Value Chain Assessment Report

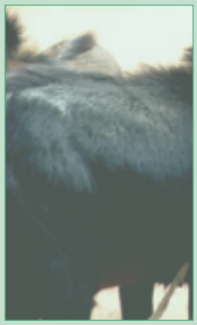
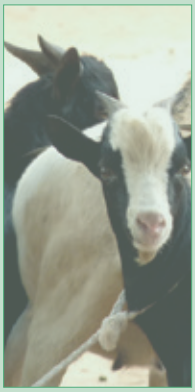
Adjumani

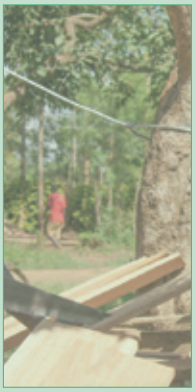
Development Response to Displacement Impacts Project

Ministry of Foreign Affairs of the Netherlands

WORLD BANK GROUP

BASMAT DAILY BAKERY
YOUTH DEVELOPING PROJECT
ZONGSHEN



Standard Disclaimer:

This volume is a product of the staff of the International Bank for Reconstruction and Development/The World Bank with external contributions. The findings, interpretations, and conclusions expressed in this paper do not necessarily reflect the views of the Executive Directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Copyright Statement:

The material in this publication is copyrighted. Copying and/or transmitting portions or all of this work without permission may be a violation of applicable law. The International Bank for Reconstruction and Development/The World Bank encourages dissemination of its work and will normally grant permission to reproduce portions of the work promptly.

For permission to photocopy or reprint any part of this work, please send a request with complete information to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA, telephone 978-750-8400, fax 978-750-4470, http://www.copyright.com/.

All other queries on rights and licenses, including subsidiary rights, should be addressed to the Office of the Publisher, The World Bank, 1818 H Street NW, Washington, DC 20433, USA, fax 202-522-2422, e-mail pubrights@worldbank.org

TABLE OF CONTENTS

LIST OF FIGURES iv
LIST OF TABLES v
PREFACE vi
ACKNOWLEDGEMENT vii
ACRONYMS viii
DEFINITIONS OF KEY TERMS x
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 11
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. Goat Value Chain 17
3.1.2. Sesame Value Chain 32
3.1.3. Soybean Value Chain 49
3.1.4. Tomato Value Chain 63
3.1.5. Okra Value Chain 75

3.2. Non-Traditional Value Chains 85
3.2.1. Agro Processing 86
3.2.2. Bakery and Confectionary 96
3.2.3. Carpentry Value Chain 107

4. CONCLUSION 119
5. REFERENCE 122
6. APPENDICES 126

LIST OF FIGURES

Figure 1: A map of Adjumani district in Northern Uganda....6
Figure 2: Approach to the assignment....8
Figure 3: Goat meat supply and demand (MT)....19
Figure 4: Goat exports (2007 – 2018)....19
Figure 5: Product flow along different nodes of the Goat value chain....22
Figure 6: Net present values for 1 local and improved 75% pure Boer goats....23
Figure 7: GM per live goat....23
Figure 8: Gross Margin per herd of live goat....24
Figure 9: GM per goat sold by the trader....24
Figure 10: Goat value chain in Adjumani....25
Figure 11: Demand and supply of Sesame 2007 -2017....34
Figure 12: Sesame exports from Uganda between 2007 and 2018....34
Figure 13: Value Chain map of Sesame in Adjumani....35
Figure 14: Gross margins per acre for Sesame farmers....38
Figure 15: Gross margins for Sesame farmers per Kg....38
Figure 16: Gross margins for Sesame actors per Kg....39
Figure 17: Share value for different Sesame value chain actors....39
Figure 18: Soybean supply and demand in Uganda (MT)....51
Figure 19: Soybean exports....51
Figure 20: Value chain map for Soybean in Adjumani....52
Figure 21: Gross margins for soybean farmers per acre by method of land opening....54
Figure 22: Gross margins for soybean farmers per Kg....55
Figure 23: Gross margins for soybean retail trader per Kg....55
Figure 24: Share of value along the Soybean value chain....56
Figure 25: Tomato production and consumption in Uganda....65
Figure 26: Export of formal tomato products from 2014 to 2018....65
Figure 27: Value chain of tomato fruit in Adjumani district....66
Figure 28: Gross margins for tomato farmers per acre....67
Figure 29: Gross margins for tomato farmers in UGX/Kg....68
Figure 30: Gross margins for tomato traders per Kg....68
Figure 31: Share of value for tomato farmers and traders....68
Figure 32: Value chain map of Okra....77
Figure 33: Gross margins for Okra farmers in UGX per acre....78
Figure 34: Gross margins for Okra farmers in UGX /kg....78
Figure 35: Gross margins for okra value chain actors per Kg....79
Figure 36: Share of value for different actors along the Okra value chain....79
Figure 37: Gross margin for different categories of Agro-processing value chain....89
Figure 38: Bakery and Confectionery Value Chain Map....98
Figure 39: Gross margin for medium and small Bakers of Mandazi....99
Figure 40: Gross margin for retail trader of bakery and confectionaries....100
Figure 41: Carpentry Value Chain Map....109
Figure 42: Gross Margin per bed made by the carpenter....111
Figure 43: Gross Margin per sofa-set chair made by the carpenter....111
Figure 44: Gross Margin for a six-seater dining set....112
Figure 45: Gross Margin for window and door products made by the carpenter....112

LIST OF TABLES

Table 1: Sub counties and villages visited 7
Table 2: Sample size of various respondent categories in Adjumani 9
Table 3: Illustration of estimating number of FTE job units per acre 12
Table 4: Factors key in breeding goats 21
Table 5: Assumptions undertaken 22
Table 6: Total number of jobs at current under the goat value chain 25
Table 7: Challenges of goat value chain 27
Table 8: Scenarios under strategic investment in goat VC 29
Table 9: Assumptions for actors along the goat value chain 30
Table 10: Impact of strategic investments on GM and Jobs 31
Table 11: Estimated number of jobs under the Sesame value chain 40
Table 12: Challenges along each node 43
Table 13: Assumptions in scenarios developed 46
Table 11: Impact of Investment scenarios 47
Table 15: Gross margin for oil extraction 48
Table 16: Total number of jobs created, and the wages earned 56
Table 17: Challenges faced by actors at different nodes of the Soybean value chain 59
Table 18: Assumptions in scenarios developed 61
Table 19: Impact of Investment scenarios 62
Table 20: Jobs created at farm and trading levels of the tomato value chain 69
Table 21: Challenges and mitigation measures along the Tomato value chain 71
Table 22: Assumptions in scenarios developed 73
Table 23: Impact of Investment scenarios 74
Table 24: Total jobs and wages under Okra value chain 80
Table 25: Challenges and mitigations along the different nodes of the okra value chain 81
Table 26: Assumptions in scenarios developed 83
Table 27: Impact of Investment scenarios 84
Table 28: Jobs and wages created along sesame processing 90
Table 29: Jobs and wages created by capacity of the mill 90
Table 30: Challenges faced by agro processors 92
Table 31: Assumptions used in agro-processing 94
Table 32: Investment under agro-processing per year 95
Table 33: Description of different bakeries and confectionaries 98
Table 34: Jobs and wages for medium scale bakery 100
Table 35: Challenges and mitigation measures along each node 102
Table 36: Assumption in bakery and confectionaries 104
Table 37: Investments in bakery and confectionary per year 105
Table 38: Prices of different carpentry products 110
Table 39: Jobs created under carpentry 113
Table 40: Challenges and mitigation measures along each node 115
Table 41: Investments in carpentry 116
Table 42: Investments in carpentry 116
Table 43: Attributes used in ranking 120
Table 44: Summary of findings from the detailed value chain analysis 120
Table 45: Ranking of the value chains in relation to each attribute 121

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 Adjumani 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.

ACKNOWLEDGEMENT

This report was a joint collaboration between the World Bank and Kilimo Trust with support from the Office of the Prime Minister (OPM), Government of Uganda (GoU). The report was written by John Ilukor from the World Bank and Joseph Mudiope, Desire Hakizimana, Moris Kabyanga, Rita Mwase, Birungi Korutaro and Henry Mwololo of Kilimo Trust. The authors are indebted to Robert Limlim, Emily Awili and Ponsiano Musiime from OPM, and Joe Nuwamanya, Ashutosh Raina, Varalakshmi Vemuru, Michael Mutemi Munavu from the World Bank for the comments and proofreading of the earlier versions of this report.

The team also acknowledges the valuable contributions by the staff of DRDIP as well as by Justine Alule, Savior Tan Lemi, Godfrey Mamawi Ambayo, James Vuciri, Daba Stella from the Adjumani District and Sub County Local Government, Maiku Christopher (Jopala Animal Rearing Farm), Charles Mawa Mana (Ofua produce and marketing cooperative - OPM), Joseph Jamal (Tamaina Wood Workers, Kulabako Yuda (Basmati Bakeries).

This work was mostly funded by the Ministry of Foreign Affairs of The Netherlands under the PROSPECTS Program.

OFFICE OF THE PRIME MINISTER

WORLD BANK GROUP

Kilimo Trust
Transforming Lives Through Agribusiness

Ministry of Foreign Affairs of th Netherlands

ACRONYMS

AAGR	Average Annual Growth Rate
ASSP	Agriculture Sector Strategic Plan
CBA	Cost Benefit Analysis
CF	Community Facilitator
CO	Community Organizations
COMESA	Common Markets for Eastern and Southern Africa
DIST	District Implementation Support Team
DRC	Danish Refuge Council
DRC	Democratic Republic of Congo
DRDIP	Development Response to Displacement Impacts Project
EAC	East African Community
EAGC	East African Grain Council
ECBA	Economic Cost Benefit Analysis
EPRC	Economic Policy Research Centre
FAO	Food and Agriculture Organization
FCBA	Financial Cost Benefit Analysis
FGDs	Focus Group Discussions
FMD	Foot and Mouth Disease
FTE	Full Time Employment
FTE	Full Time Equivalent
GADC	Gulu Agricultural Development Centre
GAP	Good Agronomic Practices
GDP	Gross Domestic Product
GHG	Greenhouse gas
GM	Gross Margin
GMA	Gross Margin Analysis
GoU	Government of Uganda
ICT	Information Communication Technology
IFAD	International Fund for Agriculture Development
IGAD	Inter Governmental Authority on Development
ITC	International Trade Centre
Kg	Kilogram
KI	Key Informant
KT	Kilimo Trust
LC	Local Council
LWF	Lutheran World Federation
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MoFPED	Ministry of Finance planning and Economic Development
MT	Metric Tonne
MTIC	Ministry of Trade industry and Cooperatives
NAADS	National Agriculture Advisory Services
NADDEC	National Animal Disease Diagnostic and Epidemiology Center
NDA	National Drug Authority
NDP	National Development Plan
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
NPA	National Planning Authority
NPV	Net Present Value
NRC	Norwegian Refugee Council
NUSAF	Northern Uganda Social Action Fund
OPM	Office of the Prime Minister
OPV	Open Pollinated Variety
OSSUP	Oil Seeds Sub Sector Platform
PBP	Payback Period
PHH	Post-Harvest Handling
PHL	Postharvest Loss
PHM	Post-Harvest Management
PI	Profitability Index
PIST	Project Implementation Support Team
PSFU	Private Sector Foundation Uganda
ROI	Return on Investment
SACCOs	Savings and Credit Cooperative Organizations
SIST	Subcounty Implementation Support Team
SoV	Share of value
TBD	Tick-Borne Diseases
TGCU	Grain Council of Uganda
TVC	Total Variable Cost
TVET	Technical and vocational education and training
UGX	Uganda Shillings
UIRI	Uganda Industrial Research Institute
UMA	Uganda Manufacturers Association
UMPCU	Uganda Meat Producers Cooperative Union Ltd
UNBS	Uganda National Bureau of Standards
UNHCR	United Nation High Commission for Refugees
UOSPA	Uganda Oil Seed Producer and Processors' Association
URSB	Uganda Registration Services Bureau
US	United States
USD	United States Dollar
VC	Value chain
VCA	Value Chain Analysis
VODIP	Vegetable oil development
VSLA	Village Savings and Loan Association
WB	World Bank

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.
Traditional Livelihoods	On-farm primary production in crop, livestock, fisheries and bee keeping.
Non-traditional Livelihoods	Off-farm enterprises including processing, trade (produce, Livestock & others), service enterprises e.g. saloons, food & beverages, events management, etc.
Value chain	Describes 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.
Supply chain	Supply chain relates more specifically to the chain of events that lead from the supply source to product consumption in a sector or subsector.
Man day	A day regarded in terms of the amount of work that can be done by one person within a day.
Strategic Investment	A catalytic investment that triggers significant growth among local enterprises, increases their profitability, creates jobs for communities and spurs local economic growth.

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 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 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. This was followed by the scoping study in the pilot district of Adjumani, identify 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 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 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. The study activities involved; a Secondary Literature Review and Primary Data Collection through FGDs at District, Sub-counties and Community Level Meetings, coupled with Key Informant Interviews while employing a participatory approach.

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 sesame, agro processing, soybean and carpentry, okra, tomato then bakery and goats. These value chains were prioritized mainly because their respective key products are profitable, having ready market and overall, they are agro ecologically suitable for production within Adjumani, among others.

The major Value Chain Actors and their characteristics for each of the prioritized value chain are as below.

Goat

Agro vets
- Capital of less than UGX 10M & deal variety Agro vet drugs
- Registered by NDA
- 90% use own capital

Producers
- 90% host and 50% refugees rear 2-4 goats
- Local and improved live goat weighs 18 and 40Kg respectively
- Sell to traders (97%) & 3% to consumers.

Traders
- Capital of less than UGX 1,000,000
- Butchers slaughter 2-4 goats a day

Sesame

Input suppliers
- Capital of less than UGX 5M per year & deal in a variety of input such as seed
- Over 98% are registered at the district
- Over 90% use own capital for the business

Producers
- Produced mostly by host on 1 - 2 acres
- Yield per acre is 400kg, 25% PHL & 10% consumed at home
- 65% is sold / marketed

Traders
- Either agents or small traders
- Agents have capital of less 5M & handle 10MT per season
- Small traders handle 35kg per week & have capital base of less than UGX 200,000

Aggregators
- Have capital of around 5M
- Handle less than 10MT per week

Processors
- Small process in Adjumani have installed capacity of 15kg/hr
- Utilization capacity is at 30%

Soybean

Producers
- Produced mostly by host on 1 - 2 acres
- Yield per acre is 800kg, 25% PHL & 1.7% consumed at home
- 73% is sold / marketed

Traders
- Have capital of around1M
- Handle 1MT per month

Cooperative/ Aggregator
- Handle less than 8MT per season

Processors (Mt Meru in Lira)
- Located outside Adjumani & has installed capacity of 300MT/hr
- Utilization capacity of 80%

Tomato & Okra

Producers
- Produced by host & refugees on 0.25 - 1 acre
- Yield per acre is 800kg, 25% PHL & 1.5% consumed at home
- 73.5% is sold / marketed

Traders
- Either agents or small traders
- Agents have capital of less 5M & handle 10MT per season
- Small traders handle 35kg per week & have capital base of less than UGX 200,000

Agro processing

Small scale processors:
- Owned by both host & refugees
- Have capital of about UGX 2M
- Installed processing capacity of 500kgs per day

Medium-scale processors:
- Owned by host
- Have capital of about UGX 15M
- Installed processing capacity of 1 to1.5 per hour.

Large scale processors
- Owned by host
- Have capital of about UGX over 100M
- Installed processing capacity of 2.5MT per hour and utilization capacity of 30%

Bakery & confectionary

Input suppliers
- Either wholesale or retail operated by both host and refugees
- Deal in variety of inputs
- Wholesale have capital base of 15M & registered at district
- Retailer have capital base of 1M & registered at subcounty

Bakers
- Both small and medium scale
- Small scale have a capital base of less than UGX 100,000 & operated by both refugees and hosts.
- Medium scale have capital base of less than UGX 10M
- Registered at the district

Bakers
- Both small and medium scale
- Small scale have a capital base of less than UGX 100,000 & operated by both refugees and hosts.
- Medium scale have capital base of less than UGX 10M
- Registered at the district

Carpentry

Input suppliers
- Both hardware shops and timber suppliers
- Hardware shops have a capital base of less than UGX 10M & registered at district.
- Deal in a variety of products both carpentry and construction.
- Timber suppliers have capital base of about 2M

Carpenters
- Both host & refugees operated carpentry. Workshops
- Registered at the district.
- Use a variety of hand & power tool
- Have a capital base of less than 2M
- Produce a variety of products such as tables, sofa, doors & windows
- They sell their products to institutions, hotels and households

The production for all the prioritized value chains is mainly for commercial purposes hence the positive gross margins except for the goat VC. Although goats generate most jobs in the district and have the highest market value, the enterprise registers the least profitability and it does not pay back even after 10 years of investment. The details of employment, profitability and market size for the different value chains are as below.

Actors	Goat	Sesame	Soybean	Tomatoes	Okra	Agro processing	Bakery and confectionary	carpentry
Gross margin for producers per year	Local goat: UGX-436,0000 per herd (UGX-145,000 per goat) Improved goat: UGX 9,500 per herd (UGX 4,750 per goat)	Hand hoe: UGX 444,000 per acre Ox-plough: UGX 484,000 per acre Tractor: UGX 604,000 per acre	Hand hoe: UGX 186,200 per acre Ox-plough: UGX 113,100 per acre Tractor: UGX 173,100 per acre	UGX 193,167 per acre	UGX 377,000 per acre	UGX 15,163,200	UGX 4,311,528	UGX 8,160,000
Trader in UGX per unit	Local goat: UGX 43,800 per goat Improved goat: UGX 47,800 per goat	UGX 41/ Kg	UGX 50 / Kg	UGX 378/ Kg	UGX 354/ Kg		UGX 10,000 per UGX 50,000 invested	
Payback period	Does not pay within 10 years	-	-	-	-	5 month for sesame	Small scale: 1 month	7 months
Employ-ment/ (FTE) in a district	Local goats: 26,696 Improved goat: 253	Hand hoe: 23,362 Ox-plough: 22,263 Tractor: 21,164	Hand hoe: 17,727 Ox-plough: 16,978 Tractor: 16,764	3,421	3,610	Sesame processing 1,099 Maize processing by DIA company: 4	400	360
Current Market value in UGX	15,840,000,000	78,014,300	19,566,995	16,020,648	9,600,844	36,480,000	11,582,500	21,480,000

The goat value chain has gross margins (GMs) per goat of UGX -145,000 per local goat and UGX 4,750 per improved goat. The traders' GM for the improved and local goats only differ by UGX 4,000 higher for the improved goats. However, the current goat management i.e. free-range grazing with minimal health management does not payback even after 10 years.

The sesame and soybean gross margins (GMs) per acre are driven by the volumes dealt in by actors. For instance, traders make the least GMs i.e. between UGX 41 to UGX 50. These GMs are beneficial because they handle large volumes gathered from different farmers. The payback period is not calculated for the Adjumani crops because they are seasonal crops. The FTE jobs for sesame and soybean value chains (VCs) in the district were estimated at 23,362 and 17,727 jobs when a hand hoe is used for land opening. The current market sizes of sesame and soybean is UGX 78 million and UGX 19.6 million, respectively.

The tomato and okra as vegetables, have gross margins (GMs) per acre per year of UGX 193,167 and UGX 377,000, respectively. However, the volumes handled are low. For instance, tomato and okra traders make the least GMs i.e. between UGX 354 to UGX 378. These GMs are beneficial because they handle large volumes purchased from different farmers. The FTE jobs for tomato and okra value chains (VCs) in the district were estimated at 3,421 and 3,610 jobs. These are the least number of jobs for the traditional livelihoods. The current market size of tomato and okra is UGX 16 million and UGX 9.6 million, respectively.

In Adjumani, the non-traditional value chains are agro-processing, bakery & confectionary and carpentry. The average GMs for each of these VCs are UGX 15.2 million, 4.3 million and 8.2 million per year, respectively. The jobs created are 1,009, 400; and 360 as FTE jobs for the 3 non-traditional value chains, respectively. The current market size for the 3 non-traditional value chains are UGX 36.5 million, UGX 11.6 million and UGX 28.5 million respectively.

Below is a summary of the positive and negative social and economic aspects within the VCs. These are presented for livestock, crops and non-traditional value chains.

	Livestock value chains	Crop value chains	Non-traditional value chains
Positive effects	• All communities participate i.e., refugees and hosts. • Goats are very important in cultural functions where they are used to pay dowry or bride price. • Use of goat droppings and urine as manure that leads to improvement in yields. • Goat meat is source of proteins and fats key in body building.	• Grown by both refugees & host. • Some crops contain minerals and vitamins that are essential for the body. • Sesame is a staple food in Adjumani. • Crops like soybean contribute to nitrogen fixation in the soils.	• Involves both hosts and refugees communities. • Fortification of minerals and vitamins in bakery products plays a role in nutrition • Carpentry engage males. • Agro processing increases the shelf-life of commodities.
Negative effects	• Goat contribute to greenhouse gases emissions in the atmosphere when the dropping are left to decompose in the open i.e it produces methane	• High level of use of agro-chemicals e.g. in tomatoes is detrimental to soil micro-organisms. • Poor use of chemicals burns and destroys the crops. • Chemicals cause pollution of the air with dangerous gases.	• Agro processing contributes to emission of greenhouse gases into the atmosphere, thus contributing to global warming. • Timber production results into deforestation, this has accelerates soil erosion, loss of below ground diversity and increased accumulation of gasses in the atmosphere, thus global warming.

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 and volumes of the crop products due poor agronomic practices, the mills are not used efficiently 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 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 investment options across the value chains. The details of the investment areas are as below.

Investment	Livestock value chains	Crop value chains	Nontraditional value chains
Public	• Invest in more livestock disease Control Infrastructure such as dips, crushes, spray race quarantine station, holding ground and valley. • Invest in road infrastructure so that production areas can easily be accessed e.g. bridges in Pachara and Ayilo	• Investment in rehabilitation of the roads e.g. in Ayilo, Pakele, Pachara • Construction of aggregation centres at the watersheds • investment in appropriate irrigation infrastructure to cushion farmers against changing weather conditions	• Construction and rehabilitation of roads to reduce transportation costs and ease movement of raw materials. • Need to address the irregular electricity supply in the region.
DRDIP	• Pilot with the district production unit, goat farming as a business dynamics for Adjumani • Build the capacity of farmers/groups in goat farming as a business • Work with AFRISA to build capacity of the farmers • Support farmers to acquire and maintain high yielding goat breeds – work with NAGRIC	• Train farmers on GAP (e.g. Kilimo Trust) • Work with NARO to avail improved and appropriate seed varieties • Investment in good packaging to reduce postharvest losses by working with East African Packaging company to produce appropriate packages for tomatoes • Link farmers to supporting services such as access to functional markets and market information. • Research into value addition opportunities for okra. • Ensure UNBS standards for the products from value addition for sesame, soybean, and tomatoes	• Improving on yield/ production coupled with establishing contract farming arrangements for farmers (Agro processors). • Access to credit facilities options and future credit plans • Purchase of equipment i.e. manual system for the medium bakers. • Building capacity of bakers in a variety of products through working with Uganda Industrial Research Institute. • Investment into packaging requirements for the different market segments (Agro processing & bakery)
Private	• To bridge the information asymmetry in the value chain • Liaise with farmers to increase access to agricultural financing. • Solutions to livestock rearing through learning exchanges within the region	• Support large scale agro-processors with operating capital • Introduction of tractor hire services • Piloting an information platform between farmers and traders to ensure accurate information available	• Support value chain actors with operating capital through grants and loans

The value chains were ranked in relation to profitability, job creation and market size. In order of priority, they were ranked as follows: sesame, agro processing, soybean and carpentry, okra, tomato then bakery and goats. Sesame which top the list is more benefiting to the host than to the refugee communities because it is land intensive. Agro-processing was second while carpentry and soybean are third in rank. Auspiciously, both agro processing and carpentry are appealing to all the communities. Goats and bakery were least ranked. However, bakery would be preferred as it has a less payback period of 8 months compared to goats which take five years under improved production system.

In conclusion therefore, DRDIP can fund the sesame and soybean VCs targeting the host communities but also for the refugees who can hire land. Agro processing, carpentry, bakery, okra and tomatoes can be funded to benefit both communities under varying target beneficiaries' groups. In contrast, the goat VC is not recommended for investment by DRDIP. The GMs for goats at farmer level are negligible even after the strategic investments while the associated payback period is above five years yet technologies for value addition at production level to goat products are not readily available.

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, metal-works, 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 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 co-existence 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 . 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 (WB) 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 for the validated traditional and non-traditional value chains. Each chapter on the value chain include a maps 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.

WELCOME TO
ADJUMANI DISTRICT

2. STUDY METHODOLOGY

2.1. Study Area

Adjumani District is located at 03°10 N 31°47 E and bordered by Moyo District to the north, South Sudan to the northeast, Amuru District to the east and south, Arua District to the southwest and Yumbe District to the northwest. It was created in 1997by splitting Moyo District. Its headquarters is The Adjumani town, the largest in the District. It is estimated that the population of the District in 2019 was approximately 470,443 people 51% of which were refugees. Prolonged civil strife led to influx of internally displaced persons (IDPs) and refugees from the 1970s to 2000.

Figure 1: A map of Adjumani district in Northern Uganda

The district is endowed with vast fertile land that is mainly grassland in Adropi sub-county and a combination of wood and grassland in Pachara and Pakele sub-counties. Although land is an abundant resource, its access and use rights largely determine the livelihood selection of its people. The average annual rainfall in Adjumani district is 1217 mm and average temperature is 25.3 °C. The tropical weather conditions make agriculture the main stay of the district with two planting seasons.

The Adjumani geographical area has for over thirty (30) years had a history of civil strife and conflict that led to the influx of refugees i.e. the West Nile Front rebel days of 1970/1980s, the Kony era of the 1990s and the Sudanese influx of the 2000s. Because of this history, the livelihood options of both host communities and refugee settlements, including some refugee non-hosting communities, have been determined by the presence of supporting partners who provide emergency and basic domestic needs. The district meanwhile is endowed with vast fertile land that is mainly grassland in Adropi and a combination of wood and grassland in Pachara and Pakele sub-counties. Although land is an abundant resource, its access and use rights largely determine the livelihood selection of its people..

Table 1: Sub counties and villages visited

Sub-county	*Status of the sub-county*	*Village*	*Status of village*
Adropi	Refugee Non-Hosting Sub-county	Tamana	Refugee Non-Hosting Village
Pachara	Integrated Sub-county	Ogujebe	Integrated Village
Pakele	Refugee Hosting Sub-county	Ayilo	Refugee settlement
		Ayilo	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 in order to understand the terms of reference. The World Bank 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 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 in November 2019 - January 2020. The prioritized value chains were categorized into **traditional** (Goat, Sesame, Soybean, Tomato, Okra) and **non-traditional** (Agro-processing, Bakery and confectionaries and Carpentry) enterprises. The prioritised value chains were validated at the districts and sub counties in January and February 2020. The next stage was a detailed value chain and market assessment of the prioritised value chains. The output of this phase are value chain assessment reports, one for each of the pilot districts and a tested 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 tested 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).

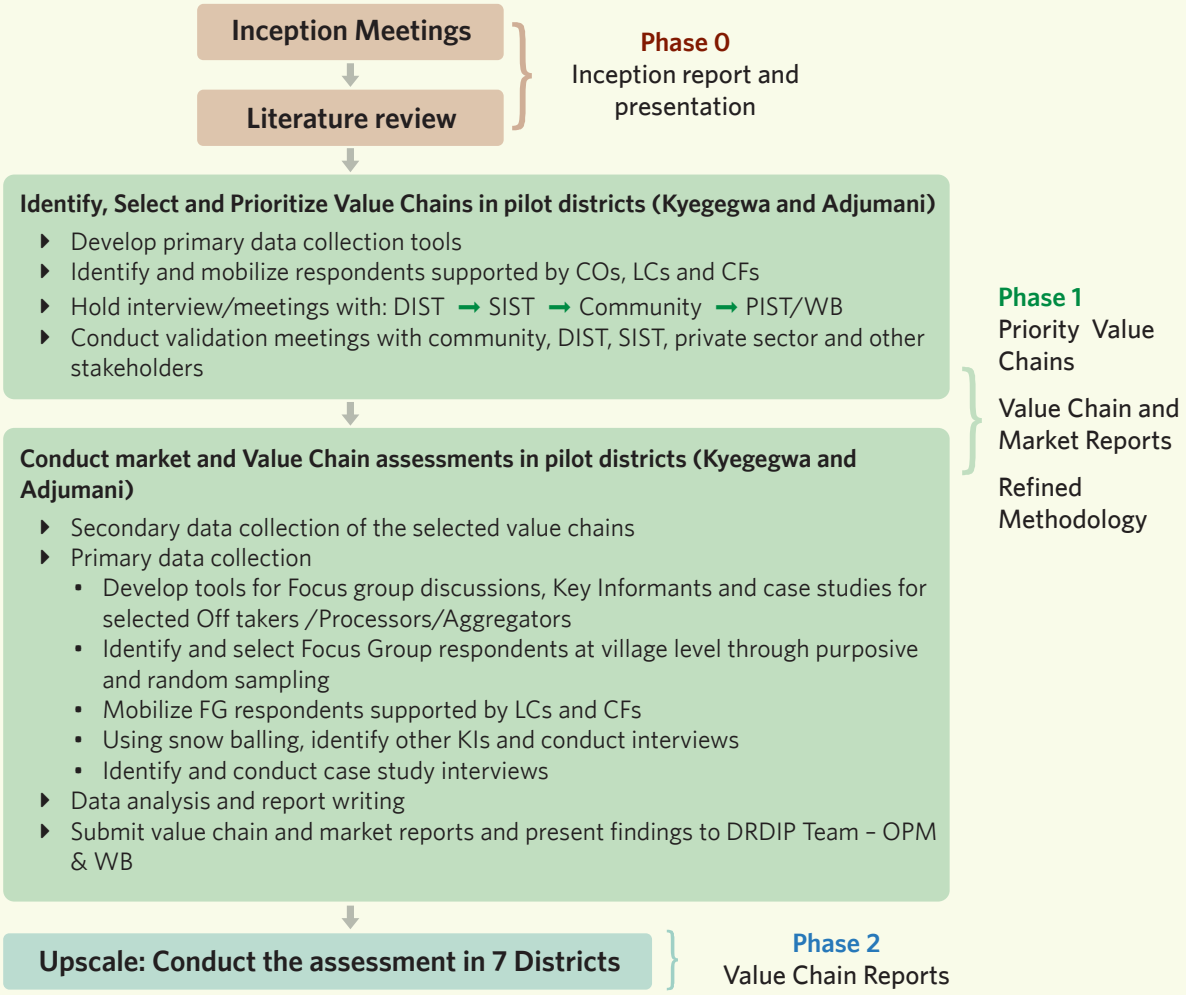


Figure 2: Approach to the assignment

2.3. Sampling Procedure and Data

Secondary information on existing value chains 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 Microsoft 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 value chains. The communities were purposively sampled with the help of the DIST because they know them. In each sub-county, there were 2 focus group discussions (FGDs) per value chain. Participants of each FGD were purposively selected from refugee, host and non-host communities to ensure fair representation of men and women. Each focus group comprised of 12 – 15 participants.

Key informants were district technical staff and private sector actors. 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. The first key informant interviewed was identified by the focussed group discussion participants. Thereafter, other key informants were identified through referrals by the first and subsequent interviewees. Farmers to be interviewed 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 valued chains were included. The sample sizes are in Table 2. And it is important to note that some value chains did not have actors in some nodes due to their nature.

Table 2: Sample size of various respondent categories in Adjumani

Respondents	Sesame	Soybean	Goats	Okra	Agro processing	Bakery & Confectionary	Carpentry	Total
Focus groups	2	2	2	2	2	NA	NA	10
Key Informants (KI)								
Farmers	5	5	5	5		NA	NA	20
Bakery	NA	NA	NA	NA	NA	3		3
Carpenters					NA	NA	3	3
Traders	3	3	3	3				12
Processors	2				3			5
Equipment operators	NA	NA	NA	NA	NA	2	2	4
District staff	1		1	1	1			4
DPs	1		1	1	1	NA	1	5
Total	12	10	12	12	7	5	6	66

Note: NA= not applicable

2.4. Value Chain Analysis

In order to analyse the value chain, actors involved at each node of the value chain were identified and mapped. Their characteristics, roles and relationships were identified and described. The supply chains, flow of information, gross margins and share of value for each of the actors 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 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 (PI). 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 project has 3 more years of implementation.

2.5.1.1. Gross Margin (GM)

The gross margin 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.

$$GM = (Q*p) - (TVC) \quad \text{---------- (Eqn. 1)}$$

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. It was computed as illustrated in Equation 3.

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

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 4.

$$PBP = CI - (TCF_t) \text{ ---------- (Eqn. 4)}$$

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 value chain studied. The level with actors depicting highest GM captures the highest SoV in the value chain. In this study, the SoV was computed as shown in Equation 5.

$$SoV = GMi / TGMvc * 100 \text{ ---------- (Eqn. 5)}$$

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 at the various nodes of the selected value chains 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 a full-time equivalent (FTE) units following the World Bank (2015). A 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.

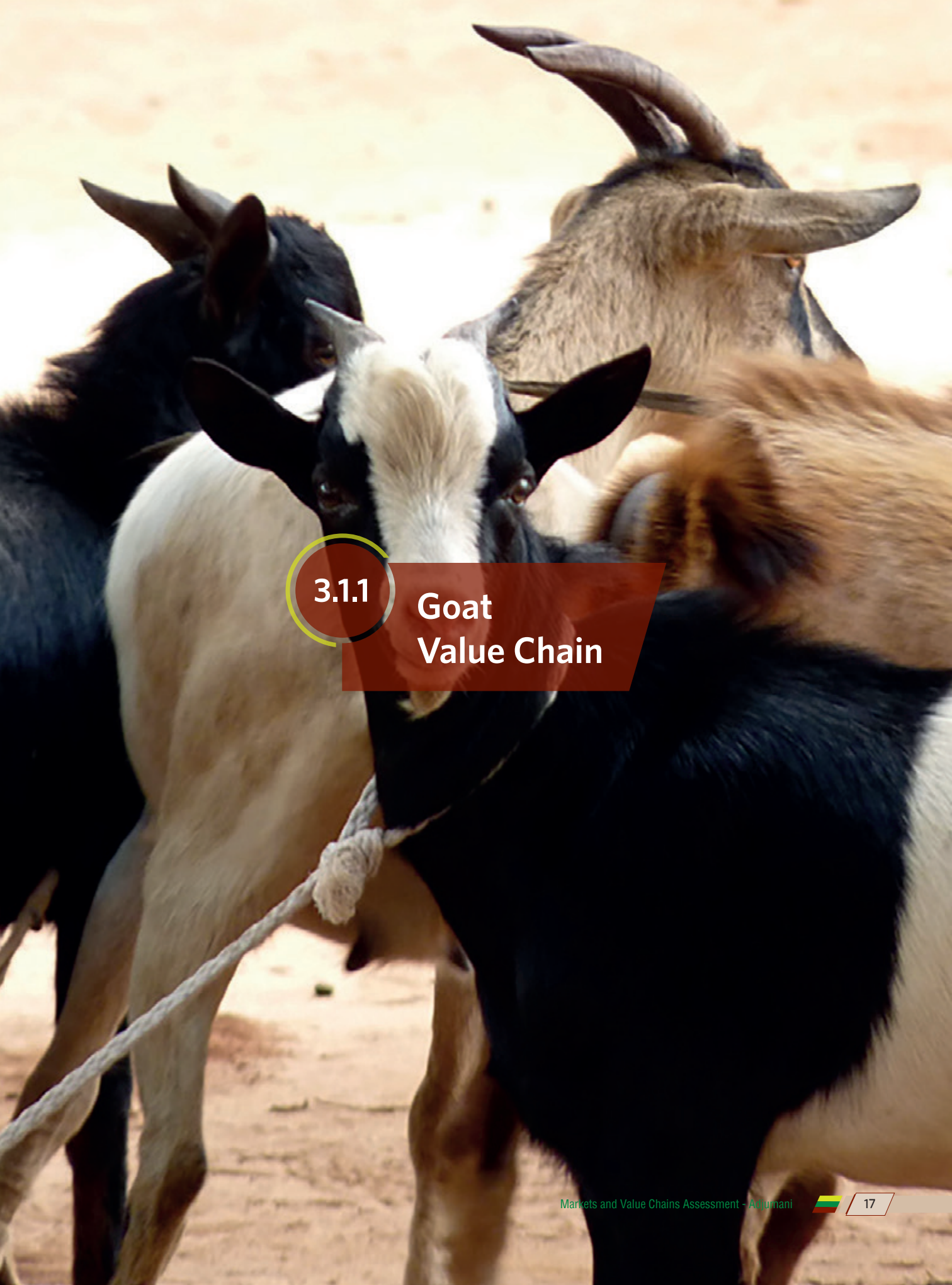
Table 3: Illustration of estimating number of FTE job units per acre

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 Goat Value Chain

A. Background

The goat population in Uganda is approximately 14 million (UBOS, 2015). Over 95% of this population comprises indigenous breeds. These breeds are tolerant to pests and diseases, heat, water scarcity and can survive on poor quality and/or inadequate feed. Thus, despite their small body size, slow growth rate and low carcass weight, they are preferred by the farmers (Onzima et al., 2017).

In Uganda, meat and other livestock products are one of the 12 value chains prioritized for investment under the National Development Plan II. In addition, the Adjumani District Development Plan (2015 – 2020) strategizes the establishment of five (5) fenced off goat units of five acres each as demonstrations for good goat husbandry practices and a goat breeding centre. However, in practice, goats are mainly kept by smallholder farmers particularly the rural poor and vulnerable women headed households for cultural reasons especially dowry or bride price (Semakula et al., 2010) and as a source of income (Muwanika et al., 2011). The main goat products are meat, hides & skins. Milk is a rare product because consumer preference for it is low as some cultures consider it a taboo to drink goat milk (Onzima et al., 2017).

Productivity is low – on average 12 Kg live weight for the indigenous mature goats and 35Kg live weight for mature improved goats in Adjumani; compared to 30Kg and 65Kg of live weight for local and improved goats respectively (NAADS, 2005; Bwire, 2008). The low productivity is attributed to several factors including the breed traits, decreasing feed resources due to increased expansion of crop agriculture, poor breeding systems, parasites and diseases prevalence exacerbated by climate change, inappropriate production systems and changes in physical environment. Adoption of improved goat breeds is low mainly due to their susceptibility to diseases (Helminths and Pneumonia), limited improved bucks and inadequate availability of pasture (Bwire, 2008).

Major parasites among goats include both ecto-parasites and endo-parasites. Ecto-parasites include ticks, mange and mites, while worms are the major endo-parasites. Besides sucking blood from the animal, ticks are vectors of several diseases particularly anaplasmosis (red water) and heart-water. The major control measure for ecto-parasites is spaying with acaricides. Specifically, for ticks, farmers are encouraged to enforce quarantine measures for newly purchased or returning animals to avoid introduction and spread of resistant ticks and tick-borne diseases (TBDs). Farmers are encouraged to use integrated pest management and good animal husbandry for the control of all parasites. Regarding worms, it is important to ensure that the browsing area is well drained and de-worming is conducted regularly. Pneumonia is another major disease among goats. Avoiding crowding and providing for good ventilation and/ or warmth is key to controlling it.

Goat 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 Adjumani District Local Government under the Five Year Adjumani District Development Plan (2015/2016–2019/2020. Relatedly, during the scoping study, the district local government and the community prioritized goats as one of the seven VCs for investment under the Development Response to Displacement Impacts Project (DRDIP).

B. Demand and Supply for Goats in Uganda

The supply of goat meat has been increasing at an average annual growth rate of 2.7% per year driven by growing demand (Figure 3). Demand on the other hand has consistently outstripped supply due to increasing population growth and growing incomes among consumers that drives consumption of animal products. In 2017, meat production stood at 40,058 MT and a deficit of 5,942 MT was recorded that year.

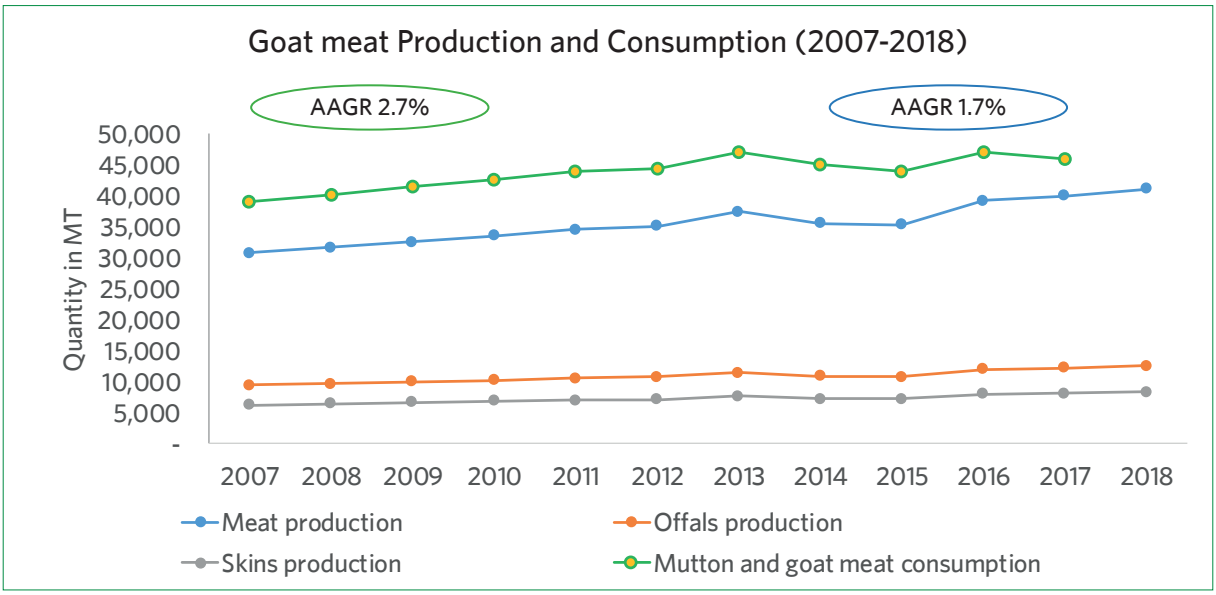


Figure 3: Goat meat supply and demand (MT)
Source: FAOSTAT, 2020

Uganda exported various goat products including live goats, goat meat, plus hides and skins. Hides and skins are the most exported goat product because domestic demand especially from the leather industry is low as the sector is underdeveloped. Live goat and meat are the least exported products. Poor goat meat quality is the major impediment to exports as the country does not have export standard abattoirs (Tatwangire, 2015). The major export destinations were Burundi and Rwanda accounting for 66% and 21% of the live goat exports; Vietnam (49%) and DRC (32%) for goat meat exports while China, Italy and Switzerland accounted for 43%, 22% and 20% of the total hides and skins exported (Figure 4).

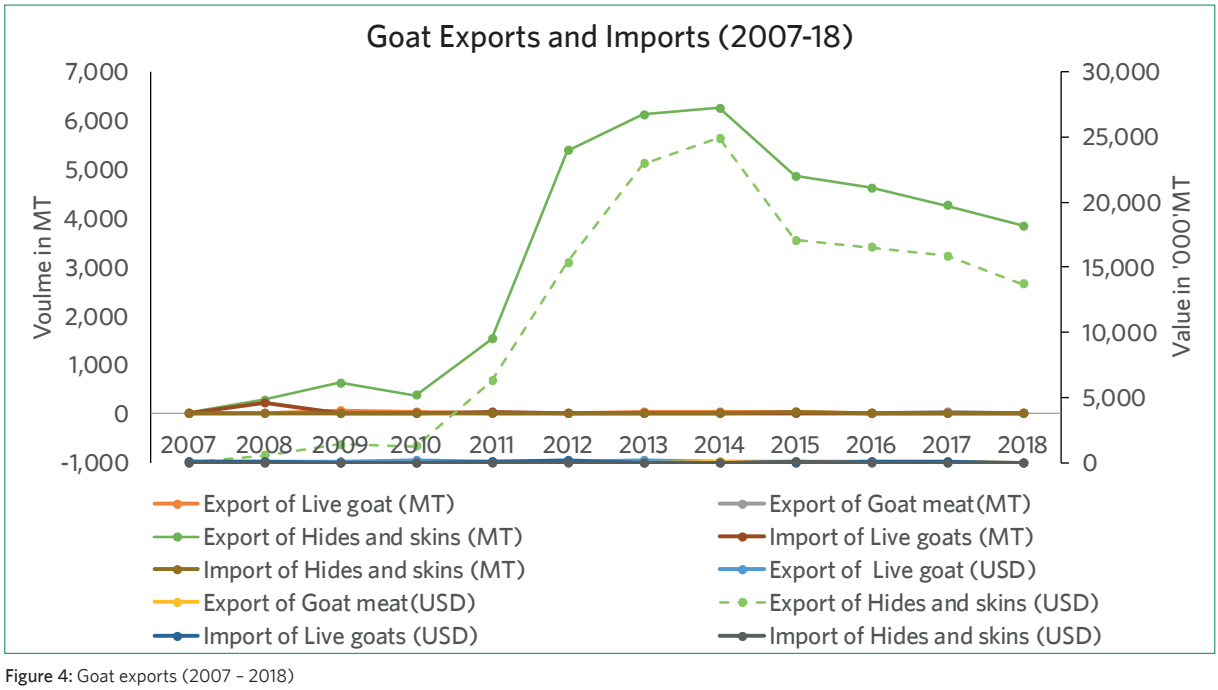


Figure 4: Goat exports (2007 – 2018)
Source: International Trade Centre, 2020

Uganda also imports goat products but the live goat imports between 2007-18 have been volatile while imports of skins were relatively stable in the same period with skins worth USD 9,000 imported in 2018 (Figure 4). The spike in imports of live goats observed in 2008 and 2012 could be attributed to increased government support of improved goats to farmers i.e. Boer goats from South Africa (FAO, 2015). Uganda mainly imports live goats from Tanzania (70%) followed by South Africa (17.5%) and Ireland (11.2%) while 100% of the skins were imported from Kenya (Figure 4).

C. Value chain Actors

Goats in Adjumani are kept by both host and refugee communities. They are reared under free-range system, which makes them easy and affordable to manage. Adjumani produces over 106,600 goats annually. Of these, about 26,550 goats are lost due to high parasite infestation and poor feeding practices while 80,050 goats are consumed annually. Driven by population growth and increase in income from the support to livelihoods from government and NGOs, there is a potential to increase the number of goats slaughtered in Adjumani from 2 to 3 goats per day bringing it to 20,160 goats in a year. The goat value chain as it stands has a variety of actors participating and these are described in detailed below.

Input dealers. There are approximately 10 agro-vets that sell livestock inputs such as veterinary drugs and equipment. They are situated in Adjumani town and the sub county 'towns' with over 80% of the shops owned by men. An agro vet shop employs 1 or 2 youth and both the host and refugees own these shops. Over 95% of their stock is purchased from Kampala and Gulu town and each has inventory of less than UGX 10 Million. At least 95% of the agro-vets use own savings while the rest access credit from SACCOs for their working capital requirements. The agro- vets are registered with the National Drug Authority (NDA) and pay an annual license fee of UGX 150,000. In addition to selling drugs (acaricides, de-wormers, bacterial and viral drugs, equipment like spray pumps) they also provide extension services to farmers. However, majority of the attendants have inadequate skills and knowledge in application of the drugs they sell.

There are two farmers with breeding stock of cross breeds sourced from Luwero, Ssembabule and Kiruhura districts. They sell a mature doe cross between UGX 200,000 to UGX 300,000. In a few cases, NAADS and NGOs like the Lutheran World Federation, Danish Refugee Council and Food Hunger supply cross breed goats to both hosts and refugee communities. Indigenous bucks are mainly selected from own flock.

Producers: Goat farming in Adjumani is a 'hobby' among the pastoral refugees. Among the host communities, goats are kept for cultural purposes and more recently are a preferred enterprise for women. About 80% of the farmers among the host communities use own savings while less than 20% access loans from SACCOs to purchase goats. The goats are fed on natural pasture and access to drink water for the animals remains a challenge most especially during the dry season. Goats are reared by 90% of the host communities and 50% of refugees with each farmer keeping between 2-4 goats. Approximately 80% of the goats are owned by men because they own land, while women and youths own 15% and 5%, respectively.

The goat health system is mainly managed by the para-vets (70%) and community animal health workers. The para-vets and veterinarians are technically skilled and qualified in animal health aspects compared to the community animal health worker. The indigenous East African small goat dominates (95%) the herd compared to the Boer goat that makes less than 5%. Over 98% of the cross breeds are between the Boer bucks and the local doe goats.

Although breeding and mating systems are key in improving and sustaining goat production, they are underdeveloped in Adjumani and in Uganda as a whole. The Boer (75% crossbreed) and Savana are kept by 5% of the farmers, while pure exotic breeds are not reared. The most important factors during breeding are presented in Table 4.

Table 4: Factors key in breeding goats

Factor	Frequency it was reported
Reproductive potential (twining ability)	60%
Growth rate	40%
Tolerance to parasites and diseases	30%
Tolerance to agro ecological conditions	15%
Body weight	10%

Source: *Primary data from District Veterinary Officer*

Artificial insemination is not practiced by farmers in Adjumani. Uncontrolled natural mating is the predominant breeding system practiced by 80% of farmers with local breeds; and by 60% of the farmers with cross breeds. This is partly attributed to the free-range grazing system that is predominant (60%) among the goat keepers. Controlled mating of goats is unpopular- managed by 20% of farmers with cross breeds; 10% with indigenous breeds; and 15% with farmers that have both breeds in their herd.

Trader: Over 98% of goats traded in host and refugee communities are indigenous. Notably, all goat trade in Adjumani is of live animals and meat. All the goats sourced from individual farmers or livestock markets are slaughtered and sold as meat. Traders have capital of less than UGX 1,000,000 each time they buy goats from producers or primary markets. About 95% of traders largely depend on own savings while 5% access finance from SACCOs. Both local and improved goats are sourced mainly from Agojo, Liri, Kureku, Forua villages. The prices range between UGX 80,000 and UGX 120,000 for a local goat and UGX 280,000 to UGX 430,000 for an improved goat depending on the size. Goats are transported on motorcycles at an approximate fee of UGX 2,000 per goat. The buying and selling of live goats in Adjumani is mainly through spot trading. Very few traders buy and keep goats for re-sale.

Butcher: On average every sub-county has approximately 9 -10 traders/butchers who slaughter 2-4 goats a day. Adjumani district has between 8 to 10 public slaughter slabs which are managed by government and the communities. At the slaughter slab, the goats are slaughtered, and meat is inspected by the veterinary assistants to determine its suitability for consumption. Once the slaughter and inspection is accomplished, meat is transported to the butcher for sell at prices varying from UGX 12,000 to UGX 14,000 per Kg. The major buyers are individual customers (75%), hotels and restaurants (20%) and institutions like schools (5%) within the district. A daily market fee of UGX 5,000 per goat is paid by butchers to the district authorities.

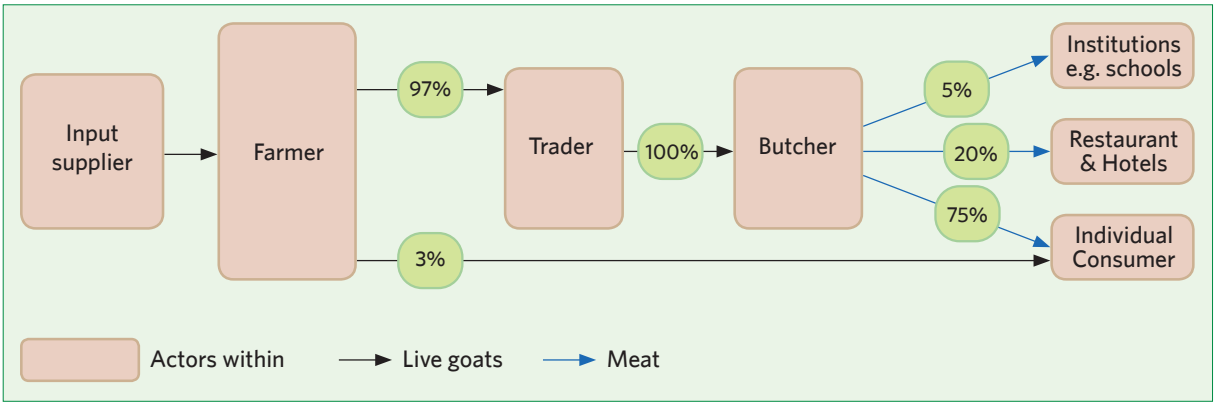


Figure 5: Product flow along different nodes of the Goat value chain
Source: Primary data, 2020

D. Profitability of the goat value chain

The profitability of the goat VC was assessed using Gross Margins (GMs) and Net Present Values (NPVs) under the current goat practices in Adjumani i.e. a local goat and cross breed under free range system were established. In calculating the GM and NPVs, the study considered the general assumptions in Table 5 below.

Table 5: Assumptions undertaken

Local goat	Cross breed Improved to 75%
Poor management practices; spraying acaricides and deworming twice year	Poor management practices; spraying acaricides and deworming twice year
Reared under free range with low quality pasture	Reared under free range with low quality pasture
No vaccination conducted	Vaccination conducted thrice a year
Price of mature goat at 1 year is UGX 80,000	Price of 9 months kid is UGX 250,000
Cost of a mature goat for slaughter is UGX 100,000; average weight is 15Kg	Cost of a mature Boer goat for slaughter is UGX 280,000; average weight is 40Kg
Doe gives birth once a year with twining ability of 85%; gestation period is 6 months	Doe gives birth twice a year with a twining ability of 85%; gestation period is 5 months
Labour (including household labour) is costed at UGX 500 per day per goat	Labour (including household labour) is costed at UGX 500 per day per goat
Mortality rate used is 25%	Mortality rate use is 50%
The doe is not sold	The doe is not sold
Productive life of a goat is 10 years	Productive life of a goat is 10 years
Discount rate 9%	Discount rate 9%
3 goats are sold annually	2 goats are sold annually
Mortality rate is 25%	Mortality rate is 50%

Source: Primary data, 2020

With the above assumptions, the goat production enterprise under current management system for indigenous and improved breeds is not a viable venture as the NPV is negative.

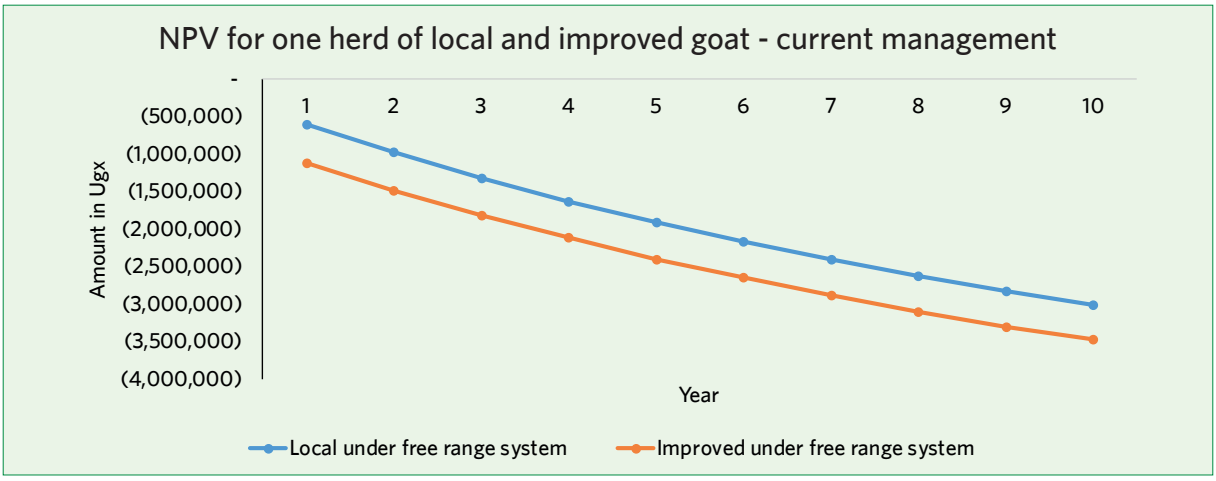


Figure 6: Net present values for 1 local and improved 75% pure Boer goats
Source: Primary data

Gross margin analysis for one goat at producer level: The GM for farmers of improved goat is higher (UGX 4,750) than for an indigenous goat (Figure 7). The high GM is mainly attributed to high selling price of an improved goat which usually has a higher body weight compared to the indigenous goat. The cost driver for both breeds is the labor to look after the goats, which was UGX 500 per day per animal.

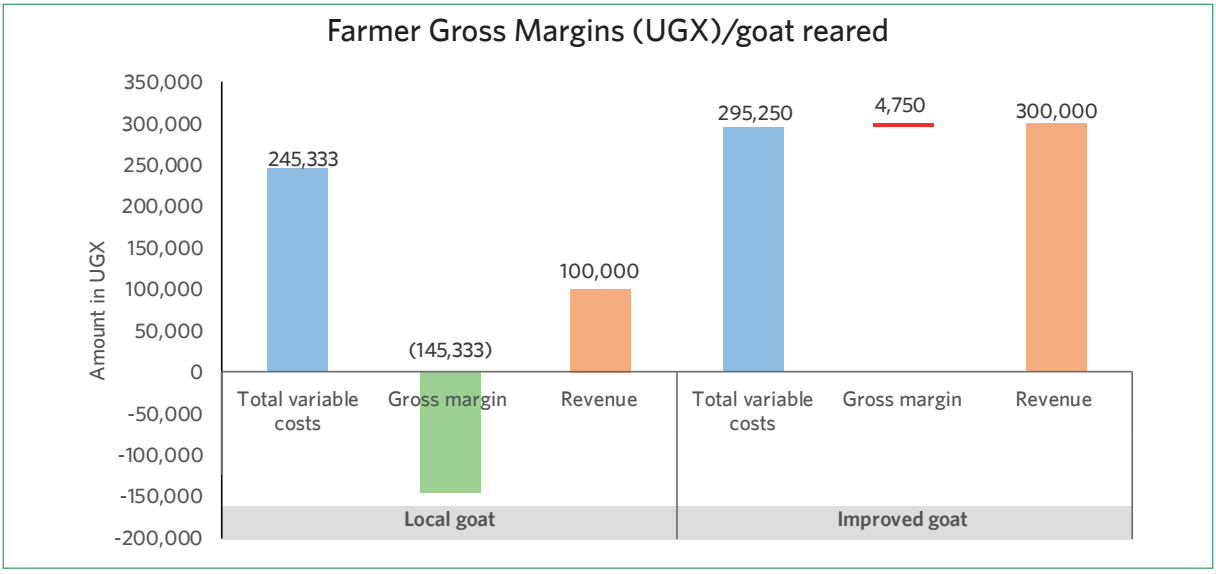


Figure 7: GM per live goat
Source: Primary data

Farmers gross margins for goats from one doe. Figure 8 shows that a loss of UGX 436,000 is incurred annually from the sale of mature goats produced by a local doe, and only UGX 9,500 is earned from goats produced by an improved doe. Commonly, each doe produces twins twice a year. However, the mortality rates are 15% and 50%, respectively, while the farm gate price for an improved goat is UGX 280,000 and for the local goat is UGX 100,000.

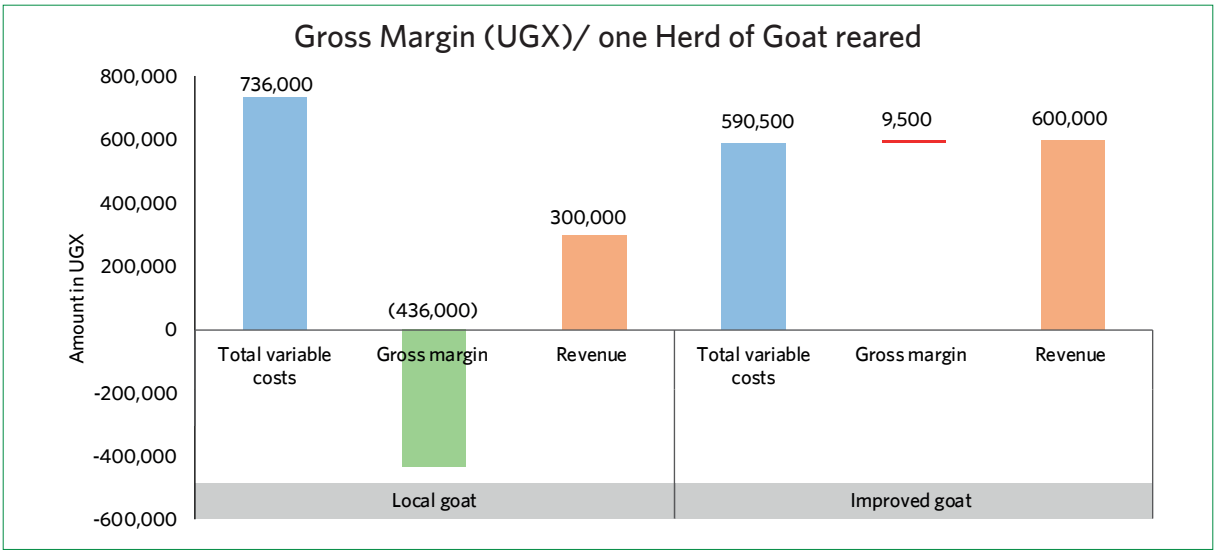


Figure 8: Gross Margin per herd of live goat
Source: Primary data

Gross Margins for traders. The gross margin for traders dealing in improved goat (UGX 47,800) is higher than that (UGX 43,800) of the local goat (Fig 9). Although the trader incurs higher costs in purchasing the improved goat coupled with more time and labor in selling of the meat than that for the local goat, the costs for the former are offset by the high revenue from goat. Moreover, the other costs such as market fees and transportation are the same.

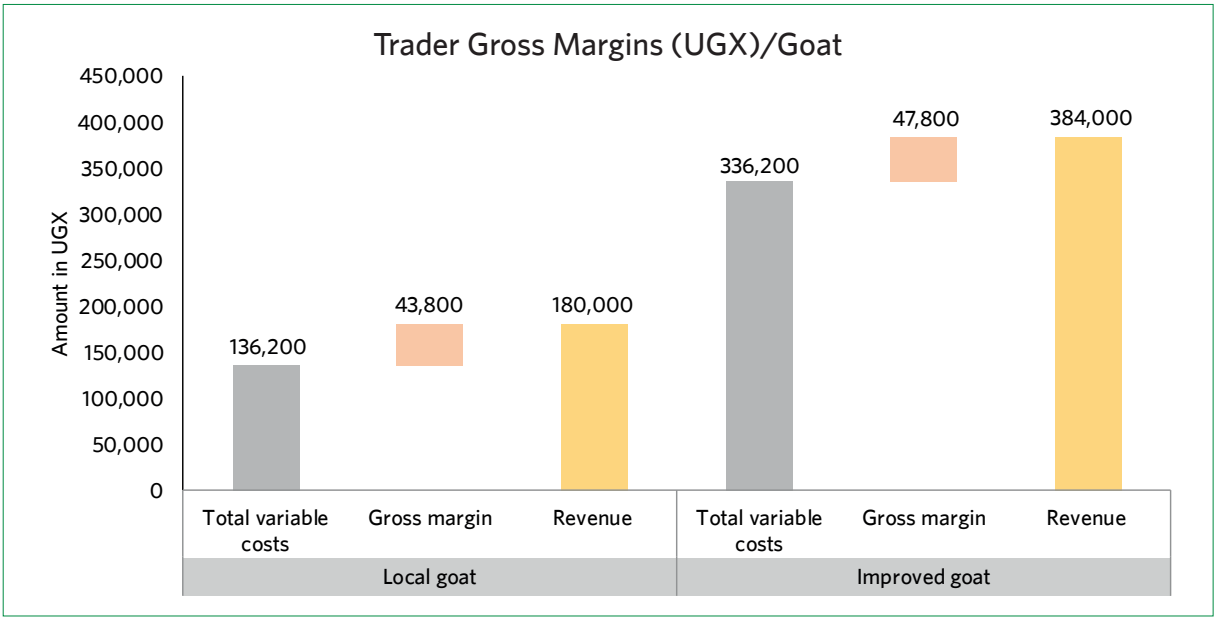


Figure 9: GM per goat sold by the trader
Source: Primary data

Share of value along the Value Chain: There are two supply channels for goat trade in Adjumani (Fig 10). Farmers get the highest share of value from channel 2 while traders get highest from channel 1. It is evident that the goat VC has very few actors. Nevertheless, the volume demanded by the consumers within channel 2 is very small compared to the production levels. Thus, channel one should be promoted with improvements like farmers trading in groups, etc.

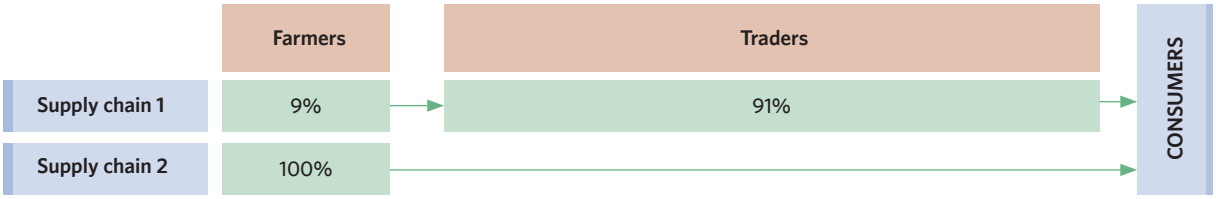


Figure 10: Goat value chain in Adjumani
Source: Primary data, 2020

E. Employment generation along the Value Chain

The employment generation potential was estimated using the Full Time Equivalent approach. In addition, the wages earned were estimated in the entire district. The FTE jobs units per herd were used as the multiplier factor to estimate the number of FTE jobs under the existing goat rearing practices in the district. According to the Adjumani District Veterinary Officer, the estimated number of local goats is 105,600 and improved breed goats are 1,000. On average, a household has 4 goats. This herd of goats is assumed to be cared for by one goat herder at a wage of UGX 500 per day per goat. Thus, the number of FTE jobs in Adjumani for the local and improved goats at production node are 26,400 and 250 and the total wages were UGX 19.2 Billion and UGX 182.5 Million respectively.

At the traders/butchers, job estimation is based on full-time equivalent (FTE) units of 8 hours per day for 312 days in a year for each activity. The jobs were calculated using the labour involved in transporting using 2 people working for 1 hour, slaughtering by 2 people for 1 hour and selling of the meat at the butcher by 1 person for 1 hour. This bring the FTE at trader level to 0.003 (i.e. 3 jobs for every 1000 goats traded). A total of 296 jobs for local goats and 3 jobs for cross bred goats at the trading node. The wages at trader level are estimated at UGX 28,000 per goat bringing the total wages to UGX 19.3 billion for local goats and UGX 205 million for improved goats.

Table 6: Total estimated number of current jobs under the goat value chain

Value Chain Node	FTE jobs per goat		FTE jobs in district		Wages in UGX per year	
	Local goat	Improved goat	Local goat	Improved goat	Local goat	Improved goat
Production	1.00	1.00	26,400	250	19,272,000,000	182,500,000
Trader	0.003	0.003	296	3	29,568,000	28,000,000
Total	1.00	1.00	26,696	253	19,301,568,000	210,500,000

Production: One full time job paid monthly for daily routine management.

The estimated number of goats are local breed 105600 and 1,000 for cross breed or improved breed

A goat herder's wage per one goat in Adjumani is UGX 500 per day

On average, a household has 4 goats which can be reared by one goat herder

A trader sells 3 goats makes two trips while a trader selling 2 goats makes 1 trip

F. Social benefits along the value chain

Goat rearing is undertaken by both host and refugee communities. For the hosts, goats are kept for cultural reasons while for the refugees, it is a sign of wealth. Women provide the main source of labour for all livestock production activities and yet they own few of the goats. As animal caregivers, it is unfortunate that women do not frequently receive information from the veterinary clinics compared to men, due to the cultural values.

In Adjumani and many other areas, goats are very important during cultural functions where they are used to pay dowry or bride price. Regarding nutrition, goat meat is a high-protein food and contains varying amounts of fat. It contains all the essential amino acids necessary for the growth, maintenance of our bodies and to build up and repair muscles.

Positive aspects towards the environment from goat rearing is the use of goat droppings and urine as manure that leads to improvement in soil quality and hence yields. Goats not only produce neater pelletized droppings, their manure does not typically attract insects as does manure from cows or horses. Goat manure is virtually odorless and is beneficial for soil health improvement.

A report by FAO (2014) on greenhouse gas emissions from ruminant supply chains indicates that globally, small ruminant (goat and sheep) production of meat and milk is responsible for 428.8 million tonnes CO2-eq, of which 174.5 tonnes CO2-eq (41 percent) are associated with goat production. Total production from the small ruminant sector amounts to 20.0 and 12.6 million tonnes of milk and meat, respectively. Goats contribute almost 60% of the milk produced by small ruminants. More so, the use of agro-chemicals in parasites and disease control leads to water and soil pollution.

G. Threats and community preparedness

The improved goat mortality is 50%, while for the local breed, it is 25%, mainly because the former is more susceptible to parasites and diseases. 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 Mange. The livestock parasites are controlled by the correct use and application of acaricides involving the right equipment, acaricide concentration and quality product. It is important to ensure that the grazing area is well drained without stagnant water for breeding worms. To address worm infestation, it is recommended that routine de-worming is observed. In the case of high infectious animal diseases like Foot and Mouth Disease (FMD), Contagious Caprine pleuropneumonias 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 other threat to goat production is climate change which greatly affects the quality and quantity of pasture and drinking water available for the livestock. Drought has a negative effect on availability of water, good quality and quantity pasture available to goats and other livestock. Climate change effects are worse especially for goats and other livestock largely reared on free range system and fully dependent on rain-fed pasture. Farmers cope by feeding goats on crop peeling which are low-quality feeds. This is complicated by inadequate availability of drinking water for the animals - heightened during drought. Moreover, there are no water wells/dams constructed to provide safe drinking water for the animals. In such cases, livestock mainly drink swampy water which are infested with parasites especially liver flukes. Under very severe drought conditions, animals are sold off cheaply at prices as low as UGX 60,000 for a goat which costs UGX 100,000 in the normal season.

Access to quality extension services is limited as the district veterinary unit is understaffed. Out of the 13 veterinarians and 10 para-veterinarians required, only 4 veterinarians and 5 para-veterinarians are available. The district has only 1 entomologist out of the 3 required and 10 Assistant Entomologist while each sub county is required to have 1. Worse still, there is no laboratory technician in the district. This has limited farm visits and follow-ups to treat sick animals as well as conduct livestock parasites 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 parasites and disease control. These challenges have resulted to frequent outbreak of infectious livestock disease leading to low productivity.

The other challenge is limited access to animal health products arising mostly from weak implementation and enforcement linked to inadequate institutional capacity, weak inter-sectoral 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 and National Drug Authority (NDA) for drugs have limited presence at the grass root. There is no central registry for input suppliers in the livestock sector. Some suppliers are registered by the NDA, others by the Agricultural Chemical Board, while suppliers of animal equipment, animal feeds and ingredient 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 and 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 at district level to promptly identify and test acaricide resistant ticks. A combination of these factors has further contributed to multi-acaricide resistance among ticks and reduced goat productivity. The constraints are summarized in table 7 alongside recommended community mitigation measures.

Table 7: Challenges of goat value chain

	Challenge	Mitigation Strategy
Farmer	1) Parasites and diseases prevalence that lead to high mortality. Loss can vary between 40-60%. 2) Limited availability of quality and quantity of pasture particularly during the dry spell that reduce yield. 3) Limited access to improved goat breeds. 4) Limited capital to invest in the enterprise	1) Apply improved and appropriate animal husbandry practices 2) Establish a pasture production and management system that produces fodder during wet season and preserves it as hay. 3) Invest in a sustainable breeding program to ease access and utilization of improved bucks by the farmers. 4) Provide support through linkage to microfinance institutions.
Trader/ Butchers	1) 1) Poor road networks that hike transport cost and increase operational costs 2) Limited market information on supply sources of sellable goats.	1) Invest in improved road infrastructure especially within the production areas. 2) Develop a market information platform for traders

Source: *Primary data, 2020*

H. Public, private and community sector support

Uganda government prioritized meat and other livestock products as one of the 12 VCs for investment under the National Development Plan II. The agriculture sector targeted production of mutton and goat meat, worth USD 421 Million by 2020. To achieve this, the Agriculture Sector Strategic Plan II (2015/16 to 2019/20) set interventions to control vectors and diseases through vaccinations, disease surveillance and construction of infrastructure such as dips, cruses for disease control; pasture development; provision of adequate water for livestock production through the construction of valley dams; provision of high genetic material; promotion of labor-saving technologies; and creating buffer animal handling grounds to support processing.

Uganda Meat Producers Cooperative Union Ltd (UMPCU) is an apex organization formed in 2008 under guidance of the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and Ministry of Trade industry and Cooperatives (MTIC) with an objective of increasing production, improving quality, value addition, and consequently increase employment and environmental sustainability of the meat VC in Uganda.

In addition, the government has enacted policies and regulations to guide the sector. These include the National Feeds Policy (2005), to support production and availability of quality and affordable feed; National Veterinary Drug Policy (2002) to guide regulation of drugs; the Animal Breeding Act, (2001) to facilitate imports and exports of animal and fish breeds; National Bureau of Standards Act, 1983 (Amended in 2013) to set standards and enforce quality and the National Agriculture Policy (2011) to promote food and nutrition security and household incomes. However, implementation and enforcement of quality related laws is weak due to inadequate institutional capacity that is exacerbated by weak inter-sectoral coordination.

I. Conclusions and recommendation for investment

The goat enterprise in Adjumani is predominantly local goats which are characterized as being genetically less productive. They take long to reach slaughter weight and adoption of good animal husbandry practices does not greatly improve the live goat weight compared to when an improved goat is used. Further, the goats are reared on a free-range system combined with tethering, with this system, breeding is not controlled. As such, inbreeding is a big threat to the farmers. In overcoming this, the farmers with local goats take them to mate with cross breed bucks reared by other goat producers. It is concluded that:

1) The current goat farming system is not profitable for the farmers although live goat meat trading is profitable for the traders.

2) Indigenous goat production is not profitable. Profitability for farmers is registered with cross breeds under open fenced production system, but the Gross Margins earned are very low.

3) Goats are kept by both refugees and host communities.

The goat VC is constrained by; high parasites and diseases occurrences coupled with limited or lack of infrastructure to control parasites and diseases, poor quality pasture, and poor goat breeds kept by farmer. Thus, there is need for investments to alleviate most of these challenges.

1. Public recommended investment

a) a) There is need to invest in more livestock disease control infrastructure as well as rehabilitation of run-down infrastructure at district and sub-county levels. Infrastructure such as dips, crushes, quarantine station, holding ground and valley dams need to be constructed and/ or rehabilitated. According to Adjumani District Development plan (2015/16 to 2019/20), the district has 4 cattle dips with 2 in use and 9 metallic cattle crushes with 8 in use. The infrastructure for construction are; quarantine station, holding ground and valley dams that do not exist in the district.

b) The district development plan further mentions establishing a goat breeding centre as well as establishing 5 fenced off units each of five acres as animal husbandry demonstration sites.

c) Investment in spray races to reduce parasite infestation.

d) Investment invest in road infrastructure so that production areas can easily be accessed by the traders as well as other actors key in goat production and marketing.

2. DRDIP recommended investment areas.

To arrive at the DRDIP investment areas, four scenarios were considered, and projections determined for each so that GMs and payback period were derived for each scenario to arrive at the best business decision. The scenario descriptions are presented in Table 8.

Table 8: Scenarios under strategic investment in goat VC

Scenarios	Description
Scenario 1: Local goat under free range system	The local goats feed under free range system, limited adoption of good animal husbandry practices coupled with uncontrolled mating. The weight of a live mature goats is 12Kg.
Scenario 2: Improved cross breed goat free range system	The improved goats feed under free range system, limited adoption of good animal management practices coupled with uncontrolled mating, although the weight is higher i.e. 32Kg than that of a local live goat.
Scenario 3: Improved cross breed goat under open fence grazing	Improved cross breed goats are kept under paddocks with adoption of good animal husbandry practices coupled with controlled mating. Some improved pasture e.g. lablab and central are planted as a source of protein and the live goat weight is around 40Kg
Scenario 4: Improved cross breed goat under zero grazing system	Improved cross breed goats are under zero grazing system coupled with controlled mating. Pasture is grown and there is improvement in good animal husbandry practices, the live goat weight is around 45Kg

Source: *Primary data*

Below are the recommendations or DRDIP drawn after the scenario analysis:

Build the capacity of farmers/groups in good animal husbandry practices such as:

1) Routine spraying and deworming to reduce on parasite infestation, keeping animal under open fencing grazing system which calls for investment in fencing/ paddocking as well as lowering the mortality rate which is about 25%.

2) Train breeders in goat breeding including record keeping on pedigree as well as changes of the breed to avoid inbreeding depression.

Essential skills required include; farming as a business, meat handling best practices, climate smart agriculture, and adult literacy. Re-skilling or refresher courses for para-vets and community animal health workers.

Support farmers to acquire and maintain high yielding goat breeds coupled with good management of the breeding system as proposed below.

1) For each group owning 32 does and 2 bucks, the bucks should be of different genetic background from those of other groups. After one year, the bucks will be exchanged among the groups. After 4 years, the breeding bucks will be withdrawn, and new ones of different genetic make introduced per group.

2) Each buckling produced will be castrated before it reaches fertility i.e. before seven weeks old to avoid inbreeding. The farmers will also replace their does after 4 years with new ones from a different source.

With a potential to increase the number of goats slaughtered to an additional 20,160 goats annually, then the analysis reveals that scenario 3 (Improved under open fence) generates the highest GM and paybacks within 5 years. DRDIP will need to support farmers to construct paddocks and rear goats under open fenced/paddocks. Given that each group has a grant of UGX 18.5 Million, this is equivalent to 637 groups each rearing 32 improved goats each. In addition, there is need to support farmers with improved goat breeds to invest in open fencing production systems as it gives better returns (see table 10).

3. Private sector support recommendations are:

1) To bridge the information asymmetry in the value chain – an information platform between farmers and traders can be piloted to ensure that there is accurate information available.
2) Liaise with farmers to increase access to agricultural financing.
3) Solutions to livestock rearing through learning exchanges within the region.

Table 9: Assumptions for actors along the goat value chain

Farmers	Traders
• Majority keep local goats (Over 90%) • Buy local goat at UGX 100,000, improved goat at UGX 250,000 • Mortality rate used for local goat and improved goat under open fence and zero grazing is 25%, while 50% for improved goat under free range. • Twinning ability is 85% • Goats deliver twice a year • Under free range farmer sells 3 local goats and 2 improved goats after one year. • Under open fence and zero grazing a farmer sells 3 goats annually.	• Traders buy goats from farmers • Traders buying 2 goats make 1 trip while those buying 3 goats make 2 trips. • They use motorcycles as a means of transport
Market opportunity	
• Currently a trader slaughters on average 2 goats per day and there are about 6 traders per sub-county. With 10 sub counties in Adjumani, this translates into 40,320 goats a year. However around 3 traders per sub-county slaughter 4 goats per day, translating into 40,320 goats for the 10 sub counties in Adjumani. Although those who slaughter 4 goats have reached saturation, those slaughtering 2 have the capacity to increase to 3 goats a day, this translates into 6,048 goats per sub-county and 60,480 for 10 sub-county • The market opportunity for additional goats is 20,160 goats annually. • With a group receiving a grant of UGX 18,500,000 per year, this translates into 4 groups	

Source: *Primary data*

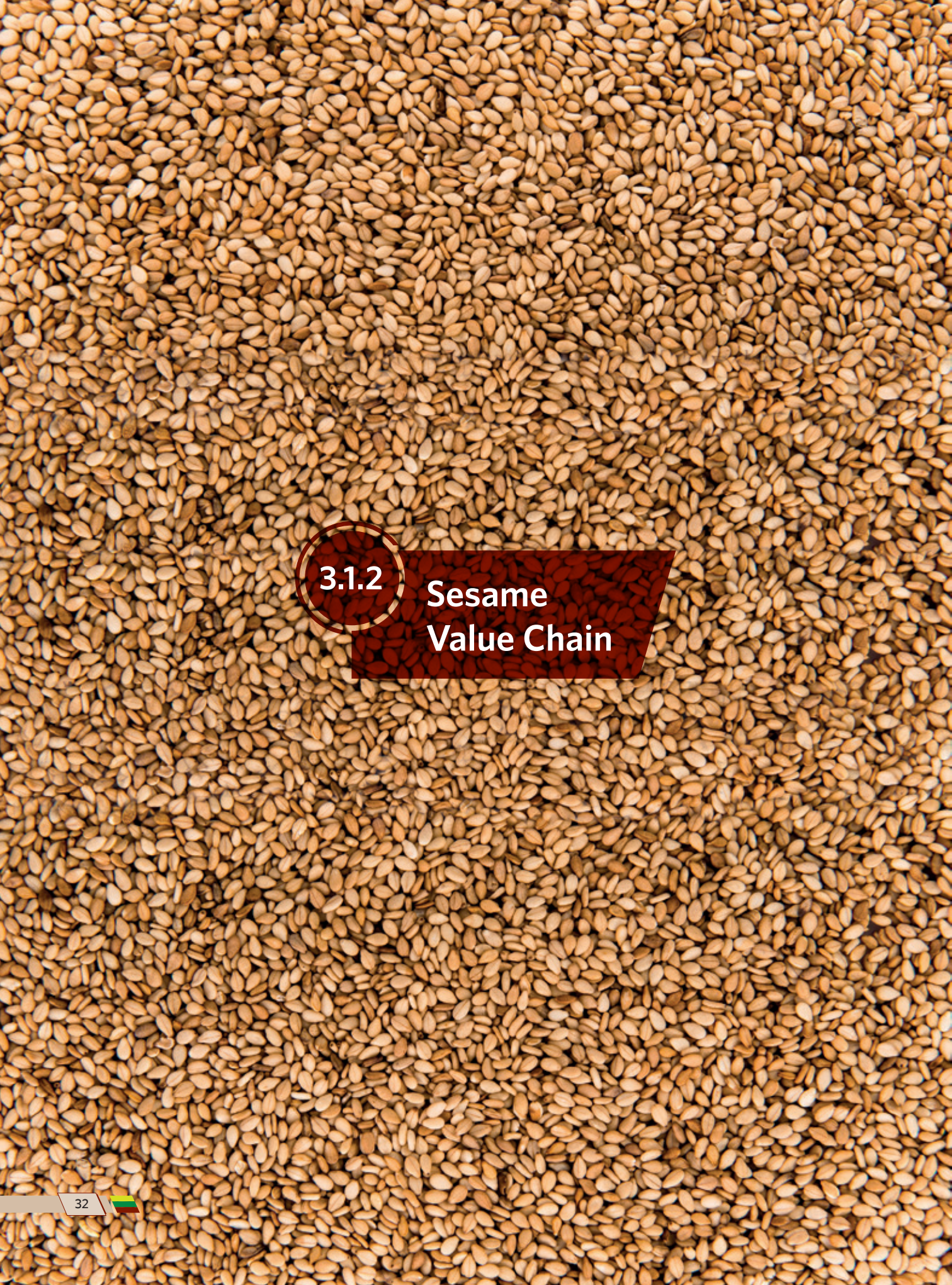
a. Scenario analysis

Table 10: Impact of strategic investments on GM and Jobs

Category	Item	Local goat under free range	Improved goat under free range	Improved goat under open fence	Improved goat under Zero grazing
Farmer	Scenario	1	2	3	4
	Price per goat in UGX	100,000	300,000	400,000	430,000
	Number of goats sold	3	2	3	3
	Revenue in UGX	300,000	600,000	1,200,000	1,290,000
	Total variable costs per herd in UGX	736,000	590,500	1,085,500	1,841,500
	Gross margin per herd of goat reared in UGX	- 436,000	9,500	114,500	- 551,500
	Gross margin per goat reared in UGX	**- 145,333**	**4,750**	**38,167**	**- 183,833**
	Percentage increase/decrease in GM		102	126	- 26
	Jobs created per goat per year	1.00	1.00	1.02	1.05
	% change in jobs created	na	0.03	2.16	5.09
	Pay back	X	X	5 years and months	X
Trader	Total variable costs	408,600	672,400	1,308,600	1,398,600
	Gross margin per herd of goat in UGX	131,400	95,600	131,400	149,400
	Revenue per herd of goat in UGX	540,000	768,000	1,440,000	1,548,000
	Gross margin per goat in UGX	43,800	47,800	43,800	49,800
	% change in gross margin	na	42	167	187
Market	Currently there 6 traders who slaughter 2 goats a day				40,320
	3 traders slaughter 4 goats a day and these have reached their saturation				40,320
	If the traders who slaughter 2 goats increase to 3 goats a day				60,480
	Market potential (Number of goats)				20,160
	With UGX 18.5 given per group				1,850,000
	Fixed costs	80,000	250,000	585,000	510,000
	# number of goats with the grant	23	7	3	4
	# number of groups with the current grant to meet the market	1,061	2,724	6,375	5,558

X=Cannot pay back even after 10 years under analysis

Source: *Primary data*



3.1.2 Sesame Value Chain

A. Background

Sesame *(Sesamum indicum)* also called benne, is an erect annual plant of the Pedaliaceae family. It is found in tropical, subtropical, and southern temperate areas of the world and matures in 90-105 days depending on the variety. India is the largest producer of sesame in the world followed by China and Nigeria. Global sesame seeds consumption was valued at USD 6,559 million in 2018 and projected to reach USD 7,244.9 million by 2024, with a cumulative average growth rate of 1.7% (Mordor intelligence, 2020). Uganda is the second largest producer of sesame seeds in Africa (Elepu and Dalipagic, 2014). The largest consumer in 2018 was China followed by Tanzania with consumption of 1Million MT and 0.089 Million MT (FAO, 2020). Sesame seed contains 50% oil and 25% proteins (Matina *et al.,* 2016). It has also been reported that the sesame flowers make good cologne and perfumes, while the oils are used in manufacturing soap, pharmaceutical and chemical (Mordor intelligence, 2020). Sesame residue is rich in protein and used as fodder for livestock and poultry feed.

In Uganda, the National Development Plan II does not mention sesame as one the priority crops. However, the crop was recommended for promotion in the North Western Savana grassland agroecological zone where Adjumani district lies. 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). Also, the District Development Plan 2015/16-2019/20 prioritized oil seed crops, sesame inclusive. Sesame is considered an oil crop because of its high oil content. It is mainly produced by small scale farmers in Northern Uganda because of the favourable weather (moderate rainfall) and soil temperature conditions. In addition, these areas have poor soils with low moisture retention and nutrient status (Anguraia et al, 2020). Apac district is the leading producer followed by Gulu and Kitgum while Adjumani ranks 11th in Uganda (UBOS, 2017). The main growing season is March-April then August-September (Elepu and Dalipagic, 2014). Local varieties are common and include Serra, Gure and black type. Improved varieties such as Sesame 2 is being popularized in Uganda. Sesame yields an average of 0.7 MT/Ha compared to the potential yield of 2.3 MT/Ha (FAO, 2020; Anyanga and Obong, 2001; Munyua *et al.,* 2013).

B. Demand and supply of Sesame in Uganda

The supply of sesame has consistently outstripped the demand for over the past 10 years (Figure 11). Unlike production, sesame seed and oil consumption in Uganda increased between 2008 and 2017 at an annual rate of 3.5 % and 0.7%, respectively. Sesame demand is largely driven by growing awareness of food health issues, growing demand from baking, confectionary and pharmaceutical industries and changing consumer preference towards 'health' products. Sesame oil is naturally antibacterial, antiviral and anti-inflammatory, effective against common skin pathogens as well as common skin fungi. The oil for pharmaceutical use is extracted from high-quality seed and is more refined than that intended for human consumption or other "food-grade" (cosmetic) applications. Sesamolin and sesamol maintain fats and increase vitamin E activity dramatically (LTS International, 2017).

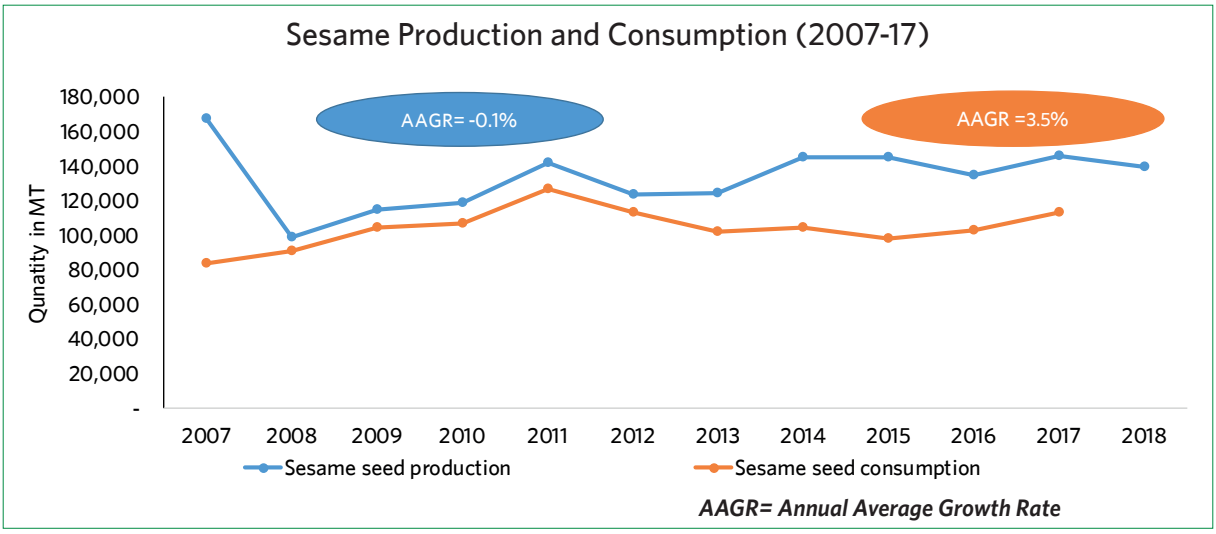


Figure 11: Demand and supply of Sesame 2007 -2017 Source: Food and agriculture Organization, 2020

In 2017 a surplus of 33,000 MT was recorded. In Uganda, of the 77% sesame seed that reaches the market, 10% is sold to urban consumers, and 25% to rural consumers, while 42% is exported (ICRISAT, 2013). The major destination countries of Ugandan sesame oil are China accounting for 46% of the total export volume followed by Singapore (24%), and Kenya. Uganda's market share in China for Sesame oil is generally less than 50% . This implies that china's has potential to absorb more sesame oil from Uganda. Sesame oil imports have been growing at annual rate of 104% in 2007 - 2018 mainly from China (50%) and United Arab Emirates (44%) (Fig 12). Reduction in production necessitated imports to supplement the low volumes produced and meet the local demand (SNV, 2018). The largest exporter of sesame oil into Uganda is China (50%) followed by United Arab Emirates and Kenya. Growth of the livestock sector in Uganda also presents a potential market for sesame as animal feed. Sesame stalks and husks are both sources of raw materials used to in making animal feed and charcoal briquettes (SNV, 2018).

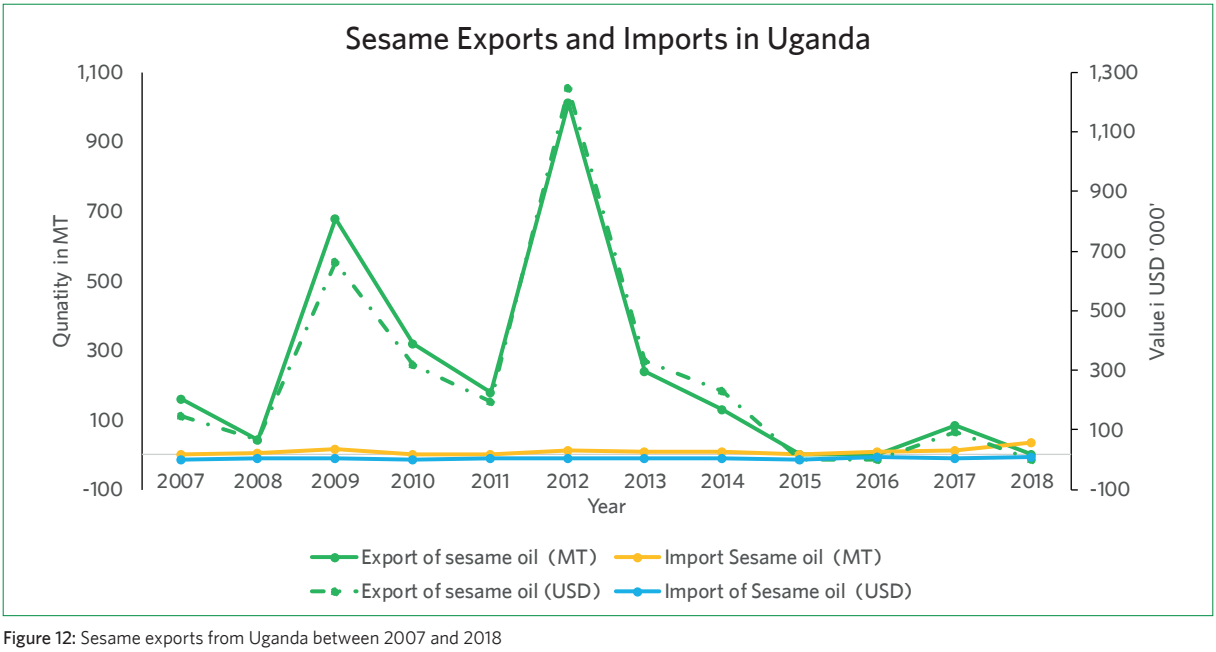


Figure 12: Sesame exports from Uganda between 2007 and 2018
Source: International Trade Centre, 2020

In 2013 – 2018, Uganda's sesame oil exports declined at rate of 89% per annum. This is attributed to declining production resulting from low labour productivity, limited use of improved inputs and high prevalence of pests and diseases (FAO, 2015). In addition, SNV (2018) reported a reduction in sesame production because of drastic fall in price from UGX 3,000/kg to UGX 1,800/Kg. This demotivated farmers. In 2017, Sesame oil worth UGX 351 million was exported (Figure 12).

C. Sesame Value chain actors in Adjumani

This study estimated annual sesame production in Adjumani to be 34,292 MT (land under sesame production is 42,865 acres). Of the total produced by farmers annually, 10% is consumed on farm, while 61%, 3% and 1% are sold by the farmers to aggregators, local processors and consumers annually, respectively. About 25% percent of the production is lost due to poor post-harvest handling practices at the farm level. The estimated annual consumption of sesame is about 25,719 MT. With the current annual production, Adjumani has a surplus of sesame. Of the total quantity of sesame produced annually, 61% is sold to off takers outside Adjumani such as Olam Uganda Ltd. Information from the key informants revealed that Adjumani district supplies only 5% of the total sesame annual needs of Olam Uganda. Below is a detailed description of the sesame VC actors.

Input suppliers: There are approximately 25 agro-input dealers mainly located in Adjumani town and operated by individuals from both the host and refugee communities. On average, they have stock/ Inventory of less than UGX 5 Million with over 90% of operating capital borrowed from financial institutions like banks. Over 98% of the input dealers are registered at the district level and each pays a trading license fee of UGX 30,000 per year. Majority (over 60%) of the agro input shops are owned by men and each employs 1 to 2 informally trained youth.

They stock a variety of agro-inputs ranging from seeds (sesame series, Gure, and black variety), agro-chemicals (herbicides, pesticides) and farm implements such as hand hoes, ox-ploughs, watering cans which are mainly sourced from Kampala and Gulu. Sesame seeds are sold at UGX 4,000/Kg while implements like ploughs are sold at UGX 400,000. They also offer a variety of services to farmers such as extension service and inputs on credit.

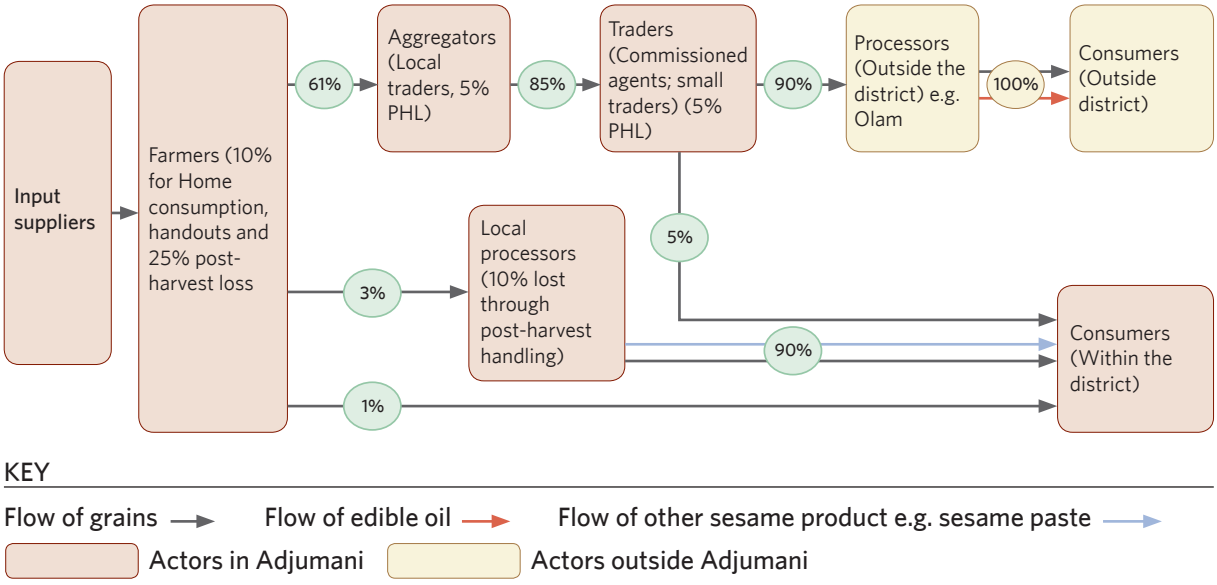


Figure 13: Value Chain map of Sesame in Adjumani
Source: Primary Data, 2020

Farmers: Sesame is mainly grown by the host communities, with few refugees involved. It is produced predominantly by small scale farmers on 1 - 2 acres. The crop is largely grown by individuals, 80% of whom are men. Producers are located in both rural and peri-urban areas e.g. Adropi, Pakele and Pachara sub-counties. The current production of sesame in Adjumani district is characterized by low resource use such as a hand hoe and limited agro-chemical use. Sixty percent of farmers use hand hoes, and 30% use animal draught power costing UGX 120,000-160,000 per acre while only 5% use tractors costing UGX 60,000 per acre for tilling the land. Broadcasting is the main method of planting and activities such as weeding, harvesting, drying and threshing are manual.

Sixty percent of the farmers grow sesame series, 20% grow Gure and 20% black type although many use home saved seeds. Sesame series variety is widely grown as it matures early, and highly demanded in the market because of its high oil content. Due to poor agronomic practices employed e.g. use of local seeds, and planting by broadcasting, farmers obtain low yield of 400Kg/acre compared to 900 Kg/Acre under research conditions (Munyua et al., 2013).

Sesame production is commercialized with 65% of the produce sold. Home consumption or given as handouts (10%), 25% is lost after harvest (Figure 13). The high post-harvest losses are attributed to limited knowledge on PHH practices and access to appropriate PHH technologies. Farmers largely sell 61% of their produce to Aggregators (61%) at an average price of UGX 3,500/Kg.

Aggregators: These are mainly from the host community and they are located in villages and trade less than 10 MT of sesame per week depending on the season. Thirty two percent of them are women who aggregate sesame on commission of UGX 100/Kg. Each village has approximately 3 aggregators who collect 85% of the sesame that is sold by smallholder on commission. A trustworthy aggregator is given by processor over UGX 500,000 per season for sourcing sesame. The selling price ranges between UGX 3,800 - 4,000 per Kg to traders and small processors. The aggregators are trained by traders on marketing. In addition, traders with commission provide aggregators with packaging materials and digital weighing scales.

Traders: Sesame traders are either agents or small traders. Agents have contracts with large processors and off takers e.g. Olam Company. They have an operating capital of over UGX 5 Million, are largely self-financed and with a few being financed by large processors. To access credit from large processors and off takers, a trader needs to have a track record of supplying at least 5 MT for 2 consecutive seasons. These agents trade on average of 10 MT per season. They are trained by processors on of quality standards, marketing skills, weighing using digital scales and warehouse management practices. The agents engage local traders/ aggregators who are paid on commission of UGX 100/Kg of Sesame they aggregate. Agents buy sesame from smallholder farmers at UGX 3,800 - UGX 4,000/Kg.

Small traders comprise 70% women and trade over 35 Kg per week per trader. Thirty percent of the small traders are refugees selling both within the refugee settlements and in markets outside the settlements. The capital base for a trader is about UGX 100,000 that is borrow from VSLAs or microfinance institutions e.g. BRAC. It was also noted that small traders operating within and around the settlements access finance from development partners including Norwegian Refugee Council (NRC) and Danish Refugee Council (DRC).

Small processors: There are on average 2 small processors per street in Adjumani making sesame paste (locally known as Odi). They are owned and operated by men. They use rudimentary processing machines that are bought from Kampala and Gulu. They also own weighing scales and sesame packaging tins that are bought from Adjumani town.

Their installed processing capacity is 15Kg/hour and the volume processed per day depends on the season. They also offer milling service at a fee of UGX 700/Kg while less than 30% buy sesame, process and package it. Sesame is bought from traders and farmers at a price of UGX 3,800/Kg and UGX 3,500/Kg, respectively. Processors on average lose 10% of the quantity processed to poor packaging and sell 90% of the processed to final consumers (Figure 13). Over 50% of the interviewed processors had machine operational skills, business skills as well as financial management skills obtained from development partners like the Danish Refugee Council (DRC) and Norwegian Refugee Council, local government and banks (e.g. Centenary Bank).

Approximately 10% of the processors are refugees who make paste as a food staple mainly for the hosts. Over 50% of processors interviewed said they access finance from banks mostly Centenary Bank while 40% depend entirely on own savings. Less than 50% of the processors are registered with the district authorities, and none is certified or complies with UNBS quality standards. A processor pays a weekly fee of UGX 5,000 to the town council as market fees.

Large scale processors: There are large scale processors that make sesame paste and press oil for sale in local markets across Uganda e.g. to bakeries in the confectionery industry. Some of the large processors in Uganda are Mukwano Industries Ltd, Mount Meru Millers and Olam is located in Pakwach has been one of the processors of sesame buying from the Adjumani farmers through agents. Olam has underutilized storage capacity of over 70MT, supplies packaging materials bought from Adjumani town (at UGX 1,500/Bag) and digital weighing scales. Currently Olam is not processing sesame, However, Mt. Meru is another Oil seed processor that is standing in the gap.

D. Profitability analysis for the sesame value chain actors

The profitability analysis investigates the feasibility of the enterprise i.e. whether it is worthwhile to invest in sesame. For the GM analysis of sesame, the assumptions below were used.

- Price per kg of sesame at farmer level is UGX 3,500; aggregator is UGX 3,800 and trader is UGX 4,000.
- Post-harvest losses are 25% at farm level and 10% at processor level
- Yield per acre is 400Kg.

Farmers using tractors make the highest GM of UGX 302,000 per acre per season while those using hand hoe make the least (Figure 14). The major cost driver among farmers using the hand hoe is labour expense which accounts for over 90% of the total production costs. Within the labour expenses, cost of weeding and harvesting accounts for the highest proportion i.e., 20% and 15%, respectively.

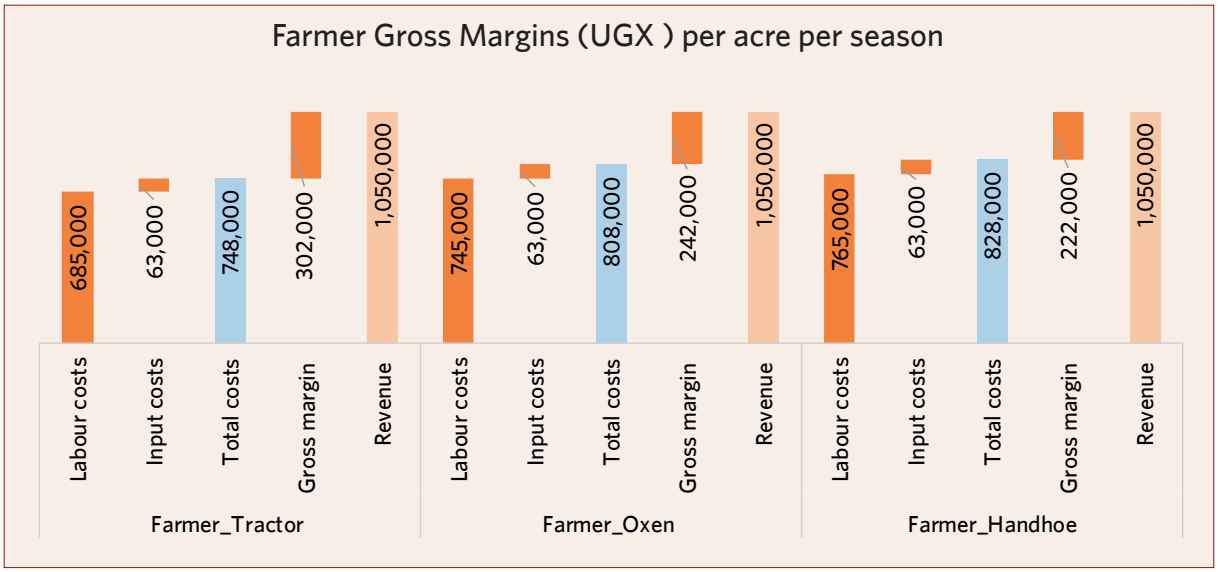


Figure 14: Gross margins per acre for Sesame farmers
Source: Primary data

For every Kg sold, the processor earns a premium for selling value-added sesame products which fetch twice the price of unprocessed sesame. For instance, the price of a Kg of sesame paste costs UGX 8,000 compared to UGX 4,000 of unprocessed sesame. The hand hoe farmers earn the least GM per Kg because of the high labour cost incurred in land opening, while traders have the lowest GM of UGX 41 per Kg because of the high cost in gathering sufficient volumes of sesame from farmers (Figures 15 and 16).

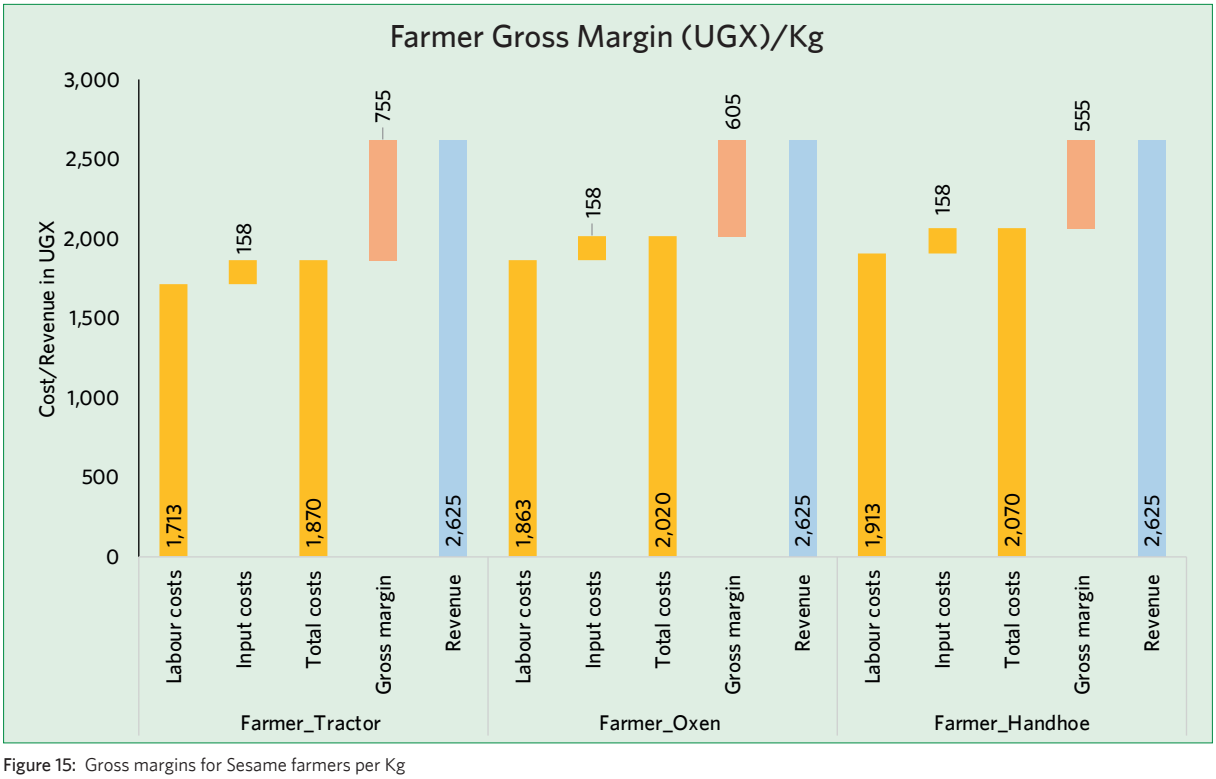


Figure 15: Gross margins for Sesame farmers per Kg
Source: Primary data

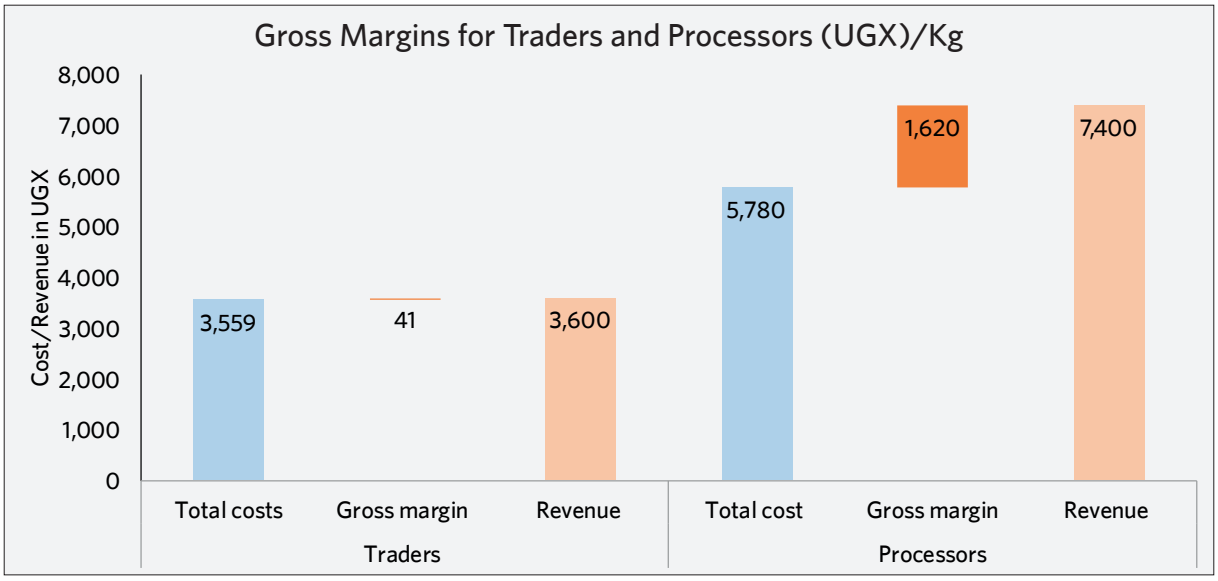


Figure 16: Gross margins for Sesame actors per Kg
Source: Primary data

The GMs for aggregators and processors outside Adjumani are not calculated because at the time of data collection these actors were not purchasing sesame citing low volumes and poor quality of sesame.

Share of value: Figure 17 shows that there are 3 major supply channels for sesame in Adjumani. Processors enjoy the lion's share of value in channels 1 and 2 because they buy the grain at low prices, add value and fetch high prices from the by-products e.g. paste sold at UGX 8,000 per Kg and sesame oil sold at UGX 20,000 for 250g. Traders have the least share in channels 2 and 3. This is because they incur high transportation costs during aggregation. The farmers gain the most from channel 3 (98.1%) when they sell grain through traders to end consumers, though the price for the sesame is good i.e. farmers sell at UGX 3,000 and trader on sells at UGX3,500 to consumer, but the volumes sold are very low. Channel 1 is the preferred channel if farmers are organized, and more processors mobilized which would enable farmers to negotiate a good price.

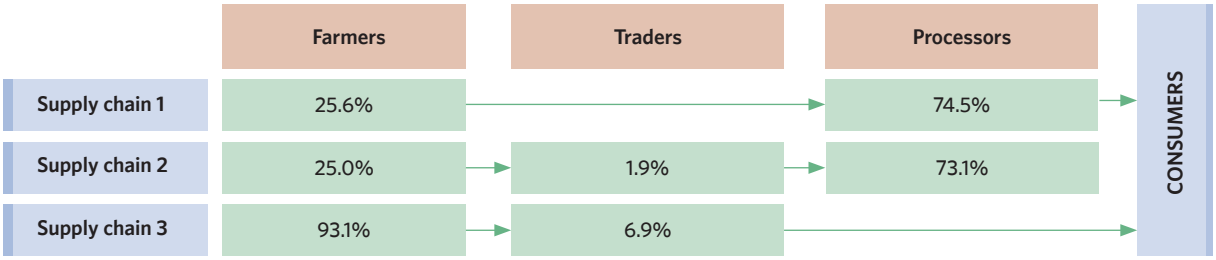


Figure 17: Share value for different Sesame value chain actors
Source: Primary data, 2020

E. Employment along the Sesame value chain

The employment generation potential was estimated using the Full Time Equivalent approach. In addition, the wages earned were estimated per district. The FTE jobs units per acre grown were used as the multiplier factor to estimate the number of FTE jobs under the existing acreage under production in the district. The employment estimates are presented by land opening options in Adjumani drawn from the detailed activities in sesame production and the human effort required. Table 11 shows that at farm level, every acre of sesame generates 0.51 FTE jobs (i.e. 51 jobs for every 100 acres produced) when using hand hoe, 0.46 FTE jobs (i.e. 46 jobs for every 100 acres produced) when using a tractor and 0.48 FTE jobs (i.e. 48 jobs for every 100 acres produced) when using an ox plough. At trading level, 0.01 jobs (i.e. 1 job for every 100 acres produced) exist, while at processor level 0.026 FTE jobs (i.e. 3 jobs for every 100 acres produced) per year per acre are generated. This implies that most jobs are created at the farm level and the node has the highest wage proportion.

In Adjumani, sesame production is on approximately 42,865 acres. Based on this, FTE job estimation for the sesame VC, the least jobs as expected are created when tractors are used for opening land. Therefore, to contribute to more job creation, there is need to increase the land allocated to sesame coupled with increased yield.

Table 11: Estimated number of jobs under the Sesame value chain

Value Chain Node	FTE jobs		Total Wages in UGX in 1 year	
	1 Acre	42,865 acres	Acre	42,865 acres
Production _Hand hoe	0.51	21,707	1,656,000	70,984,440,000
Production _Tractor	0.46	19,509	1,496,000	64,126,040,000
Production _Ox plough	0.48	20,608	1,616,000	69,269,840,000
Trade	0.01	473	36,000	3,086,280,000
Processor	0.026	1,099	646,000	27,690,790,000
Total whole value chain Hand hoe	0.55	23,362	2,338,000	101,761,510,000
Total whole value chain Tractor	0.49	21,164	2,178,000	94,903,110,000
Total whole value chain Ox plough	0.52	22,263	2,298,000	100,046,910,000

FTE implies Full Time Employment

Source: Primary data, 2020

F. Social benefits along the value chains

Historically, in Uganda, sesame was regarded as a woman's crop. It was grown on marginal lands or in kitchen gardens and grown for consumption at a local level. When commercialized sesame began to take off in Uganda, sesame became considered a cash crop. It's frequently noted in the literature that cash crops and export crops are male crops, while subsistence crops are female crops. Typically, evidence suggests, men may take over production and marketing, even of traditional women's crops, when it becomes financially lucrative to do so (Hill, et al, 2011).

Sesame production was originally a host community activity because of the land needed in production. However, it was observed especially in the integrated sub-county of Pachara that refugees too are taking to sesame production. Traditionally, the Adjumani women must have a sesame garden because it is a food staple. Key informants confirmed that women have some volume of sesame reserved for home consumption and selling off to meet domestic needs e.g. stationery for school going children, cooking oil and medical emergencies. Women were observed bringing buckets of sesame to sell to

the traders. Currently, sesame production and marketing is conducted by both host and refugees communities and both male and female participate in production, trading and processing activities.

A study conducted by Clune et al. (2016) on systematic review of greenhouse gas emissions for different fresh food categories reveal that sesame seed has a global warming potential of 0.88Kg CO2-eq/kg but it was reported lowest in field grown vegetable (field-grown vegetables (0.37Kg CO2-eq/kg) and highest among nut trees (1.20Kg CO2-eq/kg).

Sesame seeds contain up to 55% oil and 20% protein (Martinchik, 2011). Sesame oil is rich in linoleic and oleic acids and their absence in results into poor growth and development in infants, a scaly dermatitis, and an impaired immune response (Sanders, 2016). Sesame is one of the food staples of people in Adjumani and is consumed in either roasted or in paste form (Munyua et al., 2013). Sesame oil has medicinal properties and it is applied to sores as an ointment. Despite all of this, there is little research available on whether the production of sesame as a cash crop has any effect on household nutrition levels.

G. Public private and community support to the value chain

Sesame in Uganda is categorized as an oil crop. Under ASSP II 2015/2016 – 2019/20 oil seed is one of the four strategic commodities that was prioritized to lead the transformation of the smallholders from subsistence to commercial farming. The oil seed sub-sector in Uganda is coordinated by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) with the mandate of policy formulation, regulation and quality control. MAAIF works in collaboration and with support from multiple stakeholders. For instance, Uganda Oil Seed Producer and Processors' Association (UOSPA) and the Oil Seeds Sub Sector Platform (OSSUP) that are largely private sector, support the coordinated action in the oil seeds subsector.

The sub-sector is also supported by a strong Institutional framework for standards development, harmonization, and enforcement. These include Uganda National Bureau of Standards, National Agricultural Research Organization, The Grain Council of Uganda (TGCU) and East African Grain Council (EAGC), Common Markets for Eastern and Southern Africa (COMESA) and the East African Community Secretariat (EAC) at regional levels. The vegetable oil development (VODIP) interventions funded by IFAD have promoted soybean, sesame and sunflower production in close collaboration with the Government of Uganda. SNV has supported in organizing farmers into groups and improve access to market. However, the major challenge is that the coordination of all these actors in providing support to the sub sector is weak.

The seed oil subsector is guided by the following policies: National Agriculture Policy, 2016, National Fertilizer policy, 2016, National Trade Policy 2007, National Seed Policy, 2018, and National Grain Trade Policy, 2016. Despite all these policies, there is weak coordination and lack of implementation structures among multiple stakeholders in the guiding policies, quality standards and marketing regulations that needs to be harmonized in order to link production, processing and marketing and structure the soybean VC.

The private sector represented by the input suppliers at production node provide the basic tools and equipment for production. Most importantly, the input suppliers are the source of seed and agro-chemicals. However, the input suppliers cannot tell counterfeit inputs of seed and agro-chemicals. Farmers consult the input suppliers for advice on use and how to address the challenges they encounter in production.

Regarding the processors, there is an IFAD funded and SNV implemented project in West Nile-Arua as a pilot. The Partnering for Value project aims at promoting mutually beneficial partnerships between the public sector, the private sector and small-scale rural producers (4Ps) in the sesame value chain. Due to the farmers not being organized, the private sector must work with agents and middlemen to be able to buy a big enough sesame volume for export. This agent-led model has led to reduction in quantity and quality of the commodity traded and ultimately to lower incomes for both farmers and Olam, despite a significant growth and high (international) demand for sesame.

The Vegetable Oil Development Programme, a Public-Private-Producer Partnerships Project worked with farmers in West Nile Region to develop and promote cooperatives to become involved in input supply, knowledge dissemination and marketing of commodities. However, such relationships are still weak. Traders work independently and transactions are carried out on cash basis. However, Uganda Oilseeds Subsector Platform (OSSUP) has provided a space for strengthening communication, information exchange and learning among the actors of the sub-sector at regional and national levels for policy and regulatory level. It also promotes "Public Private Producers Partnerships in Agricultural Value Chains" on operational and financing matters. Trader-producer relationships are trust-based and often include pre-finance. Sesame wholesalers generally do not have contracts with their suppliers; those that do exist are seasonal.

The decentralization approach has equipped both Adjumani district and the respective sub-counties with technical staff under the department of Production to support the farmers and traders at different administrative levels (sub-county, county, district and regional levels) with best agronomic practices. The sesame transporters and exporters are heavily dependent on road network. The road infrastructure is being developed but does not meet the needs of the growing economy. With limited rail and air transportation, roads carry 95% of passenger and freight traffic (Obita, 2015). Only 19% of the national road network is paved, increasing journey times and vehicle operation and maintenance costs. Access to feeder roads is also inadequate in many rural areas, affecting producers' access to physical markets (MoFPED 2015). Thus, poor infrastructure raises transaction costs, increasing consumer prices and limiting profitability for chain actors.

H. Threats and community preparedness

In Adjumani, sesame is both a food and cash crop and the cultivation methods are traditional and highly dependent on rainfall. The farmers grow sesame on the same piece of land in successive farming seasons. However, it is important to rotate sesame with crops like sorghum, maize, soybean, green beans, cowpea, and finger millet to reduce the prevalence of diseases such as bacterial wilt and fusarium wilt, and populations of sesame gall midge and webworm but also manage the soil health.

Farmers are known to harvest sesame early which reduces yields by up to 20%. In addition, sesame production is characterized with high postharvest losses. In a bid to reduce the losses, the farmers harvest sesame when two-thirds of the pods and plants turn from green to brown, which occurs 90-120 days after planting, depending on the variety. They then bundle the cut sesame plant together and store in a clean and, ventilated area. However, they do not disinfect the store and most time dry the crop out in the open so sesame from the bursting pods is lost. In addition, the damage of sesame pods or seeds during harvesting, weeding, or storage can result in aflatoxin contamination. The farmers with capacity building can adopt postharvest best practices of Threshing: using a tarpaulin or clean concrete floor or mixed with cow dung. They step on or gently beat the dried stacks to separate the sesame seeds from the pods. Winnowing of the threshed sesame seeds is conducted using the wind or a sieve to remove small pieces of stalk, chaff, impurities, and pests in sesame seeds. Repeated winnowing removes more impurities, resulting in clean sesame grains.

Poor access to extension services: Although NAADS is present in the region, their staff concentrate on only selected crop enterprises (i.e. rice and groundnuts) leaving the rest of the crops unattended to. Although NGOs working in the area have attempted to bridge this gap, they too work with only crops of their choice and often, focus on postharvest handling and marketing leaving out production.

The low sesame yields are attributed to use of low yielding varieties, damage by pests especially the sesame webworm *(Antigastra catalaunalis)* and gall midge *(Asphondylia sesami)* and damage by diseases like Fusarium wilt, leaf spots and powdery mildew and shattering of capsules. In addition, there is a tendency for untimely identification of pests and diseases and, improper application of pesticides resulting in low yields coupled with high postharvest losses at farmer level because of absence of postharvest handling equipment.

The major constraints faced by different VC actors are poor agronomic practices e.g. use of home saved seed, high cost of opening of land for cultivation, shortage of labour, etc. The challenges coupled with the mitigation measures are presented in Table 12.

Table 12: Challenges along each node

Actor	Challenge faced by the actors	Mitigation Strategy
Farmer	1) Individual mentality of farmers and therefore do not harness their collective potential. 2) Poor agronomic practices that reduce productivity 3) Labour shortage during peak periods constrain large scale production. 4) Unreliable market linkages that make the enterprise risky. 5) Poor storage facilities at farmer level that increases post-harvest losses. 6) Poor rural roads like Ayilo road resulting in high transport cost. 7) Unpredictable weather that leads to poor planning in planting and harvesting resulting in losses..	1) Organise farmers into groups. 2) Capacity building of producer groups in GAP such as use of high yielding varieties e.g. sesame series, pesticides, herbicides, and GPHH to reduce post-harvest losses. 3) Sensitize farmers on the benefits of using tractors and enforce a mechanism at project level of using them as part of the grants / revolving fund received. 4) Securing reliable market linkages; and build strong market linkages with large processors to stimulate production and structure the value chain. 5) Build aggregation centres and proper storage facilities at the watershed to reduce the transaction costs in aggregation. 6) Rehabilitate village roads like Ayilo road.
Traders	1) Poor rural feeder roads that increases cost of doing business. 2) High post-harvest losses – 10% due to poor packaging 3) Inadequate working capital that limits quantities purchased	1) Construction and rehabilitation of rural feeder roads. 2) Build aggregation centres within the watersheds. 3) DRDIP can provide traders with a revolving fund that is accessible in financial institutions.
Processor	1) Poor quality sesame that attracts low profits 2) Rudimentary processing technologies among local processors yield low quality products	1) Build market linkages e.g. through contract farming arrangements coupled with capacity building of farmers in GAP, GPHH, standards, farming as a business, mechanization and irrigation.

Source: Primary data, 2020

The production department of Adjumani has a mandate to improve food and nutrition security, household income and welfare through investment in profitable and sustainable agricultural production and marketing. Success of the department is measured through improved household nutrition and food security, increased household income and commercialization of agriculture. The department together with NGOs and government programmers are focused on increasing agriculture production and productivity of selected strategic enterprises e.g. sesame plus improving the quality and value of agriculture commodity marketed.

I. Recommended investments for DRDIP

The findings about the sesame VC are that:

1) The VC is under-developed i.e. operate as individuals, focused on home consumption and using rudimentary methods and trade is largely unstructured.
2) The actors need to be organized to handle more volumes of sesame and benefit from the small but positive GMs.
3) Engaging in trade of sesame is profitable for all actors although the profits vary with actors.
4) Estimates of jobs created across actors employs approximately 5% of the Adjumani population.
5) Key major opportunity of the Sesame VC is increase and commercial focused production, demand for sesame oil and sesame cake for animal feed

The current sesame yields are low at 0.4MT/acre compared to expected 1MT/acre, despite a ready market for the commodity within and outside the district. However, given that there is ready market, below are public investment proposals, DRDIP investment proposals and private sector support recommendations to address the numerous challenges.

1. The public investment areas recommended are:

Investment in **rehabilitation of the roads** *(Scenario 5)* as this will increase farmer profitability by 470%, and increase jobs created by 12.3%. Processor and trader GMs would also increase by 2,309.8 % and 47.8%, respectively. Jobs on the other hand would increase by 58.8% and 63.8 % at trader and processor levels, respectively. The rehabilitated road not only improves the lives of farmers but that of traders too i.e. transportation of sesame is eased. As a result of the rehabilitated road, more traders will be able to access the farmers, more jobs are created at small trader and processors levels and the competition (from traders and processors) will increase the price of sesame. It is important to note that if only the roads are rehabilitated *(Scenario 3)*, GMs for farmers increase by only 18% and 24.7% for processors. Traders make losses.

Construction of aggregation centers at the watersheds *(Scenario 6).* The aggregation centers are critical in improving the collective marketing potential for farmers and reduces the transaction costs in aggregation especially for the small-scale traders in the villages. With aggregation centers, GMs and jobs are highest for all VC actors. Gross margins for farmers, traders and processors increase by 481%, 2,443.9 %, and 38.3%, respectively. The significant increase is due to the good road that eases the increased volumes farmers aggregate which reduces the transaction cost for processors/ off takers as well. It is important to note that if aggregation centers are built without the road, farmers make losses *(Scenario 4)*. This partly explains why numerous aggregation centers in the country remain white elephants.

Recruit and build capacity of extension service providers i.e. from district all the way to community facilitators to train farmers. The district should also coordinate with NGOs working on agronomic issues to ensure standards, avoid duplication and harness new ideas for scaling up.

2. For DRDIP, the key strategic recommendations are:

Train farmers on GAP, GPHH, Farming as Business (Scenario 2) etc. This is the lowest hanging fruit. If farmers adopt good farming practices and reduce post-harvest losses from 25% to 10%, then farmer's GMs would quadruple, and jobs increase by 13.7%. At the small traders and processors levels, jobs would increase by 66% and 100%, respectively. To respond to the potential market opportunity, DRDIP needs to support farmers to increase production by cultivating 2,615 acres. Given that each group has a grant of UGX 18.5 Million, this is equivalent to 194 groups each cultivating 13.5 acres. Alternatively, if DRDIP increases the grant from UGX 18.5 M to UGX 41.1 M per group, it will result into 87 groups assuming each group allocates 30 acres for sesame production.

Essential **skills development** in farmers are comprehensive farm management (farming as a business, financial literacy and good governance practices), repair and maintenance of tractors, irrigation systems and climate smart agriculture.

Value addition: Sesame seeds need to be cleaned and fumigated to a high standard before supply to edible product markets. To meet export quality standards of sesame, there is need to screen, clean and package sesame into 50kg bags, which are packed into 20 and 40MT containers. For the extraction of sesame oil, there is need for modern extraction methods i.e. a batch hydraulic press cost approximately US$ 15,000, where seeds are pressed to extract the oil by increasing pressure. The GM per liter of sesame oil extracted and sold is UGX 5,731 (Table 15).

Support to the large scale agro-processors with operating capital through matching grants to enable them absorb the increase in production e.g. ensure quantity and quality of sesame that allow business

3. Private sector support recommendations are:

a) To bridge the information asymmetry in the value chain – an information platform between farmers and traders can be piloted to ensure that there is accurate information available.

b) Access to credit facilities available options and future credit plans.

c) Solutions to land opening challenges through availability of tractors of different sizes for hire at sub-county level

d) If DRDIP secures a direct market linkage between farmers of sesame and a processor e.g. Olam Uganda Ltd to supply 1% (4,184 MT) of sesame of the current deficit Olam has annually, then scenario 6 that focuses on increase in yields, roads are rehabilitated, and aggregation centres built is the most desirable as farmers get the highest margins and most jobs created.

a. Assumptions

With the proposed investments above, the next section provides a snapshot of the effect of they have on profitability and jobs in Adjumani. Table 13 below present the assumptions behind the analysis.

Table 13: Assumptions in scenarios developed

Farmers	Traders	Processors
• Increase yield from 0.4MT to 0.8MT/Acre as a result of using GAP and GPHH practices. • Reduction of postharvest loss from 25% to 10%. • Tractors are used for land opening.	• Reduction of postharvest loss from 10% to 5%.	• Reduction of postharvest loss from 8% to 3%
Potential Market Opportunity		
• Adjumani currently supplies only 5% of what is produced annually to Olam Uganda Ltd. • If a contract is secured to increase the quantity supplied to Olam Uganda by 1% from 20.198 MT to 25,165MT / year this translates to 4,184MT annually. • Assuming best case scenario in yield improvement and post-harvest loss management, this is equivalent to 2,615 Acres • DRDIP provides a grant of UGX18,500,000 per group • Each group has 10-15 members • Each member can access up to a maximum of 3 acres		

Source: Primary data

b. Scenario analysis

Table 14 shows 6 scenarios that have been considered for the Sesame value Chain in Adjumani.

Table 14: Impact of Investment scenarios

Category	Item	Current scenario	Yield increase including reduction in PHL	Road Improvement only	Construction of aggregation centres only	Yield Increase + Road improvement	Yield increase + Road improvement + Construction of aggregation centres
	Scenarios	(1)	(2)	(3)	(4)	(5)	(6)
Farmer	Price per Kg	3,500	3,500	3,600	3,500	3,600	3,650
	Revenue per acre	1,050,000	2,520,000	1,080,000	980,000	2,592,000	2,628,000
	Cost of production/ acre	828,000	1,373,750	817,000	832,000	1,325,750	1,337,750
	Current GM in UGX/ acre	222,000	222,000	222,000	222,000	222,000	222,000
	New GM in UGX/ acre	NA	1,146,250	263,000	148,000	1,266,250	1,290,250
	% increase /decrease of GM	NA	416	18	(33)	470	481
	Jobs created	20,059	22,806	19,921	20,059	22,532	22,532
	% Increase / decrease in Jobs		13.7	-0.7	0.0	12.3	12.3
Traders	Variable costs UGX/Kg	3,559	3,757	3,659	3,549	3,857	3897
	Revenue UGX Kg	3,600	4,750	3,690	3,600	4,845	4940
	GM UGX /Kg	41	993	31	51	988	1043
	Jobs created	526.4	877	500	422	836	653
	% increase/ decrease in Jobs		66.6	-5.0	-19.8	58.8	24.1
Processor	Variable costs in UGX per Kg	5,780	5,325	5,380	5,280	6,245	6,325
	Revenue in UGX per Kg	7,400	8,565	7,400	7,400	8,640	8,565
	Gross margin in UGX per Kg	1620	3,240	2,020	2,120	2,395	2,240
	Jobs created	1,129	2,264	903	988	2,103	1,889
	% increase/decrease in Jobs		100.5	-20.0	-12.5	86.3	67.3
Market	Market opportunity in MT	4,184					
	Annual yield in MT	1.6					
	Additional acres	2615					
	Grant/group in UGX	18,500,000					
	Acres per group	30					
	# acres/group with grant of UGX 18.5M	22.3	13.5	22.6	13.4	14.0	13.8
	# of groups to meet market opportunity	117	194	115	196	187	189
	# of groups if grant amount in UGX is increased to cover production costs and meet market opportunity	174	87	87	87	87	87

Source: Primary data, 2020

Table 15: Gross margin for oil extraction

Costs/Revenue	Per month in UGX	Per litre produced in UGX
Rent	300,000	231
Electricity	200,000	154
Taxes	200,000	154
Water	100,000	77
Packaging	3,250,000	2,500
Maintenance and other labour costs	1,500,000	1,154
Total costs	**5,550,000**	**4,269**
Gross margin	**7,450,000**	**5,731**
Price per litre in UGX	10,000	
Quantity in litres	1,300	
Revenue in UGX	13,000,000	
1 kg of sesame grain produces 0.5 litres of sesame oil Price per litre of sesame oil in UGX 10,000 Quantity of sesame grain milled per month (100kg/day for 26 days) is 2,600Kg		

Source: primary data

3.1.3 Soybean Value Chain

A. Background

The largest producer of soybean globally is the United States of America followed by Brazil and Argentina (Karuga, 2018). Collectively the three countries account for 82% of the global soybean production (Karuga, 2018). The top soybean consumers globally are China (30%), United States (US) (18%), Argentina (14%) and Brazil (13%) (Karuga, 2018). Soy oil and meal are the most consumed products worldwide as food and feed, respectively. Soymeal accounts for over 60% of the world's meal production (vegetable and animal meal) and occupies a prominent position among protein feedstuffs used for feed concentrates. Soybean oil is the second most important vegetable oil (after palm oil) accounting for 25% of global vegetable/animal oils and fats that are consumed. The widespread use of soybean oil as edible oil is due to its reliable supplies, affordability and its neutral flavor (Thoenes, 2016).

The National Development Plan II does not mentioned soybean as one of the priority crops, however, the Adjumani District Development Plan 2015/16-2019/20 prioritized oil seed crops. Soybean protein contains significant amounts of minerals (Iron, Zinc, Calcium and Magnesium) (cite). Soybean oil is 85% unsaturated and thus good in mitigating the risk of heart diseases (Tukamuhabwa, 2016). It is mainly grown in Northern Uganda. Yam district is leading followed by Apace, Lira and Gulu that order while Adjumani district ranks 60th in Uganda (UBOS, 2016). Soybean is planted in two seasons March to April and August to September (VSLA, 2016). According to FAO (2020), the yield of soybean in Uganda is 0.6 MT/Ha. This is very low compared to a potential yield of 3.5 MT/Ha for high yielding varieties like Massey 4N and Massey 5N (Tukamuhabwa and Oloka, 2016). The limiting factors to achieving the yield potential include low use of improved varieties, limited use of fertilizer and other improved technologies and pod shattering due to delayed harvesting (Tukamuhabwa et al., 2016; SNV, 2011). However, a severe soybean rust epidemic broke out in 1996 and wiped out available soybean varieties leading to the collapse of the sub-sector. Other challenges include inadequate credit for production and marketing, price fluctuation, poor marketing policies, inadequate mechanization leading to low labour productivity, weak farmer groups and weak market linkages (SNV, 2011; VEDCO, 2011).

In Uganda, soybean was introduced in 1938 (Tukamuhabwa and Oloka, 2016). Soybean is the second important legume in Uganda following the common bean (Phaseolus vulgaris). Soybean has potential to increase farmers' income and improve their livelihoods as well as enhancing soil nutrient status by fixing nitrogen (Rokani et al., 2014). Soybean is mainly consumed as a roasted snack, ground flour, cooked, fried, soybean milk and beverages. The current local and regional market for soybean provides an opportunity for value addition especially in the animal feeds sector and product diversification.

B. Demand and Supply of Soybean in Uganda

Soybean supply and demand in Uganda remained stable with no significant surpluses between 2007 and 2017 (Figure 18). The observed decline in demand and supply from 2008 up until now is attributed to low soil fertility, inappropriate management practices, unreliable market and attack by pests and diseases (Taniya, 2015). The growth opportunities in the sector are in export markets.

Export of soybean cake represents 98% of the total exports of the crop while 2% of the exports is soybean crude oil (Figure 18). In 2018, exports of soybean cake were worth US$ 10 Million while soybean crude oil worth US$ 0.6 Million was exported. The largest export market for soybean cake is Kenya (88%) targeting animal feed industry followed by Tanzania and Rwanda. However, the largest importer of the soybean crude oil is Rwanda.

The high protein content in soybean cake makes it a perfect subsistute for animal proteins that are expensive. Uganda's market share in Kenya for soybean cake is generally less than 50% (other than in 2013 and 2016). This implies that Kenyan market has potential to absorb more soybean cake from Uganda.

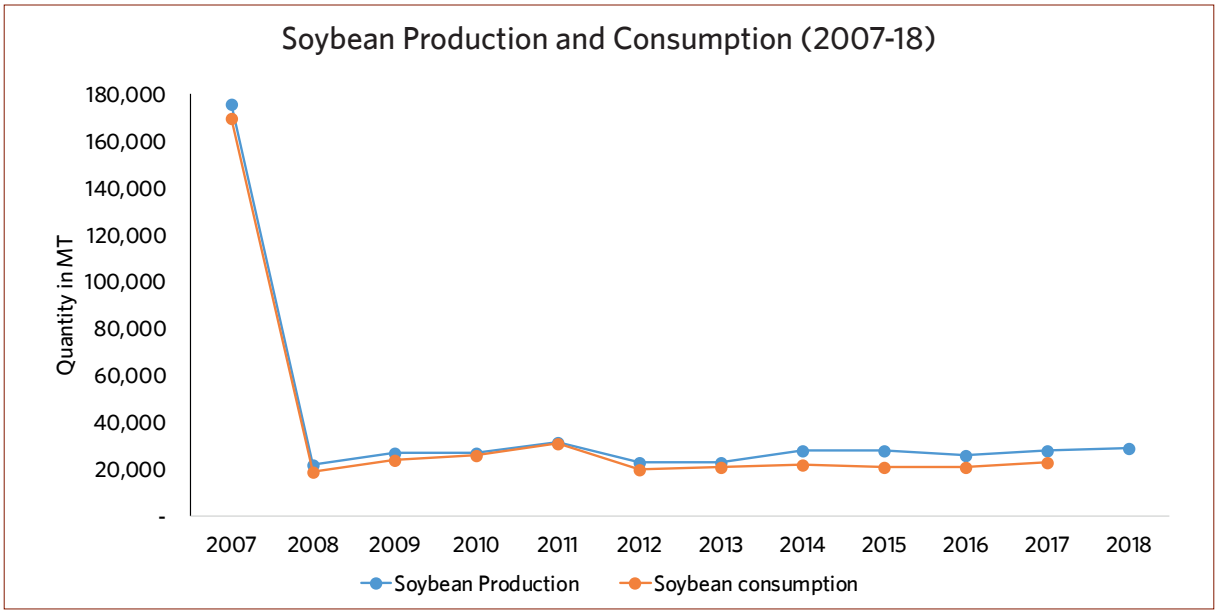


Figure 18: Soybean supply and demand in Uganda (MT)
Source: Food and Agriculture Organization, 2020

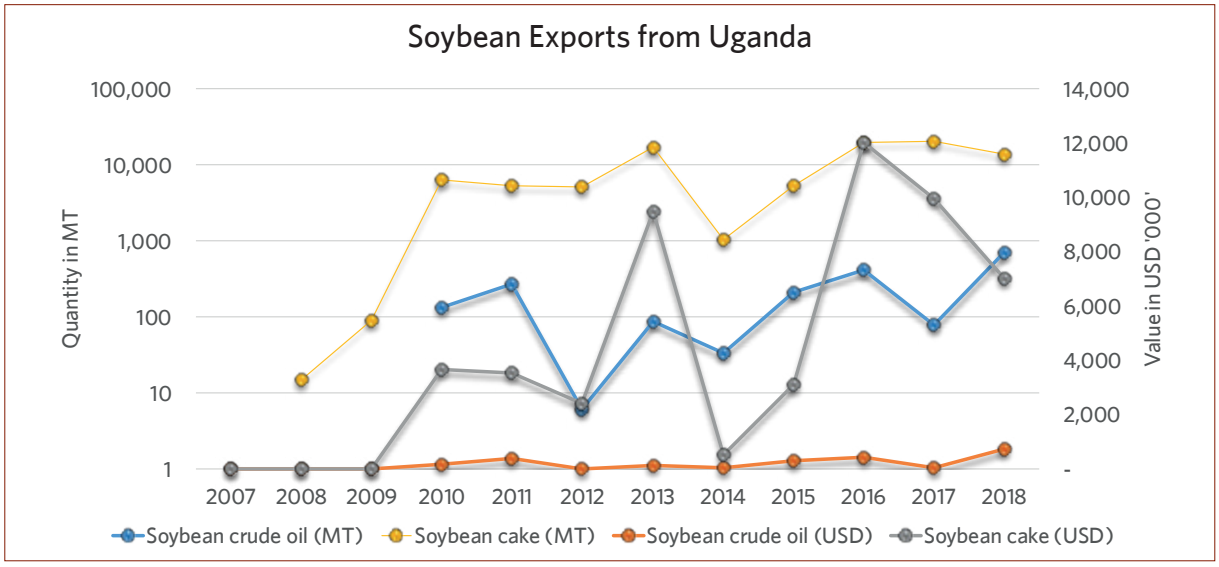


Figure 19: Soybean exports
Source: International Trade Centre, 2020

According to ITC (2020), Uganda imports less than 64 MT annually of soybean cake from Malawi, India, Rwanda and Tanzania. This is attributed to the fact that indigenous demand is heavily skewed towards soybean crude oil, with soybean cake demand left for the poultry feed sector and a small but fast-growing market for human consumption (Aced, 2012).

C. Value chain actors

The estimated annual soybean grain produced in Adjumani is 13,347 MT. Of the total produced, only 1.7% (227 MT) is consumed on farm level while, 25% (3,337 MT) is lost to poor post-harvest handling practices at farm level as the planted varieties shatter their pods before and during harvest. It is important to note that only primary processing (drying, sorting) occurs in Adjumani. Of the total quantity of soybean produced annually, more than 9,000 MT is sold to off takers/ companies outside Adjumani such as Mount Meru Company in Lira. Figure 20 is a value chain actor product flow with each actor described in detail below.

Input suppliers: There are approximately 25 agro-input dealers mainly located in Adjumani town and are operated by refugees and host communities. On average, they have stock of less than UGX 5 Million. They borrow over 90% of the operating capital from financial institutions. Over 98% of the input dealers are registered with the Adjumani town council authority and each pays a trading license fee of UGX 30,000 per year. Sixty percent of the agro input shops are owned by men and each employs 1 - 2 informally trained youth. They stock a variety of soybean related agro-inputs ranging from seeds (Massey 3N and Saga soybean seeds), agro-chemicals (herbicides, pesticides) and other farm implements. The cost of soybean seed is UGX 5,000/Kg. The agro dealers also offer limited extension services to their customers.

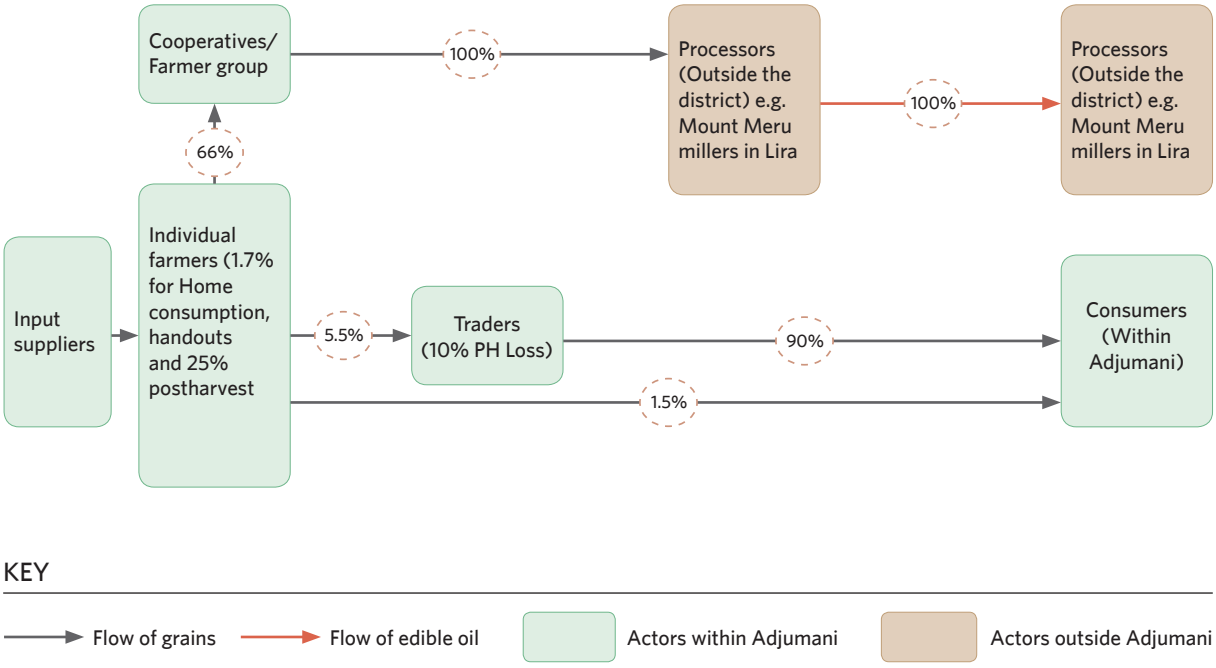


Figure 20: Value chain map for Soybean in Adjumani
Source: Primary data, 2020

Farmers: It was established that soybean is an emerging crop in the district and is mainly grown by the host communities. However, according to the District Officers of Production and Marketing, there is growing interest among refugees. Farmers are widely distributed in rural and peri-urban areas with high concentration in Itirikwa and Pakele Sub-counties. Only farmers in Itirikwa sub-county are organized into cooperatives with the rest of the farmers operating as individuals. This is possibly because Itirikwa sub-county was the first to embrace soybean production, and the farmers established cooperatives to improve market access.

Soybean is a commercial crop that is grown on small farms of 1-2 acres. Men comprise 80% of the farmers. The enterprise is characterized by low level of mechanization and inadequate use of agro-chemicals. Farmers use animal draught power (15%), hand hoes (80%) and tractors (5%) for land preparation. The common variety is Saga which is grown by 60% of the farmers while the remaining 40% grow Massey 3N. Majority of farmers do not apply GAPs and activities such as weeding, harvesting, drying, threshing and winnowing are undertaken manually leading to low yields of 0.4 - 0.8 MT/acre. Farmers sell to cooperatives at UGX 2,000/ Kg but the price can go for as low as UGX 1,000/Kg depending on the season and demand.

The farmer group in Itirikwa Sub-County consists of 89 soybean farmers and women comprise 55%. Each member pays an annual membership fee of UGX 20,000. In another group, Ofua Produce and Marketing Cooperative, farmer aggregates on average about 63 MT in a season which they harvest, dry, clean and transport directly to the processors (e.g. Mount Meru Ltd) located in Lira. Mount Meru buys the soybean at UGX 2,000 per Kg from the cooperatives.

Traders can be medium scale or retailers. Medium scale traders sell an average of 1 MT per month (10 bags) during the harvest season. On average, a trader has an operating capital of approximately UGX 1,000,000 per month. About 65% access capital from Adjumani Town SACCO. Medium scale traders purchase soybean at a price of UGX 1,000 - UGX 1,500/Kg from farmers. On a good village market day, a trader can buy produce ranging from 50 – 150 kgs from over 20 farmers (70% of these farmers are women). Most of the traders are registered either at the Awindiri market, district level and some with Uganda Registration Services Bureau (URSB). However, at the time of this study, most of them were not in operation because it was off season. The study therefore focused on retail traders.

Notably, 95% of the retailers are women that sell soybean in local markets. Retailers buy 100% of their soybean grain from farmers at a price of UGX 1000/kg. Their selling price is UGX 1,500 – 2,000/kg. A retailer pays a market fees of UGX 5,000 per month to the market authority. None of the interviewed retailers had contractual arrangements with other actors. On average, a retailer handled between 15 kg – 30 kg per week

Large scale processor: A snapshot of Mount Meru Company Ltd a major off taker of soybean from Adjumani District.

MOUNT MERU MILLERS GROUP - LIRA

The company is in Lira town with an installed capacity of 300 MT/day and is currently operating at an 80% utilization capacity. Mount Meru produces refined oil for human consumption and soybean cake for poultry feeds. Saga soybean variety is the most preferred for processing compared to the other varieties because it relatively has high protein content and yields higher. The processor sources soybean from various districts including Gulu, Adjumani and Lira using agents or farmer groups. The Ofua Produce and Marketing Cooperative (OPM) confirmed that they supply about 63 MT of soybean to Mount Meru Company every season. The buying price ranges from UGX 1500/kg to UGX 2000/kg depending on quality and season. The major constraint facing Mount Meru is inadequate volumes supplied.

D. Profitability assessment of soybean

Gross Margins (GMs) for the different actors in the soybean VC were used to assess profitability. The assumptions to enable the assessment were: (1) The yield of 0.8MT/Acre; (2) Post-harvest loss of 25%; (3) land opening is by hand hoe, ox plough and tractor were used.

Given that farmers in Adjumani use multiple methods to open land i.e. hoe, ox-plough, and tractor, the analysis considered all of them. In the analysis, the prices of UGX 2,000/Kg of soybean, postharvest losses of 25% (due to local varieties whose pods shatter prior to harvest) and yield of 0.8MT/acre was used. ***The GM analysis presented below reveal that farmers who use tractors to open land get the highest GMs in GX per acre of 173,100 followed by ox-plough (UGX 113,100) and least is with hand hoe (UGX 93,100). This is attributed to the least labour costs associated with land opening using the tractor.***

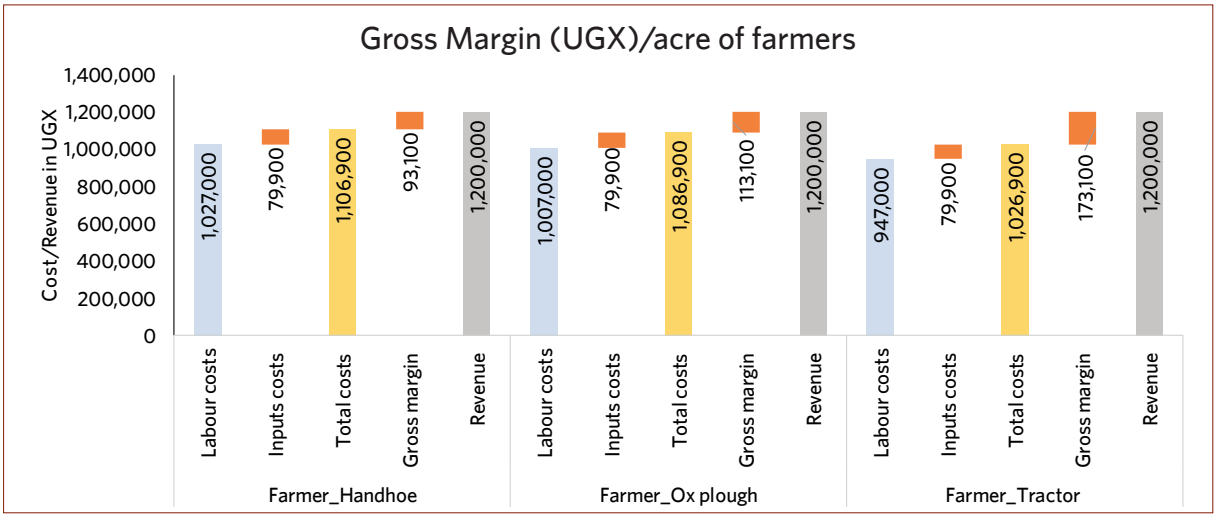


Figure 21: Gross margins for soybean farmers per acre by method of land opening
Source: Primary data, 2020

The major cost driver among farmers is labour constituting 50% of the total costs. Figure 21 above shows the GM in UGX/Kg for soybean farmers using different land opening methods. Farmers using tractors earn the highest GM per Kg of soybean and per acre of soybean as seen in figure 22.

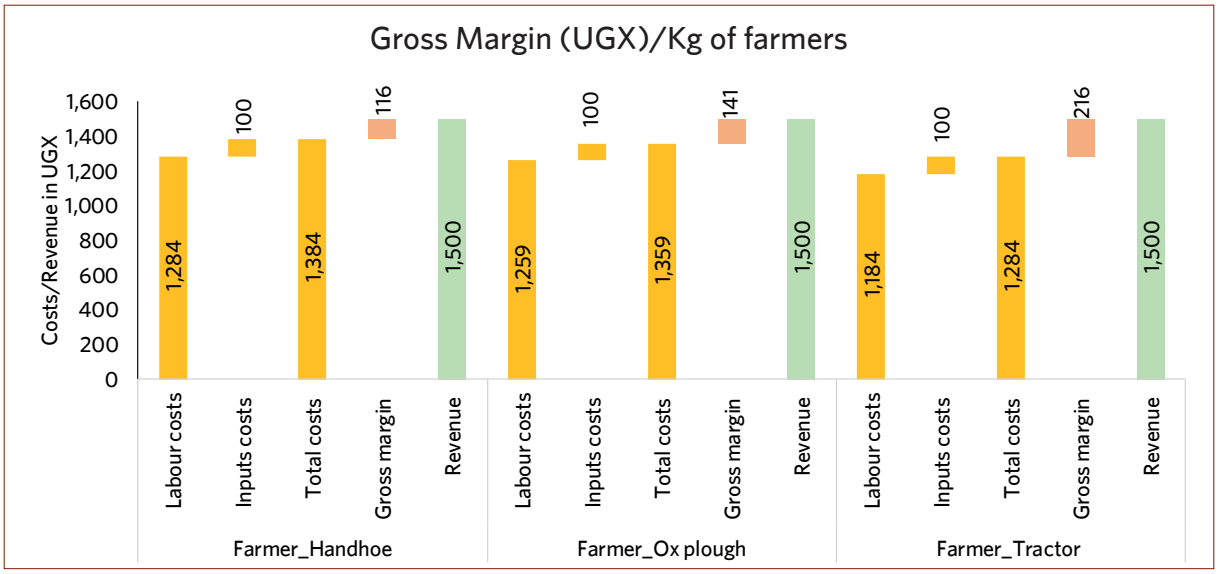


Figure 22: Gross margins for soybean farmers per Kg
Source: Primary data, 2020

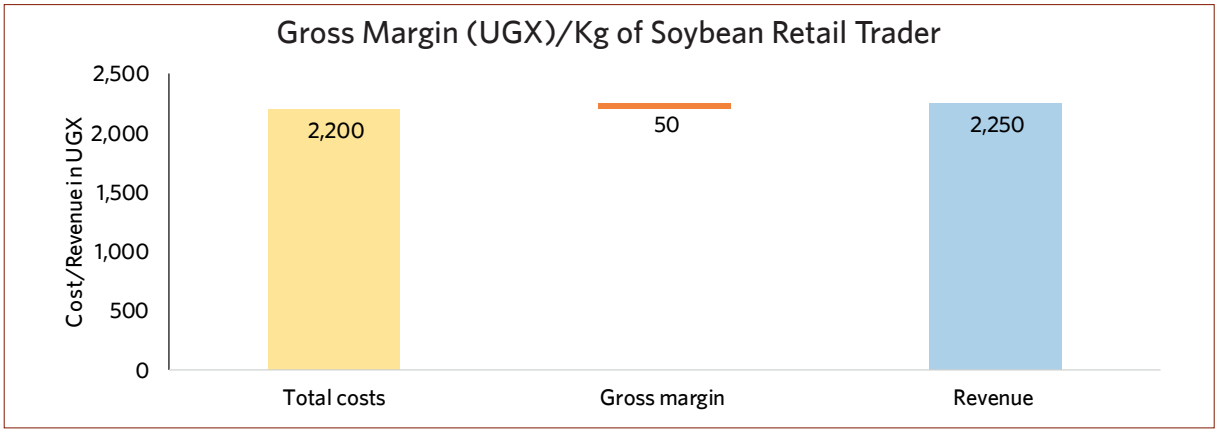


Figure 23: Gross margins for soybean retail trader per Kg
Source: Primary data, 2020

Retail traders: These get a GM of UGX 50 per Kg. The low GM is attributed to the high operational costs such as cost of gathering soybean from farmers and market fees which account for 95% of the total costs. As a result, there are very few retailers in the district. .

Share of value: The soybean has two supply channels. In all the channels, farmers take the lion's share of value i.e., 69.9%under channel 1 and 100% in channel 2. This is because there are few traders in the VC and the organized farmer groups deal directly with processors e.g. Ofua Produce and Marketing Cooperative (OPM) in Itirikwa Sub-county. Supply Channel 2 should be promoted i.e. have soybean farmers organized in produce and marketing groups.

Figure 24: Share of value along the Soybean value chain
Source: Primary data, 2020

E. Employment generation along the Soybean Value Chain

In the estimation of jobs, detailed activities from production node to processor node are taken into consideration. These converted into man days and then fulltime jobs are derived. One acre of land cultivated with soybean produced 1,600 Kgs (800 kgs per season) per year. The employment at farm level is categorized by method of tilling land. A total of 0.84 jobs per acre per year were generated at the production level and 1.282 FTE jobs were generated at the trading node. With total of 8,342 acres under soybean production in Adjumani, the least jobs were created when a tractor was used in opening land because it is energy saving (Table 16).

Table 16: Total number of jobs created, and the wages earned

Value Chain Node	FTE jobs		Total Wages in UGX in 1 year	
	1 Acre	8342 acres	Acre	8,342 acres
Production Hand hoe	0.84	7,032	2,213,800	18,467,519,600
Production Ox plough	0.75	6,283	2,173,800	18,133,839,600
Production Tractor	0.73	6,069	2,053,800	17,132,799,600
Trade	1.282	10,695	20,000	166,840,000
Total for entire value chain Hand hoe	2.13	17,727	2,233,800	18,634,359,600
Total for entire value chain_ Ox plough	2.04	16,978	2,193,800	18,300,679,600
Total for entire value chain_ Tractor	2.01	16,764	2,073,800	17,299,639,600

Source: Primary data, 2020

F. Social benefits along the soybean value chain

Both women and men engaged in numerous activities along the soybean value chain from production to marketing for instance land opening and marketing is mostly done by men while women and youth engage in activities such as planting, weeding, harvest and post-harvest management process of soybean (Tukamuhbwa, 2016). Soybean though mostly grown by host communities, the refugees too are keen to learn the market opportunities and needs so they can make a business decision.

Soybean oil plays an important role in cooking, baking and food processing, as well as in biodiesel production and other industrial applications. Soybean is the most important oil crop in the world (Thoenes, 2016). It is also an affordable source of protein for human and livestock. The protein content of soybean is the highest among legumes, averaging 40% of dry matter (Tukamuhabwa, 2016). The major soybean products in Uganda are soybean meal, soybean oil and several soybean-based food products (Tukamuhabwa & Oloka, 2016). The soybean grain is processed into edible oil and seed cake. The edible oil is sold in supermarkets and by wholesalers around the country to final consumers. The seed cake is purchased by farmers and traders that use it in making animal feed.

Regarding environmental effects, soybean has both positive and negative effect on the environment. For instance, the plants take nitrogen from the air and fix it in the soil through a symbiotic relationship with the Rhizobium bacteria, which means that soy plants need very little nitrogen fertilization (The Dutch soy coalition, 2006). In addition, soybean debris contribute to organic manure if left to decompose in the field.

Further a study by Arrietta et al. (2017) on greenhouse gas emissions and energy efficiencies for soybeans and maize cultivated in different agronomic zones reveals that the national average for production of soybeans and maize in Argentina resulted in 6.06ton/ton CO2-eq emitted to the atmosphere, while 0.887ton of soybean were produced per GJ of energy while 5.01ton/ton CO2-eq emitted to the atmosphere and 0.740ton of maize were produced per each GJ of energy used respectively.

G. Public, private, and community sector support

Soybean in Uganda is categorized as an oil crop. Under ASSP II 2015/2016 – 2019/20 oil seed is one of the four strategic commodities that was prioritised to lead the transformation of the smallholders from subsistence to commercial farming. The oil seed subsector in Uganda is coordinated by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) with the mandate of policy formulation, regulation and quality control. MAAIF works in collaboration and with support from multiple stakeholders. For instance, Uganda Oil Seed Producer and Processors' Association (UOSPA) and the Oil Seeds Sub Sector Platform (OSSUP) that are largely private sector, support the coordinated action in the oil seeds subsector.

The subsector is also supported by a strong Institutional framework for standards development, harmonization, and enforcement. These include Uganda National Bureau of Standards, National Agricultural Research Organization, The Grain Council of Uganda (TGCU) and East African Grain Council (EAGC), Common Markets for Eastern and Southern Africa (COMESA) and the East African Community Secretariat (EAC) at regional levels. The vegetable oil development (VODIP) interventions funded by IFAD have promoted soybean, sesame and sunflower production in close collaboration with the Government of Uganda. SNV has supported in organizing farmers into groups and improve access to market. However, the major challenge is that the coordination of all these actors in providing support to the sub sector is weak.

The seed oil subsector is guided by the following policies: National Agriculture Policy, 2016, National Fertilizer policy, 2016, National Trade Policy 2007, National Seed Policy, 2018, and National Grain Trade Policy, 2016. Despite all these policies, there is weak coordination and lack of implementation structures among multiple stakeholders in the guiding policies, quality standards and marketing regulations that need to be harmonized to link production, processing and marketing in order to structure the soybean VC.

Just like sesame, the soybean Public Private Producer Partnership (4P) Model promoted by SNV under IFAD funding hinges on the market opportunity, creation and strengthening of a supply relationship between the processor of soybean, and soybean producers in Adjumani district, thus addressing existing and unmet supply need for higher volumes of soybeans. The private sector has a key role in communicating buyer requirements and training in post-harvest management. Specifically focusing on the different farmer groups being able to develop their organization's capacity to effectively deliver to the off takers as per agreements signed. Trainings are needed in bookkeeping and financial management for increased transparency and to facilitate decision-making. As well, trainings in farming as a business (Faab) and good agronomic practices (GAP) are needed.

H. Threats and community preparedness

Along the soybean VC, the different actor experience threats as they engage. The actors together with the community have devised coping mechanisms that enable them minimize the extent of the threats. For instance, the input suppliers knowingly or unknowingly deal in counterfeit inputs and outputs that lead to low quality produce and resistance of the pests. Poor quality seeds lead to low levels of germinability and hence low-quality grain sold. Consequently, lower prices are received by farmers or miss markets to supply. The farmers cope by blacklisting such suppliers leading the input suppliers to pass on feedback from farmers to their suppliers.

Pests and diseases are one of the challenges in the soybean for instance soybean rust and weevils. These affect soybean during the season or during periods of storage. The way pest and diseases effects can be limited is through improved access to tolerant varieties and adoption of good storage facilities. Management of pests and diseases is associated with the extension services provided.

Extension service provision: The available extension staff at the district and sub-county has capacity but they are challenged by the ratio of technical staff to the farmers. NGOs and government programmers like NUSAF 3, VODP2 and associated PFSP have been able to train producers in agronomy, farming as a business and institutional capacity development. However, market linkages have not been forthcoming or sustained for multiple seasons. Matching the demands of the market with production level activities and initiatives to ensure sustained production for specific market has been a challenge.

Unregulated/unfair trading: During the harvesting season, there are a number of buyers who source grain from smallholders. However due to the limited volumes of grain, some buyers will artificially raise the price of soybean grain, without considering the quality and are sometimes not licensed to trade in Uganda. These are opportunistic buyers, who are unwilling to invest in the production process. They also inflate producer price expectations that make producers inflexible during future price negotiations.

Limited access to finance: Agribusinesses associated with soybean also face challenges in accessing finance. The agriculture sector is often perceived as a high-risk sector which deters investors from partnering with agribusinesses. There are various challenges faced in soybean production and marketing and these are presented in Table 17 along with mitigation strategies.

Table 17: Challenges faced by actors at different nodes of the Soybean value chain

Value chain actor	Challenge	Mitigation Strategy
Farmers	1) 1) Use of poor seed varieties that shatter during harvesting and lead to losses 2) Insufficient storage facilities at the watershed leading to high post-harvest losses. 3) Poor rural roads that increase the cost of transport. 4) Unpredictable weather leading to low productivity 5) Unreliable markets in Adjumani leading to poor planning and increasing risks in the value chain.	1) 1) Capacity building in GAP and use of non-shattering and high yielding varieties e.g. Massey 3N, 4N and 5N, fertilizer, pesticides, herbicides, and reduce post-harvest losses. 2) Build aggregation centres in the watershed to strengthen collective marketing of farmers and offtake from traders. 3) Construction of rural roads in soybean production sub counties like Itirikwa and Pakele. 4) Sensitize and promote crop insurance as well as timely planting. 5) Market linkages to processors in Adjumani (DIA Ltd) and outside Adjumani like Mt. Meru, Mukwano, GADC Ltd.
Traders	1) 1) Insufficient storage facilities leading to high post-harvest losses 2) Poor rural road resulting in high transportation costs. 3) Limited access to credit for business expansion.	1) Construction of storage and aggregation centres at the watershed. 2) Construction of rural road network. 3) Linkages to financial institutions.

Source: Primary data, 2020

I. Conclusions and recommendation for investment

From the above analysis, the following conclusions can be drawn:

1) Host communities are the main producers of soybean in Adjumani while traders are a combination of refugees and host communities.
2) The soybean VC has few individualistic actors. The trade is largely unstructured i.e. traders and the few organized farmers sell directly to processors.
3) At production level, the enterprise is profitable for farmers who use tractors. However, the GM per Kg of soybean is low and ranging between UGX 50 and UGX 114.
4) Provides jobs to approximately 4% of the population in Adjumani district

The average yield of soybean in Adjumani is 0.8MT/acre which is relatively low compared to the recommended soybean yield of 1.4 MT/acre when a good variety such as Massey 3N, 4N and 5N is used. To address the challenges, below are some investment proposals as recommendations:

1. **The Public Investment proposals to support the soybean VC are:**

   Invest in the rehabilitation of the roads and bridges e.g. Bridges in Pachara and Ayilo (Scenario 5). This can increase profitability of farmers by 174% and that of traders by 210%. A combination of building the capacity of farmers and rehabilitating roads would increase profitability by 524% and the number of jobs created by 108%.

   Construction of aggregation centres is the second investment. These are critical especially given that farmers in Adjumani will be producing 3 times their current volumes making storage at farmer level a challenge. Scenario 6, which is the best case in which all the three proposed investments are carried out, farmers, traders and processors earn better gross margins.

2. **The DRDIP investment proposals include:**

   The market for soybean is largely driven by the animal feeds industry. In the interview with Mt. Meru Ltd Operations Manager, it was established that the company has a processing capacity of 1O9,500 MT per year and can increase their yearly procurement (by 20 – 50%) to 21,900 MT. If DRDIP can secure a guaranteed market linkage with MT Meru Ltd for soybean farmers then the analysis reveals that scenario 6 in which yields increase, roads are rehabilitated, and aggregation centres are built would be the most desirable.

   Train farmers on GAP, GPHH, Farming as Business and Standards. This would increase profitability of farmers by 381% and jobs would increase by 109% at the farm level. Jobs will also increase at trader level by 20% (Scenario 2). If the market opportunity is taken into consideration, then DRDIP will need to support farmers to increase production by cultivating an additional 9,125 acres. Given that each group has a grant of UGX 18.5 Million, this is equivalent to 810 groups each cultivating 11 acres. Alternatively, if DRDIP increases the grant from UGX18.5M to UGX 49 Million per group producing on all the 30 acres, 304 groups will be needed to meet the market opportunity.

   Skills needed in comprehensive farm management (farming as a business, financial literacy and good governance practices) as well as repair and maintenance of tractors, irrigation systems and roads if possible. Skills in responsible large scale based agricultural investments and climate smart agriculture.

3. **Private sector support recommendations are:**

   a) To bridge the information asymmetry in the value chain – an information platform between farmers and traders can be piloted to ensure that there is accurate information available.

   b) Access to credit facilities available and future credit plans given by DRDIP.

   c) Solutions to land opening challenges through availability of tractors of different sizes for hire at sub-county level

a. Assumptions

Table 18: Assumptions in scenarios developed

Farmers	Traders
• Increasing yield from 0.8MT to 1.2MT/Acre as a result of using GAP • Reduction of postharvest loss from 25% to 10%. • Tractors are used for land opening.	Reduction of postharvest loss from 10% to 5%.
Potential Market Opportunity	
• Adjumani currently supplies 8,849MT • Mount Meru has an installed capacity of 300MT/day or 109,500 Mt/yr, if soybean is key in the Kenyan animal feeds industry and Mount Meru increase the demand volumes, for example by 20% (21,900MT) more per year. • Assuming best case scenario in yield improvement and post-harvest loss management, this is equivalent to **9,125 Acres** • DRDIP provides a grant of UGX18,500,000 per group • Each group has 10-15 members • Each member can access up to a maximum of 3 acres	

Source: Primary data

b. Scenario analysis

Table 19 shows 6 scenarios that have been considered for the Soybean value Chain in Adjumani.

Table 19: Impact of Investment scenarios

Category	Item	Current scenario	Yield increase including reduction in PHL	Road Improvement only	Construction of aggregation centres only	Yield Increase + Road improvement	Yield increase + Road improvement + Construction of aggregation centres
	Scenario	(1)	(2)	(3)	(4)	(5)	(6)
Farmer	Price per Kg	2,000	2,000	2,000	2,000	2,050	2,100
	Revenue per acre	1,200,000	2,160,000	1,200,000	1,120,000	2,214,000	2,268,000
	Cost of production/ acre	1,106,900	1,712,400	1,090,900	1,110,900	1,633,200	1,641,200
	Current GM in UGX/ acre	93,100	93,100	93,100	93,100	93,100	93,100
	New GM in UGX/ acre	Na	447,600	109,100	9,100	580,800	626,800
	% increase /decrease of GM	Na	381	17	-90	524	573
	Jobs created	7,032	14,726	6,978	7,032	14,605	14,605
	% Increase / decrease in Jobs	Na	109	-0.8	-	108	108
Traders	Variable costs in UGX per Kg	2,200	1,422	2,930	2,933	2,361	2,311
	Revenue in UGX per Kg	2,250	2,375	2,700	2,700	2,945	2,945
	Gross margin in UGX per Kg	50	953	-230	-233	584	634
	Jobs created	10,695	12,834	8,770	8,556	10,524	7,957
	% Increase / decrease in Jobs	Na	20	-18	-20	-2	-26
Market	Market opportunity in MT						21,500
	Annual yield in MT						2
	Additional acres						91,25
	Grant/group in UGX						18,500,000
	Acres per group						30
	# acres/group with grant of UGX 18.5M	17	11	17	17	11	11
	# of groups to meet market opportunity	819	845	538	548	806	810
	# of groups if grant amount in UGX is increased to cover production costs and meet market opportunity	456	304	304	304	304	304

Source: Primary data

3.1.4 Tomato Value Chain

A. Background

The horticulture sub-sector in Uganda is growing at a rate of 20% per year, the fastest growth in the agricultural sector (Uganda Investment Authority, 2009). The sub-sector is dominated by small farms of less than 2 Ha. Farmers produce for both local and export markets. The most important horticultural crops include green beans, cowpea, pepper, onions, crucifers, amaranthas and tomatoes.

Tomatoes are grown on small farms of about 0.2 acres. The average yield is 1.0 MT/acre compared to the potential of over 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 monocrop under rain-fed conditions in two seasons per year. The first growing season is April - May and the second is September - November (Dijkxhoorn et al., 2019).

The crop is highly susceptible to pests and diseases making pesticides a key input. 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 insect pests (Tumwine, 2010). The attack by late blight alone can lead to lose of the entire crop if fungicides are not applied on time (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. Nevertheless, the farmers are faced with a challenge of counterfeit pesticides coupled with poor skills by farmers on the use of equipment, and chemicals, leading to pesticide resistance (CABI, 2017). Relatedly, Atuhaire (2016) reported high pesticide contamination in tomatoes, which is a threat to consumers' safety and the success of the value chain.

Tomato is not among the priority commodities under the NDA II. However, the Adjumani District Development Plan (2015- 2020) recognizes vegetables as one of the strategic high value crops to be promoted for commercial production and income generation. Nevertheless, the plan does not mention any specific vegetable like tomato. The district local government and the community prioritized tomato as one of the eight value chains for investment under the Development Response to Displacement Impacts Project (DRDIP).

B. Demand and Supply

Supply and demand of tomato has been increasing steadily with an Annual Average Growth Rate (AAGR) of 4.8% and 1.2% respectively in 2007 and 2017 - mainly driven by population growth and consumer preferences especially in urban and peri-urban areas (Figure 26). 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 increasing the demand and price of tomatoes. Both planting seasons in Kenya in 2016 received reduced rains (World Weather Attribution, 2020) and production reduced by 17% (FAOSTAT, 2020).

The major local markets for tomatoes in Kampala are 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 still low at 5.5 MT/Ha as of 2018 which is far below the potential yield of 56 MT/Ha (FAO, 2020).

.

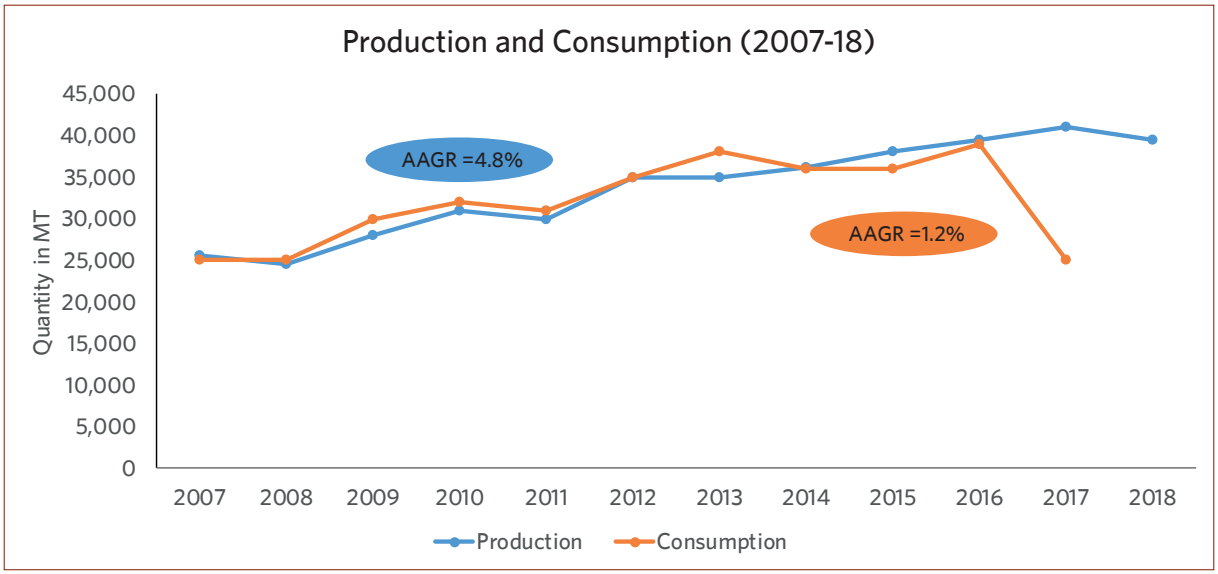


Figure 25: Tomato production and consumption in Uganda
Source: FAO, 2020

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 average annual growth rate of 93% and 34% respectively. About 81% and 77% of the fresh tomatoes and ketchup, respectively are exported to Kenya, while 77% of prepared tomatoes are exported to DRC. The other destination countries for tomato products are Burundi, Rwanda and South Sudan.

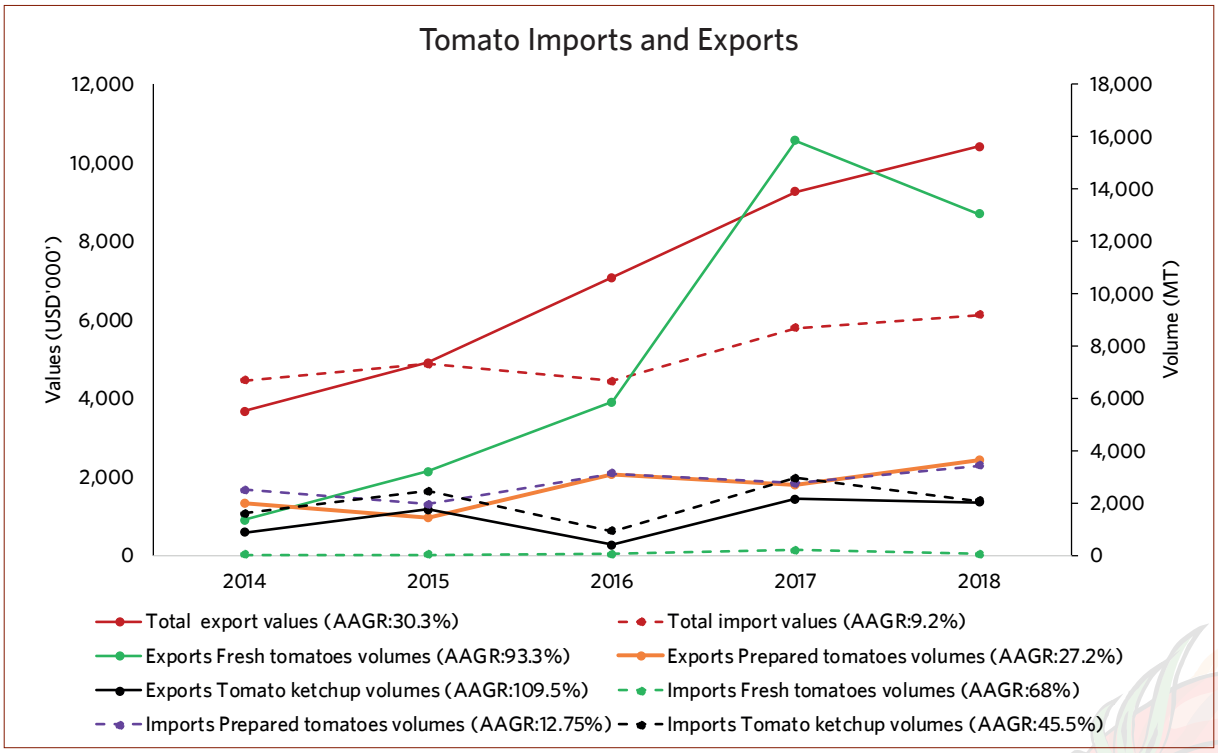


Figure 26: Export of formal tomato products from 2014 to 2018
Source: International Trade Centre, 2020

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

C. Value Chain actors

Tomato production in Adjumani is mainly undertaken by the refugee community and approximately 7,648 MT of tomatoes are produced annually. This output meets about 40% of local demand. The 60% (3,442 MT) deficit is purchased from neighbouring districts such as Luweero, Lira and Mbale. This presents a huge opportunity for tomato farmers in Adjumani to substitute purchase from other districts. All the tomatoes produced in Adjumani are sold fresh. Consumers prefer large sized tomatoes that are free from physical damage. Information gathered from the different actors in the value chain is presented below.

Input supplier are mainly located in Adjumani town council, the district's capital. Over 95% of the input suppliers are registered with the district authority and each pays an annual trading fee of UGX 30,000. Their stock base is less than UGX 5 Million and over 95% of them use own savings to finance their businesses. Ninety five percent of the input suppliers purchase their stock from Kampala and Gulu towns. Input shops are owned by 95% of men and employ one or two youths as shopkeepers. Agro-inputs stock open pollinated varieties (OPV) tomato seeds such as money maker and calge. They also stock simple tools such as hand hoes and watering cans. In addition, input suppliers provide limited extension services on use of inputs although it was observed that most of the input shop attendants are not adequately trained.

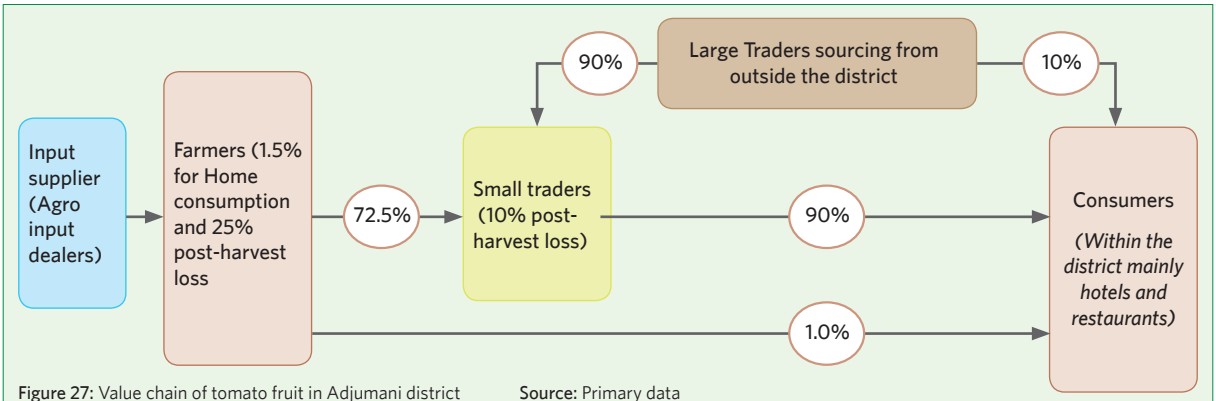


Figure 27: Value chain of tomato fruit in Adjumani district **Source:** Primary data

Farmers grow tomatoes under rain fed conditions with only 5% of them irrigating. Farmers cultivate 0.25 - 1 acre of tomatoes. Eighty percent of the refugees grow tomatoes on hired parcels of about one acre. Use of improved technologies is rare with most of the farmers using hand hoes. Irrigation technologies are rudimentary and include bottles and buckets. OPVs are common among 95% of the farmers with the rest planting hybrid varieties like Calge and Nuri 1. A Kilogram of the OPV varieties costs an average of UGX 6,000 while the hybrids cost as much as UGX 78,000 per 10g tin. Farmers reported a germination rate of 70% - 85% regardless of the variety. Ninety percent of farmers had inadequate skills of using various agrochemicals. Moreover, half of the farmers who used agrochemicals reported that they were of poor quality, as shown by their little effect on treating diseases and killing pests.

Savings was the main source of capital for 98% of the farmers with the rest securing loans from Village Savings and Loan Associations (VSLAs). Men and women were equally involved in all activities other than spraying and marketing which are dominated by men. Productivity was 0.7 MT/acre and loses were 20% - 30% of the harvested crop due to poor packaging materials, pesticides and diseases. Seventy three percent of the total harvest is sold at farm gate at an average price of UGX 2,850/Kg. Farmers have no contracts with buyer and retailers are the largest buyers of tomatoes from farmers purchasing 72.5% of the produce (Figure 28).

Small Traders (within the district): Men and women (from host and refugee communities) are involved in tomato trade with women making 60% of the traders. Each has stock of approximately UGX 2M and operate stalls in the community market. Most of the traders are not organized in groups and they deal in fresh tomato only. Traders are not registered with the district but pay a market fees of UGX 1,000 UGX/ day to the market authority. Traders purchase tomatoes on spot basis, for they do not have contracts with farmers but each trader buys about 5 MT/season. The traders also buy tomatoes sourced outside the district. The selling price ranges between UGX 3,500 - 5,000/ Kg depending on the season. The traders mainly sell tomatoes to the final consumers in Adjumani district who include households, hotel, restaurants and institutions.

Large Traders (from outside the district): These are mainly men who handle large volumes (1-ton trucks) and source their tomatoes from Luwero, Mbale and Lira. They bridge the deficit in fresh tomatoes in the district and usually transport the tomatoes in lorries and sell to traders and consumers. The traders sell 90% of the tomatoes purchased to small traders within the district and 10% to final consumers.

D. Profitability of the tomato value chain

In estimating the profitability, the GM analysis was used, and the following assumptions were considered:

- • Price of tomatoes per Kg is UGX 2,850 and UGX 3,350 for farmers and trader respectively.
- Pot harvest losses are 25% and 10% for farmers and traders respectively.
- Yield per acre is 0.8 MT.

Farmer earns a GM of UGX 193,167/ acre cultivated with the major cost driver being labour taking up 89% of the total cost. The least cost driver is input cost contributing 11% to total operation cost.

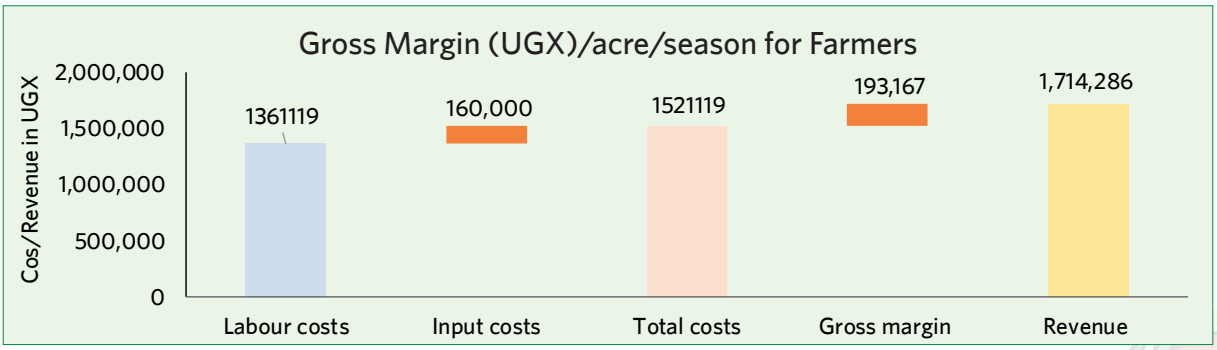


Figure 28: Gross margins for tomato farmers per acre
Source: Primary data, 2020

The GMs for farmers per unit of Kg produced is UGX 241. The traders earn a GM of UGX 378 per Kg with the major cost driver being purchase of tomatoes accounting for 96.4% of the total costs. The GMs although positive, are economically insignificant unless large volumes of tomatoes are handled by each actor.

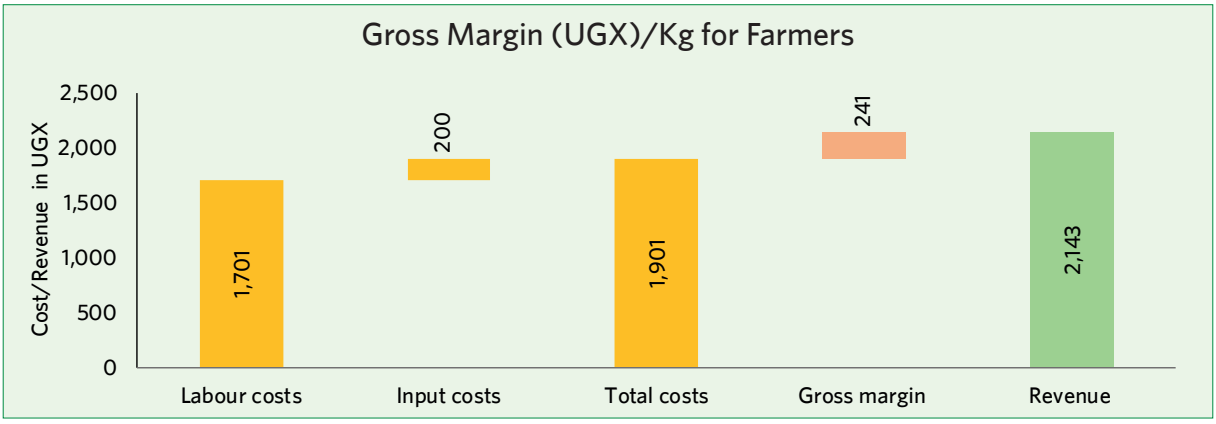


Figure 29: Gross margins for tomato farmers in UGX/Kg
Source: Primary data, 2020

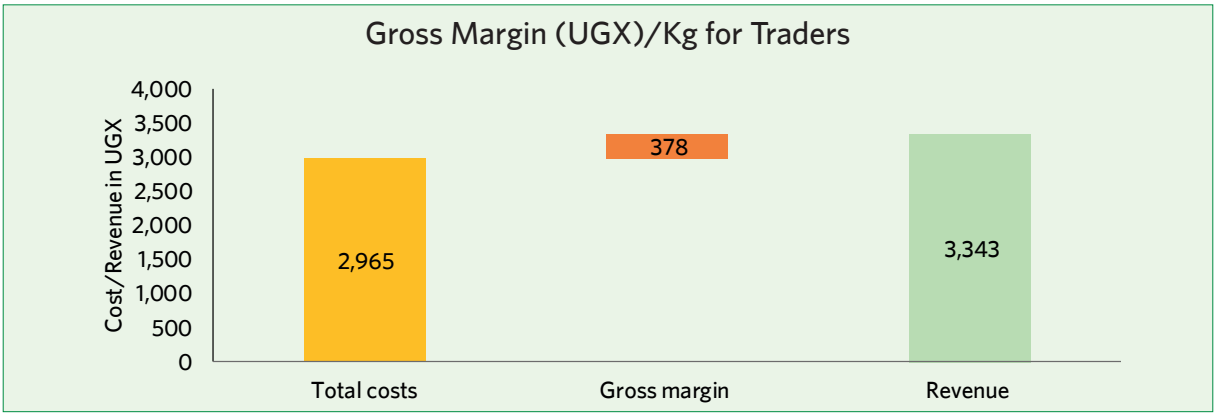


Figure 30: Gross margins for tomato traders per Kg
Source: Primary data, 2020

Share of value:

There are two supply chains in channel 1, traders get the higher share of GM compared to farmers while in channel 2, farmers keep 100% of the share since they sell to final consumers. Having the farmers organized into groups and coordinating the delivery to customers may enhance the farmers' benefits.

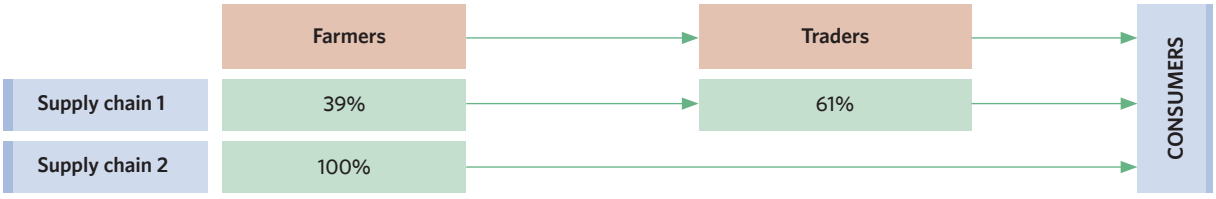


Figure 31: Share of value for tomato farmers and traders
Source: Primary data, 2020

E. Employment generation along the value chain

The employment generation potential was estimated using the Full Time Equivalent approach. In addition, the wages earned were estimated per district. The FTE jobs units per acre grown were used as the multiplier factor to estimate the number of FTE jobs under the existing acreage under production in the district. The employment estimates are presented basing on the detailed activities in tomato production and the human effort required. Cultivating an acre of tomatoes generates 0.71 FTE job units (71 jobs for every 100 acres) whereas trading creates 0.006 FTE job units (6 jobs for every 1,000 acres). Production of tomatoes is labour intensive which explains the higher FTE job units compared to trading.

According to the District Agricultural Officer, a total of 4,780 acres is under tomato production, translating to 3,378 and 43 FTE jobs at farm and trading levels respectively (Table 20). Relatedly, wages earned are worth UGX 2,626,190 when an acre of land is cultivated translating to a total of UGX 12,799,360,476 if 4,780 acres of tomatoes were cultivated (Table 20)..

Table 20: Jobs created at farm and trading levels of the tomato value chain

Value Chain node	FTE jobs		Total Wages in UGX in 1 year	
	1 Acre	4,780 acres	1 Acre	4,780 acres
Production	0.71	3,378	UGX 2,626,190	UGX 12,553,190,476
Trade	0.01	43	UGX 51,500	UGX 246,170,000
Total for Entire Value Chain	0.72	3,421	UGX 2,677,690	UGX 12,799,360,476

Source: Primary data

F. Social benefits along the value chain

Tomato production is practiced by both refugees and host communities because small plots of land are used. 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 crop production (54%), and horticulture (58%) activities. Relatedly, a study by Atuhaire (2014) in Uganda asserted that females use smaller pieces of land to grow tomatoes and this could explain why tomato farming is practiced by women as home/kitchen gardens for home consumption.

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.

G. Environment issues

A study conducted by Eshun et al. (2011) in Ghana revealed that approximately 8,544 kg CO2 -equivalents of greenhouse gas was emitted per hectare of tomato produced. The major three contributors to the greenhouse gases were Carbon dioxide (CO2), Methane (CH4) and Nitrous oxide (N2O) with Nitrous oxide (N2O) accounting for the highest value followed by Carbon dioxide (CO2). Furthermore, among the activities that generated greenhouse gases, fertilizer application ranked the first with a share of 97%. Relatedly, fertilizer use in tomato production contribute to ground water

contamination. The runoff of nitrate and phosphate into ground waterbodies from fertilizes causes accelerated eutrophication (Carrizosa et al., 2003).

H. Public, private 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 utilization 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.

There are other private partners in tomato production in Adjumani District and these are mainly NGOs such as Lutheran World Federation (LWF), World Vision, Plan Uganda, Self-help Africa and Norwegian Refugee Council (NRC). These in collaboration with the local government provide capacity building to both refugees and host communities in vegetable production especially on home/kitchen gardening for food security and income generation. They also provide extension services oh how to manage the tomato field as well as marketing skills.

Therefore, 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. Threats and community preparedness

Tomato is highly susceptible to pest and disease. The major pests are aphids, whiteflies, thrips, African bollworm, and highlands green mites that cause economic damage to the leaves, fruits and some transmit viral diseases in tomatoes. Control of pests is by spraying with synthetic pesticides; however, the challenge is improper pesticide use that is putting both producers' and consumers' health at risk. This misuse is mainly driven by inadequate knowledge, community beliefs, and market demand.

The common diseases are late blight which comes early during vegetative stages of the tomato, and early blight which comes at the stage when tomatoes are aging, these are a big threat to farmers. Diseases are managed by spraying with fungicides such as Mancozeb (Dithane M45) and copper that are reported to be not very toxic.

Presence of counterfeit pesticides coupled with the absence of harmonized pest and disease control programs and inadequate extension services escalated improper use of pesticides. 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.

Another threat to tomato production and marketing is 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. Some of the most common packaging materials are jute sacks and polytene bags. These packaging materials do not allow better aeration within the packaged tomatoes thereby causing a build-up of heat due to respiration. Farmers have adopted the use of wood crates as well as woven basket like crates to reduce losses attributed to poor handling and transportation.

Poor road network leading to tomato production and marketing areas is a major hinderance hampering drawing higher profits from tomatoes. The settlements and remote areas that are far limit access to competitive markets. Worse still the extension system is inadequate to support farmers adopt appropriate skills and productivity enhancing technologies. Table 21 below presents a summary of the challenges and mitigation measures along the tomato VC.

Table 21: Challenges and mitigation measures along the Tomato value chain

Node	Challenge	Mitigation
Farmer	1) High labor cost for land preparation and weeding. 2) High pest and disease prevalence leading to low yields. 3) Poor rural road network leading to high transport cost 4) Unpredictable weather that leads to poor planning and reduced yields 5) Individual mentality of farmers that constrains collective potential in accessing input and output markets.	1) Use of labor-saving technologies like herbicides and tractors. 2) Training in GAP and proper use of pesticides, herbicides. 3) Investment in the road construction and maintenance 4) Investment in affordable irrigation systems to mitigate against effects of weather changes 5) Build the capacity of the farmer organizations in leadership, governance and financial literacy
Trader	1) High post-harvest losses leading to reduced profits. 2) Poor road network leading to high transport cost.	1) Finance a manufacturer to add value to the tomatoes 2) Use of good packaging of tomatoes to reduce losses due to handling 3) Construction or rehabilitation of rural roads.

Source: Primary data, 2020

J. Recommended investments for DRDIP

The tomato value chain in Adjumani:

1) Has few actors in the VC
2) Refugees are the majority actors in the VC
3) Is underdeveloped and trade is unstructured.
4) It is profitable for all the actors.
5) Favors actors that sell to final consumers as they enjoy the highest share of value.
6) Is a source of jobs especially at farm level.

Within Adjumani, the farmers commonly grow OPVs and the average yield of tomatoes in Adjumani is 0.8T/acre. Despite the high susceptibility of these varieties to pests and diseases, investment in control measures is minimal and other agronomic practices such as fertilizer application and mulching are ignored by the farmers. Adjumani is a drought-prone area and the varieties grown are not drought tolerant. This leads to low tomato volumes supplied. Below are some recommendations to increase benefits to the actors.

1. Public investment recommendation areas;

a) There is need to investment in appropriate irrigation infrastructure to cushion farmers against changing weather conditions (scenario 3). The GMs increase by more than 13,000% and jobs at farmer level increase as well by 116%. Additionally, small traders have tomatoes throughout the year.

b) Feeder roads that link to production areas should be rehabilitated as well as constructing more roads that lead to production areas. Access Roads in Pakele, Ayilo settlement, Ofua and Pachara sub counties should be worked on.

c) Build community aggregation centres at watershed level so that farmers can trade in groups and the traders can save costs on aggregating tomatoes.

2. DRDIP investment recommendation areas:

a) Build the capacity of farmers in sustainable agriculture practices to enhance productivity; correct and effective use of inputs, soil conservation to increase incomes and access to markets. Train farmers in GAP, GPHH, pest and disease management, Farming as Business etc.

b) Skills required in tomato VC include farming as a business, financial literacy, value addition options, repair and maintenance of equipment as well responsible agricultural investments and climate smart agriculture. Yields would increase from 0.8 MT/acre to 15 MT/Acre.

c) Investment in good packaging to reduce postharvest losses would reduce from 25% to 10% at farm level, increasing farmers' GMs by 13,000 % and jobs at farm level by 38% (Scenario 2). With postharvest losses reduced as an intervention is implemented, there would still be a tremendous increase in profitability for the farmers and those employed in tomato production.

d) 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.

e) If we consider the market opportunity for 'import substitution', then DRDIP support could consider partnering with a tomato value addition plant so that the tomatoes produced by the Adjumani farmers can be processed for both local and export market.

3. **Private sector support recommendations are:**

a) a) To bridge the information asymmetry in the VC – an information platform between farmers and traders can be piloted to ensure that there is accurate market information that is easy to access.

b) Increased opportunities for access to agricultural financing and access to credit

c) Offer tractors hire services at sub-county level as a solution to land opening challenges

d) The necessary and fundamental investment for the tomato VC is to incentivize a private sector processor to add value to the tomatoes that have a high potential for surplus with minimal effort. A detailed feasibility study can be conducted to establish the market size in the DRC and South Sudan which are potential end markets for tomatoes produced in Adjumani.

a. Assumptions

Table 22: Assumptions in scenarios developed

Farmers	Traders
• Increasing yield from 0.8MT to 15MT/Acre as a result of using GAP and GPHH practices. • Reduction of postharvest loss from 25% to 10%. • Tractors are used for land opening. • Grow tomato 2 and 3 times a year	Reduction of postharvest loss from 10% to 5%.
Potential Market Opportunity	
• Adjumani currently imports tomatoes from another district to meet the deficit of about 3,442MT annually. • If production of tomatoes in Adjumani is increased to substitute the imported tomatoes. • Assuming best case scenario in yield improvement and post-harvest loss management, this is equivalent to 115 Acres • DRDIP provides a grant of UGX18,500,000 per group • Each group has 10-15 members • Each member can access up to a maximum of 3 acres	

Source: Primary data

b. Scenario analysis

Scenarios considered for the tomato value Chain in Adjumani.

Table 23: Impact of Investment scenarios

Category	Item	Current scenario	Yield increase including reduction in PHL without irrigation in 1 Season	Yield increase, reduction in PHL + With irrigation in 1 season
	Scenario	(1)	(2)	(3)
Farmer	Price per Kg	2,857	2,500	2,600
	Revenue per acre	1,714,286	33,750,000	35,100,000
	Cost of production/ acre	1,521,119	7,685,000	8,285,000
	Current GM in UGX/ acre	193,167	193,167	193,167
	New GM in UGX/ acre	na	26,065,000	26,815,000
	% increase /decrease of GM	na	13,394	13,782
	Jobs created	3,378	4,657	7,377
	% Increase / decrease in Jobs	na	38	118
Traders	Variable costs in UGX per Kg	2,965	2,575	2,974
	Revenue in UGX per Kg	3,343	4,267	5,715
	Gross margin in UGX per Kg	378	1,692	2,740
	Jobs created	18	1,478	7,377
	% Increase / decrease in Jobs	na	8,040	40,536
Market	Market opportunity meet the deficit imported into Adjumani in MT			3,442
	Annual yield in MT			30
	Additional acres planted with the current yield			115
	Grant per group in UGX			18,500,000
	Acres per group (Each member has a Max of 3 acres/ Household)			30
	# acres/group with grant of UGX 18.5 Million	12.2	2	2
	# of groups to meet market opportunity	177	57	57
	# of groups if grant amount in UGX is increased to cover production costs and meet market opportunity	72	4	4

Source: Primary data, 2020

3.1.5 Okra Value Chain

A. Background

Okra, *(Abelmoschus esculentus)* is a seed pod vegetable that grows on a wide range of soils provided they are fertile, well-drained, warm and with moderate rainfall. It is a fast-growing crop that takes between 50-60 days to mature. Nigeria (1,978,286 MT), Sudan (287,300 MT) and Cote d'Ivoire (112,966 MT) are the largest producers of okra in Africa in descending order (Atlas big, 2020). The global okra market is estimated to garner a revenue USD 352.7 million and growing at a rate of 9.8% per year (Globenewswire, 2020).

Okra is not among the priority commodities under the National Development Plan (NDP) II. Nevertheless, the Adjumani District Development Plan (2015 to 2020) recognizes vegetables as one of the strategic high value crops that are deliberately being promoted through vegetable gardens/ kitchen gardens for commercial production and income. However, the plan does not mention any specific vegetable like okra. In Uganda, okra (ladies' fingers), is a relatively new crop and grows mainly in the Northern and Eastern Uganda (Muzaale, 2011) as well as in Wakiso, Luwero, Masaka, Mpigi, Mukono and Rakai districts (Lwasa, 2010; Wamucii, 2020). The vegetable is rich in fibre, vitamin B6 and folic acid. Okra is extensively used by Ugandans in salads, soup and stews because of its spicy taste and the pods can also be boiled or fried and eaten as a vegetable (Muzaale, 2011). There are mainly two types of okra that are recommended for the export market; Pussa sawani 1 and Clemson spineless. The other types such as Burgundy and Burmese are consumed locally and are commonly grown in northern Uganda (Nassanga, 2019). Okra can be attacked by pests and diseases like silver leaf whitefly, rough bollworm, looper caterpillars and green vegetable bugs, these are controlled by use of right pesticides (Nasanga, 2019).

According to Katende (2006), although Okra is profitable in Uganda, quality remains the biggest problem and needs to be improved to successfully expand Uganda's okra market share. The biggest percentage of okra is consumed locally, while some of Adjumani grown okra is informally exported to Southern Sudan. In Adjumani, the District Local Government and the community prioritized Okra as a refugee favouring value chain and one of the eight VCs for investment under the Development Response to Displacement Impacts Project (DRDIP). Okra is an important food item mainly for the Sudanese refugees. It is eaten as a sauce or mixed with other vegetables or meat. There is equal preference for fresh as well as the dried Okra (Muzaale, 2011).

B. Demand and supply in Uganda

In Uganda, Okra is a non-traditional vegetable with local demand and production still low. Exports of fresh okra from Uganda increased steadily from 19 MT in 1993 to a peak of 130 MT in 1998, and then declined steadily to 69 MT in 2002, which could be attributed to the low production. However, there is a growing interest in West Nile and Northern regions of Uganda with refugees and host communities getting involved in okra production (LWR, 2018). Traders in Adjumani largely export Okra in dried form through Nimule One-Stop Border Post (OSBP) to South Sudan.

The civil war in South Sudan appears to have boosted Uganda's exports to South Sudan up to US$240 million in the 2013/14 financial year, an average increase of 196% compared to the 2012/13 financial year (WFP, 2015). Therefore, it is arguable to conclude that okra exports from production districts such as Adjumani to South Sudan increased. It is, however, uncertain to determine the volumes and values of okra exported from Uganda to South Sudan due to the informal nature of trade that takes place between the very porous Uganda-South Sudan border. Due to the limited study in relation to okra as a vegetable, there is limited documentation about the demand and supply of okra in both

Uganda and South Sudan, rather okra is mentioned as one of the major delicacies in most of the documents. Despite the high commercial potential of okra in Uganda, there has been very little or no attempt to address the problems that limit the commercialization and production of Okra. This can be evidenced by the scanty nature of data about the crop.

C. Value Chain Actors

Adjumani technical staff estimated the annual okra produced to be 4,978 MT-fresh form. Of the total produce, 30% is consumed on farm, while 55% is sold to traders annually. 15% percent of the produce is lost due to poor harvesting and post-harvest handling practices at the farm level. Okra is mainly consumed by individual households and restaurants. It is a herbal remedy used to treat diabetes and related illnesses. Informal okra exports to South Sudan are hard to trace, however, key informants have conservatively estimated that Adjumani supplies 2% of the okra required in South Sudan annually. Below is a detailed description of the actors for okra in Adjumani.

Input suppliers are not specific for the okra value chain but the same for soybean, tomato, and sesame. They sell seeds, fertilizer and equipment. Ninety five percent of them are registered by the district authority and each dealer pays trading license of UGX 30,000 per year. On average, each supplier has an operating capital of about UGX 5 Million mainly borrowed (90%) of the operating capital from financial institutions mostly banks. About 95 percent of the input shops are owned by men who are mainly host communities and employ 1 - 2 youths who are trained on the job. Ninety percent of the stock is procured more than two times a year from Kampala. Seed is the most important input. The input suppliers offer advice and technical assistance to farmers regarding utilization of inputs.

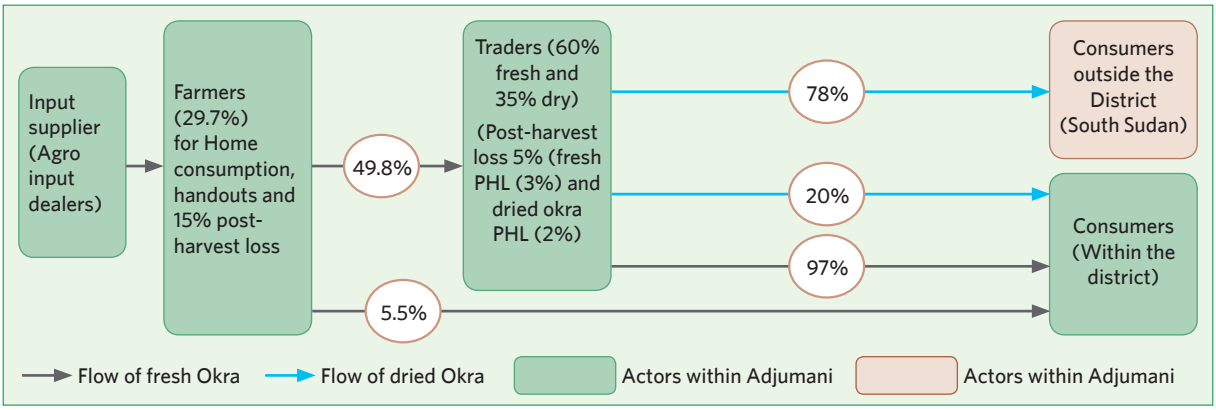


Figure 32: Value chain map of Okra
Source: Primary data, 2020

Farmers cultivate small plots of 0.25 -1.0 acre. Okra is grown mainly by refugees although hosts too have taken an interest. The crop is grown in Pakele, Dzaipi, Itirikwa, Adropi, Ciforo and Pachara sub-counties. The refugees cultivate hired land. Seventy five percent of farmers are women as Okra is a food security crop. Eighty percent of the farmers use hand hoes to till the land and 5% and 15% use tractors and oxen, respectively. Farmers grow Alunga (tall variety grown by refugees) and Pusswani 1 variety (short) grown mainly by hosts. The preferred variety is Alunga because of its tolerance to drought and ready market in South Sudan. The average yield is 0.7 MT/acre. Fifty five percent of the total harvest is sold directly to consumers and traders, 30% is for home consumption and 15% is lost due to poor handling. Selling price of okra is UGX 3,500/Kg.

Traders: These are mainly retailers who sell both fresh and dried okra as well as other crops. Both men (25%) and women (75%) are involved in trading. However, trade within the district is dominated by women while trade across the border is dominated by men especially the refugees. A trader has an average capital base of UGX 1,700,000 per season and mainly invest own savings. Often, a trader employs one youth. The traders buy okra from smallholder farmers and transport it using motorcycles at a cost of UGX 7,000 per bag. Traders lose 2% - 3% of their purchase due to poor handing of okra as well as delayed buying. They sell fresh okra at UGX 4,000/Kg and dry okra at UGX 6,000/kg. All the fresh okra and 20% of dried okra is sold in the local markets including Awindiri market, Dzaipi market, Ayilo market while about 78% of the dried okra is informally exported to South Sudan.

Consumers: These can be categorized to local (hosts and refugees) and export (in South Sudan). Ninety percent of households prefer fresh okra while export market in South Sudan buy directly from traders the dried okra because of the increased shelf life.

D. Profitability of the Okra value chain

The profitability of the Okra VC was assessed using GMs for the different actors and the following assumption were used;

- Price per Kg for farmers is UGX 3,500, traders' price UGX 4,000/Kg of fresh and UGX 6,000/kg of dried Okra.
- Yield of 0.7MT/Acre.
- Post-harvest loss of 25% for farmers and 5% for traders.

The GM presented below (figures 34 and 35) is for farmers using hand hoe. Figure 34 reveals that farmers make an average GM of UGX 377,000 per acre per year with the largest cost driver being labour constituting 71% of the total costs.

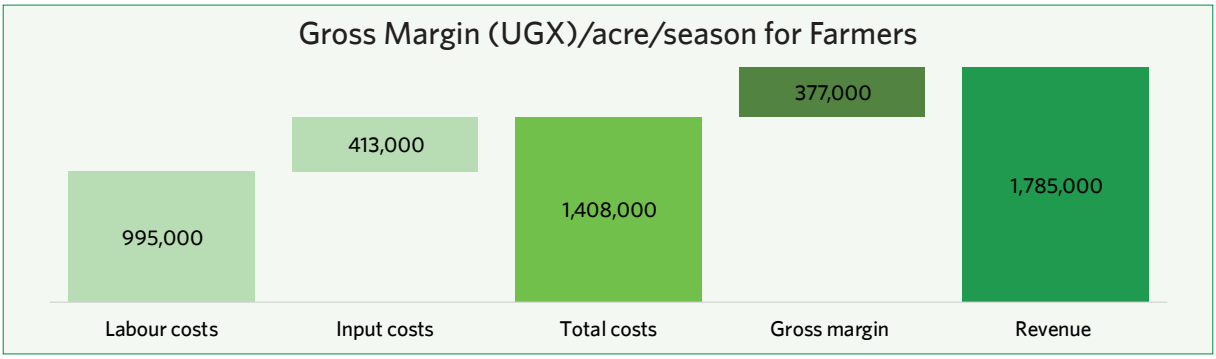


Figure 33: Gross margins for Okra farmers in UGX per acre
Source: Primary data

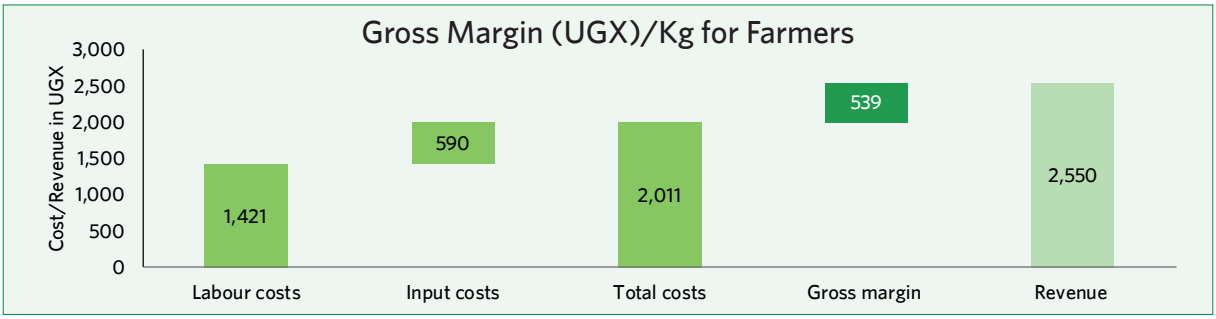


Figure 34: Gross margins for Okra farmers in UGX /kg **Source:** Primary data

Traders of fresh okra earn a slightly higher GM of UGX 390/kg than those selling dry okra (UGX 354/ Kg). The major cost driver among the traders is aggregation and purchase of okra from the farmers. These account for 82% and 91% of the total costs incurred by traders of fresh and dried Okra, respectively.

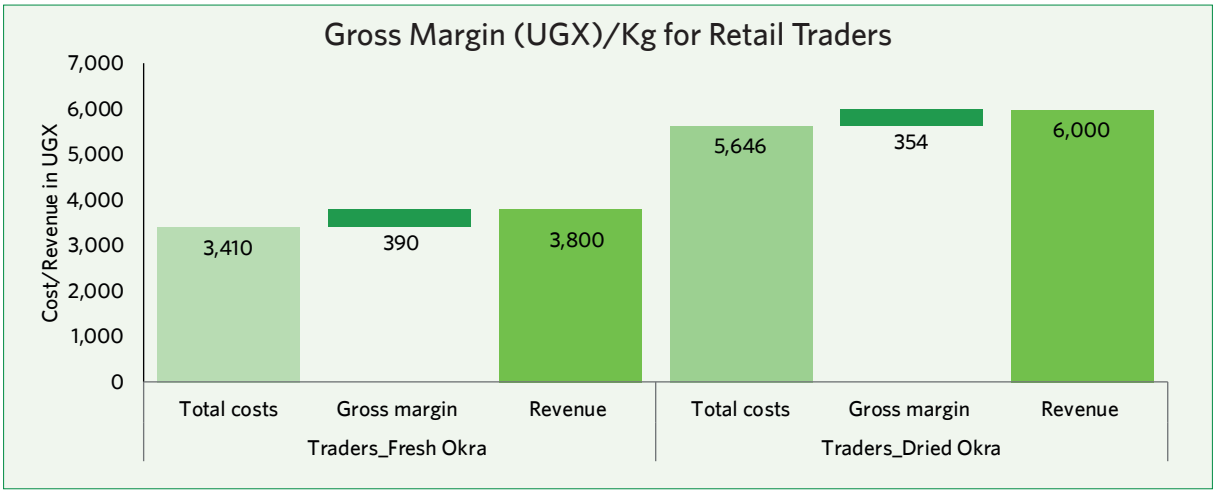


Figure 35: Gross margins for okra value chain actors per Kg
Source: Primary data

Although farmers earn the highest GMs in the okra VC, GMs per Kg of okra are insignificant across all actors. For the GMs to be of economically significant, the volumes sold should be high. Meanwhile, VC actors need to have complementary businesses.

Share of value: There are two supply chains for okra. In all the channels, farmers get the highest share i.e. 42% in channel 1 and 58%in channel 2 as can be seen in the first and second channel respectively (Figure 37). The traders of dried okra get 28% and traders for fresh Okra get 30% and 42% for the first and second channel, respectively. Well as the proportions of GMs are higher in channel 2, the volumes traded are lower than for channel 1. Thus, channel 1 is the more benefiting for the farmers.

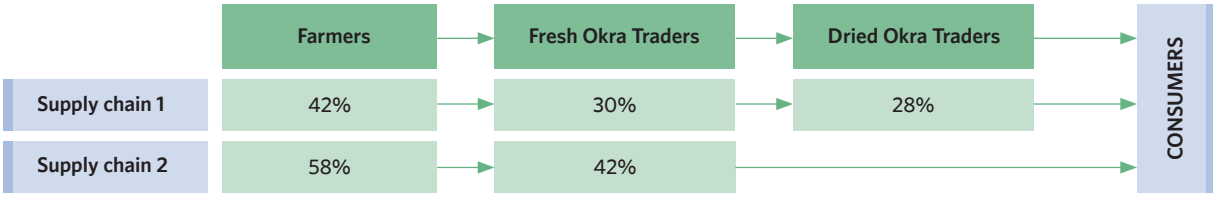


Figure 36: Share of value for different actors along the Okra value chain
Source: Primary data

E. Employment along the Okra Value Chain

The employment generation potential was estimated using the Full Time Equivalent approach. In addition, the wages earned were estimated per district. The FTE jobs units per acre grown were used as the multiplier factor to estimate the number of FTE jobs under the existing acreage under production in the district. The employment estimates are drawn from the detailed activities in okra production and the human effort required. Table 24 indicates that 0.83 FTE jobs (83 jobs for every 100 acres) are generated per acre of Okra at the farm level and 0.18 FTE jobs (18 jobs for every 100 acres), at the trading level. Production of okra is labor-intensive, and this explains the higher FTE jobs

at production compared to trading. Information from the District Agriculture Officer indicated that there are approximately 3,556 acres under okra production, with this acreage, a total of 2,963 jobs are created at farm and 647 at trading levels.

Relatedly, wages worth UGX 3,980,000 are earned when an acre of land is cultivated at the production while UGX 294,000 wages are earned at the trading level. On the other hand, a total of UGX 16,243,808,000 wages are earned along the entire Okra VC when 3,556 acres of okra are cultivated.

Table 24: Total jobs and wages under Okra value chain

Value Chain Node	FTE jobs		Total Wages in UGX in 1 year	
	1 Acre	3556 acres	Acre	3556 acres
Production	0.83	2,963	3,980,000	14,152,880,000
Trade	0.18	647	294,000	2,090,928,000
Value chain total	1.02	3,610	4,274,000	16,243,808,000

Source: Primary data, 2020

F. Social benefits along the value chains

Okra growing is mainly grown by the refugee communities with more women than men participating in production activities as it is one of their food staples. However, the host communities also engage in its production and marketing. Okra contains potassium, vitamin B, vitamin C, folic acid, and calcium. Okra has low in calories, high fibre content and antioxidant qualities recommended for those with diabetes because it lowers cholesterol. However, Okra production can degrade the environment through misuse of agro-chemicals e.g. pesticides application which may lead to air, water and soil pollution. The chemicals are also harmful to predatory spiders, ants and lady bird beetles which are key in control of okra pests (Bhutto, 2017)..

G. Public, private 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 utilization 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.

There are other private partners in okra production in Adjumani District and these are mainly NGOs such as Lutheran World Federation (LWF), World Vision, Plan Uganda, Self-help Africa and Norwegian Refugee Council (NRC). These in collaboration with the local government provide capacity building to both refugees and host communities in okra production especially on home/kitchen gardening for food security and income generation. They also provide extension services oh how to manage the okra field as well as marketing skills.

.

H. Threats and community preparedness

Pests and diseases are a big threat to okra production because they attack the crop right from sowing to harvesting. The pests include aphid, jassid, whitefly, thrip, spotted bollworms and mites. These pests cause various damages to the crop by sucking the sap directly and by transmitting viral diseases indirectly; they kill the plant if not attended to. The community is not well trained to identify the pests in early stage and they only get to know when the crop damage has gone beyond economic damage to the okra field. However, the strategies used for controlling pests and diseases are both cultural and chemical control methods. For example, the use of crop rotation and synthetic insecticides to destroy pest growth.

Okra is attached by fungal, bacterial and viral disease such as Fusarium wilt *(Fusarium oxysporum)*, powdery mildew *(Oidium asteris-punicei)*, and yellow vein mosaic disease. The following methods have been adopted in controlling disease; remove the infected plant and burn them to avoid further spread of disease, rotate crops with non-hosts and use of certified, disease-free seed; and plant varieties with higher resistance to diseases.

The other threat to okra production and marketing is the unpredictable weather conditions due to climate change. The adverse effects are climate vagaries such as floods and drought which results into crop failures, reduced yields, and reduction in quality and increasing pest and disease. The un-favorable weather condition is worsened by the fact that okra growing is mainly rain-fed and thus any shortfall rain greatly affects production. Despite these climate change related issues, the communities mitigate the effects by planting of trees and mulching to preserve moisture in the soil.

Due to climate vagaries like floods, some of the roads linking Ayilo settlement and other areas in Adjumani become impassable. At worst, the bridges have been washed away. This hampers movement and transportation of agriculture produce to market. Table 25 below illustrates other challenges long the VC and their mitigation measures.

Table 25: Challenges and mitigations along the different nodes of the okra value chain

Node	Challenge	Mitigation
Farmer	1) Low productivity due to inadequate use of improved seeds and other inputs. 2) Over reliance on rainfed agriculture that limits planting to 2 seasons. 3) High pests and diseases prevalence which suppress yields 4) High labour cost for land preparation and weeding limits increased production.	1) Adopt use of high yielding varieties coupled with use of fertilizer. 2) Training in GAP, Integrated Pest and Disease Management 3) Investing in affordable irrigation system
Trader	1) Poor rural roads that increases the transportations costs	1) Construction of rural roads.

Source: Primary data, 2020

I. Recommended investments for DRDIP

Okra VC in Adjumani district engages more refugees than the host and has very few actors. The analysis established that the farmers act as individuals and need to work more in groups and increase the volumes of okra grown. In addition, it is a profitable venture and contributes to the livelihood of the community through job creation as well as to food security.

Despite the benefits, okra faces numerous challenges such as; pests and disease infestation, low productivity due to inadequate use of improved seeds and other inputs, reliance on rain-fed agriculture that limits planting to 2 seasons and high labour cost for land preparation and weeding. Therefore, the following investment options are recommended;

1. **Under public investment, the following areas are recommended.**
   a) Investment in feeder roads construction as well as rehabilitation of dilapidated roads including collapsed bridges to allow traders access production areas and transport okra to high potential markets in other districts like Kampala.

   b) Investment in irrigation infrastructure although initial investment costs are high ranging between UGX 8 and 14m for the pump and pipes for one acre. The project would support each farmer group with a pump to be used by individuals and on group gardens. To ensure the farmers get capital, the project can also facilitate linkage of farmer groups to various actors such as financial support institutions to access credit for input purchase and to input suppliers of irrigation equipment and other agro inputs as well as to market off takers.

2. **For DRDIP, the key strategic recommendations areas are:**
   a) Enhancing production and productivity through investment in improved varieties that yield up to 6.5MT/ha. This calls for increased access and investment in good agronomic practices by farmers such as buying high yielding improved varieties, purchase of quality fertilizers and pesticides.

   b) Training farmers on GAP especially use of high yield varieties, GPHH, farming as business and use of tractor for land opening would increase yield by 185%.

   c) Reduce post-harvest losses to 10% from 15% through adopting good agricultural practices such as timely pest and disease control as well as timely and proper harvesting (See table 25). Consequently, GMs would increase by 802% and 700% at farm and trading levels, respectively, while jobs would decrease by 11%. The net change in jobs would be occasioned by a loss of 300 job at farm level because of mechanization and mulching that reduces the number of weeding from 3 to 2 times per season.

   d) Research into value addition opportunities for okra. Bearing in mind the need to meet high standard of edible product.

3. **Private sector support recommendations are:**
   a) To bridge the information asymmetry in the value chain – an information platform between farmers and traders can be piloted to ensure that there is accurate market information that is easy to access.

   b) Provide increased agricultural financing options for farmers and traders in order to increase access to credit.

   c) Offer tractors hire services at sub-county level as a solution to land opening challenges.

a. Assumptions

Table 26: Assumptions in scenarios developed

Farmers	Traders (Retailers)
• Increasing yield from 0.7MT to 2MT/acre as a result of using GAP and GPHH practices. • Reduction of postharvest losses from 15% to 10%. • Tractors are used for land opening.	Reduction of postharvest losses from 10% to 5%.
Potential Market Opportunity	
• Adjumani currently supplies only 2% of what is purchase annually by some traders in South Sudan. • If a contract is secured to increase the quantity supplied to traders in South Sudan by 1% it translates to 270 MT annually. • Assuming best case scenario in yield improvement and post-harvest loss management, this is equivalent to 68 acres • DRDIP provides a grant of UGX18,500,000 per group • Each group has 10-15 members • Each member can access up to a maximum of 3 acres	

Source: Primary data

b. Scenario analysis

Table 27 shows 2 scenarios that have been considered for the Okra value Chain in Adjumani.

Table 27: Impact of Investment scenarios

Category	Item	Current scenario	Yield increase including reduction in PHL
	Scenario	(1)	(2)
Farmer	Price per Kg	3,000	3,000
	Revenue per acre	1,785,000	5,400,000
	Cost of production/ acre	1,408,000	1,998,000
	Current GM in UGX/ acre	377,000	377,000
	New GM in UGX/ acre	na	3,402,000
	% increase /decrease of GM	na	802
	Jobs created	2,963	2,644
	% Increase / decrease in Jobs	na	-11
Traders (Retailers)	Variable costs in UGX per Kg	3,410	2,040
	Revenue in UGX per Kg	3,800	4,850
	Gross margin in UGX per Kg	390	2,810
	Jobs created	647	1,952
	% Increase / decrease in Jobs	na	202
Market	Market opportunity to supply (MT)		270
	Annual yield in MT		4
	Additional acres planted with the current yield		68
	Grant per group in UGX		18,500,000
	Acres per group (Each member has a maximum of 3 acres/ household)		30
	# acres/group with grant of UGX 18.5 Million	13	9
	# of groups to meet market opportunity	15	7
	# of groups if grant amount in UGX is increased to cover production costs and meet market opportunity	6	2

Source: Primary data

3.2. Non-Traditional Value Chains

3.2.1 Agro Processing

A. Background

The agricultural sector plays a central role in Uganda's economy, generating 24% of the Gross Domestic Product (GDP) and accounting for more than half of the country's export earnings (54%; EMF World Bank, 2019). With Uganda's Agro-industrial sector and Agro-processing, the backbone of the manufacturing sector i.e. accounting for approximately 60% of its total output. Arguably, the most promising prospects in terms of inclusive equitable economic growth and expansion in job opportunities, lie in the development of small- and medium-scale Agro-industrial firms which can supply the growing markets within Uganda and the region (Fowler and Rauschendorfer, 2019).

In the five-years to 2017, manufacturing growth was buoyant, increasing at an average annual rate of 6% (UBOS, 2019). Much of this was attributed to the rapid expansion in the food processing sub-sector (with an average annual growth rate of 8%), particularly strong growth being registered in meat, fish and dairy processing (Fowler and Rauschendorfer, 2019). Edible oils and bakery production also recorded rapid rates of growth. Over the same period, the average growth rates to produce drinks (9%), cotton ginning (35%) and textiles (15%) were well above the agro-processing average.

Domestically, demand for agro-processing is being driven by the high population growth rate of 3.2% per annum and rapid urbanization (Gollin et al., 2016). In addition, income growth in both the urban and rural areas is resulting in dietary shifts, giving rise to an increased demand for higher-value and more processed foods which are both more convenient to use and of higher quality. The demand for staple food grains, root crops and legumes is growing less quickly than income (Minot et al, 2015; World Bank, 2018). These trends are likely to intensify in the future and should be studied carefully to inform the food processing/value-addition strategy currently being promoted by national planners.

Agro processing is at forefront in the new National Development Plan III (NDP III) (2020/21-2024/25) whose goal is "Sustainable industrialization for inclusive growth, employment and wealth creation". This is further affirmed by the Adjumani District Five-Year District Development Plan's (2015/2016–2019/2020) advocating for developing agro processing and value addition. Also, the 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. Agro- processing potential in Uganda

"Commercializing agriculture has the greatest potential for increasing household productivity and incomes, while addressing unemployment in the rural communities. The approach nurtures agro-based industries across the country, employing labour that will have been released from primary agriculture". - Ministry of Finance, Planning and Economic Development, 2019.

Economic Policy Research Centre 2018 report provided the basis for the change in focus of national planning towards agro-industralization (EPRC, 2018). The rationale is drawn from the agriculture sector being the source of livelihoods. Hence agro-industrialization is the pathway to the country's long-term aspiration of transitioning into a modern industrial economy. One of the priorities "programmes"9 in the NDP III is the promotion of value-addition through "natural resource-led industrialization, especially agro-industrialization" which is assumed to result in "increased household income and reduced vulnerabilities". The focus of the programme is to create "backward and forward linkages in agro-processing" (NPA, 2019[c]).

The Ministry of Agriculture, Animal Industry & Fisheries (MAAIF) is designing a new Agriculture Sector Strategic Plan, (ASSP) for the period 2020/21-2024/25). The new ASSP will be aligned with

the overall goal of NDP III. The agro-processing sub-sector is expected to go a long way in providing import substitution potential i.e. products that are being imported can be produced within the country. Farmer organizations can be supported to access equipment that enables them to process maize into corn flex, animal feed and fish feed as examples.

C. Value chain actors and private sector strategic partnerships

In Adjumani the processors are in 3 major categories:

a) Small processors that provide a service – e.g. found in refugee communities, mills that are generator operated with a maximum capacity of 500Kgs per day.

b) Medium sized processors buy grain from farmers/ traders, process and sell the processed product to traders or consumers. Have installed capacity of less than 1-1.5 MT/ hour.

c) Large processors that buy grain from farmers, process, pack and sell branded products. They have installed capacity 1.5 -2.5 MT/hr.

Small Agro-processors: These are situated in towns and in the refugee settlements (e.g. Ayilo 1 refugee settlement) and they provide milling services. They constitute 95% of all agro - processors in the district. They own movable generator-operated mills and do not have permanent structures. Each processor has total assets of less than UGX 2Million.

They have a maximum processing capacity of 500Kgs per day. In addition, millers accept a minimum of 2Kgs and can reach 60Kgs/hour during peak times of harvesting in July. They charge between UGX 200–700/Kg for milling. During the off season, the processor handles an average of 30Kgs/day. They mainly operated and owned by men and mill mainly okra, maize, sesame and white sorghum.

Medium sized Agro-processors: These constitute 4.5% of Agro processors in Adjumani and have permanent structures. They have assets such as milling machine, building, tarpaulins, packaging and storage materials valued UGX 15 Million. The mills are powered by electricity. They buy grain e.g. rice, sesame, maize, dry cassava etc. from the farmers which they mill and sell to wholesalers, retailers or consumers. For instance, paddy rice is bought at UGX 2,000/kg and after milling, it is sold at UGX 2,500/Kg while maize grain is bought at 500/kg and sold at UGX 800 -1,000/Kg. The installed machines have a processing capacity of 1 -1.5 MT/hour with 60% utilization on average and employing 3-5 youths and largely owned by men.

Large Agro-processor: There is only one large processor (DIA Company Ltd in Adjumani that processes maize in flour. The maize bran by product is used to make animal feeds for their poultry farm. They have assets such as 2 silos each 500MT, buildings, trucks, and they employ 10 full time and 10 casual laborers. They have installed processing capacity of 2.5 MT/hour with 30% utilized. They purchased only 100 MT of maize grain from Adjumani in the last season. All the other maize needed was sourced from Moyo, Yumbe, Koboko etc. Only 10% of grain processed is purchased from Adjumani.

Market for processed sesame and soybean: Market for sesame and soybean was considered because they are some of the prioritized crops with high potential of being processed.

Sesame: Sesame can be processed into sesame paste, extraction of oil and animal feed. This study estimated annual sesame production in Adjumani to be 34,292 MT (land under sesame production is 42,865 acres). Of the total produced by farmers annually, 10% is consumed on farm, while 61%, 3% and 1% are sold by the farmers to aggregators, local processors and consumers annually respectively. About 25% of the produced sesame is lost after harvest due to poor post-harvest handling practices

at the farm level. The estimated annual consumption of sesame is about 25,719 MT. With the current annual production, Adjumani has a surplus of sesame.

Soybean: The grains can be processed into animal feed, children feed and nutritive foods. The estimated annual soybean produced in Adjumani is 13,347MT. Of the total annually produced 1.7% is consumed on farm level, while 25% is lost to poor post-harvest handling practices at farm level. Notably, only primary processing is conducted in Adjumani i.e. drying, sorting, packing and transportation. The estimated annual consumption of sesame is about 9,783 MT

D. Profitability assessment of agro-processing

Figure 38 presents GM for the processors of maize and okra, sesame, and maize alone. The sesame processor makes the highest GM per unit processed and sold. This is because the sesame processors buy directly from farmers at lower prices instead of them dealing with traders. The cost driver for the sesame processor is that of gathering and purchase of the grain for milling from farmers. The maize and okra processor is second with a GM of UGX 606 per Kg as a service to mill grains. The major cost driver for the maize and okra processors is the cost of fuel.

The maize processors (large scale) make the lowest GM per unit that is UGX 182/Kg. Although the maize (large processors) make the lowest GM per unit, they handle the largest volumes which enables them to benefit from economies of scale and make more profits. The cost driver for the maize processor is gathering and purchase of the grain for milling from farmers.

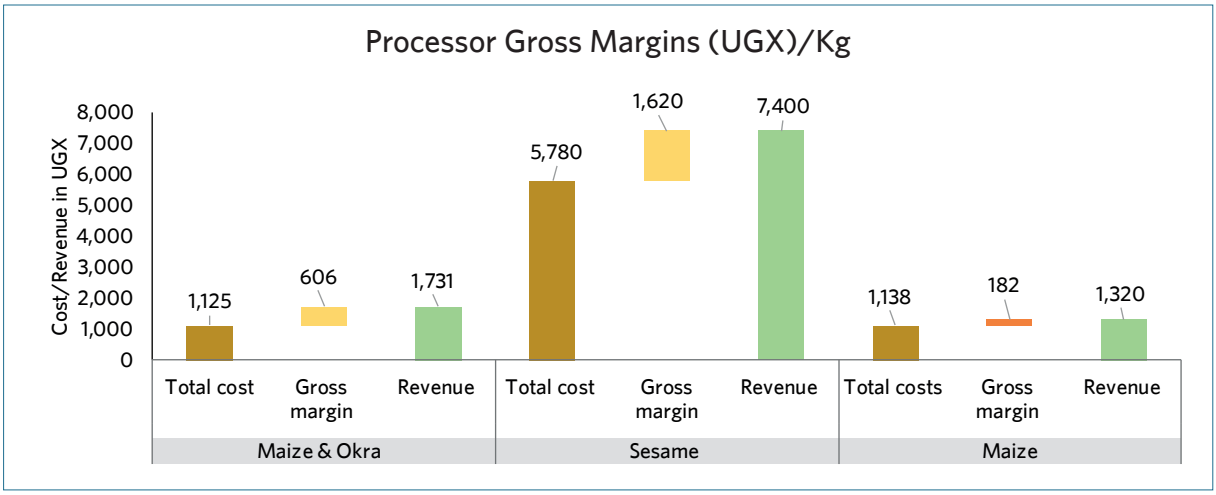


Figure 37: Gross margin for different categories of Agro-processing value chain
Source: Primary data

E. Employment generation in agro processing

Just like the GM analysis, employment along this VC considers the employment of small processors i.e. those operating mills of 15 Kg/hour for sesame and those operating mills of 50 – 300Kgs/ hour for maize and the large-scale processors operating 1 MT/hour and more. Under the 15Kg/hour for sesame, it was established that 1 acre of sesame creates 0.026 jobs at the processing node i.e. every 1,000 acres of sesame will lead to 26 fulltime jobs created at processor node.

Table 28: Jobs and wages created along sesame processing

Value Chain Node	FTE jobs		Total Wages in UGX in 1 year	
	1 Acre	42,865 Acres	1 Acre	42,865 Acres
Production	0.51	21,707	UGX 9,100,000	UGX 390,071,500,000
Trade	0.01	472.6	UGX 36,000	UGX 3,086,280,000
Processor	0.026	1,099.1	UGX 646,000	UGX 27,690,790,000
Total for Value Chain	0.54	23,279	8,035,000	UGX 420,848,570,000

Source: Primary data

Interviews with the mill operators indicated that there are core staff who work daily and these vary with the capacity of the mill and quantity available for milling. The employees undertake loading and off-loading of the grain to be milled on the car and onto the mills conveyor belt. They also ensure the milled flour is well packaged and staked. The employees informed us that they earn on average UGX 5000 per day. Table 29 is a summary of employment created for the respective mill capacities, the quantities of grain handled per year and an estimation of the wages earned per mills.

Table 29: Jobs and wages created by capacity of the mill

Processors	Wage earners/ per day	Kgs processed / year	Days of full employment in a year	Wages in a year (UGX)
15kgs/hour	1.5	10,200	468	2,340,000
50-300 Kgs/hour	3	87,600	936	4,680,000
1 MT/hour	8	175,200	2,496	12,480,000

Source: Primary data

DIA Company Ltd in Adropi sub-county is considered as a large-scale processor. Key informants from DIA Company Limited informed us that Adjumami supplied only 10% of the maize that is processed by DIA Company which currently operates at 30% utilization capacity and has 10 fulltime jobs and 10 causal labourers. If the DIA Company's maize mill utilization is increased from 30% to 85% due steady supply of maize, then fulltime jobs will increase from 10 to 12 and casual labourers increase from 10 to 14.

F. Social benefits along the value chains

Processing improves or even ensures food safety by removing harmful microorganisms, increases shelf life of food, and decreases the amount of waste. Agro-processing plays a role of fortifying food stuffs, lowering fat, salt or sugar. Both the refugees and host communalities are engaged in agro processing. The mills are owned by men and most of the activities are undertaken by men. Women usually play insignificant roles of cleaning the premises or stitching the bags before storage.

The disposal or discharges of agro-processing effluents does not comply with pre-treatment requirement leading to high degree of environmental pollution and hence health hazards. Food processing, transportation, storage, distribution and marketing have some impact on the environment and there is much concern about environmental pollution. The different agro processing operations create wastes of different quality and quantity, which, if not treated, could lead to increasing disposal problems and severe pollution problems. Additionally, the processes of harvesting and opting for agro-processing leads to loss of valuable biomass and nutrients. The agro-processing has negative

impacts on the environment, such as greater greenhouse gas (GHG) emissions and deterioration of water, soil and air quality. GHG emissions too result from the burning of fossil fuels in the food manufacturing process.

G. Public and community support to the value chain

The industrial development agenda in Uganda is spearheaded by Ministry of Trade Industry and Cooperatives (MTIC). The ministry works in collaboration with other stakeholder like the Private Sector Foundation Uganda (PSFU) whose membership base includes firms and other associations. PSFU has the mandate to advocate for the private sector to the Ugandan Government. The Uganda Manufacturers Association (UMA) is the umbrella body for the processors that organizes the annual trade fair to show case efforts of processors and manufacturers. UMA is quite active in its advocacy role with GoU, and it is considered the most influential private sector association in the country (Kjær and Katusiime, 2012).

MTIC is also responsible for the National Industrial Policy 2008. The focus of the policy is on natural domestic resource-based industries (such as petroleum, cement and fertiliser); agro-processing; knowledge-based industries (information and communication technology, ICT, call centres, pharmaceuticals); and engineering for capital goods, agricultural implements, construction materials and others. The ministry (MTIC) is also in charge of ancillary policies supporting industrial development. These include the National Trade Policy 2007, the National Textile Policy 2009, the National Standards and Quality Policy 2012, the National Leather and Leather Products Policy 2015 and the Uganda MSME Policy 2015.

Adjumani District Five-Year District Development Plan (2015/2016–2019/2020) roots for the development of agro processing and value addition through purchase and supply of key value addition equipment.

H. Threats and community preparedness

The agro-processing subsector is faced by the following challenges such as; poor and inadequate storage facilities, poor market infrastructure, inadequate and poor market information flow, poor linkages between farmers and the market, and the poorly functioning regulatory and standards-enforcement agencies. Regarding value addition, it is worth noting that the proportion of Uganda's agricultural commodities which are processed is no more than 5% (Naluwairo, 2012) .This low level of value addition is largely attributed to the low capacity of farmers to participate in value chains, the limited availability of (and access to) necessary equipment and machinery, and the poor quality and quantity of goods produced.

Table 30: Challenges faced by agro processors

Challenges	Mitigation Strategy
1) High cost of fuel for small processors and electricity for the medium and large processors increases production costs. 2) Limited operating capital to expand the business. 3) Unreliable power supply –load shedding is daily interrupts production. 4) High cost of equipment and their spares. 5) Poor quality grain supplied to processors reduces product quality and competitiveness.	1) Access to credit facilities (VSLAs and linkage to SACCOs) 2) Explore alternative energy sources like solar. 3) Establish contract farming arrangements with farmers in Adjumani to improve supply of grain 4) Capacity building in good postharvest handling practices to improve the quality of produce. 5) Construction of feeder roads to reduce transportation costs.

Source: Primary data

I. Recommended investment

Based on the finding, it was concluded that;

1) Agro-processors utilize about 50% of installed capacity
2) Agro-processing is profitable for the small and medium scale processors
3) There are job opportunities that will increase if there is increase in volumes in the maize and sesame value chains with DRDIP support.

The proposed investment options are for ensuring that the underutilized capacity is addressed, import substitution products and hence the equipment for these products e.g. corn flex, animal feed and baby food and finally packaging, quality control and UNBS certification.

The small-scale processors of sesame and maize need to improve milling efficiency and quality of sesame paste or maize flour and bran produced.

1. Public investment options

- Construction and rehabilitation of roads to reduce transportation costs and ease movement of raw materials and final carpentry products
- Need to address the irregular electricity supply in the region. This is a major deterrent for business. There is need explore alternative energy sources e.g. solar.
- Research should be intensified to improve efficiency in waste treatment, and to minimize waste in food processing and manufacturing operations through advanced manufacturing practices, and constructive utilization of what is unavoidable by bioconversion of by-products and waste into edible food, feed or industrial chemicals to decrease environmental loadings as a consequence of better integrated waste management..

2. DRDIP investment options

a) Invest in utilization of the mills i.e. increase utilization of the mills from 50% to 85%. This can be achieved by organizing the farmers so that they can aggregate their produce and hence easing the process of accessing agricultural produce for processing.

b) Establish contract farming arrangements for farmers in Adjumani with processors to improve supply and quality of grain. The farmers could also be encouraged to collect their produce at the watershed aggregation centre to ease access to the produce.

c) There is need to explore into processing of items that are being imported e.g. animal concentrates, animal feeds, breakfast cereals, vegetable preservation e.g. tomato. This will require purchase of the relevant equipment and technical know-how.

d) Investment into packaging requirements for the different market segments

e) Skills are needed in understanding the quality requirements so that these are built into the farmer level capacity building in good postharvest handling practice and requirements of processing food items. Need for knowledge and put into use the quality control processes and acquisition of UNBS certification.

f) In the interim, to address the energy shortages, the sesame agro-processing using the 15 Kg/hour may be run by either generator or electricity because the GMs, Return on Investment (RoI), payback period and NPV are not significantly differently. On the other hand, the maize agro-processing option for the 50 Kg/hour should be run by generator because of the GMs, RoI, and NPV that are supportive of the investment. However, the available DRDIP fund of UGX 25.9M is not enough for agro-processing of maize i.e. the 300 Kg/hour mill requires additional UGX 19.9 million.

g) At processor level, the DRDIP grant of UGX 25.9 million that will be allocated to a group is enough to fund the sesame local processors and maize processors (50/Kg/hr). The grant will be used to finance both initial investment in equipment and working/operational costs. The processors' payback will be 5 months and 1 year & 3 months for sesame and maize respectively. The returns on investment is high among the maize processors than sesame processors. The payback period is within the time frame the project will be implemented.

3. Private sector support recommendations are:

To bridge the information asymmetry in the value chain – an information platform between the consumers of the processed items, the processors and the producers can be piloted to ensure that there is information on quality and quantity desired.

Access to credit facilities because of the need to ensure that the working/operational costs of the processors are adequately met to ensure profitability. For subsequent years, the processors may access credit facilities from VSLAs or link with SACCOs).

Table 31: Assumptions used in agro-processing

Assumptions used	
Milling service of sesame in UGX/kg	500
Sesame conversion to paste	75%
Milling service of maize in UGX/kg	200
Maize grain to flour conversion	70%
Maize grain to bran conversion	25%
Utilization capacity	80%
Quantity of sesame milled per day in Kg	100
Quantity milled by 50Kg/hr per day in Kg	300
Quantity milled by 300Kg/hr per day in Kg	600
Wages of group members per person UGX	30,000
Aggregations and transport cost per Kg in UGX	20
Cost of a kg for maize grain	500
Price of maize flour per kg in UGX	1,500
Price of maize bran per Kg in UGX	300
Discount rate	9%
Rent for 15Kg/hr mill per month	80,000
Rent for 50Kg/hr mill per month	100,000
Rent for 300Kg/hr mill per month	200,000
Reducing balance depreciation rate (%)	20
Shelf life	10 years

Source: Primary data

Table 32: Investment under agro-processing per year

Particular per year	Generator operated	Electric operated	Generator operated	Electric operated
	Sesame local processors		Maize processors	
Mill capacity	15kg/hr	15kg/hr	50kg/hr	300kg/hr
Cost of a mill	1,300,000	1,300,000	3,500,000	18,000,000
Digital weighing scale	2,500,000	2,500,000	2,500,000	2,500,000
Stitching machine	70,000	70,000	70,000	70,000
Total fixed costs	3,870,000	3,870,000	6,070,000	20,570,000
Electricity per year/Fuel costs	720000	480000	840000	1200000
Purchase of sesame for paste selling	14,000,000	14,000,000	7,488,000	14,976,000
Transport and aggregation	80,000	80,000	299,520	599,040
Rent per year	960,000	960,000	1,200,000	2,400,000
License per year	30,000	30,000	30,000	150,000
Maintenance costs	500,000	500,000	500,000	500,000
Labour costs in UGX	5,400,000	5,400,000	5,400,000	5,400,000
Total variable costs	21,690,000	21,450,000	15,757,520	25,225,040
Total costs (fixed and variable cost)	**25,560,000**	**25,320,000**	**21,827,520**	**45,795,040**
Revenue from milling for service	12,480,000	12,480,000	11,980,800	23,961,600
Revenue from milling and selling	24,000,000	24,000,000	15,724,800	31,449,600
Revenue from maize bran			1,123,200	2,246,400
Total revenue	**36,480,000**	**36,480,000**	**28,828,800**	**57,657,600**
Gross margin	14,790,000	15,030,000	13,071,280	32,432,560
Returns of Investment	58	59	60	71
Payback period	5 months and 5 days	5 months and 1 days	1 year 3 months	9 months and 2 weeks
NPV in UGX	530,337,318	539,890,231	428,748,968	980,736,556
DRDIP Grant IN UGX	25,900,000	25,900,000	25,900,000	25,900,000
Deficit /Surplus in UGX	4,210,000	4,450,000	4,072,480	- 19,895,040

Source: Primary data

3.2.2 Bakery and Confectionary Value Chain

A. Background

Baking is specialized and uses dry heat. Mandazi making uses deep frying while chapatti uses shallow frying. Confectionaries is a business that makes products such as bread, cakes, and cookies. There is a ready market all year for bread and other confectionary products because they are common household consumables for breakfast and eaten at social / religious gatherings, and events. (Nakaweesi, 2017).

Production of different baking products requires specialized training. When trained with baking skills, one can work as bakers (own business or employed), restaurants, supermarkets, wholesale outlets, and offer catering services. Thus, baking skills can result in sustainable businesses albeit micro or small. The businesses can contribute to income diversification and economic development (Cleland, 2020)

B. Demand and supply of bakery and confectionary products

Unfortunately, there is no formal documentation about the demand and supply of bakery and confectionary products. Scouting the internet presented some comments from Wikipedia and individual observations that can be used in framing aspects of demand and supply.

Wikipedia defines breakfast in Uganda as a cup of tea, ugali porridge or Mandazi, a kind of doughnut. Observation of small roadside businesses confirmed that Rolex and Chapati are sought after snacks all categories of consumers. Making and selling Chapatis is one of the businesses that many find easy to set up due to the low start-up investment costs as well as high demand for the product(s). It is however important to note that while the business can run as a standalone, it is wise to have two or three other complementary products alongside to reap maximum benefits. Some of these products are Samosas and Mandazi that have similar requirements for inputs.

Basing on research undertaken by observing one stall in Adjumani town, the sales figures were quite interesting. One packet of Wheat Flour weighs 2 Kg and on average, produces 20 chapatis. The highest selling stall in that area consuming not less than 24 packets daily. The chapati seller hires the working table and chapati making tools. He pays a daily rate of UGX 50,000/=. Considering that each plain chapati costs UGX 500/=, the chapati maker was earning gross revenues of at least UGX 240,000/= per day. This is exclusive of extra income that comes from the combination of chapati and eggs (Rolex) as well as chapati and beans (Kikomando) sales..

C. Value Chain Analysis

Actors, their characteristics, associated roles and nature of integration

Input Suppliers: Both hosts and refugees participate as wholesalers or retailers who supply bakery/ confectionary ingredients such as wheat flour, sugar, oil, yeast, eggs etc. The largest wholesalers of general merchandise in Adjumani district are *TY Enterprises, 200d and Said enterprises*. They are situated in Adjumani town and serve over 200 retailers in the district. They have a stock/inventory of approximately UGX 15 million and the main baking ingredients account for approximately 5% of their stock. About 70% of the wholesalers use own savings and only 30% borrow from financial institutions (microfinance institutions and SACCOs). The wholesalers are registered at the district and each pays for a certificate of registration of UGX 150,000 per year. Each employs 2 - 5 youth permanently (explain) and hire casual labour whenever need arises. Most of the stock is bought from Kampala (95%) and the rest from Gulu.

Retailers are situated in sub-county townships and have stock/inventory of approximately UGX 1 million. They buy stock in Adjumani town. The main baking ingredients are wheat, sugar, yeast and account for approximately 10% of their stock. About 90% of the retailers use own savings and only 10% borrow from microfinance institutions like SACCOs. The retailers are registered at the sub-county and pay for a business permit of UGX 30,000 per year. A retailer employs one youth on part-time basis.

Bakers: Regarding the chapati and mandazi makers, this involves both host and refugees while baking is mainly for the hosts. Bakers own or rent space for the baking facilities in the small towns of the district. There are two distinct kind of bakeries/confectionaries and the characteristics are shown below.

Table 33: Description of different bakeries and confectionaries

	Small scale	Medium scale
1	Buy ingredients from wholesalers	Buy ingredients from wholesalers
2	Typically make and sell bread roll/ chapatis/ rolex/ mandazi	Make and sell good quality mandazi, and donuts
3	Operate in a small semi-permanent structure or with movable stall along the roadside.	Operate in permanent structures
4	Sell directly to consumers. Limited customer loyalty.	Supply on order to schools, restaurants, hotels, hospitals etc.
5	Operated by one person - mainly youth (male and female)	Employ 3 - 8 people *(of which 40% female/youth).*
6	Start-up capital: UGX 70,000 - UGX 100,000.	Start-up capital: UGX 5-10 Million
7	Situated in large and small towns for both host and refugee communities	Situated in Adjumani town
8	Pay a fee of UGX 5,000 - 7,000 per month to the respective landlords and UGX 1,000 as daily market fees.	Pay certification of registration of UGX 150,000 annually

Source: Primary data, 2020

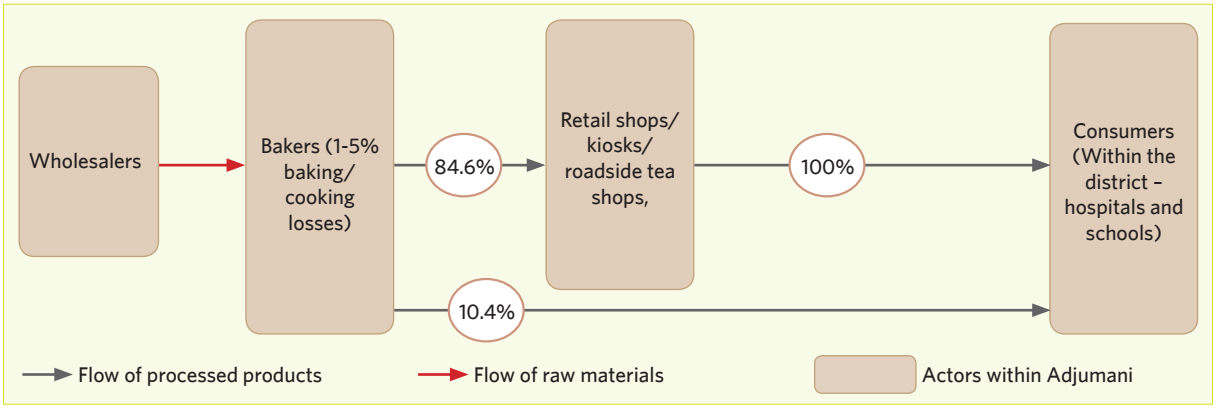


Figure 38: Bakery and Confectionery Value Chain Map
Source: Primary data, 2020

Training in baking is offered by Moyo Technical Institute. The Norwegian Refugee Council offers baking programmers for the youth. World Visino and Self-Help Africa offer apprenticeship courses in collaboration with formal and informal training centres that take 4 - 12 months to complete. The variation in training period is based on who is offering the course. Besides, the courses offered by informal establishments takes a shorter period. Upon completion of the course, the trainees are given start-up kits that comprise basic baking tools such baking frying pans etc.

Retailers: These are usually teashops that are in a mobile facility or semi-permanent structure. They buy from bakers and sell directly to consumers products such as mandazi, chapati and buns. A retailers' average daily stock is usually less than UGX 50,000. They are mainly located in Adjumani town and in sub-county townships. A retailer employs one person mainly a women youth because they are believed to be trustworthy.

D. Profitability analysis of the bakery value chain

The GM was analyzed for the small and medium bakers because these are the ones present in Adjumani district. The GM analysis is focused on mandazis. Medium scale bakers earn an average of UGX 656 per Kg of flour from Mandazi (Figure 40).

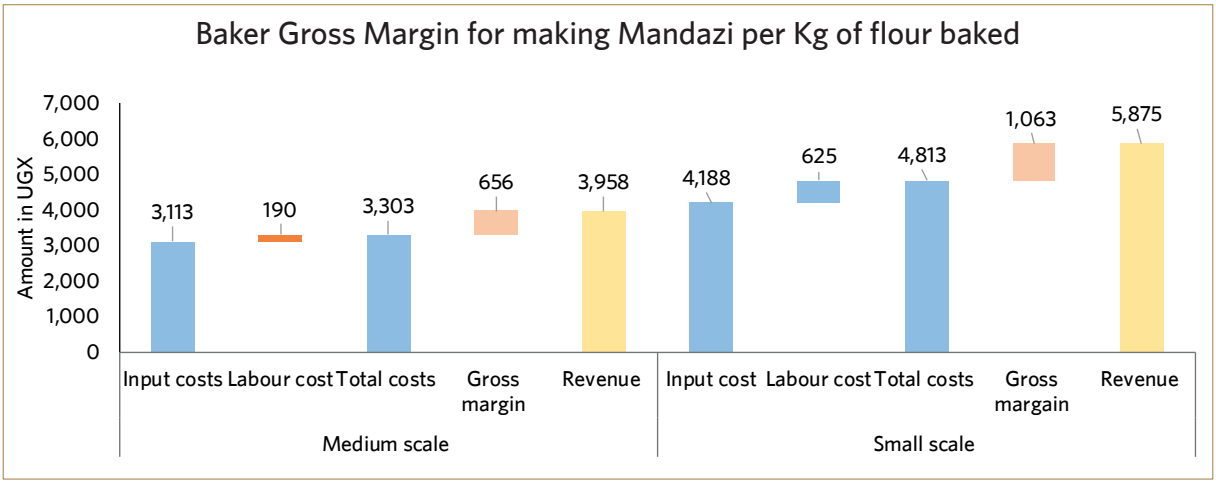


Figure 39: Gross margin for medium and small Bakers of Mandazi
Source: Primary data, 2020

The small-scale bakers make a variety of products including mandazi, chapati, and a combination of chapati and eggs (rolex). They earn a gross profit of UGX 1,063 per Kg of flour baked. Although the GM of small-scale bakers per Kg of flour baked is higher than that of medium scale. The medium scale baker earns more income because they sell large quantities of the products. For bakers, the main cost driver is baking flour.

A retailers earns UGX 10,000 per UGX 50,000 invested. They deal in a variety of products such as food items and other basic home consumables like box matches, sugar and non-alcoholic beverage. The products are delivered to their premises and thus do not incur transport cost. This implies that income for traders is driven by volume sold. The main cost driver is the purchase of mandazi.

Figure 40: Gross margin for retail trader of bakery and confectionaries
Source: Primary data, 2020

E. Employment along the Value Chain

The small-scale confectionary enterprises i.e. the ones that make mandazis and chapati have two demanding activities i.e. daily purchase of raw materials and kneading of the dough. The enterprise is characterized by employing 1 fulltime job and 1 part-time. In the morning and evenings when demand is high, the part-timer assists with frying while another takes the orders and packages the customers' orders. The fulltime employ is also the business owner. The part-time employ may receive a daily pay ranging from UGX 4,000 to UGX 6,000 depending on how the business run.

The most demanding activities are purchase of raw materials because these may have to be sourced from different suppliers, others demanding activities include; the production process and machine maintenance among the medium scale bakers.

Table 34: Jobs and wages for medium scale bakery

Activity	Number of people	Number of days worked in a month	Time taken in hours	Man days	FTE in a year
Purchase of raw materials	2	3	6	54	0.1731
Transportation	1	1	1	1.5	0.0048
Cleaning the premises	1	20	1	30	0.0962
Loading and off loading	1	10	1	15	0.0481
Packaging	3	20	1	90	0.2885
Maintenance	1	4	1	48	0.1538
Production process	3	20	5	375	1.2019
Total					**1.9663**
Total wage per year in UGX					**3,552,000**

Source: Primary data, 2020

Table 34 reveals that raw materials are purchased by two people for 54 man days, this is equivalent to a fulltime job for approximately two months per year. Further, premise cleaning is by one person taking 30 man-days i.e. a fulltime job for one month per year. Production involves three people each working for 375 man-days which is 1 job for one year. The man days and FTE for transportation, loading and offloading, and maintenance were estimated using the same approach. A total of two FTE jobs are generated when a medium scale bakery and confectionary is operated for a year.

Wages were estimated by multiplying the number of people engaged in the activity times the amount paid per activity. As a result, a total wage of UGX 3,552,000 per year is earned when production of mandazi by the medium scale bakeries is carried out.

The retailers/ kiosks are small household consumables e.g. snacks, sodas, sugar and tea leaves focused enterprises. They are setup in semi-permanent structures along the road. The kiosk is opened in the morning and one person attends to the customers. The same person is also responsible for restocking the shop. The enterprise is characterized by employing 1 fulltime job, these are mainly run by the business owners, however, in some cases employees are hired and paid a wages of UGX 80,000 per month.

F. Social benefits along the value chain

Bakery and confectionaries enterprise engage all gender, for instance majority of the male youth in Adjumani are engage in making chapati and mandazi. The women on the other hand operate small restaurants close to chapati makers and sell tea and other steamed snacks e.g. maize and beans mix. These businesses are run by both refugees and host communities.

Nutrition-wise, the bakery products are fortified with a wide range of vitamins and minerals including B group vitamins thiamine (B1), Niacin (B3) which are important for releasing energy from food and maintaining healthy skin, eyes and nails as well as preventing neural tube defects such as spina bifida.

Regarding the environment, the roadside chapati and mandazi making have a high impact because of the high charcoal and/or firewood usage which puts a strain on the trees. The enterprise generates a lot of rubbish e.g. polythene bags, eggshells that a poorly disposed of. The enterprise therefore has a footprint on negative environmental effects of the synthetic industry, effects of deforestation and the high impact at raw materials stage is due to ingredients such as dairy-based products, sugar, and palm oil.

G. Public, private and community support

The industrial development agenda in Uganda is spearheaded by Ministry of Trade Industry and Cooperatives (MTIC). The ministry works in collaboration with other stakeholder like the Private Sector Foundation Uganda (PSFU) whose membership base includes firms and other associations. PSFU is mandated to advocate for the private sector to the Ugandan Government. The Uganda Manufacturers Association (UMA) is the umbrella body for the processors that organizes the annual trade fair to show case efforts of processors and manufacturers. UMA is quite active in its advocacy role with GoU, and it is considered the most influential private sector association in the country (Kjær and Katusiime, 2012). Given the activities the bakery and confectionaries are engaged in, they are processors.

The Uganda Industrial Research Institute (UIRI), a government parastatal organization under the auspices of the Ministry of Science, Technology and Innovation (MoSTI) supports innovations on value addition. It steers and conducts applied industrial research into the bakery industry and also address the needs the local bakery industry specifically the micro and medium scale enterprises by generating appropriate bakery processing technologies.

The department of bakery technology under the UIRI's production systems directorate offer services such as; training in all aspects of Bakery processing technologies, product development and testing, design of production facilities and supervision of installation of Bakery equipment.

In Adjumani, the Danish Refugee Council (DRC) has been at the helm of promoting bakery among the communities in Adjumani with focus on refugees through providing training and apprenticeship opportunities.

H. Threats and community preparedness

The bakers are using less efficient energy sources such as charcoal for small bakers and fuel wood for medium scale bakers. These are not efficient because it is difficult to control the heat generated compared to electrically controlled oven heat. For some few medium scale bakers who use power electricity, there is always constant power outages, a problem blamed on limited generation capacity by the power supplier; thus, producing less than the needed quantity. The bakers lack preservation equipment to store perishable product whose shelf life is low, this limits production.

There is limited credit and working capital to support the bakers in buying baking inputs such as enough flour, milk and sugar. The baker tries as much as possible to use their own saved capital and sometime borrowing from VSLA, friends and relative.

Table 35: Challenges and mitigation measures along each node

	Challenges	Mitigation
Baker	1) Irregular electricity supply 2) Electricity is expensive for these small-scale businesses. 3) Insufficient operational capital to run and expand the business. 4) High transport costs that increases the cost of doing business. 5) Many business units dealing in the same products	1) There is need to improve supply of electricity 2) Provide support in acquiring efficient energy equipment 3) Support in understanding to save and borrow from VSLA and SACCOs. 4) Construction of feeder roads in the villages.
Retail owner/ kiosk	1) There is a very small margin on the products sold yet there are many kiosks. 2) Insufficient operational capital to run the business and expand.	1) Improve on the product quality to become competitive

Source: Primary data, 2020

I. Conclusions and recommendation for investment

Based on the findings above, below are the conclusions;

1) Actors operate as individuals, and trade is largely unstructured.
2) Competition is high at the baking and retailing levels due to the low level of capital required.
3) The business is profitable, but the margins are small largely due to small scale of operation..

The proposed investment options are for ensuring that the skills learned are utilized capacity, import substitute bakery and confectionary products brought into the district and hence the need for equipment that enables the production such products e.g. bread, cookies and cakes and finally packaging, quality control and UNBS certification.

1. Public investment options:

a) Construction and rehabilitation of roads to reduce transportation costs and ease movement of raw materials and final carpentry products

b) Need to address the irregular electricity supply in the region. This is a major deterrent for business. There is need to explore alternative energy sources e.g. solar.

2. DRDIP investment options

a) Purchase of equipment i.e. manual system for the medium bakers. The medium-scale bakers' group should operate as one unit and hence need to rent/lease premises and run them. In the first year, the group has to agree to receive low wages i.e. UGX 30,000 per month per person because of the investment in equipment but this will increase as more profits are made.

b) For the roadside chapati making, purchase energy efficient tools for the small-scale bakers' group. The group members can share out the grant so that the different group members can establish chapati selling spots in different locations with business potential.

c) Train in essential skills such as making more designs and a variety of products in order to tap a wide market, use of bakery waste, effective business management and marketing skills. Skills in effective business management and marketing skills are needed too.

d) There is need to explore into quality and skills in making of the bread, cookies and cakes that are imported into Adjumani and sold in the supermarkets. This will require purchase of the relevant equipment and technical know-how.

e) Investment into packaging requirements for the different market segments

3. Private sector support recommendations are:

a) To bridge the information asymmetry in the value chain – an information platform between the consumers of the processed items, the processors and the producers can be piloted to ensure that there is information on quality and quantity desired.

b) Access to credit facilities available options as a way to ensure that the working/operational costs of the processors are adequately met to ensure profitability. For subsequent years the processors may access credit facilities from VSLAs or link with SACCOs).

c) The investment options are for small and medium scale bakers propose labour-saving equipment such as use of improved baking equipment e.g. an electric or manual mixer, and an alternative to an electric oven e.g. a firewood run oven. Table 36 contains the assumptions for the investment options and table 37 presents the scenarios for the medium and small-scale bakers

Table 36: Assumption in bakery and confectionaries

Assumptions used	Medium scale	Small scale (1 person)
Flour used in production per month in Kg	2,100	30
Quantity of flour used per year	25,200	624
1kg of flour produced pieces of mandazi/Chapati	10	13
Quantity of mandazi/chapati produced	252,000	8,112
Price of 1 piece of Mandazi/Chapati in UGX	400	500
Price of flour of a Kg of flour	2,500	3,000
Cost per cooking stove for small scale in UGX		30,000
Cost per frying pan		35,000
Charcoal per day		1,000
Labour cost per day		5,000
Life span in years	10	10
Discount rate	9%	9%
Product made/used	Mandazi	Mandazi

Source: Primary data

Table 37: Investments in bakery and confectionary per year

Particular	Electric operated	Manually and firewood operated	Manually operated
	Medium scale	Medium scale	Small scale (A group of 10 people)
	15 Horsepower		
Electric Mixer cost	7,500,000	150,000	-
Oven	5,200,000	500,000	-
Trays	500,000	500,000	-
Worktables	300,000	40,000	200,000
Refrigerator	1,300,000	-	-
Storage	600,000	600,000	-
Charcoal stove (Stand)	-	-	300,000
Frying pan	-	-	350,000
Total fixed cost	**15,400,000**	**1,790,000**	**850,000**
Display	500,000	500,000	-
Leasing premises per year	3,600,000	150,000	200,000
Cost of flour per year	3,000,000	3,000,000	1,872,000
Other costs for baking ingredients	300,000	300,000	300,000
Labour costs	1,800,000	3,600,000	15,600,000
Electricity per year	1,800,000	-	-
Fuel wood/Charcoal	-	900,000	3,120,000
Total variable costs per year in UGX	**11,000,000**	**8,450,000**	**21,092,000**
Total costs (fixed and variables)	**26,400,000**	**10,240,000**	**21,942,000**
Revenue	11,582,500	11,582,500	40,560,000
Gross margin per year	582,500	3,132,500	37,440,000
Returns to investment (%)	2	31	171
Payback	Does not payback in 10 years	8 Months and 2 weeks	2 weeks and 3 days
NPV in UGX	- 209,051,588	19,586,394	762,082,150
Grant given to a group in UGX	25,900,000	25,900,000	25,900,000
Deficit/Surplus	-500,000	17,450,000	4,808,000

Source: Primary data

The investment options to be considered are for equipment and operating capital. The payback period for bakeries and confectionaries is a weighing factor. The current DRDIP grant of UGX 25.9 million is sufficient, therefore DRDIP grant should be used to:

1. Purchase of equipment i.e. manual system for the medium bakers and roadside chapati making tools for the small-scale bakers' group.
2. Train in essential skills such as making more designs and a variety of products to tap a wide market, use of bakery waste, effective business management and marketing skills. Skills in effective business management and marketing skills are needed too.
3. The medium-scale bakers' group should operate as one unit and hence need to rent/lease premises and run them. In the first year, the group has to agree to receive low wages i.e. UGX 30,000 per month per person because of the investment in equipment but this will increase as more profits are made.
4. For the small-scale bakers' group, the group members can share out the grant so that the different group members can establish chapati selling spots in different locations with business potential.

3.2.3 Carpentry Value Chain

A. Background

Carpentry is a skill of shaping and assembling structural woodwork (Merriam Webster, 2020). In Uganda, carpenters traditionally worked with natural wood to make construction materials like frames, doors, windows, home furniture such beds, chairs, and tables. In addition to wood, they use other materials like plywood, plastic and manilla to make products like cabinets and furniture. Carpentry has traditionally been dominated by men although more women are now joining the business especially in the design of bespoke home furnishings and products.

Discussions with a carpentry trainer revealed that there are different kinds of carpenters including:

a) *A finish carpenter* or a joiner who does finish carpentry, that is, cabinetry, furniture making, fine woodworking, model building, instrument making, parquetry, joinery, or other carpentry where exact joints and minimal margins of error are important.

b) *A carpenter and joiner* with skills ranging joinery, finishing carpentry, construction and form work.

c) *A trim carpenter* specializes in mounding and trimming, of items such as door and window casings, mantels, baseboards, and other types of ornamental work. They also make cabinet installers.

d) *Cabinetmakers* specialize in making of cabinets made from wood, wardrobes, dressers, storage chests, and other furniture designed for storage.

The Adjumani District Development plan recognized supporting and protecting livelihoods, and livelihood diversification through carpentry, petty shops, handicraft, etc., so that people have a safety net to rely on during all stages of drought.

B. Demand and Supply of Carpentry Products

Developing countries do not get value for wood material used since their timber products are of a lower quality and hence the products made may not compete favorably with imported products. There are several small-scale industries that locally produce furniture for low income earners. These small-scale wooden furniture industries make up to 26% of the total number of manufacturing businesses in Uganda (UBOS 2017). This means that the furniture produced may not compete with higher quality imported furniture. In this situation, there is an increased dependency on imported furniture items that affect the country's economic growth.

Local carpenters operating in Adjumani too shared that there is an increasing demand for better molded wood by clients which is driving them out of business. The carpenters say that the machines which they would have used to mold the wood to meet the test and preference of their clients are beyond the reach of their economic status. The carpenters used to send timber for molding in Gulu but now the clients opted to buying direct from Gulu. This was a missed opportunity to supply hotel owners and other big institutions like schools that have resorted to purchasing furniture from Kampala. Worse still there is a poor attitude of the natives towards not supporting local and infant firms "even after molding, still our people will prefer buying from other places "he stressed.

C. Value Chain Analysis

In Adjumani, carpenters make door frames, doors, chairs and tables. Majority are unskilled and have acquired the skill on the job mainly out of own interest in the trade and need to make ends meet. A few are trained in vocational schools and by NGOs who provide training and basic start-up kits for the trainees.

Majority (over 90%) of the carpenters make the products on order upon receiving a minimum deposit i.e. 30% -50% of the selling price from the customer. The carpentry workshop owners engage in both production and marketing of their products. For instance, 60% of the products made in the workshops are sold to institutions like schools and local government, while 30% are sold to hotels & restaurants and 10 % to individual customers. Below is a detailed description of the actors, their characteristics and associated roles.

Input suppliers: These include hardware shops and timber suppliers. The hardware shops are mainly owned by men and have an inventory of less than UGX 10 Million. Half of hardware owners finance their business with money borrowed from banks and SACCOs whereas the other half use own savings.

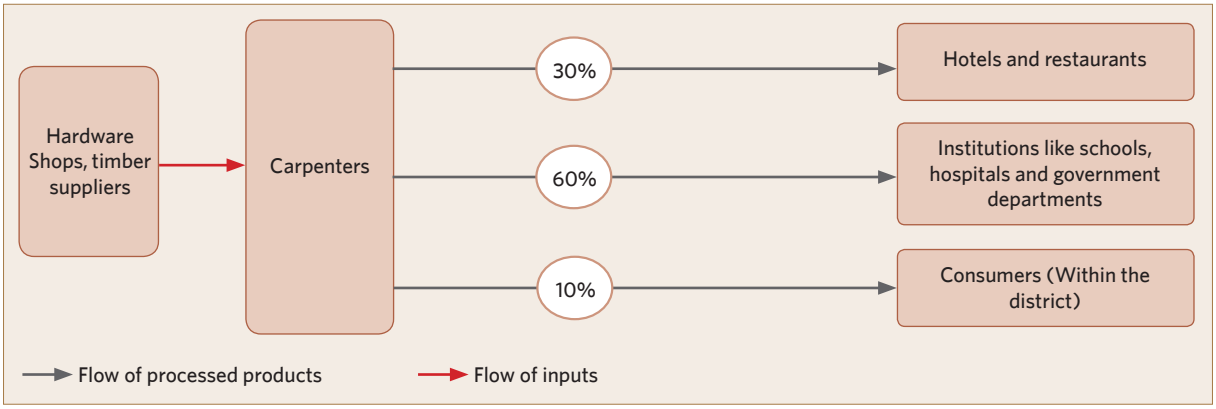


Figure 41: Carpentry Value Chain Map
Source: Primary data, 2020

The hardware shops stock a variety of products including carpentry equipment and construction materials. The carpentry related material constitutes approximately 10% - 15% of the stock and includes: nails, drills, hammers, etc. Construction material includes cement, binding wires, iron bars, iron sheets, spade, etc. The hardware shops are registered at the District and pay an annual trading license fee of UGX 100,000.

Timber suppliers' source soft and hard wood from Northern Uganda, South Sudan and DR Congo. The timber is from various trees e.g. Milicia excelsa (Eleu), Tectona grandis (teak), and Mugavu in different lengths and sizes. In Adjumani, a mature tree costs at UGX 100,000 - UGX 200,000 depending on the tree species and its size. Cutting services are hired from individuals who own a chain saw. In this case, the owner of the machine is paid in kind i.e. 20% of the lumbered timber pieces. Timber from South Sudan and DRC is expensive because of import tax and the quality of timber (mainly hard wood). Timber is transported at night to avoid bribes.

According to the Adjumani District Forest Officer, it was easier to acquire timber 10 years ago due to the abundance of trees like Tectona grandis (Teak), Mai, Maza, Manzu, Morogilo and eucalyptus. Findings from Adjumani revealed that there are fewer mature trees in Adjumani and tree felling

policies implemented by National Forestry Authority constrain tree felling significantly. In addition, transportation is costly as trucks are often asked to pay bribes or impounded if they lack required permit.

Carpenters: Thirty percent the carpenters interviewed in the study had skills in carpentry and joinery. They were trained by the Northern Uganda Social Action fund programme in the office of the Prime Minister (OPM). After the training they were given a grant that they used to buy equipment needed to start the workshop. Carpenters in Adjumani operate own workshops that are situated in both host and the refugee communities in Adjumani town, sub-county towns and near the settlements e.g. Alere and Ayilo settlements. The workshops are registered at the district and a carpenter pays an operating license fee of UGX 100,000 yearly. Ninety percent of carpenters in Adjumani are men while women offer support services like smoothening wood surfaces with sandpaper and cleaning the premises. The carpenters use a variety of hand or power tools to cut and shape wood. Some of the equipment includes tape measures, squares, chisels, power saws and plane machines, clamps, hammer, drills, etc. A carpenter employs on average five people mainly male youths that are paid 15% of the value of the product they make. The main products they make include beds, tables, and chairs. These products and their price ranges are shown below:

Table 38: Prices of different carpentry products

Product	Timber size used	Amount in UGX per unit
Bed (6 by 6)	8 by 7 inches	450,000
Five-seater	8 by 7 inches	1,500,000
Six-seater	8 by 7 inches	2,000,000
Eight-seater	8 by 7 inches	2,500,000
Dining table (Six-seater)	12 by 2 and 4 by 3 inches	1,200,000
Door and frame	12 by 2 and 6 by 2 inches	350,000
Window and frame	4 by 4 and 4 by 3 inches	140,000

Source: Primary data, 2020

About 40% of products sold are custom made mainly for schools, hospitals, hotels, restaurants and individuals. Customers make a deposit 30% - 50% of the sell price to commission the order. Sixty percent of the products sold are ready made. Carpenters have albums of a variety of products in case those on display do not meet customer's specifications. Approximately, 50% of the carpenters buy raw materials/inputs from Adjumani town or from the neighboring districts of Arua, Moyo, Yumbe.

Adjumani has no vocational Institute or school that offers training in carpentry. The nearest institute is Junior Express Adjumani. However, trainees can attend apprenticeship courses from Tamaina Wood Workers in Adjumani. The apprenticeship course lasts 4 months and the trainees are given an allowance that ranges from UGX 50,000 to 70,000 for transport fees and lunch. NGOs like the Danish Refugee Council support trainees to attend the apprenticeship courses and offer them start-up kits as well.

D. Profitability analysis for carpenters

A carpentry workshop handles more than one product at a time. As a result, the GM analysis is based on the five most sold products (beds, sofa set, 6 seater dining table, window, door). A carpenter making a 6X6 bed on average earns a GM of UGX 22,493 per bed. The major cost driver in making a bed is the cost of timber accounting for 55% of the total costs.

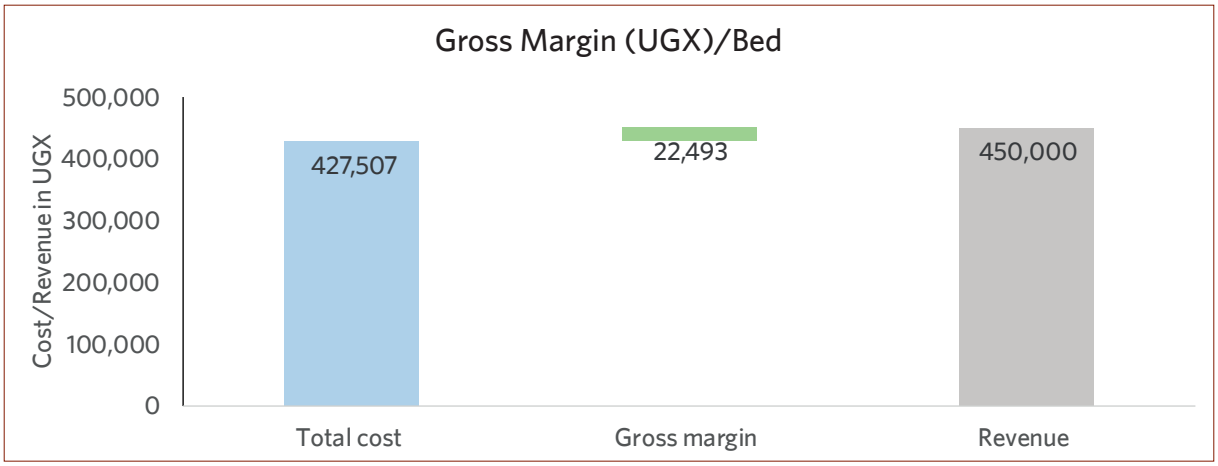


Figure 42: Gross Margin per bed made by the carpenter
Source: Primary data, 2020

In the case of a sofa, the higher the number of seaters in a set, the higher the GM (Figure 44). For instance, from an eight-seater sofa set, a carpenter earns a GM of UGX 800,000, compared to UGX 340,000 for a five-seater. The major two cost drivers are cost of timber (44% to 47%) and labour (19% to 22%) of the total costs. On average 12 sofa sets are made a year but the production of items is dependent on demand.

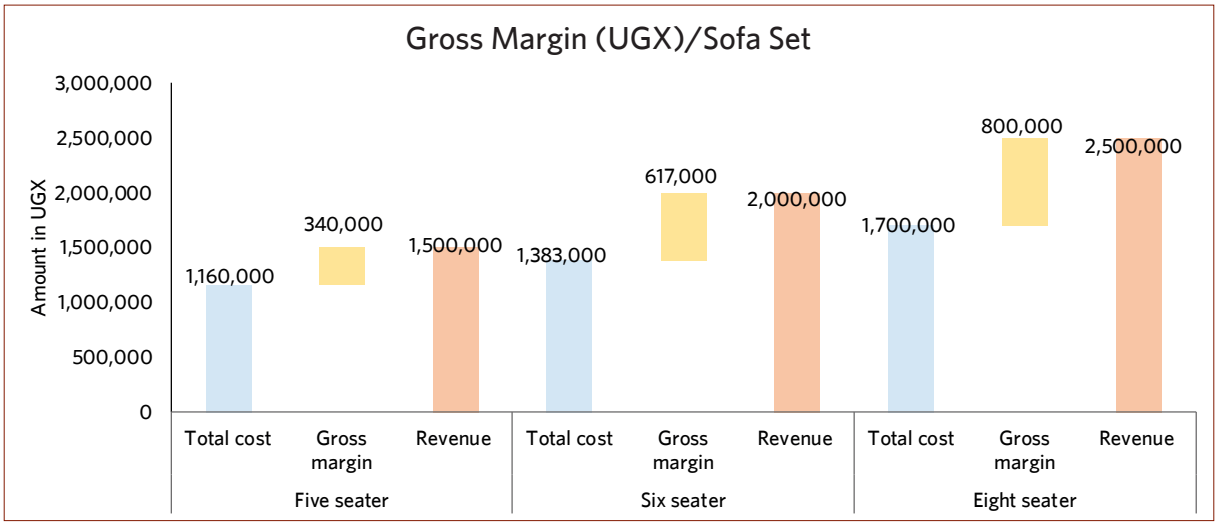


Figure 43: Gross Margin per sofa-set chair made by the carpenter
Source: Primary data, 2020

In the case of a six-seater dining set, carpenter makes a GM of UGX 450,000 and the major cost driver is timber and labour contributing 50% and 24% of the total cost, respectively. The total number of timbers used in making sofas is 22, 25 and 30 pieces of size 8 by 7 inches for five, six, and eight dinning set seaters, respectively.

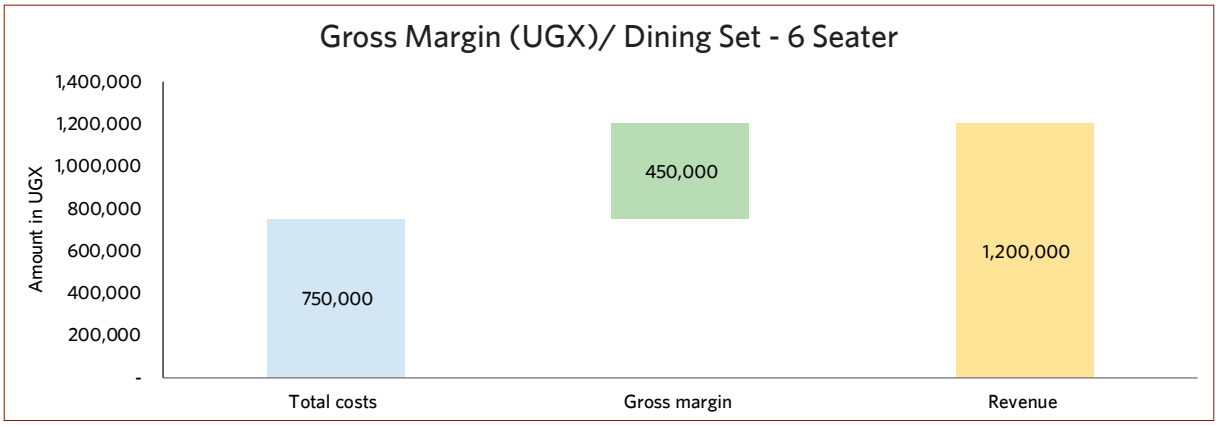


Figure 44: Gross Margin for a six-seater dining set
Source: Primary data, 2020

The carpenters interviewed also make window shutters and frame as well as doors and door frames. They earn the highest GM from door shutters (UGX 14,000/piece) following by window shutter – UGX 9,000/piece, door frame – UGX 7,500/piece and the least from window frame UGX 3,000 per piece made. The timber size mostly used to make windows, doors and door frames is of size 4 by 4 and 4 by 3 inches. The major cost driver is timber contributing 42% to 63% of the total cost depending on the product (Figure 46).

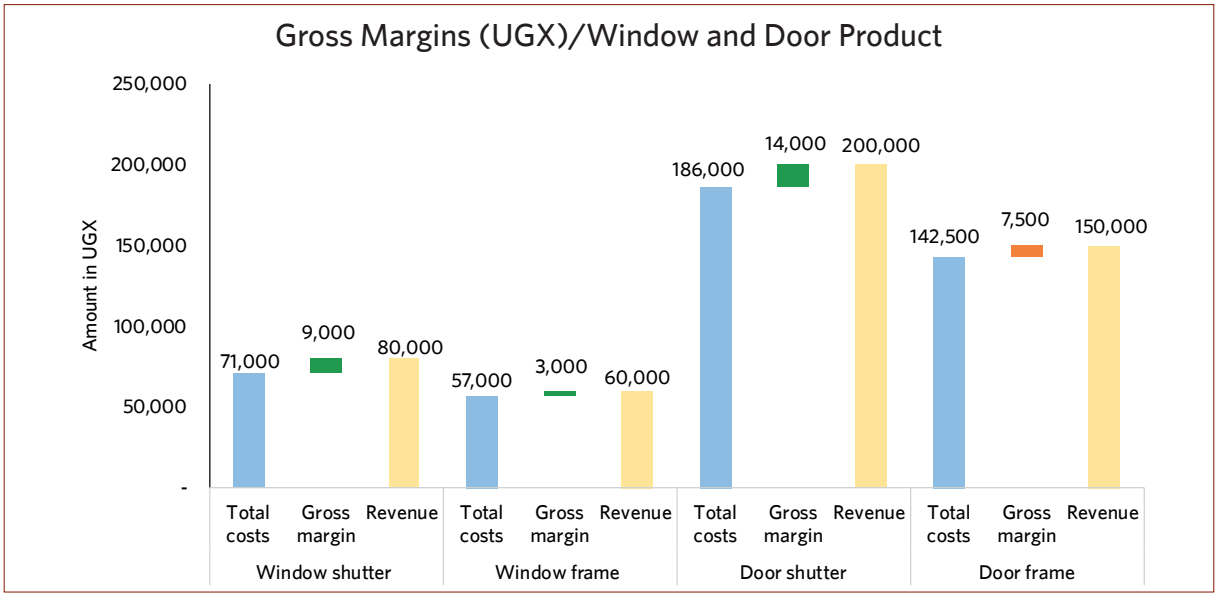


Figure 45: Gross Margin for window and door products made by the carpenter
Source: Primary data, 2020

E. Employment along the Value Chain

In the carpentry workshop, multiple products are made and each product employs more than one person in the workshop. Any employee at the workshop engages in multiple activities that include buying timber, loading, offloading the timber bought, transporting timber from supplier to the workshop and making the product. The employment analysis for the carpentry workshop reveals that on average, 4 people are employed to make a bed, door, window, sofa set chairs and dining table set, as presented in table 39.

Table 39: Jobs created under carpentry

Activity per year	Time taken for each activity in hours	Number of people	Man days	FTE
Aggregation of raw material (once in a year)	4	1	0.5	0.002
Transport	6	1	0.75	0.002
Cleaning of the premises	1	1	45	0.144
Loading and off-loading (4 times) of timber	1	2	1	0.003
Production process (15%)	6	4	1080	3.462
				3.5
Parameter			**Current**	
Wages in UGX in 1 year			4,800,000	
Gross margin per bed			22,493	

Source: Primary data, 2020

F. Social aspect in the carpentry

Carpentry is one of the activities that engage mostly men in the refugee and host communities. The activities involved in production of carpentry products are not intense and do not require highly specialized skills which can be learnt or perfected in a month's time.

Regarding environment issues: the carpentry raw material mainly timber (timber harvesting) results in deforestation whether controlled or uncontrolled which has devastating effect on the environment. The loss of trees and other vegetation causes soil erosion and flooding, which have grave effects on the communities. Further, there is loss of habitat for animal species, which can harm ecosystems and the loss of forests also results in warmer and drier weather patterns which destroy ecosystems that many animal and plants depend on. In addition, the loss of trees allows a greater amount of greenhouse gases to be released into the atmosphere. Healthy forests absorb carbon dioxide from the atmosphere, acting as valuable carbon sinks. Deforested areas lose that ability and release more carbon.

Waste Management i.e. the shavings and offcuts were the most common types of waste; sawdust and rejects scored lower. Wood shavings, off-cuts and sawdust are inappropriately managed, yet they could be utilized for several applications as raw materials such as for making briquettes. Most (70%) furniture workshops did not utilize wood waste; some burnt it, while others sold it off as fuel; only a few converted it to useful source of energy for the workshop activities.

.

G. Public, Private and community support

The carpentry enterprise falls under the Ministry of Education and Sports; but timber as a raw material fall under the Ministry of Water and Environment and the National Forestry Authority. These ministries, authority and the local government offer policy, regulation and guidance to the carpenters.

The Forestry Policy (2001) and the National Forestry and Tree Planting Act (2003) are the overarching frameworks for controlling production, movement, and trade of timber. They define the illegal and legally acceptable practices in timber trade. The Act contains several specific provisions relating to timber harvest and trade but also makes 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 in carpentry and joinery. The vocational institutes are in various districts in Uganda for instance in Adjumani there is Junior Express Adjumani, a Private Training Institution offering a variety of courses such: Carpentry/Joinery, Tailoring/Garment cutting, Brick laying and concrete practice etc.

Government and the private sector due to adverse effects of climate change have invested efforts in promoting the increase of afforestation due to the intense demand on the trees from various sectors.

H. Threats and community preparedness

Challenges are faced by the carpenters that have led to poor performance of the enterprise. For instance, Adjumani is characterized with poor electricity supply i.e. electricity is turned off in the morning and returns after 6:00pm. This affects the timber supplier who cannot split the timber into different sizes for sale. The carpenters too are affected because they need to use various electric machines to produce furniture products on order. Interestingly, the Adjumani carpenters have improvised by working at night.

There were several inefficiencies in the production of wooden furniture, such as inadequate timber seasoning, inappropriate waste management and utilization, and poor product storage. Therefore, the poor practices and inefficient production in Uganda's wooden furniture industry should be considered as a matter to be addressed.

Generally, there are poor timber management practices that could be attributed to limited exposure to suitable technologies such as kiln technologies which are expensive and may not be afforded by small scale furniture workshops. The carpenters have insufficient operating capital with the SACCOs/ VSLA being their only fallback option. The microfinance institutions have a limit that anyone member can have as outstanding. They have however used their own savings to invest in the carpentry business. Table 40 summarizes the challenges and their mitigation measures.

Table 40: Challenges and mitigation measures along each node

Challenges	Mitigation
1) Unreliable power supply – loading shedding/ power outages occur daily. 2) High cost of timber as there are restrictions on cutting trees for timber in the district. Imported timber is taxed and is more expensive that local timber. 3) Poor timber management practices e.g. high moisture content in the timber 4) Inadequate working capital 5) Limited skills in designing good quality carpentry. 6) Poor storage of the finished products	1) Use alternative energy sources such as solar. 2) Afforestation to promote tree planting and structured deforestation. 3) Promote a culture of saving through VSLAs and SACCOs 4) Vocational training centres to provide skills for designing wooden products.

Source: Primary data

I. Conclusions and recommendation for investment

Based on the finding, it was concluded that:

1) Both host and refugee communities are engaged in carpentry
2) There are few actors in the value chain.
3) The various products made by carpenters are profitable.
4) Carpentry is a source of jobs and provides skills especially to the youth

The proposed investment options for the carpenter are labour and energy efficient equipment and equipment that allows unique designs. There is need for skills learned for drying of timber i.e. to reduce it to 15%-10%

1. Public investment options:

a) Construction and rehabilitation of roads to reduce transportation costs and ease movement of raw materials and final carpentry products.
b) Explore alternative energy sources e.g. solar to address the irregular electricity supply in the region.

2. DRDIP investment options:

a) Support tools that are manually operated so that they can be used when there is no electricity. The manual operated system is a more viable business given the higher GM and shorter payback period. The GM is higher for the manual system by UGX 1.2 million, the RoI is 7% higher and the payback period is shorter (7 months).

b) Essential skills are required in making unique designs and varieties of products to tap a wide market and use of carpentry waste. There is need to explore into skills of good timber and furniture storage.

c) There is need to pilot and research into the effectiveness and performance of groups and/or cooperatives amongst carpentry workshops as producer associations.

d) Invest in equipment that has prospects of wood carving to improve timber utilization in small scale furniture workshops and introduce new designs distinctive to Adjumani. This could create national and international market interest in the furniture due to their unique appearance reflecting the Madi or Southern Sudanese culture and tradition.

3. Private sector support recommendations are:

a) To bridge the information asymmetry in the value chain – an information platform between furniture shops, carpenters and timber traders can be piloted to ensure that there is information on quality and designs desired.

b) Access to credit facilities available options to ensure that the working/operational costs of the carpenters are adequately met to ensure profitability.

Table 41: Investments in carpentry

Assumptions used	
Discount rate	9%
A chair made from timber of size 8 by 7 inches	1
Number of chairs made	3
Number of timbers for making table set of timber of size 12 by 2 inches	15
Number of timbers for making Coffin of size bby 12X2 inches	2
Discount rate	9%
Shelf life	10 years

Source: Primary data

Table 42: Investments in carpentry

Particular	Electric drill and Clamp	Manual drill and clamp
Cost of equipment (Fixed costs)	2,630,000	2,435,000
Timber	8,300,000	8,300,000
Rent per year	3,600,000	3,600,000
Electricity	1,200,000	-
Transport	1,800,000	1,800,000
Nails	600,000	600,000
License	50,000	50,000
Labour costs	3,222,000	3,222,000
Total variable costs per year	**18,772,000**	**17,572,000**
Total costs (Fixed and variable)	**21,402,000**	**20,007,000**
Gross margin per year	2,708,000	3,908,000
Revenue per year	21,480,000	21,480,000
Returns on investment (%)	13	20
Payback	1 Year 2 weeks	7 months
NPV in UGX	68,127,394	118,832,625
Grant given to a group in UGX	25,900,000	25,900,000
Deficit/Surplus in the grant	7,128,000	8,328,000

Source: Primary data

4. CONCLUSION

This chapter presents the outcomes of an analysis on the investment prioritization of the value chain selected to guide implementation of the livelihood projects component of the DRDIP among refugee settlements, hosting and non-hosting communities in Adjumani district. To draw the findings from the value chains, the ranking methodology (Rokeach, 1968) was used. In this technique, the respondent places a list of values in order of importance. The rating system is advocated for its simplicity in execution and analysis.

The process of ranking involved the following stages.

a) Identifying the factors (attributes) of consideration

b) Ranking per value chain

c) Calculating the total rank scores

d) Interpreting results

The three attributes that are core to DRDIP's livelihood component are profitability, employment and market value, and these were used in ranking the VCs. Table 43 describes each of these attributes.

Table 43: Attributes used in ranking

Attribute	Description
Profitability	Gross Margins and Pay Back Periods were used. Gross margins for the producers in UGX per acre/Kg per year for crop, per live goat per year or for the most sold product under the non-traditional VCs per year. Gross margin is the difference between revenue and variable cost for each enterprise. It is a short run measure of enterprise performance. The Pay Back Period (PBP) considered the period taken for the enterprise to break even.
Employment	These are the current total jobs in the value chain. The jobs are estimated using the full-time equivalent (FTE) approach that assumes a man day is equivalent to 8 working hours per day
Market Size	The value earned per annum from the selling of one popular product from each value chain.

The highest revenue is earned under agro processing, while most jobs and the biggest market size are under sesame VC. Conversely, the least GMs, number of jobs and market size are under goats, carpentry, and okra, respectively (Table 44).

Table 44: Summary of findings from the detailed value chain analysis (VCA)

Attributes per year	Goats	Sesame	Soybean	Tomato	Okra	Agro-processing	Bakeries	Carpentry
Profitability	14,250	604,000	346,000	386,334	754,000	14,790,000	3,132,500	3,908,000
Employment	1,020	23,362	17,727	3,421	3,610	1,099	400	360
Market Size (UGX millions)	33.9	78.0	19.6	16.0	9.6	36.5	11.6	21.5

Source: Primary data

The VC with higher weight was always prioritized in relation to the others. Thus, using the attributes in Table 44, the VCs were ranked from the leading to the least as follows: sesame, agro processing, soybean and carpentry, okra, tomato then bakery and goats.

Table 45: Ranking of the value chains in relation to each attribute

Attribute	Goats	Sesame	Soybean	Tomato	Okra	Agro-processing	Bakery	Carpentry
Profitability	1	4	2	3	5	8	6	7
Employment	3	8	7	5	6	4	2	1
Market size	6	8	4	3	1	7	2	5
Total score	10	20	13	11	12	19	10	13
Ranks	**7**	**1**	**3**	**6**	**5**	**2**	**7**	**3**

Source: Primary data

Sesame which top the list is more benefiting to the host than to the refugee communities because it is land intensive. Agro-processing was second while carpentry and soybean are third in rank. Auspiciously, both agro processing and carpentry are appealing to all the communities. Goats and bakery are ranked last. However, bakery would be preferred as it has a less payback period of 8 months compared to goats which take five years.

In conclusion therefore, DRDIP can fund the sesame and soybean VCs targeting the host communities but also for those refugees that can hire land. Agro processing, carpentry, bakery, okra and tomatoes can be funded to benefit both communities under varying target beneficiaries' groups. In contrast, the goat VC is not recommended for investment by DRDIP. The GMs for goats at farmer level are negligible even after the strategic investments while the associated PBP is above five years yet technologies for value addition at production level to goat products are not readily available.

5. REFERENCE

1. Adjumani District Five-Year District Development Plan's (2015/2016–2019/2020).
2. Africa Uganda travel guide (2020). How to grow SIMSIM/SESAME in Uganda. https://www.africa-uganda-business-travel-guide.com/how-to-grow-simsimsesame-in-uganda.html
3. Anguria P , Chemining'wa,G,N , Onwonga R,N, & Ugen,M,A (2020). Assessing the Response of Sesame to Inorganic and Organic Nutrient Sources. Journal of Agricultural Science; Vol. 12, No. 1.
4. Anyanga, W. O., & Obong, Y. Y. (2001). Sesame (Sesamum indicum L.) In J. K. Mukiibi (Ed.), Agriculture in Uganda, 11, 97-102.
5. Ardalan K (2012). Payback Period and NPV: Their Different Cash Flows . Journal of Economics and Finance Education: Volume 11 Number 2 Winter 2012.
6. Atlas big (2020).Top Okra Producing Countries. https://www.atlasbig.com/en-in/countries-by-okra-production.
7. Balgos, Carol Q. & Digal, Larry N., (2017). "Employment Generation Potential of the Rice Value Chain: The Case of Mlang, North Cotabato in Mindanao," Philippine Journal of Development PJD 2016 Vol. 43 No. 1a, Philippine Institute for Development Studies.
8. Barnard, C.S. and Nix, J.S. (1979) Farm Planning and Control. Cambridge University Press, Cambridge.
9. Bhutto, Z, A, Magsi F, Abid Ali Soomro, A,A,Chandio, M, A. (2017). Integrated pest management of Okra insect pests.https://www.researchgate.net/publication/317676857_Integrated_pest_management_of_Okra_insect_pests.
10. Brigham, E. F., & Ehrhardt, M. C. (2005). In Financial Management (11th, International Student ed., p. 347). South-Western Cengage Learning.
11. Bwire (2008). Factors Affecting Adoption of Improved Meat Goat (Boer) Production in Rangelands of Sembabule District.
12. CABI (2017). Plant wise. https://www.plantwise.org/wp-content/uploads/sites/4/2019/03/Plantwise-Annual-Report-2017.pdf
13. Chianu, J., Vanlauwe, B., Mukalama, J., Adesina, A., Sanginga, N. (2006). Farmer Evaluation of Improved Soybean Varieties Being Screened in Five Locations in Kenya: Implications for Research and Development. African Journal of Agricultural Research Vol.1 (5):pp. 143-150, December 2006.
14. Cleland M (2020). This Bakery in Uganda. https://www.globalgiving.org/learn/lgbtq-cake-bakery-in-uganda
15. Clune S, Crossin E, Verghese K, Systematic review of greenhouse gas emissions for different fresh food categories, Journal of Cleaner Production (2016), doi: 10.1016/j.jclepro.2016.04.082.
16. Dijkxhoorn, Y, Michiel van Galen, Julian Barungi, John Okiira, Joyce Gema and Valerie Janssen, 2019. The vegetables and fruit sector in Uganda: competitiveness, investment and trade options. Wageningen, Wageningen Economic Research, Report 2019-117. 80 pp.; 35 fig.; 25 tab.; 24 ref.
17. Economic Policy Research Centre (2018). Fostering a sustainable agro-industrialisation agenda in Uganda. Kampala.
18. Elepu G, Dalipagic I (2014). Eanalysis in Northern Uganda: Maize, Rice, Groundnuts, Sunflower and Sesame...

19. Eshun, J.F., Apori, S.O and Oppong-Anane, K (2011). Environmental system analysis of tomato production in Ghana. African Crop Science Journal 19(3):165 - 173.

20. FAO (2015).The State of Food and Agriculture Social protection and agriculture: breaking the cycle of rural poverty. http://www.fao.org/3/a-i4910e.pdf

21. FAOSTAT (2020) Data on commodity production

22. Fordham, R and Hadley, P.(2003). Vegetables of temperate climates | Stem and Other Vegetables in Encyclopedia of Food Sciences and Nutrition (Second Edition), 2003

23. Fowler, M and Rauschendorfer, J. (2019). Agro industrialisation in Uganda. Current status, future prospects and possible solutions to pressing challenges. https://www.theigc.org/wp-content/uploads/2019/11/Fowler-and-Rauschendorfer-2019-working-paper.pdf.

24. Globenewswire, (2020). Okra Seeds Market .https://www.globenewswire.com/news-release/2019/07/25/1887743/0/en/Okra-Seeds-Market-Size-to-Reach-USD-352-7-Million-by-2023-at-9-8-CAGR-Predicts-Market-Research-Future.html.

25. Gollin, D., Mugenyi, A and Sen, R. (2016). Agricultural transformation and urbanization in Uganda. Policy Note. Kampala: International Growth Centre. November.

26. GoU, 2011 The Uganda's Apiculture Sector Profile

27. Index Box (2017). World – Tomato – Market Analysis, Forecast, Size, Trends and Insights. .

28. Index Box (2019). Global Tomato Market 2019 – Robust Consumption Growth in China and India Drives the Global Market. https://www.globaltrademag.com/global-tomato-market-2019-robust-consumption-growth-in-china-and-india-drives-the-global-market/.

29. Indiati, R. and Sharply, A.N. 1995. Soil phosphate sorption and simulated runoff parameters as affected by fertilisers addition and soil properties. Communication in Soil Science and Plant Analysis 26:2319-2331.

30. ITC, 2020. Imports and Exports data.

31. Karuga, James (2018). "10 Countries with Largest Soybean Production." World Atlas, Aug. 30, 2018, worldatlas.com/articles/world-leaders-in-soya-soybean-production-by-country.html.

32. Lakwo and Enabel (2018). Secondary Labour Market Study in Northern Uganda.

33. LTS International Limited (2017). Sector Analysis Studies for the Commercial Agriculture for Smallholders and Agribusiness Programme. http://www.value-chains.org/dyn/bds/docs/951/Component%20A%20and%20C%20-%20Annex%20A%20-%203%20%20Uganda%20Sector%20.pdf

34. LWF (2018).9 Facts About Refugees. https://www.un.org/africarenewal/magazine/december-2018-march-2019/uganda-stands-out-refugees-hospitality

35. MAAIF (n.a).The Agriculture Industrialization Policy Framework in Uganda. Key Note Presentation by the Hon. Minister of Agriculture, Animal Industry and Fisheries at the National Budget Conference and Economic Growth Forum 2019/20. https://budget.go.ug/sites/default/files/Ministers%20talking%20notes%20on%20the%20Agro%20Industrialization%20in%20Uganda%20at%20the%20Budget%20workshop%202018_0.pdf.

36. Martin Murray (2018), Supply Chain Performance Metrics https://www.thebalancesmb.com/supply-chain-performance-metrics-2221392

37. Martina J. A., Diab H. I., Brady O. A. and Puertollano R. (2016). TFEB and TFE3 are novel components of the integrated stress response. EMBO J. 35, 479-495. 10.15252/embj.201593428 .

38. Martinchik AN (2011). Nutritional value of sesame seeds. Voprosy Pitaniia, 01 Jan 2011, 80(3):41-43.

39. Merriam-webster (2020). Definition of carpentry. https://www.merriam-webster.com/dictionary/carpentry

40. Ministry of Finance, Planning and Economic Development. 2019. Budget speech financial year 2019/20. Delivered at the 4th session of the 10th Parliament of Uganda by Hon. Matia Kasaija. June. Kampala .

41. Minot, N. R. Stringer, W. Umberger. 2015. Urban shopping patterns in Indonesia and implications for East Africa. PPT presentation to USAID Office, Kampala. Washington, D.C: International Food Policy Research Institute.

42. Mordorintelligence, 2020. Global sesame seeds market - segmented by geography - growth, trends, and forecast (2020 - 2025) https://www.mordorintelligence.com/industry-reports/sesame-seeds-market

43. Munyua, B., Orr, A., & Okwadi, J. (2013). Open sesame: A value chain analysis of Sesame Marketing in Northern Uganda. Socioeconomics discussion paper series (Series paper number 6).

44. Muwanika, V, Kabi F, Masembe C (2016). Population genetic structure of Theileria parva field isolates from indigenous cattle populations of Uganda. Tick and Tick-Borne Diseases. 2016; 7:291–297.

45. Muzaale, (2011). Monies hidden in okra veggie.https://www.monitor.co.ug/Magazines/Farming/689860-1292858-8laaajz/index.html

46. NAAD (2005). Hand book on goat production

47. Nakaweesi D (2017). Reap from bakery business. https://www.monitor.co.ug/Business/Prosper/Reap-from-bakery-business/688616-4065584-rs067v/index.html

48. Nassanga, (2019). Uganda: 'Okra Gave Me the Job I Yearned For'.https://allafrica.com/stories/201903160030.html

49. National Development Plan III (NDP III) (2020/21-2024/25), Government of Uganda.

50. National Planning Authority. 2019(c). Strengthening agroindustrialization for increased household incomes, food security and improved quality of life. NDPIII strategic direction for agricultural sector. PPT presentation. May 22. Kampala.

51. Rokani, L., Ekere, W., Walekwa, P. & Ebanyat, P (2017). Effect of entrepreneurship training of smallholder farmers on soybean productivity and household incomes in Lango Sub-region, Northern Uganda

52. Ojiewo, C, Swai a, I,S, Oluoch, Silue, D M.O. (2010).Development and Release of Late Blight-Resistant Tomato Varieties 'Meru' and 'Kiboko'.https://www.researchgate.net/publication/235915466_Development_and_Release_of_Late_Blight-Resistant_Tomato_Varieties_'Meru'_and_'Kiboko'.

53. Onzima R. B. Upadhyay, M. R. Mukiibi, R. Kanis, E. Groenen, M. A. M. Crooijmans, R. P. M., A. (2018). Genome wide population structure and admixture analysis reveals weak differentiation among Ugandan goat breeds. https://doi.org/10.1111/age.12631

54. 54. Sartori ,D, Catalano, G, Genco, M, Pancotti C, Sirtori ,E, Vignetti, S; Del Bo, C (2014). Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020. https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

55. Semakula, J., Mutetikka, D., Kugonza, R.D. and Mpairwe, D. 2010. Smallholder goat breeding

systems in humid, sub humid and semi-arid agro ecological zones in Uganda. Global Veterinaria 4 (3): 283-291

56. SNV. (2011). Increased Competitiveness of the Oilseed Value Chain Through Improved Information on the Markets for Soybean in Uganda. Downloadable at: http://api.ning.com/files/Z5VV7E.
57. Thoenes, P (n.a). Background paper for the Competitive Commercial Agriculture in Sub–Saharan Africa (CCAA) Study Soybean International Commodity Profile. http://siteresources.worldbank.org/INTAFRICA/Resources/257994-1215457178567/Soybean_Profile.pdf
58. Tukamuhabwa P and Oloka H.K 2016 (a). Soybean Research & Development in Uganda: A case of paradigm shift in an African University. Makerere University Agricultural Research Institute, Kabanyolo (MUARIK), Makerere University, Kampala.
59. Tukamuhabwa,P, Obaa,B, Obua,T, Namara,M, Okii,D, Kabayi,P (2016) (b).. Status of soybean production and impact indicators of new soybean varieties in Uganda. A report on the status of recently released soybean varieties in Uganda submitted to the Vegetable Oil Development Project II (VODP II) Ministry of Agriculture, Animal Industry and Fisheries (MAAIF).
60. Tumwine, J. Frinking H. D.& Jeger,M. J (2010). Tomato late blight (Phytophthora infestans) in Uganda. Journal International Journal of Pest Management ;Volume 48, 2002 - Issue 1.
61. Tusime, S, M (2014). Evaluating horticultural practices for sustainable tomato production in Kamuli, Uganda.
62. Twatangire, A. (2015). Uganda smallholder pigs value chain development_ Situation analysis and trends –
63. UBOS (2015). Uganda Statistical Abstract 2015
64. UBOS (2019). Key economic indicators: quarter two (Oct-Dec 2018). 112th Issue. March. Kampala: Uganda Bureau of Statistics
65. UIA (2010). Investment Abstract 2010/2011.
66. UNHCR (2018).Trends at A Glance. https://www.unhcr.org/globaltrends2018/
67. Vargas H R and Vigneri M (201). Mainstreaming gender sensitivity in cash crop market supply chains . http://www.fao.org/3/a-am313e.pdf
68. VEDCO. (2011). Stakeholders report for the Soybean Value Chain Meeting.
69. WF (2015). Annual Reports.https://documents.wfp.org/stellent/groups/public/documents/eb/wfpdoc062506.pdf
70. World Bank (2015). Monito ring & E valuation for Jobs Operations. http://documents.worldbank.org/curated/en/530811506021536510/pdf/119131-REVISED-PUBLIC-Jobs-M-E-Toolkit-June-2017-Volume-1.pdf
71. World Bank. 2018. Uganda Economic Update: developing the agri-food system for inclusive economic growth. 12th edition. Washington, D.C: The World Bank.
72. World Weather Attribution (2020). Severe drought in Kenya, 2016–17. https://www.worldweatherattribution.org/kenya-drought-2016/ Home > Drought > Severe drought in Kenya, 2016–17

6. APPENDICES

Appendix 1: Costs and revenues for the different scenarios under goat value chain

A: Variable costs per herd of goat under different production system

Activity	Current Scenario		Improved scenarios	
	Local current	Cross Current	Open fenced supple-mented with fodder	**Zero grazing**
	1 goats +3 for sale	**1 goat + 2 for sale**	**1 goat + 3 for sale**	**1 goat + 3 for sale**
Fixed Cost				
Purchase of She goat	100,000	250,000	250,000	250,000
Shade construction			120,000	230,000
Paddock			200,000	
Seed for pasture			15,000	30,000
Sub Total Fixed Costs	**100,000**	**250,000**	**585,000**	**510,000**
Oxytetracycline /Drugs			40,000	40,000
Deworming	6,000	12,000	48,000	48,000
Acaricide		12,000	48,000	48,000
Feed trough		4,000	4,000	
Mineral block			80,000	80,000
Water			36,500	36,500
Vaccination			24,000	24,000
Routine daily management	730,000	547,500	730,000	1,460,000
Weeding pasture			30000	60000
Cost of maintain the bucks for servicing the goats			30,000	30,000
Hand spray		15,000	15,000	15,000
Sub Total Variable Costs	**736,000**	**590,500**	**1,085,500**	**1,841,500**
Total cost	836,000	840,500	1,670,500	2,351,500
Revenue from goat sale	300,000	600,000	1,200,000	1,290,000
Gross margin	**- 436,000**	**9,500**	**114,500**	**- 551,500**

Appendix 2: NPV and PBP for the different scenarios under goat value chain

Years	Local	Improved_current	Improved_Open fenced	Improved_Zero grazing
Initial Investment	- 100,000	-250,000	-585,000	-510,000
1	- 637,615	-516,514	-479,954	-1,607,706
2	- 1,004,587	- 508,518	-383,582	-2,071,893
3	- 1,341,259	-501,182	-295,167	-2,497,752
4	- 1,650,133	-494,452	-214,052	-2,888,449
5	- 1,933,503	-488,278	-139,635	-3,246,886
6	- 2,193,475	-482,613	-71,362	-3,575,727
7	- 2,431,982	-477,416	-8,727	-3,877,417
8	- 2,650,796	-472,649	48,737	-4,154,196
9	- 2,851,542	-468,275	101,456	-4,408,122
10	- 3,035,713	-464,262	149,822	-4,641,081

Costs and revenue for a trader

Item	Current		Improved	
	Local goat (weighs 15 KG) (3 goats soald)	Improved goat (Weighs 32KG) (2 gaots sold)	Open fenced goat (Weights 40KG) (3 goats soald)	Zero grazing goat (weights 43KG) (3 goats soald)
	Scenario 1			
Purchase of goats	300,000	560,000	1,200,000	1,290,000
Market fees	15,000	10,000	15,000	15,000
Polythene sheet	7,500	5,000	7,500	7,500
Rent	700	700	700	700
Total input costs	323,200	575,700	1,223,200	1,313,200
Slaughtering	18,000	12,000	18,000	18,000
Transportation of live goat	13,000	8,000	13,000	13,000
Loading and off-loading	5,000	3,000	5,000	5,000
Selling	27,000	20,000	27,000	27,000
Transportation from the slaughter house	13,000	8,000	13,000	13,000
Total labour costs	76,000	51,000	76,000	76,000
Total cost	399,200	626,700	1,299,200	1,389,200
Revenue	540,000	768,000	1,440,000	1,548,000
Gross margins	**140,800**	**141,300**	**140,800**	**158,800**

Appendix 3: Costs and revenues for the different scenarios under current sesame production

Sesame Current production			
Cost/Revenue item	Quantity per acre	Unit price in UGX	Amount in UG
Input costs			
Seed in Kg	4.5	4,000	18,000
Planting ropes (Pieces)	2	5,000	10,000
Bags/packaging material	4	3,750	15,000
Tarpaulin	1	20,000	20,000
Total input costs			63,000
Labour costs			
Opening with a tractor	1	120,000	120,000
Ox plough opening	6	30,000	180,000
Hand hoe	20	10,000	200,000
Planting	10	10,000	100,000
1st Weeding	14	10,000	140,000
2nd weeding	10	8,000	80,000
Harvesting	10	10,000	100,000
Transport from the garden to home	2	10,000	20,000
Drying	6	10,000	60,000
Threshing	2	10,000	20,000
Winnowing	2	10,000	20,000
Sorting and packaging	2	5,000	10,000
Transport to market	2	7,500	15,000
Total cost with hand hoe			828,000
Total cost with ox plough			808,000
Total cost with tractor			748,000
Volume (400 kg, 25% PHL)	300		
Price	3,500		
Revenue	1,050,000		1,050,000
Gross margin with a hand hoe			222,000
Gross margin with ox plough			242,000
Gross margin with ox plough			302,000
Scenario analysis			280
Total Costs with Aggregation centre			832,000
Price			3,500
Quantity (with 30% PHL)			280
Revenue per acre			980,000
Gross margin			152,000
Total costs with road construction			817,000
Quantity in Kg			300
Price			3600
Revenue			1,080,000
Gross margin			263,000

Appendix 4: Costs and revenues for the different scenarios under improved sesame production

Sesame improved production			
Cost items	**Quantity per acre**	**Unit price in UGX**	**Amount in UGX**
Seed in Kg	5	12,000	60,000
Planting ropes	2	5,000	10,000
Bags/packaging material	8	10,625	85,000
Tarpaulin	1	63,750	63,750
Pallets	1	25,000	25,000
Fertilizer per bag	1	120,000	120,000
Total input costs			**363,750**
Labour costs			
Opening with a tractor	1	120,000	120,000
Planting	10	10,000	100,000
1st Weeding	14	10,000	140,000
2nd weeding	10	8,000	80,000
Fertilizer application	10	8,000	80,000
Harvesting	18	10,000	180,000
Transport from the garden to home	4	10,000	40,000
Drying	9	10,000	90,000
Threshing	3	10,000	30,000
Winnowing	3	10,000	30,000
Sorting and packaging	6	10,000	60,000
Transport to market	6	10,000	60,000
Total cost with tractor			**1,373,750**
Volume (800kg and PHL 10%)	**720**		
Price	3,500		
Revenue	**2520000**		**2,520,000**
Gross margin per acre with a tractor			1,146,250
Total costs with road construction			**1,325,750**
Price			3600
Quantity			720
Revenue			2,592,000
Gross margin			1,266,250
Total costs with road construction and aggregation centre			**1,337,750**
Price			3650
Quantity			720
Revenue			2,628,000
Gross margin			1,290,250

Appendix 5: Costs and revenues for the different scenarios under sesame trading

Variable cost/ Revenue in UGX/Kg	Current scenario	Yield increase including reduction in PHL	Road Improvement	Construction of aggrega-tion centres	Yield Increase + Road improvement	Yield increase + Road improvement +Construction of aggregation centres
Purchase of produce	3,500	3,500	3,600	3,500	3,600	3,650
Packaging material	2	200	2	2	200	200
Storage facility	5	5	5	5	5	5
Licenses	3	3	3	3	3	3
Market fees	4	4	4	4	4	4
Total input cost	3,514	3,712	3,614	3,514	3,812	3,862
Total input cost	3,514	3,712	3,614	3,514	3,812	4,073
Aggregation	10	14	15	-	16	-
Transportation	25	23	20	25	18	19
Packaging	10	8	10	10	11	16
Total labour cost	45	45	45	35	45	35
Total costs	3,559	3,757	3,659	3,549	3,857	3,897
Gross margin in UGX/kg	41	993	31	51	988	1,043
Revenue	3,600	4,750	3,690	3,600	4,845	4,940

Appendix 6: Costs and revenues or the different scenarios under sesame processing

Variable cost/ Revenue in UGX/Kg	Current scenario	Yield increase including reduction in PHL	Road Improvement	Construction of aggregation centers	Yield Increase + Road improvement	Yield increase + Road improvement +Construction of aggregation centers
Purchase of produce	4,500	4,200	4,100	4,100	4,000	5,200
Packaging material	63	63	63	63	63	63
Electricity	100	100	100	100	100	100
Renting the premises	250	125	250	125	250	125
Water	60	30	60	30	60	30
Total input cost	4,973	4,518	4,573	4,418	4,473	5,518
Transportation	40	38	35	30	40	30
Loading and off loading	10	12	15	18	12	18
Packaging	8	8	8	10	6	10
Maintenance cost	750	750	750	1,770	555	750
Total labour cost	808	808	808	1,828	613	808
Total costs	5,780	5,325	5,380	6,245	5,085	6,326
Gross margin	1,620	3,240	2,020	2,395	2,315	2,240
Revenue	7,400	8,565	7,400	8,640	7,400	8,565

Appendix 7: Costs and revenues for the different scenarios under current soybean production

Cost /Revenue item	Quantity	Unit Price in UGX	Amount in UGX
Seed in Kg	25	2,500	62,500
Planting ropes	3	1,800	5,400
Bags/packaging material	8	1,500	12,000
Total input costs			**79,900**
Tractor	2	60,000	120,000
Oxen plough	6	30,000	180,000
Hand hoe	20	10,000	200,000
Planting	20	8,000	160,000
1st Weeding	20	8,000	160,000
2nd weeding	15	5,000	75,000
Fertilizer application	10	5,000	50,000
Harvesting	27	8,000	216,000
Transport from the garden to home	10	5,000	50,000
Drying	6	7,000	42,000
Threshing	5	5,000	25,000
Winnowing	2	4,500	9,000
Sorting and packaging	4	5,000	20,000
Transport to market	2	10,000	20,000
Total cost for hand hoe			1,106,900
Total cost for ox plough			1,086,900
Total cost for tractor			1,026,900
Volume (800kg, 25% PHL)			600
Price per Kg			2,000
Revenue per acre			1,200,000
Gross margin using hand hoe			93,100
Gross margin using ox plough			113,100
Gross margin using tractor			173,100
Total costs with road construction			1,090,900
Price in UGX			2,000
Quantity in Kg			600
Revenue under road construction			1,200,000
Gross margin with road construction			**109,100**
Cost with aggregation centre construction			1,110,900
Volume in aggregation			560
Price			2,000
Revenue under aggregation			1120000
Gross margin with aggregation			9,100

Appendix 8: Costs and revenues for the different scenarios under improved soybean production

Cost /Revenue item	Quantity	Unit Price in UGX	Amount in UGX
Seed	25	5,000	125,000
Planting ropes	3	1,800	5,400
Bags/packaging material	8	1,500	12,000
Tarpaulin	2	25,000	50,000
Pallets	7	1,000	6,800
Fertilizer per bag	1	120,000	120,000
Total input costs			**319,200**
Tractor	2	60,000	120,000
Planting	20	10,000	200,000
1st Weeding	25	8,000	200,000
2nd weeding	15	5,000	75,000
Fertilizer application	5	5,000	25,000
Harvesting	40	8,000	320,000
Transport from the garden to home	30	5,000	150,000
Drying	12	7,000	84,000
Threshing	10	5,000	50,000
Winnowing	8	5,000	40,000
Sorting and packaging	10	5,000	50,000
Transport to market	8	10,000	80,000
Total costs			**1,713,200**
Price			2,000
Quantity in Kg			1,080
Revenue			2,160,000
Gross margin			**446,800**
Costs with road construction			**1,633,200**
Price per Kg			2050
Quantity in Kg			1,080
Revenue			2,214,000
Gross margin			**580,800**
Cost of Combination of aggregation and road construction			**1,641,200**
Price per Kg			2100
Quantity in Kg			1,080
Revenue			2,268,000
Gross margin			626,800

Appendix 9: Costs and revenues or the different scenarios under sesame processing

Cost/Revenue per Kg	Current	Current and road	Current and Aggregation	Improved and road	Improved yield, road, and aggregation
Purchase of produce	1,000	2,000	2,000	2,050	2,100
Packaging material				30	15
Hiring a storage facility per month	367	367	367	50	40
Licenses	167	167	167	35	35
Total input costs	1,533	2,533	2,533	2,165	2,190
Transport	133	230	230	100	98
Aggregation	133	133	136	50	3
Security of the premises	400	33	33	41	20
Total labour cost	667	396	399	191	121
Total costs	2,200	2,930	2,933	2,356	2,311
Gross margin	50	-230	-233	589	634
Revenue	2,250	2,700	2,700	2,945	2,945

Appendix 10: Costs and revenues for the different scenarios under tomato production

Cost/Revenue item	Current			Improved without irrigation			Improved with irrigation		
	Quantity	Unit price	Amount	Quantity	Unit price	Amount	Quantity	Unit price	Amount
Seed (Kg)	5	15,000	75,000	5	75,000	375,000	5	78,000	390,000
Planting ropes	10	500	5,000	2	5,000	10,000	10	500	5,000
Pesticides				1	20,000	20,000	2	20,000	40,000
Fungicides				1	40,000	40,000	2	40,000	80,000
Fertilizer at planting				1	120,000	120,000	2	120,000	240,000
Foliar fertilizer				2	10,000	20,000	3	10,000	25,000
Mulching material				1	200,000	200,000	1	200,000	200,000
Bags/packaging material	10	5,000	50,000	1,872	3,000	5,615,000	1,875	3,000	5,625,000
Stakes for tomatoes	6	5,000	30,000	7	5,000	35,000	10	5,000	50,000
Total input costs			**160,000**			**6,435,000**			**6,655,000**
Tractor				1	120,000	120,000	1	120,000	120,000
Hand hoe	40	15,000	600,000						
Planting	11	10,000	114,286	12	10,000	120,000	12	10,000	120,000
Staking for tomatoes	6	50,000	285,714	6	50,000	300,000	6	50,000	300,000
1st Weeding	18	10,000	180,000	16	10,000	160,000	16	10,000	160,000
2nd weeding	8	5,000	38,500	8	5,000	40,000	10	5,000	50,000
Fertilizer application at planting				2	5,000	10,000	3	5,000	15,000
Watering in the morning and evening for 60 days							8	50,000	375,000
Fungicides				6	5,000	30,000	6	5,000	30,000
Manure application				18	5,000	90,000	16	5,000	80,000
Harvesting	15	5,000	75,000	36	5,000	180,000	36	5,000	180,000
Transport from the garden to home	10	5,000	47,619	15	5,000	75,000	15	5,000	75,000
Sorting and packaging	2	5,000	10,000	16	5,000	80,000	16	5,000	80,000
Transport to market	2	5,000	10,000	15	3,000	45,000	15	3,000	45,000
Total labour costs			1,361,119			1,250,000			1,630,000
Total costs			**1,521,119**			**7,685,000**			**8,285,000**
Price			2,857			2,500			2,600
Quantity			600			13,500			13,500
Gross margin			193,167			26,065,000			26,815,000
Revenue			1,714,286			33,750,000			35,100,000

Appendix 11: Costs and revenues for the different scenarios under Okra production

Activity	Current			Improved		
	Quantity	Unit price	Amount	Quan-tity	Unit price	Amount
Land hiring	1	250,000	250,000	1	250,000	250,000
Seed	1	20,000	20,000	1	50,000	50,000
Herbicides	1	20,000	20,000	1	20,000	20,000
Planting ropes	2	24,000	48,000	2	24,000	48,000
Bags/packaging material	10	3,000	30,000	20	5,000	100,000
Tarpaulin	4	50,000		4	50,000	200,000
Knives	15	3,000	45,000	15	3,000	45,000
Fertilizer	1	120,000	-	1	120,000	120,000
Total input costs			**413,000**			**833,000**
Tractor				2	60,000	120,000
Hand hoe	20	10,000	200,000			
Planting	7	10,000	70,000	7	10,000	70,000
1st Weeding	20	10,000	200,000	20	10,000	200,000
2nd weeding	16	8,000	128,000	16	8,000	128,000
Fertilizer application				50	5,000	250,000
Manure application	7	10,000	70,000	7	10,000	70,000
Harvesting	21	5,000	105,000	21	5,000	105,000
Transport from the garden to home	6	5,000	30,000	6	5,000	30,000
Drying	8	5,000	40,000	8	5,000	40,000
Threshing	6	5,000	30,000	6	5,000	30,000
Winnowing	8	5,000	40,000	8	5,000	40,000
Sorting and packaging	4	3,000	12,000	4	3,000	12,000
Transport to market	7	10,000	70,000	7	10,000	70,000
Total labour costs			995,000			1,165,000
Total costs			1,408,000			1,998,000
Price per Kg in UGX			3,000			3,000
Quantity in Kg			595			1,969
Gross margin			377,000			3,909,300
Revenue			1,785,000			5,907,300

ENTERPRISE GUIDANCE NOTE

A. PROFITABILITY SUMMARY

General assumptions

Crop Production	Non-traditional (Trade/Processing/ Bakery/Carpentry)
• Use of good agronomic and postharvest handling practices with improved technologies like fertilizer, improved seed, pesticides, and good storage • Farmers using aggregation centres for soybean and sesame • Farmers provide land equivalent to UGX 4.000.000 per acre • Farmer provide labour for all activities except land opening provided by the project	• 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 is 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
- Improved road network
- Functional input and output market linkages
- Actors strengthened in financial literacy, governance, and group dynamics
- Access affordable finance
- Repayment period for traditional and non-traditional is 6 and 4 months respectively

S/N	V/C	Enterprise	Production		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	Assumptions
			Q'nty	Unit	Q'nty	Unit									
1	Goat	Goat trading	56	Goat	56	Goat	430,000	24,080,000	22,704,000	1,376,000	4 months	• South Sudan • Local market and Gulu districts • Individual consumers, hotels, etc	388,000,000	• Obulejo Geofrey Ajeo (0785399079)	• Goat weighs 40kg live weight • Selling price for meat is UGX 12,000/Kg • DRDIP contribution is UGX 22,704,000

| S/N | V/C | | |

| S/N | V/C | | |

S/N	V/C		Enterprise	Production		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	Assumptions
5	Okra		Okra production					3,000	162,960,000	51,323,390	111,636,610	4 months	Local market in Adjumani Individual consumers and Traders	11,465,539,680	• Majak Angok (0782811699), Matiop Manyok Mabior (0787409076), Apul Guer Deng (0785572258), Santino Laul (0787462576)- Ayilo Settlement • Mr. Amoko ((0779740708))-Cifro Subcounty	• 3% Post harvest loss • Use of improved seed varieties such as Pussa sawwani (Indian) and Spanless okra (Mexican). • NPK fertilizer used • Contribution from DRDIP is UGX 16,280,000 and from community is UGX 35,043,390
			Trading					3,800	25,289,684	22,976,544	2,313,140	4 months	Individual consumers in Adjumani and Traders South Sudan		• Kacik Atiop (0784334617), Chol Paul Parach (0783243931)- Ayilo Settlement	• 2% Post harvest loss • Contribution from DRDIP is UGX 22,976,544
6	Agro processing		Milling and selling flour					1,5000	61,320,000	50,822,000	10,498,000	4 months	Local market in Adjumani and neighbouring districts	26,208,000,000	• DIA Company Ltd (0780392879)- Adjumani Town • Abraham Ayuenmayen (Okra & maize) (0774155644) & Thui Aguto thui-Okra & Maize (0779856666) Ayilo Settlement • Zalia Ahmed (0773071317) 7 Odongo Alli (0778153822) sesame -Adjumani Town	• Milling per day is 1,000 Kg • Maize conversion to flour is 70%, Loss is 5% and 25% is maize bran • Milling service UGX 200/Kg • Utilization capacity is 80% • Maize flour, bran is sold at UGX 1,500 and UGX 300 per kg respectively • Maize grain is bough at UGX 500. • Milled for service is 233,600 Kg • Purchased and milled is 58,400 Kg • Revenue sources are from milling service, sale of flour and bran • Maize conversion to flour is 70%, Loss is 5% and 25% is maize bran • Milled for service is 233,600 Kg • Purchased and milled is 58,400 Kg • Revenue sources are from milling service, sale of flour and bran. • Contribution from DRDIP is UGX 22,787,520
		Unit			Kg											
		Q'nty			2,000 (Fresh form)											
		Unit		Acre												
		Q'nty		28												
			Trading					3,800	25,289,684	22,976,544	2,313,140	4 months	Individual consumers in Adjumani and Traders South Sudan		• Kacik Atiop (0784334617), Chol Paul Parach (0783243931)- Ayilo Settlement	• 2% Post harvest loss • Contribution from DRDIP is UGX 22,976,544
6	Agro processing		Milling and selling flour					1,5000	61,320,000	50,822,000	10,498,000	4 months	Local market in Adjumani and neighbouring districts	26,208,000,000	• DIA Company Ltd (0780392879)- Adjumani Town • Abraham Ayuenmayen (Okra & maize) (0774155644) & Thui Aguto thui-Okra & Maize (0779856666) Ayilo Settlement • Zalia Ahmed (0773071317) 7 Odongo Alli (0778153822) sesame -Adjumani Town	• Milling per day is 1,000 Kg • Maize conversion to flour is 70%, Loss is 5% and 25% is maize bran • Milling service UGX 200/Kg • Utilization capacity is 80% • Maize flour, bran is sold at UGX 1,500 and UGX 300 per kg respectively • Maize grain is bough at UGX 500. • Milled for service is 233,600 Kg • Purchased and milled is 58,400 Kg • Revenue sources are from milling service, sale of flour and bran • Maize conversion to flour is 70%, Loss is 5% and 25% is maize bran • Milled for service is 233,600 Kg • Purchased and milled is 58,400 Kg • Revenue sources are from milling service, sale of flour and bran. • Contribution from DRDIP is UGX 22,787,520

S/N	V/C	Enterprise	Production		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	Assumptions
			Q'nty	Unit	Q'nty	Unit									
7	Bakery and confectionaries	Baking per year	252,000	pieces			400	11,582,500	8,450,000	3,132,500		Local market in Adjumani	11,582,500	Adinan Funga (0789323415) Kulabako Yuda (0788658676)	• Product considered is Mandazi • 1kg of flour (UGX 2,500) produce 10 pieces of mandazi each costing UGX 400 • Local made oven is used • Contribution from DRDIP is UGX 22,787,520
8	Carpentry	Making sofa sets	14	Pieces	14	Pieces	1,5000,000	21,480,000	18,772,000	2,708,000	4 months	Local market in Adjumani, Individuals households, Institutions eg schools, hos-pitals and local government	214,800,000	Joseph Jamal (0770602276) Tamaina Wood Workers (0789166089/075098811)	• Sofa set are made • Labour cost account for 15% of the product value • Contribution from DRDIP is UGX 6,640,000 and community contri-bution is UGX 3,600,000

B. SUMMARY OF KEY IN PUTS PER ENTERPRISE

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
1	Goat trading	Purchase of goats	56	Goat	350,000	19,600,000	• Amelo Technical Institute (0781878428	DRDIP
		Market fees per goat	56	Goat	5,000	280,000	• Local government	DRDIP
		Polythene sheet for slaughtering	56	Goat	2,500	140,000	• T.Y enterprises	DRDIP
		Rent per year	1	Monthly	1,200,00	1,200,000	• Community member	DRDIP
		Total input costs			358,200	21,220,000		
		Slaughtering fee	56	Goat	6,000	336,000	• Local government and community	DRDIP
		Transportation of live goat from the farmer to slaughter slab		Goat	5,000	280,000	• Truck hire and boda boda	DRDIP
		Loading and offloading of goats		Goat	1,500	84,000	• Community member	DRDIP
		Selling of meat		Goat	9,000	504,000	• Community member	Community
		Transportation live goats from the slaughterhouse to butcher		Goat	5,000	280,000	• Truck hire and boda boda	DRDIP
		Total labour costs				1,484,000		
		Total cost				22,704,000		
		Total costs for DRDIP				22,200,000		
		Total cost for community				504,000		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
2	Sesame (30 acres	Seed for planting an acre	5	Kg	12,000	60,000	• Local Market in Pakele and Adjumani • Kinyera Richard (0774299678)	DRDIP
		NPK Fertilizer per bag	1	50 kg bag	120,000	120,000	• Kampala	DRDIP
		Planting ropes	1	Piece	5,000	5,000	• Anyama -Adjumani- (0774495864)	DRDIP
		Bags/packaging material	8	Piece	10,625	85,000	• Ameku Enterprises (Pakele) - (0774940772)	DRDIP
		Tarpaulin for drying	1	Piece	63,750	63,750	• Ameku Enterprises (Pakele) - (0774940772)	DRDIP
		Pallets for storage	2	Piece	25,000	50,000	• Carpenters	DRDIP
		Transport of grain to market	8	Sack	10,000	80,000	• Trucks in Town	DRDIP
		Tractor hire for land opening	1	Tractor	120,000	120,000	• Adjumani District local Government • Community members in Adjumani Town	DRDIP
		Total costs	0			583,750		
		Planting of an acre	10	Man days	10,000	100,000	• Community members	Community
		1st Weeding of an acre	14	Man days	10,000	140,000	"	Community
		2nd weeding of an acre	10	Man days	8,000	80,000	"	Community
		Fertilizer application of an acre	10	Man days	8,000	80,000	"	Community
		Harvesting of an acre	18	Man days	10,000	180,000	"	Community
		Transport from the garden to home	4	Man days	10,000	40,000	"	Community
		Drying of sesame grains	9	Man days	10,000	90,000	"	Community
		Threshing	3	Man days	10,000	30,000	"	Community
		Winnowing	3	Man days	10,000	30,000	"	Community
		Sorting and packaging	6	Man days	10,000	60,000	"	Community
		Total labour cost				830,000		
		Total costs				1,413,750		
		Total costs for DRDIP (28 acres)				28		
		Total costs for Community (28 acres)				16,280,000		
		Total Costs (28 acres)				23,240,000		
		Total costs for DRDIP (28 acres)				39,520,000		
	Trading in sesame	Purchase of produce	6,067	Kg	3500	21,234,500	• Farmers	DRDIP
		Packaging material	6,067	Pieces of bags	150	910,050	• Liberty Home Base Enterprise Limited and other general merchandise shops in Adjumani	DRDIP
		Renting storage facility	1	Lumpsum per month	50	300,000	• Community members	DRDIP
		Transportation of produce	1	Truck hire	28	170,000	• Truck hire services in Adjumani Town	DRDIP
		Total input cost				22,614,550		
		Licenses per year	1	Annually	Lumpsum	50,000	• Collected by the parish chief under local government	DRDIP
		Aggregation of produce	6067	Kg	14	84,941	• Community members	DRDIP
		Packaging of produce	6067	Kg	8	50,000	• Community members	DRDIP
		Total labour cost				184,941		
		Grand total				22,799,491		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
	Sesame processing	Cost of a milling machine	1	Mill		1,300,000	• Musa Body Machinery (U) Ltd (+256(0) 393 283351; +256(0) 702 917518	DRDIP
		Digital weighing scale	1	Scale		2,500,000	"	DRDIP
		Stitcher	1	Stitcher		70,000	"	DRDIP
		Shade for protecting milling machine	1	Shade		3,950,000	• Community members	DRDIP
		Total fixed costs				7,820,000		
		Electricity per year/Fuel costs	35,00	Kg	37	997,520	• Umeme	DRDIP
		Purchase of sesame for milling into paste	3,200	Kg	35,000	11,200,000	• Farmers and other traders	DRDIP
		Transport from the aggregation centre to factory	1	Lumpsum		80,000	• Trucks for hire	DRDIP
		Rent per year for smaller businesses	1	Annual		960,000	• Community member	DRDIP
		License per year	1	Annual		30,000	• Collected by Parish chiefs under local government	DRDIP
		Maintenance costs per year	1	Lumpsum		500,000	• Community member	DRDIP
		Labour costs	1	Mill		900,000	• Community member	DRDIP
		Total variable costs				14,667,520		
		Total costs (fixed and variable cost)				22,487,520		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
3	Soybean (21 acres)	Seed for planting an acre	25	Kg	5,000	125,000	• Mt Meru Ltd • Farmers, Nirikwasa (0781579194)	DRDIP
		Planting ropes	1	Pieces	5,000	5,000		DRDIP
		Bags/packaging material	12	Pieces	10,000	120,000	• Ameku Enterprises (Pakele)- (0774940772)	DRDIP
		Tarpaulin for drying grain	2	Pieces	50,000	100,000		DRDIP
		Pallets for storage	2	Pieces	25,000	50,000	• Carpenters	DRDIP
		NPK Fertilizer in bags	1	50 kg bag	120,000	120,000	• Kampala	DRDIP
		Tractor hire for opening land	1	Tractor	120,000	120,000	• Adjumani District local Government • Community members in Adjumani Town	DRDIP
		Transport of produce to the market	12	Sack	10,000	120,000	• Trucks for hire in Town	DRDIP
		Total costs				760,000		
		Planting an acre	20	Man days	10,000	200,000	• Community members	Community
		1st Weeding an acre	25	Man days	8,000	200,000	"	Community
		2nd weeding an acre	15	Man days	5,000	75,000	"	Community
		Fertilizer application per acre	5	Man days	5,000	25,000	"	Community
		Harvesting per acre	40	Man days	8,000	320,000	"	Community
		Transport from the garden to home	30	Man days	5,000	150,000	"	Community
		Drying	12	Man days	7,000	84,000	"	Community
		Threshing	10	Man days	5,000	50,000	"	Community
		Winnowing	8	Man days	5,000	40,000	"	Community
		Sorting and packaging	10	Man days	5,000	50,000	"	Community
		Sub total				1,194,000		
		Grand total				1,954,000		
		Number of acres to be cultivated with DRDIP support				21		
		Total costs for DRDIP (21 acres)				16,280,000		
		Total costs for Community (21 acres)				25,074,000		
		Total Costs (21 acres)				41,354,000		
	Soybean trading	Purchase of produce	9,862	Kg	2,100	20,710,200	• Farmers and other traders	DRDIP
		Packaging material	9,862	Pieces	56	552,500	• Ameku Enterprises (Pakele)- (0774940772)	DRDIP
		Hiring a storage facility per month	1	Monthly	Month	300,000	• Community members	DRDIP
		Transport to market	1	Truck hire	Lumpsum	1,050,000	• Trucks for hire in Town	DRDIP
		Total input costs				22,612,700		
		Licenses per year	1	Annually	Annually	50,000	• Collected by parish chiefs under local government	DRDIP
		Security for premises	1	Monthly	Lumpsum	129,587	• Community members	DDRIP
		Total labour cost				179,587		
		Total costs				22,792,287		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
4	Tomato (17. acres)	Seed for planting an acre	5.0	kg	75,000	375,000	• Agro input shop in Adjumani and Moyo (for Emmanuel 0777282157)	DRDIP
		Pesticides per acre	1.0	Tins	20,000	20,000	• Agro input shop in Adjumani and Moyo (for Emmanuel 0777282157)	DRDIP
		Fungicides per acre	1.0	Litre	40,000	40,000	• Agro input shop in Adjumani and Moyo (for Emmanuel 0777282157)	DRDIP
		NPK Fertilizer at planting	1.0	1 bag of 50Kg	120,000	120,000	• Kampala	DRDIP
		Foliar fertilizer towards flowering	2.0	Litre	10,000	20,000	• Kampala	DRDIP
		Mulching material per trip of truck	1.0	lumpsum	200,000	200,000	• Community members (Ataboo West, Wanjiri in Adjumani)	DRDIP
		Planting ropes	2.0	Pieces	5,000	10,000		DRDIP
		Tractor hire for opening land	1.0	Acre	120,000	120,000	• Adjumani District local Government • Community members in Adjumani Town	DRDIP
		Transport of produce to the market	15		3,000	45,000	• Truck for hire in Town	DRDIP
		Sub total				950,000		
		Purchase of stakes for tomatoes	7	Bundles	5,000	35,000	• Community members	Community
		Planting an acre	12	Man days	10,000	120,000	"	Community
		labour for staking for tomatoes	6	Man days	50,000	300,000	"	Community
		1st Weeding of an acre	16	Man days	10,000	160,000	"	Community
		2nd weeding of an acre	8	Man days	5,000	40,000	"	Community
		Fertilizer application at planting	2	Man days	5,000	10,000	"	Community
		Fungicides application	6	Man days	5,000	30,000	"	Community
		Manure application	18	Man days	5,000	90,000	"	Community
		Harvesting per acre	36	Man days	5,000	180,000	"	Community
		Transport from the garden to home	15	Man days	5,000	75,000	"	Community
		Sorting and packaging	16	Man days	5,000	80,000	"	Community
		Sub total				1,120,000		
		Grand total				2,070,000		
		Number of acres to be cultivated with DRDIP support				17		
		Total costs for DRDIP (17 acres)				16,280,000		
		Total costs for Community (17 acres)				19,193,263		
		Total Costs (17 acres)				35,473,263		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
	Tomato trading	Purchase of produce	8,856	Kg	2,500	22,140,000	• Farmers	DRDIP
		Packaging material	8,856	Pieces	26	229,986	• Liberty Home Base Enterprise Limited and other general merchandise shops in Adjumani	DRDIP
		Transportation of produce to market	1	Truck hire	22	194,832	• Community members	DRDIP
		Total input cost				22,564,818		
		Market fees per month	1	Monthly	1	30,000	• Collected by parish chiefs under local government	Community
		Loading and off loading	1	Truck	10	88,560	• Community members	Community
		Labour for Packaging	8856	Kg	12	106,272	• Community members	Community
		Total labour cost				224,832		
		Total costs				22,789,650		
	Tomato processing	Tomato fruits	47,040	kg	1,000	47,040,000	• Farmers	DRDIP
		Aggregation and Transport	30	Man days	5,000	150,000		DRDIP
		Machinery Maintenance				2,000,000		DRDIP
		License per year	1	Year	100,000	100,000		DRDIP
		Working space renting	3	Month	300,000	900,000		DRDIP
		Labor for packaging	120	Man days	5,000	600,000		DRDIP
		Labelling and Packaging material	47,040		250	11,760,000		DRDIP
		Electricity	3	Months	150,000	450,000		DRDIP
		water	3	Months	100,000	300,000		DRDIP
		Total Variable Costs				63,300,000		
		Motorcycles	2	Motorcycle	3,500,000	7,000,000		DRDIP
		Tomato paste processing line				92,500,000		DRDIP
			Bubble type tomato washing machine					
			Impurity removal machine					
			Broken screw pump					
			Tomato paste machine					
			Grinding Machine					
			Sterilization machine					
			Tomato paste packing Machine					
		Total fixed costs				99,500,000.00		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
5	Okra (28 acres)	Seed for planning an acre	1	Kg	20,000	20,000	• Agro input shops in Ayilo Market, Alere, Ayilo,Gu-lu, South Sudan-Juba	DRDIP
		Herbicides per acre	1	Litre	20,000	20,000	• Ameku Enterprises (Pakele)- (0774940772)	DRDIP
		Planting ropes	2	Pieces	5,000	10,000	• Ameku Enterprises (Pakele)- (0774940772)	DRDIP
		Bags/packaging material	10	Pieces	3,000	30,000	• Ameku Enterprises (Pakele)- (0774940772)	DRDIP
		Tarpaulin for drying	4	Pieces	50,000	200,000		DRDIP
		Fertilizer per acre	1	50 kg per bag	120,000	120,000	• Balton Uganda and other companies dealing in agro inputs	DRDIP
		Tractor hire for opening land	1	Acre	120,000	120,000	• Adjumani Local Government and community members	DRDIP
		Transport of produce to the market	7		10,000	70,000	• Kampala	DRDIP
		Total cost				590,000		
		Knives	15	Pieces	3,000	45,000	• T.Y enterprises	Community
		Planting of an acre	7	Man days	10,000	70,000	•Community members	Community
		Land hiring per acre	1	Acre	250,000	250,000	"	Community
		1st Weeding per acre	20	Man days	10,000	200,000	"	Community
		2nd weeding per care	16	Man days	8,000	128,000	"	Community
		Fertilizer application	50	Man days	5,000	250,000	"	Community
		Manure application per acre	7	Man days	10,000	70,000	"	Community
		Harvesting per acre	21	Man days	5,000	105,000	"	Community
		Transport from the garden to home	6	Man days	5,000	30,000	"	Community
		Drying	8	Man days	5,000	40,000	"	Community
		Threshing	6	Man days	5,000	30,000	"	Community
		Winnowing	8	Man days	5,000	40,000	"	Community
		Sorting and packaging	4	Man days	3,000	12,000	"	Community
		Sub total				1,270,000		
		Grand total				1,860,000		
		Number of acres to be cultivated with DRDIP support				28		
		Total costs for DRDIP (28 acres)				16,280,000		
		Total costs for Community (28 acres)				35,043,390		
		Total Costs (28 acres)				51,323,390		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
	Okra trading	Purchase of produce	6,791	Kg	2,800	19,015,200	• Farmers and other traders	DRDIP
		Packaging material	6,791	Pieces	250	1,697,750	• Ameku Enterprises (Pakele)- (0774940772)	DRDIP
		Hiring a storage facility per month	1	Monthly	90	651,664	• Community members	DRDIP
		Market fees per month	1	Monthly fees		50,000	• Collected by parish chiefs under local government	DRDIP
		Total input cost			3,200	21,414,614		
		Aggregation	6,791	kg	20	135,820	• Community members	DRDIP
		transportation	1	Truck hire	100	679,100	• Trucks for hire in Town	DRDIP
		Loading and off loading	6,791	Kg	40	271,640	• Community members	DRDIP
		Packaging	6,791	Kg	50	339,550	• Community members	DRDIP
		Selling	6,791	Kg	20	135,820	• Community members "	DRDIP
		Total labour cost				1,561,930		
		Total costs				22,976,544		
6	Agro pro-cessing	Mill capacity				1000kg/hr		
		Cost of a milling machine	1	Mill	40,000,000	40,000,000	• Musa Body Machinery (U) Ltd (+256(0) 393 283351; +256(0) 702 917518)	DRDIP
		Digital weighing scale	1	Scale	2,500,000	2,500,000	"	DRDIP
		Stitcher	1	Stitcher	70,000	70,000	"	DRDIP
		Shade construction	1	Shade	15,000,000	15,000,000	• Community members	DRDIP
		Total fixed costs			57,570,000	57,570,000		DRDIP
		Electricity per year/Fuel costs	292,000	Kg	37	10,804,000	• Umeme	DRDIP
		Purchase of maize for maize flour and bran	58,400	Kg	500	29,200,000	• Farmers and traders	DRDIP
		Transport from aggregation to factory premises	1	Lumpsum	1,168,000	1,168,000	• Trucks for hire	DRDIP
		Rent per year	1	Annual	3,600,000	3,600,000	• Community members	DRDIP
		License per year	1	Annual	150,000	150,000	• Collected by Parish chiefs under Local Govern-ment	DRDIP
		Maintenance costs	1	Lumpsum	500,000	500,000	• Community members	DRDIP
		Labour costs				5,400,000		
		Total variable costs				50,822,000		
		Total costs (fixed and variable cost)				108,392,000		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
7	Bakery and confection-aries	Mixer cost	1	Piece	150,000	150,000	• Biva Victory (Gulu) (0774006144), 200D (0784091074)	DRDIP
		Oven	1	Piece	500,000	500,000	• Local community members	DRDIP
		Trays	1	Piece	500,000	500,000	• Biva Victory (Gulu) (774006144), 200D (0784091074)	
		Worktables	1	Piece	40,000	40,000	• T.Y enterprise (0782779697)	DRDIP
		Storage	1	Annual	600,000	600,000	• Community members	DRDIP
		Total fixed cost				1,790,000	• Community members	
		Display		Lumpsum		500,000		DRDIP
		Leasing premises per year	1	Annual		150,000	• Community members	DRDIP
		Cost of flour per year	15	50kg bag	200,000	3,000,000	• T.Y enterprise (0782779697)	DRDIP
		Other costs for baking ingredients		Lumpsum		300,000	• T.Y enterprise (0782779697)	DRDIP
		Labour costs		Lumpsum		3,600,000	• Community members	
		Fuel wood/Charcoal		Lumpsum		900,000	• Charcoal and wood dealers in Adjumani	DRDIP
		Total variable costs per year in UGX				8,450,000		
		Total costs (fixed and variables)				10,240,000		

S/N	Enterprise	Inputs[1]	Quantity	Units	Unit Price	Total cost	Potential Source and contact	
8	Carpentry	Timber	368	Pieces	25,000	9,195,000	• Adjumani & Neighbouring districts, Cong, DRC, South Sudan	DRDIP
		Rent per year	1		3,600,000	3,600,000	• Community members	DRDIP
		Electricity per year	1	Lumpsum	1,200,000	1,200,000	• Umeme	DRDIP
		Transport per year	1	Lumpsum	1,800,000	1,800,000	• Local transporters	DRDIP
		Nails		Lumpsum	600,000	600,000	• Hardware shops in Adjumani	DRDIP
		License per year	1	Lumpsum	50,000	50,000	• Collected by parish Chief under local government	DRDIP
		Labour (15% of value)				3,222,000		Community
		Total variable costs				19,667,000		
		Electric Clamp	2	Piece	120,000	240,000	• Wood Machinery Kampala Uganda and other shops selling carpentry machine	DRDIP
		Manual Clamps	3	Piece	40,000	120,000	"	DRDIP
		Hammer	3	Piece	10,000	30,000	"	DRDIP
		Plier	3	Piece	10,000	30,000	"	DRDIP
		Manual Drills	3	Piece	75000	225,000	"	DRDIP
		Electric drill	2	Piece	150,000	300,000	"	DRDIP
		Drill bit	1	A set	40,000	40,000	"	DRDIP
		Saws (bow/hand)	1	Piece	45,000	45,000	"	DRDIP
		Jack plane/randar	1	Piece	150,000	150,000	"	DRDIP
		Circular machine	1	Piece/DCA made type	450,000	450,000	"	DRDIP
		Chisel	3	Piece	10,000	30,000	"	DRDIP
		Plane machine	1	Piece	150,000	150,000	"	DRDIP
		Wood glue	3	Piece	10,000	30,000	"	DRDIP
		Screw drivers	1	A set (flat & stars)	35,000	35,000	"	DRDIP
		Screws	1	A box	60,000	60,000	"	DRDIP
		Rooter machine	1	Piece /DCA made type	450,000	450,000	"	DRDIP
		G-saw machine	1	Piece/DCA made type	300,000	300,000	"	DRDIP
		Tap measure	3	Piece	10,000	30,000	"	DRDIP
		Square	3	Piece	10,000	30,000	"	DRDIP
		Half- round bit & groove bit	1	Bit set rooter	200,000	200,000	"	DRDIP
		Sharpening stone	3	Piece	10,000	30,000	"	DRDIP
		A span set	1	A set	150,000	150,000	"	DRDIP
		Total fixed costs				3,125,000		
		Grand total				22792000		

C. Complementary/SUPPLEMENTARY enterprises for diversification

COMPLEMENTARY/SUPPLEMENTARY ENTERPRISES FOR DIVERSIFICATIOn					
S/N	**Enterprise**	**Complementary /supplementary enterprise**	**Description**	**Contribution to the farm income (UGX)**	**Assumptions**
1	Sesame	Ground nuts	• Ground nuts fixes nitrogen into the soil • Reduced weed infestation as well as soil and water erosion • Groundnut creates a favourable microclimate for the sesame crop • There is increased labour utiliza-tion efficiency during field activities like weeding	• Sesame income = 24,071,250 • G nuts income = UGX 12,384,750 • Total income = 36,456,000 • Contribution= 34.0 • •	• Sesame is intercropped with groundnuts with land proportions of 75% and 25%, respectively. • Sesame yield is 800Kg/ acre and price is UGX 3,500/Kg • Groundnuts yield is 900Kg/acre and price is UGX 3,800/Kg • Two growing seasons per year • 10% post-harvest loss for both g nuts and sesame • Gross margin analysis used to compute income • A total of 28 acres considered
2	Soybean	Maize	• The system suppresses the pest (aphids) infestation and damage levels • Maize improves the amount of light transmitted to the legume canopy while soybean fixes nitrogen to the soil that benefits the maize	• Soybean income= UGX 35,910,000 • Maize income= UGX 6,506,325 • Total income =UGX 42,416,325 • Contribution =2.9%	• Soybean is intercropped with maize with land proportions of 75% and 25%, respective-ly. • Soybean yield is 1,200Kg/ acre while price is UGX 2,000/Kg • Maize yield is 1,400Kg/acre and price 1,000/Kg • 5% post-harvest loss for soybean and 10% maize • Gross margin analysis used to compute income • A total of 21 acres considered
3	Tomatoes	Okra	• Okra traps tomato pests like whiteflies and redi=uces their associated damages to tomatoes	• Tomato income = UGX 39,009,500 • Okra income = UGX 2,138,000 • Total income = UGX 41,147,500 • Contribution= 6.8%	• Tomato is intercropped with okra with land proportions of 75% and 25%, respectively. • Tomato yield is 15,000Kg/ acre and price is UGX 2,500/Kg • Okra yield is 2,000Kg/ acre while price is UGX3,000/Kg • Postharvest loss for Tomato and Okra is 10% and 2% respectively • Gross margin analysis was used in computing income • A total of 2 acres have been considered
4	Okra	Watermelon	• Watermelon reduced weed infestation as well as soil and water erosion • It creates a favourable microclimate for okra	• Okra income=UGX 75,699,000 • Watermelon income= UGX 16,681,167 • Total income= 92,380,167 • Contribution = 5.3%	• Okra intercropped with Watermelon occupying 0.25 acre • Watermelon yield is 4,000 fruits/acre and price per fruit is 1,000, Average fruit is 2Kg • Okra yield is 2,000kg per acre while price per Kg is UGX3,000 • 10% post-harvest loss for both crops • Gross margin analysis was used in computing income • A total of 26 acres have been considered
5	Agro processing	Local poultry	Bran from agro processing provides feed for rearing local chicken	• Agro processing gross margin per year =UGX 47,874,000 • Local poultry gross margin per year = UGX 15,616,095 • Total gross margin = UGX 63,490,095 • Contribution = 24.6%	• 1,000Kg of grains processed daily at 80% (800Kg) utilization capacity; thus maize bran released daily is 160Kg • Conversion ratio of grain to bran is 1.0:0.25 • On average, one bird feeds 120g/day. Thus 1,333 birds are fed per day • Mortality rate of birds is 10% • Maturity of birds is one year • Poultry feed (bran) accounts for 80% of the variable costs • Price per local chicken is UGX 20,000 • Cost of maize bran =300/Kg • The poultry structures and other labour costs are meet by the farmer • Birds are delivered when they are vaccinated against new castle

COMMON RISKS INVOLVED PER ENTERPRISE AND MITIGATION MEASURES

S/N	Enterprise	Risks involved		Mitigation measures
1	Goat	Production risk	High level accumulation of hazardous pesticide residues in the animal tissues	a) Undertake thorough inspection before slaughter b) Train producers on appropriate use of drugs in control of livestock parasites and diseases
			Fluctuation in supply of live goats by the farmers due to low production and quarantine measures against disease outbreaks	Invest in market intelligence and market linkages with the farmers
		Marketing risk	Under estimation of the live goat weight	• Use weighing scale while buying live goats
		Social [2]risks	Theft of goats and money from traders during search and transportation of goats to slaughter locations	Work with the government security to protect traders from robbers
		Environmental risks	Contamination of water bodies with blood or effluents from the slaughtered animals	Use properly constructed slaughter slabs with drainage channels for efficient disposal of effluents
2	Sesame	Production risk	• Adverse weather (dry spell or excessive rainfall) that lead to poor planning, crop failure and high post-harvest damage	a) Adopt risk mitigation practices. This includes using Climate Smart Agriculture practices while following recommended production practices such as timely planting, weeding, and harvesting b) Diversify sesame enterprise by growing different crop varieties c) Invest in crop insurance against volatile weather patterns
			• Pest and diseases outbreaks	• Use of resistant varieties and cultural practices like use of trap crops
		Marketing risk	• Loss of market access due to buyers/processors like Olam Uganda pulling out from purchasing sesame from Adjumani	• Form group marketing cooperative to enhance prices and guarantee a market
			• Price fluctuations of sesame	• 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	a) Spread planting, harvesting and sales over the season b) Use irrigation to produce during off season
			• Changing consumer preferences	Invest in value addition for product diversification
		Social [3]risks	Straying animals especially goats destroying crops in the field	• Enacting bylaws that compel farmers to tether their goats as well as fencing
			• Use of child labour in production and over exploitation of women labor in production activities	• Invest in labor saving technologies a) Sensitize beneficiaries on the dangers of child labor exploitation b) Enforce by laws against exploitation of child labor
		Environmental risks	Sesame processing is associated with emitting greenhouse gases in the environment	• Promoting afforestation and reduce deforestation
3	Soybean	Production risk	As for sesame	• As for sesame
		Marketing risk	Loss of market access due to buyers/processors like Mt Meru and Mukwano pulling out from purchasing sesame from Adjumani	• Form group marketing cooperative to enhance prices and guarantee a market
			Price fluctuations of sesame	• Enter into price contracts with buyers; and use improved storage facilities to store produce until prices improve
			Seasonality of supply	• Spread planting, harvesting and sales over the season
			Changing consumer preferences	
		Social risks	As for sesame	• As for sesame
		Environmental risks	Phosphate and potash nutrient depletion leading to reduced soil fertility	• Apply Good Agronomic Practices including use of Integrated Soil Fertility Management Practices

4	Tomatoes	Production risk	As for sesame	
		Marketing risk	As for sesame	
		Social risks	As for sesame	
		Environmental risks	• Excessive and indiscriminate use of agro chemicals leading to: a) Accumulation of pesticide residues in the fruits that endanger humans; b) Environment pollution and destruction of organisms like bees and fish and; c) Development of pesticide resistance	Train farmers on Integrated Pest and Diseases Management including judicious use of agro chemicals a) Apply Good Agronomic Practices including use of Integrated Soil Fertility Management Practices b) Sensitize communities on sustainable wetland use; enforce by laws on ecosystem use; and invest in irrigation for production during off season
			Environment destruction through: a) Continued mining of soil nutrients especially Nitrogen, Phosphorous and Potassium during production b) Growing the crop in the wetlands during off season	
5	Okra	Production risk	As for sesame	
		Marketing risk	As for sesame	
		Social risks	As for sesame	
		Environmental risks	As for tomato	
6	Agro processing	Production risk	Sub optimal use of installed equipment due to: a) Inconsistent and insufficient supply of raw materials due to seasonality of supply, producers/suppliers of raw materials changing business priorities, etc b) Erratic electric power supply	Establish market linkages with suppliers of raw materials • Explore alternative energy sources like solar and use of generator
			Poor and inconsistent quality and of processed products due to: a) Poor quality of raw material supply and high losses during transport from farm to factory b) Absence of competent management and technical staff of the processing facility once commercialized	• Invest in training competent staff such as machine operators as well as governance and busines management
		Marketing risk	Price fluctuation	• Establish contracts with market off takers
			Inadequate markets for the finished products	a) Invest in research on market analysis to establish the market potential of the different products b) Diversify products processed
		Social risk	Pollutants from the processing plants detrimental to the health of the workers and surrounding environment	• Adhere to the principles and guidelines for the Good Manufacturing Practices (GMPs) that protect workers safety and safeguards against environment pollution including safe disposal of by products
		Environmental risk	Agro processing contributes to emission of greenhouse gases into the atmosphere, thus contributing to global warming.	• Adhere to the safe operating procedures for safe disposal of the industrial wastes
7	Bakery	Production risk	As for Agro processing	
		Marketing risk	As for agro processing	
		Social risk	Engages child labour especially in search for fuel wood	
		Environmental risks	High use of wood fuel excarnating deforestation and smoke from oven pollutes the environment	• Invest in alternative energy sources with less effects on the environment
8	Carpentry	Production risk	Erratic and inconsistent government policies on access and utilization of wood resources	Need to enact policies that favour both the carpenters as well as the authority
			Erratic power supply	• Invest in alternative energy sources with less effects on the environment
		Marketing risk	Fluctuation of market demand	• Investment in marketing and advertisement of carpentry products
		Social 4risks	As for agro processing	
		Environmental risks	Timber production leads to deforestation, accelerates soil erosion, loss of below ground diversity and increased accumulation of gasses in the atmosphere, thus global warming	• Promote afforestation among the communities

D. STRATEGIC INVESTMENT

S/N	Prioritised Value Chain	Strategic Investments	Responsible partner
1	Goat	Invest in more livestock disease Control Infrastructure such as dips, crushes, spray race quarantine station, holding ground and valley.	DRDIP/LG
		Invest in road infrastructure so that production areas can easily be accessed	DRDIP/LG
		Build the capacity of farmers/groups in goat production, management and trading	DRDIP/LG-PPP
		Work with AFRISA to build capacity of the farmers	DRDIP/LG-PPP
		Support farmers to acquire and maintain high yielding goat breeds work with NAGRIC	DRDIP/LG-PPP
2	Sesame	Investment in rehabilitation of the roads e.g. in Ayilo, Pakele, Pachara	DRDIP/LG
		Construction of aggregation centres at the watersheds	DRDIP/LG
		Train farmers on GAP (e.g. Kilimo Trust)	DRDIP/Kilimo Trust/LWF
		Work with seed companies to avail improved seed varieties	DRDIP/NARO
		Link farmers to supporting services such as access to functional markets and market information	DRDIP/Kilimo Trust
		Support large scale agro-processors with operating capital	DRDIP
		Introduction of tractor hire services	DRDIP/LG
		Piloting an information platform between farmers and traders to ensure accurate information available	DRDIP/LWF
3	Soybean	Investment in rehabilitation of the roads e.g. in Ayilo, Pakele, Pachara	DRDIP/LG
		Construction of aggregation centres at the watersheds	DRDIP/LG
		Work with seed companies to avail improved seed varieties	DRDIP/NARO
		Train farmers on GAP, GPHH, Farming as Business and as well as on tandards	DRDIP/Kilimo Trust/LWF
		Support access to labor saving technologies especially tractor services	DRDIP/LG
		Access to credit facilities available options and future credit plans given by DRDIP	DRDIP/Financial Institution
4	Tomatoes	Investment in rehabilitation of the roads e.g. in Ayilo, Pakele, Pachara	DRDIP/LG
		investment in irrigation infrastructure to cushion farmers against changing weather conditions	DRDIP/LG
		Train farmers on GAP (e.g. Kilimo Trust)	DRDIP/Kilimo Trust/Self-help Africa
		Work with seed companies to avail improved seed varieties	DRDIP/NARO
		Investment in good packaging to reduce postharvest losses by working with East African Packaging company to produce appropriate packages for tomatoes	DRDIP/East African Packaging Industries
		Invest in Value addition for tomatoes	DRDIP/PPP
5	Okra	Enhancing production and productivity through investment in high yielding varieties	DRDIP/NARO
		Research into value addition opportunities for okra. Bearing in mind the need to meet high standard of edible product.	
		Other same as Sesame and soybean	DRDIP/Kilimo Trust
6	Agro processing	Construction and rehabilitation of roads to reduce transportation costs and ease movement of raw materials.	DRDIP/LG
		Need to address the irregular electricity supply in the region.	DRDIP/PPP
		Improving on yield/production coupled with establishing contract farming arrangements for farmers (Agro processors).	DRDIP/Kilimo Trust
		Access to credit facilities available options and future credit plans	DRDIP/Financial Institutions eg Centenary and Stanbic
		Support value chain actors with operating capital through grants and loans	DRDIP/Financial Institutions eg Centenary and Stanbic
		Piloting an information platform between producers and the market	DRDIP/Kilimo Trust
7	Bakery and confectionaries	Purchase of equipment i.e. manual system for the medium bakers.	DRDIP
		Building capacity of bakers in a variety of products through working with Uganda Industrial Research Institute	DRDIP/UIRI
		Investment into packaging requirements for the different market segments of bakery	East African Packaging Industries
		Others same as agro processing	
8	Carpentry	Explore alternative energy sources e.g. solar to address the irregular electricity supply in the region.	DRDIP/PPP
		Support tools that are manually operated so that they can be used when there is no electricity	DRDIP
		Invest in equipment that has prospects of wood carving in order to improve timber utilization in small scale furniture workshops and introduce new designs	DRDIP
		Others same as for agro processing	

For more information please visit
www.worldbank.org/uganda

Join discussion on
ugandainfo@worldbank.org
http://www.facebook.com/worldbankafrica
http://www.twitter.com/worldbankafrica
http://www.youtube.com/worldbank

WORLD BANK GROUP