports.

Farmers sell 90% of the onions produced; 50% to small traders, 40% to wholesalers and 10% to retailers. Like the farmers, the small traders mainly (98%) sell to wholesalers, and the latter sell (97%) to retailers outside Kyegegwa. However, in a few cases, the wholesalers sell to local retailers and to consumers (Figure 36).

Input suppliers are mainly located in Kyegegwa town council, the main town. There are about 15 agro input dealers in the district providing inputs for multiple value chains. They have an average capital base of about UGX 2,000,000. Over 60% of them use own savings. Financial institutions include Centenary and Equity Banks and Kyegegwa SACCO.

Each input supplier pays an annual trading license of UGX 100,000. Over 85% of the input suppliers are registered at the district authority but none is certified by MAAIF. Most (80%) of the input dealers buy their stock from Kampala and the rest from Mbarara. Majority of the agro input shops in the district are owned by men (80%). The shop owners employ attendants- usually one or two youth who should at least be certificate holders. They sell a variety of agro inputs such as onion seeds (Red creole and Red Bombay F1), agro chemicals like pesticides, herbicides, fertilizers and simple implements like hand hoes, and watering cans. Input dealers sell 70% of their stock to farmers mainly during the planting season meaning demand is seasonal. They also offer a variety of services to farmers such as extension services on use of inputs although most of them are not adequately trained. The cost of seed for both Red creole and Red Bombay F1 is UGX 40,000/ Kg.

Producers comprise refugees, host and non-host communities. Twenty percent of refugee households grow onions in their backyard gardens of less than 0.2 acres, while the host communities cultivate about 0.5 acres. According to the District Production Officer, among refugee and host communities, approx..60% of the farmers are women. Farmers' working capital ranges between UGX 100,000 and UGX 150,000 per acre. Majority of the farmers use own capital with less than 5% accessing credit from Village Savings and Lending Associations (VSLAs).

Over 85% of the farmers reported using improved onion varieties especially Red creole and Red Bombay F1 that cost UGX 20,000/10g tin. Cultivation is by men and women. However, spraying and marketing are dominated by men. On average, farmers produce 1.05 MT (7 bags @150Kgs) of onions per acre and lose approximately 10% of the harvest due to poor post-harvest handling (cut during harvesting while using a hoe). Farm gate price is UGX 810/kg. Refugees, however, produce for home consumption because of the small plots they are allocated. All the farmers interviewed were not in groups and did not have contracts with buyers.

Wholesalers are over 200 in the district, 95% of whom are men. They sell between 5 to 10 bags per week or 2 to 10 bags per day: and a bag weighs 150Kgs. However, on market days, one sells between 5 – 15 bags per day. The average working capital of a wholesalers is between UGX 180,000 – 500,000 per week. About 60% have access finance from banks such as Centenary and Equity and SACCO's. Onion is transported using motorcycles at a cost of UGX 2,000 per bag and sold at UGX 1,200/Kg in markets out of Kyegegwa. Wholesalers pay a market fee UGX 1,000 daily. Only 5% of the wholesalers interviewed were registered at the district. Post-harvest losses at the wholesale level were estimated to be 2%. Wholesalers interviewed had marketing, measurement and packaging skills that they needed to operate their businesses.

Small traders are vital in linking farmers to wholesalers. They are individuals living in the production areas and therefore have information on the farmers Traders purchase 50% of the onions produced. Only in a few instances are they commissioned by wholesalers to aggregate onions.

Retailers are over 2,400 in the district, and 99% are women. They operate with a capital of UGX 50,000 - UGX 100,000 per week and 65% of them rely on own savings. The remaining 35% access loans from SACCOs. Retailers buy 6% of onions produced by the farmers. They also purchase from wholesalers (2%) and small traders (2%). Buying prices were UGX 1,000 per Kg from wholesalers and UGX 810 per Kg from farmers. Transportation cost was UGX 1,000 per 150 Kg bag when using a bicycle and UGX 2,000 when using a motorcycle. On average, retailers sell between 75 and 150Kg per week at a price of UGX 1,600/Kg.

Typically, retailers own semi-permanent structures, sell onions and several other commodities like groceries. From the study, it was established that they lose 2% of their onions due to rotting. They pay market fee of UGX 1,000 per day to the market authority although none of the interviewed retailers was registered with the district authority.

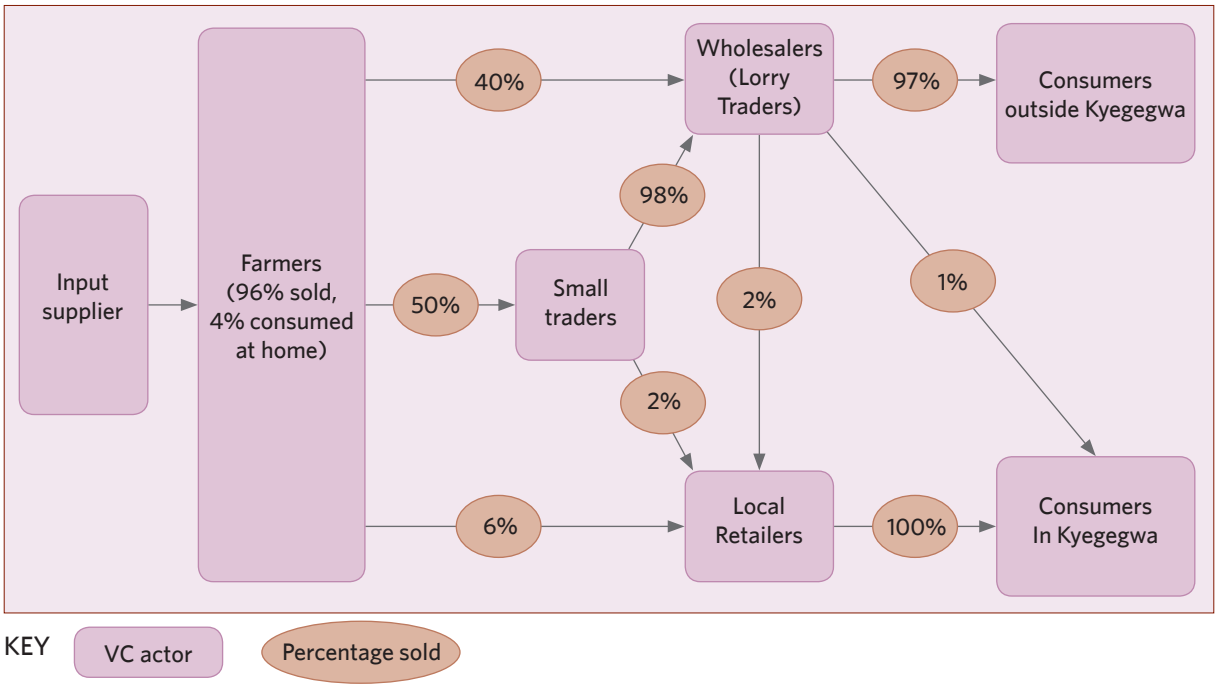


Figure 36: Fresh tomato flow and quantification in Kyegegwa
Source: Primary data, 2020

D. Profitability of the Dairy value chain

Farmer gross margins. Farmer GM was UGX 497,600/ acre/season and the highest cost drivers were land preparation, planting and weeding collectively contributing 81% of the total production cost (Figure 37).

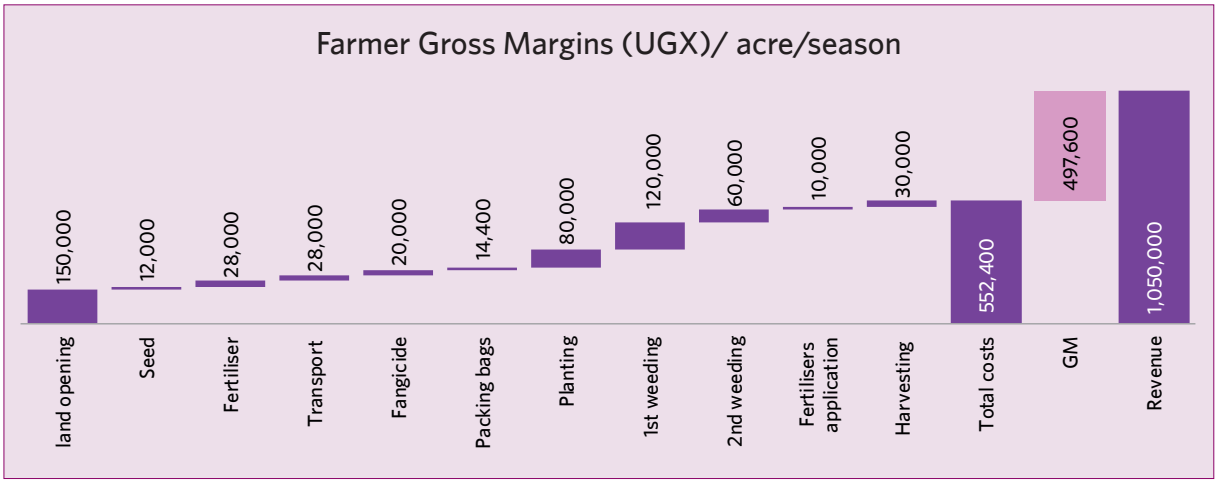


Figure 37: GM for the onion farmers per season per acre
Source: Primary data, 2020

Gross margins for wholesalers and retailers: The wholesalers made higher GMs (UGX 182,900) compared to retailers (UGX 56,400) because the former trade bulk volumes per acre per season (Figure 38). The main cost driver is purchase of the onions constituting 80% of the cost of operation and transport costs comprising 10% of the total cost for both traders. Other costs include packaging material, wages and market fees.

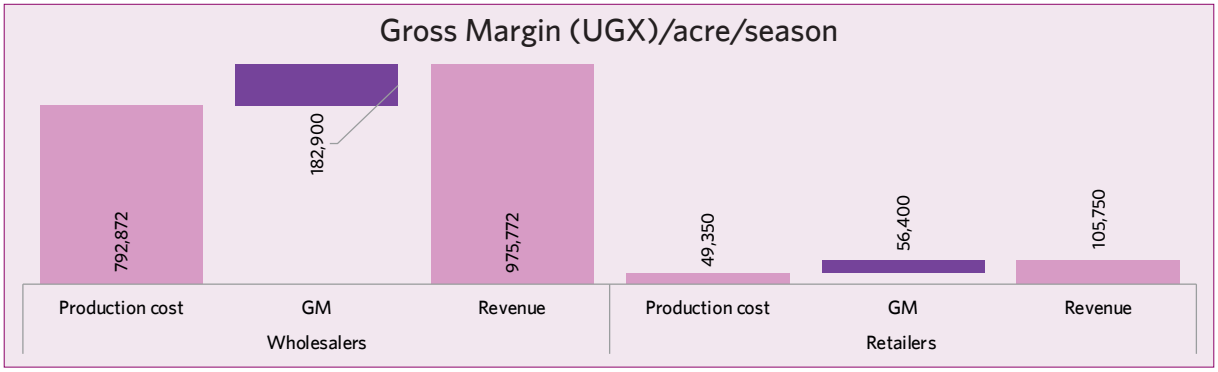


Figure 38: GM for the onion VC actors in UGX per season per acre
Source: Primary data, 2020

A closer look at the GMs per Kg for the different actors shows that the highest GMs are for retailers (UGX 800) followed by the farmers (UGX 429) then the wholesalers (UGX 200). The investment costs for retailers are the lowest, hence the high margins compared to the other actors.

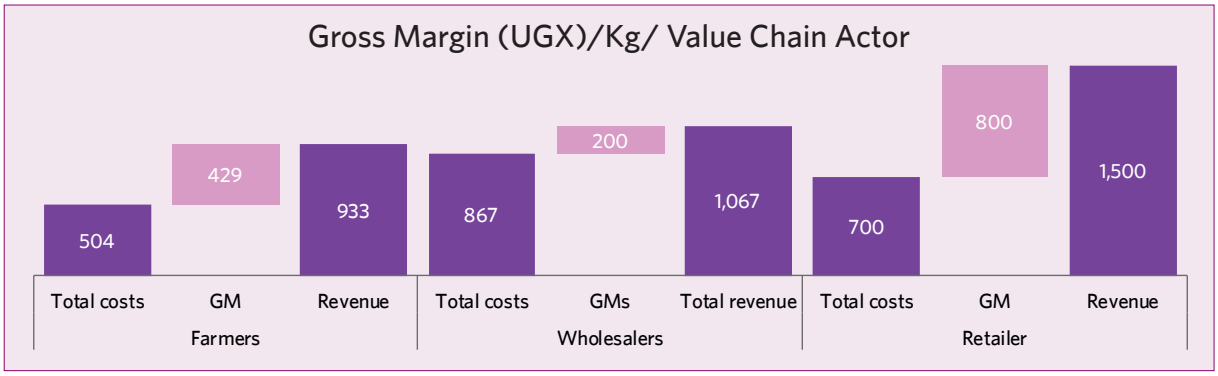


Figure 39: GM for the onion VC actors
Source: primary data, 2020

Farmers get the highest share of value under channel 2, while retailers have the highest share of value in channels 1 and 3 chain as they sell to final consumers (Figure 40). Besides farmers registering high value share under channel 2, the quantities purchased from the farmers by the wholesalers under this channel are higher than those retailers purchase from the producers under channel 3. Thus, channel 2 is the most suitable for investment for the benefit of the producers considering the market opportunity. However, facilitating the farmers to be in organized groups and coordinating the picking of the commodity by the wholesalers would enhance the farmers' benefits.

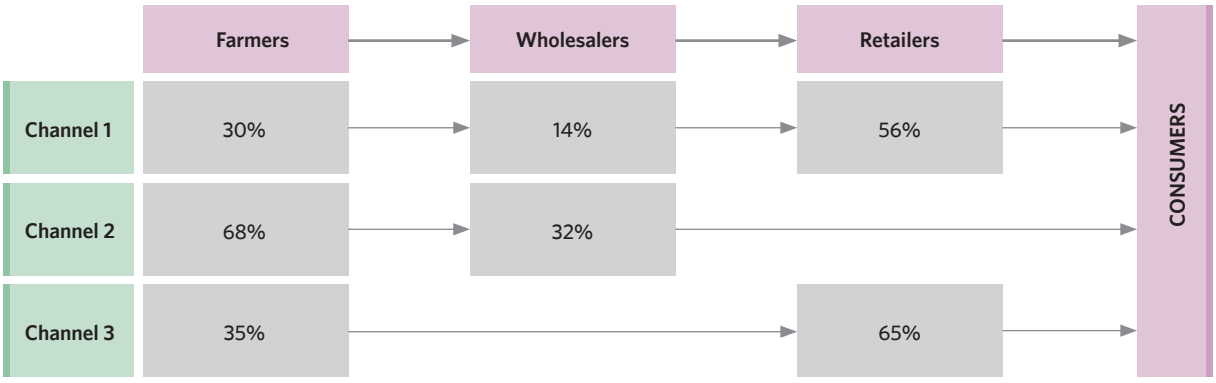


Figure 40: Share value for different value chain actors
Source: Authors computation using primary data

E. Employment generation potential and other potential impacts

The employment generation potential was estimated using the Full Time Equivalent (FTE) approach. In addition, the wages earned were estimated for the entire district. The FTE jobs units per acre cultivated were used as the multiplier factor to estimate the number of FTE jobs under the existing acreage (130 acres) for onion production in the district. The employment estimates are presented basing on the detailed activities in onion VC from producer to retailer. At farm level, the major labor costs are land opening (30-man days), planting (7-man days), staking (7-man days), mulching (4-man days), weeding (7-man days) and harvesting (12-man days). This is equivalent to 0.43 FTE jobs per acre per years or 134 man-days per year at the production node.

In the case of wholesalers, the activities considered in calculating the man-days were transportation to market, loading and offloading which make 0.208 FTE jobs of 6.5 man-days per year. For retailers, they trade many other commodities (on average 5). Thus, it was assumed that they can spend 2 hours a day trading onion. This translates into 28 hours, 0.011 FTE Jobs or 3.5-man days per year. There is currently an estimated total of 60 FTE jobs and the current annual wages earned in the onion VC of Kyegegwa are UGX 118,944,800 (Table 23).

Table 23: Total number of jobs created and wage rate under the onion value chain

Value Chain Node	FTE jobs		Total wages	
	1 Acre	130 acres	1 Acre	130 acres
Production	0.4300	55.90	670,800	87,204,000
Wholesaler	0.0208	2.70	227,000	29,510,000
Retailer	0.0110	1.43	17,160	2,230,800
Total for entire value chain	**0.4618**	**60.03**	**914,960**	**118,944,800**

F. Social benefits along the value chain

Onions production is by both refugees and host communities as it is mostly produced using small plots which are also available to the refugees. A study conducted by Food and Agriculture organization (2018) on National gender profile of agriculture and rural livelihoods revealed that a higher proportion of women compared to men are involved in horticulture (58%) activities. Production of leafy vegetables like onions provides employment, especially to women and youth, through production and sale of produce to markets. Besides, this is a quick return to meet a family's daily cash requirements for purchasing other food requirements.

Onions contain beneficial nutrients and antioxidants and are a rich source of vitamins C and sulphur. Due to its richness in nutrients, onions have various health benefits, and these are not limited to; combating the formation of free radicals known to cause cancer, heart disease, blood pressure etc.

Onions also have environment related benefits. They produce compounds such as allicin with repellent effects on insect pests such as bugs, mosquitoes, snakes, several flies etc. For example, intercropping cabbage with onions reduces the populations and damage to cabbage by whitefly, webworm and aphids (Katsaruware and Dubiwa, 2014). This reduces the use of agro chemicals that are detrimental to the environment and to human health.

G. Threats and community preparedness

Onions like most horticultural crops are highly susceptible to pest and disease that cause economic damage to the crop. The crop is also vulnerable to drought which is are a frequent occurrence in Kyegegwa. Relatedly, during off season, onions and other vegetables are grown and flourish well in swampy areas. Although they attract lucrative farm gate prices which can be as high as UGX 3,000/Kg during off season (November to December and April to June), swampy cultivation endangers the ecosystem. During bumper harvests (July to September), the price per Kg is very low (i.e. between UGX 800 to 1,500/Kg depending on the size). Sadly, farmers do not have equipment and skills in value addition to the perishable commodity, and this demotivates them to invest in the value chain

The common pests include thrips, aphids, and onion maggots, while the diseases are mainly leaf blights. Control of pests and diseases is commonly by spraying with synthetic pesticides and fungicides; however, the challenge is the improper use that is putting both producers' and consumers' health at risk. Presence of counterfeits coupled with the absence of harmonized pest and disease control programs, and inadequate extension services, have escalated improper use of pesticides. This has resulted in pesticide resistance and accumulation of residues in target commodities which can endanger consumer health. Moreover, measures to monitor pesticide residues in agricultural products are dismal although there are existing food laws like the Public Health Act, (1935), Uganda Bureau of Standards Act (1983) and implementing authorities like Ministry of Health, Ministry of Local Government, Ministry of Trade and Industry dealing with food safety issues. Inadequate enforcement of the measures in regulating the importation and use of agro chemicals is partly because of role duplication and ineffective coordination among the mandated institutions coupled with their being understaffed and underfunded to reach the grassroots. Relatedly, the inadequate extension service is attributed to poor funding and limited technical staff at the local level. Currently within Kyegegwa, there are 10 staff in crop production comprising the Production Coordinator, the District Agricultural Officer, and 9 field extension staff. However, the number of Field Extension Agents is just half of the required number of 18. Moreover, out of the 9, only 4 have motorcycles.

Prolonged drought can be addressed through use of irrigation. However, the initial investment costs in irrigation are high ranging between UGX 8m and 14m for the pump and pipes for one acre. This is not affordable by most of the small-scale farmers in Kyegegwa. Moreover, the interest rates from financial support institutions are high for farmers to access loans for investment in the irrigation system. Relatedly, financial institutions require collateral which most farmers do not have, while accessing credit through producer groups is hard as there are no existing groups for onions, while those of other enterprises are weak in governance and leadership.

Another threat to onion production and marketing is high postharvest losses. A mitigation for this is improved handling and packaging of the product using mesh/ net sacks or strop boxes. A good packaging system should protect the commodity against pathogens, rotting, moisture loss, temperatures extremes, crushing, deformation and bruising of the product. Some of the most common packaging materials include jute sacks. These packaging materials do not allow better aeration within the packaged onions causing a build-up of heat due to respiration. In addition, there is need to invest in research to generate marketable high value nonperishable onion products through value addition.

Poor road network leading to onion production and marketing areas is a major hinderance to earning high profits from the commodity. The refuge settlements and remote areas that are far from town limit access to competitive markets. Table 24 below is a summary of the challenges and mitigation measures along the onion VC.

Table 24: Constraints at different value chain nodes

	Constraint	Mitigation Strategy
Farmer	1) High cost of improved technologies that make farmers use rudimentary agronomic practices resulting in low yields. 2) High prevalence of pest and diseases. 3) High cost of labour for land preparation and weeding. 4) Poor rural roads which increases transportation costs.	1) Promote affordable and appropriate production and post-harvest practices with emphasis on Integrated Pests and Disease Management (IPDM), and timely harvesting. 2) Build the capacity of farmers through awareness, training to use labour-saving technologies like herbicides. 3) Construction and rehabilitation of rural roads.
Traders	1) High cost of sourcing of onions from multiple smallholder farmers. 2) High post-harvest losses attributed to: (a) Harvesting physiological immature onions. (b) Inappropriate packaging material that eases bruising in transportation (c) Delays due to roadblocks and poor road networks. 3) High transportation costs because of poor rural feeder roads and buying from individual farmers..	1) Organize farmers into groups to increase volume produced and aggregated at key points. 2) Secure market linkages between farmers and traders in the short term, but long term if volumes increase cold storage transportation may economically viable. 3) Construction and rehabilitation of rural feeder roads.

H. Public and community sector support

There is no specific policy targeting the Horticulture sub-sector in Uganda. There are however various ministries and agencies that are mandated to support the horticulture sub-sector. Often, their roles are duplicated that results in ineffective utilisation of limited resources and diminished impact.

For instance, the Agricultural Chemicals Control Act, 2006 mandates the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) to regulate importation, distribution and trade of agricultural pesticides. On the other hand, National Environment Management Authority (NEMA), Uganda National Bureau of Standards (UNBS), and National Drug Authority (NDA) all have an oversight role of regulating and monitoring the use of agro-chemicals in the country. Ineffective coordination coupled with limited funding and inadequate staffing negatively affects the effectiveness of these agencies in delivering their mandate. This leads to importation of illegal pesticides, proliferation of unlicensed dealers and high incidence of counterfeits in the market.

The district production sector is the main public support institution providing extension services to farmers producing onions. The local government collaborates with NGOs i.e., DRC, JESE and ACTED which provide farmers especially refugees with extension services coupled with vegetable seeds mainly for food security. The vegetable gardens are commonly established as kitchen gardens by the farmers.

Overall, there is need to establish a functional national pesticide residue surveillance plan to safeguard consumer safety, uphold fairness with trading partners and strengthen international trade ties. To effect this, the Agricultural Chemicals Board under MAAIF should decentralize the inspection function to Local Governments and build their capacity to regulate the quality of agrochemicals distributed and traded across the country. Besides, the Ministry of Health MAAIF, Local Governments and NGOs need to undertake Health Education Programs on Safe Use of Pesticides at all levels. Also, there is need for the government to enforce existing laws as well as enact and implement a National Horticulture Policy to guide the sector activities at the national and local levels.

I. Recommended strategic investments for DRDIP

Overall, onion is a profitable VC that can generate employment opportunities for the people of Kyegegwa especially for women and youth besides boosting household nutrition. However, there is need to establish a functional pesticide residue surveillance plan to safeguard consumer safety, uphold fairness with trading partners and strengthen international trade ties. To effect this, the Agricultural Chemicals Board under MAAIF should decentralize the inspection function to Local Governments and build their capacity to regulate the quality of agrochemicals distributed and traded across the country. Besides, the Ministry of Health MAAIF, Local Governments and NGOs need to undertake Health Education Programs on Safe Use of Pesticides at all levels. Also, there is need for the government to enforce existing laws as well as enact and implement a National Horticulture Policy to guide the sector activities at the national and local levels. Similarly, there is need to protect the ecosystem by enforcing the environment bye laws and safeguard the wetlands which are being destroyed by vegetable production.

Therefore, the key <u>strategic public investment</u> areas recommended are:

1) **Invest in increasing crop production and productivity.** This will involve the following:
    - Train farmers on GAP, GPHH, farming as a business. To bridge the staff gap while ensuring training of farmers, the project should work with the Horticultural Unit at National Crops Resources Research Institute (NaCRRI) and the district to develop guidelines on Good Agronomic Practices for adoption by all DRDIP beneficiaries; and facilitate existing staff to train farmers.
    - Recruit more staff under the crop production department and equip them with adequate transport. Currently, there are 10 staff in crop production comprising the Production

Coordinator, the District Agricultural Officer: and 9 extension staff in the field. The number of Field Extension Agents is just half of the required number of 18. Moreover, out of the 9, only 4 have motorcycles.

- Invest in irrigation infrastructure and associated facilities. The government should work with DRDIP to construct structures of water for agricultural production and mitigate against the effects of prolonged drought. The project should also equip farmers with irrigation equipment. Irrigation coupled with use of GAP and GPHH as stated above can lead to three production seasons in a year. This can increase farmer GMs higher than 550.7% and increase in jobs by 76.4% (Scenario 2).
- Enforce regulations on judicious use of agro chemical use. The government should support this by streamlining and enhancing coordination as well as increasing staffing levels for the various institutions (like MAAIF, NEMA, and UNBS) that are dealing with regulation and judicious use of agro chemicals and safeguarding of the wetlands.
- Establish a functional national pesticide residue surveillance plan. This will safeguard consumer safety, uphold fairness with trading partners and strengthen trade ties. To effect this, the Agricultural Chemicals Board under MAAIF should decentralize the inspection function to Local Governments and build their capacity to regulate the quality of agrochemicals distributed and traded across the country. Besides. MOH, MAAIF, Local Governments and NGOs should undertake Health Education Programs on Safe Use of Pesticides at all levels. Also, the government should enact and implement a National Horticulture Policy to guide the sector activities at the national and local levels. The central government should also empower the local government with skills, equipment and other necessary materials for regular monitoring of pesticide residues in commodities.

2) Increase market access and reduce Post-Harvest Losses

- Invest in building strong farmer groups. This should be accompanied with equipping farmer groups with knowledge and skills in leadership /governance, financial literacy, market-oriented production and farming as business. The groups should also be linked to large scale traders, and FSIs including being supported to establish their own VSLAs and aggregation centres.
- Invest in construction and rehabilitation of community feeder roads to enable safe movement of produce from production zones to markets.

3) Invest in research to generate appropriate Post-Harvest technologies and competitive value-added onion products.

- During bumper harvest (July to September), the average farm gate price for a Kg of onions is as low as UGX 810 but under scarcity, the price reaches UGX 3,000/Kg. As the commodity is perishable, farmers cannot hoard it for a better price during the normal season; consequently, they register losses. Worse still, the appropriate market competitive value-added onion products and associated processing technologies are not readily available.

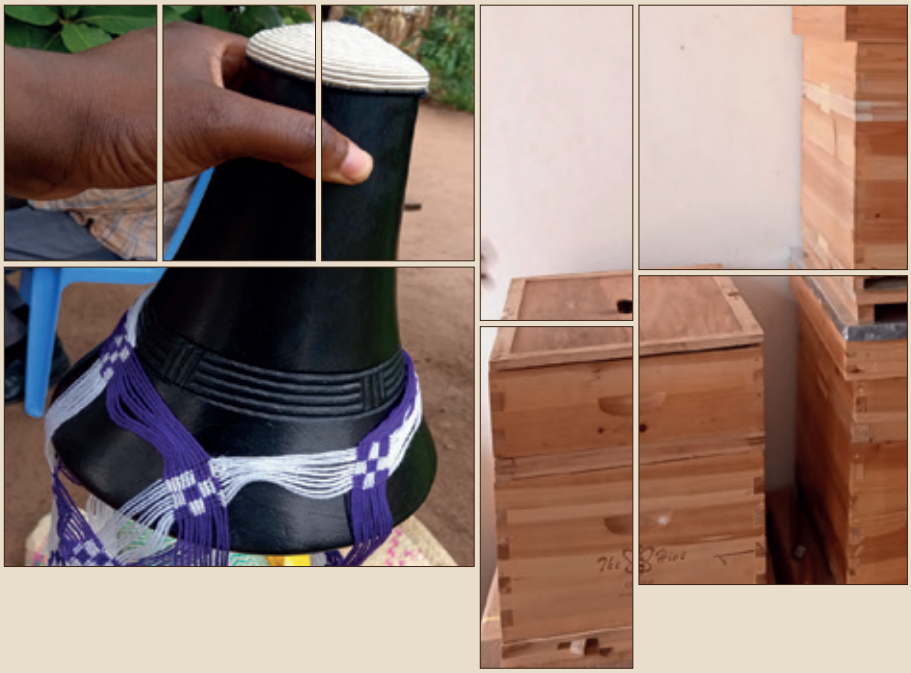
Table 25: Assumptions for Different scenarios for improving onions VC in Kyegegwa

Scenarios	Description/Assumption
Scenario 0:	Current scenario: Yields are low 1.05 MT/season with 2 production seasons) and roads are not improved.
Scenario 1:	Farmers are trained on GAP, investment in fertilizers, manure, and in high yielding varieties like Red Bombay. Yields/acre increase to 3.15 MT/season with two production seasons.
Scenario 2:	Use of GAP coupled with irrigation. Thus, producing three seasons per year with a yield of 3.15MT/season.

Table 26: Summary of the Impact of Investment scenarios

Category	Item	Current scenario	Yield increase including reduction in PHL	Yield increase , reduction in PHL+ irrigation
	Scenario	0	1	2
Farmer	Yield per acre in Kg per season	1,050	3,150	3,150
	Yield per acre in Kg/acre/ year	2,100	6,300	9,450
	Revenue per acre per year	2,100,000	6,300,000	9,450,000
	Cost of production/ acre/ year	1,104,800	1,984,800	2,977,200
	Current GM in UGX/ acre/year	995,200	4,315,200	6,472,800
	% increase /decrease of GM from scenario 1	Na	333.6	550.7
	Jobs created at district level per year	55.9	88.2	132.3
	% Increase / decrease in Jobs	Na	17.6	76.4
Traders	Variable costs in UGX/acre/year	1,584,876	4,752,027	7,128,041
	Revenue in UGX per acre per season	1,950,476	5,849,294	8,773,941
	Gross margin in UGX per acre per year	365,600	1,097,267	1,645,901
	Jobs created	5.64	27.72	68.04
	% Increase / decrease in Jobs	Na	391.5	1,106.4
Market	Market opportunity in MT (14% of the 2017 deficit)		968.5	968.5
	Yields per acre per year		6.3	9.45
	# of acres required to meet the demand		154	102.5
	# acres/group with grant of UGX 18.5 M		7	5
	Number of groups to meet market opportunity		22	20
	# of groups if grant amount in UGX is increased and all 30 acres are under onion production		5	3
	Maximum grant offer per group in UGX		18,500,000	18,500,000
	Investment required to increase yields per acre		2,530,000	3,795,000
	Amount of grant required per group if DRDIP is to increase grant amount		75,900,000	113,850,000

3.2. Non-Traditional Value Chains



3.2.1 Crafts

A. Background

Handicrafts, crafts or craft products are synonyms for Artisanal Products, which is a component of Creative Industries (Florence, 2005). The sector is recognized as important in the drive for expansion and diversification of the national export base (UNEP, 2005). Craft also acts as a vital source of income and employment and has also been recognized internationally as a tool for poverty reduction and as a means of promoting and preserving artistic tradition and culture (Yongcheng et al., 2018). According to Maranatha tours and travel (2014), the craft varieties produced have attracted tourists from different parts of the world. This enhances the incomes of the craft makers.

In Uganda, crafts include basketry, pottery, mats and wood carvings are made. Crafts in Uganda can be identified under categories such as: gourd and wood vessels for serving food and drinks; pottery; basketry; stools clothing and adornments; skins and bark cloth; pipes for musical instruments, tails and aprons; belts and girdles; hair dressing; headdresses and facial ornaments; neck, arm and leg ornaments, shields, spears, bows and arrows; swords, dancing weapons; hunting knives; finger knives and wrist knives; hunting gear and sound instruments (Daily Monitor, 2019). Among these, basketry and mats are the most highly developed craft products in Uganda; and most of these come from Buganda, Toro, Kigezi and Bunyoro. The type, design and price of these depend on type and source of materials used. However, production is mainly on individual basis. Besides, the artisans produce in fragmented environment, with no appreciation of market requirements, quality, design, standards and systematic organization of markets (UNEP, 2004).

Nevertheless, during the scoping study under DRDIP, craft was prioritized by the district and by the refugees and hosts for household income generation. The main attributes for selection include availability of raw materials; income generation; some crafts like bags can contribute to sustainable environment management through less use polythene bags; low capital investment; and is suitable for men, women and youth. Currently there are craftsmen and women in the district who make several products like baskets, mats, shoes, etc. However, these products are of low quality due to inadequate skills and poor-quality tools used. Moreover, these tools are labor demanding and time consuming compared to the modern labor and time saving tools. This background justifies why during the scoping study of livelihood and value chains in Kyegegwa identified the crafts sector as a priority livelihood sector that DRDIP project should consider

B. Demand and supply of crafts

Trade in handicrafts in Uganda is largely informal. It is marked with ad hoc market access, entry and penetration approaches, and inadequate market distribution networks (Florence, 2005). However, there is a substantial market for art and craft products among international visitors. Although recent data on volume and values of craft export is not readily available, official handicraft export statistics for 2002 and 2003 reveal total export values of a paltry US$49,841 and US$ 63,535 respectively (Florence, 2005). The low value earned is partly because of limited innovations in production, design and product adaptations, given the low skills and capacity of Uganda's artisanal producers (UNEP, 2005).

Quantified data on trade in crafts is scanty. This is partly because, the village artisans who are the majority producers, sell their products in either the neighborhoods or to domestic craft traders, or direct to tourists through informal means. The domestic craft traders serve as intermediaries, who sell mainly on the local markets. Basketry and mats are the major craft products produced. Locally, these products are demanded for traditional functions like marriages. They also have international

markets in USA, Germany, Italy, Netherlands, Canada, Japan, etc where they are used for table-top accessories such as table and plate mats, fruit bowls, bread baskets, coasters, beach mats, and floor mats etc (UNEP, 2005). The wood products have remained very tradition with rationalized skills for example milk containers (Ebyanzi) from Western Uganda, and Karamojong headrest from North Eastern Uganda (UNEP, 2005). Other common ones are stools, beds, mortars and pestles, wooden canoes, walking stick etc. On the other hand, for hand textiles and Hand-loomed Products, tourist and foreign residents in Uganda form part of the local market with Europe (Italy, Germany) as the main export markets for this range of products. Trade data on demand and supply of craft products like pottery, leather products, and Jewelry is hard to come by.

C. Value chain actors

There are several crafts produced in Keyegegwa. The main ones considered for this study are baskets, shoes, and bags. The major actors are input suppliers and handicraft makers.

Input suppliers: These access materials from different places. In making crafts like baskets and bags, while natural raw materials like papyrus, palm leaves and banana fibres are obtained from within the community, materials such as zips and color for dyeing are purchased from Kampala. Also for bags made of clothes, the Bitenge, Linning, and threads as well as the raw materials for shoes are sourced from Kampala. The District tourism officer mentioned that sourcing inputs from Kampala increases cost of production. He added that the locally sourced material are also reducing overtime. Thus, producers have resolved to plant some of the raw materials such as papyrus.

Handicraft makers: These work either as individuals or as groups. However, individual makers are informal, scattered and difficult to account for. There are nine groups of handicraft makers in Kyegegwa according to the district data. Each group has an average of 50 members from host communities. There are five groups of refugees; and are dominated by women members, with men comprising only 5. The groups make laptops and schools' bags, baskets, mats, shoes, and gourds, among others. The associations have selling outlets and market stalls within Kyegegwa while random retailers are also sourcing from their outlets.

Table 27: Common craft products, prices and price determinants

Product	Price range (UGX)	Price determinant
School bags	5,000 - 25,000	Quality and size of bag
Baskets	1,000 - 50,000	Weaving material; size of basket
Shoes	15,000 -30,000	Product quality

Note on average, it takes about 2 days to make the best product for each of the above items.

The market allows the makers in one association to sell 20 baskets, 30 pairs of shoes, 15 mats and 20 bags a month. This indicates that the handicraft makers are limited by market/demand. The value chain is generally short, informal, and production is mainly through associations (Fig 41). The products are made and purchased within Kyegegwa with limited outlet to other districts and other markets such as Kampala. This is mainly due to the low quality of the products produced in Kyegegwa resulting from inadequate skills and the use of traditional tools.

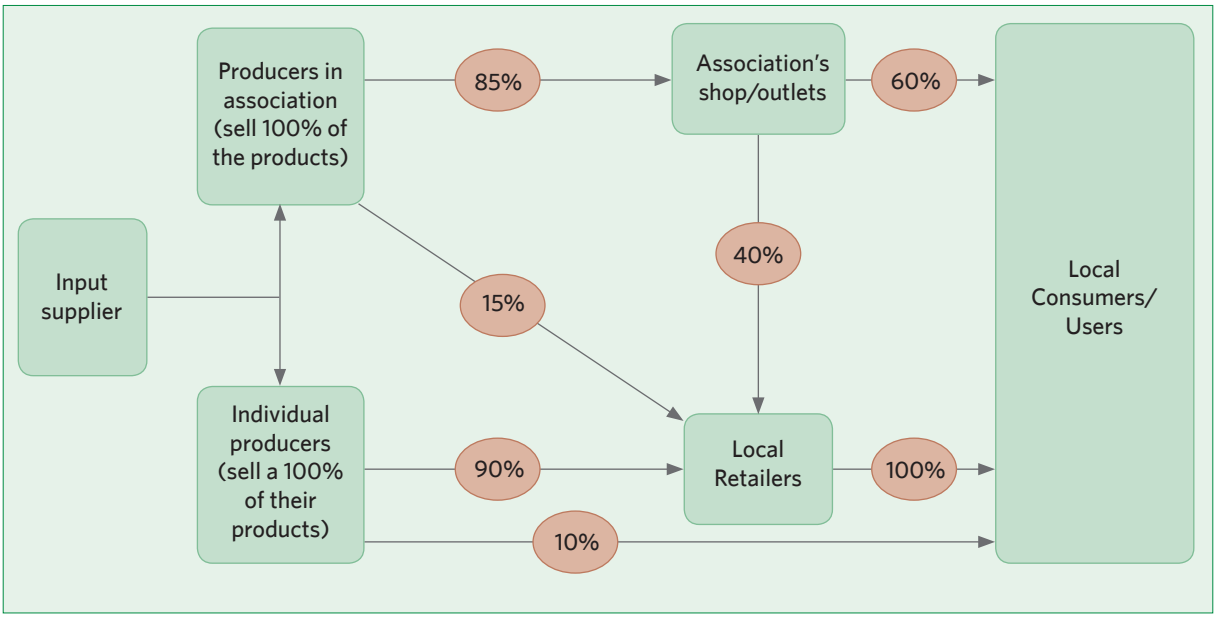


Figure 41: Share value for different actors in the Crafts value chain
Source: primary data

D. Profitability analysis

The various craft products are made mainly at association level. Based on the market availability and profitability, baskets, shoes and school bags were identified among the major products by the interviewed producers. Baskets registered the highest GM followed by bags and least were the shoes (Fig 42). The major cost driver for these crats is labor, accounting for 77%, 43% and 48% of the production costs, respectively.

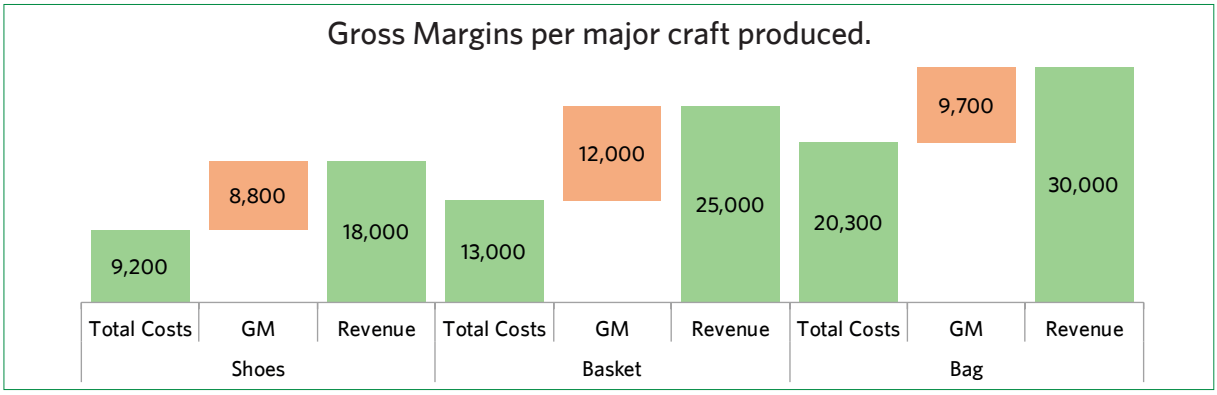


Figure 42: Gross Margins per major craft produced.
Source: primary data

E. Employment

The employment generation was estimated using the Full Time Equivalent (FTE) approach. In addition, the wages earned from the different crafts were estimated. The FTE jobs were calculated based on the time spent to make each of the craft product and the number of crafts made per year. The cost of labor was estimated at UGX 5,000 per day. It takes about 2 days to make each of the mentioned craft and the market allows the makers to sell 20 baskets, 30 pairs of shoes, and 20 bags a month. Annually, this takes 480-man days to make the baskets, 720-man days to make shoes, and 480-man days to make bags. This translates into FTE jobs of 1.5 for baskets, 2.3 for shoes, and 1.5 for bags. Thus, for the 3 products, the FTE is estimated at 5.3 providing wages amounting to UGX 8,268,000 (Table 28).

Table 28: Estimated number of jobs under the craft value chain within Kyegegwa district

Product	FTE jobs per year	Wage	Total profit per year considering GMs
Basket	1.5	2,340,000	3,168,000
Shoes	2.3	3,588,000	2,880,000
Bag	1.5	2,340,000	2,328,000
Total	**5 .3**	**8,268,000**	**8,376,000**

FTE implies Full Time Employment and calculated without fixed costs

F. Social benefits

Despite the current low employment levels among handicraft makers, crafts provide employment for vulnerable households like women, youth and refugees who have inadequate access to productive resources like land. Also, craft products play a very important function in the Tooro culture. During cultural marriage, baskets are used to serve millet bread and coffee beans to the bridegroom entourage while gourds are used to milk. However, increased exploitation of the natural raw materials without replacement is leading to ecosystem degradation. The communities mentioned to begin replanting some of the resources like papyrus that are being depleted.

G. Public and community support

The District Commercial Department provides technical support and guidance on development of projects for income generation. Besides, there are two vocational training institutes i.e., Kyaka Vocation Training Centre (VTC) and Bujubuli Vocational Secondary School that build the capacity of handicraft makers. These are also supported by the Danish Refugee Council (DRC) which promotes the crafts sector in building knowledge and skills of crafts makers, group management, financial literacy, and market linkage.

H. Threats and community preparedness

Crafts sector has several challenges including, inadequate skills, limited market access, high costs of none locally available materials coupled with inadequate working space and equipment. There are only two formal vocational institutions i.e., Kyaka Vocation Training Centre under the catholic church and Bujubuli Vocational Secondary School founded by Finnish Church Aid – one located in refugees occupied area and the other in nonhost community. The craft makers do not have

appropriate equipment for use, and this is attributed to inadequate capital. Besides, there is increased destruction of ecosystem especially wetlands for materials to make crafts, while the rate at which they are mined is high compared to that for replacement. This is causing increasing scarcity of these materials and some are threatened with extinction. Increased ecosystem exploitation is partly attributed to inadequate enforcement of laws safeguarding natural resources by the district local government. Enforcement on wetland use is mainly by the wetland and environment officers while for the forest resources, the mandate lies upon the Forest Officers. Although the district is required to have a Wetland Officer and Environment Officer, these two are currently occupied by one staff. Similarly, the district has only 3 forest staff out of the required 4, and they lack transport facilitation to effectively undertake enforcement.

Also due to inadequate capital, the handicraft makers have limited access to financial support institutions. This is worsened by their limited access to lucrative markets like those in Kampala that offer fair prices. The district has limited number of commercial officers to support in linking craft makers to markets. The major constraints and mitigation measures are indicated in Table 29.

Table 29: Major challenges in crafts

Major challenges	Mitigation measure
Limited working capital	Linkages to Financial institutions and increase access to VLSAs
Lack of modern machinery such as weaving machines, shoe sewing machines, tools like Angled High Precision Shear, Plato Cutter, clamps, pliers, etc for basketry	Invest in modern machineries to increase competitiveness through enhancing quality of the crafts
Low quality of produce due to inadequate skills, tools and equipment	Invest in building skills to produce high quality products that attracts high prices
Limited access to input and output markets	Explore opportunities and widen linkages to inputs and outputs markets
Lack of operation and storage facilities	Build a crafting center at district level for exhibiting the finished products
High cost of transport of raw materials	Invest in raw material supply at district level
Some natural raw materials like twigs plants, ratten, and papyrus shrubs are being depleted.	Invest in environment restoration and sustainable use of ecosystem

I. Recommended strategic investment for DRDIP

The analysis of the crafts sub sector revealed that:

a) The value chain flow channels are short i.e., from makers to users.

b) The crafts market is very small, but all products are profitable.

c) Skills for making crafts and associated tools and equipment are inadequate.

d) The enterprise is threatened with increased ecosystem degradation especially forests and wetlands where most of the raw materials are derived

Therefore, the key **strategic public investment** areas recommended are:

1) **Invest in increased and sustainable production of high-quality crafts products**

- ***Recruit more staff under the commercial department and equip them with adequate transport.*** The commercial department is mandated to provide technical support and guidance on development of income generating projects. However, the department is understaffed, has inadequate transport facilitation, and need refresher training courses to support building the skills of craft makers.

- ***Invest in vocational training institutes.*** There are two church founded vocational institutes i.e., Kyaka Vocational Institute located in host community and Bujubuli Vocational Secondary School in the refugee community; and none is in the nonhost community. The government should construct at least one vocational well-equipped training center in the nonhost communities. Besides, the following are recommended for the project:

  - Equip the existing training institutes with trainers, equipment and tools

  - Build the technical skills of craft makers such as designing and measurements, marketing strategies, financial literacy and group management etc. Currently, there are nine crafts making groups in the district. These need technical capacity building in making quality products. They should also be sensitized on sustainable use of environmental resources. Besides, new groups should be empowered in crafts making.

  - Empower craft makers with equipment and tools for making quality products.

- Support enforcement of by laws on sustainable use of ecosystem resources. Enforcement on wetland use is mainly by the wetland and environment officers while for the forest resources, the mandate lies upon the Forest Officers. These are also understaffed and not well facilitated with transport. The government should fill the vacant positions, provide motorcycles and fuel to staff so that they effect the enforcement of the bye laws. The staff should also receive refresher training on monitoring and evaluation of natural resources use.

2) ***Link handicraft makers to sustainable markets outside Kyegegwa.*** The combined presence of refugees and Kyegegwa district being in the tourism corridor, present a strategic market opportunity for the crafts products to be bought by tourists and staff working with refugees. DRDIP can support government to establish a one stop market center for handicrafts in Kyegegwa. This coupled with facilitating exchange visits will enhance visibility of the crafts products by tourists and other buyers.

Scenario Analysis

For each craft product considered, it was established that the annual actual production capacity stands at 14% while the potential monthly production would stand at 150 units of each of the major crafts and hence 1,800 units a year. Assuming that the market exposure and enhanced quality of produced crafts can enable craft makers to operate at 50% of their full capacity, the annual production of each product would stand at 900 units per year. This would raise employment from 5.3 to 17.01 i.e. triple the wage (from UGX 8,628,000 to 26,520,000) and increase total profits per year from the actual UGX 8,376,000 to UGX 40,500,000.

Table 30: Impact of projected scenario on jobs and GMs

Current situation					
Product	FTE jobs	Wage	GM per Unit	Number of Units per year	Total GMs per year
Basket	1.5	2,340,000	12,000	240	2,880,000
Shoes	2.3	3,588,000	8,800	360	3,168,000
Bag	1.5	2,340,000	9,700	240	2,328,000
Total	**5.3**	**8,268,000**	**30,500**	**840**	**8,376,000**
Projected scenario					
Basket	5.63	8,775,000	13,700	900	12,330,000.00
Shoes	5.75	8,970,000	18,800	900	16,920,000.00
Bag	5.63	8,775,000	12,500	900	11,250,000.00
Total	**17.01**	**26,520,000**			**40,500,000**

3.2.2 Artisan

A. Background

Apiculture is an important sector in Uganda with over 1.5 million households deriving their incomes from bee keeping. Besides, bees support agriculture through pollinating of crops (DIMAT, 2012). As well, apiary products like honey, bee brood, royal jelly and pollen provide nutrition and health benefits to people. Medically, honey can be used as a sedative, laxative or antiseptic (AU, 2019). Despite its importance, bee keeping is underdeveloped. This is partly because most farmers use the traditional beehives resulting in poor quality and low volume of products produced compared to the yield from KTB and Langstroth hives. For instance, the respective annual average productivity in Kg per hive is 12, 18 and 44. Consequently, beekeepers using traditional hives register less profitability compared to those using the improved ones. The traditional hives are popular because they require limited skills to make, the raw materials are locally available and are cheaper than for the improved hives.

Although apiculture is not prioritized under the National Development Plan III, it is a priority commodity in the Agriculture Sector Strategic Plan II 2015/16-2019/20. In Kyegegwa, apiculture is a common livelihood source for the hosts, non-hosts and refugees' communities. It is also one of the key value chains prioritized for investment by the Tooro kingdom (Rudnitska, 2015) and it is being promoted by the District Local Government under the Department of Entomology. Also, during the scoping study, apiary was one of the value chains prioritized by all the communities for income generation by households. Currently there are artisans in the district who make KTB hives, but they are of low quality due to inadequate skills and poor-quality tools. Moreover, these tools are labor demanding and time consuming compared to the modern labor and time saving tools.

B. Value chain actors

Input suppliers: These mainly supply materials for making KTB hives and are located in trading centers. They comprise two categories i.e. small shops of general merchandize or hardware shops that supply iron sheets, nails and wood glue; and timber dealers who supply timber-the main input for making KTB hive. The input suppliers are not unique to hive makers.

Hive makers: Artisans make hives of two types: traditional and KTB.

- **Traditional hives makers:** These make hives using papyrus, banana leaves and fibre, cow dung, sticks, grass, logs, bark, raffia palm and clay. All the inputs are locally sourced from the swamps, forests and gardens making the capital requirement minimal. They work as individuals and make hives on order. Each hive is sold at an average price of UGX 15,000 and a hive maker can sell up to 5 beehives per month.
- **KTB hives makers:** These are mainly small-scale carpenters producing several types of furniture. Making hives is not their major business. They are situated in both towns and villages within Kyegegwa. They are characterized by low skills in making hives, limited access to modern labor and time saving equipment like the power drill kit, inadequate capital and limited market access. Consequently, they produce low quality KTB hives compared to those supplied by big honey processing companies such as The Hive, government and development partners like DRC. On average, a skilled carpenter can produce between 3 to 5 KTB hives per day with modern equipment. Currently, a local carpenter in Kyeggewa has capacity to produce 20 KTB hives per week but has on average a market for only two KTB hives per month. The average selling price is UGX 90,000, which is low compared to an average of UGX 120,000 for hives supplied by processing companies like The Hive.

Beekeepers: These are small scale farmers who buy hives from artisans. Besides, some beekeepers make own traditional hives. The estimated number of hives in the district is 520 KTBs and 1,213 traditional. Average yield of the KTB hive was 18 Kg annually compared to 12 Kg for the traditional hive. KTB is however unpopular compared to the traditional hive because it is expensive and requires skills to make.

C. Profitability analysis

Makers of traditional beehives earn UGX 3,000 per hive. The main drivers of this profit is the cost of labor in sourcing raw materials and the low selling price. The GM of UGX 3,000 for the traditional hive makers is 7.5% of the total revenue and 8% of the total cost. The GM of UGX 39,660 per beehive for KTB makers is 44% of the revenue and 78.7% of the production cost.

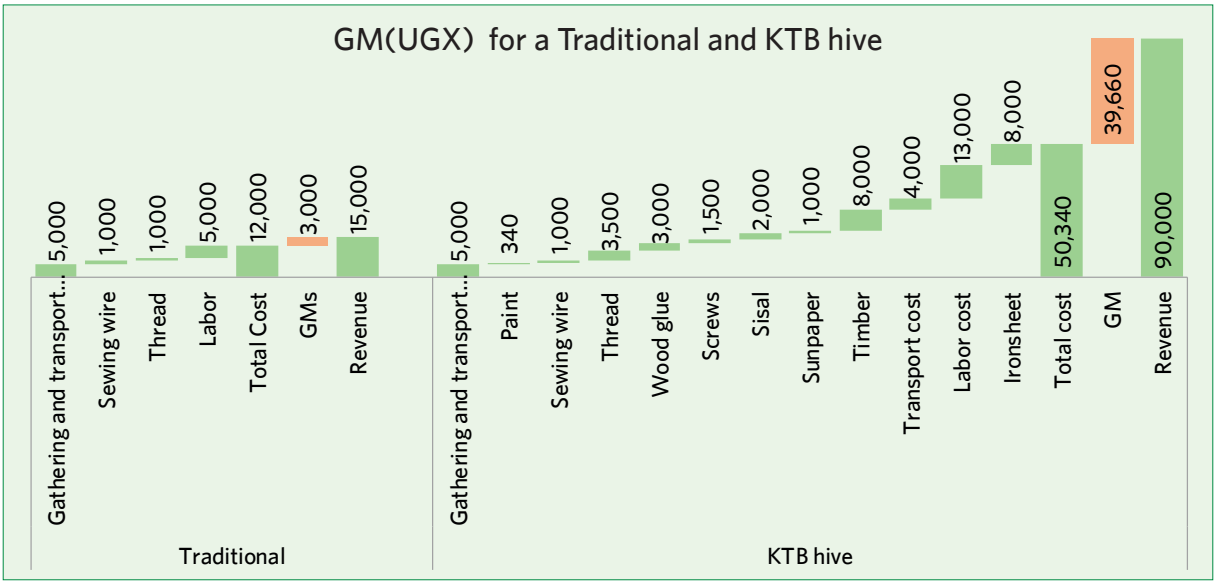


Figure 43: GM for traditional and KTB hive makers in UGX per hive
Source: primary data, 2020

D. Employment

The employment generation potential was estimated using the Full Time Equivalent approach. In addition, the wages earned from the different hive types were estimated. It takes one day (8 hours) to make a traditional hive and a half day to make a KTB hive. Currently, the market opportunity for artisans is to produce two KTB and five traditional hives monthly. This provides 12-man days for KTB and 60 man-days for traditional hives. The FTE analysis (with a year equivalent to 312 days) shows that for the 2 artisan products, 0.228 jobs worth UGX 780,000 are created per year.

Table 31: Employment created in the artisan sector

Product	Man days	FTE jobs	Wage per man day	Total Wage
Local beehives	60	0.19	10,000	600,000
KTB	12	0.038	10,000	120,000
Total	84	0.228		780,000

E. Social benefits

Despite the current low employment levels among artisans, hives are very important in beekeeping - a valuable and strategic economic activity especially for vulnerable households like women, youth and refugees who have inadequate access to productive resources like land. Besides, bees increase crop yields through pollination, while bee products like honey are a source of food and medicine for humans. Also, some products like bee wax are raw materials for secondary products such as candles, soap, etc.

However, mass beehives making may result in deforestation as the main raw material is timber. Besides, some carpenters burn the wood shavings and saw dust in open air causing pollution while other artisans leave these by products in the open which release bad odour with negative effects to the environment. Moreover, wood shavings and sawdust contain toxins that can produce severe allergic reactions, and within the workshop, they have been reported to cause eye irritation, cough and skin problems.

Nevertheless, wood shavings and sawdust are used as beddings in chicken and piggery farms. They are also raw materials for making briquettes - a cost-effective option to reduce CO and C02 (Unidas, 2011). Also, compared to other biofuels like firewood, briquettes have high energy density, require low transportation and storage costs, and have uniform product quality.

F. Public and community support to the value chain

Timber for carpentry is obtained mainly from Central Forest Reserves (CFRs) managed by the National Forestry Authority (NFA), National Parks and Wildlife Reserves (NPs & WRs) mainly managed by the Uganda Wildlife Authority (UWA), local forest reserves (LFRs) managed by Local Governments and from private plantations. These institutions are under MOWE and are guided by the Forestry Policy (2001) and the National Forestry and Tree Planting Act (2003), which are the overarching frameworks for controlling production, movement, and trade of timber. The Act contains several specific provisions relating to timber harvest and trade but also has provision for development of regulations and guidelines by the forest authorities.

Business, Technical, Vocational Education and Training Act (2008) under the Ministry of Education and Sports empower the Technical and vocational education and training (TVET) institutions to provide skills training that include carpentry. The Vocation Training Centre (VTC) in Kyaka II and Bujubuli Vocational Secondary School are among the training centers in Kyegegwa that DRDIP can leverage on..

G. Threats and community preparedness

The artisan work is shaped by various challenges including, inadequate skills, limited market access, high costs of timber coupled with poor storage facilities, working space and equipment, and inadequate electricity supply. There are only two formal skilling institutions i.e., Kyaka Vocation Training Centre and Bujubuli Vocational Secondary School - both located in refugees occupied areas and none in host communities. The artisans do not have appropriate equipment in term of quantity and quality for use, and this is attributed to inadequate capital, erratic power supply, and completely lacking in some areas as well as poor infrastructure which is risky to store materials and equipment. Besides, there is increased destruction of forests where timber is derived, while the rate of tree planting is not commensurate with that of forest mining. Which is causing scarcity and increased cost of timber.

Increased deforestation is partly attributed to inadequate enforcement of laws safeguarding forest resources by the district local government. There are Forest staff in the district who are required to enforce by-laws against forest degradation and provide technical backstopping on management and sustainable use of the three forest reserves under NFA i.e., Rwensambyia, Kitechura and Buhungiro. These forest staff are also required to train the communities in forest conservation including tree planting. However, the district has only 3 forest staff out of the required 4. Also, these staff lack transport facilitation and require capacity building in sustainable forest management and conservation as well as monitoring and evaluation of forest resources.

Also due to inadequate capital, the artisans have limited access to financial institutions. This is worsened by their individualistic nature that does not enable them to access capital from SACCOs and VLSAs. The major constraints and mitigation measures are indicated in Table 32.

Table 32: Major constraints in artisan sector

Major challenges	Mitigation majors
Limited market availability	Establish functional linkages with buyers (beekeepers)
Poor storage facilities, working space and inadequate tools and equipment	Invest in improved storage/working infrastructure with improved equipment
High cost of timber	Invest in sustainable environment management including tree planting
Inadequate skills for making hives and other products	Build skills of the artisans to make hives, other furniture and secondary products like briquettes

H. Recommended strategic investment for DRDIP

The analysis of the apiary related artisan work revealed that:

a) Artisan products (KTB and Traditional hives) flow channels are short i.e., from makers to users.
b) Hive market is very small, while skills for making the improved KTB hives and associated tools and equipment are inadequate.
c) By products of saw dust and wood shavings are not being effectively utilized to produce secondary products like briquettes.
d) The enterprise is threatened with increased forest degradation while timber is the main raw material for hive making
e) Selling KTB is more profitable compared to selling traditional hives.

The proposed investment options include building and furnishing vocational centre with equipment for skilling artisans, and supporting artisans access capital

1) ***Invest in vocational institutes and build capacity of artisans.*** There are two vocational institutes i.e., Kyaka Vocational Institute located in host community and Bujubuli Vocational Secondary School in the refugee community but none in the nonhost community. The following are recommended:
   - Equip the training institutes with trainers, equipment and tools and construct at least one vocational training center in the nonhost communities.
   - Build the technical skills of artisans such as identification of appropriate wood species, and well-seasoned timber, designing and measurements etc. for making hives and other furniture. This should also include building skills in turning wood by-products like

wood shavings and saw dust into secondary products especially briquettes. Enterprises like briquettes are strategic in providing alternative planet friendly energy sources than firewood and charcoal that escalate deforestation. Also briquette making can be a source of employment especially for the vulnerable groups like women, youth and refugees.

- Empower artisans with equipment and tools for making hives and secondary products like briquettes.

2) ***Build the capacity of staff and community in sustainable environment management.*** Judicious use of forest resources will ensure sustainable access to timber for making hives and other furniture by the carpenters. Thus, the following are recommended.

   - Recruit and build technical capacity of staff and facilitate them with transport. There are Forest staff in the district who are required to enforce by laws against forest degradation and provide technical backstopping on management and sustainable use of the three forest reserves under NFA i.e., Rwensambyia, Kitechura and Buhungiro. Besides, these forest staff are required to train the communities in forest conservation including tree planting. However, the district has only 3 forest staff out of the required 4. Also, these staff lack transport facilitation and require capacity building in sustainable forest management and conservation as well as monitoring and evaluation of forest resources.

   - Currently, there are 10 tree nursery management groups in the district. These need capacity building in forest establishment and management; and empowering new groups to scale out tree planting in the district.

   - There is need to strengthen the environment and natural resources committees at the district and sub county with transport and technical skills to effectively monitor, evaluate and advise on the use of forest resources within the district.

3) ***Link beehive makers to beekeeper groups.*** This will ensure consistent and sustainable production of hives by artisans and access by the keepers whenever required.

Scenario Analysis for DRDIP investment to kick start Hive making in Kyegegwa

Assuming DRDIP invests in the apiary VC, there will be demand of at least 5,000 KTB for the three years of intervention. To meet the demand, DRDIP should invest in the following:

- ☑ Build capacity of artisan groups in making quality KTB hives. The capacity building should focus on recommending appropriate wood species, and well-seasoned timber, designing and measurements etc.), group management, leadership and networking coupled with market linkage

  One artisan can produce one of the following per day: two hives using low level and limited number of tools (scenario one); 3 hives using improved manual tools (scenario two); 5 hives using improved powered tools (scenario three). Thus, a group of 10 artisans can produce 20 or 30 or 50 hives under the respective scenarios (See description of scenarios in table 33). Therefore, under these scenarios, the respective number of days needed to produce the 5,000 KTB hives are 250, 167, and 100. Thus, DRDIP investment for the group would be UGX 252,795,000; UGX 263,153,333 and UGX 258,004,000 for the respective scenarios.

  Tables 34 and 35 indicate that the variable cost for producing a KTB hive is UGX 50,340 for scenario 2, UGX 52,307 for scenario 3 and UGX 51,130 for scenario 4. Thus, investment of UGX 24.5 million enables a group of 10 to make 465, 437 and 434 KTBs under scenario 2, 3 and 4,

respectively, while also catering for the fixed costs. The respective number of days required for a group to deliver the KTBs using this grant are 23, 15 and 9. In a day, an individual produces 2, 3 and 5 hives respectively. Under these conditions, to make 5,000 hives, 11 groups need to be funded under the 2nd and 3rd scenarios, and 12 groups for the 4th scenario.

- ☑ Invest in modern carpentry equipment and tools for carpentry such as Circular saw machine, Drill Power Kit, span set, smooth plane, etc. to be used for making of hives and other furniture
- ☑ Promote linkages between artisans and consumers of their products like beekeepers.

Table 33: Description of scenarios

Scenario	Description
Scenario 1: Current scenario (Traditional)	Hives made using natural materials such as papyrus, banana fibres, twigs, cow dung etc . The labor cost for gathering material and making the hive is UGX 10,000 (83% of the total costs). The selling price is at UGX 15,000.
Scenario 2: Current scenario (KTB)	Hives made using limited and low-level equipment (lacks clamps, power drill, circular machine, smooth plane, span set, etc). An artisan can produce 2 hives a day. The total cost is estimated at UGX 50,340 and the selling price is estimated at UGX 90,000. As opposed to traditional hives, artisans invest in materiel such as timber, iron sheets, screws etc. The labor cost is only 19.8% of the total cost. The GM per hive is UGX 39,660.
Scenario 3: Modern manual equipment	Hives made from a workshop at group level. Acquisition of improved but manual working tools enable an artisan to produce 3 hives per day. The total cost is estimated at UGX 52,307 and the selling price is estimated at UGX 100,000. The increment in costs is mainly due to renting of workshop place, business license and security fees. The GM per hive is UGX 47,693.
Scenario 4: Modern powered equipment	Hives made using powered material enables artisans to produce 5 hives per day. The total cost is estimated at UGX 51,140 and the selling price is estimated at UGX 100,000. The increment in costs is mainly due to renting of workshop place, business license and security fees. The GM per hive is UGX 48,866.

Table 34: Impact of the investment in a group of artisans

Particular	Current scenario Traditional Hives (2/day)	Current scenario KTB (2/day)	Manual (3/day)	Powered (5/day)
Paint	NA	1,000	1,000	1,000
Sewing wire	1,000	1,000	1,500	1,500
Thread	1,000	3,500	4,000	4,000
Wood glue	NA	3,500	4,000	4,000
Screws	NA	5,000	9,600	9,600
Sisal	NA	2,000	NA	NA
Sunpaper	NA	1,000	NA	NA
Timber	NA	10,000	10,000	10,000
Transport cost	NA	4,000	4,000	4,000
Labor cost	10,000	10,000	6,667	4,000
Power	NA	500	500	2,000

Particular	Current scenario Traditional Hives (2/day)	Current scenario KTB (2/day)	Manual (3/day)	Powered (5/day)
Iron sheet	NA	5,000	5,000	5,000
Renting working space	NA	3,840	3,840	3,840
License	NA	NA	200	200
Security fees	NA	NA	2,000	2,000
Total Production Cost	12,000	50,340	52,307	51,140
GMs	**3,000**	**39,660**	**47,693**	**48,860**
Revenue	15,000	90,000	100,000	100,000
% Increase in GM considering traditional as current	NA	1,222	1,490	1,528
% Increase in GM considering KTB as current	NA	NA	20.3	23.2
Jobs Created per hive	0.019	0.038	0.001	0.0006
% Increase/Decrease in Jobs per hives		-50	-37.5	-40
Market size (Number of KTB hives required) assuming the investment in apiary VC				**5,000**
Fixed costs for equipment		1,095,000	1,620,000	2,304,000
Number of hives produced by a group of 10 artisan/ day		20	30	50
Number of days required to meet the demand of 5,000		250	167	100
Required investment if one group is to supply the market		252,795,000	263,153,333	258,004,000
Number of hives assuming DRDIP investment of 24.5 M		465	437	434
Number of days required to produce the KTB hives under the available Grant		23	15	9
Number of groups required to meet the market considering the Grant of 24.5M		11	11	12

Table 35: Fixed costs per group

TOOL/ EQUIPMENT	CLASS	UNIT MESAUREMENT	QUANTITY	UNIT PRICE (UGX)	Current Scenario	Manual	Powered
Clamps	Hand clamp	Piece	1	40,000	NA	40,000	40,000
Hammer	Normal	Piece	1	10,000	10,000	10,000	NA
Plier	Normal	Piece	1	10,000	10,000	10,000	NA
Drills	Manual drill	Piece	1	75,000	75,000	75,000	NA
Drill Power Kit	Electrical drill		1	574,000	NA	NA	574,000
Drill bit	Normal	A set	5	40,000	200,000	200,000	NA
Hand saw	Normal	Piece	1	45,000	45,000	45,000	NA
Jack plane	Normal	Piece	1	150,000	150,000	150,000	150,000
Circular saw machine	Normal	Piece/DCA made type	1	450,000	NA	NA	450,000
Chisel	Normal	Piece	1	10,000	10,000	10,000	10,000
Smooth plane	Normal	Piece	1	150,000	NA	150,000	150,000
Screw drivers	Normal	A set (flat & stars)	10	35,000	175,000	350,000	350,000
Tap measure	Normal	Piece	1	10,000	10,000	10,000	10,000
Square	Normal	Piece	1	10,000	NA	10,000	10,000
Half- round bit & groove bit	Normal	Bit set rooter	1	200,000	200,000	200,000	200,000
Sharpening stone	Normal	Piece	1	10,000	10,000	10,000	10,000
A span set	Normal	A set	1	150,000	NA	150,000	150,000
Setting work space			1	200,000	200,000	200,000	200,000

3.2.3 Trade in Agro produce

A. Background

Over the past decade, food commodities like millet, cassava, sorghum, simsim, among others were never regarded as commercial. However, urbanization in Uganda has led to increased demand of these foods. Subsequently, these commodities are now traded across the country including in trading centres at the village level (Wire, 2018). The trading at village level takes two forms i.e., farmers sell their produce at the roadside to traders and to travelers, or the trader buys from farms. But in both cases, trading is informal and characterized by low volume transactions (Ayoki, 2007). Also, the trading is commonly seasonal mainly because of the seasonality of the commodities. Seasonality affects volumes available for trade and prices. This prompts traders to diversify to non-agricultural commodity trade and other services. The commodities traded are not processed and therefore attract low price in the marketplace. A study by Nkonya (2002) reports that female traders are likely to engage in trading of low value food crops because of low capital requirement.

Kyegegwa district recognizes trade in agricultural produce as one of the key activities for income generation to the community and source of revenue for the local government. Small scale trading in agro produce is a common source of livelihood for the hosts and non-host communities and the refugees; and it was prioritized by all these communities for investment under DRDIP. The positive attributes the communities used to prioritize trade in agro produce were ease of liquidation; requires relatively less land to establish; and there is ready market for the produce– mainly due to the influx of refugees.

B. Value chain actors

Farmers are mainly small-scale cultivating farms ranging of 0.2 - 0.5 acres and comprising hosts, non-hosts and refugees. The farmers are not specialized but practice mixed farming growing crops like tomatoes and onions and keeping livestock such as poultry, goat and pigs among other enterprises. Some enterprises such as cattle, bananas and cassava are unique to hosts and non-hosts because they have access to land unlike the refugees. Farming is rain fed and farmers use rudimentary technologies such as hand hoes and indigenous varieties and breeds. Consequently, yields are low in volume and quality. Besides, value addition is limited, and most of the products are sold green or dried. Also, seasonality of production makes business unpredictable.

Transporters: They are mainly located in Kyegegwa town and trading centers and their key role is to transport cargo on pay. Under agro produce, they play two major roles i.e., a) transport produce for farmers and traders from farms to the market; and b) buy produce directly from farmers and sell to local traders and or to consumers but with minimal or no value addition.

Traders. Among host and non-host communities, 75% of traders are women, while among the refugees, all are women. They are situated in large markets within the town, sub counties and in small centres at village level, where they own market stalls or small shops. They source agricultural products within the district and each has an average working capital of UGX 100,000 – 150,000. The working capital is obtained from VSLAs, friends and family members. They are affected by seasonality of the produce. On average, a trading center such as Ndama or KyakaII has 20 - 30 small scale traders although they can accommodate up to 40 traders. According to the District Commercial Officer, each sub county has at least a major trading center with between 10 to 40 small traders. The table below summarizes the average number of traders per trading center

Table 36: Number of registered traders per trading center

Subcounty	Major Trading Centers	Estimated Current jobs
Hapuyo	Hapuyo	10
Kakabara	Mugasana and Buraro	25
Kyegegwa	Bukere and Mundama	25
Mpara	Bujuburi and Sweswe (both in Kyaka II)	25
Kyegegwa Town Council	Katente	25
Ruyonza	Rwensasi	10
Rwentuha	Kahungura, Rwentuha, Kazingo and Kayembe	40
Kasule	Kikonge, Ruyibara, Mukikoona	35
Kigambe	Kyangambara	10
Total		**205**

The traders work below their capacity due to limited capital, price fluctuation and inadequate storage facilities. The latter contributes to a 20-30% loss in fresh produces like tomatoes and onion. The traders deal in several commodities but the major ones according to profitability, availability, and demand are bananas, tomatoes, onions, ground nuts flour and fresh beans. On a monthly basis, a small trader deals with 100Kg of onion, 75Kg of tomatoes, 10 Kgs of ground nuts flour, 40 bunches of bananas and 20Kg of beans.

Consumers: These comprise both refugees and hosts communities. However, because the refugees have limited land for production, they are the main consumers and the demand is high during months when refugees receive cash distributions.

C. Profitability assessment of agro-trading

The respective GMs were calculated per Kg of product (Figure 44). In all cases, the major transaction cost is the purchase of the commodities i.e., 72%, 70%, 75%, 77% and 80% of the total costs for onions, tomatoes, fresh beans, ground nut flour and bananas, respectively. Ground nut flour has the highest GM because of the value addition into flour and the high selling price per Kg.

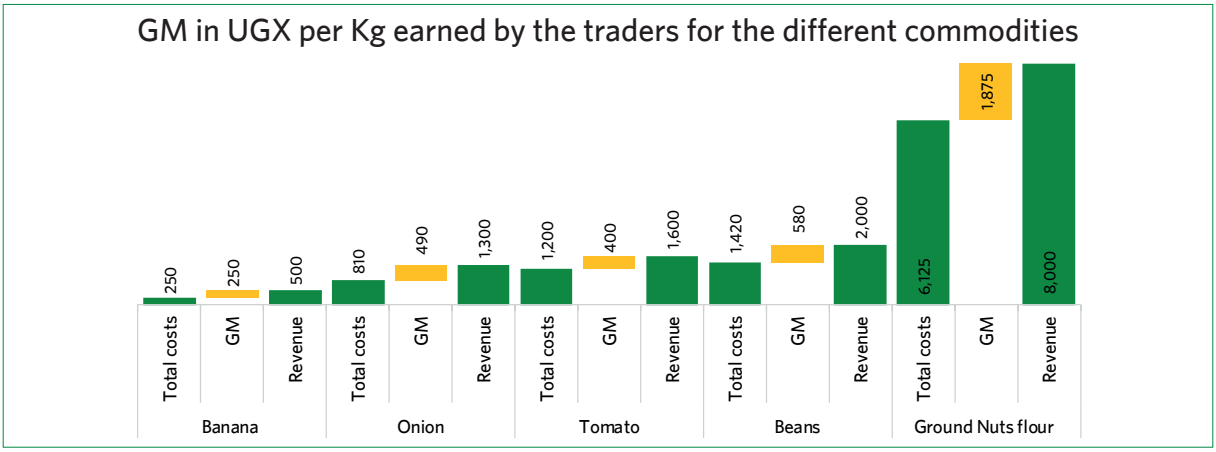


Figure 44: Gross margins for Onions, Tomatoes and Fresh Beans per Kg
Source: primary data, 2020

D. Employment in small scale agro trading

Jobs generated were estimated for the traders and transporters using the Full Time Equivalent approach. In addition, the wages earned were estimated using 205 stalls registered in the district. The small-scale traders deal in many agricultural products. Thus, the time spent in dealing with a retail shop or a market stall can hardly be attributed to a specific commodity. However, each stall provides full time employment for a stall or shop attendant. On a weekly basis, a bodaboda or bicycle rider is hired twice per stall/shop to supply the agricultural products at an average fee of UGX 5,000 per trip which takes about 30 minutes. Hence, a bodaboda is employed for one hour a week by a stall/shop. This translates to 6-man days a year and FTE jobs of 0.019. Considering an average, the payment of UGX 5,000 per trip ad that many commodities are transported per trip, we assume that the contribution of the commodities of interest is UGX 1,000 per trip and hence UGX 2,000 per week. Therefore, the total wage at transportation level is estimated at UGX 89,142 per year per trader. Thus, the trade in agricultural product employs 209 people per year in the district. The total wage generated is estimated at UGX 338,074,110.

Table 37: Employment along the value chain

Actor	FTE jobs per stall	Wage per stall	FTE jobs per the 205 stalls	Wage for the 205 stalls
Stall/shop keeping	1	1,560,000	205	319,800,000
Transport of products	0.019	89,142	3.971	18,274,110
Total	1,019	1,649,142	208.971	338,074,110

FTE implies Full Time Employment and calculated without fixed costs

E. Social benefits along the value chains

Urbanization and increasing influx of refugees in Kyegegwa has led to increased demand of various food crops that initially had low commercial value. Subsequently, this is benefiting small scale producers particularly those that are far from lucrative markets and or have low marketable quantities which do not justify transporting to distant markets as well as small scale retailers within the community. According to FAO (2019), the most resilient households among hosts and refugees are those that have diversified their sources of income and have a limited dependency on labor as a source of income.

The markets enhance access to food by consumers especially refugees who do not own land. A market analysis report in Kyaka II settlement by VENA (2019) indicated that the most common (97.2%) type of market customers are refugees living in the settlement and demand for food items increased during periods when refugees received cash distributions.

Nevertheless, while the food price increases may positively affect some households in refugee-hosting regions, this negatively affect those who are vulnerable like the rural landless and even the urban poor. Besides, the lucrative markets may tempt some farming households to sell all their produce, thereby increasing their vulnerability to food insecurity. According to Garcia and Sarah (2009) push up in prices can lead to humanitarian crises. However, the market availability motivates farmers to increase production, which can create jobs and incomes for the vulnerable groups and increased food availability to the households. For instance, two years after influx of refugees in Kagera and Kigoma

in Tanzania, total banana production increased in these areas partly due to increased demand by the refugees, while the total level of production nationwide remained relatively flat (Garcia and Sarah, 2009).

F. Public and community support to the value chain

The government has several policies to support agro trade. The agriculture policy targets promoting domestic and international trade in agricultural commodities. One of the key areas is improving linkages between producers, traders and enabling institutions such as financial service providers and road infrastructure. The trade policy aims to drive the country out of poverty, into wealth and prosperity through transforming the country into a dynamic and competitive economy by stimulating the productive sectors -with agricultural products inclusive. However, support in trade related interventions has received less attention from the government and development partners within the district.

G. Threats and community preparedness

Trade in agricultural products sector is faced by threats such as; irregular and inconsistent supply, limited working capital to purchase the produce, high transport costs to access the produces from the farmers, high level of theft especially in the refugee communities, high losses in commodities due to poor market infrastructure, poor handling and high perishability of some commodities, as well as high default rates from customers.

Irregular and inconsistent supply is mainly attributed to production depending on the season and inadequate market. Under normal seasons, there is a bumper harvest and prices are low while the reverse is true in dearth periods. The traders' limited capital is an impediment to sourcing the adequate produce volume and quality for the market especially during the dearth season. The effect of seasonality is risk in output trading which prompt traders to hedge it by diversifying their commodity marketing or engaging in other non-trade activities. With poor market infrastructure and the perishability nature of most of the commodities, post-harvest losses are high – going beyond 20% during marketing and this substantially reduces the GMs for the traders.

There is limited community preparedness to address the threats. Technical support and guidance for delivery of commercial services at the local level is by the District Commercial Department This takes care of trade development projects across sectors i.e., Agriculture, Tourism and Trade. However, the department has only four staff out of the required 6. Besides, although there were initially Assistant Commercial Officers-one for every town council, these were phased out by the government. The major constraints faced by the traders and the corresponding mitigation measures are listed in Table 38.

Table 38: Constraints and mitigation measures

Challenge	Mitigation
1) Limited working capital to purchase the produce. 2) Many customers buy on credit and there is a high default rate. 3) Fluctuation in supply due to seasonality of the produce 4) High level of theft especially in the refugee communities. 5) High losses in commodities due to poor handling and the high perishability of some commodities. 6) High transport costs to access the produces from the farmers.	1) Build capacity of traders to save in groups e.g. VSLAs 2) Build trading and lending skills of the traders 3) Establish trader-farmer group linkages, and support farmers with irrigation equipment to produce in off season 4) Invest in improved market infrastructure that reduce loss due to perishable nature of commodities and theft. 5) Invest in construction and rehabilitation of feeder roads.

H. Recommended strategic investment for DRDIP

The analysis of the study reveals that:

a) Small scale agricultural trade is informal, conducted by few people; and actors have limited capital.

b) Traded commodities are profitable, and the presence of refugees offer a ready market.

c) Existing market infrastructure is poor. This exacerbates the already high losses resulting from spoilage of the perishable commodities and theft due to inadequate security.

d) High transport costs to deliver the produce to traders from producers resulting in low profit

e) There is fluctuation of supply by farmers due to seasonality in production.

The proposed investment options are for small-scale traders to have improved market infrastructure. The specific investments proposed are as below:

1) **Construct market infrastructure** and reduce Post-Harvest Losses of agro produce. Currently there are 205 agro produce traders registered in the district. Considering the major products dealt in i.e., onion, tomatoes, ground nut flour, beans and banana, the total value dealt in per district is UGX 996,154,860. The investment in good market stalls enables to reduce the PHL and the total value dealt becomes UGX 1,100,120,610 (See table 40). If 1% of this value is the annual increment in demand, 2 additional stalls would be required to meet the demand (See table 41).

2) **Support the traders with start-up working capital.** This will enable traders to regularly access produce from the farmers in adequate volumes and quantities as required by the customers.

3) **Build capacity of traders in post-harvest handling and food safety, financial literacy and marketing skills** and building business linkages. Then support establishing functional linkages with Financial Support Institutions for credit acquisition and with farmers for consistent supply of produce.

4) **Rehabilitate feeder roads** to reduce cost of transportation of produce from production areas to markets. Such roads include: Kyegegwa to Kyaka (19Km), Kyaka-Kakoni-Kihumuro (10Km) and Kyaka-Kayonza-Kisagazi (15Km).

Scenarios for investment in agro trade

Table 39 contains the scenarios for the small-scale traders within Kyegegwa district. At small scale trader level, the DRDIP grant of UGX 25.9 million that will be allocated to a group is sufficient to fund the traders. The grant will be used to finance both initial investment in construction of improved market infrastructure and working capital. The traders' payback is 1 year and 11 months; and the business is profitable. The payback period is within the time frame for the project life of activity.

Table 39: Different scenarios under trade in agro produce

Scenario	Description
Scenario1: Stall with local grass thatched shade	The state of the stall allows partial to full sunshine to exacerbate the perishability of the products. The stall also requires movement of the products in the mornings and evenings during which products quality are affected. Thus, the PHH losses are high: 20% for tomato and onion, 10% for banana, 2% for ground nut flour and 1% for beans. The revenues are obtained after deducting these losses.
Scenario2: Semi permanent stall with wooden poles material & Iron sheets gauge 32 (not cemented floor) not constructed with bricks	The sunshine effect is reduced. However, the state of the stall requires frequent movement of the products in the mornings and evenings during which products quality are affected. PHH losses are high: 10% for tomato and onion, 7% for banana, 2% for groundnut flour and 1% for beans. GM per year increases by 17%.
Scenario3: Stall with Permanent shade with bricks (cemented floor with iron roof sheet gauge 28 and ventilation)	Products well stored with less sunshine movements that affect products quality. The PHL are 5% for tomato and onion, 2% for banana, 1% for groundnut flour and 1% for beans. GM per year increases by 13% from the previous scenario.

Table 40: Impact of the investment on GMs and pay back period

Item	Products	Scenario 1	Scenario 2	Scenario 3
Volume dealt in per year in Kg	Onion	1,200		
	Tomato	900		
	Ground Nut Flour	120		
	Beans	240		
	Banana	9,600		
PH losses	Onion	20	10	5
	Tomato	20	10	5
	Ground Nut Flour	2	2	1
	Beans	1	1	1
	Banana	10	7	2
Volume sold	Onion	960	1,080	1,140
	Tomato	720	810	855
	Ground Nut Flour	118	118	119
	Beans	238	238	238
	Banana	8,640	8,928	9,408
Procurement per kg	Onion	810	810	810
	Tomato	1,200	1,200	1,200
	Ground Nut Flour	6,125	6,125	6,125
	Beans	1,420	1,420	1,420
	Banana	250	250	250

Item	Products	Scenario 1	Scenario 2	Scenario 3
Selling price per Unit	Onion	1,300	1,300	1,300
	Tomato	1,600	1,600	1,600
	Ground Nut Flour	8,000	8,000	8,000
	Beans	2,000	2,000	2,000
	Banana	500	500	500
Total Cost per year	Onion	972,000	972,000	972,000
	Tomato	1,080,000	1,080,000	1,080,000
	Ground Nut Flour	735,000	735,000	735,000
	Beans	340,800	340,800	340,800
	Banana	2,400,000	2,400,000	2,400,000
Total Revenue per year	Onion	1,248,000	1,404,000	1,482,000
	Tomato	1,152,000	1,296,000	1,368,000
	Ground Nut Flour	940,800	940,800	950,400
	Beans	475,200	475,200	475,200
	Banana	4,320,000	4,464,000	4,704,000
Total cost per year		5,527,800	5,527,800	5,527,800
Total revenue per year		8,136,000	8,580,000	8,979,600
GM per year		2,608,200	3,052,200	3,451,800
% Increase in GM			17	32
PBP		1 Year and 3 Months	1 Year and 7 Months	1 Year and 11 Months
Market value in UGX (see table 41)		9,961,549	10,529,809	11,001,206
# of traders/stalls required to meet the market		2	2	2
Variable costs per group		2,125,000	2,425,000	2,425,000
Total fixed costs per group		509,000	2074500	3511000
# of traders/stalls considering DRDIP investment of 24.5 M, fixed costs, and variables costs		9	5	4

Table 41: Estimation of the market at 1% of the current market value

Product	Current volumes dealt in per local trader	Current Market volumes at district level (considering the PHL and total number of local trader in the district)[1]	Current Market Value (Considering the procurement cost [2]	1% of the current market value [3]
Scenario 1: (PHL 20% for onion and tomatoes, 10% for banana, 2% for ground nut flour and 1% for beans)				
Onion	1200	196,800	159,408,000	1,594,080
Tomato	900	147,600	177,120,000	1,771,200
Ground Nut Flour	120	24,108	147,661,500	1,476,615
Beans	240	48,708	69,165,360	691,654
Banana	9600	1,771,200	442,800,000	4,428,000
Total value of the market			996,154,860	9,961,549
Scenario 2: (PHL 10% for onion and tomatoes, 7% for banana, 2% for ground nut flour and 1% for beans)				
Onion	1200	221,400	179,334,000	1,793,340
Tomato	900	166,050	199,260,000	1,992,600
Ground Nut Flour	120	24,108	147,661,500	1,476,615
Beans	240	48,708	69,165,360	691,654
Banana	9600	1,830,240	457,560,000	4,575,600
Total value of the market			1,052,980,860	10,529,809
Scenario 3: (PHL 5% for onion and tomatoes, 2% for banana, 1% for ground nut flour and beans)				
Onion	1200	233,700	189,297,000	1,892,970
Tomato	900	175,275	210,330,000	2,103,300
Ground Nut Flour	120	24,354	149,168,250	1,491,683
Beans	240	48,708	69,165,360	691,654
Banana	9600	1,928,640	482,160,000	4,821,600
Total value of the market			1,100,120,610	11,001,206

*[1]: Current volume * 205(Number of traders at district level) *(100+% of PHL)/100*

*[2]: Current market value: Current volume * Procuring costs*

[3]: Current market value 1%*

Table 42: Variable and fixed costs per group

Variable costs

TOOL/EQUIPMENT	UNIT MESAUREMENT	QUANTITY	UNIT PRICE (UGX)	TOTAL PRICE
Working Capital	Lump sum	1	500,000	500,000
Market fees	Month	312	500	156,000
Labor	Piece	312	5,000	1,560,000
Transport cost	Trip	89	1000	89,000
Packaging material	Bundle	120	1,000	120,000
Total Variable Costs				2,425,000

Fixed costs

TOOL/ EQUIPMENT	Local grass thatched shade	Semi-permanent with wooden material & Iron sheets (not cemented	Permanent shade (cemented with iron roof and ventilation)
Weighing scale	300,000	300,000	300,000
Refrigerators			
Stall construction			
Ironsheet		375,000	480,000
Thatching grass	50,000		
Poles	99,000	220,000	
Metallic bars (Y12)			300,000
Cement		150,000	300,000
Bricks			300,000
Stones		320,000	640,000
Sand		300,000	450,000
Labour	60,000	409,500	741,000
Total Fixed costs	**509,000**	**2,074,500**	**3,511,000**
Total costs	**2,934,000**	**4,499,500**	**5,936,000**

4. CONCLUSION

From the study, five traditional and three non-traditional value chains were selected and prioritized by the project beneficiaries. The prioritized traditional VCs were dairy, banana, apiary, onions and tomatoes, while the non-traditional ones were crafts, artisanry for making beehives and small-scale trade in agro produce. Under the current scenario, all the VCs prioritized were found to be profitable and sources of employment but at varying levels.

The major challenges faced by the traditional VCs were pests and disease prevalence coupled with use of counterfeit agro chemicals, prolonged droughts, high post-harvest losses, inadequate skills due to weak extension system, weak farmer organizations, seasonality of the produces and poor road network. For the non-traditional VCs, the key challenges were low quality of the products due to inadequate skills, tools and equipment, resources depletion and lack of market. The opportunities are mainly existence of refuges for the market, and interest by government and development partners to invest in the prioritized VCs.

From the analysis, strategic investments which address these challenges while exploiting the existing opportunities were generally found to create more employment opportunities, increase profitability and market size for all the prioritized value chains. The study used these three attributes to rank the prioritized VCs following the strategic investments. The ranking focused at the production level for all the attributes as this is the node of interest for investment by DRDIP. The main commodity produced under each VC was used in the assessment at producer level, and the results were extrapolated to district level for ranking.

Profitability was analyzed as GMs (UGX) earned per year at the production node for the key commodity in the VC. Employment was estimated at the district level considering all the production activities while applying the Full-Time Equivalent (FTE) approach that assumes a man day equivalent of 8 working hours per day. The market size was assessed using the value earned per annum from the selling of the major product from each VC.

Table 43 presents the estimated employment generation, profitability and potential market size per year in the entire district after strategic investment at the production node for each VC for the key commodity.

Table 43: Summary of findings from the detailed value chain analysis

Attribute	Banana	Dairy	Apiary	Tomato	Onion	Crafts	Artisan	Trade in agro produce
Profitability	2,622,517,164	108,402,975,000	1,220,590,000	265,995,000	715,303,560	247,050,000	244,300,000	13,807,200
Employment	9,884	21,480	700	189	132	156.6	380	205
Potential Market Value	3,169,647,000	5,796,000,000	960,000,000	690,000,000	968,500,000	591,300,000	500,000,000	11,001,206

Using the findings in Table 44 above, the VCs were weighted on a scale of 1-8 for each attribute. For any attribute, the higher the weight, the better the performance of the VC in relation to others. The total weighted score for all the attributes per VC was then used to compare and rank all the value chains. Ultimately, the ranking of the VCs in order of performance at production node for the popular commodity is: dairy, banana, apiary, onion, tomato, crafts and artisan then trade in agro produce (Table 44).

Table 44: Ranking of the value chains in relation to each attribute

Attribute	Banana	Dairy	Apiary	Tomato	Onion	Crafts	Artisan	Trade in agro produce
Profitability	7	8	6	4	5	3	2	1
Employment	7	8	6	4	2	3	5	1
Potential Market Value	7	8	5	4	6	3	2	1
Total Wighted Score	27	30	21	16	17	13	13	7
Rank	2	1	3	5	4	6	7	8

Although dairy and banana are highly ranked due to the high profitability and job creation, they are land intensive at the production level. Thus, they do not appeal to the refuges who are majorly landless. Conversely, VCs like beekeeping, vegetables and the non-traditional do not require a lot of land and therefore, are popular across communities. For apiary, the district has three forests under NFA that the various communities can sustainably use for bee keeping, while the refugees are also able to produce vegetables on small plots under intensive system using kitchen gardens. Notably, artisanry making of beehives boosts the apiary sector. For crafts, all the different communities can sustainably use the wetlands and forests to access the major raw materials. Trade in Agro produce was least rated as most of the hosts grow their own food, while there are few traders in that business. Nevertheless, it is an important enterprise that enables refugees and landless hosts to access food.

In conclusion therefore, DRDIP can invest in dairy and banana targeting mainly the host communities, while investment in the other prioritized VCs equally favor all the communities.

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6. APPENDICES

Appendix 1: Costs and Revenues for Banana Value Chain

A. Variable cost per acre per year under current and improved farming system

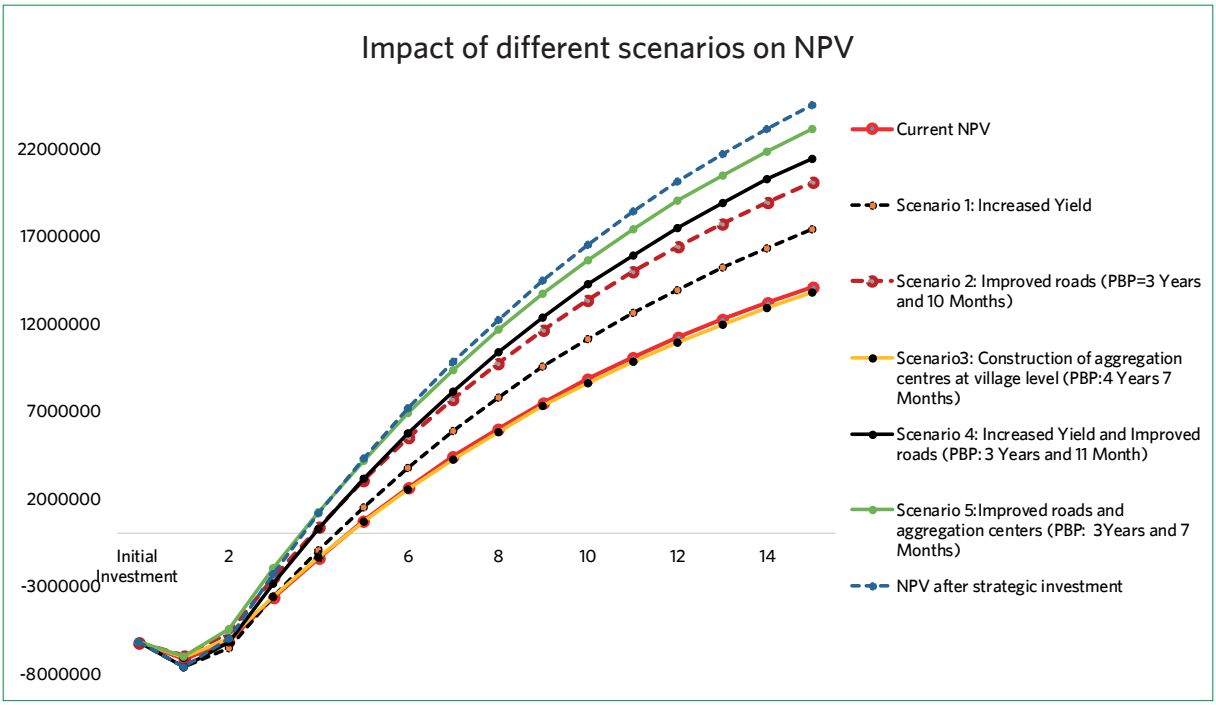
	Current Farming System	Improved Farming System
Manure (Truck)		133
Mulch (Bundles)		56
Manure application		222
De-suckering	222	222
De-leafing	111	111
Weeding	667	111
Mulching		267
Harvesting and lifting	500	500
Total Cost	1500.3	1622
GM	3499.7	5378
Revenue	5000	7000

B. Fixed costs per acre

Costs Item	Costs (UGX)
Purchase/lease of land	4,000,000
Purchase of Suckers	500,000
Land opening	500,000
Digging planting holes (1000 per hole)	500,000
Planting suckers (500 per sucker)	250,000
Planting rope	5,000
Wheel barrow	100,000
Panga	50,000
Pick axe	40,000
Hoes	60,000
Spades	100,000
Sledge hammers	50,000
Garden Fork	50,000
Total	6,205,000

Appendix 2: NPV under various scenarios of banana farming systems

	Current NPV	Scenario 1: Increased Yield	Scenario 2: Improved roads (PBP=3 Years and 10 Months)	Scenario3: Construction of aggregation centres at village level (PBP:4 Years 7 Months)	Scenario 4: Increased Yield and Improved roads (PBP: 3 Years and 11 Month)	Scenario 5:Improved roads and aggregation centers (PBP: 3Years and 7 Months)	NPV after strategic investment
Initial Investment	-6205000	-6205000	-6205000	-6205000	-6205000	-6205000	-6205000
1	(7,145,642.20)	(7,621,284.40)	(6,998,577.98)	(7,085,871.56)	(7,621,284.40)	(6,998,577.98)	(7,621,284.40)
2	(6,114,836.71)	(6,553,402.91)	(5,643,473.19)	(6,000,230.62)	(6,198,845.22)	(5,454,095.19)	(6,009,467.22)
3	(3,636,243.57)	(3,619,105.69)	(2,489,103.68)	(3,575,574.49)	(2,808,959.74)	(1,952,243.11)	(2,272,099.17)
4	(1,362,304.91)	(927,089.89)	404,813.31	(1,351,119.33)	301,026.94	1,260,465.22	1,156,678.85
5	723,877.35	1,542,649.38	3,059,783.02	689,665.22	3,154,225.72	4,207,904.06	4,302,346.76
6	2,637,806.03	3,808,465.22	5,495,535.05	2,561,944.63	5,771,839.29	6,911,976.38	7,188,280.62
7	4,393,703.90	5,887,195.35	7,730,169.94	4,279,632.16	8,173,319.62	9,392,776.68	9,835,926.37
8	6,004,619.38	7,794,287.22	9,780,293.70	5,855,492.28	10,376,512.59	11,668,740.26	12,264,959.16
9	7,482,523.49	9,543,912.78	11,661,141.18	7,301,235.50	12,397,790.54	13,756,780.24	14,493,429.61
10	8,838,398.82	11,149,073.85	13,386,689.32	8,627,605.44	14,252,173.99	15,672,413.25	16,537,897.92
11	10,082,321.14	12,621,698.68	14,969,761.02	9,844,458.59	15,953,443.20	17,429,874.73	18,413,556.91
12	11,223,534.27	13,972,730.63	16,422,120.37	10,960,837.62	17,514,240.64	19,042,224.71	20,134,344.98
13	12,270,518.80	15,212,209.49	17,754,560.14	11,985,038.58	18,946,164.90	20,521,444.87	21,713,049.63
14	13,231,055.07	16,349,346.06	18,976,981.95	12,924,672.48	20,259,856.88	21,878,527.59	23,161,402.52
15	14,112,281.00	17,392,590.61	20,098,469.85	13,786,721.93	21,465,078.89	23,123,557.61	24,490,166.64


Impact of different scenarios on NPV
22000000
17000000
12000000
7000000
2000000
-3000000
-8000000
Initial Investment
2
6
8
10
12
14
Current NPV
Scenario 1: Increased Yield
Scenario 2: Improved roads (PBP=3 Years and 10 Months)
Scenario3: Construction of aggregation centres at village level (PBP:4 Years 7 Months)
Scenario 4: Increased Yield and Improved roads (PBP: 3 Years and 11 Month)
Scenario 5:Improved roads and aggregation centers (PBP: 3Years and 7 Months)
NPV after strategic investment

Appendix 3: Costs and revenues for the different scenarios under dairy value chain

A: Variable costs per cow per farming system

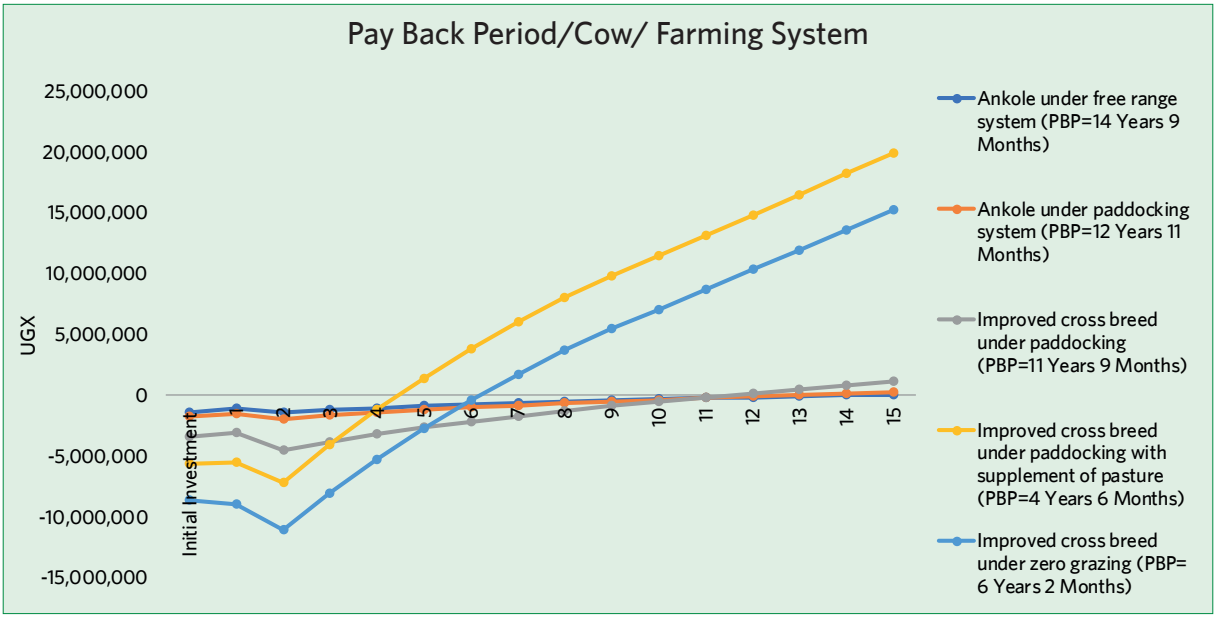
	Ankole under free range system	Ankole under paddocking system	Improved cross breed under paddocking	Improved cross breed under paddocking with supplement of pasture	Improved cross breed under zero grazing
Accaricides(2 tins per week)			200000	200000	200000
Butalex (1 Vials per month)			120000	120000	240000
Curamycin			26000	26000	52000
Biogaz plant maintenance				14400	14400
Articial insemination				120000	120000
Bull service	20,000	20000	20000		
Dewormers (1 litters per month)	40,000	40000	100000	200000	200000
Water		100000	100000	100000	100000
Weeding				50000	50000
Salt	105,000	105000	140000	140000	140000
General management of the herd, spraying, milk, planting. (All regarded as one activity and paid for monthly)	204,000	204000	360000	432000	432000
Transport(bodaboda to transport milk on daily basis)			600000	600000	600000
Total costs for Ankole under scenario 1: Free range	369,000	469000	1666000	1930400	2436400
GM	279,625	369750	959000	4117600	4006400
Total revenue	648,625	838750	2625000	6048000	6442800

B: Fixed costs per cow per farming system

	Ankole under free range	Ankole under paddocking	Improved under paddocking	Improved under paddocking and supplement of pasture	Improved under zero grazing
Cost of Heifers	700000	700000	2,000,000	2000000	2,000,000
milking cans			200,000	200000	200,000
Feeding trough	50000	50000	50,000	50000	50,000
spraying pump	150000	150000	150,000	150000	150,000
Shade Construction	640000	500000	500,000	500000	2,000,000
Paddock construction	60000	500000	500,000	500000	
Labor for construction		60000	60,000	60000	60,000
Land preparation				75000	75,000
Planting				100000	100,000
Seeds ()				20000	40,000
Land				2000000	4,000,000
Total fixed	1600000	1960000	3460000	5655000	8,675,000

Appendix 4: NPV and PBP for the different scenarios under dairy value chain

	Ankole under free range system (PBP=14 Years 9 Months)	Ankole under paddocking system (PBP=12 Years 11 Months)	Improved cross breed under paddocking (PBP=11 Years 9 Months)	Improved cross breed under paddocking with supplement of pasture (PBP=4 Years 6 Months)	Improved cross breed under zero grazing (PBP= 6 Years 2 Months)
Initial Investment	**(1,450,000)**	**(1,760,000)**	**(3,460,000)**	**(5,655,000)**	**(8,675,000)**
1	(1,111,865)	(1,513,609)	(3,055,107)	(5,492,676)	(8,976,896)
2	(1,445,779)	(1,931,690)	(4,524,013)	(7,184,122)	(11,094,232)
3	(1,253,190)	(1,669,508)	(3,850,155)	(4,071,246)	(8,067,223)
4	(1,078,430)	(1,430,901)	(3,237,442)	(1,220,901)	(5,295,654)
5	(920,026)	(1,213,923)	(2,680,825)	1,388,590	(2,758,436)
6	(776,629)	(1,016,786)	(2,175,671)	3,777,114	(436,217)
7	(646,997)	(837,854)	(1,717,732)	5,962,915	1,688,754
8	(529,996)	(675,622)	(1,303,109)	7,962,733	3,632,764
9	(424,583)	(528,712)	(928,225)	9,791,924	5,410,756
10	(329,799)	(395,859)	(589,800)	11,464,576	7,036,436
11	(244,769)	(263,006)	(251,374)	13,137,228	8,662,116
12	(168,686)	(130,153)	87,051	14,809,880	10,287,796
13	(100,811)	2,700	425,476	16,482,532	11,913,476
14	(40,468)	135,553	763,901	18,155,185	13,539,156
15	12,967	268,406	1,102,327	19,827,837	15,164,836



Appendix 5: Costs and Gross margin of Apiary VC at farm level under different scenarios

i. Variable costs and GMs

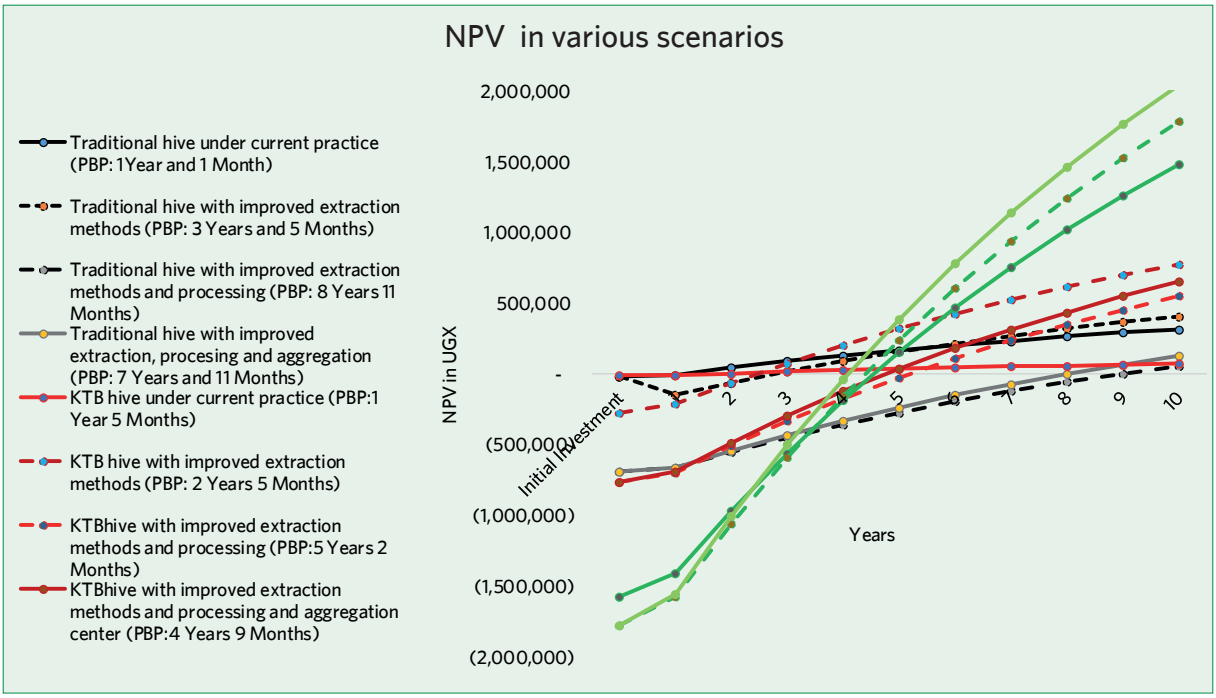
	Traditional				KTB				Langstroth		
Cost Items	Existing practice	Improved extraction	Improved Extraction & Processing	Improved Extraction, Procesing and aggregation	Existing practice	Improved extraction	Improved Extraction & Processing	Improved Extraction, Procesing and aggregation	Modern extraction	Extraction & processing	Extraction & processing + Aggregation
Placing/siting hives (UGX 500/ hive)	2,000	2,000	2,000	2,000	1,981	1,981	1,981	1,981	2,000	2,000	2,000
Monitoring (2x a month at 5000 per 10 hives. Each time, 4 hrs used	18,381	18,381	18,381	18,381	17,661	17,661	17,661	17,661	17,999	17,999	17,999
Harvesting: 5,000 per day	1,250	625	625	625	1,250	625	625	625	625	625	625
Processing	-	1,250	1,250	1,250	-	1,250	625	625	625	625	625
Packaging in 18 litre jerricans	333	333	333	333	491	491	491	491	1,000	1,000	1,000
Cost of jerricans (18l)	3,200	3,200	3,200	3,200	4,800	4,800	4,700	4,700	11,978	11,978	11,978
Annual transport fo market honey	800	800	800	350	800	800	800	350	800	800	350
Aggregation fees (UGX 100/Kg	0	0	0	106	-	-	-	169	-	-	431
Total Variable costs	**25,964**	**26,589**	**26,589**	**26,245**	**26,982**	**27,607**	**26,882**	**26,602**	**35,026**	**35,026**	**35,007**
Revenues	84,480	126,720	158,400	168,960	172,800	207,360	253,800	270,720	560,560	646,800	689,920
GM	58,516	100,131	131,811	142,715	145,818	179,753	226,918	244,118	525,534	611,774	654,913

ii. Fixed costs per scenario

	Traditional				KTB				Langstroth		
Cost Items	Existing practice	Improved extraction	Improved Extraction & Processing	Improved Extraction, Procesing and aggregation	Existing practice	Improved extraction	Improved Extraction & Processing	Improved Extraction, Procesing and aggregation	Modern extraction	Extraction & processing	Extraction & processing + Aggregation
Cost of hives	15,000	15,000	15,000	15,000	90,000	90,000	90,000	90,000	250,000	250,000	250,000
Extraction & Processing	-	-	-	-	-	-	-	-	-	-	-
Harvesting gears	2,000	2,000	2,000	2,000	2,000	20,000	20,000	20,000	20,000	20,000	20,000
Mosquito net	2,000	2,000	2,000	2,000	2,000	-	-	-	-	-	-
Smoker	-	-	-	-	-	-	-	-	-	-	-
Double strainer	-	-	15,000	15,000	15,000	15,000	-	-	-	-	-
Honey press	0	150000	150000	150,000	0	150,000	150,000	150,000	-	-	-
Food grade stainless steel settling Tanks 200kgs and strainer	0	0	300000	300,000	-	-	300,000	300,000	300,000	300,000	300,000
Langstroth Cather boxes	0	0	0	0	-	-	-	-	**6,000**	**6,000**	**6,000**
Honey Centrifuge Extractors steel with stands 9frames	0	0	0	0	-	-	-	-	1,000,000	1,000,000	1,000,000
Honey Refractometer (Atago model)	0	0	200000	200000	-	-	200,000	200,000	-	200,000	200,000
Total Fixed costs	19000	169000	684000	684000	109,000	275,000	760,000	760,000	1,576,000	1,776,000	1,776,000

Appendix 6: NPV under various scenarios of Apiary Value Chain

	Traditional				KTB				Langstroth		
Years	Traditional hive under current practice (PBP: 1Year and 1 Month)	Traditional hive with improved extraction methods (PBP: 3 Years and 5 Months)	Traditional hive with improved extraction methods and processing (PBP: 8 Years 11 Months)	Traditional hive with improved extraction, procesing and aggregation (PBP: 7 Years and 11 Months)	KTB hive under current practice (PBP:1 Year 5 Months)	KTB hive with improved extraction methods (PBP: 2 Years 5 Months)	KTBhive with improved extraction methods and processing (PBP:5 Years 2 Months)	KTBhive with improved extraction methods and processing and aggregation center (PBP:4 Years 9 Months)	Langstroth with Modern extraction (PBP:4 Years 7 Months)	Langstroth hive with modern extraction & processing (PBP:4 Years 5 Months)	Langstroth hive with modern extraction and processing with aggregation center Aggregation (PBP:4 Years 1 Month)
Initial Invest-ment	(19,000)	(16,900)	(684,000)	(684,000)	(10,900)	(275,000)	(760,000)	(760,000)	(1,576,000)	(1,776,000)	(1,776,000)
1	(4,068)	(141,602)	(663,190)	(658,030)	(5,449)	(211,545)	(695,697)	(687,678)	(1,406,163)	(1,575,052)	(1,555,255)
2	45,183	(57,323)	(552,247)	(537,909)	6,824	(60,251)	(504,706)	(482,209)	(963,832)	(1,060,134)	(1,004,028)
3	90,368	19,996	(450,465)	(427,707)	18,084	78,551	(329,484)	(293,705)	(558,024)	(587,733)	(498,315)
4	131,822	90,931	(357,087)	(326,604)	28,414	205,892	(168,729)	(120,765)	(185,722)	(154,337)	(34,359)
5	169,854	156,009	(271,419)	(233,849)	37,891	322,719	(21,249)	37,895	155,839	243,274	391,289
6	204,745	215,714	(192,825)	(148,753)	46,586	429,900	114,055	183,455	469,197	608,055	781,792
7	236,755	270,489	(120,720)	(70,683)	54,563	528,231	238,187	316,996	756,682	942,716	1,140,052
8	266,122	320,741	(54,569)	941	61,881	618,442	352,069	439,511	1,020,430	1,249,745	1,468,731
9	293,064	366,844	6,121	66,651	68,595	701,205	456,548	551,910	1,262,400	1,531,423	1,770,271
10	317,782	409,140	61,799	126,936	74,754	777,135	552,400	655,028	1,484,392	1,789,842	2,046,913


NPV in various scenarios
Traditional hive under current practice (PBP: 1Year and 1 Month)
Traditional hive with improved extraction methods (PBP: 3 Years and 5 Months)
Traditional hive with improved extraction methods and processing (PBP: 8 Years 11 Months)
Traditional hive with improved extraction, procesing and aggregation (PBP: 7 Years and 11 Months)
KTB hive under current practice (PBP:1 Year 5 Months)
KTB hive with improved extraction methods (PBP: 2 Years 5 Months)
KTBhive with improved extraction methods and processing (PBP:5 Years 2 Months)
KTBhive with improved extraction methods and processing and aggregation center (PBP:4 Years 9 Months)
2,000,000
1,500,000
1,000,000
500,000
-
(500,000)
(1,000,000)
(1,500,000)
(2,000,000)
NPV in UGX
Initial Investment
1
2
3
4
5
6
7
8
9
10
Years

Appendix 7: Costs and Gross margin of tomato farmers under different scenarios

	Current scenario	Yield increase including reduction in PHL without irrigation	Yield increase+ With irrigation
Seed (Tins)	40000	40,000	40,000
Fertiliser (1 Littre)	100000	200,000	200,000
Herbicides	50000	200,000	200,000
Manure		340,000	340,000
Stakes	50000	100,000	100,000
Mulches	50000	500,000	500,000
Planting ropes	5000	25,000	25,000
Land opening	150000	150,000	150,000
Planting	35000	35,000	35,000
Staking	35000	100,000	100,000
Weeding	35000	15,000	15,000
Mulching	20000	10,000	10,000
Labor for irrigation		300,000	100,000
Harvesting	50000	200,000	200,000
Harvesting boxes		150,000	200,000
Irrigation equipment maintenance			500,000
Total costs	620000	2,365,000	2,715,000
Revenue per season	1000000	4,000,000.00	4,000,000.00
GM per season	380000	1635000	1285000

Appendix 8: Costs and Gross margin of Onion farmers under different scenarios

	Current scenario	Improved scenario
land opening	150,000	150,000
Seed	12,000	40,000
Fertiliser	28,000	100,000
Transport	28,000	28,000
Fangicide	20,000	100,000
Packing bags	14,400	14,400
Planting	80,000	80,000
1st weeding	120,000	120,000
2nd weeding	60,000	60,000
Fertilisers application	10,000	10,000
Harvesting	30,000	90,000
Machinery maintenance		200,000
Total costs	992,400	992,400
GM	2,157,600	2,157,600
Revenue	1,050,000	3,150,000

Appendix 9: Scenarios, Costs and Gross margin for craft makers

a) Detailed Scenarios

	Products	Current production	Improved scenario 1	Improved scenario2
Number of Item produced per year	Bags	240	240	900
	Shoes	360	360	900
	Basket	240	240	900
Cost of production per unit minus labor	Bags	10,300	10,300	10,300
	Shoes	4,200	4,200	4,200
	Basket	3,000	3,000	3,000
Labour	Bags	10,000	8,000	8,000
	Shoes	5,000	3,500	2,000
	Basket	10,000	9,500	9,500
Total variable Cost of production	Bags	20,300	18,300	18,300
	Shoes	9,200	7,700	6,200
	Basket	13,000	12,500	12,500
Total Production Costs		11,304,000	10,164,000	33,300,000
Selling price per Unit	Bags	30,000	31,000	32,000
	Shoes	18,000	18,000	25,000
	Basket	25,000	25,000	25,000
GMs per unit	Bag	9,700	12,700	13,700
	Shoes	8,800	10,300	18,800
	Basket	12,000	12,500	12,500
Total GM per year		**8,376,000**	**9,756,000**	**40,500,000**

b) Variable and Fixed costs for crafts makers

Variable Costs				
Cost Item	Unit	Number of items	Unit Price	Total price
Bitenge	Piece	750	5,000	3,750,000
Sponge	Piece	900	2,500	2,250,000
Zip	Piece	900	1,000	900,000
Linning	Piece	900	1,300	1,170,000
PV	Piece	900	1,000	900,000
Strips	Piece	900	1,000	900,000
Plastic locks	Piece	900	1,000	900,000
Threads	Piece	900	500	450,000
Sole	Piece	100	1,500	150,000
Leather	Meter	900	1,200	1,080,000
Plastic tube	Piece	550	200	110,000
Glue	Piece	500	1,000	500,000
Colour	Tin	51	5,000	255,000
Sacks	Piece	500	2,000	1,000,000
Rent of working space	Month	12	80,000	960,000
License	Year	1	50,000	50,000
Measuring tape 7S		15	25,000	375,000
Needle	Piece	100	500	50,000
Total variables costs				**15,750,000**
Fixed Costs				
Sewing machine	Piece	2	1,500,000	3,000,000
Furniture	Piece	2	100,000	200,000
Cutting tools	Piece	1	703,000	703,000
Smoother machine	Piece	1	4,400,000	4,400,000
Total costs fixed costs				**8,303,000**

ENTERPRISE GUIDANCE NOTE

1. General assumptions

Crop Production	Dairy and Apiary	Non-traditional (Trade/ Processing/ Bakery/Carpentry)
• Good agronomic and Post-Harvest Handling practices with improved technologies like agro chemicals, improved seed, etc used • Farmers bulking using aggregation centres • Farmers provide land equivalent to UGX 4.000.000 per acre for production • Farmer provide labour for all activities except land opening which is provided by the project • Farmers using irrigation for off season production	• Producer groups linked to buyers (large traders, supermarkets or processors) • Farmers provide land for pasture growing and for setting hives	• Reliable supply of electricity • Reliable supply of raw materials • Equipped with necessary skills • Supplied with necessary equipment and tools for production and marketing
• Profit/Income computed using gross margin analysis (Total revenue -Total variable costs) • Market demand estimated using potential market (Projected volume sold X Selling price) • Production and Trading units guided by DRDIP grant (UGX 18,500,000 and UGX 25,900,000 traditional and non-traditional respectively less 12% administrative costs • Actors using improved road network • Functional input and output market linkages for the actors • Actors strengthened in financial literacy, governance, and group dynamics • Actors access affordable finance		

A. PROFITABILITY SUMMARY

S/N	V/C	Enterprise	Production/ year		Yield		Price per unit (UGX))	Total revenue (UGX)	Total cost (UGX)	Profit(1st cycle)(UGX)	Maturity period (months)	Potential market & contact	Market demand (UGX)	Best practitioners	Specific assumptions per VC
			Q'nty	Unit	Q'nty	Unit									
1	Banana	Banana Growing on 5.7 acres (Second Year)	5.7	acre	450	Bunch	7,000	17,955,000	8,322,000	9,633,000	1.5 Years	-	3,169,647,000	• ENOC NGIRE 0777-748-105 Kyakatwanga • KABAGAMBE GODFREY 0783-783-683 Mpasana village	• 450 Mats per acre • Each Mat produces 1 bunch • A bunch has average weight of 25Kg • The Buyers pick matooke from the aggregation centre
		Banana Growing on 5.7 acres (Subsequent Years)	5.7	acre	900	Bunch	7,000	35,910,000	7,039,500	28,870,500	5 months	-	3,169,647,000	• KATUSIIME JUSTINE 0781-403-432 Kyakatwanga • BITUNGWA WILLIAM 0782-142-904 Mpasana Village	• 450 Mats per acre • Each Mat produces 2 bunches annually • A Bunch is 25 Kgs • The Buyers pick matooke from the aggregation centre • DRDIP Contribution is: UGX 16,330,500
		Banana trade	1,652	bunches	1,570	bunches	9,500	14,909,300	13,024,000	1,885,300	4 Months	-		• NALUKENGE IMELDA 0753-944-182 Mityana • NALONGO EVA 0784-155-900	• The group will be able to trade in 1652 bunches a week with a 5% PHHL • Group has 2 motorcycles to collect banana from farmers and aggregate for sale to large scale traders • The group is linked to large traders using trucks • DRDIP Contribution is: UGX 22,785,000
2	Dairy	Milk Production/yr	4	Cow	22,560	Litre	700	24,192,000	7,721,600	16,470,400	9 months	Brookside & Pearl	5,796,000,000	• KAMUKAMA DICK 0778-350-651 Kateirwe village • AKAMUMPA DAWSON 0778-691-588; 0702-746-069 Kateirwe Village • MPOORA JOHN 0774-804-622 Mirembe Village	• Improved cow under paddocking system • Cow produces an average of 20 litres of milk per day • Average Post Harvest Milk Loss is 6% • Lactation period is 300 days • There are revenues from selling calf per year at UGX 1,500,000 • There are revenue equivalent from biogas at UGX 2,400,000 from all the animals • Farmers provide land for pasture production to complement open fenced grazing system • The group is linked to large scale buyers like Brookside and Pearl Dairies Ltd • DRDIP Contribution is: UGX 17,440,000
		Milk trade/ Year	24,150	Litre	22,701	Kitres	700	15,890,700	14,592,500	1,298,200	4 Months	Brookside & Pearl		• ATWINE DANIEL 772397791 Mengo • SIBYANGU Paul 758370320 Natete	• Traders pay cash to farmers • Post Harvest Milk Loss is 6% • The group picks milk from farmers and take it directly to milk cooling facilities • The group has two boda bodas for transporting milk • The group has milk cans for milk collection • DRDIP Contribution is: UGX 22,792,000
		Ghee processing	14,631	Litres	2,926	kg of Ghee	10000	29,262,000	15,091,700	14,170,300	4 Months	Supermarkets		• Kakonge 782173394 Mirembe village • Mugabi Ronald 789199119 Mirembe village • ATWINE DANIEL 772397791 Mengo	• A group will be given 1 Ize Chan ghee equipment wotth UGX 3,500,000 • The Capacity of the processing machine is 30kg of ghee per hour • 5litres of milk translate into 1kg of Ghee • 1kg of ghee is UGX 10,000 • The group is linked to supermarkets • DRDIP Contribution is: UGX 22,791,000

S/N	V/C	Enterprise	Production/ year		Yield		Price per unit (UGX))	Total revenue (UGX)	Total cost (UGX)	Profit(1st cycle)(UGX)	Maturity period (months)	Potential market & contact	Market demand (UGX)	Best practitioners	Specific assumptions per VC
			Q'nty	Unit	Q'nty	Unit									
3	Apiary	Honey	150	Hive	17	Kg	16,000	40,608,000	3,990,300	36,617,700	6 months	The Hive Ltd& Malaika	960,000,000	• Tukugize Gonzaga 0775259715 • Taremwa Michael 0772847097, 0755827697 • Amanyire Alice 0786107696, 0782833905 • Mpara Vicent 0772556386	• Yield per year 18kg • PH losses 6% • KTB hives are used • There is improved Extraction, Processing and aggregation at farm level • 1Kg of honey costs UGX 16,000 • DRDIP Contribution is: 16,411,500
		Honey Trade	1,893	Kg	1,798	Kg	15,000	28,395,000	20,240,000	8,155,000	4 Months			• Kajumba Magret 772831215 Kyegegwa • Asaba Bob 774754782 Kakabara • Mazima 701725436 Kyegegwa	• Deals in 1,893 kg a Month with PHL 5% • Have linkages with farmer groups • DRDIP Contribution is: UGX 22,790,000 • 10% PHHL
4	Tomatoes	Tomatoes production/ season / Acre	7	Acre	4000	Kg	1,000	28,000,000	19,005,000	8,995,000	4 Months	-	690,000,000	• Tindihunga Robert 778247604 Rwakahinda Village • Baguma James 782401913 Buluk Village • Kaijuka K Solomon 787634910Kasambya Village	• DRDIP Contribution is: UGX 16,280,000 • Packaging material provided the trader • NPK fertilizers applied • High yielding varieties such as Nouella and Kilelele • Farmers use irrigation and produces 3 times a year
		Tomatoes Trade	11,171	Kg	10053.9		1,400	14,075,460	12,631,000	1,444,460	4 Months			• Mutebi Jane Annette 774453134 Buluk Village • Nalweyise Madina 788458897 Kyegegwa • Mwesigwa Leonard 702624845Bukere Village	• Group trades in 11,171 kg a season • DRDIP Contribution is: UGX22,792,000 • PHL is 10%
		Tomato processing	47,040	Kg	47,040	Bottles of 400 g	1,500	70,560,000	63,300,000.00	7,260,000.00	4 Months	Supermarkets		Reco Industries Ltd, Kasese	• Group buy fresh tomatoes and process into Ketch up • The group able to process 85 MT of tomatoes per a season • The Capacity of the processing machine is 500 kg per hour • 1kg of tomatoes translate into 0.088 kg of Ketchup • 47 MT of tomatoes give 47,040 bottles of Ketch up (400g each) • Each 400 g bottle of Ketch up is UGX 1,5000 • DRDIP Contribution is: UGX 185,000,000 • The tomato processing line include: o Bubble type tomato washing machine o Impurity removal machine o Broken screw pump o Tomato paste machine o Grinding Machine o Sterilization machine o Tomato paste packing Machine
5	Onion	Onion production/ season/acre	19	Acre	3150	kg	1,000	59,850,000	18,855,600	40,994,400	4 Months		968,500,000	• Nakyeyune Margret 787942189 Kyakatwanga Village • Mbabazi Zama 788646577 Buraro Village	• DRDIP Contribution is: UGX 16,280,000 • Packaging material provided the trader • NPK fertilizers applied • High yielding varieties such as Red Bombay and Red Creole • Farmers use irrigation and produces 3 times a year
		Onion Trade	12,412	Kg	12,164	Kg	1150	14,273,800	12,630,800	1,643,000	4 Months			• Tumuhame Ann 783059631 Ndama Village • Masika joan 706828592 Bujubuli Village • Byamukama 70292823 Bukere Village	• The group will be able to trade in 12,412 kg of onion a per season • PHL: 2% • DRDIP Contribution is: UGX22,391,600

S/N	V/C	Enterprise	Production/ year		Yield		Price per unit (UGX))	Total revenue (UGX)	Total cost (UGX)	Profit(1st cycle)(UGX)	Maturity period (months)	Potential market & contact	Market demand (UGX)	Best practitioners	Specific assumptions per VC
			Q'nty	Unit	Q'nty	Unit									
7	Agro pdce trade	Beans trading	6,300	Kg	6,111	Kg	2,500	15,277,500	16,031,000	4,888,380	4 Months			• MAMA AINE 0750-382-864 Kyegegwa • MWASI SIMWERAYI (DRC refuge-Bukere mkt) 0787-237-638 • Lwamitami Asafu 0779-847-765 Bukere Market	• PHL is 3% at trading beans; and 6% at trading maize grains • DRDIP Contribution is: UGX22,792,000
		Maize grain trading	6.002	Kg	5641.9	Kg	1,000	5,641,880							
6	Crafts	baskets, Shoues and Bags made per year	1	Group 900 900	900	Baskets,	25,000	22,500,000	11,250,000	11,250,000	4 Months	-	591,300,000	• Birungi Beatrice 0782774259, Kyegegwa S/C • Margret 0777992847, Ruyonza S/C • Anna 0774042121 Kakabara S/C	• Training of craft makers to enhance the quality of crafts • Crafting centre is constructed in Kyegegwa • DRDIP Contribution is: UGX22,703,000
					bags	32,000	28,800,000	16,470,000	12,330,000	4 Months					
					shoes	25000	22,500,000	5,580,000	16,920,000	4 Months					
7	Artisan	1 hive	434	KTB Hive			100,000	43,400,000	22,194,760	21,205,240	4 Months	-	500,000,000	• Musinguzi Aston 788656175 Nyangabo Village • Sekito David 785532323 Rwentuha Village • Busingye phoebe 780204396 Ngangi Village	• Apiary Sector is strengthened by DRDIP • DRDIP Contribution is: UGX22,759,000

B. SUMMARY OF KEY IN PUTS PER ENTERPRISE

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	Cost Allocation
1	Banana Production	Manure (Truck)	1	Truck	120,000	120,000	Kyomuhendo 0789282412	DRDIP
		Mulch (Bundles)	20	Bundles	2,500	50,000	Wetland and crop residues	DRDIP
		Purchase/lease of land	1	Acre	4,000,000	4,000,000	Owned by farmers	Community
		Purchase of Suckers	500	Sucker	1,000	500,000	Mbabazi Steven 0785801813	DRDIP
		Planting rope	1		-	5,000	Hardware shops	DRDIP
		Wooden Wheel barrow	1	Piece	100,000	100,000	Hardware shops	DRDIP
		Panga	5	Piece	10,000	50,000	Hardware shops	Community
		Pick axe	2	Piece	20,000	40,000	Hardware shops	Community
		Hoes	5	Piece	12,000	60,000	Hardware shops	Community
		Spades	5	Piece	20,000	100,000	Hardware shops	Community
		Sledge hammers	2	Piece	25,000	50,000	Hardware shops	Community
		Garden Fork	5	Piece	10,000	50,000	Hardware shops	Community
		Manure application	40	Man days	5,000	200,000	Hardware shops	DRDIP
		De-suckering	40	Man days	5,000	200,000	Group Members	DRDIP
		De-leafing	20	Man days	5,000	100,000	Group Members	DRDIP
		Weeding	20	Man days	5,000	100,000	Group Members	DRDIP
		Mulching	48	Man days	5,000	240,000	Group Members	DRDIP
		Harvesting and lifting Year1	450	Bunch	500	225,000	Group Members	Community
		Harvesting and lifting Year2	900	Bunch	500	450,000	Group Members	Community
		Land opening	100	Man days	5,000	500,000	Group Members	DRDIP
		Digging planting holes	500	Hole	1,000	500,000	Group Members	DRDIP
		Planting succers	500	Sucker	500	250,000	Group Members	DRDIP
		Total Costs for DRDIP				2,865,000		
		Total COSTS for Community				5,025,000		
		Total Costs per Acre				7,890,000		
		Number of possible acreage Considering the USD 5000 grant				5.7		
		Total Costs DRDIP for 5.7 acres				16,330,500		
		Total Costs for Community				44,973,000		
2	Banana Trade	Purchase of banana	1,652	Bunches	7,000	11,564,000	Farmers	DRDIP
		Transport of banana	60	Man days	10,000	600,000	Group Members	DRDIP
		Motorcycle Maintenance				500,000	Group Members	DRDIP
		Security fees	30	Days	5,000	150,000		DRDIP
		Stall attending	30	Days	5,000	150,000	Group Members	DRDIP
		Market fees	30	Days	2,000	60,000		DRDIP
		Total variable Costs				12,989,000		DRDIP
		Motorcycle	2	Motorcycle	3,500,000	7,000,000		DRDIP
		Stall construction Material	1	Unit	3,511,000	3,511,000	Harware shops	
		Labor	150	Man Days	5,000	750,000	Group Members	DRDIP
		Material for stall construction				2,761,000		DRDIP
		Total fixed costs				10,511,000		
		Profit				2,670,000		
		Total Revenue	1647		9,500	15,694,000		
		Number of possible bunches in USD 5,000	1,652					
		Total DRDIP				22,785,000		
		Total Community				750,000		
		Total Budget				23,535,000		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	Cost Allocation
3	Dairy production	Accaricides				200,000	Agro Vet Shops	DRDIP
		Supona Extra	1	Litre	120,000		Agro Vet Shops	DRDIP
		Duoip	1	Litre	80,000		Agro Vet Shops	DRDIP
		Butalex	1	Bottle	120,000	120,000	Agro Vet Shops	DRDIP
		Curamycin	5	Cure	5,200	26,000	Agro Vet Shops	DRDIP
		Articial insemination	1	Time	120,000	120,000	Agro Vet Shops	DRDIP
		Dewormers				200,000	Agro Vet Shops	DRDIP
		Albafas (Drench)	2	Litre	25,000	50,000	Agro Vet Shops	DRDIP
		Albendazo (Drench)	5	Litre	30,000	150,000	Agro Vet Shops	DRDIP
		Water				100,000	Dums	DRDIP
		Weeding	10	Man days	5,000	50,000	Farmer group members	Community
		Salt	4	Bloc	35,000	140,000	Agro Vet Shops	Community
		Cost of Heifers	1	Head	2,000,000	2,000,000	Livestock Market	DRDIP
		milking cans	4	Piece	50,000	200,000		DRDIP
		Feeding trough	1	Piece	50,000	50,000	Artisans	DRDIP
		spraying pump	1	Piece	150,000	150,000	Agro Vet Shops	DRDIP
		Shade Construction				500,000	Hardware shops	DRDIP
		Paddock construction				500,000	Hardware shops	DRDIP
		Seeds ()	1	Box	20,000	20,000	Input dealers shop	DRDIP
		Land	0.50	Acre	4,000,000	2,000,000	Owned by farmer groups	Community
		General management	72	Man days	5,000	360,000	Farmer groups members	Community
		Biogaz Plant Maintenance	2.88	Man days	5,000	14,400	Farmer groups members	Community
		Transport of milk	300	days	2,000	600,000	Farmer groups members	Community
		Labor for shade and padock construction	12	Man days	5,000	60,000	Farmer groups members	Community
		Land preparation	15	Man days	5,000	75,000	Farmer groups members	DRDIP
		Planting of Pasture	20	Man days	5,000	100,000	Farmer groups members	DRDIP
		Total DRDIP				4,361,000		
		Total Community				3,224,400		
		Total Budget				7,585,400		
		Number of Cows (USD 5,000 grant)				4		
		Total Costs for DRDIP for 4 cows				17,444,000		
		Total Costs for community for 4 cows				12,897,600		
		Total costs for 4 cows				30,341,600		
4	Dairy Trade	Purchase of milk	24,150	Litres	550	14,591,500	Milk producers in Kyegegwa	DRDIP
		Transport	60	Man days	10,000	600,000	Farmer groups members	DRDIP
		Motorcycle Maintenance				500,000		DRDIP
		License	30	Days	2000	60,000		DRDIP
		Office renting	1	Month	150,000	150,000		DRDIP
		Total variable Costs				15,901,500		
		Motorcycle	2	Motorcycle	3,500,000	7,000,000		DRDIP
		Milking Cans	5	Cans	40000	200,000	KARMA milk machines 0776304000	DRDIP
		Refractometers	5	Pieces	200000	1,000,000	KARMA milk machines 0776304000	DRDIP
		Total fixed costs				8,200,000		
		Profit				2,312,500		
		Revenues	24,150		700	16,905,000		
		Number of litres (USD 7,000 grant)	24,150					
		Total Community				0		
		Total DRDIP				22,792,500		
		Total Budget				22,792,500		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	Cost Allocation
5	Ghee processing	Milk purchase	14,631	kg	500	7,315,500.00	Milk producers in Kyegegwa	DRDIP
		Aggregation and Transport	50	Man days	5000	250,000.00	Farmer groups members	DRDIP
		Machinery Maintenance				2,000,000.00		DRDIP
		License	1	Year	100000	100,000.00		DRDIP
		Working space renting	4	Month	300000	1,200,000.00		DRDIP
		Labor	50	Man days	10000	500,000.00	Farmer groups members	Community
		Labelling and Packaging	2,926	kg	1000	2,926,200.00		DRDIP
		Electricity	4	Months	100000	400,000.00		DRDIP
		Water for ghee processing	4	Months	100000	400,000.00		DRDIP
		Total Variable Costs				15,091,700.00		
		Ize Chan ghee equipment	1	Machine	3000000	3500000	KARMA milk machines 0776304000	DRDIP
		Motorcycle	1	Motorcycle	3500000	3500000		DRDIP
		Milking Cans	5	Milking Cans	40000	200000	KARMA milk machines 0776304000	DRDIP
		Refractometers	5	Pieces	200000	1000000	KARMA milk machines 0776304000	DRDIP
		Total fixed costs				8,200,000.00		
		Revenue from Ghee	2,926	Kg	10000	29,262,000		
		Profit				14,170,300.00		
		Volume of milk to deal in				14,631		
		DRDIP				22,791,700.00		
		Community				500,000.00		
		Total				23,291,700.00		
6	Bee keeping	Cost of jerricans (18l)	50		4,800	240,000		DRDIP
		Cost of hives	150	Hive	90,000	13,500,000	The Hives LTD 0700482501	DRDIP
		Harvesting gears	1	Set	20,000	20,000	The Hives LTD 0700482501	DRDIP
		Honey press	4	Piece	150,000	600,000	The Hives LTD 0700482501	DRDIP
		Food grade stainless steel settling Tanks 200kgs and strainer	3	Piece	300,000	900,000	The Hives LTD 0700482501	DRDIP
		Honey Refractometer (Atago model)	5	Piece	200,000	1,000,000	The Hives LTD 0700482501	DRDIP
		Placing/siting hives	150	Hive	1981	297,150	Farmer group members	Community
		Monitoring	150	Hive	17661	2,649,150	Farmer group members	Community
		Harvesting	150	Hive	625	93,750	Farmer group members	Community
		Processing	150	Hive	625	93,750	Farmer group members	Community
		Packaging in 18 litre jerricans	150	Hive	491	73,650	Farmer group members	DRDIP
		Transport fo market honey	150	Hive	519	77,850		DRDIP
		Number of possible hives (USD 5,000)			150			
		Total costs for DRDIP				16,411,500	-	
		Total COSTS for Community				3,133,800		
		Total Costs				19,545,300		
7	Honey processing and trade	Purchase of Honey	1,893	Kg	10,000	18,930,000	Bee keepers	DRDIP
		Transport and Agregation	30	man days	10,000	300,000	Farmer group members	Community
		Equipment Maintenance				200,000		Community
		Market fees	30	Days	2000	60,000		Community
		Working space renting	1	Month	150,000	150,000		Community
		Labor	60	Man days	10,000	600,000		
		Total variable Costs				20,240,000		
		Honey press	1		150,000	150,000	The Hives LTD 0700482501	DRDIP
		Food grade stainless steel settling Tanks 200kgs and strainer	2		300,000	600,000	The Hives LTD 0700482501	DRDIP
		Honey Centrifuge Extractors steel	1		1,000,000	1,000,000	The Hives LTD 0700482501	DRDIP
		Honey Refractometer (Atago model)	4		200,000	800,000	The Hives LTD 0700482501	DRDIP
		Total fixed costs				2,550,000		
		Profit				6,735,250		
		Revenues	1,798		15,000	26,975,250	Agro input dealers shop	
		Possible volume of honey			1,798			
		Total DRDIP				22,790,000		
		Total Community				-		
		Total Budget				22,790,000		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	Cost Allocation
8	Tomatoes production	Seed (Tins)	2	Tins	20,000	40,000	Agro input dealers shop	DRDIP
		Fertiliser (1 Littre)	2	Litres	100,000	200,000	Agro input dealers shop	DRDIP
		Herbicides				200,000	Agro input dealers shop	DRDIP
		Manure	2	Trucks	170,000	340,000	Cattle keepers	DRDIP
		Stakes	1000	Pice	100	100,000	Wetland ancrop residues	DRDIP
		Mulches	200	Bundle	2,500	500,000	Wetland ancrop residues	DRDIP
		Planting ropes	5	Pice	5,000	25,000	Hardware shops	DRDIP
		Harvesting boxes	200	Box	1,000	200,000	Artisans	DRDIP
		Irrigation equipment maintenance				500,000		DRDIP
		land opening	30	Man days	5,000	150,000	Farmer group members	DRDIP
		Planting	7	Man days	5,000	35,000	Farmer group members	Community
		Staking	20	Man days	5,000	100,000	Farmer group members	Community
		Weeding	3	Man days	5,000	15,000	Farmer group members	Community
		Mulching	2	Man days	5,000	10,000	Farmer group members	Community
		Labor for Irrigation	20	Man days	5,000	100,000	Farmer group members	Community
		land	1	Acre	4,000,000	4,000,000	Farmer group members	
		Harvesting	40	Man days	5,000	200,000	Farmer group members	Community
		Total costs for DRDIP				2,255,000		
		Total costs for Community				4,460,000		
		Total Costs				6,715,000		
		Number of Acres considering the USD 5000				7		
		Total costs for DRDIP (7acres)				16280000		
		Total costs for Community (7Acres)				31,220,000		
		Total Costs (7Acres)				47,500,000		
9	Tomato Trade	Purchase of tomatoes	11,171	Kg	1,000	11,171,000	Tomato farmers	DRDIP
		Transport and aggregation	60	Man days	10,000	600,000	Farmer group members	DRDIP
		Motorcycle Maintenance				500,000	Farmer group members	DRDIP
		Security fees	30	Days	5,000	150,000		DRDIP
		Stall attending	30	Days	5,000	150,000	Farmer group members	DRDIP
		Market fees	30	Days	2,000	60,000		DRDIP
		Total variable Costs				12,631,000		DRDIP
		Motorcycle	2	Motorcycle	3,500,000	7,000,000		DRDIP
		Stall construction	1	Unit	3,511,000	3,511,000		
		Labor	150	Man days	5,000	750,000	Farmer group members	Community
		Material for stall construction				2,761,000	Hardware shops	DRDIP
		Packaging Boxes	200	Boxes	2,000	400,000	Artisans	DRDIP
		Total fixed costs				10,511,000		
		Profit				1,444,460		
		Revenue	10,054		1,400	14,075,460		
		Possible volumes (USD 7,000)			10,054			
		Total DRDIP				22,792,000		
		Total Community				750,000		
		Total Budget				23,542,000		
10	Tomato processing	Tomato fruits	47,040	kg	1000	47,040,000.00	Tomato farmers	DRDIP
		Aggregation and Transport	30	Man days	5000	150,000.00	Farmer group members	DRDIP
		Machinery Maintenance				2,000,000.00		DRDIP
		License	1	Year	100000	100,000.00		DRDIP
		Working space renting	3	Month	300000	900,000.00		DRDIP
		Labor	120	Man days	5000	600,000.00	Farmer group members	DRDIP
		Labelling and Packaging	47,040		250	11,760,000.00	Farmer group members	DRDIP
		Electricity	3	Months	150000	450,000.00		
		Water	3	Months	100000	300,000.00		DRDIP
		Total Variable Costs				63,300,000.00		
		Motorcycles	2	Motorcycle	3,500,000	7,000,000.00		DRDIP
		Tomato paste processing line machinery				92,500,000.00	Gelgoog Ltd	DRDIP
		Total fixed costs				99,500,000.00		
		Revenue	47,040	Bottles (400 g)	1500	70,560,000		
		Profit				7,260,000.00		
		Volume in kg of tomatoes (USD 50,000)				47,040		
		DRDIP				185,000,000.00		
		Community				16,455,000.00		
		Total				201,455,000.00		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	Cost Allocation
11	Onion production	Seed	2	Packs	20,000	40,000	Agro Input Dealers shops	DRDIP
		Fertiliser	1	Litre	100,000	100,000	Agro Input Dealers shops	DRDIP
		Fangicide	2	Litre	100,001	100,000	Agro Input Dealers shops	DRDIP
		Packing bags	14	Box	1,100	14,400	Agro Input Dealers shops	DRDIP
		Irrigation equipment maintenance				200,000		DRDIP
		Transport	5.6	Man days	5,000	28,000	Farmer groups members	Community
		Planting	16.0	Man days	5,000	80,000	Farmer groups members	DRDIP
		1st Weeding	24.0	Man days	5,000	120,000	Farmer groups members	DRDIP
		2nd Weeding	12.0	Man days	5,000	60,000	Farmer groups members	DRDIP
		Fertilizer application	2.0	Man days	5,000	10,000	Farmer groups members	Community
		Land opening	30.0	Man days	5,000	150,000	Farmer groups members	DRDIP
		Harvesting	18.0	Man days	5,000	90,000	Farmer groups members	Community
		Land	1.0	Acre	4,000,000	4,000,000	Farmer groups members	
		Total costs for DRDIP				864,400		
		Total costs for Community				4,388,000		
		Total Costs				5,252,400		
		Number of Acres considering the USD 5,000				19		
		Total costs for DRDIP (19 acres)				16,280,000		
		Total costs for Community (19Acres)				82,643,036		
		Total Costs (19Acres)				98,923,036		
12	Onion Trade	Purchase of Onion	12,412	Kg	900	11,170,800	Onion Farmers	DRDIP
		Transport and aggregation	60	Man days	10,000	600,000	Farmer groups members	DRDIP
		Motorcycle Maintenance				500,000		DRDIP
		Security fees	30	Days	5,000	150,000		DRDIP
		Stall attending	30	Days	5,000	150,000		DRDIP
		Market fees	30	Days	2,000	60,000		DRDIP
		Total variable Costs				12,630,800		DRDIP
		Motorcycle	2	Motorcycle	3,500,000	7,000,000		DRDIP
		Stall construction						
		Labor	150	Man days	5,000	750,000		Community
		Material for stall construction				2,761,000		DRDIP
		Packaging Boxes	200	Boxes	2,000	400,000		DRDIP
		Total fixed costs				10,911,000		
		Profit				1,643,000		
		Revenues	12,164		1,150	14,273,800		
		Volume of onion in kg (USD 7,000)				12,164		
		Total costs for DRDIP				22,391,600		
		Total costs for Community				960,000		
		Total Budget				23,351,600		
13	Trade in Agro Produce	Purchase of Maize	6002	Kg	500	3,001,000	DRDIP	
		Purchase of beans	6300	Kg	1,900	11,970,000	DRDIP	
		Transport of produce	60	Man days	10,000	600,000	DRDIP	
		Bicycle Maintenance				100,000	DRDIP	
		Security fees	30	Days	5,000	150,000	DRDIP	
		Stall attending	30	Days	5,000	150,000	DRDIP	
		Market fees	30	Days	2,000	60,000	DRDIP	
		Hiring Stores	1	Month	200,000	200,000	DRDIP	
		Packaging Bags	1000	Bag	1,000	1,000,000	DRDIP	
		Total variable Costs				16,031,000		
		Bicycles	10	Motorcycle	350,000	3,500,000	DRDIP	
		Stall construction	1	Unit	3,511,000	3,511,000		
		Labor	150 Man Days		5,000	750,000	Community	
		Material for stall construction				2,761,000	DRDIP	
		Weighng scale (Platform Scales With Stainless Steeel Plate			500,000	500,000		
		Total fixed costs				7,011,000		
		Profit				4,888,380		
		Revenue from Beans	6,157		2,500	15,277,500		
		Revenue from Maize	5,820		1,000	5,641,880		
		Total Revenue				20,919,380		
		Total DRDIP				22,792,000		
		Total Community				750,000		
		Total Budget				23,542,000		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	Cost Allocation
14	Craft	Bitenge	Piece	750	5,000	3,750,000	General Merchandize shops	DRDIP
		Sponge	Piece	800	2,500	2,000,000	General Merchandize shops	DRDIP
		Zip	Piece	800	1,000	800,000	General Merchandize shops	DRDIP
		Linning	Piece	800	1,300	1,040,000	General Merchandize shops	DRDIP
		PV	Piece	800	1,000	800,000	General Merchandize shops	DRDIP
		Strips	Piece	800	1,000	800,000	General Merchandize shops	DRDIP
		Plastic locks	Piece	800	1,000	800,000	General Merchandize shops	DRDIP
		Threads	Piece	800	500	400,000	General Merchandize shops	DRDIP
		Sole	Piece	100	1,500	150,000	General Merchandize shops	DRDIP
		Leather	Meter	800	1,200	960,000	General Merchandize shops	DRDIP
		Plastic tube	Piece	550	200	110,000	General Merchandize shops	DRDIP
		Glue	Piece	300	1,000	300,000	General Merchandize shops	DRDIP
		Colour	Tin	51	5,000	255,000	General Merchandize shops	DRDIP
		Sacks	Piece	400	2,000	800,000	General Merchandize shops	DRDIP
		Rent of working space	Month	12	80,000	960,000	General Merchandize shops	DRDIP
		License	Year	1	50,000	50,000	General Merchandize shops	DRDIP
		Measuring tape 7S		15	25,000	375,000	General Merchandize shops	DRDIP
		Needle	Piece	60	500	30,000	General Merchandize shops	DRDIP
		Sewing machine	Piece	2	1,500,000	3,000,000	General Merchandize shops	DRDIP
		Furniture	Piece	2	100,000	200,000	General Merchandize shops	DRDIP
		Cutting tools	Piece	1	703,000	703,000	General Merchandize shops	DRDIP
		Smoother machine	Piece	1	4,400,000	4,400,000	General Merchandize shops	DRDIP
		Paint				1,000	General Merchandize shops	DRDIP
		Sewing wire				1,500	General Merchandize shops	DRDIP
		Thread				4,000	General Merchandize shops	DRDIP
		Wood glue				4,000	General Merchandize shops	DRDIP
		Screws				9,500	General Merchandize shops	DRDIP
		Labour				17,550,000		Community
		Number of crafts	900 pair of shoes, 900 baskets and 900 bags					
		Total costs for DRDIP				22,703,000		
		Total Costs for Community				17,550,000		
		Total Cost				40,253,000		
15	Artisan	Timber	434	Piece	10000	4,340,000	Hardware shops	DRDIP
		Sewin wire	434	Piece	1500	651,000	Hardware shops	DRDIP
		Transport cost	434	Per hive	4,000	1,736,000	Hardware shops	DRDIP
		Thread	434	Piece	4,000	1,736,000	Hardware shops	DRDIP
		Wood Glue	434	Pice	4,000	1,736,000	Hardware shops	DRDIP
		Screws per hive	434	kg	9,600	4,166,400	Hardware shops	DRDIP
		Labor cost	434	Per hive	4,000	1,736,000	Community	Community
		Power	12	Month	100,000	1,200,000		DRDIP
		Iron sheet	434		5,000	2,170,000	Hardware shops	DRDIP
		Renting working space per Month	12	Month	200,000	2,400,000		DRDIP
		License				100,000		DRDIP
		Security fees per day	360	Day	3000	1,080,000		DRDIP
		Clamps	5	Piece	40,000	200,000	Hardware shops	DRDIP
		Drill Power Kit	1		574,000	574,000	Hardware shops	DRDIP
		Jack plane	5	Piece	150,000	750,000	Hardware shops	DRDIP
		Circular saw machine	5	Piece	450,000	2,250,000	Hardware shops	DRDIP
		Chisel	5	Piece	10,000	50,000	Hardware shops	DRDIP
		Smooth plane	1	Piece	150,000	150,000	Hardware shops	DRDIP
		Screw drivers	10	A set	35,000	350,000	Hardware shops	DRDIP
		Tap measure	5	Piece	10,000	50,000	Hardware shops	DRDIP
		Square	5	Piece	10,000	50,000	Hardware shops	DRDIP
		Half- round bit & groove bit	1	Set	200,000	200,000	Hardware shops	DRDIP
		Sharpening stone	5	Piece	10,000	50,000	Hardware shops	DRDIP
		A span set	1	A set	150,000	150,000	Hardware shops	DRDIP
		Setting work space	40	Man days	5,000	200,000	Community	Community
		Number of possible hives	434					
		Total cost for DRDIP	22,759,400					
		Total cost for community	3,780,000					
		Total cost	26,539,400					

A. Complementary/SUPPLEMENTARY enterprises for diversification

S/N	Enterprise	Enterprise	Description	Contribution to the farm income (UGX)	Assumptions
1	Banana	Beans	Beans are intercropped with banana during the first year	• Income from 5.7 acres of Banana during the first year: UGX 9,633,000 • Income from 5.7 acres of beans: UGX 2,565,000 • Total income from the first year: 14,920,000 • Contribution of beans=21%	• Bush beans are intercropped with banana • Beans occupy 75% of the land • Yield of beans is 500 kg per acre translating in 2,850 kg of beans on 5.7 acres • There are two seasons of beans a year • Price per Kg of beans is: UGX 2,000 • The GM per Kg of beans is estimated at UGX 600
2	Dairy farming (4 cows)	Vegetables (Tomatoes) and biogas	Dairy farming provide dung that generate biogas and bio slurry for tomatoes production	• Income from milk and calf: UGX 14,128,000 • Income from 0.16 acre of tomatoes: UGX 616,800 • Income from biogas: UGX 2,342,400 • Total income for a group per year: UGX 17,087,200 • Contribution of tomatoes: 3.8% • Contribution of biogas: 13.7%	• Considered average weight of heifer/cow is 450Kg and that of calf is 80Kg; Feed intake per day is 3% body weight • Thus, one cow & calf eat 16Kg/day; Manure generated is 20% of what is eaten, which is 3.2Kg/cow and calf. Manure generated from 4 cows and 4 calves is 1.2T/season or 3.6T for 3 seasons. One acre uses 7.5T in a season or 22.5T in 3 seasons, thus the manure generated will be for 0.16 acres in 3 seasons. • There is investment in GAP and Irrigation • Tomatoes are harvested 3 times a year. The yield/acre/year is 12MTs and hence 1920 kg for 0.16 acres • There is income from biogas • Manure generated by one animal and its calf feeds 6 cubic meter plant generating biogas equivalent to UGX 60,000 /month. All the 8 animals generate equivalent of UGX 2.4M but variable costs on biogas plant is UGX 57,600 in a year.
3	Apiary (150 KTB hives)		Orchard/fruit trees (Mangoes) for siting/hanging the beehives	• Income from 150 KTB hives: UGX 36,617,700 • Income from mangoes per year: 16,940,000 • Total Income: 53,557,700.00 • Contribution of Mangoes: 31.6%	• One hive per mango tree hence 150 Mango trees • A group has a hectare of land to plant mango trees • Mango trees start yielding at the 6th year • The costs for planting mango trees include cost of seeds, cost of manure, land preparation and transplanting • All the costs (UGX 1,060,000.00) will be met by the group members • There are two harvest seasons of mangoes in a year • Each mango tree yields 3 sacs of mango fruits • Each sac is sold at UGX 20,000
4	Tomatoes (7 acres for the group)	Onion	Onion and Garlic repeal insects that attack tomatoes	• Income from tomatoes per year per 6 acres: UGX 23,130,000 • Income from Onion: UXG 5,515,020 • Contribution of onion to farm income: 19%	• Tomato to be grown on 6 acres instead of 7 acres using high yielding hybrids like Nouvelle and Kilele • Tomato yield is 4,000 kg/acre/season; and is grown thrice a year • Farm Gate Price of tomato is 1,000/Kg • Tomato producer group has functional market linkage for input and output markets • Onion to be put on one acre using high yielding varieties such as Bombay Red • Onion will be harvest thrice a year • Onion yield is 3,150 kg/acre/season • Farm Gate Price of onion is 1,000/Kg
5	Onion	Carrots	Carrots and Onion complement each other in improving the nutritional properties and in increasing yield	• Income from Onion on 78% of 19 acres (13 acres): UGX 28,048,800 • Income from Carrots on 6 acres: UGX 10,750,000 • Total Income:27%	• Onions to be grown on 70% of the land and carrots on 30%. • The yield of carrots is estimated to 3 MT per acre per season • Onion producer group has functional market linkage for input and output markets • FGP of onion is 1,000/kg • The price of a Kg of carrots is estimated at UGX 1000 • Production costs are estimated UGX 1,250,000 per acre.
6	Agro process-ing	Poultry	While selling maize grains and beans, the group can invest in value addition of maize. Group dealing in agro processing will have enough feeds for poultry	• Agro processing gross margin per year =UGX 47,874,000 • Local poultry gross margin per year = UGX 16,000,000 • Total gross margin = UGX 63,874,000 Contribution = 25%	• The group will be given DRDIP grant of USD 50,000 to invest in agro processing • Maize will be sourced from farmers, milled packed and branded • The group will invest in a milling machine with a capacity of 1000kg/hr • With the USD 50,000 funds, the group will be able to process 100,000kg • The grain to flour processing rate is 70% flour, 25% bran and 5% losses • The processed maize flour will be sold at UGX 1,500 per Kg • Agro processing produces 73,000 kg of bran a year • Cost of bran per Kg is UGX 300 • On average each chicken consumes 120g of bran per day • Annually each bird consumes feed 43,800 g =43.8 Kg • Given the current bran produced from agro processing, 1,667 local birds are reared per year • Mortality rate of birds is 10% • Poultry feed accounts for 80% of the costs variable costs • Price per local chicken is UGX 20,000 • The poultry structures and other labour costs are meet by the farmer • Birds are delivered when they are vaccinated against new castle

D. Common risks involved per enterprise and mITIGATION MEASURES

S/N	Enterprise	Risks involved		Mitigation measures
1	Banana Growing	Production risk	• Adverse weather (prolonged dry spell or excessive rainfall) that lead to poor planning, crop failure and high post-harvest damage	• Adopt risk mitigation practices. This includes using Climate Smart Agriculture practices while following recommended production practices such as timely planting, mulching, construction of soil and water conservation structures, etc • Invest in crop insurance against volatile weather patterns
			Pest and diseases outbreaks	• Diversify tomato enterprise by growing different crop varieties
		Marketing risks	Loss of market access due to buyers/processors pulling out from purchasing bananas from Kyegegwa	• Form producer marketing groups to enhance prices and guarantee a market
			Price fluctuations of banana	• Enter into price contracts with buyers; and use improved storage facilities to store produce until prices improve
		Social [1]risks	Straying animals especially goats destroying crops in the field	• Enacting by laws against untamed livestock
			Use of child labour in production and transportation of banana and over exploitation of women labor in production activities	• Invest in labor saving technologies for production activities • Sensitize beneficiaries on the dangers of child labor exploitation • Enforce by laws against exploitation of child labor
		Environmental risks	• Excessive and indiscriminate use of agro chemicals leading to: o Accumulation of pesticide residues in the banana fruits that endanger humans; o Environment pollution and destruction of organisms like bees and fish and; o Development of pesticide resistance	• Train farmers on Integrated Pest and Diseases Management including judicious use of agro chemicals • Enforce by laws on regulation and use of agro chemicals
			Environment destruction through: o Replacing of natural forest plantations with banana fields o Continued mining of soil nutrients especially Nitrogen, Phosphorous and Potassium during production	• Sensitize communities on sustainable agricultural production; enforce by laws on sustainable forest management • Apply Good Agronomic Practices including use of Integrated Soil Fertility Management Practices

D. Common risks involved per enterprise and mITIGATION MEASURES

S/N	Enterprise	Risks involved		Mitigation measures
2	Dairy Cattle keeping	Production Risks	• Prolonged dry spells causing water and pasture scarcity	• Construct water sources for water for livestock • Invest in pasture production and conservation: grow nutritive and drought tolerant pasture species, and train farmers in pasture conservation – making hay and silage
			• High input costs, and limited availability of quality agro chemicals and semen	• Link producer associations to suppliers of quality inputs at affordable rates • Develop the veterinary center at the district to supply semen
			• High parasites and diseases prevalence resulting in high mortality rate.	• Promote improved livestock management practices including access to animal health services – treatment, vaccination, judicious use of acaricides etc. and training of farmers in livestock production and management • Enforce quarantine measures as appropriate • Invest in construction and use of communal cattle crushes to treat community livestock against common parasites • Construct communal water sources for livestock to reduce infestation by end parasites like liverflukes
			• Development of pesticide resistance	• Train farmers on judicious use of pesticides; • Sensitize agro vets on dangers of use of counterfeits chemicals; and train farmers on identification of counterfeit/fake chemicals • Enforce by laws on regulations and use of chemicals
			• Reluctance of financial lending institutions to provide credit, and or providing at high lending rates	• Support producer groups to build VSLAs for credit access
		Marketing risks	• Loss of market access due to buyers/processors pulling out from purchasing milk from Kyegegwa	• Form producer marketing groups to enhance prices and guarantee a market
			• Price fluctuations of milk	• Enter into price contracts with buyers • Promote diversification into other products like ghee processing during bumper harvest periods
			• Seasonality of supply with reduced supply during dry spell	• Support farmers to invest in improved pasture production and conservation for use during off season • Invest in water for livestock production
			• Purchase of adulterated and or spoilt milk	• Sensitize Value Chain Actors on dangers of milk adulteration • Facilitate traders/processors to enter into agreements with producers and agree on quality parameters • Enforce by laws on quality milk trade
			• Disruptions in electric power supplies	• Invest in alternative power sources like solar and generators
			• Breakdown of feeder roads to production areas	• Construct and rehabilitate feeder roads.
		Social risks	• Theft of livestock	• Enforce by laws against theft
		Environmental risks	• Production of GHG emissions and leaching of nitrogen from the cow dung into ground water sources	• Implement appropriate livestock production and management practices such as production of quality forage, and feed conservation that: a) reduce emission of methane and other GHGs, and reduces overgrazing
			• Ecosystem degradation due to overgrazing	

D. Common risks involved per enterprise and mITIGATION MEASURES

S/N	Enterprise	Risks involved		Mitigation measures
3	Bee keeping	Production Risks	• Pests and disease prevalence	• Train beekeepers on management of bee pests and diseases
			• Destruction of bees through bush burning and pesticides applied in crop fields	• Enforce by laws on environment management and judicious use of agro chemicals
			• Theft of honey from the hives	• Enforce by laws against theft
		Marketing risks	• Limited access to affordable equipment and packaging material	• Link processors to suppliers of equipment and packing material.
			• Purchase of adulterated honey	• Sensitize Value Chain Actors on dangers of adulteration of bee products • Facilitate traders/processors to enter into agreements with producers and agree on quality parameters • Enforce by laws on quality bee products trade
		Social risks	Bees attacking of humans	• Site the hives in well isolated locations far from human settlements
4	Tomatoes	Production Risks	• Adverse weather (prolonged dry spell or excessive rainfall) that lead to poor planning, crop failure and high post-harvest damage	• Adopt risk mitigation practices. This includes using Climate Smart Agriculture practices while following recommended production practices such as timely planting, weeding, and harvesting • Diversify tomato enterprise by growing different crop varieties • Invest in crop insurance against volatile weather patterns
			• Pest and diseases outbreaks	• Use of resistant varieties such as XX which is resistant to bacterial wilt; and cultural practices like use of trap crops
		Marketing risks	• Loss of market access due to buyers/processors pulling out from purchasing tomatoes from Kyegegwa	• Form producer marketing groups to enhance prices and guarantee a market
			• Price fluctuations of tomatoes	• Enter into price contracts with buyers; and use improved storage facilities to store produce until prices improve
			• Seasonality of supply due to practicing rainfed agriculture	• Spread planting, harvesting and sales over the season • Use irrigation to produce during off season
			• Changing consumer preferences	• Invest in value addition for product diversification
		Social risks	• Theft of tomatoes in the field • Straying animals especially goats destroying crops in the field	• Enacting by laws that safeguard against theft and that compel farmers to look after their livestock
			• Use of child labour in production and over exploitation of women labor in production activities	• Invest in labor saving technologies • Sensitize beneficiaries on the dangers of child labor exploitation • Enforce by laws against exploitation of child labor
		Environmental risks	• Excessive and indiscriminate use of agro chemicals leading to: o Accumulation of pesticide residues in the fruits that endanger humans; o Environment pollution and destruction of organisms like bees and fish and; o Development of pesticide resistance	• Train farmers on Integrated Pest and Diseases Management including judicious use of agro chemicals • Enforce by laws on regulation and safe use of agro chemicals
			Environment destruction through: o Continued mining of soil nutrients especially Nitrogen, Phosphorous and Potassium during production o Growing the crop in the wetlands during off season	• Apply Good Agronomic Practices including use of Integrated Soil Fertility Management Practices • Sensitize communities on sustainable wetland use; enforce by laws on ecosystem use; and invest in irrigation for production during off season
5	Onion	Production Risks	• As for tomatoes	
		Marketing risks	• As for tomatoes	
		Social risks	• As for tomatoes	
		Environmental risks	• As for tomatoes	

D. Common risks involved per enterprise and mITIGATION MEASURES

S/N	Enterprise	Risks involved		Mitigation measures
6	Crafts	Production Risks	• Limited availability of raw materials such as papyrus, reeds, and twigs due to persistent exploitation without replacement	• Sensitize the community on sustainable utilization of environmental resources
		Marketing risks	• Lack of market for the finished products	• Build a one stop crafts centre within the district for exhibition of the finished products; and invest in advertisement of the crafts products
		Environmental risks	• Increased destruction of ecosystem especially wetlands and natural forests for raw materials	• Invest in environment restoration and sustainable use of ecosystem
7	Artisan	Production Risks	• As for crafts	

A. STRATEGIC INVESTMENTS FOR EACH VALUE CHAIN

S/N	Prioritised Value Chain	Strategic Investments	Responsible partner
1	Banana Value chain	Invest in increasing crop production and productivity. • Recruit and fill the vacant positions under the crop • Develop guidelines on Good Agronomic Practices • Implement a Volunteer Technology Transfer Scheme (VTTS) • Develop affordable labour-saving technologies • Enforce by-laws on good agronomic practices in banana plantations	• District crop production department • Kawanda Banana Research Program/Kilimo Trust • Universities • Namalere Agricultural Mechanization Resource Centre • LCs at the village and sub county levels
		Increase market access and reduce Post-Harvest Losses: • Invest in building strong farmer groups • Build aggregation centres at sub county level • Construct the Katente market • Rehabilitate rural roads and build skills of the community on feeder roads maintenance	• Kilimo Trust • Project/LG-PPP • Project/LG-PPP • Project/LG-PPP
		Invest in research to generate appropriate Post-Harvest technologies and competitive value-added banana products. • Develop competitive banana value added products	• Uganda Industrial Research Institute (UIRI) • Makerere University Department of Food Technology & Nutrition
		Promote afforestation of degraded and non-agricultural fields	• District Forest officer • Kilimo Trust
2	Dairy VC	Invest in increased and sustainable milk production • develop guidelines on appropriate livestock production practices • Seeds and pasture production and conservation technologies • enforce regulations and by-laws on registration and use of animal drugs • Design and implement a Volunteer Technology Transfer Scheme (VTTS) • Build capacity of the district staff and Agro vets in the district • Recruit and fill the vacant positions in the livestock and entomology units, and facilitate all technical staff with transport • Build the necessary infrastructure in the district to sustainably manage the production and animal health services • Support farmers to invest in improved breeds through Artificial Insemination	• AFRISA • Kilimo Trust • Universities • Kilimo Trust • MAAIF • Project/LG-PPP
		Increase market access and reduce Post Milking Losses and Post-Harvest Losses in apiary • Link farmers to large processors like Brookside Ltd and Pearl Diaries Ltd and to FSIs like VSLAs. • Invest in building strong farmer groups. This should be accompanied with equipping farmers and farmer groups with knowledge and skills in leadership /governance, financial literacy, market-oriented production and farming as business • Invest in aggregation centres with group owned cooling facilities for milk handling • Construct feeder roads from production units to collection centres	• Kilimo Trust • Kilimo Trust • Project/LG-PPP
		Invest in PHH and Value Addition • Invest in equipment • Providing skills for generation of secondary products like ghee, biogas and bio slurry	• Project/LG-PPP • Kilimo Trust

3	Apiary	**Invest in increased and sustainable production of bee products** • develop and disseminate guidelines on increased and sustainable production and processing of bee products and facilitate existing staff to train farmers. • Build the capacity of beekeepers. Capacity building would be two-fold: a) Training and enabling beekeepers to access modern equipment including hives. Train beekeepers on bee keeping best practices; honey harvesting, and processing; and b) Train beekeepers on group management, negotiation skills and collective marketing. • Build the capacity of artisans with skills and equipment to make KTB hives. • Enforce judicious use of agro chemicals, by-laws against indiscriminate bush burning and adulteration of bee products.. • Build capacity of the district staff to offer technical backstopping to the staff.	• TUNADO • The district Entomology Department • Kilimo Trust • The Hives Ltd • Malaika Honey Ltd • MAAIF, UNBS
		Increase market access and reduce Post-Harvest Losses in apiary • Link farmers to large processors like The Hive and Malaika Ltd companies and support producers access finance by promoting VSLAs. • Invest in building strong farmer groups. • Invest in aggregation centres with group owned extraction and processing facilities • Construct feeder roads from production units to collection centres	• Kilimo Trust • Kilimo Trust
		Invest in Value Addition • Diversify and increase production of products like venom and pollen at farmer level. Also, the project should support the actors to produce secondary products such as candles, soap, etc.	• Kilimo Trust • Makerere University
4	Tomatoes	**Invest in increasing crop production and productivity.** • Train farmers on GAP, GPHH, farming as a business. • Recruit more staff under the crop production department and equip them with adequate transport. • Invest in irrigation infrastructure and associated facilities. • Enforce regulations on judicious use of agro chemical use. • Establish a functional national pesticide residue surveillance plan. • The central government should also empower the local government with skills, equipment and other necessary materials for regular monitoring of pesticide residues in commodities.	• Kilimo Trust • Horticultural Unit at National Crops Resources Research Institute (NaCRRI) • Project/LG-PPP • MAAIF, NEMA, and UNBS
		Invest in sustainable market linkages	• Kilimo Trust
		Invest in value addition for competitive value-added tomato products	• Kilimo Trust
5	Onion	**Invest in increasing crop production and productivity.** • Train farmers on GAP, GPHH, farming as a business. • Recruit more staff under the crop production department and equip them with adequate transport. • Invest in irrigation infrastructure and associated facilities. • Enforce regulations on judicious use of agro chemical use.	• Kilimo Trust • Horticultural Unit at National Crops Resources Research Institute (NaCRRI) • MAAIF, NEMA, and UNBS
		Establish a functional national pesticide residue surveillance plan	• MAAIF
		Increase market access and reduce Post-Harvest Losses	• Kilimo Trust
		Invest in research to generate appropriate Post-Harvest technologies and competitive value-added onion products.	• Kilimo Trust • Horticultural Unit at National Crops Resources Research Institute (NaCRRI)
6	Crafts	**Invest in increased and sustainable production of high-quality crafts products** • Recruit more staff under the commercial department and equip them with adequate transport. • Invest in vocational training institutes. • Equip the existing training institutes with trainers, equipment and tools • Build the technical skills of craft makers such as designing and measurements, marketing strategies, financial literacy and group management etc. • Empower craft makers with equipment and tools for making quality products. • Support enforcement of by laws on sustainable use of ecosystem resources.	• Government • Kyaka Vocational Institute located in host community and Bujubuli Vocational Secondary School in the refugee community • Kilimo Trust • Project/LG-PPP • Forest Officers
		Link handicraft makers to sustainable markets outside Kyegegwa.	• Kilimo Trust

7	Artisan	**Invest in vocational institutes and build capacity of artisans.** • Equip the training institutes with trainers, equipment and tools and construct at least one vocational training center in the nonhost communities. • Build the technical skills of artisans such as identification of appropriate wood species, and well-seasoned timber, designing and measurements etc. This should also include products diversification • Empower artisans with equipment and tools for making hives and secondary products like briquettes	• Government • Kyaka Vocational Institute located in host community and Bujubuli Vocational Secondary School in the refugee community
		Build the capacity of staff and community in sustainable environment management. • Monitor, evaluate and advise on the use of forest resources within the district.	• Kilimo Trust • NFA
		Link beehive makers to beekeeper groups.	• Kilimo Trust
8	Trade in Agro Produce	**Construct market infrastructure** **Support the traders with start-up working capital.** **Rehabilitate feeder roads**	• Project/LG-PPP
		Build capacity of traders in post-harvest handling and food safety, financial literacy and marketing skills	• Kilimo Trust

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