PARM
PLATFORM FOR AGRICULTURAL RISK MANAGEMENT

Platform for Agricultural Risk Management

AGRICULTURAL RISK ASSESSMENT STUDY

Uganda

October 2015

European Commission

afd AGENCE FRANÇAISE DE DÉVELOPPEMENT

Cooperazione Italiana allo Sviluppo
Ministero degli Affari Esteri

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Foreword

The Platform for Agricultural Risk Management (PARM), a G8-G20 initiative hosted by the International Fund for Agricultural Development (IFAD), is a multi-donor partnership co-financed by the European Commission (EC), Agence française de Développement (AfD), Italian Government and IFAD, to support Governments and stakeholders on Agricultural Risk Management (ARM). The Platform works in strategic partnership with NEPAD / CAADP in African countries to mainstream agricultural risk management into the national agricultural policy and investment plans (www.p4arm.org). Current work supports ARM assessment and policy process in Cabo Verde, Cameroon, Ethiopia, Liberia, Mozambique, Niger, Senegal, The Gambia and Uganda.

This Risk Assessment Study is part of the ARM process in Uganda. The report was coordinated by Jan Kerer (international consultant) and Herbert Talwana (Associate Professor, Applied Entomology and Nematology, Makerere University). The study has benefited from the guidance of Bernard Bashaasha (Principal, College of Agricultural and Environmental Sciences, Makerere University) and inputs from many experts and researchers, among them, Josephine Muchwezi Mukiibi (consultant) and Ibtissem Taghouti (intern at IFAD) deserve a special mention.

The Government of Uganda and, in particular, the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), has largely contributed to this report with inputs and suggestions. PARM thanks the engagement of the MAAIF, and in particular Tom Mugisa, who guided the risk assessment process and led the organization of the Agricultural Risk Management Validation Workshop in Kampala on the 29th and 30th of July 2015. Many stakeholders were able to contribute to this report through their active participation in the discussions of that workshop.

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Acronyms

ACF	Agricultural Credit Facility
APHLIS	African Postharvest Losses Information System
ARM	Agricultural risk management
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASSP	Agriculture Sector Strategy Paper
BBW	Banana bacterial wilt
BOU	Bank of Uganda
BXW	Banana Xanthomonas Wilt
CAADP	Comprehensive Africa Agriculture Development Programme
CBSD	Cassava Brown Streak Disease
CDO	Cotton Development Organization
CMVD	Cassava Mosaic Virus Disease
CV	Coefficient of variation
CWD	Coffee wilt disease
DRDPM	Department of Relief, Disaster Preparedness & Management
DSIP	Agricultural Sector Development Strategy and Investment Plan
EAGC	East Africa Grain Council
EC	European Commission
EM-DAT	Emergency Events Database
EWS	Early warning system
FAO	Food and Agriculture Organization
FMD	Food and Mouth Disease
GDP	Gross Domestic Product

HDI	Human Development Index
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IPCC	International Panel on Climate Change
IRA	Insurance Regulatory Authority
IRR	Internal rate of return
LRA	Lord's Resistance Army
MAAIF	Ministry of Agriculture, Animal Industry, and Fishery
MLHUD	Ministry of Lands,Housing and Urban Development ..
MLND	Maize Lethal Necrosis Disease
MPCI	Multi peril crop insurance
MSV	Maize streak virus
MT	Metric ton
MTI	Ministry of Trade and Industry
MWE	Ministry of Water and Environment
NAADS	National Agricultural Advisory Services
NAP	National Agriculture Policy
NAPA	National Adaptation Plan
NARO	National agricultural research organization
NDP	National Development Plan
NEMA	National Environment Management Authority
NEPAD	New Partnership for Africa's Development
NFA	National Forestry Authority
NGSD	Napier grass stunt disease

NRM	National Resistance Movement
NRP	Nominal Rate of Protection
PARM	Platform for Agricultural Risk Management
PEAP	Poverty Eradication Action Plan
PMA	Plan for the Modernization of Agriculture
PMO	Prime Minister's Office
RAS	Risk Assessment Study
UBOS	Uganda Bureau of Statistics
UCA	Uganda Census of Agriculture
UCDA	Uganda Coffee Development Authority
UNADA	Uganda National Agro-Input Dealers Association
UNBS	Uganda National Bureau of Standards
UNFFE	Uganda National Farmers Federation
UNISDR	United Nations Office for Disaster Risk Reduction
UNMA	Uganda National Meteorological Authority
USD	US Dollar
USTA	Uganda Seed Trade Association
WFP	World Food Program
WRS	Warehouse receipt system

Executive Summary

Scope of study. This Risk Assessment Study (RAS) provides a comprehensive mapping and assessment of agricultural risks in Uganda through a holistic approach. The report provides stakeholders with data and information on priority risks for Ugandan agriculture in order to develop appropriate policy solutions aimed at improving agricultural risk management (ARM) in the country. The guiding policy framework for this work is the recently developed Agricultural Sector Strategy Paper 2014/15-19/20 (ASSP). The discussions with the stakeholders on a first draft of this study during the Risk Assessment Validation Workshop organized by the Government of Uganda in 29-30 June 2015 have contributed to improve this study.

The country context

Importance of agriculture. The agricultural sector is still the mainstay for a large part of the Ugandan population. But while the contribution to GDP (22.5% in 2013/14), exports (54% in 2014) and employment (70%) is still high, the growth rate of the sector is way below average GDP growth. The low growth rate can be attributed to weather hazards, economic downturns, limited availability of improved inputs, diversion of investment into the industrial sector, and/or insurgencies in neighbouring countries.

Focus on smallholders. The current production structure of agriculture in Uganda is dominated by small-scale farmers comprising of an estimated 2.5 million households (90% of the farming community), the majority of who own less than 2 acres of land each. Despite good agro-climatic conditions with two rainy seasons in most parts of the country, yields of smallholder farmers remain low. Limited access to quality inputs, low adoption of modern technology, and lack of storage and market infrastructure are constraints to the sector.

Identification of agricultural risks: country risk profile

Range of risks. Farmers are faced by a plethora of risk. The majority of risks are linked to specific stages in the agricultural value chain (e.g. the input risk during the planting and growth stage of the crops). Policy risk, safety risk, and health risk, on the other hand, may occur during any stage of the agricultural production cycle. The major risks are:

- *Input risk*: The problem is a consequence of a poorly developed seed sector where the informal seed system accounts for an estimated 87% of planted seed.). The total demand for grain crop seeds is estimated at approximately 110,580 MT, while total sales from the formal seed market account for only 12,000 MT. The supply shortages create incentives for substandard and/or counterfeit seed; studies suggest counterfeiting affects 30-40% of purchased seed.
- *Weather risk*: Ugandan agriculture is mostly rain-fed making it vulnerable to weather hazards and climate change. Therefore, drought has affected the highest number of people in Uganda. Often drought and flooding follow each other. In the last 30 years (1985-2015), Uganda has experienced fourteen riverine floods, which affected more than one million people and killed

more than 200 people. Landslides and mudslides usually occur in the Eastern region. The population pressure and environmental degradation of the hilly areas around Mt. Elgon are root causes for the frequent occurrence of landslides.

- *Biological and environmental risk*: A range of pests and diseases have caused crop failures and livestock deaths in Uganda in the recent past. On the crop side, Cassava Brown Streak Virus African, Cassava Mosaic Virus, Banana Bacterial Wilt (BBW), Maize Streak Virus (MSV), Maize Lethal Necrosis Disease (MLND), and groundnut rosette are severely affecting food crops and threatening food security in Uganda. For cash crops diseases such as Coffee wilt and Coffee rust are still not properly managed. On the livestock side, the endemic Newcastle disease in poultry and the sporadic and cyclic outbreaks of African swine fever in pigs wipe out stocks of poultry and pigs in the country every year. Other diseases such as foot and mouth disease, Bovine pleuropnemonia, East Coast fever, and Black quarter although largely managed by routine vaccination still occur in livestock.
- *Logistical and infrastructural risk*: The lack of sufficient storage capacity, both at the farm level and the crop trading system, leads to high losses for farmers due to attacks from pests and animals. Uganda has 550,000 metric tonnes (MT) of storage capacity, but estimated demand for storage facilities totals 2.3 million MT. In 2012 alone an estimated 18.3% of cereal production was lost in post production activities.
- *Market risk*: Uganda experiences high price fluctuations on account of weather conditions, low level of stocks, low level of organization of producers in the value chain, and segmentation of regional and domestic markets. Farmers are exposed to both inter-annual and intra-annual price volatility. Yet the country lacks price stabilization instruments.
- *Public policy and institutional risk*: The legal environment for the agricultural sector is conducive but implementation of many initiatives has been poor in the past due to a lack of institutional and financial resources. The ongoing restructuring of the extension system has created many challenges for farmers to access advisory and other support services.
- *Political and security risk*: The security situation in the country has improved greatly since the containment of the Northern Insurgency. Still, regional security threats such as the Karamoja cattle raiding are a constraint for the development of agriculture in some regions of Uganda.

Mapping of existing Agricultural Risk Management policies and tools

Policy environment. The Government of Uganda (GoU) is trying to tackle these risks through various policies, most notably the National Development Plan II (NDP II). In the past, risks have not been handled in a comprehensive manner but the recent ASSP contains a section on ARM. The Ministry of Agriculture, Animal Industries, and Fishery (MAAIF) is driving this process with other public sector entities (e.g. Office of the Prime Minister, Ministry of Water and Environment), and non-state actors playing an important role as well. Lack of capacity and financial constraints are impediments to improved risk management from the government.

Risk management landscape. Major risk initiatives are currently being implemented:

- *Information systems*: A broad range of state and non-state actors (e.g. MAAIF, UBOS, UNMA; Infotrade, Farmgain) currently provide farmers and other stakeholders with data on specific aspects of agricultural risk, e.g. weather, market prices. Despite the broad range of service providers, timely and accurate information does not yet always reach the target audience. The absence of effective extension services is a major factor contributing to this situation.
- *Initiatives related to input risk*: MAAIF is currently in the process to finalize the National Seed Policy aimed at improving quality assurance in the seed sector. The private sector, particularly the Uganda National Agro-Input Dealers Association (UNADA) is involved in this process. The issue of quality assurance, in particular concerning the use of counterfeited inputs is addressed by a number of initiatives from donors and the private sector. Yet access to quality inputs remains a key issue in the sector.
- *Initiatives related to weather risk*: Despite significant investments in recent years (USD 25 million in 2013), the irrigation potential remains largely untapped, in particular small-scale irrigation. The irrigation potential for Uganda is estimated at 445,041 ha at an investment cost of USD 2.3 billion. Other initiatives related to weather risk have mostly been driven by the insurance sector; the introduction of weather based insurance (such as the Kungula Agrinsurance by a consortium of companies) has witnessed some early success.
- *Initiatives related to biological risk*: Pest and disease management are mostly the domain of MAAIF and/or respective value chain organizations (e.g. UCDA in the coffee sector). Still, access to support services for plant protection remains low. Decentralization and privatization of clinical veterinary services and downscaling of civil service since the 1990s have severely constrained the access to animal health services for farmers.
- *Initiatives related to infrastructure risk*: Post harvest losses are at the centre of a few recently implemented initiatives, most notably a project on Post-Harvest Food Loss Reduction by the WFP that has reached 16,600 farmers since 2014. There is, however, much scope to expand the outreach of such initiatives on low-cost storage for smallholders to many more households in Uganda.
- *Initiatives related to market risk*: Currently, no price control mechanisms are found in the food crop sector. For various cash crops such as coffee, tea, and cotton a range of price setting mechanisms are applied that provide some level of protection to these sub-segments. Still, fluctuations on international markets, for example for coffee, directly affect farmers and price drops directly translate to income loss for farmers.

Risk analysis: a systematic quantification of impacts and likelihood

Cost of risk. The overall economic impact of agricultural risk is estimated to amount to USD 606 million to USD 804 million per year. Based on an agricultural GDP of USD 5.71 billion, losses therefore amount to between 10.61% and 14.08% of total annual production, which is between 2.3% and 3.1% of the GDP of Uganda.

Ranking of most severe risks. An evaluation of all risks was carried out based on average frequency and severity, and the impact of the worst case scenario. The following table provides an overview on the scoring:

Risk	Average Severity	Average Frequency	Worst Case Scenario	Score
Crop pest & diseases	very high	very high	very high	5.00
Post harvest loss	very high	very high	high	4.75
Price risk food & cash crops	very high	high	high	4.35
Livestock pest & diseases	high	very high	medium	4.10
Droughts	medium	medium	very high	3.50
Counterfeit inputs	medium	very high	low	3.40
Karamoja cattle raids	low	high	very low	2.37
Floods	very low	high	very low	1.75
Hailstorms	very low	high	very low	1.75
Thunderstorms	very low	high	very low	1.75
All other natural risks	very low	high	very low	1.75
Northern Uganda insurgency	very low	very low	medium	1.50

The top six risks make up more than 99% of average annual losses in Uganda. These major risks in terms of severity are:

1. *Price fluctuations*: Inter-annual price variability is a major concern for all major food crops and cash crops. For example, coffee has experienced shocks of up to 49% every 3 years. Matooke/banana are similarly affected while cassava, maize, and potatoes have seen smaller shocks in recent years. On average, losses for farmers due to price risk are estimated at USD 262.22 million p.a.
2. *Crop pests and diseases*: Average crops losses in Uganda due to pests, diseases, and weeds are estimated at 10-20% during the pre-harvest period and 20-30% during the post-harvest period. The annual losses for major crops are in the range of USD 113 million to USD 298 million (mainly banana, cassava, coffee, and cotton).
3. *Post harvest losses*: The weight loss resulting from attacks of pests and animals to major cereals (mostly for maize, but also barley, millet, rice, sorghum, and wheat) cause losses of USD 97.17 million p.a. This figure does not yet include opportunity cost for farmers that were forced to sell at low market prices directly after harvest due to lack of proper storage facilities.
4. *Livestock pests and diseases*: The economic impact of diseases on farming households are diverse: farmers incur cost for disease control, treatment, and vaccination. Direct losses are associated with animal mortality, reduced milk production, and use of animal for traction. The total economic cost for diseases in cattle alone are estimated at USD 76.5 million p.a.
5. *Droughts*: Uganda has been hit severely by droughts in recent years (2002, 2005 to 2008, and 2010/11). The return period of large-scale droughts that affected 25,000 people or more is 5.3 years. The average annualized losses amount to USD 44.4 million. But, drought has the highest

probable loss of all risks in Uganda. For example, the drought period of 2010/11 caused extensive damage of USD 383.45 million in 2011 alone.

6. *Low quality inputs*: Yields for maize, millet, rice, and sorghum are only 20% to 33% of the potential yield for rain-fed agriculture and even less for irrigated agriculture. A major factor is the lack of good-quality, higher-yielding, more vigorous, drought-resistant, and disease-free seeds and planting material. A pronounced problem is the issue of counterfeit inputs that lead to losses to farmers of USD 10.7 to 22.4 million p.a.

Impact. Apart from turning to relatives and friends in times of need, selling of livestock, reducing expenditures, and reducing the food intake are the most common reactions by farmers to distress. Poorer farmers (i.e. smallholders) are affected stronger by risk than commercial agriculture.

Conclusions and recommendations

Required changes in the institutional framework. ARM has not been managed in a holistic manner in the past. In the future more efforts and funding is required by MAAIF to tackle the issues raised in the report. Establishment of an ARM unit within the ministry in charge of monitoring risks and developing policy responses is proposed. Dedicated ARM personnel within the Planning Department of MAAIF is in charge of coordinating with other MAAIF departments and the stakeholder forum on ARM in Uganda.

Building up capacity for ARM. The starting point for improved use of ARM tools in Uganda is investment in human resources: trainings for MAAIF officials at national and local level, for extension workers, farmer organizations, and other important stakeholders is required to build up capacity in the country on risk analysis and management.

Improved data collection and analysis. Improving data collection and analysis of risk related information is one important strategy to reduce the key risks (pests and diseases for both crops and livestock, and intra-annual price fluctuations). This assessment report has suffered from the lack of information on risks at farm or district level, including information on production, yields and losses. A key issue for improving information systems and early warning is the dissemination of information to smallholder farmers which is currently often lacking.

Risk reduction. It is critical to raise awareness of farmers on their individual risk exposure and on the best way to protect their livelihoods. This requires well trained and informed extension officers that can provide practical advice to farmers. Integrating risk management into the core extension messages is important to help farmers understand how they can reduce, transfer, or cope with risks. Improving the value chain for inputs and developing low-cost storage options for farmers are two other important areas that require further attention.

Risk transfer. The current outreach of agricultural insurance still leaves much room for further increasing penetration amongst farmers. Further analysis of the current constraints and opportunities should be carried out for the GoU to develop a support strategy for agricultural insurance. Government support is required to enhance farmers opportunities to transfer some of their risk to the market.

Risk coping. Formal social safety nets are non-existent in rural areas. In the past, many emergency response programs have supported farmers after external shocks. GoU should analyze this experience and decide ex-ante what support mechanisms for farmers are established for times of distress. This helps to avoid profiteering after disasters from criminal groups or individuals and ensures that the help really reaches to smallholder farmers that have been affected most by a shock.

Preface

Every day, the livelihoods of farmers in Uganda are threatened by various risks. Agricultural Risk Management (ARM) can significantly contribute to improving the resilience of vulnerable rural households by increasing their capacity to absorb and adapt to risks. In order to better support its farming population, the Government of Uganda under the leadership of the Ministry of Agriculture, Animal Industries, and Fisheries (MAAIF) has undertaken efforts to better understand and analyze risk, and to develop an agricultural risk management strategy aimed at reducing the risk exposure of farmers. In this endeavor, the GoU has enlisted the support of international partners. The Platform for Agricultural Risk Management (PARM), a G8-G20 initiative hosted by the International Fund for Agricultural Development (IFAD), provides technical support to the GoU on Agricultural Risk Management. PARM Secretariat is working in strategic partnership with the New Partnership for Africa's Development (NEPAD) Agency which, in collaboration with the Food and Agriculture Organization (FAO) has established since 2011 an Agriculture and Food Insecurity Risk Management (AFIRM) initiative to support African countries in mainstreaming agriculture and food security risk management into their Comprehensive Africa Agriculture Development Programmes (CAADPs).

This Risk Assessment Study (RAS) is intended to help the stakeholders in Uganda develop a common understanding of the risk exposure of farmers and build a consensus on the priority areas for agricultural risk management in the future. The purpose of this RAS is to provide comprehensive mapping and assessment of agricultural risks in Uganda in the past and the foreseeable future. As well as provide information on their likelihood, their economic and agricultural impact on the livelihoods of rural producers in Uganda. Preliminary results of this report have been incorporated into the new Agricultural Sector Strategy Paper 2014/15-19/20 (ASSP). Thus, this final report is intended to provide the stakeholders with solid information on agricultural risks in Uganda so as to allow for evidence-based implementation of the ASSP and the development of initiatives and programmes in line with the ASSP for agricultural risk management in the country.

The report is structured in the following manner: Chapter 1 provides an overview of the agricultural sector and the main parameters relevant to agricultural risk (e.g. soils, climate, and production systems). Chapter 2 analyzes the risk exposure of Uganda and provides a description of all major risks in agriculture. Chapter 3 describes the political and institutional framework for agricultural risk management and lists the major initiatives and programmes currently dealing with the various agricultural risks. Chapter 4 provides a systematic quantification of economic (and social) impacts of agricultural hazards and likelihood of events. Chapter 5 provides a summary of all the analysis and a prioritization of risks for Uganda. This final chapter also provides recommendations for improved agricultural risk management in the future.

Part One: Risk Profile

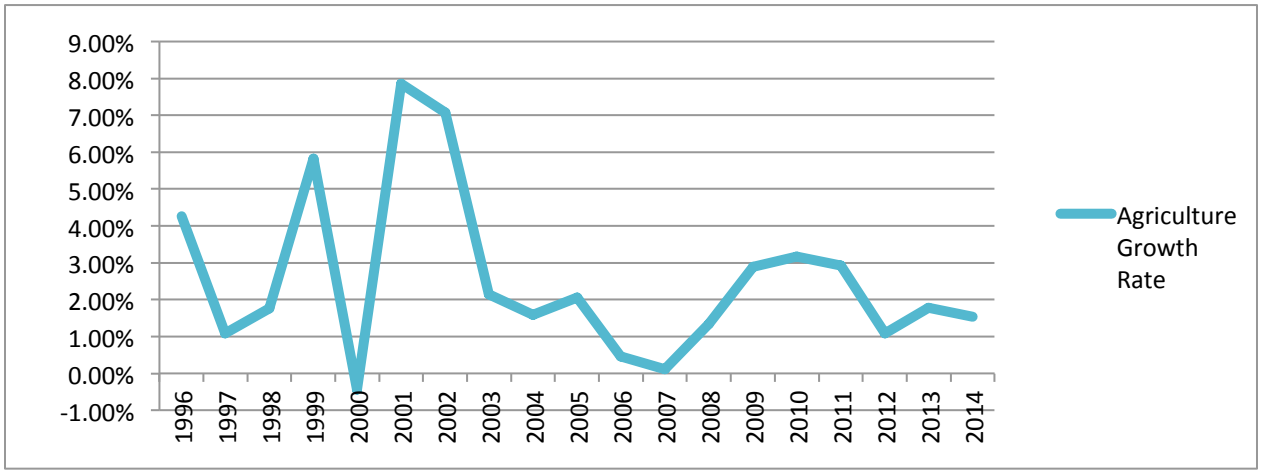
1 The country context

Uganda is gifted with fertile soils and a favourable climate having one of the best environments for agricultural production in Africa. The agricultural sector in Uganda includes food crops, cash crops, floriculture, livestock, forestry and fishery, and employs more than 70% of the working population. Despite the importance of agriculture to the economy, the growth of the agricultural sector (at 1.5% in FY 2013/14) is still much below the National Development Program (NDP) annual growth target of 5.6% and the 5.9 % growth rate that is required for effective poverty reduction. It is also below the 6% annual growth target of the African Union's Comprehensive Africa Agriculture Development Program (CAADP).

Agriculture's contribution to the Gross Domestic Product (GDP) at current prices has fluctuated over the years, from a contribution of above 35% in the 1990s to a contribution fluctuating between 26% and 30% in the 2000s and 2010s. GDP estimates for the fiscal year 2013/14 grew by 4.7 % compared to a revised growth of 6.0 % in 2012/13. For the calendar year 2013, GDP grew by 4.7 % compared to a revised growth of 3.6 % in 2012. The agriculture sector activities generally recorded minimal growth across most activities (cash crop, food crop, livestock and forestry activities), except for fishing which registered a strong decline. Agriculture sector activities contributed 22.2 % of total GDP at current prices in the fiscal year 2013/14 compared to 22.5 % in 2012/13.The overall growth in the agriculture sector activities was 1.5 % in 2013/14 compared to a revised 1.3 % in 2012/13 (UBOS, 2014).

Looking at the growth of the sector over the years (Figure 1), a decreasing tend is observed that could be attributed to weather hazards, economic downturns, limited availability of improved inputs, diversion of investment into the industrial sector, and/or insurgencies in neighbouring countries such as Rwanda, Southern Sudan and the Republic of Congo (leading to reduced agricultural exports crossing the borders).

Figure 1: Annual growth of the agricultural sector (1990-2014)



Source: World Bank

Agricultural products make up nearly all of Uganda's foreign exchange earnings and continue to contribute more than half of Uganda's formal export earnings, although the percentage has gone down from 61% in 2005 to 54% in 2014 (UBOS: 2010, 2012, and 2014). However, exports of non-traditional products, such as vegetables, maize, cocoa beans, soybeans and oil-seeds are growing, while traditional exports such as coffee, cotton, tea, and tobacco remain strong (Table 1). Due to the significant increase in the coffee earnings in 2013 the overall formal export earnings increased from 25.1% in 2012 to 27.5%- in 2013. Overall, coffee remained the main foreign exchange earner for the last five years; followed closely by tobacco, tea and cotton. The share of the Non-Traditional Exports (NTEs) to total formal export earnings slightly dropped from 74.9% in 2012 to 72.5% in 2013. However, total non-traditional earnings steadily increased over the same period due mainly to increased contributions from fish and fish products and animal, vegetable fats and oils (UBOS, 2014).

Despite its diversity of agricultural products, Uganda imports many agricultural products including vegetable fats and oils, sugars and sugar preparation, honey, organic chemicals, Oil-seeds, oleaginous fruits and animal feeds.

Table 1: Major Agricultural products of Uganda (export in tonnes)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Traditional Exports									
Coffee	142,513	126,887	164,540	200,640	181,324	159,433	188,623	161,656	220,546
Cotton	30,403	18,480	16,228	7,950	20,515	11,891	25,587	43,258	18,671
Tea	36,532	30,584	44,015	46,022	44,446	54,555	55,650	54,855	61,971
Tobacco	23,730	15,794	26,384	29,042	32,000	32,373	19,284	31,684	55,818
Non-traditional Exports									
Fish and Fish Products	39,201	36,461	31,681	24,965	21,501	23,376	21,552	22,928	20,087
Flowers	6,162	4,989	5,243	5,349	3,910	3,727	3,436	4,297	4,364
Legumes	28,332	27,087	22,532	37,211	38,140	24,417	35,920	30,357	37,785
Bananas	2,196	494	1,151	396	695	471	761	760	650
Fruits	3,061	7,821	7,361	3,114	3,290	2,904	3,682	1,439	2,123
Pepper	817	218	194	304	320	111	314	397	405
Maize	92,794	115,259	101,190	66,671	94,440	166,251	89,246	174,776	122,107
Ground-nuts	22	63	101	30	66	88	299	2,810	3,541
Sesame Seeds	7,412	7,568	5,945	14,154	12,107	12,065	14,841	11,503	22,055
Cocoa Beans	7,600	7,632	9,404	8,982	11,882	16,478	17,936	19,664	26,352
Hides and Skins	25,349	22,214	20,942	13,042	5,160	10,869	22,635	23,484	30,714
Vanilla	234	195	422	192	254	235	135	106	82
Soya-beans	574	3,048	5,798	3,250	2,630	918	1,579	2,613	1,938
Sorghum					11,029	5,416	1,016	13,978	55,224
Animal/Veg. Fats & Oils			47,474	37,694	44,950	51,633	70,791	73,505	79,540
Sugar & Sugar Confectionary			72,772	88,959	91,967	99,139	110,469	158,285	124,852
Rice			24,739	25,426	38,289	33,323	38,254	69,914	71,017
Vegetables			2,269	3,329	3,706	3,271	3,720	7,356	8,059

Source: UBOS

1.1 Land use

Uganda has an area of 241,550.7 square kilometres of which 18.2% is open water and swamps, and 81.8% is land. The altitude above sea level ranges from 620 metres (Albert Nile) to 5,111 metres (Mt. Rwenzori peak). A total of 42% of the available land is arable land although only 21% is currently utilised, mostly in the southern parts of the country. Land is fairly evenly distributed throughout the country with the average land holding being about 1.6 to 2.8 hectares in the south and 3.2 hectares in the north (where the climate tends to be drier and larger landholdings are required for sustainable management of farms).

The vegetation is mainly composed of shrubs, savannah, grassland, woodland, bush land and tropical high forest. Table 2 shows the national land cover in sq. km by type. The cultivated land cover being the largest increased from 84,010 sq. Km in 1990 to 99,018.4 sq.km in 2005. The second in size are the grasslands but which remained constant at 51,152.7 sq. Km for the same periods. Notably, the bush lands and woodlands decreased from 14.223.9 sq. Km and 39.740.9 sq.km in 1990 to 11,893.6 and 29,528.1 sq. Km in 2005 respectively. Similarly, plantations (hard and soft woods), tropical high forest have decreased over the period. The causes of loss of forest cover continue to be over-harvesting of forest products, mainly timber and charcoal, land clearance for agriculture, overgrazing, urbanization, and industrial development. The rapid growth of population also exerts a lot of pressure on the forest resources. This calls for the need to strengthen the land use interventions that will curb environmental degradation and depletion of vegetation cover (UBOS Statistical Abstracts, Ministry of Lands, Housing and Urban Development report, 2010).

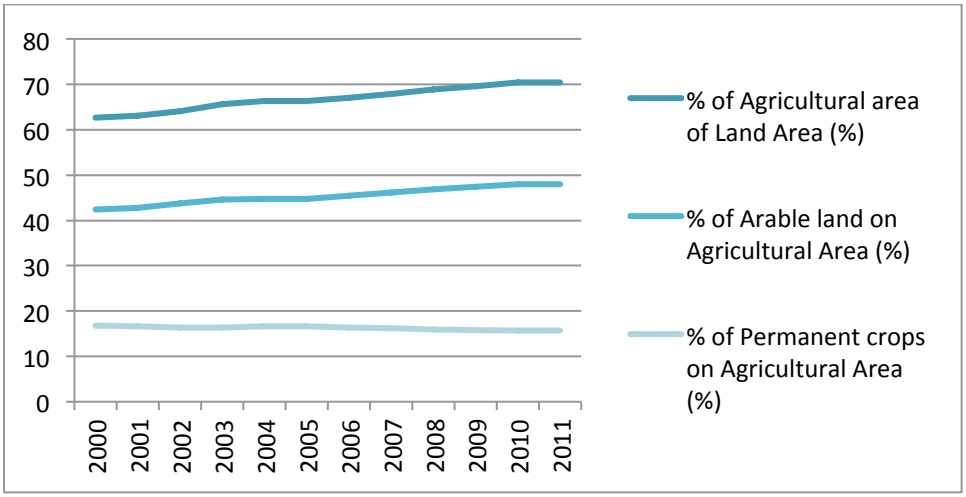
Table 2: National Land cover statistics

Type of land cover	1990 (km^2)	2000 (km^2)	2005 (km^2)
Built-Up Areas	365.7	365.7	365.7
Bush-lands	14 223.9	12 624.5	11 893.6
Commercial Farmlands	684.5	684.5	684.5
Cultivated Lands	84 010.0	94 526.7	99 018.6
Grasslands	51 152.7	51 152.7	51 152.7
Impediments	37.1	37.1	37.2
Plantations – Hardwoods	186.8	153.3	138.6
Plantations – Softwoods	163.8	80.0	121.5
Tropical High Forest	2 740.6	2 248.2	2 036.3
Tropical High Forest Normal	6 501.5	5 333.5	4 830.6
Water Bodies	36 902.8	36 902.8	36 902.9
Wetlands	4 840.4	4 840.4	4 840.6
Woodlands	39 740.9	32 601.4	29 527.8
Total	241 550.7	241 550.7	241 550.7

Note: The figures indicated in the above table are based on projections. Actual vegetation studies were undertaken in 1994 based on 1992 satellite imagery.

Source: National Forestry Authority (NFA)

Figure 2: Agriculture land statistics



Source: MAAIF

1.1.1 Land Tenure System

Land is a primary input in agricultural production. Having a clear land law that ensures easy access to and guarantees tenure on land is crucial. In Uganda, land is in various tenure systems, namely customary (68.8%), mailo (9.2%), freehold (18.6%), and leasehold (3.6%). Citizens and foreigners can access, own and utilize it under the land law enshrined in the 1995 Ugandan constitution and the 1998 Land Act. Customary tenure is the most common system in Uganda where access to land is governed by the rules of the community. It is a secure tenure but does not offer formal land titles. Mailo tenure is a quasi-freehold tenure system that is secure and well-defined. Although, tenants are restricted in their security of tenure on the land they farm. Freehold tenure is a system where owners have titles with unrestricted and indefinitely access to their land. Leasehold tenure is a system where the owner of the land grants the tenant exclusive use of the land for a specific period of time for an annual rent or service fee.

Under the law land tenure relationships could be defined and enforced properly in formal courts of law or through customary structures in a community and the four tenure systems have different implications for land development and utilization. For example, better farming practises such as, soil management practices, application of manure and crop residues, and long time investments such as tree growing are more common for land owners instead of tenants (Kyomugisha, 2008).

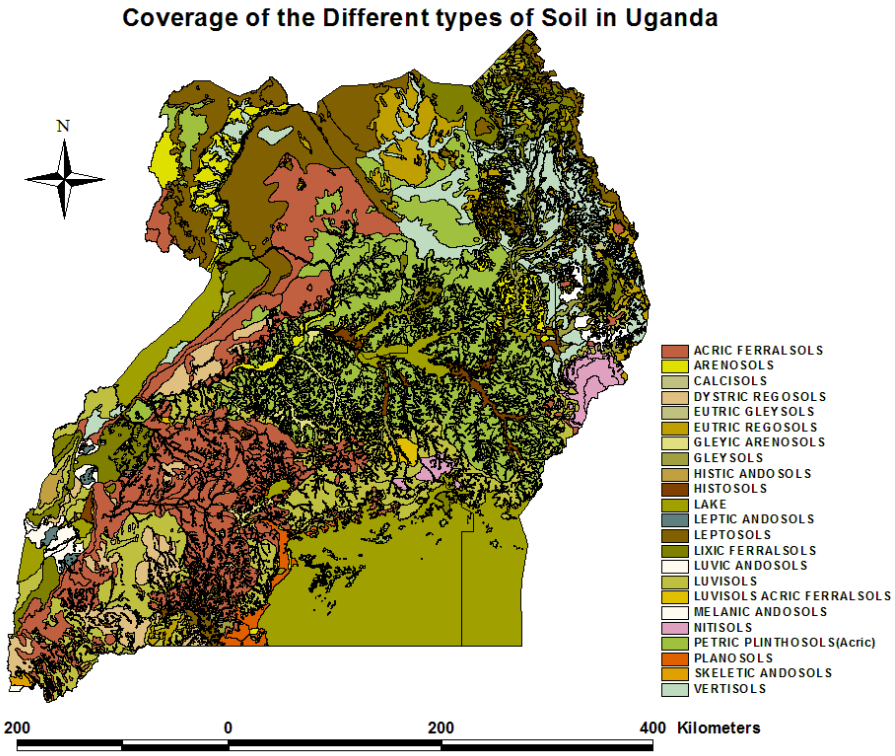
1.1.2 Soils

The soils of Uganda have been classified according to levels of productivity. Of the land area 8% have high productivity soils, 14% medium productivity soils, 43% fair productivity soils, 30% low productivity soils, and 5% negligible productivity soils. The main soil types in Uganda are 18 divided into 7 groups based on their occurrence and agricultural productivity;

1) ***The Uganda surfaces*** cover most areas south of Lake Yoga. This group embraces five types of deep, sandy clay loams with medium to high productivity.

2) ***The Tanganyika surfaces*** cover most areas north of Lake Kyoga, West Nile and some parts of the South Western tip of Uganda, embracing five types of sandy clay loam with low to medium productivity.
3) ***The Karamoja surfaces*** cover the North Eastern part of the country and embrace two soil types of sandy clay loams and black clays with very low productivity.
4) ***Rift valley soils*** in the Western and Northern parts of the country, bordering on the Western Rift Valley, embracing two types of mainly sandy clay loams with alluvial parent rock of medium to high productivity.
5) ***Volcanic soils*** are dominant in Mt. Elgon, Northern Karamoja, and the extreme South Western tip of Uganda (Kabale and Kisoro) with medium to high productivity except in N. Karamoja where their productivity is low.
6) ***Alluvial soils*** are found outside the Rift Valley, mainly in Central Northern Uganda (Lango and Acholi) as well as West of Lake Victoria. The productivity of these sandy soils is very low.
7) The last group of soil types is in Northern Uganda and their productivity is low (Parsons, 1970).

Figure 3: Map of soil type distribution in Uganda



Source: Yield Gap

1.1.3 Water resources

According to a study carried out by Japanese International Cooperating Agency (JICA), potential irrigable area in Uganda is approximately 202,000 ha with 14,418 ha under formal irrigation and 67,000 ha under informal irrigation, much of it for rice. The study also indicates that while the total renewable water

resources in Uganda is over 66 km^2 only some 22km^2 is being utilized (for both small and large scale initiatives). There is therefore great potential to harness the available water in order to increase production and productivity.

Figure 4: Rivers and lakes in Uganda

Source: JICA

1.2 Climate

Overall, Uganda experiences moderate temperatures throughout the year, ranging from 16-31^{o}C with mean daily temperatures at about 28^{o}C. The highest temperatures (above 30 °C) are experienced in the north and north-eastern parts of the country. The southern parts of Uganda are also warming up, with the fastest warming regions in the south west of the country (Government of Uganda (GoU), 2007).

In Uganda, annual rainfall ranges between 700 - 2,000 mm with averages of about 318 mm per year. The dominant rainfall distribution patterns over East Africa, is related to the sun's path over the plane of the equator, which is biannually. This produces a bimodal rainfall pattern, with the first season from March to May and the second season from October to December. The bimodal rainfall pattern is predominant in the southern parts of Uganda with average annual rainfall between 1,200 – 1,500 mm per year. However, in the northern parts of Uganda, the second season tends to peak earlier on August (due to the moisture effect from the Congo basin on the north easterly winds from the Indian ocean) seemly merging the two seasons into one, thus the unimodal rainfall distribution pattern (Ogallo, 1988). The annual rainfall ranges between 900 - 1,300 mm in the northern parts of Uganda.

The bimodal rainfall distribution and moderate temperature ranges in the southern parts of Uganda allow for two cropping seasons that favouring crops such as coffee, bananas, beans, and vegetables and

adequate grazing of livestock all through the year. The northern parts of the country are restricted in the range of crops that can be grown, due to the unimodal rainfall pattern and higher temperature ranges, favouring mainly oil seed crops and extensive livestock production (Komutunga & Musiitwa, 2001). The relative humidity typically ranges from 59% (mildly humid) to 97% (very humid) over the course of the year, rarely dropping below 44% (comfortable) and reaching as high as 100% (very humid).

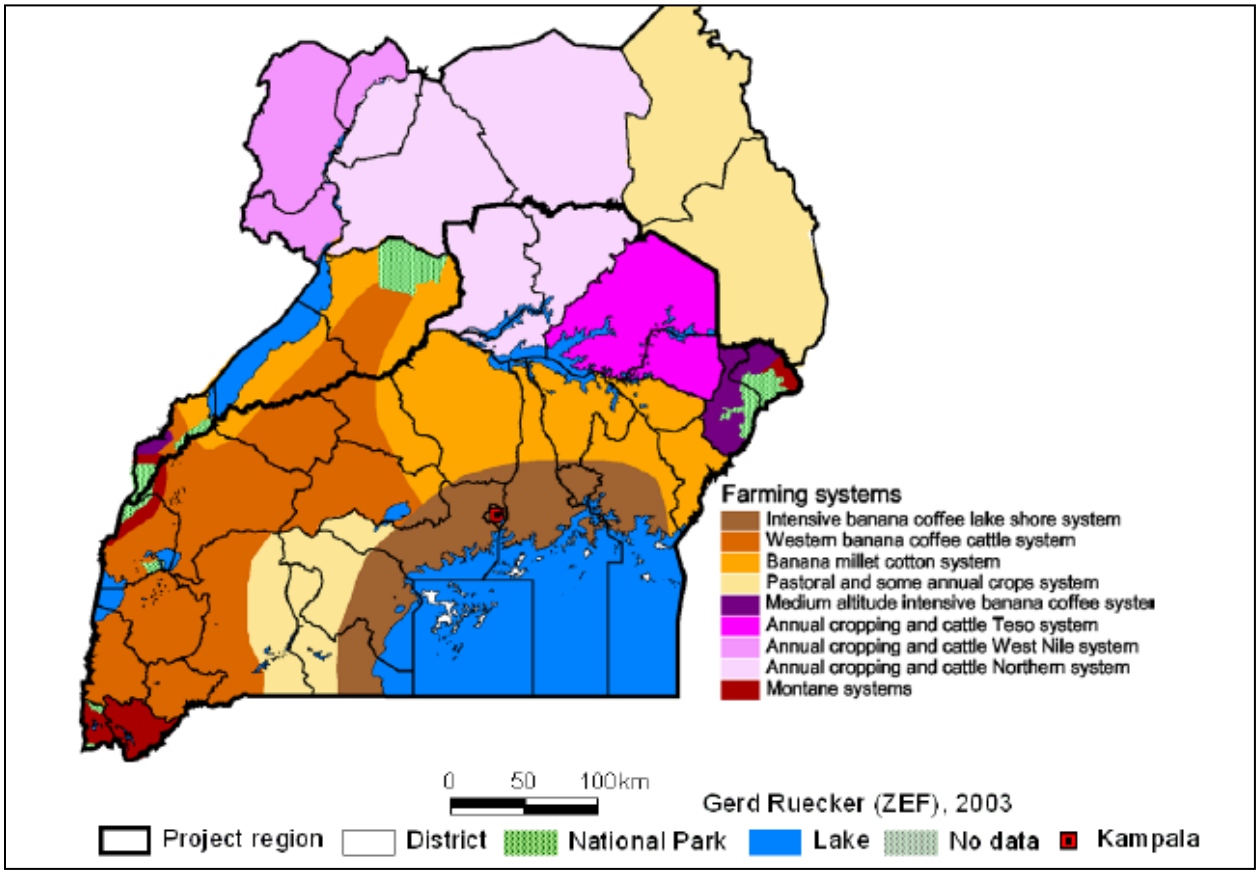
In Uganda, agriculture the backbone of the economy is rain-fed making it vulnerable to climate change, not excluding other factors (Mubiru, Komutunga, Agona, Apok, & Ngara, 2012). Climate change is affecting the distribution and type of rain through the seasons; the onset and cessation of rains have increasingly become erratic, heavier and more violent. Furthermore, minimum temperatures have been steadily rising faster than maximum temperatures by about 1^{o}C higher (Oxfam, 2008). Climate change models for Uganda from the IPCC point to an increase in temperature of between 0.7^{o}C and 1.5^{o}C by the year 2020. The same models predict a likely increase in the variability of rainfall with most areas probably getting higher rainfall. In fact, vulnerability assessments for Uganda identified precipitation as the most important climate change related variable (NEMA, 2008).

The influence of soils, topography and climate on the farming systems, livelihood and development in Uganda has led to the dividing of the country into several agro-ecological zones, livelihood zones and developmental domains, see figures 1,2, 3 and 4 below (Wortmann and Eledu 1999, Bashaasha 2001, Ruecker *et al.,*2003). Climate change impacts are also envisaged to exacerbate the constraints on livelihood systems leading to a decline in water rights, increased insecurity, rising unemployment and a spread of HIV/AIDS (NEMA, 2006/07). In 2007, Uganda launched a National Adaptation Plan (NAPA) with support from the Global Environmental Fund (GEF) whose provisions are yet to be implemented.

1.3 Farming systems

The farming systems vary across Uganda based on climatic and soil conditions, cultural practices, etc. The nine major farming systems are: 1) Intensive banana-coffee lakeshore system, 2) medium altitude intensive banana-coffee system, 3) western banana-coffee-cattle system, 4) banana-millet cotton system, 5) annual cropping and cattle Teso system, 6) annual cropping and cattle West Nile system, 7) annual cropping and cattle Northern system, 8) pastoral and some annual crops system, and 9) montane systems.

Figure 5: Major farming systems in Uganda

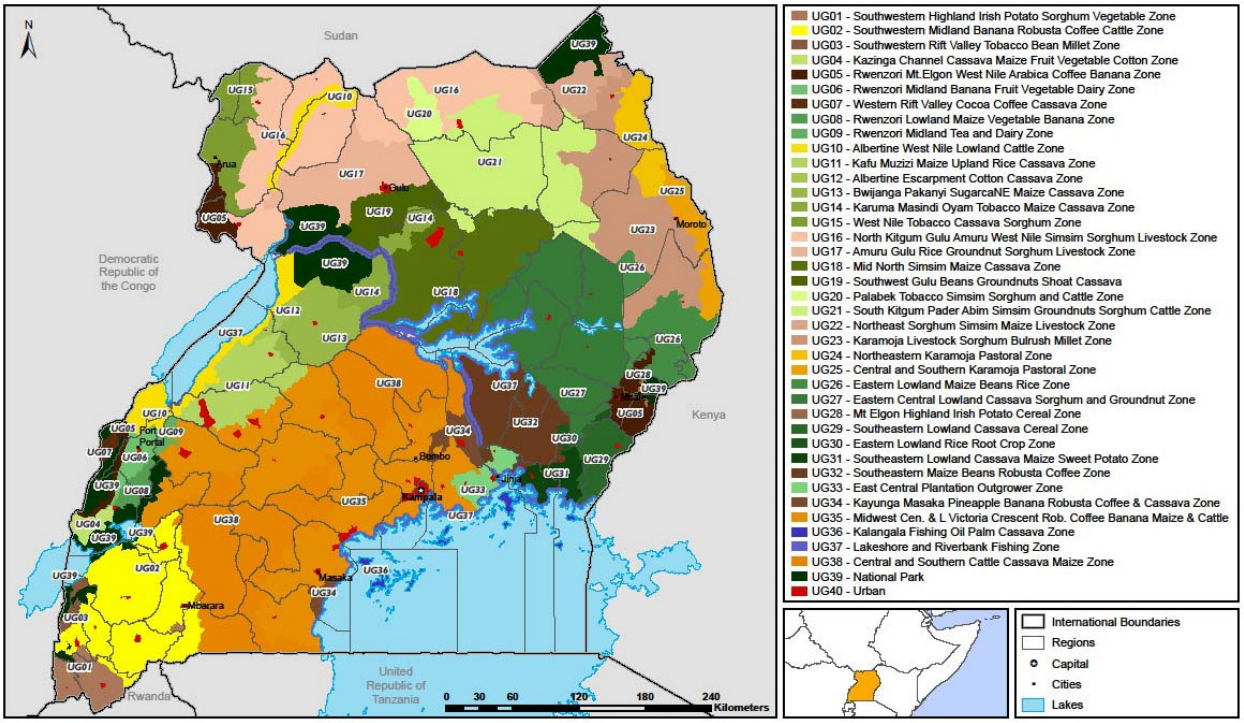


Source: Ruecker et al., (2003)

Within these major farming zones, a multitude of agricultural practices are applied. Even within one major farming system, farmers are affected differently by agricultural risk as the combination of crops grown varies. Therefore, a more detailed breakdown of sources of income can be found in the livelihood zoning map hereafter (Figure 6). Livelihood zoning is the first step taken in the process towards the creation of livelihood profiles or baselines for a specific geographic area. The objective is to group together people who share similar options for producing food and cash-crops and livestock, securing cash income and using the market, how they are affected by hazards such as rain failure or crop disease, which is related to geographical location. For example, pastoralists and cultivators have different measures of what constitutes poor rains and/or drought, and they have different responses to these threats. Comparative livelihoods information provides a solid base for monitoring food security amongst a population, thereby helping governments and international agencies to prevent humanitarian disasters.

In most developing countries, such as Uganda, livelihoods are based significantly on the production of food crops, cash crops, and livestock, which play an important role even outside pastoral and agro-pastoral areas making agro-ecological mapping play a dominate role in livelihood zoning. Other elements also play a role in livelihood zoning such as accessibility to roads and markets, or proximity to large cities, irrigated plantations, local culture and government policy decisions (FEWS NET, 2010).

Figure 6: Livelihoods zones in Uganda



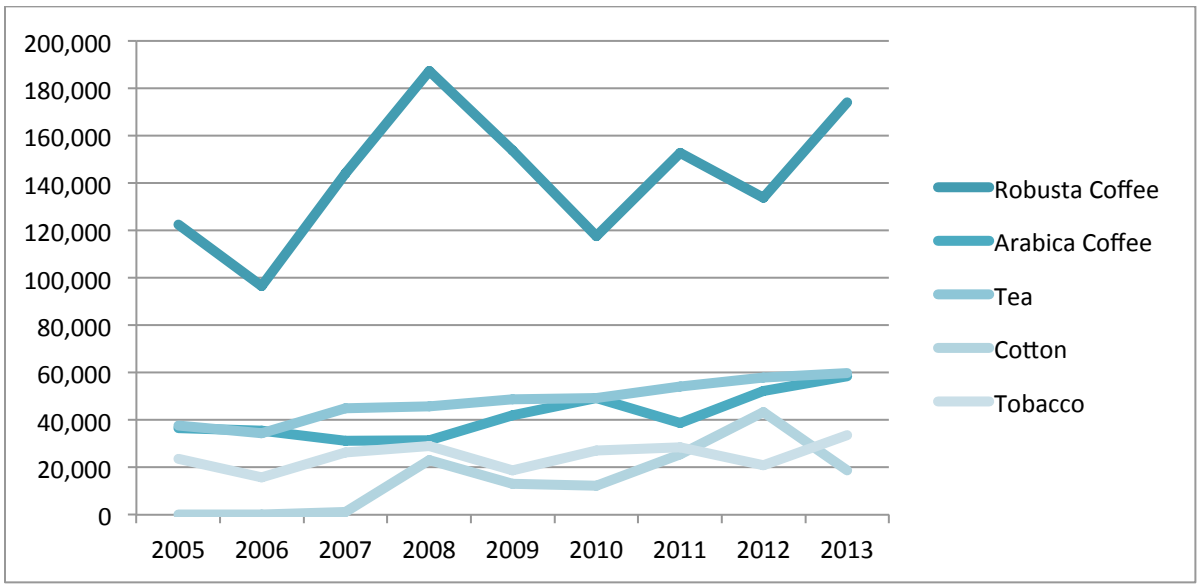
Source: FEWS NET (2010)

1.4 Commodities

1.4.1 Cash Crops

In Uganda the major cash crops are coffee, tea, cotton, tobacco, cocoa, sugar cane and exported flowers, fruits and vegetables. There are two types of coffee grown in Uganda: Robusta coffee and Arabica coffee with Robusta being produced more than Arabica. The majority of cash crops, including tobacco, tea, cocoa and coffee registered an increment in exports for FY 2012/13 apart from cotton, which registered a drop of more than 50% in sales (see Figure 7).

Figure 7: Main export cash crops in tonnes (2005-2013)



Source: Uganda Coffee Development Authority (UCDA), Uganda Tea Authority, CDO, B.A.T (U) Ltd and Mastermind Tobacco (U) Ltd and Uganda Cotton Development Authority

1.4.2 Food Crops

Uganda grows about sixteen major food crops namely; Cereals (maize, millet, sorghum, rice); Root crops (cassava, sweet potatoes, Irish potatoes); Pulses (beans, cowpeas, field peas, pigeon peas); and Oil crops (groundnuts, soya beans, sesame), bananas, and plantains. Additionally, wheat is increasingly become a major food crop in Uganda and should be included in the major food crops. Between 2005 and 2013, the area planted with food crops registered a growth of 5.2% occupying about 5,743,000 hectares from 5,447,000 hectares. However, within this period, there was a marked decline in total area planted with food crop from 2007 to 2009 by 7.9%, this was probably due to climate change, after that the area planted increased by 11.2% by 2013. Cereals occupied 30.6% of total area planted for major food crops, while root crops occupied 23.4%, Pulses 13.2%, banana and plantains 16.9% and oil crops 15.9% maize, cassava, beans and groundnuts continue to occupy the largest proportions of area planted (see Table 3).

Table 3: Area planted for selected food crops (000 ha), 2005-2013

Year	Plantain & Bananas	Cereals	Root Crops	Pulses	Oil crops	Total
2005	1,675	1,063	1,063	1,009	637	**5,447**
2006	1,677	1,053	1,053	1,032	651	**5,466**
2007	1,678	1,070	1,070	1,055	662	**5,535**
2008	919	1,612	1,304	724	764	**5,323**
2009	942	1,560	1,275	718	605	**5,100**
2010	978	1,642	1,271	717	637	**5,245**
2011	979	1,701	1,309	740	878	**5,607**
2012	979	1,748	1,342	756	904	**5,759**
2013	972	1,756	1,343	759	913	**5,743**

Source: MAAIF and UBOS

The Eastern region leads in the production of cereals and root crops followed by the western and northern region. The northern region leads in the producer of oil crops, followed by the eastern region. The western region led in the production of all types of banana and plantains, followed by the central region. (UCA 2008/09, UBOS). The national estimates of food crops in Uganda show that the majority of food crops such as bananas, cassava, sorghum, millet, beans, ground nuts, soya beans sesame, sweet and Irish potatoes registered increments in production (Table 4).

Table 4: Production of food crops (Tonnes) by region, Uganda Census of Agriculture (UCA) 2008/09

Regions	Banana & Plantains	Cereals	Root crops	Pulses	Oil crops	Total
Central	1,039,837	468,444	735,504	167,859	33,092	**2,444,736**
Eastern	342,234	1,476,900	1,912,950	109,372	89,822	**3,931,278**
Northern	31,626	605,177	1,277,367	276,109	192,471	**2,382,750**
Western	2,883,648	654,894	941,694	414,775	53,949	**4,948,960**

Source: MAAIF and UBOS

1.4.3 Livestock-

According to the 2008/09 livestock census, the northern region has the highest number of livestock; it has the highest number of cattle, goats, sheep and ducks. It is followed by the western region, which has the second highest number of cattle, goats, sheep and pigs. The eastern region has the highest number of chicken and turkey, followed by the central region. The central region has the highest number of pigs, with the least number in the northern region (see Table below).

Table 5: Total number of livestock (Head count) by region, UCA 2008/09

Region	Cattle	Goats	Sheep	Pigs	Chicken	Ducks	Turkey
Central	2,475,856	1,676,052	269,604	1,307,454	10,530,429	271,302	44,728
Eastern	2,488,467	2,599,978	319,367	699,675	10,696,098	366,904	238,024
Northern	3,921,849	4,616,136	2,254,015	398,818	9,007,237	519,439	43,667
Western	2,548,623	3,452,241	567,385	778,350	7,210,117	300,608	21,895
Total	**11,434,795**	**12,344,407**	**3,410,371**	**3,184,297**	**37,443,881**	**1,458,253**	**348,314**

Source: UBOS

From 2005, the number of livestock and poultry has steadily increased over the year. This is attributed to the steady efforts to control animal diseases and improve livestock production systems by an increase in routine livestock production extension interventions. Between the years 2005 and 2013, cattle, sheep, goats, and pigs increased in numbers by about 48.0%, 59.3%, 46.6% and 45.5%, while poultry increased the least by 14.4% in the same period (Table 6). In FY 2012/13, cattle, sheep and goat numbers increased by about respectively, while pigs and poultry numbers increased by 2.5% and 3.0% respectively in the same period.

Table 6: Livestock numbers in '000 (2005 – 2013)[1]

Year	Cattle	Sheep	Goats	Pigs	Poultry
2005	6,770	1,600	7,800	2,000	32,600
2006	6,973	1,648	8,034	2,060	26,049
2007	7,182	1,697	8,275	2,122	26,950
2008	11,408	3,413	12,450	3,184	37,404
2009	11,751	3,516	12,823	3,280	33,819
2010	12,104	3,621	13,208	3,378	34,834
2011	12,467	3,730	13,604	3,496	35,879
2012	12,840	3,841	14,012	3,583	36,956
2013	13,020	3,937	14,614	3,673	38,064

Source: Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), and Uganda Bureau of Statistics (UBOS)

There has been a steady growth (about 13.7%) in all meat, and milk production between 2008 and 2013, poultry egg, 3.3% and 2.9% for indigenous and exotic eggs, respectively (see Tables 7 and 8). One of the reasons for the increments is the increased demand of these products from neighbouring countries such as Southern Sudan, Rwanda, and the Republic Of Congo as well as improvements in the provision of services.

Table 7: Meat production in metric tonnes (2008-2013)

Year	Beef	Goat/Mutton	Pork
2008	169,950	31,689	18,540
2009	175,049	32,640	19,096
2010	180,300	33,619	19,669
2011	185,709	34,627	20,259
2012	191,280	35,666	20,867
2013	197,019	36,736	21,493

Source: MAAIF and UBOS

Table 8: Milk and egg production in Uganda (2008 – 2013)

	Milk production (in million litres)			Egg production (in millions)		
Year	**Indigenous**	**Exotic**	**Total**	**Indigenous**	**Exotic**	**Total**
2008	624	673	1,298	141.84	567.36	709.2
2009	643	694	1,337	143.26	573.03	716.29
2010	662	715	1,377	144.69	578.76	723.45
2011	682	736	1,418	146.14	584.55	730.69
2012	703	758	1,460			
2013	724	780	1,504			

Source: MAAIF and UBOS

[1] The accuracy of the headcount for cattle for the years 2005 to 2007 is contested. An increase in cattle by approximately 59% from 2007 to 2008 is not plausible. The increase is most likely due to improved data collection in 2008 during the Agricultural Census 2008/09.

1.4.4 Fisheries

The Fisheries sector is comprised of both capture and culture (aquaculture) fisheries with the former contributing most of total production. The capture fishery is basically artisanal while aquaculture is increasingly becoming commercialized because of the increased demand for fish and noticeably reduction in catches from capture fisheries (see Table 9). The water bodies of Uganda comprises of five major lakes (Victoria, Albert, Kyoga, Edward and George and about 160 minor lakes, rivers and wetlands), and have an estimated production potential of over 800,000 tonnes of fish although the current catch was estimated at 419,000 MT in 2014. Lake Victoria continues to be the most important water body in Uganda both in size and contribution to the total fish catch. It is important to note that over 90% of the fish catch is harvested from Lakes: Victoria, Albert and Kyoga.

Fishing constitutes a source of livelihood for about 10.8% of the households in Uganda and has contributed more than 5% to overall GDP. However, fish and fish products' contribution to the agricultural exports to GDP has been decreasing steadily over the past five years from 7.1% in 2009 to 5.3% in 2013. This decline in contribution is attributed to declining catches due to destructive fishing methods (artisan), over-fishing, non-compliance of regulations and weed infestation due to pollution. In fact, recent data indicates that while catches from Lake Victoria are dwindling, fish populations in Lake Edward and George are almost extinct. The EU ban of fish imports from Uganda in mid 2000s drastically reduced export earnings from the fishing sector but having attained high quality and safety standards for production and export, in 2006 fish exports became the second largest export earner for Uganda There is also increased efficiency in fisheries management with the creation of Beach Management Units (BMUs), leading to improvement in species-specific management plans and in the understanding of the economics of fisheries development, as well as use of appropriate fishing gears.

Table 9: Fish catch by water body (.000s tonnes), 2005 – 2013

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Lake Victoria	253.3	215.9	223.1	219.5	221.3	162.9	175.8	185.5	193.0
Lake Albert	56.4	56.4	56.4	56.5	56.5	154.2	163.6	152.6	160.0
Lake Kyoga	68.4	60.0	60.0	60.0	60.0	49.1	61.6	44.1	40.0
Other Waters	33.7	29.9	29.8	28.8	28.8	19.8	20.1	25.5	26.6
Total	**411.8**	**362.2**	**369.3**	**364.8**	**366.6**	**386.0**	**421.1**	**407.6**	**418.6**

Source: Fisheries Department, Ministry of Agriculture, Animal Industry and Fisheries (MAAIF).

1.4.5 Forestry

Forests in Uganda are defined to include all alpine, tropical high- and medium-altitude forests, woodlands, wetland and riparian forests, plantations and trees, whether on public or private land (Ministry of Water, Lands and Environment, 2001). In 1990s, forest cover was estimated at 4.9 million hectares (24% of the land area), of which 81% (3,974,000 ha) was woodland, 19% (924,000) was tropical high forest and <1% (35,000 ha) was forest plantations (National Environment Management Authority NEMA 2002). However, growth in human population and corresponding increase in demand for forest products for domestic and industrial use, expansion of agricultural land, illegal settlements and weak forest management capacity have adversely affected the status of natural forests in Uganda, reducing it to 17 % (3,556,000 ha) of total land area of the country. Over the last 15 years (1990–2005), the average

rate of deforestation was 1.9 %; deforestation rate was considerably higher (2.9 %) in unprotected areas than in Central Forest Reserves (0.3 %). Until recently, natural forests supplied the bulk of forest products but plantations are gaining prominence (National Forestry Authority NFA, 2008).

The percentage share of the forestry sector to the agricultural exports to GDP was at 2.1% in 2013, which is a significant increase from 0.4% in 2012. However, there are conceptual and methodological challenges to the estimation of the contribution of forests to the national economy in Uganda. In general, it is believed that the contribution of forests is routinely underestimated. Forestry also supports the economy through the sale of timber, ecotourism, honey, herbal medicines and rattan-cane. In addition to promoting re-forestation and afforestation, the government is also attempting to enforce forest and environmental laws and regulations, and strengthen networks to enable participation in the global carbon credit market.

1.5 Structure of the agricultural sector

By 2010, the estimated number of agricultural households was at 3.95 million, with an estimated population of 19.3 million people 79% of which were male headed and 21% female headed. Crop production was practised by 46% of the agricultural household members, while 23% carried out livestock rearing, of which only 5% belonged to farmers' groups; 51% males and 49% females. Chicken are the most reared animal, followed by goats, then cattle then pigs and least sheep (UBOS, 2014).

Ugandan farmers are basically divided into three major categories: subsistence/small scale, medium, and large. The current production structure of agriculture in Uganda is dominated by small-scale farmers comprising of an estimated 2.5 million households (90% of the farming community), the majority of whom own less than 2 acres of land each. It is reasonable to assume that, in the next several years, there will still be a large number of small-scale producers.

Uganda has significantly lower on-farm crop and livestock yields than on-station yields in spite of an excellent agro-climatic environment (yields on research stations are 2 to 5 times higher than farm yields). It is widely believed that this is a result of little use of modern inputs. One of the important factors underlying the low level of modem input use is lack of an efficient distribution system that would ensure timely availability of inputs at reasonable prices. To improve access to inputs the Government carried out a number of policy reforms to encourage and promote the private sector's role in input distribution to producers, but this has not increased farmers access to productive inputs. The farmers are still not able to obtain a good return to their efforts, which is primarily because of low market prices, poor yields, and poor access to markets.

Ugandan farmers, still use poor and outdated technologies for farming which limited production systems and inputs reducing scope and capacity. For example, the hand hoe is the main implement used for land opening and preparation in most parts of Uganda and it is a labour-intensive technology which limits the size of farms under production. This has been the case for over a century and there has been no revolution in agricultural production. The ox-plough, which is more labour-saving than the hand hoe, is mainly used in the north eastern part of the country which is favourable for livestock production and the land terrain also favours its use. The tractor has been in Uganda for over four decades and it, too,

has not produced a revolution in agricultural production. The lack of massive adoption and efficient utilization of appropriate technologies by farmers may be attributed to policy failures.

The majority (96%) of the agricultural households still rely on the hand hoe as the source of farm power and still depend on local seed (92%) as the main planting material; only 31% use improved seeds and/ or tractors (0.8%). Food shortages were experienced by 51% of the agricultural households with crop loss as the main reason for the food shortage, mainly attributed to drought and to pests and diseases. Irrigation is rarely practiced (0.9 %) and flooding and swamp drainage are most common in the Eastern region, which accounts for more than half (52%) of the drained area in Uganda.

The most important source of agricultural information for farmers was from radio and farmer to farmer communication. Radio was the main source of information on weather (85 %), farm machinery (44 %) and credit (50%), whereas farmer to farmer communication was the major source of information on crop varieties (43%), new farming methods (40%), diseases and pests (45%) and agricultural market information (51 %). Bicycles are the most common means of transport and are owned by 51% of the agricultural households. Low numbers (9.1%) of the agricultural households had accessed credit and only 51% had storage facilities.

Financial services are important instruments for improving agricultural productivity. Most small- and medium-scale farmers are usually constrained when it comes to increasing their investment in agriculture due to problems of availability of and/or access to credit. Where credit institutions exist, collateral requirements for individuals to get credit are rather prohibitive. For such farmers, a well-designed credit policy would make it possible to finance technological and capital improvements, acquire working capital to obtain inputs in a timely manner, and take advantage of market opportunities. In addition, due to limited rural off-farm employment, direct large scale foreign investment in agriculture would have a positive impact on the economy by providing employment opportunities to the rural population and increasing their capacity to generate more household incomes.

The Ugandan government has initiated infrastructure development programs geared towards improving marketing efficiency; however, a lot still needs to be done to improve marketing of agricultural commodities, lack of proper infrastructure which is an essential ingredient for efficient marketing of finished goods and services. Improving agricultural marketing requires improved marketing infrastructure such as roads, railways, water transport, and telecommunications. One of the greatest hindrances to efficient agricultural marketing in Uganda is the high transport cost associated with moving products from remote rural areas to urban markets. High transport cost may be due to the high cost of fuel, poor roads, lack of competition or a combination of all these and other factors. High transport costs translate into high retail prices for urban consumers. Road transport is the major means of transporting agricultural products in Uganda. The railway network is underdeveloped and poorly maintained. Transport services across rivers and lakes are limited.

Future expansion and increase in productivity in agriculture depends to a great extent on the sector's ability to produce cheaply and be able to compete in regional and international markets. There is a

general belief that Uganda can be the hub of the Great Lakes region in term of food supply. However, Uganda is a high cost producer and it is not clear how many of the country's main agricultural products can effectively compete within the regional markets.

In Uganda, public storage facilities that exist (former Produce Marketing Board stores/silos) are not efficiently utilized. Storage facilities such as silos and cold storage ensure longevity, freshness, and safe delivery of agricultural products.

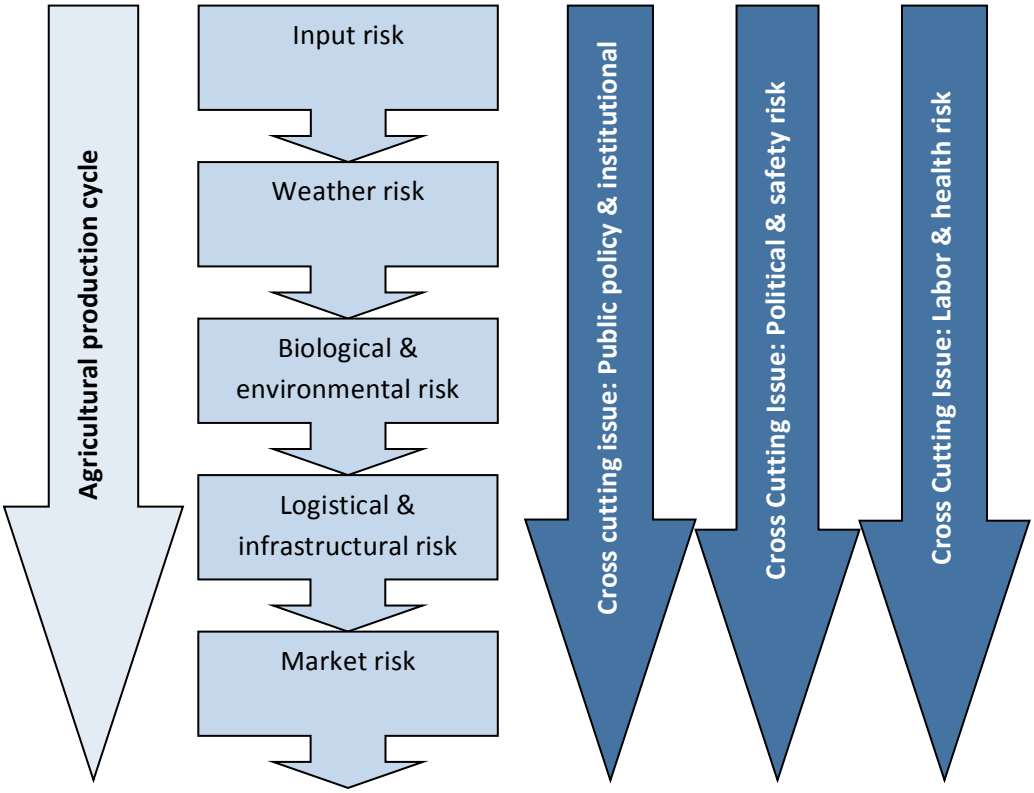
2 Identification of agricultural risks

2.1 Agricultural risks in Uganda

The livelihood of farmers in Uganda is threatened by a number of constraints and risks[2]. Constraints are often related to infrastructure such as lack of rural roads, markets, or storage facilities. All these constraints have contributed to a situation where farmers are not able to generate revenues that would be achievable in a fertile country such as Uganda. Risks on the other hand lead to losses by farmers on a more or less infrequent basis and are a major cause for lack of investment in rural areas. Constraints and risks are often interlinked: for example, the lack of on-farm storage facilities is a constraint, but its effects are highly influenced by weather and price fluctuations. Therefore, for the purpose of this study, infrastructure risk (i.e. mainly storage facilities) is included in this report.

The majority of risks are linked to specific stages in the agricultural value chain (e.g. the input risk during the planting and growth stage of the crops). Policy risk, safety risk, and health risk, on the other hand, may occur during any stage of the agricultural production cycle. Key risks faced by farmers are shown in Figure 8.

Figure 1: Overview on agricultural risks in Uganda



Source: Authors' illustration

[2] Risks are uncertain events that lead to losses; constraints are permanent conditions that lead to sub-optimal performance.

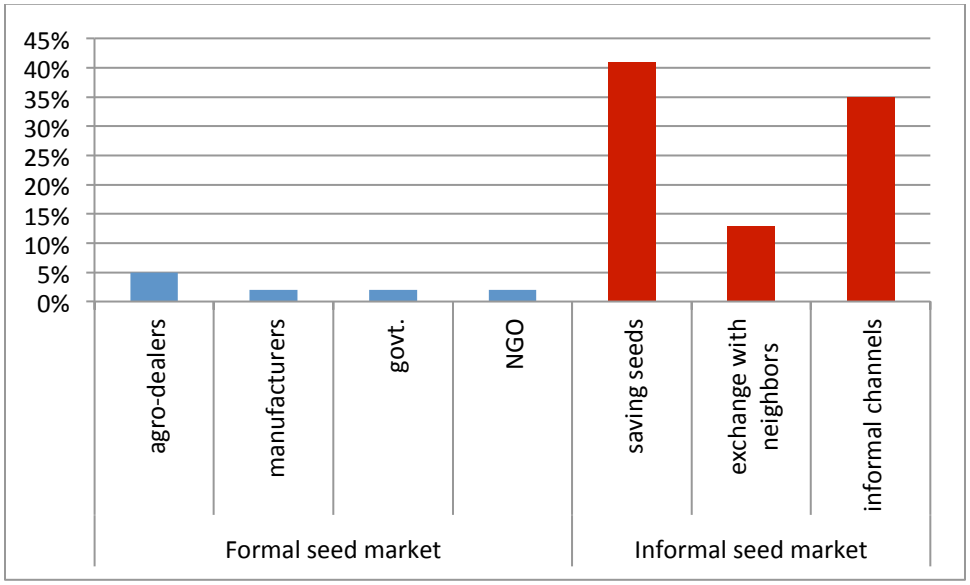
Additionally, farmers face limitations that do not enable them to either improve or increase their production and revenues; such as inadequate access to affordable finance, distance from markets, poor access to inputs, lack of advisory services and information, and poor infrastructure (for example, poor rural roads, storage facilities). In Uganda, these limitations are exacerbated by poor delivery of public goods and private sector services.

2.1.1 Input risk

Access to quality inputs remains a key constraint in Uganda. The problem is a consequence of a poorly developed seed sector where the informal seed system accounts for an estimated 87% of planted seed. There are 23 seed companies licensed and certified by the Uganda Seed Trade Association (USTA). The total demand for grain crop seeds is estimated at approximately 110,580 MT, while total sales from the formal seed market account for only 12,000 MT. The supply shortages create incentives for substandard and/or counterfeit seed; studies suggest counterfeiting affects 30-40% of purchased seed (Bill and Melinda Gates Foundation, 2015). The formal system consists of agro-dealers, manufacturers, government entities and Non-Governmental Organizations (NGOs) that distribute seeds. The informal system consists of three elements:

- Farmers saving seed for own use (no trade involved);
- Farmers exchanging seed with neighbours;
- Farmers and farmers' groups growing seed (improved or otherwise) for sale through informal channels, including local markets, NGOs, seed fairs, and development projects (Joughin, 2014).

Figure 8: Structure of the seed market in Uganda (market share of each group of actors)



Source: Bill and Melinda Gates Foundation

Key challenges for seed companies include: limited financing, lack of technical know-how, inadequate breeder/foundation seed, low seed quality, limited infrastructure (e.g., roads, storage, and transport),

price variability, weak regulatory bodies, and unfavourable seed policies. Therefore, informal markets continue to dominate due to:

- Supply shortages and inadequate access to appropriate seed markets
- Limited financial resources (less than 20% of farmers obtain credit to purchase seeds)
- Lack of awareness of improved varieties

The use of informal system is particularly prevalent in subsistence farming (except for maize): for example, only 3.5% of groundnut seeds, 6.7% of rice seeds and 1.3% of bean seeds are provided by the formal seed sector. The use of low quality inputs often leads to poor harvests and exposes agricultural production to a plethora of risks (weather, pests and diseases).

Table 10: Seed source for major crops grown in Uganda

Crop	Formal seed sector (%)	Informal seed sector (%)
Maize	44.17	55.83
Beans	1.25	98.75
Sorghum	17.40	82.60
Rice	6.67	93.33
Finger millet	4.69	95.31
Groundnuts	3.47	96.53
Soybean	0.47	99.53
Sunflower	10	90
Sesame	20.24	79.76
Total	**8.98**	**91.02**

Source: MISEREOR

Of particular importance in the public eye is the issue of counterfeit or fake inputs. The prevalence of counterfeiting in Uganda is highest within herbicides. Counterfeiting in maize seeds – especially among hybrid varieties – is also prevalent, but less so than in herbicides. Smallholder farmers rarely use fertilizer; therefore counterfeiting is not as prevalent as in the other two inputs in Table 11 (Bill and Melinda Gates Foundation, 2015). The following table provides an overview on the most common fake products.

Table 11: Most common counterfeit products in Uganda

Herbicides	Maize seeds	Fertilizer
• **Mislabelled / Sub-standard Product in which the label does not reflect contents in the bottle (often Chinese imports)** • **Label Reuse / Sub-standard Product in which a premium product's label is placed**	• Mislabelled / Diluted Seed in which seed growers "top-up" orders with grains in order to meet contracted amount or mobile salesmen sell grains mixed with seeds out of the back of trucks • Label Imitation / Adulterated or Sub-	• Mislabelled / Underweight Product in which fertilizer is removed from bag and then the bag is resealed • Mislabelled / Diluted Product in which agro-dealers dilute fertilizer with ash or sand during re-packaging

on a bottle of sub-standard product • **Bottle Reuse / Adulterated Product in which premium bottles are refilled with diluted or fake product** • **Label Imitation / Sub-standard or Adulterated Product in which a premium brand is imitated, but the product is sub-standard or adulterated**	standard Seed in which imitation packages of leading seed companies are produced and filled with grain and/or fake seeds • Label Reuse / Adulterated Seed in which agro dealers acquire and re-use bags of reputable seed companies	• Mislabelled / Adulterated Product in which large packages are broken into smaller packages and fake materials are placed in the small packages

Source: Bill and Melinda Gates Foundation

The use of counterfeit products may have negative consequences for farmers and their crops:

1. Dangers to users: Some of the ingredients used in counterfeit products may be similar to those in legitimate products, but they are untested (toxicology, eco-toxicology, etc) and may contain potentially harmful and toxic impurities and by-products. When used in agriculture, these impurities could have severe acute and/or chronic effects to users exposed to them.

2. Damage or destruction of crops: The use of untested materials in counterfeit products poses a severe risk of major phytotoxic problems when applied to growing crops. The damage caused may affect yields or destroy the crop completely. Using counterfeit products can mean the farmer's crop is rejected by exporters and retail food companies. For example, in Luweero and Rukungiri in 2008 hundreds of fields of rice were severely damaged or entirely wiped out by a fake herbicide, which contained the wrong active ingredient. Use of fake fertilizers and seeds results in significant losses in productivity and revenue, and undermines the confidence of producers in the "improved inputs" being promoted by researchers and suppliers (ASARECA, 2010).

In addition to losses for farmers, there are a number of other detrimental impacts:

- Food safety risks: Residues (MRLs) in the harvested crop: Owing to the uncertainties of both the nature and content of counterfeit or illegal product, harvested crops could have residues of unknown and untested substances that could compromise consumer's health. Billions of kilos of fresh fruit and vegetables contaminated with illegal pesticides are believed to enter East African markets each year.

- Environmental risks: Impact on sensitive species: The nature of the untested materials contaminating counterfeit products means that there is a high potential for these materials to enter the environment and the food chain. The impact on environmentally sensitive areas could be devastating to indigenous species.

- Commercial and tax losses, and stifling of innovation and competitiveness: Many legitimate and commercially available plant protection products are covered by composition and use patents that are violated by counterfeit and illegal products. Product labels carry a variety of registered trademarks that are infringed by copying. Counterfeit manufacturers undermine this right and other areas of intellectual property. Counterfeiting illegal imports and fake products impact significantly on the whole industry and supply chain through the erosion of consumer confidence. In addition, the tax payer and government are defrauded through lost taxes and levies from the sale of genuine plant protection products. The tax revenue losses for governments can be significant (ASARECA, 2010).

Box 1: Farmers' voices on access to inputs

Mr Richard Mugisha, manager at the Agriprofocus Uganda office, states that only 20-30% of the seed on the market are certified and about 80% of input dealers are selling fake seeds. Musa Ludigo, a farmer in Kamuli district testified his maize production loss when he bought 50 kilograms of fake seeds, he is quotes as saying "We farmers do not understand fake seed, as long as it is coloured, we think it is improved, we are losing because government is not educating us on how to tell the fake seed, even the dealers don't know, they want cheap suppliers".

In May 2015, Uganda self-imposed a ban on its horticulture exports to the European market due to poor standards caused by the presence of chemical residues and moths found in its exports. Some of the reasons cited for the contamination were use of fake and counterfeited inputs, and unskilled application of inputs. These counterfeited inputs stay longer on the crops and increasing resistance of pests as is the case with the moth, coupled with unskilled application and storage of the chemicals. According to the Chairperson of the Uganda Fruit and Vegetable Exporters and Producers Association Mr. Thomas Yiga, Farmers incomes are negatively affected and the country has made losses of close to UGX 7 billion (USD 1.9 million) per week.

Source: Daily Monitor

2.1.2 Weather risk

For weather risk management purposes, there are two main types of risk to consider. Those related to sudden, unforeseen events such as, windstorms and heavy rains and those related to cumulative events occurring over an extended period of time such as drought. The impacts that these risks have varies widely according to the farming system, available water resources, soil and crop type, the scope of these risks and the use of other risk management tools such as irrigation and improved crop varieties. These risks are further aggravated by poor infrastructure and mismanagement. The following table provides an overview on the occurrence of each type of weather risk in Uganda since 1933.

Table 12: Main weather risks affecting agriculture production in Uganda (1933-2015)

Hazard	Events	Share
Flood	771	31.75%
Drought	613	25.25%
Hail storm	439	18.08%
Storm	327	13.47%
Landslide	256	10.54%
Wind storm	14	0.58%
Thunder storm	4	0.16%
Flash flood	1	0.04%
Cyclone	1	0.04%
Frost	1	0.04%
Other	1	0.04%

Source: PMO

It is important to note that livelihoods in different regions of the country may be affected by a diversity of climate-related hazards and disasters at any one time. The following table illustrates the hazards and disasters that have been experienced in different regions of Uganda, and the fact that they are spread across Uganda.

Table 13: Weather hazards across Uganda

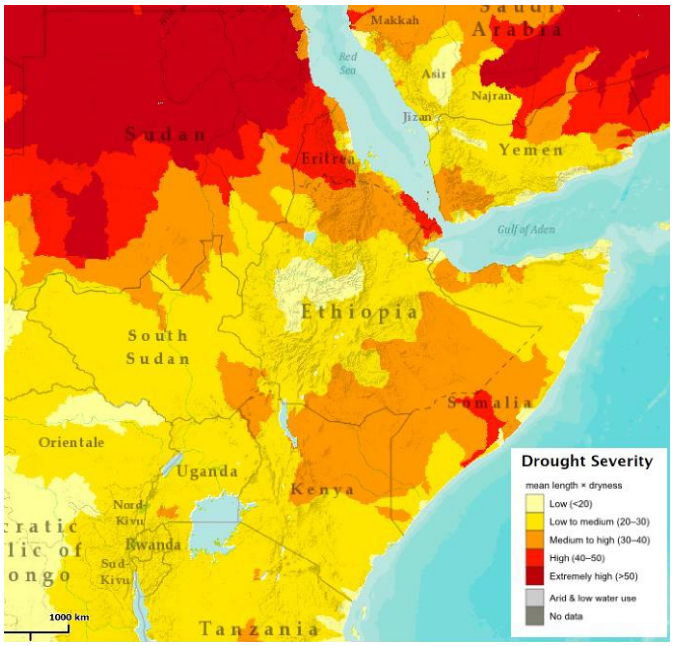
Region	Primary hazards / disasters	Examples of Impacts on livelihoods
Northern Uganda and Teso	drought and floods, conflict, ethnic violence, cattle rustling,	Floods from July to November 2007 left thousands of people affected; crops destroyed and an increase in water-borne diseases.
Rwenzori	Landslides, floods and refugee influx.	In highlands, loss of fertile soil, increasing land pressures due to searching for fertile land and semi-displacement of people when floods or other disasters occur. Reduced rainy season affecting yields of basic food crops like beans. Mountain icecaps receded by 40% of 1955 cover.
Karamoja	Drought, conflict, ethnic violence and cattle rustling.	Increased food insecurity, animal losses due to drought and conflict over water. Increased tribal conflicts. Tick-borne diseases increase, tsetse belt expansion, dust storms, increased chest and eye infections.
Elgon	Landslides, floods and refugee influx	Increased deforestation as farmers forced to higher levels. Species loss.
South-West	Fastest warming region, 0.3°C per decade with more frequent, severe droughts.	Becoming unsuitable for coffee. Dairy cattle yields fall due to heat stress. Malaria is at epidemic proportions e.g. Mbarara – 135% increase in malaria cases.
Kampala	More intense rain, inadequate	Increased risks of floods, urban disruption, diarrhea

	waste disposal, drainage problems and encroachment on wetlands.	and dysentery.
Lake Victoria	Hotter temperatures.	Declining lake water volumes due to increased evaporation and prolonged drought, consequently reducing hydropower generation and affecting hydropower dependent livelihoods.

Source: (Barihaihi, 2010)

Ugandan agriculture is mostly rain-fed making it vulnerable to weather hazards and climate change. Any slight variability in rainfall may therefore be reflected in the productivity of agricultural systems and pronounced variability may result in adverse physical, environmental and socio-economic impacts. Therefore, of the weather risks, drought has affected the highest number of people in Uganda.

Figure 9: Drought severity in Eastern Africa[3]



Source: IFPRI

Common physical impacts may include prolonged drought, delayed rains and floods, environmental impacts may include the loss of biodiversity and vegetation cover whereas socio-economic impacts include famine and transhumance. Rainfall across the country is highly variable in terms of its onset, cessation, amount and distribution, leading to either low crop yields or total crop failure. In addition, the lack or low use of quality inputs, the use of rudimentary implements, poor crop husbandry practices and

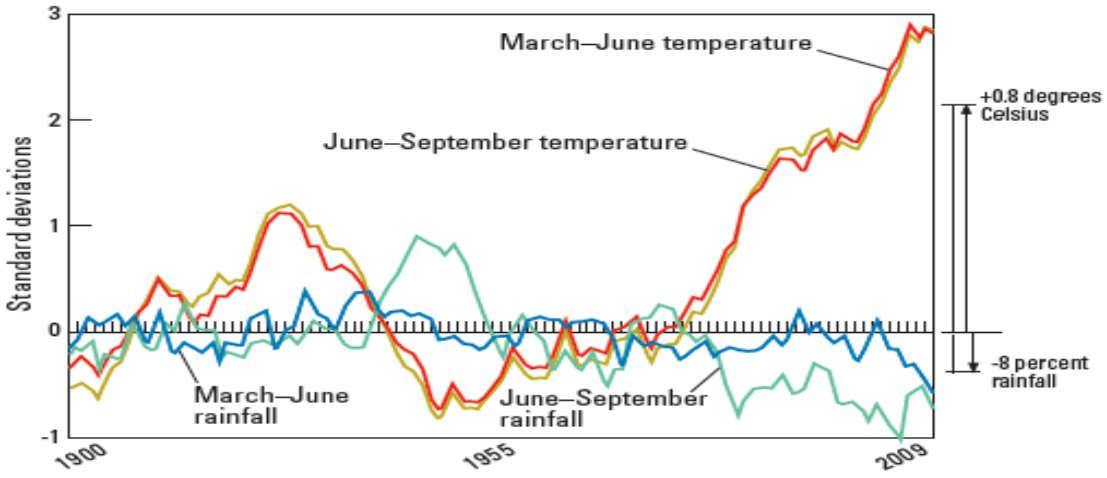
[3] Drought severity measures the average length of droughts times the dryness of the droughts from 1901 to 2008. Calculation: Drought severity is the mean of the length times the dryness of all droughts occurring in an area. Drought is defined as a contiguous period when soil moisture remains below the 20th percentile. Length is measured in months, and dryness is the average number of percentage points by which soil moisture drops below the 20th percentile. Drought data are resampled from original raster form into hydrological catchments

a lack of precise information on rainfall onset, duration, amount and cessation make smallholder farming a risky business (Mubiru, Komutunga, Agona, Apok, & Ngara, 2012).

In most instances, farmers start tilling land after the onset of rainfall, and therefore valuable moisture is lost before they finally plant. In reality, potential crop productivity is never attained as a result of a mismatch between the timing of optimum moisture conditions and the crop's peak water requirements. Farming is therefore prone to risks because of the seasonal distribution and variable nature of rainfall in space and time, coupled with its unpredictability. Extreme climatic variability, such as droughts, has severe impacts on agricultural production, often leading to instability in agricultural production systems. Rains excessive in both intensity and duration lead to water-logging that negatively affects crops and pasture. These conditions are also detrimental to the post-harvest handling and storage of crops (Mubiru, Komutunga, Agona, Apok, & Ngara, 2012).

Droughts have been frequent in recent years. Long-term trend analysis also indicate that 2000–2009 rainfall has been, on average, about 8 percent lower (-0.65 standard deviation) than rainfall between 1920 and 1969. Although the June–September rainfall appears to have been declining for a longer period, the March–June decline has only occurred recently. At the same time, the magnitude of recent warming is large and unprecedented within the past 110 years. It is estimated that the 1975 to 2009 warming has been more than 0.8°C for Uganda during both the March–June and June–September rainy seasons. This transition to an even warmer climate is likely to amplify the impact of decreasing rainfall and periodic droughts, and will likely reduce crop harvests and pasture availability (Funk, Rowland, Eilerts, & White, 2012).

Figure 10: Climate trend Uganda 1900-2009



Source: (Funk, Rowland, Eilerts, & White, 2012)

Often drought and flooding follow each other. The soil is not able to soak up rainfall after a dry period which leads to flooding. This phenomenon is aggravated by poor watershed management in flood prone areas and has led to mudslides and landslides with many casualties. Flooding mostly occurs in the Central and Eastern regions of Uganda. In the last 30 years (1985-2015), Uganda has experienced

fourteen riverine floods, which affected more than one million people and killed more than 200 people. Of these floods the major ones occurred in the years 1997, 1998, 2004, and 2007, and affected a total of 153,500, 15,000, 30,000 and 718,045 people, respectively (EM-DAT, 2015). Furthermore, La Niña and El Niño influence the weather pattern in Uganda with significantly drier and wetter years, respectively (Government of Uganda (GoU), 2009).

Landslides and mudslides usually occur in the Eastern region; for example in 2010, a mudslide killed almost 400 people and affected 12,795 people in Bududa district in the Eastern region. The cause was a combination of heavy rainfall and poor watershed management on the heavily crop exploited slopes of that area. The population pressure and environmental degradation of the hilly areas around Mt. Elgon are root causes for the frequent occurrence of landslide, such as the events of 2001 and 2012 that affected 3,366 and 3,432 people, respectively (EM-DAT, 2015).

2.1.2.1 Climate change

Climate change has been defined in many ways but one encompasses all; climate change is a change in climate over time, either due to natural variability or as a result of human activity. Scientists suggest the increased levels of carbon dioxide and other polluting gases (collectively known as greenhouse gases-GHGs) in our atmosphere has contributed to climate change or global warming. As temperatures increase, precipitation will increase as well as frequency and intensity of droughts, and floods (IPCC, 2007). Evidence is emerging that climate change is increasing rainfall variability and the frequency of extreme events such as drought, floods, prolonged dry spells, hailstorms, and pest and diseases epidemics for both crops and livestock. In Africa predictions indicate a warming up of temperatures (about 1.5 times greater) across all seasons in this century, with projections in East Africa suggesting that increasing temperatures will lead to an increase in rainfall from December to February, and a decrease in rainfall from June to August (IPCC, 2007).

Uganda is vulnerable to climate change because it heavily relies on nature for agriculture production. Additionally, Uganda as a developing country lacks skills in climate change adaptation. Climate change models for Uganda point to an increase in temperature of 0.7^{o}C to 1.5^{o}C by the year 2020 (IPCC, 2007).. The same models predict an increase in the variability of rainfall with most areas expected to receive increased rainfall (IPCC, 2007). Vulnerability assessments for Uganda identified precipitation as the most important climate change related variable in Uganda. The comparatively wetter areas of Uganda, around the Lake Victoria basin and the East and Northwest are expected to receive even more rainfall in the future (Government of Uganda (GoU), 2007).

In recent years, the rains of the first cropping season start late and end early leading to reduced levels of production. In the second cropping season the rains also start late but continue past the expected end of season well into the first months of the following year affecting the harvesting time and causing pre-harvest and post-harvest losses. For crops such as coffee and bananas, rising temperatures, increase the incidence of pests and diseases. For livestock, lack of water and insufficient pasture account for 72% of livestock production challenges directly related to climatic changes Government of Uganda (GoU), 2007).

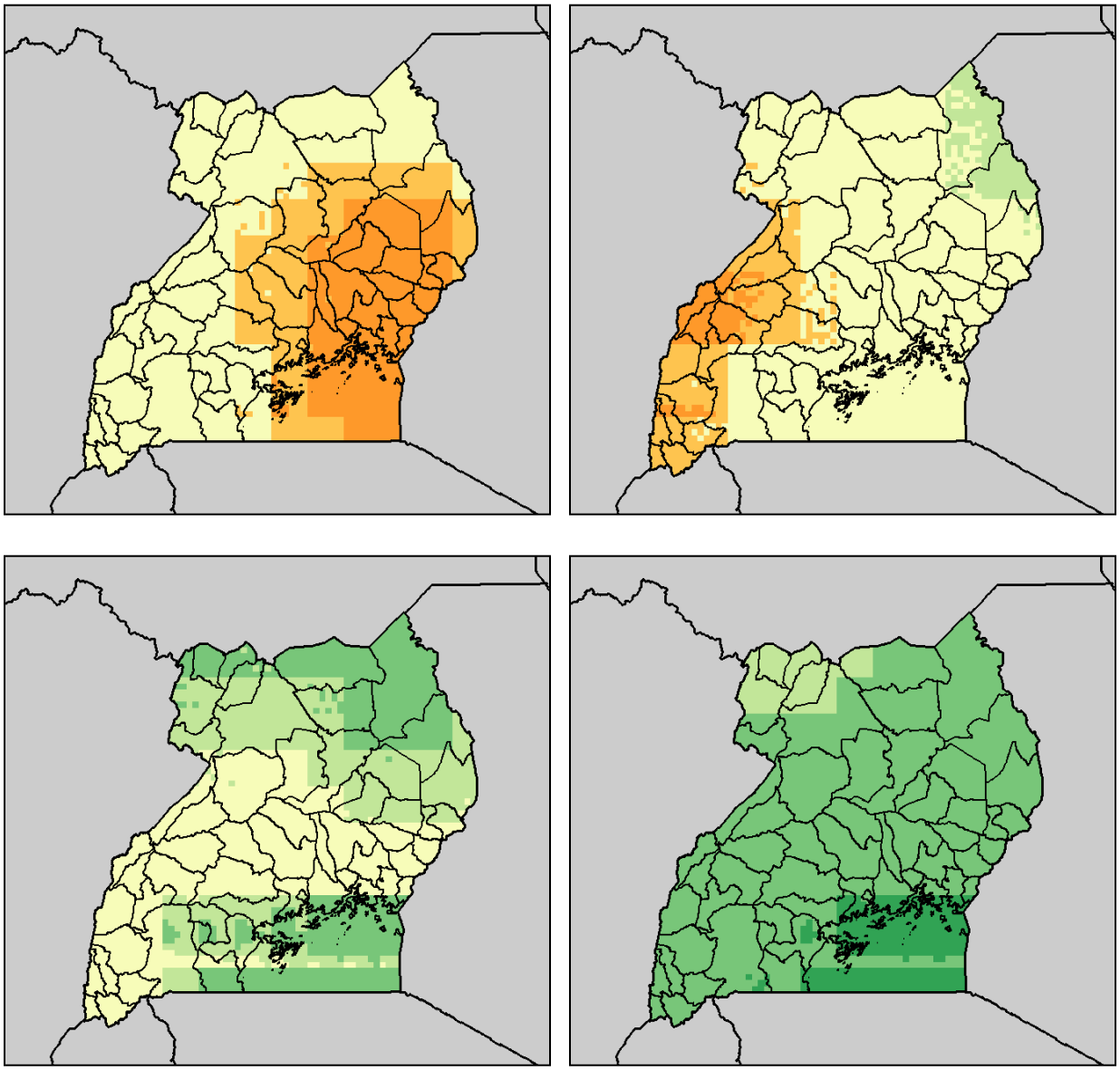
During the 1997/98 El Niño in Uganda, about 300 hectares of wheat were destroyed in Kapchorwa district. Tea estates were flooded leading to suspension of operations. Coffee exports dropped by 60% between October and November due to disrupted transport systems (NEMA, 2008). During the 1999/2000 droughts, the water table level dropped leading to drying of wells and boreholes resulting in increased cattle deaths, low milk production and food insecurity within the cattle corridor. However, it is interesting to note that despite negative impacts of climate change, the increase in lake levels could have boosted fish stocks due to the flooding in 1997/88 and also lead to a reduction in the water hyacinth weed which was clogging many bays of Lake Victoria and Lake Kyoga (MWE, 2014). However, the negative impacts still outweigh the positive impacts due to climate change.

Table 1: Overview of climate change related disasters in Uganda.

Year	Nature of Disaster	Effects
1999	Drought and famine	Over 3.5 million people in 28 districts suffered food insecurity and a livestock suffer scarcity of water and pasture
2005/06	Drop in Lake Victoria water levels	Lead to limited water resources and reduction in water hyacinth weed and affected hydroelectricity generation leading to frequent black outs
2007	Teso Floods	Highly affected Pader and Serere districts, destroying plantations, homesteads and roads
2010	Landslides	Hit eastern and south eastern regions of Uganda, about 3 villages buried and over 90 people killed and many more displaced and homeless
2012	Caterpillar infestation	Hit east and central Uganda due to prolonged rains, leading to distraction of hectares of crops in a week
2012/13	Prolonged drought	Famine in Karamoja region and central Uganda; Loss of water and pasture in the cattle corridor; increased incident of bush fires leaving nine people dead.
2013	Quelea bird infestation	Affected Kapchorwa and eastern region, leading to destruction of 1095 areas of sorghum
2013	Floods	Banks of river Nyamwamba burst and flooded many areas of Kasese district, properties, crops and livestock lost

Source: Kasimbazi

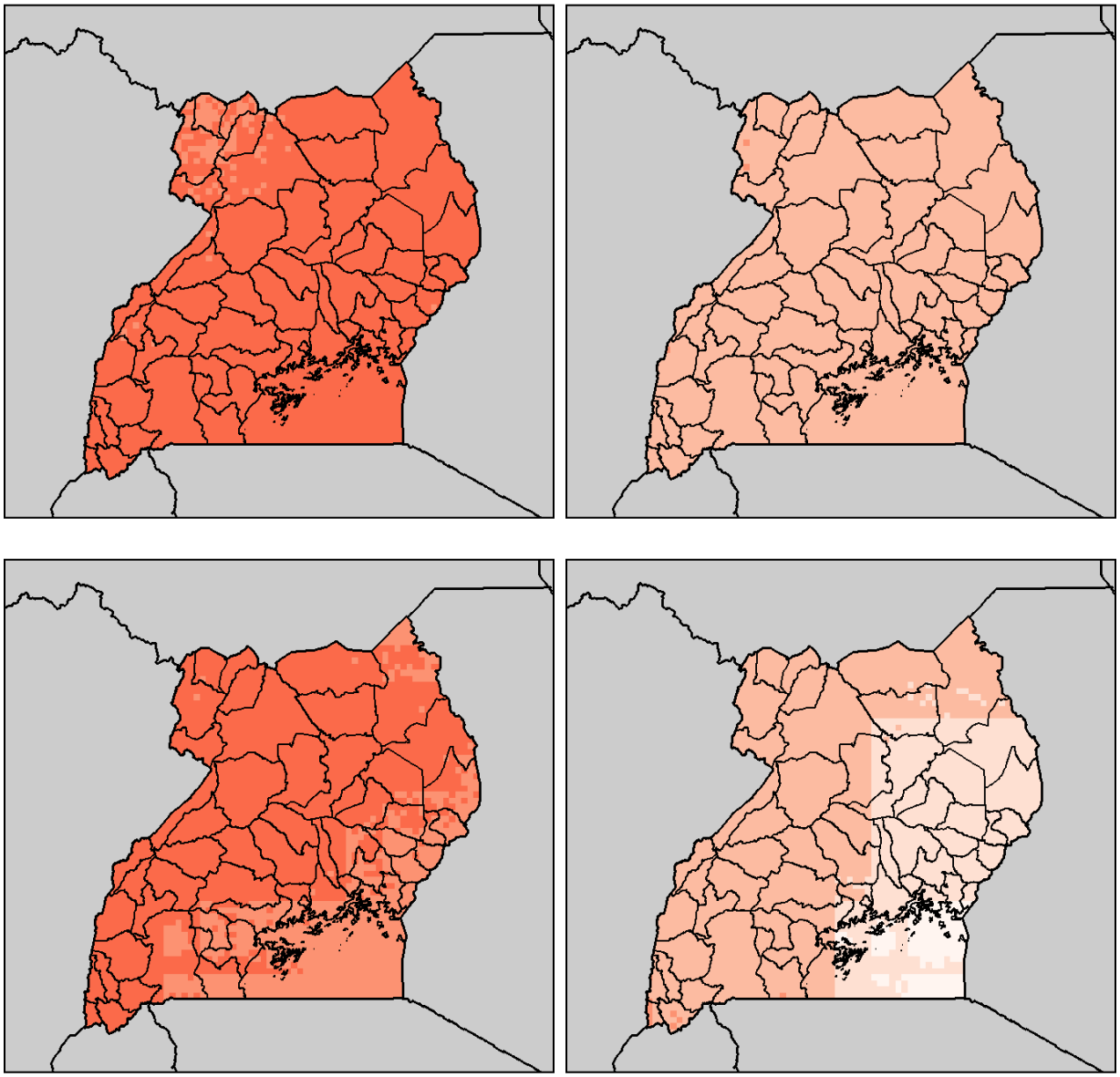
Figure 11: Predicted changes in mean annual precipitation for Uganda between 2000 and 2050



Note: All maps assume the A1B scenario. The top left is from the CNRM-CM3 GCM; the top right is from the CSIRO-MK3 GCM; the bottom left is from the ECHAM5 GCM; and the bottom right is from the MIROC3.2 medium resolution GCM.

Source: IFPRI

Figure 12: Predicted changes in normal annual max. temperature for Uganda between 2000 and 2050



Note: All maps assume the A1B scenario. The top left is from the CNRM-CM3 GCM; the top right is from the CSIRO-MK3 GCM; the bottom left is from the ECHAM5 GCM; and the bottom right is from the MIROC3.2 medium resolution GCM.

Source: IFPRI

These changes are expected to have an impact on agriculture, forestry, and fisheries. The effects of climate change are estimated to cause losses in food crop production of USD 1.5 billion by 2050 through a 40% drop in production of cassava, potato and sweet potato. Coffee and tea are predicted to drop by 50% by 2050 resulting in loss of about USD 1.4 billion (Baastel Consortium, 2015).

2.1.3 Biological and environmental risk

There are examples of pests and diseases causing crop failures and livestock deaths in Uganda in the recent past. The African Cassava Mosaic Virus disease is estimated to have caused US$40 million loss/year since early 1990s. The (re) occurrence of Cassava Brown Streak Virus is severely constraining food security and livelihoods of many rural families in Uganda. Other important crop diseases include Maize Streak Virus (MSV), Maize Lethal Necrosis Disease (MLND), Coffee wilt, Coffee rust, and groundnut rosette. Besides, weed infestations of crops fields and pastures cause losses in the range of 20 – 80%, with farmers, especially women, spending 80% of their working hours weeding crops.

Animal diseases have been on the rise amongst livestock herds in Uganda. The endemic Newcastle disease in poultry (Kasozi, Ssuna, Tayebwa, & Alyas, 2014), and the sporadic and cyclic outbreaks of African swine fever in pigs (Atuhaire et al., 2013) wipe out stocks of poultry and pigs in the country every year. Other diseases such as foot and mouth disease, Bovine pleuropnemonia, East Coast fever, and Black quarter although largely managed by routine vaccination still occur in livestock. The increasing human population is occupying more land and reducing on the limited grazing areas, leading livestock farmers to graze their animals in wildlife-gazetted areas, and causing an emergence of zoonotic diseases in Uganda.

In the absence of adequate pests and diseases (for both crops and livestock) control programmes, and lack of extension staff or other paraprofessionals to demonstrate implementation of proven technologies and encourage farmers to adopt the new practices of pest control, there is an over reliance on the reactive use of pesticides for pest control. This provides fertile ground for increasing illegal imports of pesticides and proliferation of unlicensed dealers, who are unlikely to have vital information on the safe use of pesticides to correctly inform the farmers. However, with horticulture (flowers, vegetables and fruits) where the majority of the produce is exported, there are clear legislations on maximum residue levels of pesticides and permitted agrochemicals on the exports and information on banned or restricted pesticides for use on the market. However, majority of smallholder farmers see no economic incentive for using pesticides even if the crop yields are still low. They however, control pests using other methods such as intercropping/mixed cropping, burning refuse in livestock holding grounds to discourage nesting of insect pests, and improve on hygiene.

2.1.3.1 Crop Pests and Diseases

According to the 2008/09 Uganda Census of Agriculture (UCA) out of the total 3.95 million Agricultural Households, almost 50% experienced food shortage. 1.3 million (66.0%) of these households stated that they had experienced pests/diseases. The major pests and diseases of crops in Uganda include:

i) Coffee Wilt disease (CWD) : first observed in 1993 that has destroyed about 56% or 160 million trees of the old Robusta estimated to be equivalent to 1.5 million 60 kg bags or about USD 170 million.

ii) Banana Xanthomonas Wilt (BXW); all Banana cultivars in Uganda are susceptible. In some instances there are incidences of up to 70-80% with yield loss of 90% on some farms and a national loss estimated at a staggering US Dollars 360 million per annum (World Bank, 2008). The disease was reportedly introduced into Uganda in 2001 and has since spread rapidly to all the major banana growing areas. This disease had a significant impact on the regional distribution of agricultural production: due to the devastating effects of BXW, the major growing region has shifted from the Central Region to the Western Region of the country (Tushemereirwe at al., 2001; Kalyebara et al., 2006).

iii) There are also many other economically important significant crop pests and diseases such as: Cassava Brown Streak Disease (CBSD), Napier Grass Stunt disease (NGSD), Cassava Mosaic Virus Disease (CMVD), Maize Lethal Necrosis Disease (MLND), Fruit flies (Bactrocera Spp), The Larger Grain Borer, Banana Nematodes, Banana Weevils, Black Sigatoka Panama wilt and Coffee leaf rust.

At smallholder farmers' level in Uganda, pests and diseases are among the systemic risks (as well as drought and price risks) that reduce the productivity and sustainability of most crops, and affect the product quality. Unfortunately, the abundance of crop pests and the severity of diseases are greatly underestimated; and the losses caused extremely hard to validate. Among the hundreds of thousands of pests and diseases listed for crops in Uganda, the diseases like Cassava Mosaic virus disease, Brown Streak virus disease, Banana bacterial wilt (*Xanthomonas campestris* pv. *musacearum*), Maize Lethal Necrosis, Coffee leaf rust (*Hemileia vastatrix*), and Coffee wilt (*Gibberella xylarioides*/*Fusarium xylarioides*), and the pests; tephritid fruitflies, larger grain borer (*Prostephanus truncatus*) are affecting major crops critical to Uganda's food security and disrupting agricultural exports. Increased globalization, trade and climate change, as well as reduced resilience and diversity in production systems due to over-cultivation, have led to increased occurrence of trans-boundary plant pests and diseases such as the invasive tomato leaf miner (*Tuta absoluta*), weeds (*Parthenium hysterophorus*), diseases (Banana bunchy top virus). Among smallholder farmers, there is lack of insight in control measures for crops and diseases leading to low yields and crop failure. Pests and diseases are of particular concern in perennial crops since the damage may accumulate over the years calling for agro-ecological management methods that reduce their long-term impact. Developing such management strategies involves looking for sources of sustainable resistance, while establishing appropriate crop management sequences and cropping systems.

According to the Ministry of Agriculture, the key bottlenecks in the sector are:

- Uganda has very few researchers and crop pest and disease specialists especially epidemiologists, crop breeders, weed scientists critical for pest and diseases control;

- Limited budget for agricultural research which hinders continuity in research as well as weak collaborative linkages of NARO with tertiary universities;
- Proliferation of illegal imports by unscrupulous private companies and the presence of unlicensed dealers who are unlikely to have the requisite knowledge to correctly inform farmers what the appropriate pesticides to use are and how to use them safely;
- No food safety routine tests conducted on the food grown under pesticide use to check on contamination;
- The proportion of farmers using recommended personal protective equipment while handling pesticides is very low and exposure to hazards is amplified given that some farmers allow their children to do the spraying;
- Widespread re-use of pesticide containers for storing food or water for humans or livestock;
- Overlap or lack of clarity on the responsibilities of NEMA, UNBS, NDA, GAL, and MAAIF as regards pesticides monitoring and management, a cause for ineffective monitoring due to unclear responsibilities (Ministry of Agriculture, 2014).

2.1.3.2 Animal pests and diseases

Infectious livestock zoonotic diseases remain a major threat to attaining food security for people dependent on livestock for their livelihood. East Coast Fever disease, Trypanosome spp., and Helminth infections are the important infections associated with livestock in Uganda. Emerging diseases like Rinderpest, contagious bovine pleuropneumonia (CBPP), foot-and-mouth disease (FnMD), African swine fever, lumpy skin disease, and Rift Valley fever are increasing in occurrence and their effect is devastating to the livestock sector. Knowledge of the vital infectious diseases that account for the majority of deaths is crucial in determining disease control strategies and in the allocation of limited funds available for disease control. However, deficiencies in national veterinary services have contributed to failures in early detection and response; in many places investigation and diagnosis services have deteriorated. Furthermore, livestock production and health are significantly vulnerable to the impact of climate change and resource poor farmers and pastoralists are the most vulnerable. Absence of adequate knowledge on climate change effects on animal health and the increasing prevalence of zoonotic diseases have created a knowledge gap, which affects livestock management authorities and several development projects. Early warning systems, preparedness and improved public and private veterinary services should be strengthened so as to lower the adverse effect of climate change. In addition, adaptation and mitigation approaches should be practiced to minimize the effects.

A recent study by Baluka et al., 2015 showed that FnMD and CBPP transmission were associated with drought and subsequent cattle movements. The study demonstrated that in Western Uganda, bulls and cows were sold a price 83% and 88% below market price, respectively, resulting in losses of USD 198.1 and USD 1,552.9 in small herds and medium herds respectively. The study recommends interventions to address drought risk by providing adequate and sustainable water resources for livestock farmers.

2.1.3.3 Water-related pests

Several water bodies in Uganda have been infested with a serious weed known as the water hyacinth. This is a recurring problem in Uganda. This weed is native to South America and is believed to have been introduced into the country's water bodies in the 1980s by human activity. The weed spread rapidly and

at its peak was estimated to grow at 3 hectares per day. In the areas where the weed is prolific, increases in several diseases and insect pests have been observed, as well as destruction of biodiversity and depletion of oxygen from the water. This led to reduced water quality and affecting fish sensitive to low oxygen levels.

The economic impact of the water hyacinth problem has been quite dramatic. For example, cleaning intake screens at the Owen Falls hydroelectric power plant at Jinja in Uganda were calculated to have a cost of US$1 million per annum during the peak years of the infestation (Water hyacinths increased rapidly between 1992–1998, were greatly reduced by 2001, and have since resurged to a lesser degree). And maintaining a clear passage for ships to dock at Port Bell in Uganda was estimated to cost US$ 3-5 million per year (UNEP, 2013).

2.1.4 Logistical and infrastructural risk

The most important logistical and infrastructural risk in Uganda is connected to the lack of sufficient storage capacity, both at the farm level and the crop trading system. Grain storage is largely in the hands of the private sector. Much of the existing capacity is in the hands of the Ugandan Grain Traders Association (UGTA). UGTA currently owns 59,000 Mt of storage with a planned capacity of 285,000 MT. According to UGTA, Uganda has proper storage facilities with a total capacity of 550,000 metric tonnes (MT), but estimated demand for storage facilities totals 2.3 million MT.[4] Current licensed warehouses have a storage capacity of between 22,000 to 32,000 MT. The Ministry of Trade, Industry and Cooperatives (MTIC) plans to install 430,000 MT of additional storage. This still leaves a capacity gap of 1,750,000 MT, which needs to be addressed urgently to minimise post harvest losses. The government of Uganda does not own any storage facilities, although it is common for governments to own agricultural storage facilities in the interest of national food security.

Storage facilities such as silos and cold storage ensure longevity, freshness, and safe delivery of agricultural products. There is need to develop alternative (low-cost) storage arrangements at the household level to minimize postharvest losses. Additional storage facilities for both for the domestic and export markets are also required to reduce on post harvest losses suffered by the majority of small holder farmers in Uganda. Smallholder farmers store a large portion of their produce at home mainly for their own consumption, due to poor transport system to the markets and the fact that the trading system lacks sufficient storage capacity for their produce.

Smallholder farmers in all four regions of Uganda cultivate maize, millet, rice, sorghum, and wheat; barley is cultivated in all but the Central Region. Over the period 2008-2012, the estimated weight losses of wheat and barley was 12-13%, the other cereal crops had higher and more variable weight losses - maize 17-25%, millet, rice and sorghum (12-24%). In the case of wheat and barley the loss values were stable over recent years because there was no annual variation in seasonal factors used in the APHLIS calculation (see table below). For the other crops, the major factor in annual variation was the incidence of damp weather during the harvesting and field drying. In the case of maize the longer periods of storage on the farms also had an impact.

[4] Comparatively, Kenya and Zimbabwe have 450,000 MT and 250,000 MT of grain storage capacity, respectively.

In 2012, total cereal production was about 3.4 million tonnes of which an estimated 18.3% was lost in post production activities.[5] Most of this loss was attributed to maize both in absolute terms, because it had by far the largest production, and in relative terms suffered higher losses. In 2012, there was damp weather at harvest time, which prevented good drying and increased losses in millet and rice in the central region and in maize and rice in the western region. Moreover, the fungal metabolite aflatoxin is a common contaminant of stored grains, particularly when stored in damp conditions. Chronic exposure of aflatoxin to humans is carcinogenic and high levels can result in acute hepatic necrosis and death. Further losses can be attributed to the Larger Grain Borer, an important pest of stored maize prevalent in neighbouring Kenya where attacks occur on a large scale. Therefore, the lack of adequate storage facilities poses both a financial and health risk to farmers and consumers.

Table 14: Percentage of cereal post-harvest losses in the four regions of Uganda (2008-2012)

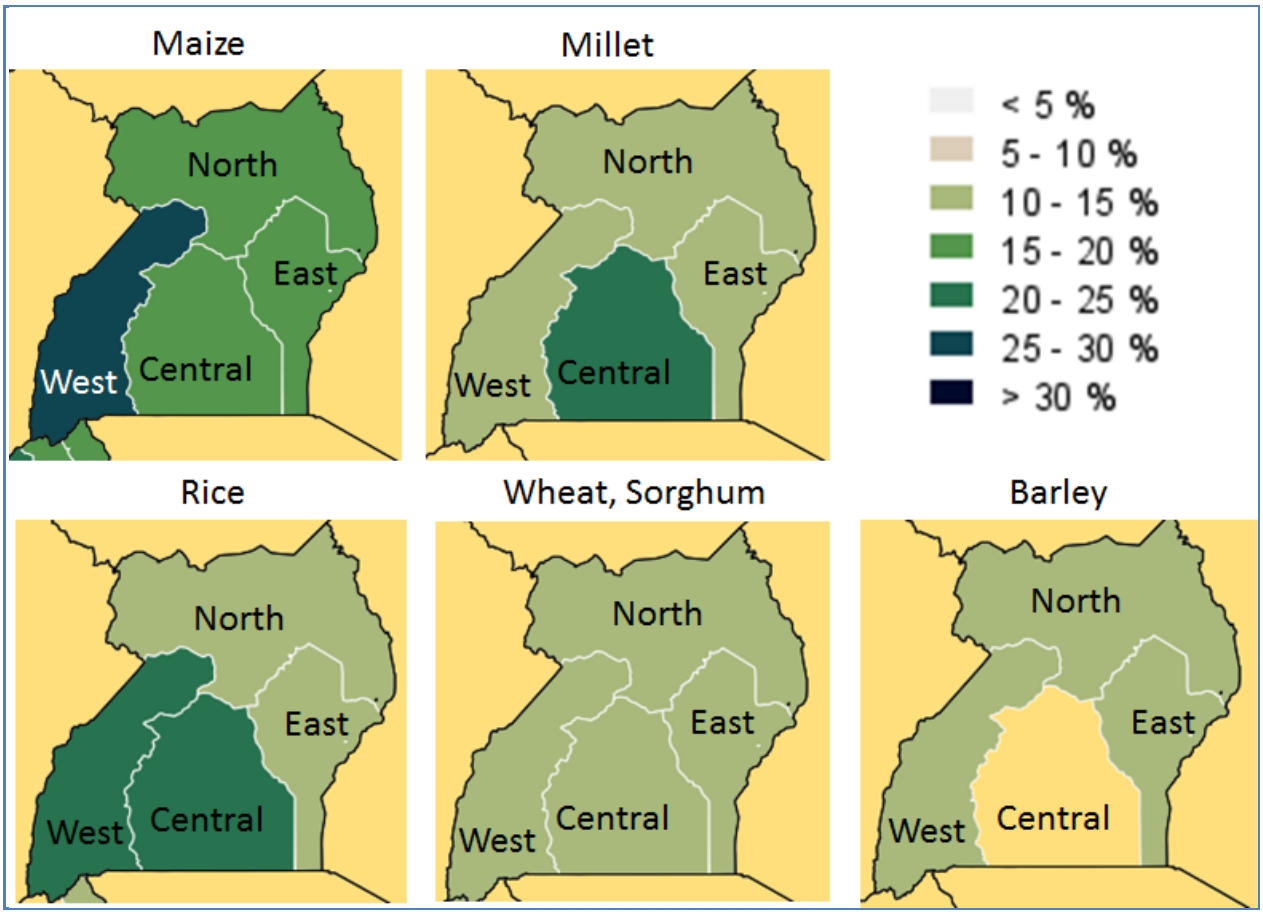
Cereal	Region	2008	2009	2010	2011	2012
Maize	Central	17.3	17.3	17.3	17.3	17.3
	East	18.7	19.3	26.1	20.1	19.3
	North	19	19.5	17.5	17.5	17.5
	West	17.5	17.6	25.2	17.6	25.1
Millet	Central	24.3	12.4	12.2	12.3	24
	East	24.1	12.4	12.5	24	12.7
	North	12	23.8	12.3	24	12.5
	West	24	12.7	12.5	12.8	12.4
Rice	Central	13.6	24.2	13.5	13.3	24.1
	East	24.5	13.8	24.2	13.5	13.5
	North	13.5	24.2	13.5	24.3	13.7
	West	13.5	24.2	13.5	13.4	24.3
Sorghum	Central	23.6	12.9	23.6	23.6	12.9
	East	12.7	12.7	12.7	12.7	12.7
	North	23.5	12.7	12.7	12.7	12.7
	West	23.5	12.7	23.5	12.7	12.7
Wheat	Central	13.3	13.3	13.3	13.3	13.3
	East	13.2	13.3	13.3	13.3	13.2
	North	13.3	13.2	13.3	13.3	13.3
	West	13.3	13.3	13.2	13.3	13.2
Barley	East	12.5	12.5	12.5	12.5	12.5
	North	12.5	12.5	12.5	12.5	12.5
	West	12.5	12.5	12.5	12.5	12.5

Source: APHLIS

[5] In many parts of Uganda there is a bimodal rainfall pattern so that there are two annual cereal harvests but national statistics combine the two harvests as single production estimates. Loss estimates are based on the combined figures which results in some inaccuracy as seasonal data that affect the losses are less specific when seasons are combined.

There is little difference between regions in the contribution made by each link in the postharvest chain to the overall cumulative loss for maize; the largest single contribution is harvesting and field drying, especially in the western region where production was affected by damp weather at harvest. This is followed in magnitude by platform drying and storage which are broadly similar to each other except for the western region were a shorter farm storage period (only 5 months) resulted in relatively lower storage losses.

Figure 13: Post harvest losses of maize crop in different parts of Uganda



Source: APHLIS

2.1.5 Market risk

As a major exporter of agricultural goods, Uganda is exposed to market risks arising from quality standards and other export requirements. The European Union has remained the biggest market for Ugandan goods like fish, flowers and agricultural products earning the economy more than USD 800 million annually. Non-compliance with international quality and safety standards can lead to export bans such as the 1997 and the 1999 EU ban on fish imports and the temporary ban of horticulture exports from Uganda. The loss due to the continued ban on fish exports from March to July 1999 was estimated at USD 36.9 million. The fishermen community lost USD 1.0 million per month (Balagadde, 2002) while losses to horticulture exports was estimated at USD 1.9 million per week.

Uganda experiences high price fluctuations on account of weather conditions and other factors (lack of storage, lack of market information) yet the country lacks price stabilization instruments, exposing farmers to the full blunt of price risks. In particular prices for cash crops, such as coffee or tea, depend on the international demand for these goods as well as production conditions (such as weather) in other export nations.

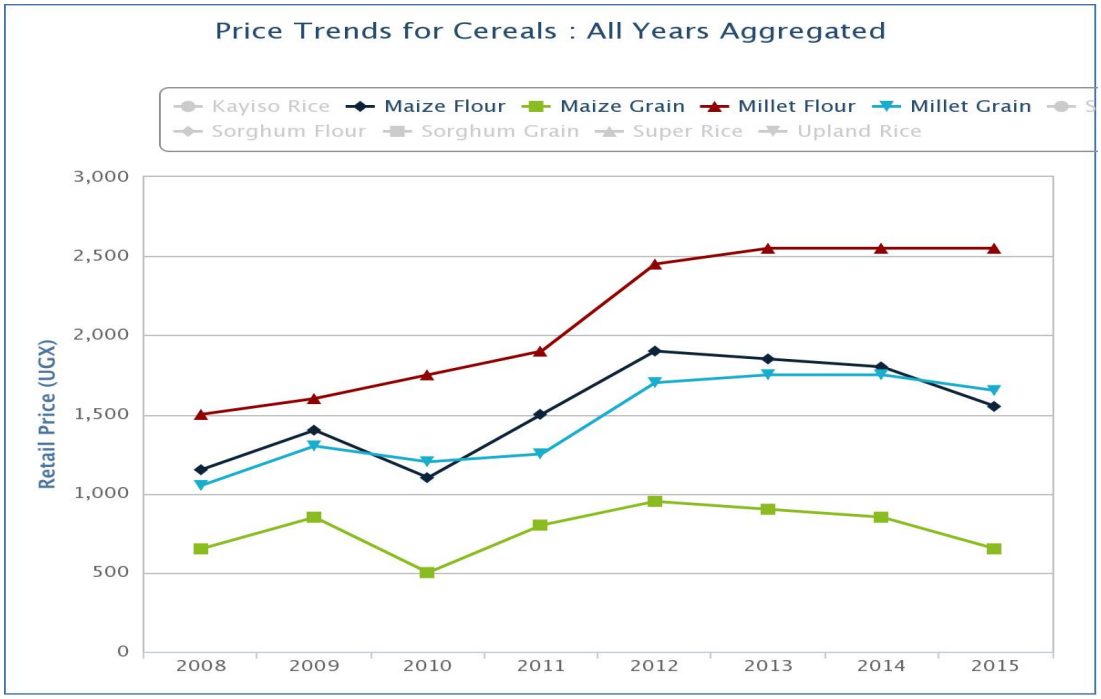
Crop farmers in Uganda are affected by two different types of prices risks:

1. Inter-annual (between different crop years) price volatility
2. Intra-annual (within the same crop year) price volatility

2.1.5.1 Inter-annual price volatility

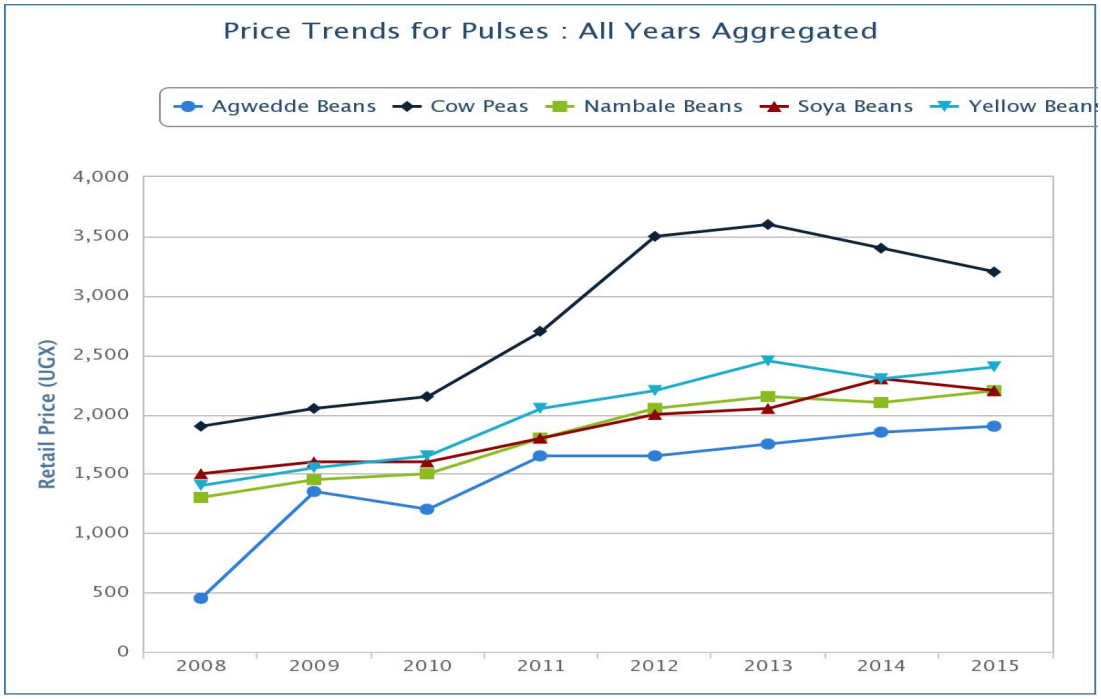
There are different determinants of inter-annual food price variability in Uganda. From the supply side, variability due to the impact of natural factors on harvests. The agricultural sector suffers from the lack and/or low use of quality inputs making the production very vulnerable to climatic shocks or weather variations. Other factors contributing to price variability are: the low level of stocks, the low level of organization of producers in the value chain, and segmentation of regional and domestic markets. Non-tradability of local foodstuff excludes the possibility of using exports to adjust supply to domestic demand. Therefore, almost all crop prices fluctuate significantly from year to year and farmers are exposed crop to price risks.

Figure 14: Inter-annual price fluctuations for cereals (2008-2015)



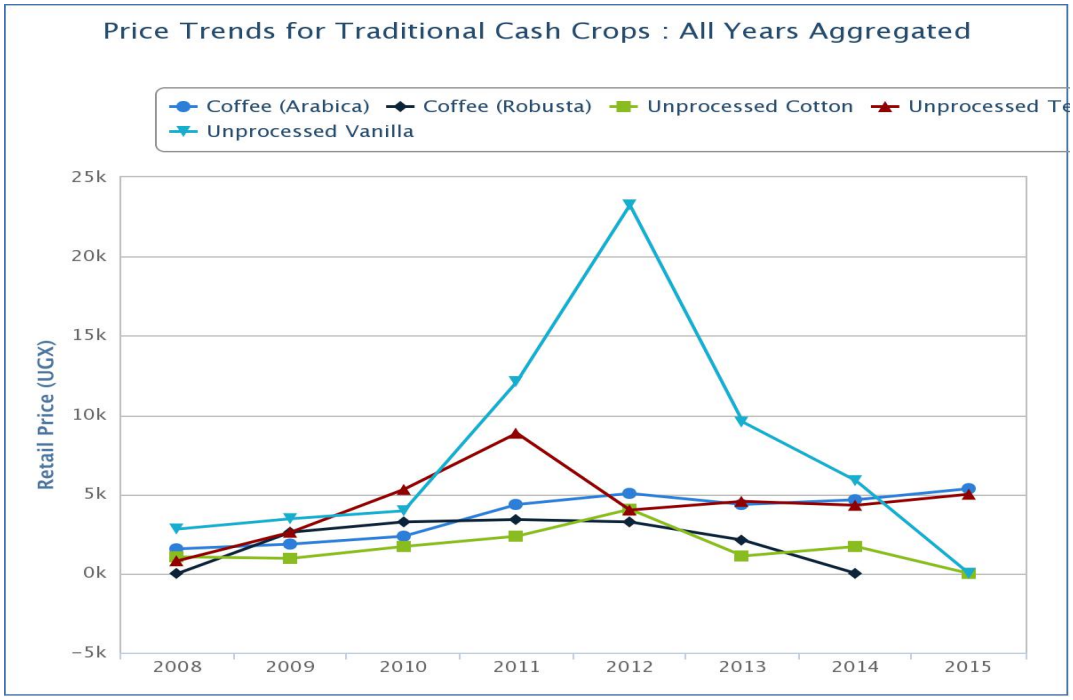
Source: Infotrade

Figure 15: Inter-annual price fluctuations for legumes (2008-2015)



Source: Infotrade

Figure 16: Inter-annual price fluctuations for cereals (2008-2015)



Source: Infotrade

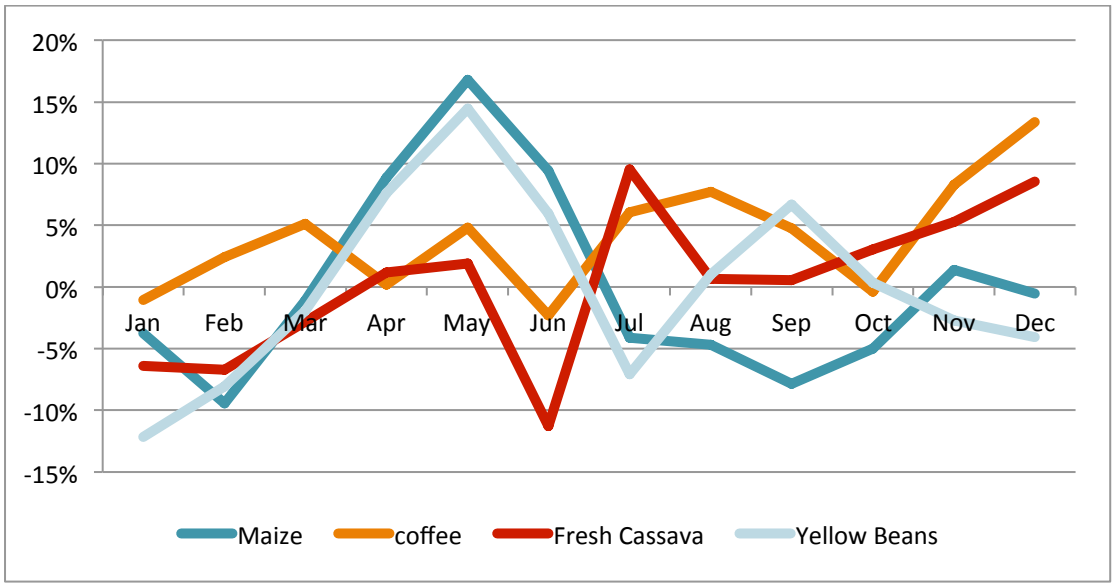
2.1.5.2 *Intra-annual price volatility*

Agricultural prices often follow a seasonal pattern because production is seasonal and storage is costly. If production is seasonal, but storage is inexpensive, then prices will not be strongly seasonal as it is the case of the cereal sorghum, for example. Otherwise if storage is expensive, the commodity will be available all year but the price will be strongly seasonal. This is the case for most commodities that smallholder farmers in Uganda grow.

The seasonal behaviour of food prices depends heavily on tradability of the commodity. So, if a commodity is internationally traded, then the domestic price will generally follow the international prices of the same commodity. If it is not international traded, domestic prices will be largely determined by domestic production cycles within each crop year, as is the case with most food and fruit crops of Uganda.

Figure 17 below represents the average price deviation in each month of the year compared to that year's average during the period 2008-2015 of four commodities. Maize and beans prices have a clear seasonal behaviour with one cycle per year for maize around the long rainy season, and two cycles in the case of beans. On the other hand, coffee and cassava have no clear price seasonality. In the case of coffee this could be explained by the high correlation with prices at international market.

Figure 17: Average Prices deviation in each month across years per commodity (2008-2015)



Source: Calculations by Ibtissem Taghouti (IFAD) based on Infotrade data

The seasonality of prices implies that farmers without proper storage facilities, such as smallholder farmers, lose out on higher revenue as they are forced to sell directly after harvest. The intra-annual price risk is a direct consequence of the lack of storage and its impact is, therefore, included in the analysis of the infrastructure risk later in this report.

2.1.6 Public policy and institutional risk

2.1.6.1 Policy risk

The legal environment for agriculture in Uganda is quite conducive with agriculture being one priority area in the National Development Plan with a number of laws and policies designed to promote the agricultural sector (such as the new Agriculture Sector Strategy Paper 2014/15-2019/20). But while Uganda has adequate laws and policies, the country is short on adequate enforcement mechanism to guard against risks associated with adulterated counterfeit inputs, environmental standards, and poor quality processed products. Most counterfeit goods entering Uganda are manufactured in China and India. Counterfeit pharmaceuticals and agricultural inputs are openly sold in Uganda's market places, and are increasingly becoming a problem (KPMG, 2012). The Uganda Revenue Authority, Ugandan Customs, and the Ugandan National Bureau of Standards share enforcement of Uganda's minimal existing counterfeit laws, but lack the funding and resources to adequately enforce these laws. An Anti-Counterfeiting Bill pending in Parliament would, if passed, considerably clarify and strengthen Uganda's laws with enforcement guidelines and stiffer penalties.

Uganda has one of the most attractive and enabling investment climate in Africa due to the liberal policies implemented by government aimed at attracting investment. However, current macroeconomic stability is not yet a sufficient condition to attract investors into agriculture. Further improvements in the investment climate are required to promote private sector's involvement in priority areas such as agro-processing, large-scale commercial farming, and cultivation of high value crops.

Financial services are important instruments for improving agricultural productivity. Most small- and medium-scale farmers are usually constrained when it comes to increasing their investment in agriculture due to problems of availability and/or access to credit. Where credit institutions exist, collateral requirements for individuals to get credit are rather prohibitive. Uganda's financial sector is currently undergoing major restructuring, which includes privatization for enhancing economic efficiency, and increased supervisory capacity for Bank of Uganda in the banking sector. In spite of these reforms, the smallholder farmers' prospects of gaining access to credit and banking services in the restructured system remain limited. There is thus need for the promotion of efficient institutional alternatives for providing credit to farmers.

2.1.6.2 Institutional risk

Development of appropriate technology is a precondition for increasing on-farm production and productivity. Current production systems and inputs are limited in scope and capability. For instance, the hand hoe is the main implement used for land opening and preparation in most parts of Uganda and it is a labour-intensive technology which limits the size of farms under production. This has been the case for over a century and there has been no revolution in agricultural production. The ox-plough, which is more labour-saving than the hand hoe, is mainly used in the North-eastern part of the country which is favourable for livestock production and the land terrain also favours its use. The tractor has been in Uganda for over four decades and it, too, has not produced a revolution in agricultural production. The lack of massive adoption and efficient utilization of appropriate technologies by farmers may be attributed to several causes, potentially including policy failures.

To realize the country's vision of transforming into a middle income country, there is need to put in place a functioning and competent extension system that immediately handles the changing needs of farmers. The country has had several reforms in extension provision ranging from the use of government extension workers at district levels in a supply driven approach to the National Agricultural Advisory Services (NAADS) programme in which farmers were supposed to be empowered to demand for extension services. In June 2014, NAADS activities as an advisory service provider were replaced with a new extension system that has been dubbed the "single spine extension system". One of the key tenets of the single spine system is to mainstream NAADS programme into local government structures and eliminate the existing parallel extension systems that existed in the NAADS framework.

Due to perceived lack of efficiency of the extension system, the Government of Uganda has let go all agricultural extension officers and called in Uganda Peoples Defence Forces (UPDF) personnel to take over their role. During the first cropping season 2015, military personnel took on the role of logistical distribution of planting material. This is, in essence, a return to a supply-driven approach that existed before NAADS. This system failed to meet the changing needs of farmers in the past and is not expected to deliver the desired results of commercializing agriculture in the future.

2.1.7 Political and security risk

In Uganda, the Northern region has suffered the highest incidence of political risk but this has decreased greatly due to the containment of the Lord's Resistance Army. Between 1988 and 2008, the northern region of Uganda has been terrorized by the LRA, a rebel group lead by Joseph Kony, a self-proclaimed prophet. During this time they have abducted children as slaves, killed entire villages and caused the displacement of thousands of people from their homes and land. As a result people have been away from their property and land and have thus not carried out any farming for two decades in addition, the younger generation having no skills in farming their land. This led to a severe drop in agricultural production and increase in food scarcity and insecurity. Food aid was necessary to sustain the population that was largely in Displaced Peoples Camps (DIPs) (Lirri, 2009). More than 90% of the 1.8 million displaced people who lived in camps during the height of the crisis have returned to their homes or settled somewhere else. An estimated 180,000 people remain in camps after end 2010. Many have returned to areas lacking in basic services, healthcare and education. However, in some parts of the North-Eastern region of Uganda there is still a security risk such as cattle raids and road raids, mainly in the Karamoja region, with the districts of Napak and Moroto being the most affected. Cattle's raiding goes back centuries. But the death toll from such raiding surged when, in the 1990s, Karamoja was flooded with automatic weapons from war-torn Sudan and Somalia and clashes between tribes and communities and across the Kenyan and Southern Sudan borders started to happen frequently (PCCR, 2012).

Political conflicts in central Uganda usually are a result of clashes between the National Resistance Movement (NRM) party and the opposition resulting in riots, unrest and disruption of trade mainly during electoral campaigns. Additionally, disputes over land have also affected agriculture production in the past.

3 Mapping of existing Agricultural Risk Management policies and tools

3.1 Policy environment for risk management in Uganda

Since 1997, the policy environment for agriculture in Uganda has been shaped by several national policy frameworks. From the Poverty Eradication Action Plan (PEAP) to the National development Plan (NDP), and the Prosperity for All (PFA), these frameworks were implemented through the Plan for Modernisation of Agriculture (PMA) and the Rural Developmental Strategy (RDS). MAAIF then published the first and second DSIP (Development Strategy and Investment Plan) in 2005 and 2010, respectively to implement the component and agriculture chapter of the PMA and NDP, respectively. In an effort to harmonise the different approaches to national agricultural development the National Agricultural Policy (NAP) was developed.

Although a holistic approach to Agricultural Risk Management (ARM) is a new concept for the Government of Uganda (GoU), ARM elements have been integrated within the guiding principles, objectives, strategies, the support sector polices and services, the implementation framework and the monitoring and evaluation systems of the NAP (MAAIF, 2013). The MAAIF is responsible for the implementation of NAP and the office of the Prime minister has been identified as the most robust coordinating entity for managing the linkages between sectors.

3.1.1 The National Agricultural Policy (NAP)

The National Agricultural Policy (NAP) was launched in 2013 with the main objective of promoting food and nutrition security and improving household incomes through coordinated interventions that enhance sustainable agricultural productivity and value addition by providing employment opportunities and promoting agribusiness, investments and trade. This policy is modelled on the National Developmental Plan (NDP) and calls for an intra- and inter-sectoral approach in order to achieve its main objective. The NAP is guided by six interrelated objectives which are as follows: (1) ensuring household and national food and nutrition security for all Ugandans; (2) increasing incomes of farming households from agricultural production and agriculture related activities; (3) promoting specialization in strategic, profitable and viable enterprises and value addition through agro-zoning; (4) promoting domestic, regional and international trade in agricultural products; (5) ensure sustainable use and management of agricultural resources; and (6) developing human resources for agricultural development.

Agriculture Risk Management (ARM) tools and strategies are included in various sections of the NAP:

1. Within the first objective, elements related to price and market risks are “promoting and facilitating the construction of appropriated agro-processing and storage facilities at appropriate levels to improve post-harvest management, add value and to enhance marketing” and “the establishment of a national strategic food reserve system as well as development and improvement of food-handling, and marketing and distribution systems that provide linkages at different market levels”.
2. Within the second objective ARM elements related to the input and production risks are covered such as “encourage and promote dry season livestock feeding through pasture

preservation and other feeding mechanisms" and "strengthen the certification and regulatory system to guarantee the quality of agriculture inputs at all levels".

3. Within the third objective ARM related activities are "ensure basic infrastructure and reliable access to utilities to encourage investment and ensure that agricultural products compete effectively in domestic, regional and international markets".
4. Within the fourth objective market risk is tackled: "address supply and demand constraints to markets such as those related to inadequate information, inappropriate production and value-addition technologies or poor handling, transportation and marketing infrastructure'.
5. Within the fifth objective elements are related to market and information risk as well as weather risk: "ensure the collection, analysis and dissemination of information to households and communities regarding proper use of agricultural resources" and "develop capacity to harvest and utilise rainwater for agricultural production".
6. Within objective six the weak institutional framework for ARM is addressed: "support agricultural training institutions and increase training to all levels of education" and "provide information to farmers to aid them with their enterprise selection, production and marketing decisions".

3.1.2 Second National Development Plan 2015/16 – 2019/20 (NDPII)

The new NDP confirms agriculture as the backbone of Uganda's economy with the key objectives of increasing productivity and improving access to certified inputs and markets. It is noted that agricultural risks constitute a cross-cutting limitation that needs to be managed at all stages of the different agricultural value chains. Managing these risks will involve a diverse and a holistic agricultural risk management approach, which includes appropriate policy instruments and tools, some beyond the agriculture sector such as insurance, information, water management, and social protection.

Although, there is no direct reference to agricultural risk management in this policy document, a number of interventions directly contribute to improved risk management for farmers such as:

- Development of an enhanced integrated information system for agricultural production, weather, pests, diseases and markets;
- Promotion of investment in small community level infrastructures such as feeder roads, water use, good agricultural practices;
- Access to well performing inputs and outputs markets; and
- Linking smallholder farmers to storage and financing (Government of Uganda, (GoU), 2015).

3.1.3 DSIP/ASSP 2014/15-19/20

The Ministry of Agriculture has developed an investment plan for the years 2014/15-19/20 based on the newly developed NDP II. During the development of this new investment plan, the Agriculture Sector Strategy Paper (ASSP) 2014/15-19/20 a review of the previous investment plan, the DISP 2010/11-14/15 has been carried out. The review report concluded that agricultural risk had been addressed by various government initiatives in the past but overall had not been addressed in a comprehensive manner. The DSIP has been analyzed for its relevance for risk management initiatives and although, there is no

dedicated sub-programme or component for risk management, a number of activities in the DSIP are actually risk management tools/strategies such as:

- Sub-programme 1.3: Pest and Disease Control;
- Component 1.4.1: Scaling up Sustainable Land Management (SLM);
- Component 1.5.2 Water for crop production;
- Component 1.5.3 Water for Livestock;
- Sub-programme 1.8: Promoting Strategic Enterprises;
- Sub-programme 2.2: Promoting the Use of High Quality Inputs, Planting and Stocking Materials;
- Component 2.3.2: Dissemination of Market Information to Relevant Stakeholders;
- Sub-programme 2.4: Rural Market Infrastructure;
- Sub-programme 2.5: Promoting Collective Marketing;
- Component 3.6.3: Integration of Climate Risk Management in Agri-Business Strategies.

In addition to this, some risk management tools/strategies (for example, insurance, warehouses and warehouse receipts, and agricultural finance) are explicitly mentioned in the DISP but no concrete activity or component has been proposed (Ministry of Agriculture, 2010). Many of the components and sub-programmes mentioned above are also continued within the new ASSP 2014/15-19/20. As mentioned earlier in this report, the policy framework is conducive for agricultural risk management but the question remains whether sufficient financial and human resources will be made available for implementation of all these activities and whether the implementation structure is suitable to carry out all these many ambitious initiatives.

This report has been written to assess Agriculture Risk Management (ARM) in Uganda and contribute to the development of a comprehensive ARM strategy for the country that is in line with the ASSP 2014/15-19/20. The recommendations at the end of this report are intended to assist stakeholders in Uganda implement the initiatives related to ARM in the new ASSP.

3.1.4 Other relevant policies

Besides the policy guidelines developed by the MAAIF, a range of other laws and policies are relevant for Agricultural Risk Management. The most relevant policy documents relating to ARM are:

- The Food and Nutrition Policy of 2003;
- The National Industrial Policy, 2008
- The National Policy for Disaster Preparedness and Management of 2010;
- The National Climate Change Policy of 2012.
- The National Land Use Policy (2013) and the amendments of the Land Act.

All of the policies listed above have strong champions in the Ministry for Health, the Ministry for Trade and Industry (MTI), the Prime Minister's Office and the Ministry for Disaster Preparedness and Refugees (MDPR), the Ministry of Water and Environment (MWE), and the Ministry of Lands, Housing and Urban Development (MLHUD). The NAP has a detailed implementation strategy, which takes into account the inter- and intra-coordination of the different actors involved in agricultural development.

Communication and coordination are of utmost importance to ensure timely implementation of the policy and avoiding duplication.

3.2 The Institutional Framework

3.2.1 MAAIF

Agricultural Risk Management (ARM) is a relatively new approach for the Ministry of Agriculture, Animal Industries, and Fisheries (MAAIF). Currently, there is no department or unit dedicated to this topic, although there is people within most departments and units that deal with one or more aspects of agricultural risk. However, the Agricultural Planning Department has taken a lead in putting ARM on the agenda, supported by Plan for Modernization of Agriculture (PMA). The Planning Department has led the process of incorporating ARM into the new ASSP 2014/15-19/20. Being the host of the agricultural early warning system and having well educated staff in ARM, the Planning Department is an obvious choice for institutionalizing ARM. However, the department will need to further increase the knowledge of the staff related to ARM.

Although, other departments such as crop protection, animal health, crop inspection, and fisheries, play a crucial role in ARM, no coordination mechanism concerning ARM has been established. Field staff and extension services of MAAIF play the most important part in ensuring that ARM is applied at farm level, although the capacity to inform farmers about ARM tools and services is still limited. The restructuring of the extension services presents an opportunity to integrate ARM into the core extension services.

3.2.2 Office of the Prime Minister (PMO)

Under its mandate, the Directorate of Relief, Disaster Preparedness and Refugees, the Office of the Prime Minister, initiated a process to develop a policy describing structures for the effective and practical management of disasters. The policy covers subjects of vulnerability assessment, mitigation, preparedness, response and recovery, constituting what they call comprehensive disaster management. It aims to incorporate all the lead sectors, local governments, international development and humanitarian partners, the private sector and the NGOs. It also presents an institutional framework under which the partners coordinate their operations. It further recognizes the need to place emphasis on the vulnerable groups and persons with special needs (OPM, 2010).

Implementation of this important initiative is still not fully accomplished, mainly due to a lack of capacity, resources and coordination at the local level. Hazard mapping, early warning systems, and land, soil and water management need to be strengthened and improved (UNOCHA, 2011). Uganda still focuses on post disaster instead of taking preventative measures. There is no national forum where different organizations at all levels come together to share information on risk neither does the government have adequate capacity for disaster management coordination.

3.2.3 Climate change Unit, Ministry of Water and Environment

The Climate Change Department (CCD), formerly Climate Change Unit (CCU) was created in 2008, directly under the office of the Permanent Secretary of the Ministry of Water and Environment. The main objective for the establishment of the CCU is to strengthen Uganda's implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol (KP). The

department had been in the lead in the development of the Uganda National Climate Change Policy of 2012. The following objectives of the department are directly related to ARM:

- Co-ordination of national climate change actions (Mitigation and Adaptation) in different sectors, including the creation of awareness among various stakeholders to enable them to internalize their roles and responsibilities under the Convention and its Kyoto Protocol.
- Monitoring the implementation of mitigation and adaptation activities and progressively update Government, the Uganda population and the COP to the UNFCCC and its Kyoto Protocol
- To initiate the development and review of appropriate policies, laws and programmes necessary to ensure effective implementation of adaptation and mitigation activities in Uganda.
- To establish and maintain the relationship with national, regional and international organizations, institutions and agencies as may be appropriate for facilitating the implementation of the relevant policies, programmes, projects and decisions.
- To guide on precautionary measures to anticipate, prevent or minimize the causes of climate change and its adverse effects.
- To prepare for adaptation to the adverse effects of climate change by guiding the development of elaborate, appropriate and integrated plans for key sectors as well as the rehabilitation of areas affected by drought, desertification and floods.
- To coordinate and guide on the education, training and public awareness programmes on climate change, consistent with Article 6 of the Convention.

3.2.4 Other relevant institutions

Agricultural Risk Management is a very broad field; therefore, listing and describing all involved parties is not feasible within this report. But it is important, to mention the major players listed below:

- Farmer organizations: Uganda National Farmers Federation (UNFFE) is the largest private sector, farmer-based NGO in Uganda which advocates for, lobbies and articulates farmers' developmental issues and programs.
- Industry associations: membership-based organizations for specific industries or crops such as the Eastern Africa Grain Council (EAGC), the Uganda Grain Council, or the Uganda National Agro-Input Dealers Association (UNADA) play an important role in the field of agricultural risk management, for example through their various initiatives (e.g. warehouse receipt systems, hotline for counterfeit inputs, etc.)
- Commodity boards: boards such as the Uganda Coffee Development Authority (UCDA) or Cotton Development Organization (CDO) are active in a broad range of fields related to agricultural risk management ranging from input supply, to pest and disease management, and to price setting mechanisms.
- Uganda Commodity Exchange (UCE): UCE is mandated to establish a market that brings value to its members and the trading public. In so doing, facilitate trade between buyers and sellers of any agricultural commodity in Uganda and the world at large. It provides market information and marketing services to buyers and sellers of commodities by establishing and operating a commodity exchange of the highest integrity available to Ugandans as well as regional and

international buyers and sellers, based upon an open and free market system for the mutual benefit of the sellers and buyers.

- Financial sector: banks such as Centenary Bank, DFCU, Stanbic Bank and Housing Finance Bank and other small financial institutions like ECLOP and Pride Microfinance play a key role in increasing investment in agriculture production in rural areas. Institutions like Centenary Bank, and DFCU, have established sizeable agricultural portfolios that are also exposed to agricultural risk. In addition, financial institutions at the village level, for example SACCOs and MFIs, are important for farmers to save in order to build up a financial buffer for times of distress. Bank of Uganda is supporting agricultural finance through various initiatives, for example the Agricultural Credit Facility (ACF).
- Insurance sector: agriculture insurance is on the rise in Uganda, driven by the commitment and creativity of various insurance companies such as the Kungula Agrinsurance partners, UAP and Jubilee Insurance. The Insurance Regulatory Authority (IRA) provides the necessary political backing for this development and the Uganda Insurers' Association (UIA) supports its members by lobbying for relevant activities and disseminating information.
- Uganda National Meteorological Authority: UNMA (formerly Department of Meteorology) under Ministry of Water and Environment is a semi autonomous government institution for weather and climate services (UNMA Act. 2012) and a focal institution to Inter-Governmental Panel on Climate Change (IPCC), an international body of experts mandated to analyse scientific research findings on climate change.
- Service providers: In recent years, a number of organizations have started to develop market information services, such as Infotrade, Farmgain or RATIN. This development is supported by the increasing penetration of mobile technology in rural areas, promoted by companies such as MTN, Airtel, and Vodafone.
- Civil Society: More and more organisations have started to realise that there is a need for disaster risk management. Yet, there is still little to no coordination between these different (types of) organisations. In Uganda, there are a number of ecumenical organisations with a strong network and a lot of influence across the country and in politics.
- International partners: all Rome-based UN organizations (FAO, IFAD, and WFP) have a strong country presence in Uganda and are active in various fields of agricultural risk management. Other partners such as GIZ, DANIDA, and USAID have also invested significant resources in tackling key issues related to agricultural risk.

3.3 Risk Management Initiatives

3.3.1 Information systems

Access to information is an important risk management tool on various levels: government and other actors require data and information to adequately analyze the risk situation in the country and monitor important developments both for policy and strategy development purposes as well as for rapid reactions to, for example, an outbreak of a contagious crop or animal disease somewhere in the country. Private sector requires information to plan their investment and to develop products that are targeted to farmers, for example insurance companies need data on production, weather, and historical

losses to develop their products. Finally, farmers need information on a broad range of topics (use of inputs, weather forecasts, control of pests and diseases, and market prices) in order to conduct their farm business in a more efficient manner.

Currently, a number of public and private sector entities have developed information systems for various parameters relevant for Agricultural Risk Management, for example, weather forecasts, market prices of inputs and goods for harvest, and better farming methods. The following table provides an overview of existing information systems.

Table 15: Information and early warning systems

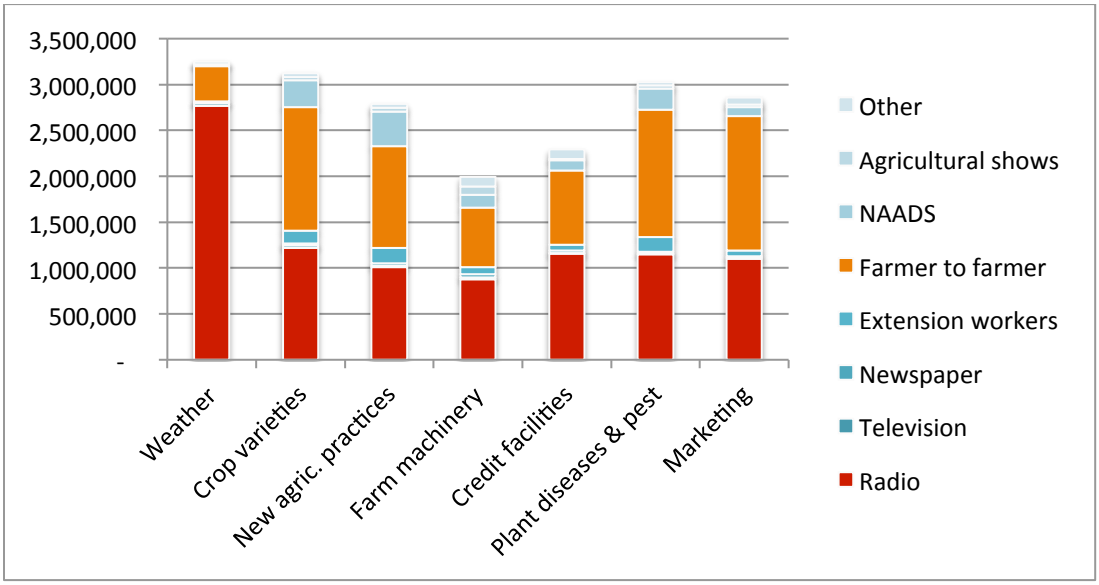
Information System	Data/Information provided	Accessibility	Timeliness	Linkage
CountryStat	Production data	Web-based, Macro level	Annual	MAAIF, UBoS
Grameen Foundation	Prices of agricultural commodity Agronomic advice Livestock production Weather/climate	On demand by SMS, call centre, modules in smart phones through CKW Micro level	Available on demand Weather available daily and 5day forecasts	Infotrade UNMA
Infotrade	Prices of agricultural commodities, fuel, inputs Commodity offers List of input suppliers, traders, bulk stores Weather	On demand by SMS, Radio, Notice Boards, Blackboards, email, web-based Micro, meso and macro level	Weekly price summaries Broadcast three times a week for members	•Grameen Foundation, •AMITSA
Farmgain	Market prices	On demand by SMS, email Micro and macro level	Weekly prices on demand	FEWSNET
FEWSNET	Early Warning on food Security and livelihoods	Monthly reports on internet or mailing list Macro level	Timely monthly updates, food security outlook with six-month lead period	MAAIF, DEWS/ACTED, Farmgain and UNMA
MAAIF	EW on food security	IPC reports online or from the ministry Meso (Karamoja), Macro levels	Annually (Karamoja), biannual for other areas of country. Reports not timely because of limited funding	FEWSNET, UNMA, DEWS
MAAIF	Crop pests and diseases	Plant doctors,(where available) on market days Extension and NAADS staff Information on high	Weekly during plant clinic days, where available When extension staff visit	

		impact pests and diseases may be provided on radio Micro, meso and macro levels	Online reporting lags behind by months because of challenges of receiving reports from the field	
MAAIF	Livestock diseases	Veterinary and para-veterinary staff, where available (micro) Available online (macro)	When extension staff visit Online reporting lagging behind by months because of challenges with receiving reports from the field	Adhoc linkage to FEWS NET/DEWS through districts.
MAAIF	Crop and livestock husbandry	Extension and NAADS Staff when available Print media	When extension staff visit but currently constrained by restructuring of extension services	None
MAAIF	Impact of seasonal weather forecast on agriculture	Media; print and radio whenever possible Ministry reports	At the start of the each rain season (typically Feb/Mar and Aug/Sep)	FEWS NET, DEWS, IPC
UNMA	Weather/climate	Media (broadcast mainly) Internet Micro, meso and macro levels	Daily Seasonal Monthly Mostly timely particularly seasonal forecasts	All
UBOS	Production/yield data trends in measurement of living standards	Macro and meso levels Reports	Annual (production) Panel and household surveys every 2–5 years Censuses at least every10years	None.
Agrinet	Food commodity prices Commodity offers	On demand by SMS, Radio, Notice Boards, Blackboards, email, web based Micro, meso and macro level	prices available on demand	None
WFP	Prices of sorghum, beans, maize, goat and wage labour for 5 markets in Karamoja	On request from WFP	Monthly	FEWS NET

Source: Information collected by Agnes Atyang

Despite the broad range of service providers, timely and accurate information does not always reach the target audience. Most smallholder farmers still rely on radio and farmer to farmer information exchange. The figure below shows the source of information indicated by agricultural households for various topics during the last agricultural census. Recently, the use of mobile phones has increased rapidly and more and more information systems are using mobile phone technology to reach out to farmers.

Figure 18: Farmers' access to information by source



Source: UBOS

Apart from radio and mobile phone, farmers rely on the public sector to receive information. The agricultural extension system NAADS, the main source of agricultural information for smallholder farmers, is undergoing yet another transition. NAADS was the main provider of extension and advisory services to farmers in Uganda. This is complemented by the district and sub-county agricultural officers, the NARO regional centre staff, and the field officers of various NGOs involved in rural development. The first two former systems are under MAAIF and are being restructured to create a single spine system which is expected to increase farmers' access to information services.

The various early warning information systems are disjointed and not integrated which leaves farmers with numerous sources of information which can result in confusion. There is need to coordinate and harmonize approaches and bring efficiency, coherence and synergy to the diversity of early warning systems in Uganda and build a sustainable comprehensive system. Furthermore, the analysis and integration of data and information from multiple sources is most effective when it is coordinated under a single authority. To this effect, the OPM is currently implementing a plan to integrate the various EWS from ACTED (DEWS), MAAIF, FEWS NET, UNMA, IDSR, among others to create the National Early Warning System.

3.3.2 Initiatives related to input risk

MAAIF is currently in the process to finalize the National Seed Policy aimed at improving quality assurance in the seed sector. The private sector, particularly the Uganda National Agro-Input Dealers Association (UNADA) is involved in this process.

The issue of quality assurance, in particular counterfeited inputs is being addressed by a number of initiatives which are listed below:

Table 16: Quality assurance initiatives in the seed sector in Uganda

Solution Type	Initiative Name	Description	Key Learnings	Sector Applicability
End-user authentication	SMS Verification Pilot	18-month pilot funded by USAID and implemented by CropLife, IFDC, and Grameen Foundation to test e-verification/ coin-scratch technology; Conducted retailer training and farmer outreach to discourage counterfeit crop protection products; 76 agro-dealers participated; 30,000 packages sold with coin scratch labels	Coin-scratch label drove sales; market share of pilot products doubled if code is authenticated, effectively verifies that the product was produced by the stated manufacturer; However, there is some concern that counterfeiters will take advantage of farmers who do not text in the code (7.3% of products were authenticated)	Crop protection products
Smallholder education	Video Blasts & Training Program	Funded by aBi Trust, CropLife collaborated with the Ministry of Agriculture to develop videos warning against the effects of counterfeit goods; Videos were translated into 4 languages and screened approximately 100 times over 2 years in villages in Northern Uganda; Simultaneously, aBi Trust funded a project to educate extension officers, NGOs, and agro dealers on counterfeit inputs	Anecdotal evidence shows the project was successful in sensitizing farmers in rural villages; 17,000 people viewed the video and CropLife received many requests for additional viewings; farmers were receptive and engaged; Despite increased education and awareness surrounding the issue, counterfeiters are getting more and more sophisticated so that even with training it is difficult to discern between genuine and fake products	Crop protection products; Seeds
Smallholder education	Radio Programs	Private companies, such as Monsanto and Keith Associates, use radio	Helps farmers more easily identify counterfeit products;	Crop protection products;

		programing to raise awareness of counterfeits and encourage people to call in with questions about counterfeit products	However, education alone may not be sufficient to prevent counterfeiting without coupling with another solution (e.g., quality assurance, end-user verification)	Seeds
Quality assurance & track and trace technology	Feed the Future	The USAID-funded project has 2 primary anti-counterfeiting components: 1.Improvement of the regulatory environment through the facilitation of industry associations to lobby government players 2.Market-facing anti-counterfeiting initiatives; activities under consideration include: anti-counterfeiting hotline; e-verification; preferred distributor program	Feed the Future initiatives have only been underway for 6 months; therefore, it is difficult to assess the project's activities	Crop protection products; Seeds
Product, package, or channel investment	Tamper-Proof Packaging	Private companies have invested in high-end packaging material and labels that are more difficult to imitate or re-use (e.g., NASECO invested in local packaging equipment to create bags that are more difficult to counterfeit)	Improved packaging deters some forms of fraud, however packages did not include *technologies* to tackle counterfeiting (e.g., end user authentication)	Crop protection products; Seeds; Fertilizer

Source: Bill and Melinda Gates Foundation

In addition to the above mentioned initiatives, Transparency International Uganda (TIU) has established a hotline for farmers to call when they suspect that the inputs they have purchased are counterfeit. The results from the hotline are used to engage the private sector in a discussion on which input products are most tampered with and identify low-cost solutions to improve quality assurance in the sector.

3.3.3 Initiatives related to weather risk

3.3.3.1 Irrigation schemes

From 2000 to 2013, MAAIF managed to construct 711 water projects for production facilities in 54 districts. Out of the 711 facilities, 278 facilities are under the community management system and the rest are privately owned but under private public partnerships. This latter includes 71% availability of water facilities for production in the country. According to a sector report from MWE, in the financial

year 2012/2013, the cubic volume storage of water for production had improved from 27.3 million cubic meters in December 2012 to 27.5 million cubic meters in December 2013 (East African Business Week, 2014). Due to the recent history of large scale droughts in Uganda, water resources still remain a critical bottleneck. The irrigation potential for Uganda is estimated at 445,041 ha at an investment cost of USD 2.3 billion and an internal rate of return (IRR) of 46% (IFPRI, 2010).

Besides small scale irrigation, the Ministry has invested in a few larger projects. In 2013 the government invested approximately USD 25 million in the rehabilitation of three major irrigation schemes in the country; namely Mubuku Irrigation Scheme, Doho in Butalejja and Agolo in Lamwo Districts (East African Business Week, 2014).

3.3.3.2 Agricultural insurance

Agriculture insurance is one of the approaches or instruments available for the financial management of agricultural risks by transferring the risk to a third party (insurance company) for a small fee (premium), which is a percentage of the total risk. In Uganda agriculture insurance has an estimated revenue potential of about USD 106 million although penetration is still less than 0.3%. The Insurance Regulatory Authority (IRA) is the governing body in charge of all insurance in the country. In the last two years the IRA has approved several innovative agriculture insurance products from different insurance companies. The majority agriculture insurance products address risks associated with the productive stage of agricultural production. Such risks include unpredictable weather hazards, and untimely death of livestock. Considering, that the penetration of insurance is still very low at 0.65% of the GDP, agriculture insurance is expected to slowly but surely boost the insurance industry while promoting good farming practices (Muchwezi, 2014).

3.3.3.2.1 Kungula Agrinsurance

Kungula Agrinsurance with the backing of the several insurance companies and continued support from aBi-Trust and Swiss Re. successfully introduced the first batch of pre-underwritten agriculture insurance products in the country. Lion Assurance Co. Ltd is the leading insurance company with the following as co-insurance companies; APA Insurance (U) Ltd, First Insurance Co. Ltd, National Insurance Corporation Ltd, NIKO Insurance (U) Ltd, UAP Insurance Co. Ltd, Trans-Africa Assurance Ltd and Phoenix Assurance Ltd; collectively known as the Kungula Agrinsurance Scheme (KAS). The KAS aim is to put aside their competitiveness, share the high risks, and provide insurance cover for agriculture production.

Kungula Agrinsurance products are mainly Weather Indexed based Insurance (WII) products for both crops and livestock that were approved by the Insurance Regulatory Authority (IRA) and launched in June 2013. They are relatively affordable and can be bundled with other financial products such as loans and inputs (Muchwezi, 2014).

Table 17: Description of Kungula Agrinsurance products

Insurance Products	Cover	Items Covered	Basis of cover
Weather Indexed based Insurance	Drought	Crops and grazing animals	Expected or pre-agreed value of harvest or animal or loan cover.
All Risk Mortality (ARM)	Death	Livestock	pre-agreed value of animal

Insurance			
Greenhouse Insurance	Damage	Greenhouse structure, equipment and crops	Cost of structure and equipment and expected harvest or input value of crops

Source: Lion Assurance

3.3.3.2.2 UAP Agriculture Insurance

It was launched after UAP opted out of the Kungula Agrinsurance Scheme and decided to launch its own agriculture insurance products. There are four products namely; Multi-peril Crop Insurance (MCPI), Crop weather Index Insurance, Livestock Insurance and Greenhouse Insurance.

Table 18: Description of UAP agricultural insurance products

Insurance Products	Cover	Items Covered	Basis of cover
Multi-peril Crop Insurance (MPCI)	Losses due to excessive rainfall, drought, hail and frost, windstorm, fire, pests, diseases	Crops	65% of pre-agreed value of growing crop or harvest
Crop Weather index Insurance	Drought	Crops	Expected or pre-agreed value of growing crop /harvest or loan cover.
Livestock Insurance	Accidental death and theft	Livestock	pre-agreed value of animal
Greenhouse Insurance	Damage	Greenhouse structure, equipment and crops	Cost of structure and equipment and expected harvest or input value of crops

Source: UAP Insurance

3.3.3.2.3 Jubilee Agriculture Insurance

Jubilee Insurance developed two agricultural insurance products, namely multi Crop Peril Insurance (MCPI) and Livestock insurance.

Table 19: Description of Jubilee agricultural insurance products

Insurance Products	Cover	Items Covered	Basis of cover
Multi-peril Crop Insurance (MPCI)	Physical Loss or damage due to drought, flooding, windstorms, hailstorm, pests, diseases, earthquakes, riots, strikes, explosions	Crops	Pre-agreed value of production costs or expected harvest
Livestock Insurance	Accidental death But can be extended for theft	Livestock	pre-agreed value of animal

	and transit risks

Source: Jubilee Insurance

For all products, the insurance will pay for any shortfall below the guaranteed level resulting from losses caused by what is covered. Form all products listed above particular conditions have to be met before coverage is offered, such as at least 5 years historical records of production and risks incurred, farm inspection during cropping season, compulsory identification tagging of livestock, post-mortem report form certified veterinary officer before claims are processed.

With the low insurance market penetration in Uganda, there are several lessons we can learn from other countries that have or have had agriculture insurance products. Success has been observed in countries that have had public support in the form of premium subsidies and reinsurance. The Ugandan products do not have government support and neither have they encouraged lower interest rates on agricultural loans. The majority of farmers in Uganda, do not know what insurance is and those that do have little trust in insurance companies, they need to be involved in the formation, management and distribution of agriculture insurance so as to protect their' interests whilst assisting the various financial and service providers to build and market their products (Sandmark, Debar, & Tatin-Jaleran, 2013).

3.3.4 Initiatives related to biological risk

3.3.4.1 Crop

MAAIF has set up a Crop Diseases and Pests Control Project under the Department of Crop Resources from 2006-2012 to minimize crop losses, effectively control these pests and diseases, with the following interventions:

- Rapid response to control the epidemics whenever they break out;
- Equipping staff with the necessary knowledge and skills;
- Setting up mechanisms for pest and diseases surveillance, forecasting, diagnosis and prompt control.

The objectives of the project included:

- To reduce the crop losses from the current 50% to 10%.
- To equip staff with the up-to-date knowledge and skills to control pests and diseases effectively and in an environmental safe manner.
- To establish a surveillance, forecasting and diagnostic system to enable timely and effective control of the pests and diseases.
- To set up an effective Plant Quarantine System to protect Uganda's Agriculture against foreign pests and diseases.
- To strengthen the inspection and certification services to assure quality and safety of Agricultural exports (Ministry of Agriculture, 2014).

However, access to support services for plant protection remains low. Before the restructuring of the extension system, only 4.3% of farmers reported having received information on plant protection through NAADS; 2.9% reported having received support from other service providers (UBOS, 2009).

In the coffee sector, UCDA has established its own structures to address pest and disease risk. In case of pest and disease outbreaks, UCDA through collaboration with MAAIF and NARO conduct checks to establish the pest or disease's mode of attack. Subsequently, laboratory trials are conducted to identify the most suitable options. After that, demonstrations are conducted to farmers in every coffee growing area on how to deal with the particular pest or disease. According to the UCDA, the areas of focus relevant to pests and diseases for the coming years include:

- Generation of clean planting materials through Elite seed and Vegetative propagation of the CWD resistant lines;
- Management of diseases and pests (Black twig borer, Coffee leaf rust, Coffee berry disease, Antestia bugs and lace bugs, Stem borers);
- Supporting research in the development of varieties for adaptation to climatic change;
- Provide both technical and general extension to coffee stakeholders, farmers and processors (Ministry of Agriculture, 2014).

3.3.4.2 Livestock

In Uganda, government adopted the structural adjustment programs in late 1980s and early 1990s. This resulted in decentralization and privatization of clinical veterinary services and downscaling of civil service. Clinical services, breeding and spraying for tick control were privatized while vaccination of animals against epidemic diseases, quarantines and tsetse control were retained under MAAIF. As a result of the continued fiscal challenges, the government has adopted a reactive rather than a proactive approach to service delivery. In the veterinary sector, vaccinations are conducted when there is an outbreak rather than routine vaccination as per the policy. Regulatory policy that is supposed to guide delivery of veterinary services such as the Veterinary and Paraprofessionals Act of 1958 and Animal Disease Act of 1964 are old, weak and do not provide strong incentives to guide disease control and promote ethical behaviour in the provision of veterinary services in Uganda. As a result, there are many actors of varying capacities, interests and relevance providing veterinary services without being effectually regulated. All these actors have different goals, interests, and resources and conflicting interests and yet their actions are interrelated (Ilukor J et al., 2013).

As a result, reaching out to farmers with animal health services is problematic. According to the last agricultural census, out of a total of 3.6 million agricultural households 149,000 (4.2%) received services on animal health by the livestock department of MAAIF, 3.6% of households received support through NAADS extension workers, and 0.9% through farmers associations (UBOS, 2009).

Some of the major challenges for the provision of animal health services are the following:

1. Policy inconsistency: The creation of autonomous institutions like National Agricultural Advisory Services (NAADS) which has its own governance structure has resulted in the duplication of responsibilities and multi or dual accountability. Under NAADs, local governments have to hire

NAADs staff and MAAIF staff in both crop and livestock. These staff perform the same task but NAADS staff are facilitated and are paid higher salaries. This has undermined the traditional public services system because NAADs is running a parallel system yet is also under government/MAAIF. Also, under decentralized governance system, technical and financial lines of management are separated as district veterinary offices (DVOs) have to report to both MAAIF for technical matters, and the Ministry of Local Government and district local government for administrative matters.

2. Limited resources: insufficient budgetary allocation and lack of financial discipline by government is a major challenge. A study of the Economic Policy and Research Centre (EPRC), revealed that allocations to animal health and entomology from the recurrent expenditure varied between USD 250,0000 to USD 300,000, only, between 2005 to 2008.
3. Institutional friction: in some districts the relationships between government veterinarians and paraprofessionals veterinarians (paravets) are poor. Paravets rarely report disease out breaks to the government veterinarians as mandated by the Animal Diseases Act 1964 revised edition 2005.
4. Drug overuse and misuse: Drug abuse problem is common among paravets and farmers. The reasons for the drug abuse problem among paravets are the following: first, the training of paravets is often inadequate. Secondly, most of the paravets are trained in crop science or general agriculture but because of the high demand for veterinary services, crop trained paravets have joined the veterinary market. Thirdly paravets are driven with desire to make profits and tend to over-diagnose the animals in order to increase sales and revenue. Under-diagnosing is also an issue when a paravet believes that a farmer is not able or willing to pay for the correct dose. Paravets then decide to give lower doses equivalent to the fee a farmer is able to pay (Ilukor J et al., 2013).

3.3.5 Initiatives related to infrastructure risk

Since March 2014, the WFP has initiated a project on Post-Harvest Food Loss Reduction in Uganda through improved storage and handling at the start of the supply chain. In 2014 activities for 16,600 farmers (female beneficiaries accounted for more than 60%) in 28 districts throughout the country were conducted. These farmers received training on improved methods to harvest, process, dry and store crops; as well as subsidized household food storage equipment. Training materials were translated into 14 local languages. 4 different storage options were made available for farmers (Super Grain Bags, plastic tanks, and 2 sizes of metal silos), along with drying tarpaulins. More than 63,000 pieces of storage equipment were distributed with the help of 9 implementing partners.

For 2015/16, WFP is targeting to reach out to approximately 34,000 farming families (for details on the used low-cost technology see Table 21). Unfortunately, WFP has a focus on selected geographical areas (food insecurity hotspots such as the Karamoja region, Acholi land, Lango region, West Nile region Eastern region and the South-western region); therefore, additional resources need to be mobilized to ensure a countrywide implementation of improved access to low cost storage options.

Table 20: Low-cost storage facilities for Uganda 2015/16

Equipment Type	Number of Pieces	Number of Farmers
Medium Metal Silo (500lt capacity): Cylindrical metal storage unit capable of providing air-tight grain storage for an indefinite period. Life expectancy +30 years.	4,080	4,080
Large Metal Silo (1200lt capacity): Cylindrical metal storage unit capable of providing air-tight grain storage for an indefinite period. Life expectancy +30 years.	3,400	3,400
Medium Plastic Silo (250lt capacity): Cylindrical plastic storage unit capable of providing air-tight grain storage for an indefinite period. Life expectancy +15 years.	7,140	7,140
Large Plastic Tanks (500lt capacity): Cylindrical plastic storage unit capable of providing air-tight grain storage for an indefinite period. Life expectancy +15 years.	7,140	7,140
Hermetic storage bags x4 per farmer (80lt capacity): Multilayer Polyethylene bags, measuring 75 by 130 cm. Life expectancy 1-2 years.	48,960	12,240
Tarpaulins: 4x 5 meters ,Weight: 3.5 kgs. 150 GSM. Life expectancy 3-5 years.	41,480	34,000

Source: WFP

3.3.6 Initiatives related to price risk

3.3.6.1 Warehouse receipt systems

Warehouse receipting in Uganda can be classified into two main categories: (a) unregulated warehouse receipting, consisting mainly of conventional collateral management agreements, and a number of developmental pilots supported by donors and/or Government, and (b) the regulated public warehousing system for grain introduced under the WRS Act of 2006.

Unregulated warehouse receipting account for most warehouse receipting in Uganda. The activity started in the wake of market liberalization and bank restructuring of the 90s, but was shaken by two major frauds in the new millennium. At least three collateral managers now share the market (namely, ACE, Coronet, and DCL), and, there being a fairly modest but sustained business volume with at least nine banks involved in financing. Unfortunately, the industry has not been able to put an end to fraud-related problems, and it is now reported that the Capital Markets Authority intends to establish a regulatory framework specifically for collateral managers (not to be confused with the regulatory system for grains discussed below). There have been various development pilots, including a successful scheme where cooperatives near Kasese obtained financing while having their cotton toll-ginned, and another with grains in Eastern Uganda which was at first highly successful but subsequently collapsed due to disastrous fraud.

Regulated public warehousing for grains was implemented with EU assistance from 2006 to 2010. In implementing the Act, Government vested regulatory Authority in the Uganda Commodity Exchange (UCE). A Chief Warehouse Examiner (CWE) was hired, and trained to train the warehouse staff to carry out regular inspection to ascertain compliance with all aspects of the system, such as grain quality,

before requesting for remedial action. Considerable training was provided to farmers and farmer groups around the hinterland of licensed warehouses, and a South African software company was contracted to install an electronic warehouse receipt system (eWRS) linked to that in South Africa. UCE also re-established a previously inactive trading floor, and EU assistance was provided to train brokers and design and install a settlement system. Given the mainly informal and fragmented nature of the grain trade, UCE sought to enlist the dominant buyer (WFP) as a market maker to ensure there was strong demand for receipted grains in the early stages and that prospective warehouse operators would wish to get licensed. WFP came on board at the end of 2008, only after two years of discussions, eventually committing itself to buying 150,000 tons of commodities through the WRS, and making 326 series of investments in drying and storage facilities, market collection points, access roads and farmer capacity building.

UCE licensed five warehouses, but deposits were limited; about 22,600 tons in 2013, a small fraction of what was needed to ensure the financial viability of the warehouses and the regulatory agency. The low level of procurement was attributed to problems of quality, i.e. non-compliance of stored grains with the quality standards that WFP since 2011 had started enforcing strictly with all it purchases. Despite this, all WRS loans were reportedly repaid. With the end of the EU funding in 2010, UCE became fully dependent on Government budgetary resources, leading to a decline in services and compliance, with the regulatory system now hardly operational. Notwithstanding, at least two warehouses remain operational and one reports that it is working with about 162 POs representing 10,000 farmers, and to handling 8,000 tons of maize per season (J Coulter, 2015).

3.3.6.2 Price setting mechanisms

3.3.6.2.1 Food crops

Three of Uganda's most important food staples – East African Bananas (Matooke), cassava and sweet potatoes – are largely not traded across international borders. The remaining two of Uganda's top five calorie sources, maize and beans, are widely traded. Because Uganda typically produces a surplus of these two commodities, the country exports maize and beans within the region. Given chronic maize deficits in Kenya, Uganda has become a regular exporter of these two staples (Haggblade, Steve; Dewina, Reno, 2010).

Public food stocks or strategic reserves have been discontinued by the Government of Uganda in the early 1990s. The government disbanded the parastatal Produce Marketing Board (PMB), and abolished their marketing monopoly thus liberalizing the marketing of all food crops. Now, the government no longer holds large public food stocks. Price controls, formerly enforced by the PMB, lapsed as prices were subjected to the forces of supply and demand. Since the early 1990's, Uganda has operated a liberal, market oriented trading regime. The government requires that all private traders register with the Ministry of Justice and obtain a tax identification number. The government does not intervene in free market pricing decisions.

3.3.6.2.2 Coffee

Between 2005 and 2011, producer prices of coffee in Uganda follow export price trends very closely. Producers received 64% of export price in 2005 and as high as 88% of the export price for fair average quality (FAQ) beans in 2011. This suggests that exporters in Uganda receive small margin of profit, given transportation and processing costs. Changes in the international Robusta coffee price are in general passed from exporters to traders and producers. Price increases in the international coffee price were passed on to domestic traders, but not fully to coffee farmers. However, with this exception, the price received by coffee farmers was found to track the international coffee price (Ahmed, 2013).

A rise in the international price is readily reflected in export and wholesale prices, down to the first processing stage. But growers receive a smaller share of the international price when it rises. In other words, when the international price rises, all domestic prices follow except for the price paid to producers, which rises by less than the full amount of international price increase (Ahmed, 2013).

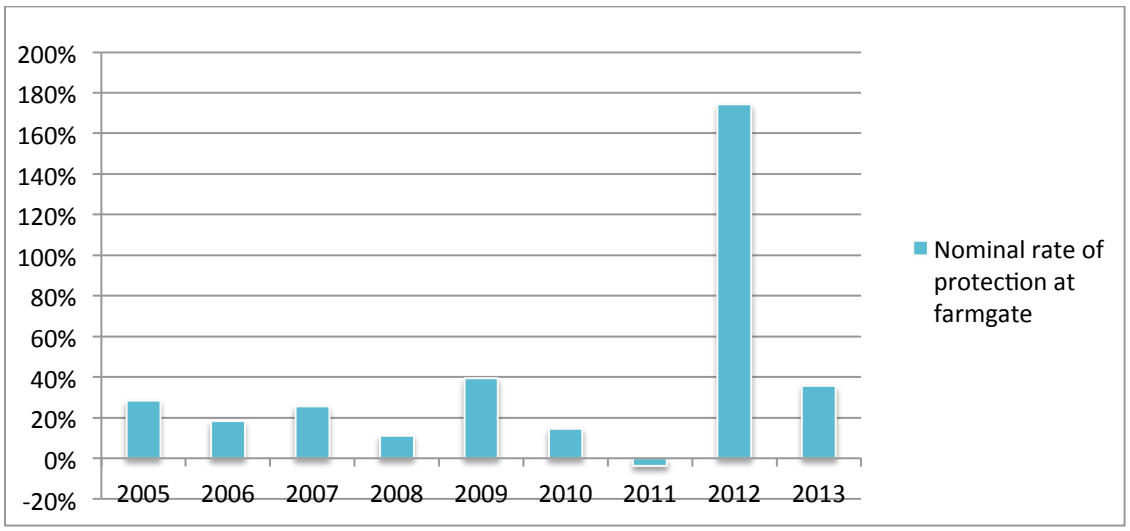
The introduction of a coffee auction has been often argued as a way to increase marketing efficiency, especially price transparency. The coffee auctions of Moshi (Tanzania) and Nairobi (Kenya) are often cited as successful cases; both, however, have the requirement that all coffee must be marketed through them.

3.3.6.2.3 Cotton

One notable example for price setting mechanisms in Uganda is the cotton sector: just before the start of cotton harvesting and ginning activities, the Cotton Development Organization (CDO), in consultation with the industry stakeholders including ginners, evaluates the situation in world and domestic markets, at the end of which an indicative price is set on the basis that they help farmers negotiate a fair share of world prices. In practice, indicative prices are set at conservative levels. The indicative price, which can be considered as a minimum price, is not binding and the actual market price for seed cotton depends on market demand and supply. In particularly bad years, however, the government has intervened with price subsidies in the past: for example, in August 2008, CDO announced a pre-season indicative price of USX 800 per kg of seed cotton. However, in November 2008, actual producer's prices dropped to USX 450 per kg of seed cotton as a result of lower international prices at the time of purchase. Ginners could not give a firm offer for seed cotton. As a consequence, the farm gate price dropped from USX 800 announced in August to 450 in November 2008. Subsequently, the government intervened with a price support of USX 150 per kg of seed cotton raising the farm gate price from USX 450 to USX 600 per kg of cotton (FAO, 2014).

The observed Nominal Rate of Protection (NRP) in the graph below measures the effect of policy distortions and overall market performance on price incentives for producers. The observed price incentive indicators were moderate (below 30% in most years) with the exception of the surge in 2012 caused by the decline of the lint export prices while the indicative price remained high in 2012 following the world price peak of 2011. The high observed nominal rate of protection in 2009 was driven by the government subsidy advance to cotton farmers with the decline in world lint price (FAO, 2014).

Figure 19: Rate of protection of cotton farmers



Source: CDO

3.3.6.2.4 Tea

Prices for another important cash crop, tea, largely depend on the international market. Tea is unusual among the major agricultural commodities in that it is sold through auctions or in private deals and unlike coffee or cocoa, there is no futures market for tea. As such, there is no single world price for tea, but rather differing prices at different auctions. The main determining factor for tea price levels is the Mombasa tea auction. Farm gate prices are determined by tea factories in this buyer-driven value chain. Compared to large plantations that are often run by multinationals with access to the latest technical information, smallholders lack the knowledge of how to pick and store the leaves properly, and how best to treat the bushes and the land. Therefore, smallholder farm gate tea prices tend to be lower than prices for plantation tea because of the generally lower quality. Over the period of 2005-2011, estate tea received a quality premium of up to 10 percent above the price received by smallholder growers. However, this quality premium appears to be recently declining perhaps due to improvement in the quality of the tea produced by smallholder farmers as a result of better handling (Kiwanuka B., and Ahmed M., 2013).

The price received at the auction depends on the quality of tea. Uganda produces a medium quality tea that is primarily used in blends with premium quality teas, such as those from Kenya and the quality of Ugandan tea is comparable to tea from Tanzania. Thus, Ugandan tea receives a lower price than Kenyan tea at the Mombasa auction, where 70 percent of the Ugandan tea is sold. The price discount averaged 24.8 percent during 1994-97 and slightly declined to 22.5 percent during 2001-05. For the period 2005-2011, the price discount averaged 29.56% (Kiwanuka B., and Ahmed M., 2013). The main intervention strategy, therefore, to improve price setting is to improve tea quality assurance in Uganda, in particular for smallholder farmers.

Part Two: Risk Analysis and Implications

4 Risk analysis: a systematic quantification of impacts and likelihood

As described in the chapter 2.1, the livelihood of farmers in Uganda, in particular smallholders, is threatened by a broad range of risks. The impact of these risks for the smallholder farmers is either the loss of food for home consumption or the loss of income through reduced sales on markets. In addition to these direct impacts, a number of side effects also occur at varying degrees such as lost productivity due to a weakened labour force or the depletion of farm assets which later results in reduced income generating potential. Risks also impact on the overall economic performance of the country and the budget of the government: reduced purchasing power of farmers slows down economic progress, government budgets are strained by the need to assist farmers in times of distress through food assistance, cash/food for work programs.

The overall economic impact of agricultural risk is estimated to be between USD 606 million and USD 804 million (Table 21)[6]. This estimate is based on loss assessments presented in the coming chapters. Based on an agricultural GDP of USD 5.71 billion, annual losses are between 10.61% and 14.08% of total production, which is between 2.3% to 3.1% of the GDP.

Table 21: Quantification of annual losses due to agricultural risks in Uganda

Risk Category	Risk	Average Annual Loss (US $)	Frequency of shocks
Input risk	Access to quality inputs	10 700 000 to 22 400 000	The risk occurs on an annual basis but only an estimated 3 to 4.5% of farmers are affected by counterfeit products every year
Weather risk	Drought	44 402 581	Local rainfall deficits occur every year but rarely at regional or national level. The return period of large-scale droughts that affect ≥ 25,000 people is 5.3 years. The catastrophic drought of 2010/2011 was the worst in 60 years
	Flood	166 271	Frequent risk in the Eastern parts of the country with larger shocks affecting ≥ 25,000 people occurring every 2.8 years
	Hail storm	68 377	Small scale events every year but no regional or national catastrophe has been recorded so far
	Storm	20 974	Small scale events occur every year but no regional or national catastrophe has

[6] It has to be noted that this estimate is only a rough calculation of the economic losses. For some risks (for example prices and post harvest losses) only a limited number of crops are included in the calculation due to a lack of sufficient data on other value chains. The figures presented in this chapter are, therefore, likely to be too low.

			been recorded so far
	All other natural risks	9 296	Small scale events every year but no regional or national catastrophe has been recorded so far
Biological risk	Crop pest & diseases	113 000 000 to 298 000 000	High (annual) frequency of plant pests and diseases
	Livestock pest & diseases	76 524 482	High (annual) frequency of livestock diseases
Infrastructure risk	Post-harvest revenue loss	106 923 541 to 97 179 571	Annual phenomenon concentrated in some parts of the farming population: for example, postharvest loss for maize is concentrated among only 21.5% of the population. The loss level is fairly constant except for particularly wet years when losses are 10% higher than normal; this phenomenon occurs on average every 5.75 years
Price risk	Price risk food & cash crops	262 226 143	Depending on the crop, major price shocks may occur every 2.7 to 7 years ()
Conflict risk	Northern Uganda insurgency	n/a	Low probability of occurrence in the future
	Karamoja cattle raids	1 906 670 to 3 177 783	Annual with slightly declining tendency
Total cost of risk			**606 million to 814 million US $**

Source: Authors' calculations (details are given in the chapters hereafter)

4.1 Severity and frequency of risks in Uganda

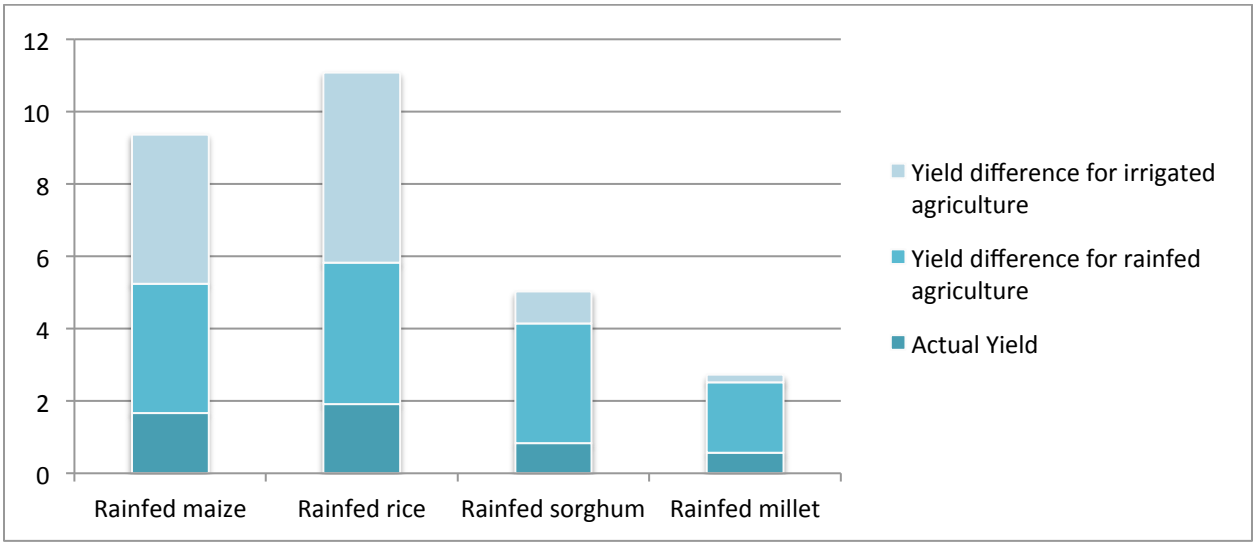
4.1.1 Inputs

Evidence from research trials indicates that average yields in Uganda are well below their attainable potential. The analysis shows that current yields for maize, millet, rice, and sorghum are only 20% to 33% of the potential yield for rain-fed agriculture and even less for irrigated agriculture. A major factor is the lack of good-quality, higher-yielding, more vigorous, drought-resistant, and disease-free seeds and planting material. 90 percent of crops are produced using home-saved seed and/or vegetatively propagated planting materials (Joughin, 2014, p. 10).

The low use of improved inputs is a structural constraint that farmers face. This structural problem is made worse by the high reported incidence of counterfeits inputs. Farmers who have purchased seeds that do not germinate or that bought ineffective pesticides or herbicides have been suffering significant losses in recent years. Preliminary results from a recent study by Svensson, Yanagizawa-Drott, and Bold show that perhaps 3 in 10 commercial seed bags sold in Uganda fail to germinate. According to Transparency International Ugandan farmers lose between USD 10.7 and USD 22.4 million annually due to counterfeit maize, herbicide and inorganic fertilizer sales (Transparency International, 2014).

In addition to these losses, counterfeit inputs are also one major reason why many farmers still rely on home-saved seed and/or vegetatively propagated planting materials. This, in turn, leads to low yields and significant losses in terms of potential revenue for Ugandan farmers. The net effect of the input risk could therefore be higher than the figures stated above.

Figure 20: Yield gap for important food crops in Uganda



Source: Yield Gap

In Uganda, the probability of buying fake seeds that fail to germinate or fake pesticides that fail to protect your plants is high. The Association for Strengthening Agricultural Research in Eastern and Central Africa estimates that counterfeits and fake agro chemicals account for between 10% to 15% of the national agrochemicals in the market valued at U$ 6 million per year (ASARECA, 2010, p. 2). The risk does not affect the entire farming community as only 10-15% of farmers buy improved seed from formal markets in Uganda. 80-85% of farmers rely on seeds saved from the previous season or traded informally between neighbors, but such seeds generally produce far lower yields than genuine high yield hybrids (Joughin, 2014, p. 7).

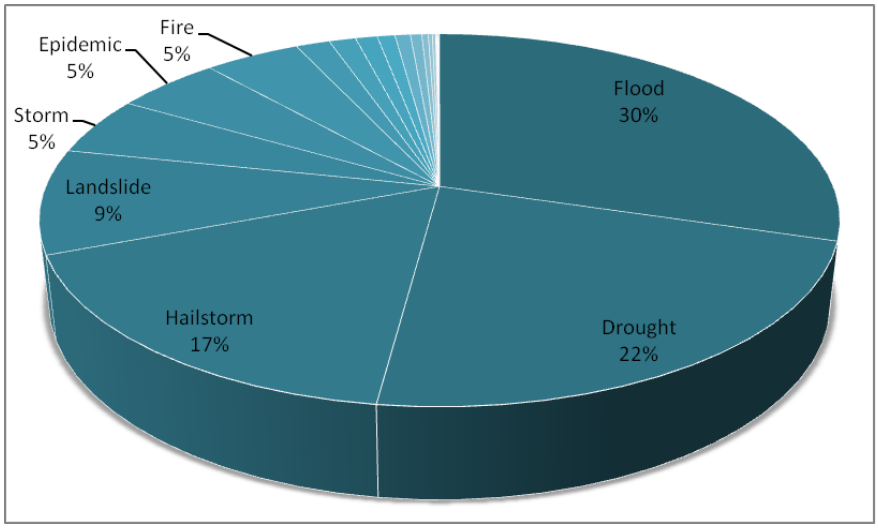
The input risk is a structural problem of the agricultural sector that leads to losses on an annual basis (in the range of USD 10.7 million to USD 22.4 million). The risk is geographically systemic as it often affects a large number of farmers in a district or area where a criminal gang operates. Overall, the risk remains idiosyncratic as not all low-quality inputs lead to failed crop (only 30% of fake seeds fail to germinate according to recent studies). The frequency of the risk is high (i.e. annual) with a high probability for farmers that buy improved inputs. Overall, the risk affects between 3% and 4.5% of the farming population every year (Bill and Melinda Gates Foundation, 2015).

4.1.2 Weather

One of the major sources of risks for agriculture in Uganda is nature itself. Droughts, floods, storms, and landslides all occur frequently in the country. Pests and diseases are also prevalent and climatic factors such as above average temperatures or humidity often cause or aggravatethe problem.

In recent years, the Department of Relief, Disaster Preparedness and Management (DRDPM) at the Prime Minister's Office has started to develop an extensive database on all loss events in Uganda. This database captures all disasters in the country, including the agricultural sector.[7] According to this database a total of 2,571 disaster events affecting agriculture were recorded in the 1,382 sub-counties of Uganda. The most important risk in terms of frequency was flooding, followed by drought hailstorm, landslides, storms, epidemics, and fires.

Figure 21: Frequency of natural risks in Uganda (as share of total events recorded in PMO database 1933-2014)

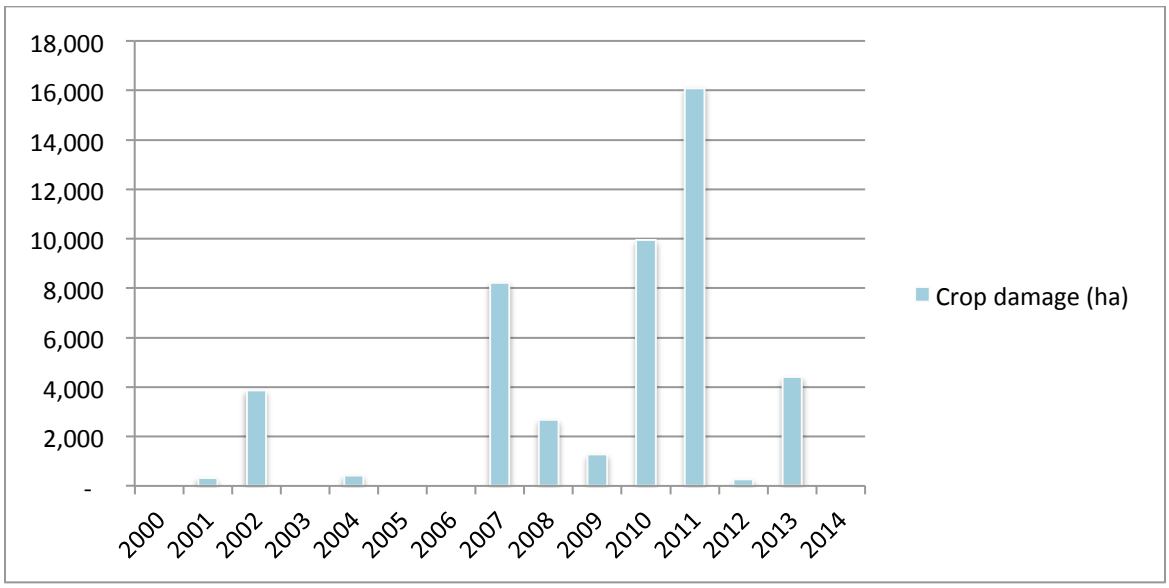


Source: Authors' calculation based on data from the Office of the Prime Minister

Prior to 2010, impact of disaster was not recorded in a systematic way. This is also visible from the data entries of the disaster database, which mostly only state type of event and whether agriculture was affected but not what acreage or what plants were damaged. According to this database the average affected production area was just 3,164.73 ha per year, thus, only about 0.04% of the total cultivated land. The main reason for this low figure is likely that the area affected by droughts has not been included in the database; the majority of events in terms of crop area affected are floods (63%), hail storms (26%), and storms (8%). All these are normally localized events, while droughts tend to affect larger geographical areas. The following shows a distribution of area affected over the last 15 years.

[7] The records go back as far as 1933 but the majority of recorded events are from the last 15 years (98.45% of data entries).

Figure 22: Crop damage in Uganda 2000-2014 (in hectares)



Source: Authors' calculation based on data from the Office of the Prime Minister

Overall economic losses (excluding agriculture) have been calculated by UNISDR to amount to USD 630,416,135 for the period 1970 to 2013. When indirect losses are included this figure increases to USD 953,197,014.[8] Crop loss and livestock loss add only USD 5,048,541 to this figure. (UNISDR, 2013, p. 28 of Annex 2). When indirect losses are included the total estimate for agricultural losses for the period 1970 to 2013 would only amount to app. USD 7.5 million. This figure, however, seems very low for a country with an estimated agricultural GDP of USD 5.71 billion. As noted earlier, most disaster records do not provide estimates for agricultural losses; for drought in particular, very few loss figures are recorded. However data from DRDPM shows that in the last ten years damage and production loss of drought events amount to more than USD 754 million. From this data, the average loss due to drought since 2005 was close to USD 84 million per year. However, most of the losses occurred during the devastating drought years of 2010 and 2011.

Table 22: Economic losses from droughts in Uganda 2005-2013 (in million USD)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Food crops	0.07	0.24	0.22	0.00	0.00	151.60	121.57	0.00	0.00
Cash crops	17.99	16.62	2.62	0.00	0.00	37.90	30.39	0.00	0.00
Livestock	1.81	1.69	0.28	0.11	0.00	111.42	231.50	17.24	11.58
Total	**19.87**	**18.54**	**3.12**	**0.11**	**0.00**	**300.92**	**383.45**	**17.24**	**11.58**

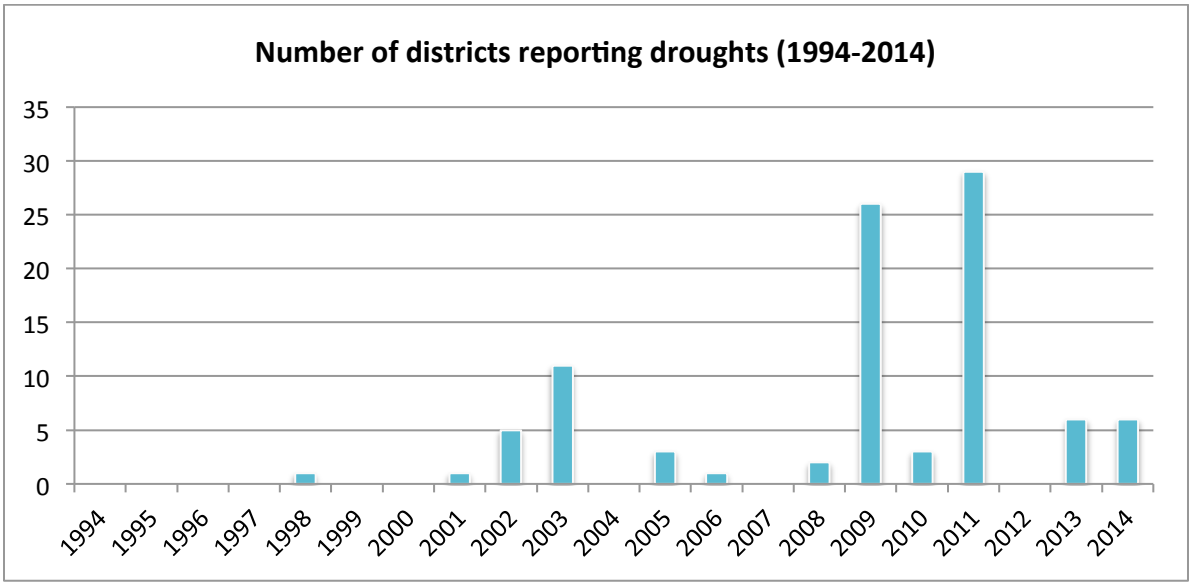
Source: Authors' calculation based on data from the Office of the Prime Minister

Drought events are affecting Uganda quite frequently in recent years with major drought periods in 2002, 2005 to 2008, and 2010/11. The following figure illustrates that in Uganda droughts (or simply a

[8] 164 rigorous post-disaster Damage and Loss Assessments conducted by the United Nations and World Bank show that on average 66% of losses are due to direct damage and the remaining 34% are indirect losses, suggesting that a proxy for indirect losses could be safely estimated as 50% of the value of direct losses.

rainfall deficit for specific crops) is a recurrent phenomenon that affects, at least, one district in most years. The figure also illustrates that droughts can also be large-scale events that affect a high number of farmers across various districts; for example, in 2011 more than a quarter of all districts (29 out of 111) were affected by droughts.

Figure 23: Frequency of droughts in Uganda 1994-2014



Source: Authors' analysis based on PMO dataset

In the past 50 years Uganda has been hit by 9 large scale droughts that have affected more than 6 million people in total. Based on data from the Centre for Research on the Epidemiology of Disasters (CRED), the return period of these large-scale droughts that affected, at least, 25,000 people each is 5.3 years.

Table 23: Return period for large-scale droughts

People Affected	Occurrence since 1967	Return Period
More than 25,000	9	5.3
More than 125,000	8	6.0
More than 500,000	7	6.8

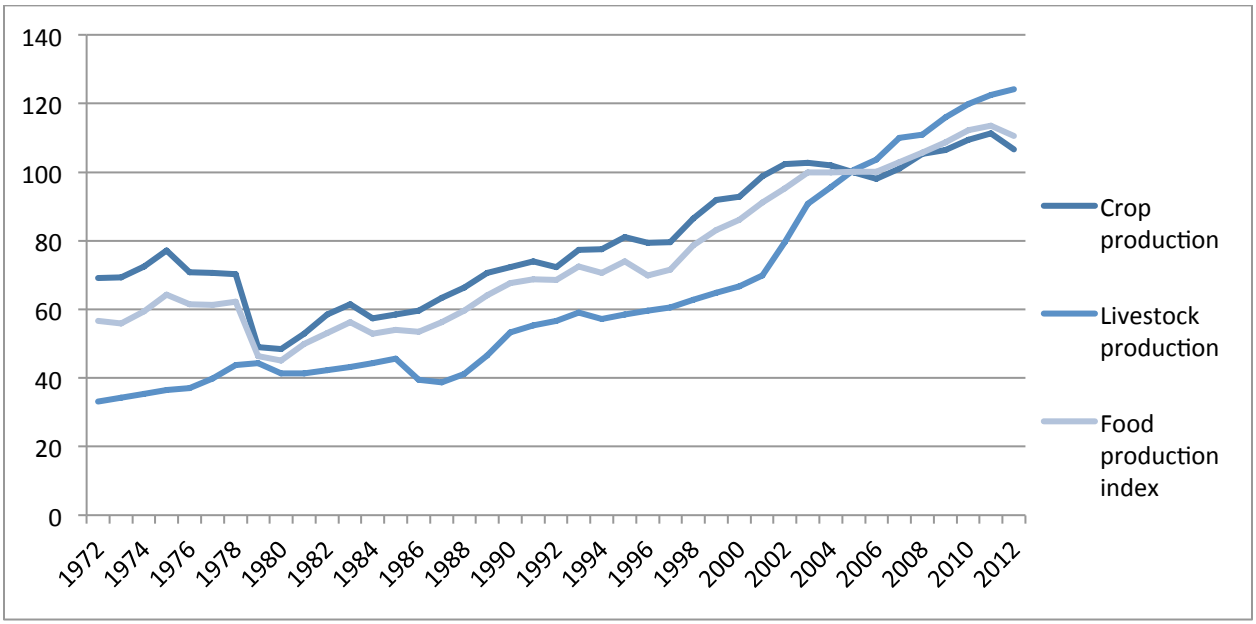
Source: EM-DAT

As has been shown earlier in this report, the economic impact of droughts varies quite significantly. The probability of a major-scale event such as the 2010/11 drought with hundreds of millions USD in economic losses is very low. UN's Office for the Co-Ordination of Humanitarian Affairs (OCHA) classified that drought in the Horn of Africa as the worst in 60 years.

The direct impact of disaster events, in particular droughts, on agricultural production can be seen from the crop and food production indexes in the figure below. Major events such as the drought periods 2005-2008 and 2010-2011 have led to visible slow-downs or declines in the production indexes. The relationship between weather events and livestock production is less pronounced in this figure; this is

somehow surprising considering the large losses of the livestock sector described in the impact assessment report of the Department of Disaster Management.

Figure 24: Crop, livestock, and food production indices in Uganda (1972-2012)



Source: World Development Indicators

Recent studies show that livestock production in the North, particularly the Karamoja sub-region, was severely affected by the recent droughts. Livestock population estimates for 2014 are significantly lower than from the last agricultural census 2008/09. The estimated reduction of livestock herds by about 70 percent is in line with reports from the Northern region concerning the significant losses suffered by most herders during the protected kraals system (FAO, 2014, p. 17).

Table 24: Livestock losses in the Karamoja sub-region (2008-2014)

	Cattle	Goats	Sheep	Total
Total livestock (2014 estimates)	568,000	646,354	592,236	1,806,000
Agricultural census 2008/09	2,253,960	2,025,293	1,685,502	5,964,755
Change from 2008 to 2014 (in %)	-75%	-68%	-65%	-70%

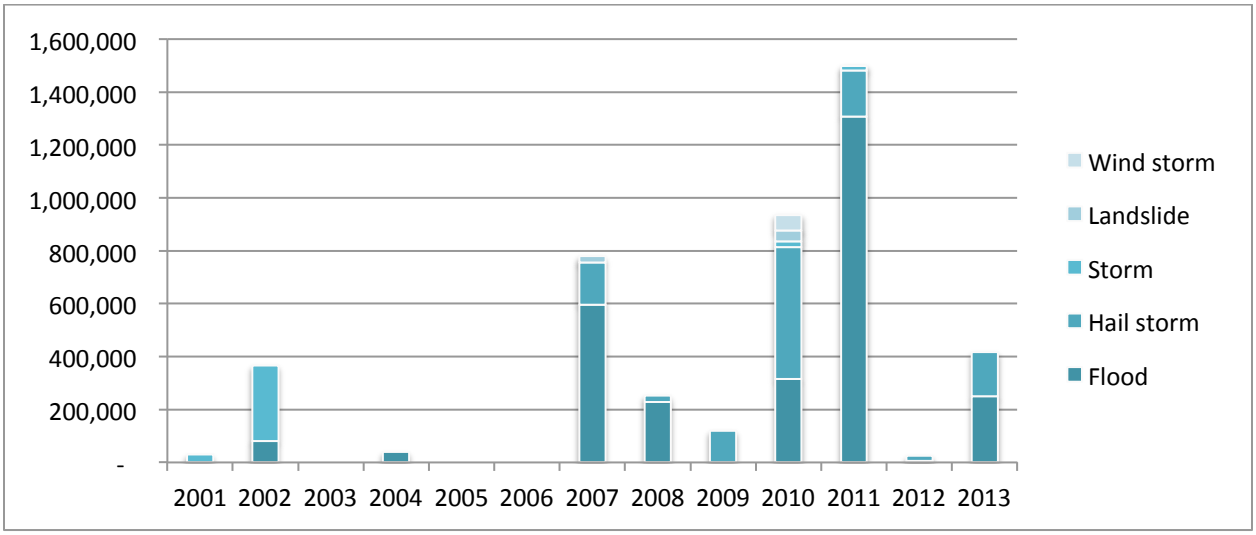
Source: FAO

In all the calculations listed above only the direct and indirect impact on agricultural production is assessed although the loss of production also greatly impacts on the agro-processing sector. Unfortunately, loss data on most of the disastrous events that have occurred in Uganda in the last decades is limited. However, Only a thorough analysis was carried out for the drought event 2010/11 that valued the losses of the agro-processing industry at USD 91.74 million (Office of the Prime Minister, 2012, p. 33).

The severity of losses caused by all other natural risks besides drought is much smaller on the national scale. For example, the average annual cost of droughts is approximately USD 44 million, while the

figure is only USD 166,270 for floods, USD 68,377 for hailstorms, and USD 20,973 for thunderstorms. The following graph shows the economic cost of the five major natural risks (beside drought) for the years 2001-2013.

Figure 25: Economic losses due to natural disasters in Uganda (2001-2013)



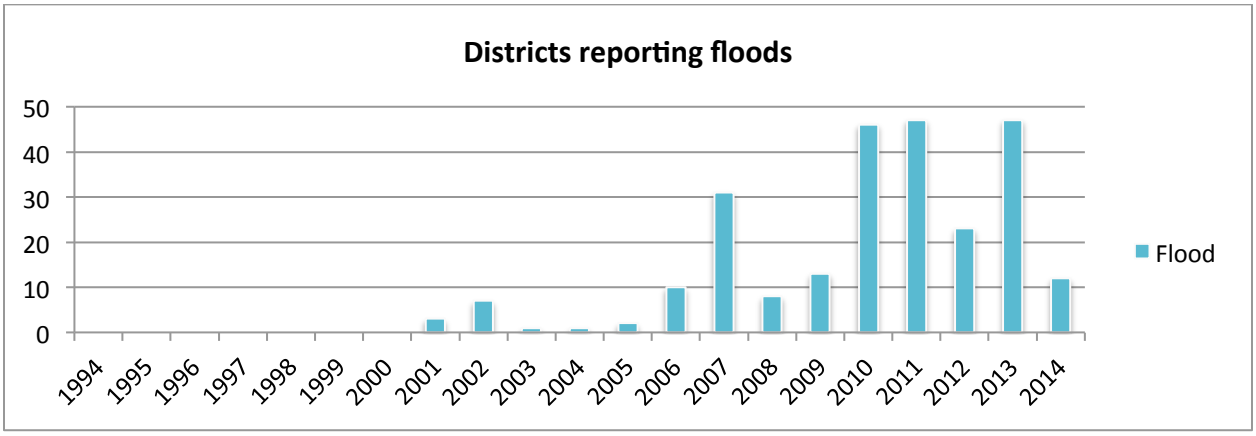
Source: Authors' calculations based on PMO data

But while the overall effect of these natural disasters is comparatively small on the national scale, it should not be forgotten that also small scale events can have a devastating effect on the livelihood of people with specific geographical areas. For example, smallholder farmers in the Mt. Elgon area have been severely affected by floods and landslides over the years and some villages are even being relocated due to their high risk exposure.

In addition, the data extracted from the PMO database might not always give the full pictures as far as damage from natural risks is concerned. For example, the total area damaged by floods in 2007 was 6,295 ha according to the PMO database but, according to an assessment of the flood damage by FAO/WFP an estimated area of 48,583 ha for Amuria and Katakwi districts in the first season alone was damaged by floods. Following widespread destruction of first season production by floods, shortages of seed for 2007 second planting and for the 2008 growing season were widely reported during farmer interviews (FAO/WFP, 2008, p. 11). This indicates that the economic impact of the floods were also felt in subsequent cropping cycles. The total economic loss for the first cropping season of 2007 was likely the USD 4,609,100 reported by FAO/WFP, instead of the USD 597,211 calculated from the database of DRDPM at the Office of the Prime Minister.

According to the DRDPM at the Office of the Prime Minister flooding is the most frequent risk in Uganda. A total of 771 flood events have been reported by villages and parishes in Uganda. Reported incidents have increased significantly over the years (Figure 26). As rainfall records do not suggest a major increase in rainfall over the years, this increased incidence might simply be due to improved reporting mechanisms.

Figure 26: Frequency of flooding in Uganda (1994-2014)



Source: Authors' calculations based on PMO data

As with droughts, there is a large variation in the economic impact of floods with local events that affect a few households to large scale events such as the 2007 floods that affected more than 438,000 and caused losses amounting to more than USD 4 million. The likelihood of a major flood event such as the 2007 floods is very low and is the only disaster of such magnitude in the database of EM-DAT (reaching back to 1900). However, the frequency of smaller events is comparatively high. Floods that affect at least 5,000 people occurred every 1.4 years since 1998 to date.

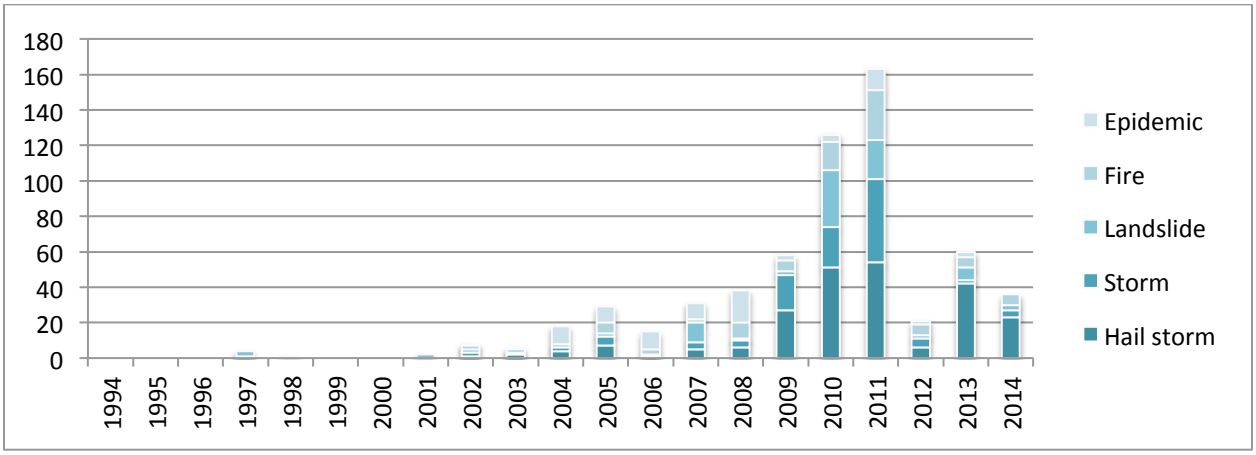
Table 25: Return period for large-scale floods in Uganda

People Affected	Occurrence since 1998	Return Period
More than 5,000	12	1.4
More than 25,000	6	2.8
More than 150,000	3	5.7

Source: EM-DAT

Of the 5 other major hazards (hailstorms, thunderstorms, landslides, fires, and epidemics), only hailstorms occur with a similar frequency as floods. The remaining four hazards are only half as frequent as floods and hailstorms. As already seen in previous figures, since 2010 there seems to be an increased number of events in recent years but this is likely due to improved record keeping.

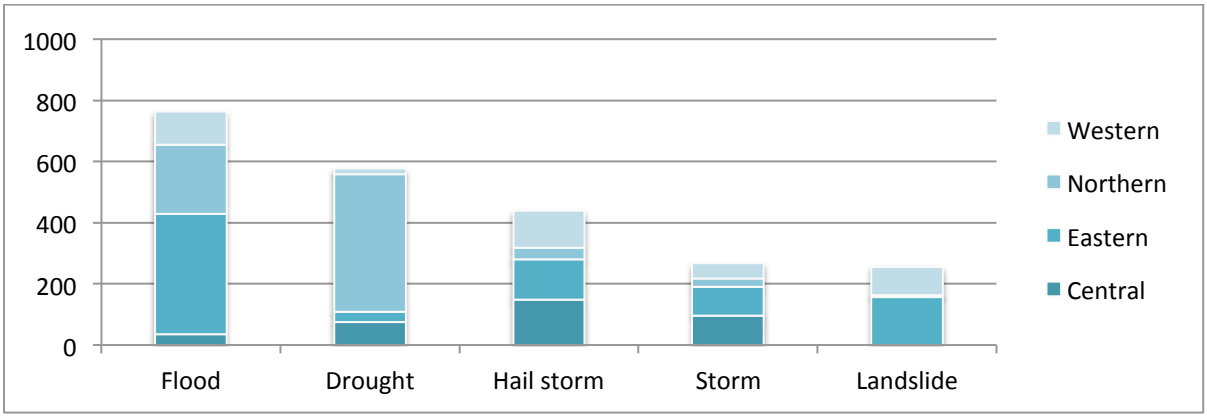
Figure 27: Frequency of natural disasters in Uganda (1994-2014)



Source: Authors' calculations based on PMO data

All weather risks are systemic, that is they affect a large number of people within one geographical location or area. However, there are differences in the probability of being affected by these risks depending on the geographical location of farmers. For example, over 80% of flooding events occur in the Eastern and Northern Region. The drought risk mostly affects the Northern Region (78.16%). The following figure illustrates the differences in probability of the occurrence of different weather risks in the different regions of Uganda.

Figure 28: Regional distribution of the 5 most important natural risks in Uganda (1994-2014)



Source: Authors' calculations based on PMO data

4.1.3 Pests and diseases

Outbreaks of pests and diseases are part of the agricultural sector. Technological progress (either more resistant varieties or improved farming techniques) in recent decades has wiped out or, at least, contained a range of diseases that have been major threats to the sector in the past. Nevertheless, some pests and diseases have not been wiped out completely and continue to threaten the livelihood of farmers. With the onset of climate change, which has extended warm temperatures to new regions, Uganda is bound to see pest-related problems spread to even wider areas. Warmer temperatures are expected to both encourage the spread of pests into new areas as well as render some plants more

susceptible to their effects (MAAIF, 2014, p. 9). In addition, new diseases or mutations of known diseases are always looming around the corner. For example, Maize Lethal Necrosis Disease (MLND) was first reported in Kenya in 2011 and by 2012 had already affected 2% of the production in Kenya. In 2013, it had spread to Uganda with the first incidences of MLND were reported for Busia and Tororo districts in Eastern Region with a risk of spreading further (FAO, 2013, p. 1).

Pests and diseases are often a side-effect of adverse climatic conditions. For example in the coffee sector, farmers explained that the incidence of leaf miners has increased over recent years. They associate their increased incidence with drought. Likewise, coffee leaf rust is associated with warmer temperatures and is recorded to be moving up the mountain slopes (Jassogne, Läderach, & Van Asten, 2013, p. 15).

Furthermore, outbreaks of diseases often follow a specific pattern with very high increase in prevalence in the first years until an effective containment strategy has been developed. For example, in the case of BXW, the disease started to spread in 2001 and by 2005 had affected large parts of the banana production with some areas reporting 100% of plants being attacked. In subsequent years the Government of Uganda managed to bring the disease under control without being able to completely wipe it out to this date.

The biological risk is therefore systemic in nature and affects both livestock and crop farmers. Currently, the subsectors that are most strongly affected are with fluctuating probability banana, cassava, coffee, and cotton. The risks are spread throughout the country.

4.1.3.1 Crops

According to MAAIF, average crops losses in Uganda due to pests, diseases, and weeds are estimated at 10-20% during the pre-harvest period and 20-30% during the post-harvest period. At times, losses up to 90% occur; caused by epidemics or diseases in perishable horticultural crops (MAAIF, 2014, p. 18). Currently, the most affected crops are banana, cassava, coffee, and cotton.

Table 26: Loss levels of major crop groups due to pest and diseases

Crop	Pest/Disease	Potential Loss Level
Banana	i. Black Sigatoka ii. Bacterial wilt iii. Fusarium wilt iv. Banana streak virus v. Banana weevil vi. Nematodes	i. 30-50% ii. up to 100% for affected field iii. up to 100% for susceptible varieties iv. 40% v. 60% in 4 years vi. 51% in 4 years
Coffee	Coffee wilt	Up to 100%
Cassava	i. Brown streak ii. Mosaic virus disease	i. 100% ii. 80%
Cereal and legume grains	Post-harvest losses due to insects, microbes, rodents and birds	5-15%
Roots and tuber crops	Post-harvest losses due to intrinsic, physiological and biochemical deterioration, and microbial decay	20-35%

Horticultural crops	Post-harvest losses due to intrinsic physiological deterioration, microbial decay	35-100%
Beans	i. Bean stem maggot: Ophiomyia spp. ii. Black bean aphid: Aphis fabae iii. Flower thrips: Megalurothrips sjostedti iv. Common bacterial blight: Xanthomonas campestris pv phaseoli var fuscans v. Angular leafspot: Phaeoisariopsis griseola	i. 53-74% ii. 10-58% iii.1-3 kg/ha iv. up to 60% on susceptible varieties v.40-55%

Source: MAAIF

The economic impact of pest and diseases does not only include the direct yield loss (or weight loss in case of post-harvest losses) but also opportunity cost and expenditure incurred in control measures. MAAIF has calculated that the annual losses for major crops range between USD 113 million to USD 298 million.

Table 27: Estimated annual losses due to pest and diseases (in USD)

Crop	Estimated Annual Loss (USD)
Bananas	35 - 200 million
Cassava	60 - 80 million
Cotton	10 million
Coffee	8 million

Source: MAAIF

As mentioned in the previous sections, Banana Xanthomonas Wilt (BXW) was first reported in the central district of Mukono in August 2001 and has since spread to all banana-growing areas in the country. Between 2001 and 2007, BXW spread from central parts of the country where bananas are grown for subsistence, into more than 35 districts in areas of intensive banana production. In some parts, the disease attacked 60 percent of the bananas grown. Up to 650,000 tons of bananas were produced in Uganda in 2005; however, output is estimated to have dropped to about 400,000 tons in 2008, even though prevalence was kept below 5% between 2005 and 2008. In 2010, BXW prevalence in the region increased to 34% due to incomplete and distorted information reaching the farmers; inadequate systems for surveillance of the disease and inadequate mobilization of stakeholders to control the disease. However the introduction of awareness campaigns and improved management practices (in particular, early removal of the male bud to prevent transmission by insects and strict sanitation on the farm to avoid transmission through contaminated tools), has helped in the recovery of banana production by 40% equivalent of USD 64.4 million in per year (NARL, 2014, p. 7). MAAIF estimates that the disease can only be contained if funding of up to USD 1 million per year is secured for control measures which will save bananas worth over USD 200 million annually (MAAIF, 2014, p. 18).

A new and highly virulent strain of the Cassava Mosaic Disease (CMD) virus appeared in Uganda in 1988 and spread to epidemic proportions between 1989 and 1999. The annual loss is estimated at over 600,000 metric tonnes of fresh cassava roots valued at USD 60 million (MAAIF, 2014, p. 19).

Uganda's National Agricultural Research Organization (NARO) estimates that yield losses for cotton due to insect pests are 40%. Annual cotton yield losses due to insect pest pressure totalled close to 50,000 bales ì equivalent to USD 10 million in export earnings (MAAIF, 2014, p. 19).

Coffee Wilt Disease (CWD) has severely affected coffee production in the past decades. By 2002, at least 90% of Robusta coffee farms were infected and more than 45% of coffee trees destroyed in the whole country. The overall effect was a significant reduction in coffee exports of about 50%: from 4.2 million 60-kilo bags of green coffee beans exported in 1996 to 2.0 million bags in 2006. Many rural smallholder Robusta coffee farmers lost their main income source, leading to reduced expenditure on education, health and food consumption as well as social welfare. As a result, 27 per cent of households liquidated their assets and opted to invest in non-crop farming enterprises. In recent years, improved pest management practices have led to an increase in coffee production and exports, from 2.0 million bags in 2006 to 3.6 million in 2013. Still, the death of up to half of Uganda's Robusta trees due to coffee wilt caused a sharp decline in yields with an estimated loss of USD 800 million over a 10 year period to 2012. It has been estimated that if losses due to CWD had been avoided, Uganda would be exporting more than 5 million bags of green coffee beans (Kangire, 2014, p. 3). The revenue loss based on 2013 world market prices is close to USD 170 million p.a.

4.1.3.2 Livestock

Diseases are a major factor for the livestock sector in Uganda. The economic impact of diseases on farming households is diverse with farmers incurring cost for disease control, treatment, and vaccination. Direct losses are associated with animal mortality, reduced milk production, and use of animal for traction. A study in the three agro-pastoral systems of Uganda revealed that farmers annual average economic cost due to diseases per head of cattle was: USD 14.27 for farmers in semi-humid agro-pastoral land; USD 5.31 in humid mixed crop-livestock systems; and USD 7.62 in semi-arid pastoral systems (Ocaido, Otim, & Kakaire, 2009). As an example, the following table shows the economic cost of animal diseases for an average household in Soroti district in Eastern Uganda.

Table 28: Economic cost of livestock diseases for farmers in Soroti

Disease	Treatment/control costs	Mortality loss	Vaccination costs	Milk loss	Traction loss	Total economic cost (USD)
ECF	0.23	8.36	-	-	-	**8.59**
Anaplasmosis	0.36	13.57	-	2.67	2.12	**18.72**
Heart water	0.32	-	-	2.92	2.11	**5.35**
Trypanosomosis	0.13	15.58	-	3.92	2.26	**21.89**
Helminthosis	0.34	4.36	-	5.69	8.97	**19.36**
FMD	0.06	-	0.67	7.69	2.02	**10.43**

LSD	0.31	5.39	-	5.63	6.48	**17.82**
Tick control	3.51	-	-	-	-	**3.51**
Total costs	**5.26**	**47.27**	**0.67**	**28.51**	**23.96**	**105.66**

Source: National Livestock Research Institute

Based on the research by the National Livestock Research Institute, the economic cost for diseases in cattle can be quantified as USD 57 million p.a. for the agro-climatic zones of the Eastern, Central, and Western region.[9] By including livestock from the Northern region, in particular the Karamoja sub-region, this loss figure is estimated to be as high as USD 76.5 million p.a.

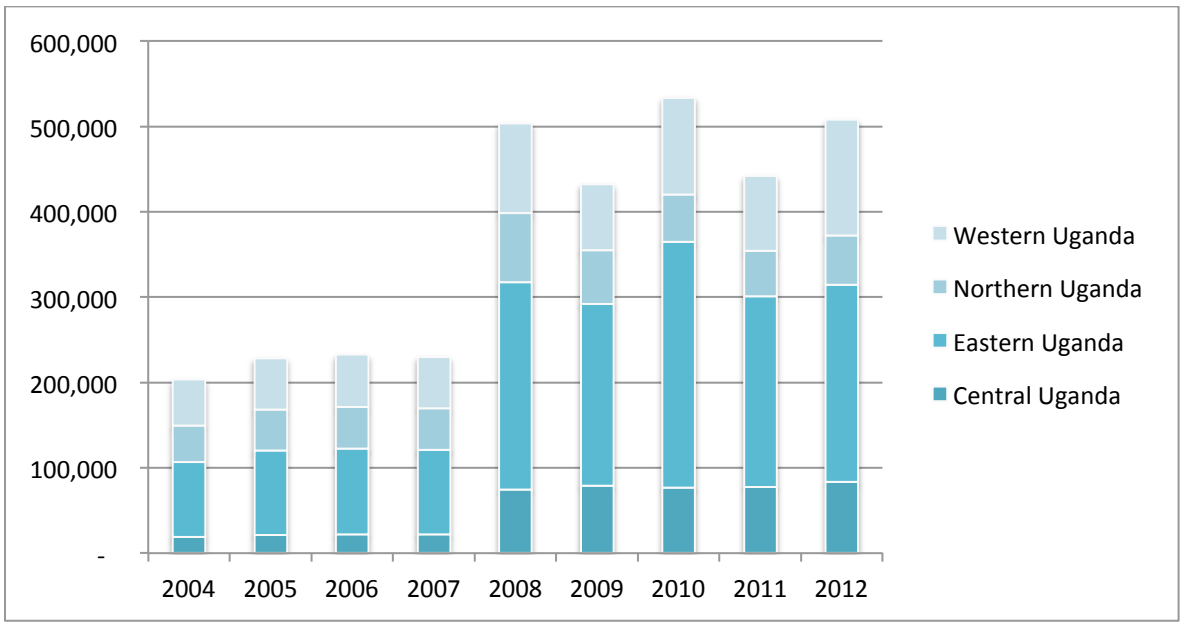
4.1.4 Infrastructure

4.1.4.1 Post Harvest losses

Based on the definition presented in chapter 2.1.4, the lack of infrastructure, in particular storage facilities, markets, and roads, is more a constraint than a risk. However, this constraint is often closely correlated with other risk factors: for example, lack of storage leads to higher losses for farmers in seasons with wetter conditions during and after harvest as it increases the risk of rotting in crops. For example, APHLIS estimates show that 18.3% of the harvest of 2012 was lost (0.62 million tonnes of 3.4 million tonnes of cereal production)). Over the period of 2008-2012, the estimated weight losses due to improper storage of wheat and barley was 12-13%. Other cereal crops had higher and more variable weight losses: maize 17-25%, millet, rice, and sorghum 12-24%. The incidence of damp weather during the period of harvesting and field drying is a major factor in annual variation in post harvest losses, particularly in the case of maize where the longer periods of farm storage also had an impact. For example in 2012 damp weather at harvest time prevented millet and rice crops in Central region and in maize and rice in Western region from drying well, leading to higher than average losses (APHLIS). The following graph shows the variation in post-harvest losses for maize from 2004 to 2012. Therefore, even though lack of storage is a structural problem, weight losses are correlated to the climatic condition of each year.. This variation is a risk that impacts on the revenue of farmers.

[9] Based on livestock figures from the UBOS 2008/09 Livestock Census.

Figure 29: Weight loss for maize due to lack of proper storage (2004-2012)[10]



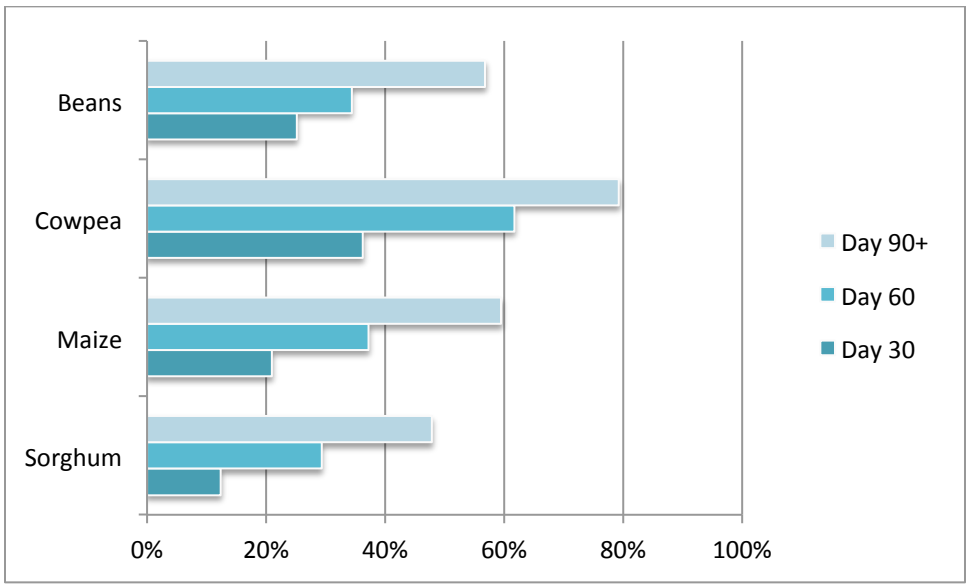
Source: APHLIS

All these figures have to be handled with care: a more recent World Bank study[11] concluded that post-harvest losses are less wide-spread than previously thought. Postharvest loss for maize was found to be concentrated among only 21.5% of the population. It was also reported that the probability of losses increased with humidity and temperature and declined with better market access, post-primary education, higher seasonal price differences, and improved storage practices. The average losses for those households that reported losses was 27.4%. Based on these figures postharvest losses for maize amount to 5.9% only, which is considerably lower than the figures stated earlier (Kaminski & Christiaensen, Post-Harvest Loss in Sub-Saharan Africa: What do farmers say? - Policy Research Working Paper 6831, 2014, p. 24).

[10] The jump in production losses due to post-harvest handling between 2007 and 2008 is linked to a jump in production figures for maize during that period (APHLIS only provides an estimate for the percentage in post harvest losses). The most likely reason for this production increase is a data collection issue: the production figures in 2008 are based on the 2008/09 agricultural census, while the data of 2007 and earlier is based on national estimates only and these figures are likely to have been underestimated for all the years 2004 to 2007.

[11] The paper used self-reported measures from nationally representative household surveys in Uganda.

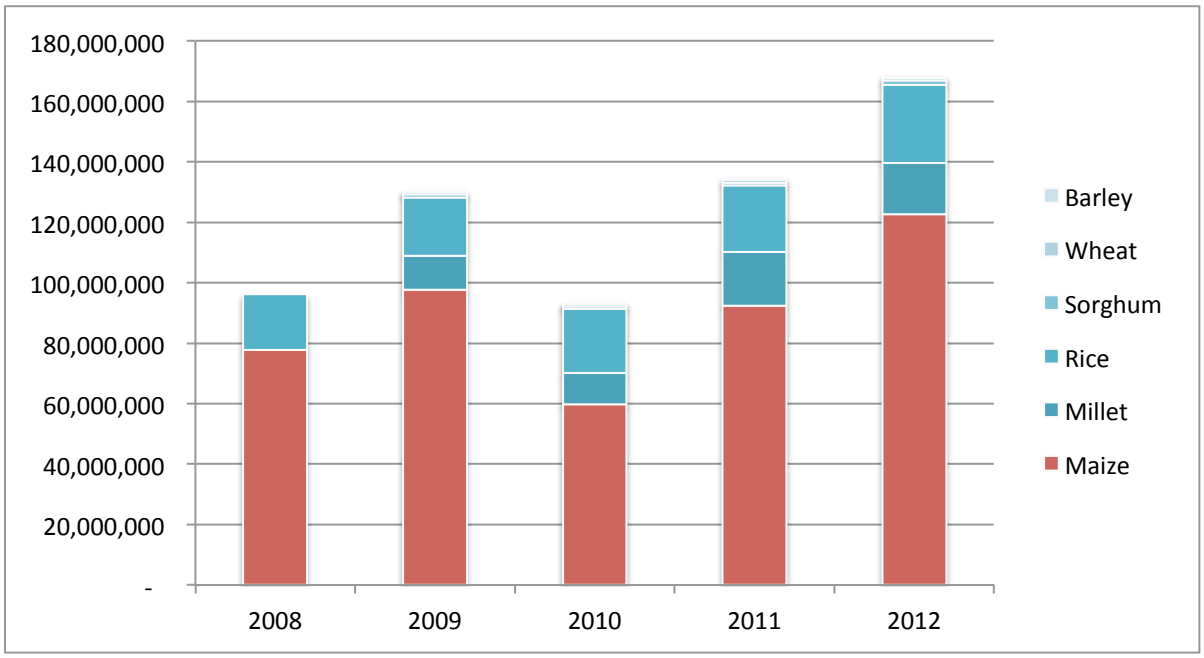
Figure 30: Average recorded post-harvest losses for Uganda (Dec 2013 -Apr 2014)



Source: WFP

The overall effect of the infrastructure risk is hard to quantify as there are different estimates on the amount of produce lost due to different factors as illustrated above. Additionally,, the increase in price of produce in the months after harvest does often compensate farmers, at least in part, for the weight loss suffered. But assuming that the weight loss outweighs the effect of increasing prices, the average revenue loss for farmers based on APHLIS figures is USD 97,179,571 per year. The following graph shows that maize carried the biggest percentage of post harvest losses (72.34% on average) compared to other cereals.

Figure 31: Annual revenue loss from post-harvest loss in Uganda (2008-2012)

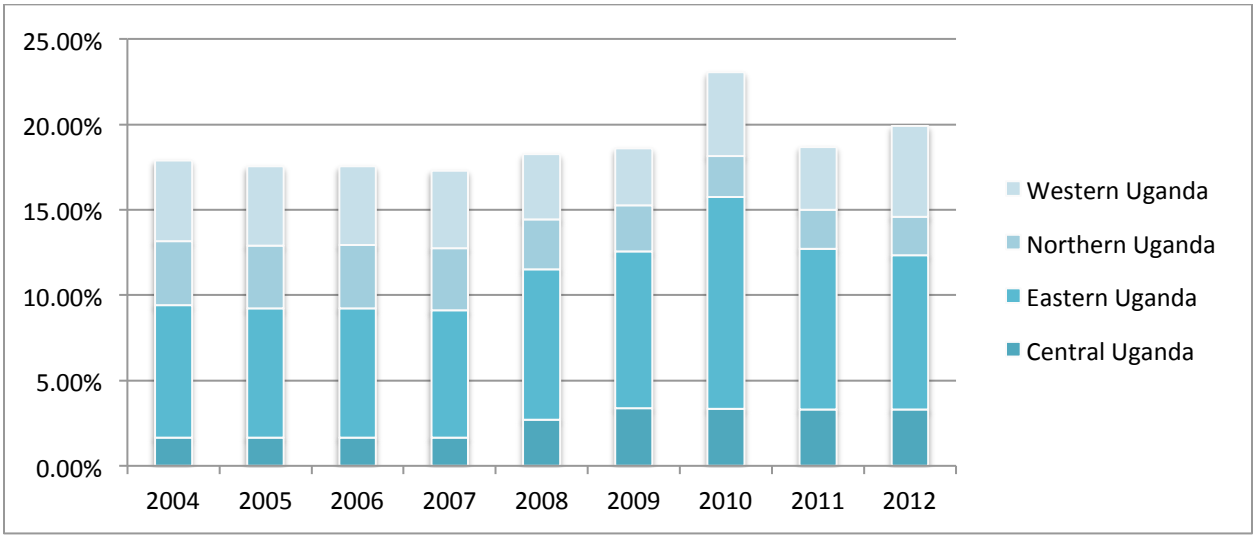


Source: Authors' calculations based on APHLIS (weight loss data) and Regional Agricultural Trade Intelligence Network (market price data)

Infrastructure is a structural issue that is common in all parts of the country. The risk of post-harvest losses due to weight loss and/or price fluctuations is spread throughout all districts. The data from APHLIS shows that all regions suffer fairly constant weight losses: 12% to 13% for wheat and barley, 17% to 19% for maize, 10% to 13% for millet, 13% to 14% for rice, and 12% to 14% for sorghum. The incidence of post harvest losses is higher only in years with particularly wetter or other unfavourable weather conditions during harvest. Overall, there is a 17.39% probability that post-harvest losses are 10% higher than the long-term average (i.e. a 5.75 return period) in wetter years.

However, not all crops are affected in the same way by wet years: for example, there is a 8.3% probability for maize that post-harvest losses increase by 10% points higher in wetter than average years. For millet this probability is 19.4%, for rice 35%, and for sorghum 16.6%. Losses for wheat and barley are constant throughout the years at 12% to 13%. The figure below shows that maize: losses throughout the years were in the range of 17% to 18% except for 2010 when the wet climate in Eastern Uganda led to an increase in losses.

Figure 32: Post harvest losses of maize (2004-2013)



Source: APHLIS

4.1.4.2 Price seasonality

Another issue related to the lack of storage is the risk of seasonal price fluctuations. This price risk is more pronounced for farmers that lack access to markets. In the absence of proper storage facilities farmers, in particular smallholder food crop farmers, are forced to sell their produce after harvest for whatever price is currently offered. Smallholder farmers predominantly use traditional ways of storing their crop. Research trials by WFP show that traditional storage methods (such as storage on roof tops and home yards) lead to more than 20% post-harvest losses for most major crops within the first 30 days after harvest. Post-harvest losses for maize, for example, were approximately 60% for the first three months after harvesting.

The high potential losses from traditional storage means that farmers are often forced to sell directly after harvest when prices are lowest. This price risk can be higher for smallholder farmers that have only access to middlemen or nearby markets. Prices tend to be considerably lower for farmers that are further away from markets. It is estimated that for maize farmers one additional driving hour to a market increases the price spread between the farm gate price and the market price by 2.3% points. Maize farmers that are located 5 hours away from the nearest market receive at least a 10% point lower maize price than farmers who live near the market (Yamano & Arai, 2011, p. 36). But these studies show no evidence on the variability of these prices.

Box 2: Inter-Annual versus Intra-Seasonal price variability[12]

Intra-annual (within crop year) price volatility measures the variation of prices between months or seasons in the same year, while inter-annual (between crop years) price volatility measures the variability on the level of prices across different years as measured by the average price for each year. Both indicators have been calculated in the form of CV for Maize, Coffee, Fresh Cassava and yellow Beans (Table 29). Most farmers are aware of the importance of intra-annual variability which underline

[12] The analysis in this text box was prepared by Ibtissem Taghouti, IFAD

the advantages of stocking production. However, they are often forced to sell at harvest time when prices are low. Due to liquidity constraints at harvest time and lack of storage capacity That is the undervaluation of produce occurs when farmers in surplus areas sell low during harvest season, rather than waiting for the lean season when profits are higher.

There are different determinants of inter-annual food price variability in Uganda. From the supply side, variability due to the impact of natural factors on harvests. The agrarian system in Uganda is generally extensive and uses few inputs, being very vulnerable to climatic shocks or weather variations. Other factors contributing to price variability are: the low level of stocks, The lack of organization of producers in the value chain, Segmentation of regional and domestic markets. Non tradability of local foodstuff which excludes the possibility of using exports to adjust supply to domestic demand.

Table 29: Inter-annual and annual price variability

CV	commodities	Maize	Coffee	Fresh cassava	Yellow beans
Inter-annual		17	42	29	21
Intra-annual	2008	5	28	29	6
	2009	8	12	13	11
	2010	17	20	10	8
	2011	21	28	28	19
	2012	14	11	7	12
	2013	6	10	4	7
	2014	19	16	8	8
	2015	20	13	8	15
Avg. Intra-annual		14	17	13	11

Source: Authors' calculations based on Infotrade data

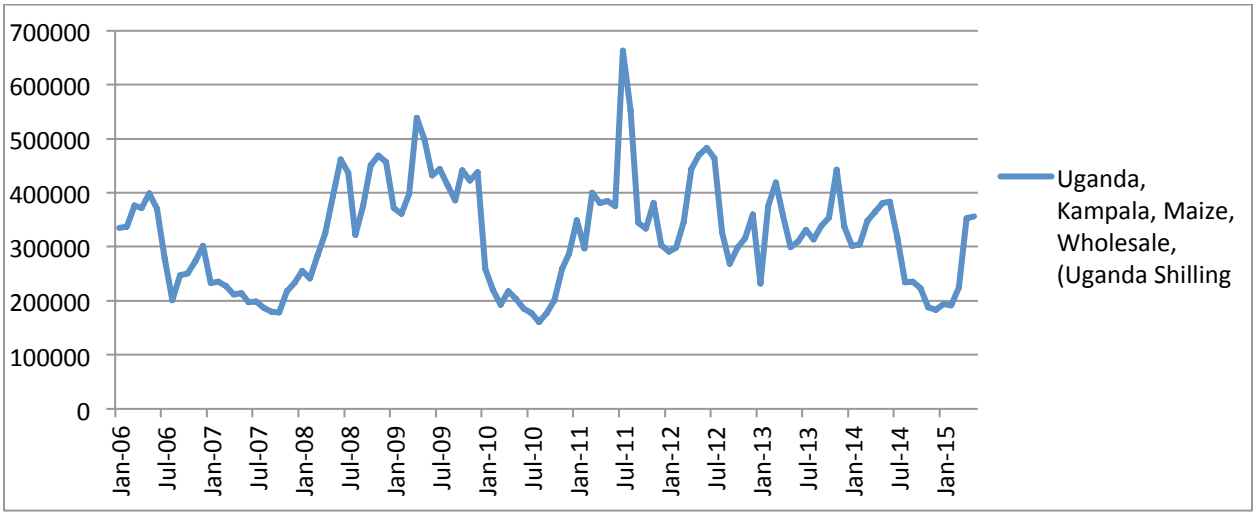
The size of the intra-annual variability varies significantly from one year to another. For instance, the intra-annual CV of the price of fresh cassava was 4% in 2013 and 29% in 2008. However, the average intra-annual CV is similar across the four commodities, in the range between 11% (Yellow beans) and 17% (coffee). The inter-annual variability is higher than the intra-annual CV for the four commodities in Table 2. However the difference between inter and intra annual variability significantly differs across commodities: Inter-annual variability of the price of coffee and cassava is double than the corresponding intra-annual CVs; on the other hand maize and beans have similar levels of inter and intra annual price variability. This reflects the higher importance of seasonal price cycles in these latter commodities.

Seasonal (or intra-annual) price fluctuations are a recurring phenomenon: farmers are forced to sell shortly after harvest due to the lack of storage, therefore, foregoing higher revenue from sale of produce at a later point in the year. For example, maize prices vary seasonally: during June, the maize price falls sharply. Prices reach their lowest level in July and August, during the main harvest period of the first season. The maize price dips again in December (in Kampala) and January/February (in the other markets), corresponding to the harvest period in the second season.

The following figure shows the price fluctuations for maize: even though a bi-annual price drop pattern can be observed, the timing and intensity of the variation are not constant over the years. A recent study concluded that 27% of total volatility in monthly wholesale maize prices is explained by the seasonal pattern. Wholesale maize prices during the peak months of a year are estimated to be 33%

higher than those during the troughs (Kaminski, Christiaensen, Gilbert, & Udry, 2014, p. 17). This means that maize farmers could generate a much higher income if they were able to sell their produce during peak times.

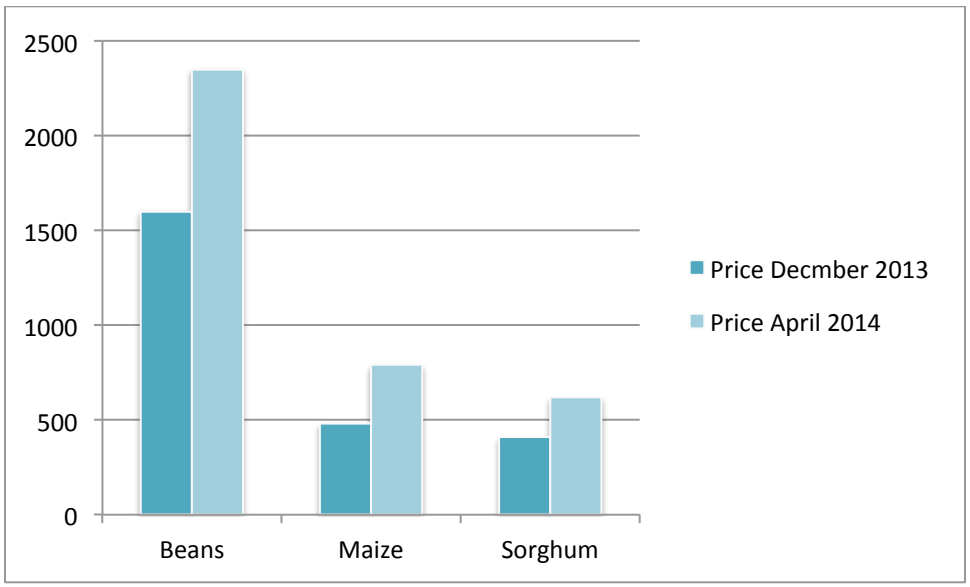
Figure 33: Inter-annual price fluctuations for Maize (January 2008 to March 2015)



Source: FAO Food Price Monitoring and Analysis Tool

In 2013/14, for example, market prices for winter crops where on average 35% lower directly after harvest in December than they were 4 months later. Beans, maize, and sorghum farmers, that had to sell shortly after harvest, therefore, generated significantly lower revenue than those farmers who were able to store their produce. But keeping the harvest stored often leads to significant weight loss due to insects, pests, and fungi.

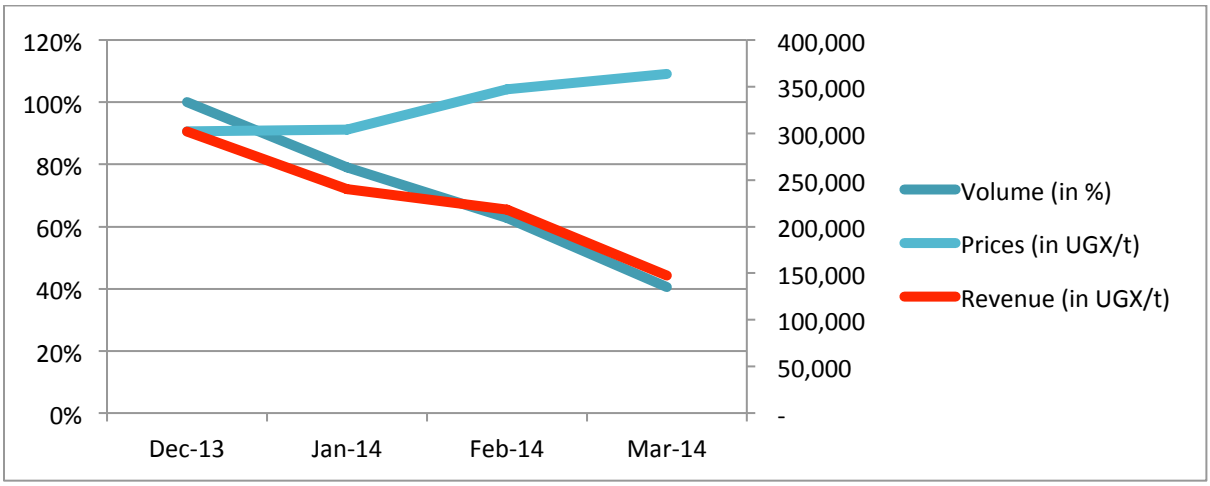
Figure 34: Market prices for food crops in 2013/14



Source: WFP

In essence, the lack of good storage facilities forces farmers to either sell their produce at low prices shortly after harvest or risk losing it to storage pests and fungi attacks. Based on the figures from WFP, the weight loss effect is more damaging to farmers than the price effect. For example, maize farmers would have lost 59% of their harvest if they decided to store all their maize from harvest in December 2013 to March 2014.. During the same period of time prices increased by 20.54%. Figure 35 shows the effects of both decreasing harvest weight and increasing prices on the overall revenue of farmers (in red). Farmers who sold all their produce in March generated almost 50% less revenue than farmers who sold all their produce in December.[13]

Figure 35: Price and weight loss effect on farmer revenue for maize in 2013/14



Source: Authors' calculation based on WFP and FAO data

Table 30 presents the results of an analysis of market price monthly data for the period 2008-15. In theory, cassava, because of its capacity for harvest season and for inter-annual in-ground storage, should offer an elastic supply response that serves to moderate its price volatility (Haggblade & Dewina, 2010, p. 5). The analysis hereafter, however, shows a high volatility also for cassava and lower volatility for coffee, but without a seasonal pattern in either of them.

Table 30: Monthly price deviation from annual average (2008-13)

	Peaks			Troughs		
	Period	Average	Max. Shock (%)	Period	Average	Min. Shock (%)
Maize	May	17	33	Feb	-9	-21
Yellow Beans	May	14	27	Jan	-12	-18
Coffee	Dec	13	61	June	-2	-12
Fresh Cassava	July	10	57	May	-11	-53

Source: Calculations by Ibtissem Taghouti (IFAD) based on Infotrade data

[13] This calculation is based on the assumption that farmers either sell 100% of their produce after harvest or 100% three months later. In reality, farmers often sell part of their produce after harvest and smaller quantities in the course of the next months. The exact impact of the opposing effects from weight loss and price increase are, therefore, difficult to determine.

The analysis reveals that maize and bean farmers generate on average 9% and 12% lower revenue when selling directly after harvest. The revenue loss can be as high as 21% and 18% during particularly bad years. For maize, seasonal price peaks tend to occur around May-June, which is the period just before harvesting for the long rain season in Uganda (November). Maize farmers in Uganda should be very careful about the marketing timing because prices tend to be high before harvesting or in the period of harvesting. On average the price of maize in May (the month with highest average prices) is 17% higher than in other months, and it can be even 33% higher. The trough of prices occurs in February: on average prices are 9% lower but can be up to 21% lower. The difference between the peak and the trough of maize prices in May and February is around 26% on average, but can be larger than 50%. Waiting three months for selling can be very profitable if good storage proprieties were available.

Bean prices more or less follow a similar seasonal price pattern to maize, but may have a second less extreme price cycle around the short rainy season. Peak prices occur in September and in May. The seasonality prices are lowest in the October-January period because those months are the harvest season. On average the price of beans in May (the month highest average prices) is 14% higher than in other months, and it can be even 27% higher. The trough of prices occurs in January: on average prices are 12% lower but can be up to 18% lower. The difference between the peak and the trough of beans prices in May and January is around 26% on average, but can be larger than 45%.

Overall the price of cassava does not seem to respond to a seasonal cycle. The peaks occur in July with 10% higher prices than in other months. The trough of prices occurs in May: on average prices are 11% lower. The difference between the peak and the trough of cassava prices was smaller than maize and beans and less linked to cropping seasons. The main variability of prices looks to be due to inter-annual volatility.

Relative to other commodities coffee present low intra-annual seasonality but high volatility. On average the price of coffee in December (the month highest average prices) is 13% higher than in other months. The trough of prices occurs in June: on average prices are 2% lower than the annual average.

4.1.5 Prices

The intra-annual price fluctuations described in the previous chapter is different from the risk of price fluctuations between the years: the risk of losing income due to intra-annual price fluctuations can be managed on an individual household level by improving storage facilities and by increasing access to market information. The risk of price fluctuations between years is a more systemic issue as prices fluctuate depending on market demand (for export goods), the overall production of the commodity (and its substitutes), etc. In the past, bumper harvests for various commodities have led to sharp drops in commodity prices: for example, bumper harvests in the maize sector led to low prices in 2009/10 after a year with high prices due to bad production conditions in 2008/09 (New Vision, 2010). Uganda being a net exporter of maize is also strongly affected by production conditions in other countries: the bumper harvest of maize in Kenya in 2012/13 led to price drops also in Uganda (The East African, 2013).

Box 3: Prices Vs Yields: Which risk is more pronounced in Uganda?[14]

Table 31 presents the results of an analysis of variability of yields prices and revenues for a selection of commodities in Uganda. In our analysis, the calculated variability of prices is larger than the variability of yields for all commodities except rice. It is important to qualify this statement as the analysis was carried out on an aggregate level only, which reduces the measured variability of production. This does not mean that farm level yields could not be more variable than market prices. However there is no information about yields and its variability at farm or district level. There are significant differences in variability of aggregate market prices across commodities with the highest variability above 30% found in cassava, coffee, tea, apple banana (Latundan banana) and sunflower. The variability of the price of tea and coffee could be a good reflection of price instability at the international market. Yield variability across selected commodities is less relevant than prices. Products with high yield variability above 10% are rice, cow peas, sorghum and sunflower. Among these commodities, tea has by far the largest coefficient of variation for price which cause a high variability in revenue.

Prices and yields tend to move in opposite directions. This negative correlation is particularly evident for those products, which are produced mainly for the domestic consumption, respond to supply, and demand laws in a small domestic market (Fresh cassava, Maize, groundnuts). In that case, the negative correlation between yield and price naturally stabilizes crop revenue and is expected to facilitate revenue stabilization. This is reflected in a lower revenue CV compared to price CV for cassava and groundnut (see table hereafter).

Table 31; Coefficient of Variation of yields, prices and Revenues per commodity in Uganda

Crop	Yields	Prices	Revenue
Fresh Cassava	5.6	31.3	28.5
Maize	6.7	25.8	27.7
Coffee (green)	1.4	45.9	50.2
Tea (unprocessed)	6.5	114.8	118.3
Apple Bananas	2.9	41.7	43.6
Groundnuts	7.7	21.6	19.9
Sweet Potatoes	2.5	21.0	20.8
Sunflower	10.7	38.6	42.6
Soya beans	6.6	17.4	19.0
Sorghum	12.8	22.7	24.2
Upland Rice	19.4	18.8	21.4
Cow peas	14.3	25.6	26.3
Yellow Beans	8.5	20.5	16.6

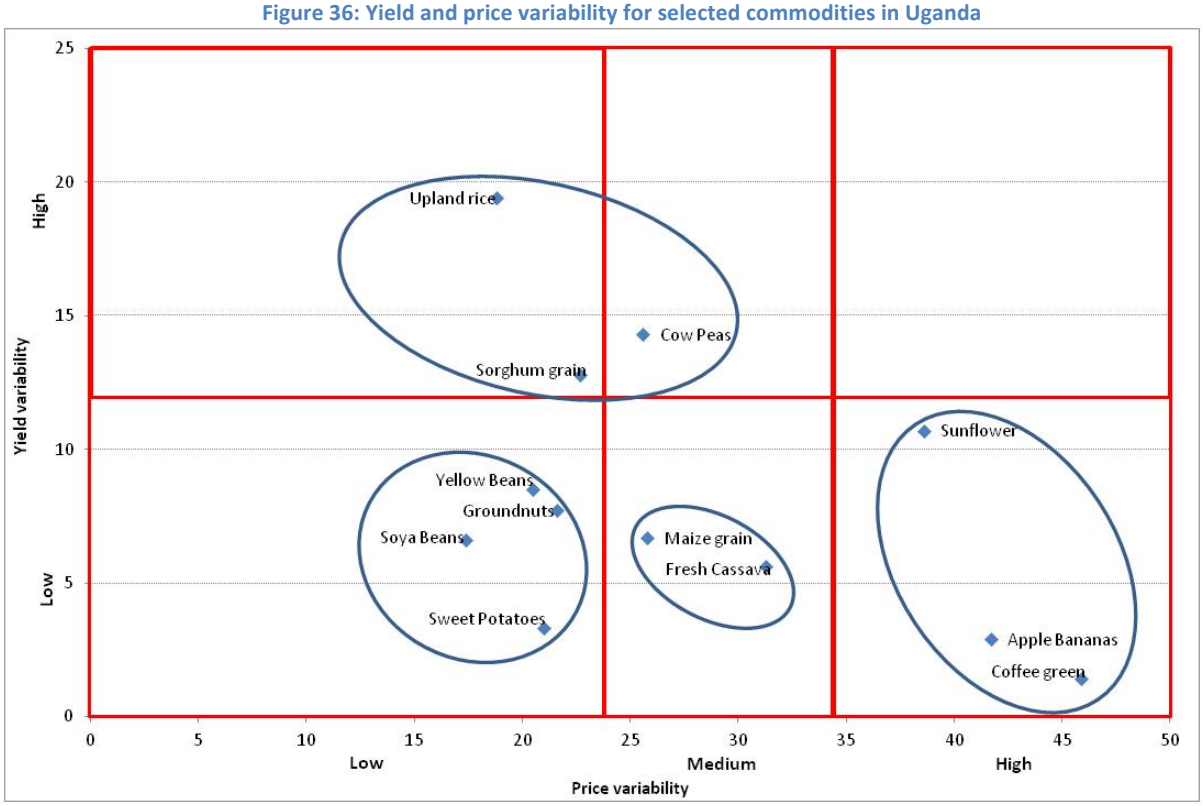
Source : Authors' calculations based on Info trade and FAOSTAT data

Figure 36 allows for comparisons of price and yield CVs across selected products. Selected commodities are classified into 4 main groups. The first group includes tea, sunflower, apple bananas, and Coffee and has the highest CVs price in comparison with others commodities. This means that these commodities are the most risky products to be cultivated by farmers in terms of prices variability. The second group of commodities is characterized by low variability for both price and yield but yield variability is smaller. This group includes important products such as beans, groundnuts, soya beans and sweet potatoes and has the lowest exposure to price and yield risks. The third group includes products with a high yield CV and different degrees of price variability. Sorghum and rice have high yield variability and cow peas have medium price variability. Group 4 has medium price variability, low yield variability commodities and it includes the most cultivated crops in Uganda, and they are very important for food security in Uganda:

[14] The analysis in the text box was carried out by Ibtissem Taghouti, IFAD

Maize and Cassava.

Figure 36: Yield and price variability for selected commodities in Uganda

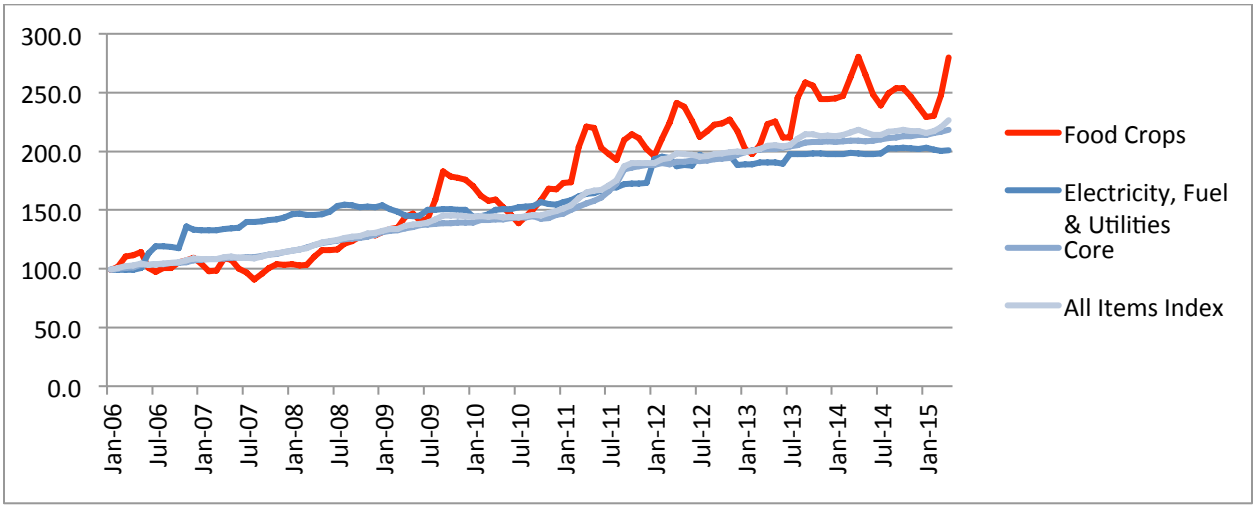


Source : Authors' calculations based on Info trade and FAOSTAT data

Market prices are an important uncertainty for farmers, in particular smallholder farmers that often lack access to markets other than middlemen buying their produce at the farm gate or the nearest local market. It is important to note that in this risk assessment study we focus on the income and welfare effect of price shocks on the farmers themselves. Given the importance of agriculture for the Ugandan economy, changes in market prices have, of course, also more general welfare impacts. After the world food crisis in 2007/08 commodity price movements in Uganda had real welfare implications in the short run. Changing prices affected welfare predominantly in a negative way, with welfare losses up to 36 percent of initial welfare for people below the poverty line. The effects were heterogeneous in that for some commodities (maize, for example), price increases were accompanied by welfare increases. In such cases the income gains for farmers outweighed the consumption losses. However, for most other commodities the effect went in the opposite direction (Van Campenhout, Pauw, & Minot, 2013, p. 33).

Food prices in Uganda have been volatile in recent years, particularly since 2009. Food price volatility is considerably higher than the volatility of other consumption items and the headline inflation rate. In addition, food price inflation is generally higher than core inflation. Drivers for increases in food prices in the past 6 years have been increased world food prices, increased fuel cost, and climatic events within the country such as the 2010/11 drought period.

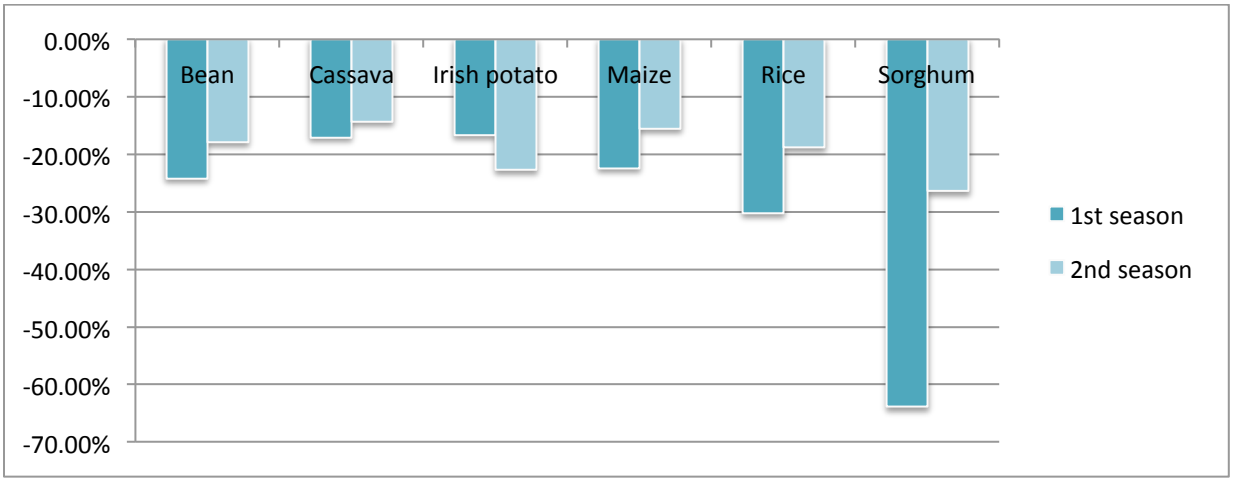
Figure 37: Food, power, and headline inflation in Uganda (2006-2015)



Source: Bank of Uganda

As farmers have no way of knowing what prices will be offered at harvest, they incur a considerable investment risk (input costs) and by the time of the harvest all their labour, input, and other cost are sunk cost. Drops in market prices directly impact on their revenues and lessen their profit margins. For example, a 10% drop of prices for some of the major food crops lead to over-proportional reductions in profit margins of farmers. For some crops, for example field pea and finger millet, a 10% reduction of market prices turn these farming activities into loss-making businesses. The following graph shows the implications of reduced prices for some major commodities in Uganda; the results vary according to the different costs associated with the different planting seasons.

Figure 38: Reaction of farm income to a 10% drop in commodity prices



Source: Authors' calculation based on IFPRI data on farm productivity

Therefore, Ugandan farmers are extremely vulnerable to price shocks. Food price volatility is a major issue for a country in which domestic prices are closely linked to international markets. Negative price shocks can be caused by structural changes, such as increasing input costs, changes in the demand

structure, the expansion of bio-energy production, and also by seasonal changes in availability due to the production cycle and storage constraints. In this analysis we focused only on negative price shocks that are affecting farmers as producers. Many farmers are net buyer of food staples and thus, this analysis deserves some caveats on the net effects of price fluctuations for these farmers.

The analysis factors in both the frequency of small price shocks (average number of months between two consecutive shocks) and severity (percentage reduction in prices). Small shocks are defined as those with more than 10% and less than 30% reduction in prices. Frequencies of small shocks are presented after analysing the monthly series of prices 2008-2015 (see table below). It is important to note that those years have been characterized by relatively high prices and large volatility (particularly in the first half of the period). The analysis in Table 33 also includes the severity and the frequency of large shocks; the frequency is measured as the average number of years between two consecutive shocks.

Coffee is the most risky commodity in terms of prices with the highest frequency of both large and small negative shocks: every 3 years and every 3 months, respectively. The severity of both large and small shocks is among the highest at -49% and -20%, respectively. The other three commodities (maize, cassava and beans) have a similar impact of small shocks (with lower frequency and higher severity for maize). However they differ in the importance of large negative price shocks: beans have no record of such a shock in the period of 2008-15, which could mean that its frequency is beyond the eight year period. Maize and cassava have only one large event in the eight year period. The severity of these large shocks was -34% for maize, and -52% for cassava.

From the perspective of the negative price shocks analyzed in this section, out of the four commodities considered beans is the least risky commodity followed by maize and cassava. Coffee is the most risky commodity with frequent large and small shocks.

Table 32: Average severity and frequency of small and large shocks of selected commodities 2008-15

	Small shocks [-10%,-30%[			Large shocks [-30%, ∞[		
	Avg. severity (%)	Frequency (month)	Avg. Expected value	Avg. severity (%)	Frequency (year)	Avg. expected value
Maize	-21	1/ 7	-3.0	-34	1/ 8	-4.2
Coffee	-20	1/ 2.7	-7.4	-49	1/ 2.7	-18.1
Fresh Cassava	-16	1/ 4.4	-3.6	-52	1/ 8	-6.5
Matooke	-19	1/2.8	-6.8	-41	1/2.7	-15.2
Potatoes	-18	1/4	-4.5	-51	1/8	-6.4
Yellow Beans	-13	1/ 4.6	-2.8	No shocks recorded		

Source: Calculations by Ibtissem Taghouti (IFAD) based on Infotrade data

Based on this analysis, the average annual loss to the agricultural sector in Uganda has been USD 262,226,144, of which 58.75% were borne by Matooke/banana farmers. Losses for coffee, cassava, maize, and potatoes are in the range of USD 19.2 million to USD 31.2 million. No major losses were recorded for beans during the observed timeframe (2008-2013).

4.1.6 Conflict

The insurgency of the LRA as well as armed conflicts in the Karamoja region have exacted a heavy toll on the people living in the Northern Uganda. For example, recurrent cattle raids in Karamoja have led to loss of lives and have undermined local livelihood strategies and discouraged private sector investment. Agriculture, livestock production, artisanal mining, charcoal production, and other income-generating activities had declined, and fewer cows are sold on the market than in previous years diminishing the economic cooperation and trade between communities in Karamoja (Mercy Corps, 2011, p. 8). The cost of the LRA insurgency is even more staggering: estimates for the years 1986-2005 put the total cost of the war at USD 1.7 billion, or USD 85 million annually. (CSOPNU, 2006, p. 8) With many people living in IDP camps and/or not being able to access their land, agricultural production in the North dropped significantly during the conflict years; no exact figures for the production losses are available but it can be safely assumed that a significant portion of overall economic losses of the insurgency are associated with agriculture.

Today, the Northern Insurgency is not an imminent threat anymore. By the end of 2013 the Lord's Resistance Army (LRA), which started its rebellion two decades earlier, had moved from Uganda to the border regions of Congo, South Sudan and the Central African Republic (CAR). While the LRA still poses a risk to the safety of people in Northern Uganda, the risk is mainly confined to small scale incidents and has no major impact on the rural economy of the North as in previous years. Provided that the LRA does not regain its former strength it seems unlikely that the security threat will return.

Howecer, the security risk in the Karamoja region still remains. Despite the disarmament and development processes that have begun to show impact. Cattle raids still occur and pose a threat to the safety and livelihood of many people in the region. The result is a big decrease in the wealth held in livestock. Livestock such as cattle, sheep and goats that are grazed shows the largest implied declines. Poultry, which can be exclusively raised within a compound or village, shows the lowest relative decline in numbers. Interestingly, pig holdings have shown a large increase in numbers in the North except Karamoja where there is no interest in pigs. Overall, the value of the average livestock portfolio declined by roughly 260,746 shillings (USD 86.91), which represents roughly 65% of the average value of livestock holdings and 25.5% of the mean annual consumption (Rockmore, 2014, p. 14). According to the Conflict Early Warning and Response Mechanism (CEWARN) of the Intergovernmental Authority on Development, from 2003 to 2010 2,054 incidents took place that claimed 3,027 lives and resulted in 133,111 cattle raided (USAID, 2011, p. 24). Farm gate prices for cattle were between UGX 300,000 and 400,000, and prices on larger markets such as in Kotido ranged from UGX 350,000 to 500,000. The economic impact of cattle raiding to pastoralist in Karamoja region ranges between USD 1.9 million to 3.1 million p.a.

In the past, the conflict risk also greatly influenced cropping patterns, and in times of insecurity, households favoured crops with short maturation times, crops which did not require repeated work (such as weeding), and crops which are relatively difficult to steal. For example, millet was grown more during the conflict years because it is difficult to harvest making it more likely to survive a raid by the LRA. The production of all other important food crops, such as cassava, beans, maize, or sorghum thus decreased. The large decrease in households growing cassava (-7.4%) is likely due to two factors: first,

relative to other alternatives, cassava takes long to mature. Consequently, in areas where there was the threat of the LRA displacing populations, crops with long maturation periods could leave households without a harvest. Additionally, despite cassava's ability to do well in marginal and stressed environment, its yields crucially depend on weeding with delays leading to yield reductions of over 90%. Insecurity may reduce the ability of households to consistently weed their plots, particularly if these are not located near there homesteads. Beans (-9.7%) and sweetpeas (-1.6%) also require extensive weeding and care. Moreover, these were viewed as crops liked by the LRA since they are easy to harvested and prepared and are very nutritious (Rockmore, 2014, p. 18). Overall, since the return of peace and stability to Northern Uganda, agricultural production has increased in almost all areas. Still, productivity in Northern Uganda is considerably lower than in the rest of Uganda: in 2014 for example, average maize productivity was 1.2 t/ha compared to the national average of 2.3 t/ha (Action Against Hunger, 2014, p. 11). The lower productivity is mostly due to less favorable production and value chain conditions and to a lesser effect the result of the civil war. The economic impact of the insurgency prior to the improvement of the security situation (USD 85 million p.a.), was therefore not included in the overall calculation of annual losses presented in this report.

4.2 Impacts of risks

The impact of the losses described in the previous chapter can be felt on various levels of the agricultural sector: the livelihood of individuals, the sustainability of institutions, and the development of the agricultural sector as a whole.

4.2.1 Impact on livelihood of farmers

Farmers usually turn to relatives and friends in times of need but where droughts and floods occur, due to them being covariate risks, family and friends are likely to be equally affected and thus the community is affected as a whole. In such cases, field research on coping strategies by farmers has revealed that in Kapchorwa and Oyam districts selling of livestock is the most prevalent risk coping strategy applied by farmers in times of natural calamities. Reducing expenditures and food intake are also common reactions by 38% and 23% of people, respectively. It is interesting to note that only few respondents were willing to take out children from school as education for their children is seen as the most important investment for the future (Helgeson, Dietz, & Hochrainer-Stigler, 2012, p. 11).

Table 33: Risk coping strategies by farmers after external shocks

	Total	Kapchorwa	Oyam
Sell livestock	68%	70%	65%
Reducing expenditures	38%	38%	40%
Reduction of food intake	23%	23%	23%
Borrow food	19%	20%	18%
Begging	10%	10%	11%
Sell household items	10%	10%	11%
Change profession	9%	9%	10%
Send children to work	6%	4%	7%
Sell land or home	3%	2%	4%
Take children out of school	2%	2%	3%

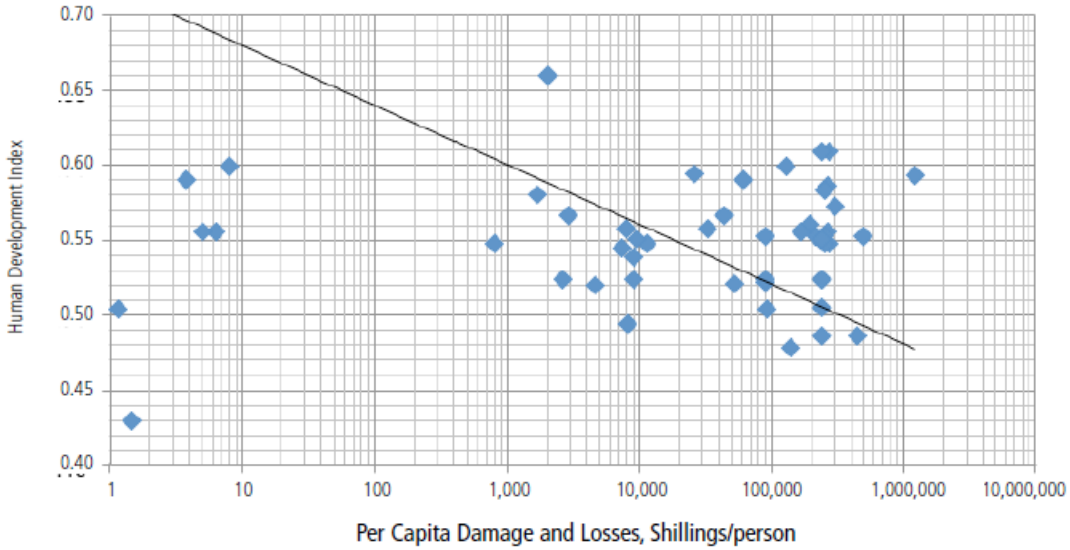
Send children to live elsewhere	1%	2%	1%
Migrate	1%	2%	1%

Source: Centre for Climate Change Economics and Policy (CCCEP)/Grantham Research Institute on Climate Change and the Environment

In the analysis in previous chapters, in most cases only direct economic losses and impact on livelihood were calculated. However, it is important to note that the impact of shocks often permanently damages the farmers' capacity to generate income. The sale of assets such as livestock and land means reduced income sources and income generating opportunities for the farmer in the future The depletion of assets decreases the chances of accessing loans due to a lack of collateral.

The lack of knowledge on risk management and the lack of financial resources often keeps farmers trapped in poverty. Smallholder farmers cannot afford (or are not aware) of risk management tools, and thus get affected more severely by external shocks than more commercial farmers. This, in turn, depletes their assets, leading to permanently reduced income streams, lessening their capacity to invest in risk management. This effect was observed in the 2010/11 drought with the most severe effects of the rainfall deficits felt in districts with the lowest human development conditions. Figure 39 below shows that in general the higher values of damage and losses occurred in districts where the HDI was lowest. In other words, the poor were affected the most (Office of the Prime Minister, 2012, p. 15).

Figure 39: Per capita damage versus HDI by district for the 2010/11 drought



Source: Office of the Prime Minister

Another potential impact on the livelihood of farmers is through the resulting increase in prices of basic food products. For example in the 2010/11 drought, the higher food prices are caused directly by the scarcity due to domestic food production losses and indirectly by speculation from traders due to the drought effects in neighbouring countries. Inflation in 2011 rose significantly partly due to these higher

prices of foodstuffs. Farmers who lost their subsistence crops and did not receive food assistance from the government had to purchase food at higher prices (Office of the Prime Minister, 2012, p. 19).

4.2.2 Budgetary impact of agricultural risk

External shocks often negatively affect macroeconomic aggregates such as GDP, and the fiscal sector. However, it is quite difficult to isolate the impact from other external and domestic issues. For example, it was estimated that GDP growth was reduced by 1.8% in 2010 and 1.7% in 2011 as a result of the drought in 2010/11. The Government of Uganda estimated that the government deficit in 2010 would have been 7.5% lower and the expected surplus for 2011 would have been 7.1% higher if the drought had not occurred. The main reasons are lower tax revenues arising from the production losses in all affected sectors and the increase in expenditures to meet relief and other emerging needs during this period. Such expenditures included food and nutrition assistance, medical assistance, vector control costs, and other similar government disbursements (Office of the Prime Minister, 2012, p. 19).

Table 34: Fiscal implications of the 2010/11 rainfall deficit (in USD million)

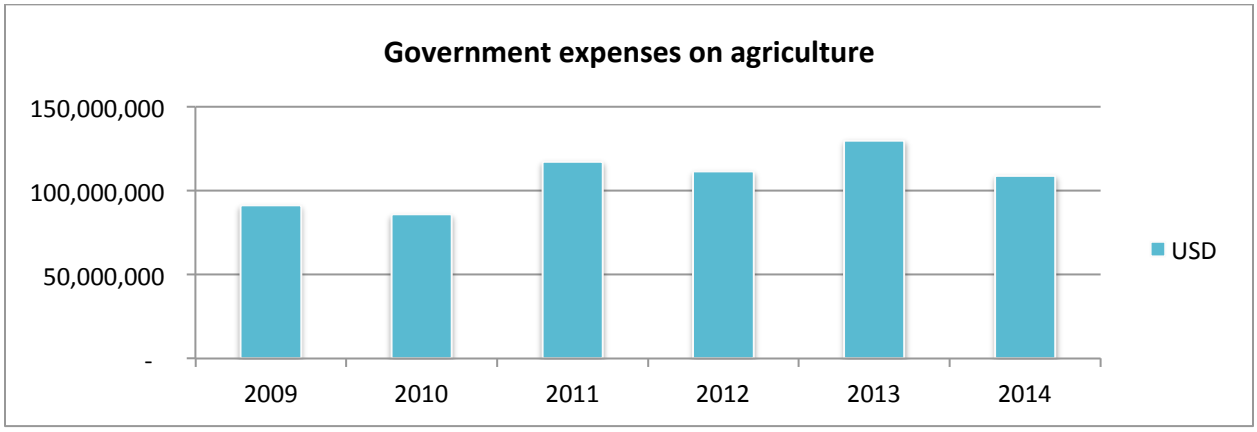
	2010			2011		
	Without rainfall deficit	Estimated losses	After rainfall deficit	Without rainfall deficit	Estimated losses	After rainfall deficit
Tax revenues	1,641.79	5.25	1,636.54	2,023.97	20.77	2,003.20
Expenditures	1,825.98	9.66	1,835.65	1,578.94	8.74	1,587.68
Surplus/deficit	**-184.19**	**14.91**	**-199.10**	**445.02**	**29.50**	**415.52**

Source: Office of the Prime Minister

It is impossible at this stage to quantify the exact impact on Uganda's development due to agricultural risk but it is very obvious that the direct and indirect effect are of major economic impact. A reduced government budget leads to reduced investment which in turn negatively affects employment, economic growth, and many other areas.

Financing agricultural risks is a huge challenge for the GoU. On average, as per the national budget the government has allocated for the agricultural sector is slightly more than USD 107 million (incl. donor contributions), which is lower than the losses derived from agricultural risks.

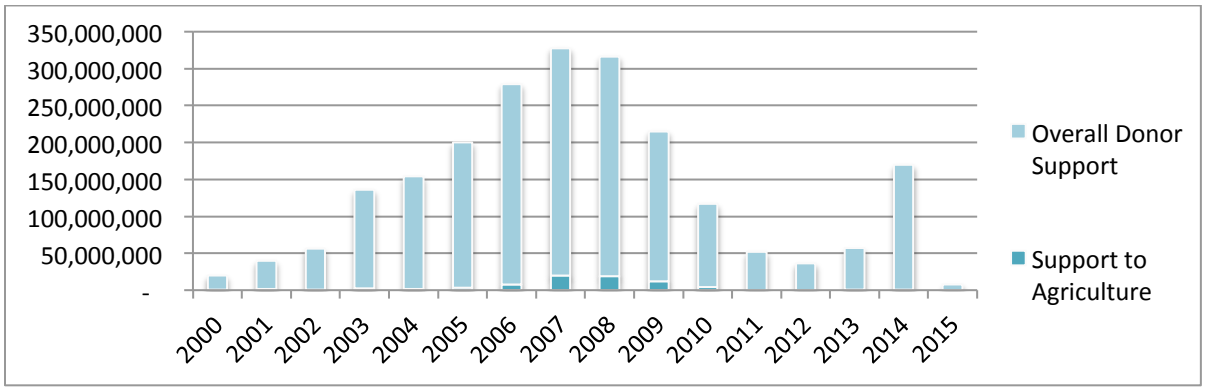
Figure 40: Government expenditures on agriculture in Uganda (2009-2014)



Source: Ministry of Finance, Planning and Economic Development

Not included in the budget figures are emergency and relief programs: after many large scale events, the international donor community provides support to the Government of Uganda. According to UN OCHA, the Government of Uganda received USD 2.18 billion in emergency assistance in the last 15 years of which a very large proportion was used in dealing with the influx of refugees. In the same period, only about USD 75 million were provided for emergency relief for agriculture (3.46% of total emergency relief). On average only about USD 4.7 million was provided in emergency support to farmers through the international community.[15]

Figure 41: Donor support for emergency assistance and for agriculture (2000-2015) in USD



Source: Authors' calculation based on UN OCHA data

All these figures show that there is a large financing gap between the losses that farmers are suffering and the support they are receiving. This means, that the loss burden is, mostly, carried by farmers themselves. Through a coordinated effort on risk management and targeted investment in various risk management tools, the government would be able to significantly enhance the management of these risks and lower this burden. The question therefore is what risks should be tackled first and what risk

[15] This calculation does, however, not include funding provided by agricultural support programs that often also provide direct assistance to farmers in need.

management tools would provide the best cost-benefit ratio for government investment. The following chapter attempts to answer some of these questions

5 Conclusions and recommendations

5.1 Framework for agricultural risk management

The high average annual losses caused by risk factors show that the current risk management practices do not suffice to effectively manage, reduce or transfer the risks. The Government of Uganda has acknowledged this gap and has set the first steps to improve this situation: a working group on agricultural risk management has been established in 2013 under the leadership of the MAAIF, and agricultural risk management is included as a cross cutting issue in the recent ASSP.

This report is written with a view on informing stakeholders on the current status of agricultural risks and to guide the discussion for future policymaking. A first draft was discussed during the Risk Assessment Validation Workshop organized by the Ministry of Agriculture on the 29-30 June 2015, and many comments have been incorporated. The findings of this report should guide the development of a comprehensive risk management policy for agriculture that is foreseen as a key element of the ARM section of the new ASSP.

The development of an ARM policy and the implementation of the policy requires an appropriate institutional set-up. The difficulty is that agriculture faces a broad range of risks that are sometimes interlinked. It is therefore proposed to assign clear responsibilities for agricultural risk management within MAAIF in order to drive the ARM initiative. An ARM focal point is needed to coordinate all relevant stakeholders to ensure that all voices are heard. In order to avoid creating new institutional units and to save cost, it would make sense to simply upgrade the current Early Warning Office (housed in the Planning Department of MAAIF) into an Agricultural Risk Management Unit (ARM Unit). The main scope of work for the ARM Unit would comprise the following:

1. Monitor the effects of weather and disease events across the country and provide farmers and other stakeholders with early warning advice (Note: already ongoing as the current scope of work of the early warning office)
2. Coordinate the development of a comprehensive Risk Management Policy for Agriculture in Uganda
3. Analyze and quantify the risk exposure of the 12 priority commodities set out in the NDP II/SIP (Cotton, Coffee, Tea, Maize, Rice, Cassava, Beans, Fish, Beef, Milk, Citrus and Bananas) and developed cost-efficient risk management strategies for the 12 priority commodities
4. Supervise the execution of ARM projects e.g. capacity building activities, feasibility studies for selected risk management tools (agricultural insurance, warehouse receipts, social security mechanism, etc.)
5. Collect data on all agricultural risks (e.g. market price fluctuations, post-drought and post-flood loss assessments, losses from diseases and pests, etc.)

5.2 Prioritization of risks

This report has shown the severity and frequency of risks that affect the agricultural sector. In addition, large scale events (worst case scenarios) and their impact on the agricultural sector have been analyzed. The following tables summarize the findings from this quantification. The Average Annual Loss (AAL)

provides a good indication on the average damage caused by each risk over the years but looking at the worst case scenario is also important as such large shocks can disrupt the entire economy and lead to significant losses even for years after the event. Most of the risk show high frequencies, meaning that the risks occur on a more or less annual basis with a few particularly bad years in-between (but no years where the risk does not occur at all). Only droughts show a different pattern in frequency as severe shocks occur with a very low frequency (such as the 2010/11 droughts with large economic losses) but medium shocks occur with a frequency of 5.3 years.

Based on the analysis presented in this report, the most important risks to tackle for the agricultural development of Uganda are: (1) crop pest and diseases, (2) price risks, (3) risks related to lack of storage (both weight losses and intra-annual price fluctuations), (4) livestock pests and diseases, (5) droughts, and (6) counterfeit inputs, and (6) droughts. A special case are floods: while the effect of floods on the overall agricultural production are limited, floods do present serious threats to agricultural communities in some locations, particularly in the East. Furthermore, floods have severe impacts on many other sectors outside agriculture (e.g. housing, roads, schools, etc.). Therefore, the low ranking within this assessment does not imply, that floods do not need to be tackled but that this issue is not necessarily a priority for the Ministry of Agriculture but rather of other Government of Uganda entities.

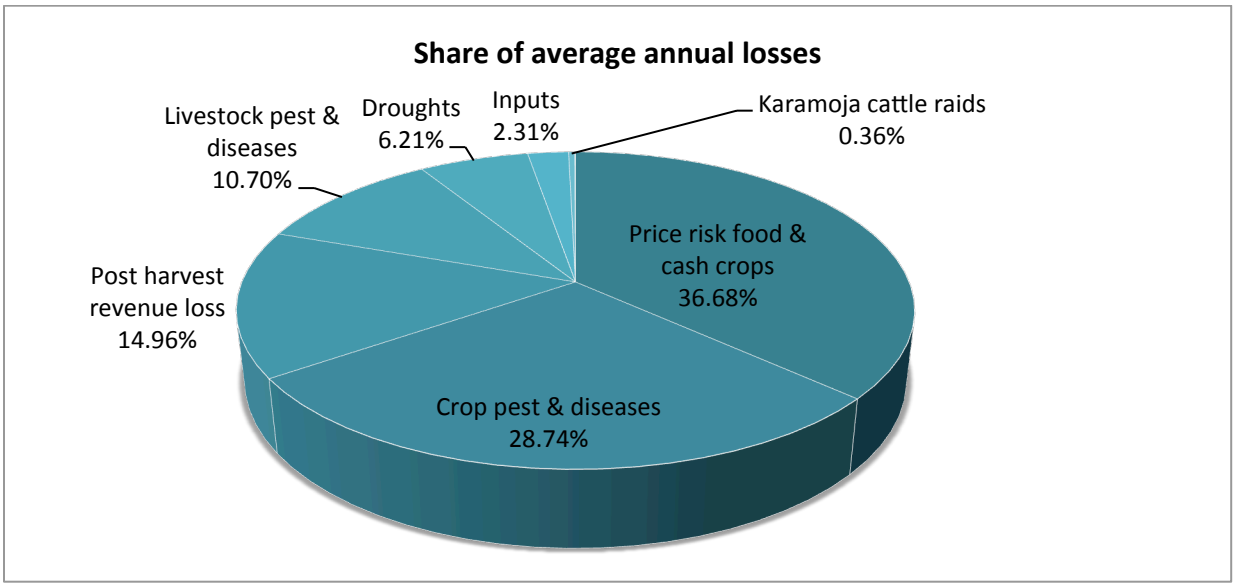
Table 35: Risk scoring for Uganda

Risk	Average Severity	Average Frequency	Worst Case Scenario Severity	Score
Crop pest & diseases	very high	very high	very high	5.00
Post harvest loss	very high	very high	high	4.75
Price risk food & cash crops	very high	high	high	4.35
Livestock pest & diseases	high	very high	medium	4.10
Droughts	medium	medium	very high	3.50
Counterfeit inputs	medium	very high	low	3.40
Karamoja cattle raids	low	high	very low	2.37
Floods	very low	high	very low	1.75
Hailstorms	very low	high	very low	1.75
Thunderstorms	very low	high	very low	1.75
All other natural risks	very low	high	very low	1.75
Northern Uganda insurgency	very low	very low	medium	1.50

Source: Authors' calculation

These 6 risks make up more than 99% of average annual losses in Uganda (Figure 42).

Figure 42: Share of average annual losses per risk



Source: Authors' calculations

The analysis presented above does not yet factor in regional differences in the country. Cattle raiding, for example, might rank lower on the overall relevance for the Ugandan agricultural sector but is clearly a major risk factor for the Karamoja area. Also, the analysis has shown that the drought risk is affecting the Northern areas much more severely and frequently than the rest of the country. Similarly, many floods and landslides are confined to the Eastern region. The following table provides a geographical breakdown of the risks for the 4 regions of Uganda.

Table 36: Geographical breakdown of risk analysis for Uganda

Risk Category	Risk	Western	Central	Eastern	Northern
Input risk	Access to quality inputs				
Weather risk	Droughts				
	Floods				
	Hailstorms				
	Thunderstorms				
	All other natural risks				
Biological risk	Crop pest & diseases				
	Livestock pest & diseases				
Infrastructure risk	Post harvest revenue loss				
Price risk	Price risk food & cash crops				
Conflict risk	Northern Uganda insurgency				
	Karamoja cattle raids				

Note: red indicates a high risks, yellow indicates a moderate risk, and green indicates a low risk

Source: Authors' assessment

Similarly, the analysis at the beginning of this chapter does not yet differentiate between different types of farmers. The crop planted, the livestock held, or the fisheries established determine the risks that

farmers are exposed to. It is obvious that some risks are confined to a specific group of farmers, for example the cattle raid risk to livestock farmers or the hailstorm risk to fruit farmers. Therefore, dedicated risk management strategies for groups of farmers or value chains are needed in order to address the risk exposure of those commodities in a more effective way. For some value chains, for example coffee and dairy farming, risk assessments have already been carried out. Other priority commodities as defined in the upcoming Agriculture Sector Strategy Paper (ASSP) have not yet been analyzed from a risk management perspective. The following table provides an overview of the most important risk broken down to broader segments of the agricultural sector. This analysis can and should be deepened in the future by breaking it further down to commodities.

Table 37: Sub-sector breakdown of risk exposure in Uganda

Risk Category	Risk	Food crops	Cash crops	Live-stock	Fish-eries
Input risk	Access to quality inputs				
Weather risk	Droughts				
	Floods				
	Hailstorms				
	Thunderstorms				
	All other natural risks				
Biological risk	Crop pest & diseases				
	Livestock pest & diseases				
Infrastructure risk	Post harvest revenue loss				
Price risk	Price risk food & cash crops				
Conflict risk	Northern Uganda insurgency				
	Karamoja cattle raids				

Note: red indicates very important risks, yellow indicates a moderate risk, and green indicates a low risk

Source: Authors' assessment

5.3 Improved use of risk management tools

The prioritization of risks based on their severity and frequency is a good starting point for the development of a comprehensive risk management strategy for Uganda. Based on this prioritization, the Government of Uganda can decide which risk management tools show most promise to significantly reduce or manage risk and provide the best cost-benefit ratio for its investments. For example, NARO officials estimated that a funding for the fight against Banana Xanthomonas Wilt (BXW) of at least USD 1 million p.a. could effectively save bananas worth over USD 200 million annually (International Institute of Tropical Agriculture, 2009). Unfortunately, so far only a few tools have been analyzed concerning the risk reduction potential or the internal rate of return (IRR): for example, the potential for reducing drought risk through improved irrigation has been analyzed. Interestingly, as opposed to many other Sub-Saharan countries in Uganda the potential for small-scale interventions is even higher than large-

scale projects. The calculated internal rate of return (IRR) for small-scale irrigation is 32%, while the IRR for larger dams is only 2.36% (Cenacchi, 2014, p. 17).[16]

Analysing the exact cost benefit-ratio or IRR of various risk management tools will require further research. This analytical work is very important in order to develop a sound basis for policymaking and to decide which investments will generate the largest possible benefits. In this context it is important to remember that risks can often not be tackled in isolation: adverse weather often directly leads to pests and disease, or low quality inputs directly affect markets prices as farmers only produce low quality fruits. In such scenarios, the best combination of risk management tools has to be explored. The following table provides an overview on risk management tools that might be suitable to improve risk management in the Ugandan context (based on the risk prioritization in the previous chapter).

Table 38: Risk management tools for Uganda

Ranking	Risk	Risk management option
1	Crop pest & diseases	Information systems & early warning; Improved varieties; Improved farmer trainings & advice (extension services); Improved farm management practices; (Agricultural insurance);
2	Price risk food & cash crops	Commodity exchange; Market Information systems; Government sponsored price stabilization; Strategic reserves;
3	Livestock pest & diseases	Early warning systems; Improved farmer trainings & advice (extension services); Improved veterinary services; (Agricultural insurance)
4	Post harvest weight loss & intra-annual price variations	Warehouse & storage facilities; Improved farmer trainings & advice (extension services); Warehouse receipt systems; Market information systems;
5	Droughts	Information systems & early warning; Adaptive agriculture; Improved water management; Agricultural insurance; Social safety nets;
6	Access to quality inputs	Information systems; Input certification systems;
7	Karamoja cattle raids	Community development; Security policy;

[16] This is relevant, as a large survey of past irrigation projects in 50 countries worldwide estimated that projects with an IRR of less than 10 percent resulted in failure of the scheme

8	Floods	Watershed management; Agricultural insurance;
9	Hailstorms	Agricultural insurance;
10	Thunderstorms	Agricultural insurance;
11	All other natural risks	(Agricultural insurance);
n/a	Northern Uganda insurgency	Security policy

Source: Authors' assessment

Risk management is a combination of risk reduction, risk transfer, and risk coping tools. Reducing risk exposure of farmers is sometimes often and provides in many cases the best cost-benefit ratio for government investment. It is, however, not possible to completely eliminate the risk exposure of farmers, often because the cost of risk reduction is outside the government budget limits, e.g. expanding irrigation systems to every household in the country. Some risks can be managed best by farmers directly at the household level provided they have access to appropriate tools. In these cases it is important that farmers have the opportunity to transfer some of the residual risk, for example to the insurance markets. But even in systems with risk reduction and transfer systems, large scale events can still harm the population at large. For these events, risk coping mechanism have to be established, such as social safety nets. The following paragraphs highlight some critical issues related to the use of risk management tools in Uganda and provides recommendations for next steps.

5.3.1 Risk reduction

5.3.1.1 Information systems and early warning

The basis for policy development and the design of intervention strategies is information. Evidence-based policy-making requires the systematic collection of data from various sources such as the statistics department of MAAIF, the meteorological department, and other sources. In order to design risk management interventions information needs to be collected on production (volumes, yields, quality, etc.), weather (climatic conditions around the country, both for early warning purposes and ex-post analysis), markets (prices, volumes traded, etc.), pre- and post-harvest losses, etc. An assessment carried out by MAAIF with the support of PARM found that various information systems on a range of issues (e.g. weather, prices, diseases) exist but that these systems are disjointed and not integrated. This leaves farmers which numerous sources of information which can result in confusion. There is, therefore, a need to coordinate and harmonise approaches and bring efficiency, coherence and synergy to this diversity of EWS in the country and build a sustainable comprehensive system.

Improving data collection and analysis of risk related information is one important strategy to reduce the risk of pests and diseases for both crops and livestock, as well as for reducing losses due to intra-annual price fluctuations. A key issue for improving information systems and early warning is the dissemination of information to smallholder farmers which is currently often lacking. More partners in the agriculture value chain should be encouraged to provide information to farmers, for example the Uganda National Agro-Input Dealers Association and Uganda Seed Trade Association.

5.3.1.2 Storage, warehouse receipts, and price stabilization

Crop farmers suffer major losses through low quality storage and low prices for bad quality produce. In recent times, a number of programs such as the Karamoja Livelihoods Programme (KALIP) have started to direct their focus on supporting low-cost storage improvements. The results from these initiatives are very encouraging and return on investment for farmers is considerable. It is important to expand these initiatives to all areas of Uganda and to improve the capacity of farmers to store their produce. In combination with improved market information systems, these upgrades have large potential to benefit in particular smallholder farmers.

In addition to small-scale storage improvement, the warehouse system in Uganda is currently also not functioning well. While some private sector initiatives, for example by the EAGC, are positively transforming the markets in selected locations, the country at large remains in need of improved warehouse systems. Further analysis on how to revitalize the system, potentially, in combination with improving trading of major food crops on the Uganda Commodity Exchange (UCE) is required.

In addition to this, the price fixing of major commodities (both food and cash crops) through the Ugandan government is another risk management instrument that could reduce losses of farmers due to inter-annual price fluctuations. However, the experience in other countries has shown that the potential welfare gain on the level of smallholder farmers can easily be outweigh by the cost to government and inefficiencies in the system due to corruption or other constraints. An interesting case is the price stabilization mechanism for cotton in Uganda: a recent FAO study concluded that the price incentives failed to overcome the constraints facing the cotton sector. The policy-generated incentives do not shield cotton producers against the volatility and low prices in the world markets. (FAO, 2014, p. 33). Only after careful examination of potential benefits and costs should such a mechanism be considered.

5.3.1.3 Improved agricultural practices

It is critical to raise awareness of farmers on their individual risk exposure and on the best way to protect their livelihoods. This requires well trained and informed extension officers that can provide practical advice to farmers. Integrating risk management into the core extension messages is important to help farmers understand how they can reduce, transfer, or cope with risks.

In addition, developing appropriate, safe, climatic change resilient and cost-effective agricultural technologies requires a sound understanding of how new technologies affect the risk exposure of farmers. Improving the understanding on risk management of people working for the National Agricultural Research System (NARS) is an important precondition to ensure that new technologies do not cause unintended side effects that increase farmers risk exposure and losses.

5.3.2 Risk transfer

5.3.2.1 Agricultural insurance and access to finance

As has been shown in chapter 3.3.3.1, agricultural insurance is on the rise in Uganda. The current outreach, mainly of the Kungula product, still leaves much room for further increasing insurance penetration amongst farmers. The discussion on the potential of agricultural insurance is still at an early

stage in Uganda: risk transfer is an important element within any risk management strategy. However, expectations on the potential of insurance have to be realistic. There is scope to develop insurance against droughts, floods, hailstorms, and other natural disasters. However, pests and diseases, particularly for crops, are often a farm management problem rather than an unexpected or unforeseeable event. For such cases agricultural insurance is not the right solution as insurers will not be willing to provide such cover. In addition, agricultural insurance for events with high frequencies (return periods of only a few years) are, potentially, expensive and farmers might not be willing to purchase such products.

Further analysis of the current constraints and opportunities for agricultural insurance should be carried out. Based on this analysis the Government of Uganda has to decide on how to best enhance the performance of agricultural insurance markets and other risk transfer mechanisms. Government policies may be required (either directly through the value chain or indirectly through the financial sector should be explored together with the provision of other services) to facilitate farmers transferring of some of their risk.

Overall, agricultural insurance also has the potential to unlock investment opportunities in rural areas, in particular in combination with agricultural finance. By transferring some of the risk exposure away from farmers, banks and financial institutions might be more willing to provide credit to the agricultural sector.

Initiatives to reduce risk (described in the previous chapter) and to transfer some parts of the risk to markets, will also help to make farmers more bankable. The current drive by some banks and other financial institutions as well as the Agricultural Credit Facility to expand agricultural lending are positive signs that the financial sector begins to realize business opportunities in agriculture. Still, many farmers struggle to access financing. Similarly, savings mobilization is also on the rise but not all farmers have yet access to sound financial institutions to deposit their money. Building up a sufficient capital base to cope with risk is important for farmers to ensure continuous production even after experiencing an external shock. It is therefore needed (a) to train staff of financial institutions to better understand and analyze the risks faced by farmers, (b) to develop products tailored to the needs of farming enterprises (factoring in the risk exposure of the enterprises), (c) to increase use of modern technology to reach out to farmers in rural areas, and (d) to ensure refinance is available to financial institutions venturing into the agricultural sector.

5.3.3 Risk coping

5.3.3.1 Social safety nets

Despite improved risk management, large scale events are likely to affect farmers also in the long run. It is currently not well-defined how the social security system has to be designed to ensure that farmers can best cope with risks. In the past, many emergency response programs have supported after external shocks. It is high time to analyse this experience and to decide ex-ante what support mechanisms for farmers are established for times of distress. This helps to avoid profiteering after disasters from

criminal groups or individuals and ensures that the help really reaches to smallholder farmers that have been affected most by a shock.

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Annexes

Annex 1. Methodology to quantify the severity and frequency of risks

Wherever possible this study used results of reputable studies and documents to quantify the severity and frequency of shocks. For the majority of risks, however, either no quantification had been carried out in the past or only certain aspects of a risk had been analysed (for example, for a specific geographical area only). Furthermore, this study relied on multiple sources of data and information that were not always consistent in the results. The limitations concerning available datasets also meant that the calculations sometimes had to use a number of assumptions or use plausibility considerations. An additional concern is the non-availability of long-term time series and the analysis is, therefore, only limited to the last decade or 15 years. Clearly, this skews the results to overestimate the overall effect of risks that have shown a comparatively high frequency in recent years. The following paragraphs described the methodology used for the effect of those risks that had previously not been quantified in other studies/documents.

A1.1. Weather

The main basis for the analysis of weather risks was the databased produced by the Prime Minister's Office. The databased has only been established in 2010. All data points prior to that year have been imputed manually from exisiting records. This might be the reason why data entries become less and less frequent for all the years before 2000. The analysis therefore mainly considered the last two decades.

A major problem in the PMO dataset is that the economic impact of the different risks is (mostly) not recorded as far as agricultural production is concerned. The only way to estimate damage is to use the asssessment of area damaged (in ha). But even the area damaged is, likely, to be underestimated. For example, the total area damaged by floods in 2007 is 6,295 ha according to the PMO database. An FAO/WFP assessment of the flood damage estimates a total area of 48,583 ha for Amuria and Katakwi districts in the first season alone. But as there is no other comprehensive and reliable source of information is available, the PMO database was used to assess the economic damage of all weather risks except droughts (see notes on droughts hereafter). The area damaged was then multiplied with a loss factor per ha (or per animal) derived from the UNISDR Global Assessment Report on Disaster Risk Reduction (GAR): USD 94.87/ha (or TLU).

Calculating the impact of droughts from the PMO database was not possible as the effect of droughts on agricultural production and area planted are not recorded in the database. The economic impact of droughts was therefore mainly based on assessment reports of the drought periods 2005-2008 and 2010-11 by the Government of Uganda. This clearly skwes the analysis as only periods with a relatively high occurence of droughts (2005-2011) have been looked at. To compensate for this bias, in the frequency analysis the records of the EM-DAT database have been used; this database includes records for the last 100 years. Unfortunately, only very little economic data is available for Uganda. Therefore, the frequency of events was calculated using the series on number of people affected as a proxy for

economic damage. An additional problem for the calculation of drought impact is the difficulty to define a drought event: small scale events such a rain deficits in only a few villages/parishes have not been included in the analysis (as data was simply not available). The drought analysis, therefore, mainly focused on large scale events.

A1.2. Pests & diseases

The economic impact of crops and diseases on crop production has been estimated by the Ministry of Agriculture. The impact on animal production, however, had to calculated using plausibility considerations. For this analysis a number of limitations, most importantly the focus of the analysis on cattle (due to data limitations).

The National Livestock Research Institute has calculated the average cost of diseases per household and cattle head for three major agro-climatic zones: that farmers suffered annual average economic cost due to diseases per head of cattle was USD 14.27 for farmers in semi-humid agro-pastoral land, USD 5.31 in humid mixed crop-livestock systems, and USD 7.62 in semi-arid pastoral systems. The 2008/09 agricultural census and subsequent estimates of cattle heads in the country are based on districts and regions, not on agro-climatic zones. The only pragmatic approach was to match regions with the predominant agro-climatic system in each region. The following provides the overview on the matching.

Agro climatic zone	Region
semi-humid agro-pastoral system	Eastern
humid mixed crop-livestock system	Central
semi-arid pastoral system	Western

The cost per cattle head of each region was then multiplied with the cattle headcount for the corresponding region. As no average cost per head was available for the agro-climatic zone of the North, an average was calculated for all the other regions and multiplied with the cattle headcount of the Northern Region.

A1.3. Infrastructure

The economic impact of harvest losses was assessed based on weight loss estimates provided by the Africa Post Harvest Loss Information System for the years 2004 to 2012 for maize, millet, and sorghum. For barley, rice, and wheat information was available for the years 2008 to 2012 only. The lost production for each crop and year was multiplied with the average annual price for each crop during the corresponding year to generate an estimate of the monetary loss. As no estimates for post harvest losses at district level were available, it was not possible to use market prices as recorded in district markets. The analysis simply relied on market prices as recorded in Kampala.

Another difficulty in the calculation of post harvest losses was the issue of price risk versus weight loss risk: in a separate calculation we therefore estimated the severity of each risk compared to the other risk. The calculation simply used a real case scenario in 2013/14 for which data was aavailable: we compared a situation where a farmer would sell all of his/her crops after the harvesting season at a comparativley lower price (using real market price data of that period) and then compared it to a

situation after 30 days, 60 days, and 90 days where a farmer had already lost a portion of his/her harvest (based on FAO/WFP reports) and sells all of the remaining harvest at the prevailing spot price. The calculations showed that the weight loss effect in the calculated scenario is much larger than the price effect. It has to be noted that this conclusion might not be valid for all crops and all years. But for simplicity reasons we assumed that the weight loss effect is more significant than the price loss effect; in the calculations of the economic impact we therefore focused on the weight loss effect as described in the previous paragraph.

A1.5. Prices

For the statistical analysis of prices the coefficient of variation (CV) has been calculated, which measures the degree of variability of prices and yields time series. The Coefficient of Variation (CV) is the standard deviation divided by the mean and its main advantage is that is can be compared across variables that are measured in different units, for instance a CV of prices can be compared with a CV of yields or revenues. In the analysis of this report we used data of prices and yields of the last eight years starting from 2008 until 2013.

The analysis looks at both seasonal variations and variations between the years. Intra-annual variability is calculated for the 12 months of each year. Inter-annual variability is calculated for the average price across the 8 years.

For the calculation of average annual losses in the price risk section we only considered larger shocks (above 30%) between the years. The smaller shocks (between 10% and 30%) during the year do not necessarily affect all farmers. It was not possible to find data on the quantities sold for each crop to assess the exact value of losses for farmers due to seasonality of prices. Furthermore, the seasonal price risk is dealt with in the chapter on infrastructure risk.

For the calculation of losses due to annual price risk we analysed the average severity and frequency of shocks to derive an average expected loss ratio. This ratio was multiplied with the average production volume and average price for each commodity during the period 2008-2013.

Table 39: Large Price Shocks

	Large shocks [-30%, ∞[					
	Avg. severity (%)	Frequency (year)	Avg. expected value	Average production volume 2008-2013	Average price (USD) 2008-2013	Average annual loss
Matooke	-41	1/2.7	-15.2	4,481,173,833	0.2262	-154,068,970
Cassava	-52	1/7	-6.5	2,890,651,333	0.1663	-31,250,253
Maize	-34	1/7	-4.2	2,512,679,000	0.1821	-19,221,693
Potatoes	-51	1/7	-6.4	1,864,162,000	0.2503	-29,864,770
Beans	No shocks recorded			918,527,666	0.4573	-
Coffee	-49	1/ 2.7	-18.1	182,171,520	0.8437	-27,820,457
Total						-262,226,144

A1.6. Notes on risk scoring

Risk analysis was carried out first by looking at the average severity and frequency of shocks as well as the worst case scenario.

The following table provides an overview on average severity and worst case scenarios for each risk:

Table 40: Severity of Risks (Estimated losses in US $)

Risk	Avg. Annual Losses	Worst Case Losses
Counterfeit inputs	16 550 000	22 400 000
Droughts	44 402 581	383 454 390
Floods	166 271	1 307 554
Hailstorms	68 377	497 322
Thunderstorms	20 974	284 996
All other natural risks	9 296	107 515
Crop pest & diseases	205 500 000	298 000 000
Livestock pest & diseases	76 524 483	76 524 483
Post harvest revenue loss	106 923 541	140 703 396
Price risk food & cash crops	262 226 144	1 295 750 917
Northern Uganda insurgency	0	85 000 000
Karamoja cattle raids	2 542 196	3 177 783

In addition, a risk score for the frequency of shocks has been assigned as well. The frequency as described in chapter 4.1 as well as the average severity and the worst case scenario were scored using the following ranking:

Risk scoring was carried out by using the following point system:

Table 41: Risk scoring template

Average annual losses (AAL)	Frequency of shocks	Worst case scenario (PML)	Score
very low (--) = < 1 m	very low (++) > 25 yrs RP	very low (--) = < 10 m	1
low (-) = 1 m to 5 m	low (+) = 10 yrs to 25 yrs RP	low (-) = 10 m to 50 m	2
medium 5 m to 50 m	medium = 5 yrs to 10 yrs RP	medium 50 m to 150 m	3
high (+) = 50 m to 100 m	high (-) = 2 yrs to 5 yrs RP	high (+) = 250 m to 150 m	4
very high (++) > 100 m	very high (--) = annual	very high (++) > 250 m	5

The scores were weighted based on the following formula to reflect the greater importance of average losses as a better indicator for the long term cost of risk:

Risk Score = 0.75 * (Average Severity * Frequency)^0.5 + 0.25 * Worst Case

The following table provides the results of the risk scoring:

Table 42: Risk scores in Uganda

Risk	Average Severity	Frequency	Worst Case Scenario	Score
Counterfeit inputsCrop pest & diseases	5	5	5	5.00
Post harvest loss	5	5	4	4.75
Price risk food & cash crops	5	4	4	4.35
Livestock pest & diseases	4	5	3	4.10
Droughts	3	3	5	3.50
Counterfeit inputs	3	5	2	3.40
Karamoja cattle raids	2	4	1	2.37
Floods	1	4	1	1.75
Hailstorms	1	4	1	1.75
Thunderstorms	1	4	1	1.75
All other natural risks	1	4	1	1.75
Northern Uganda insurgency	1	1	3	1.50

Annex 2: Price trends in in selected commodities from Uganda

Figure 43. Potatoes (2008-2015)

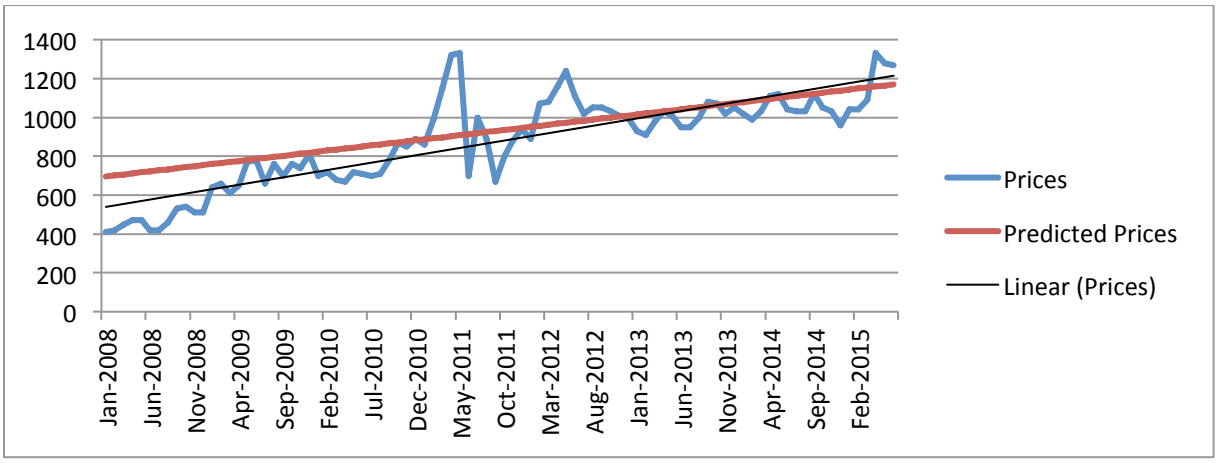


Figure 44. Matooke (2008-2015)

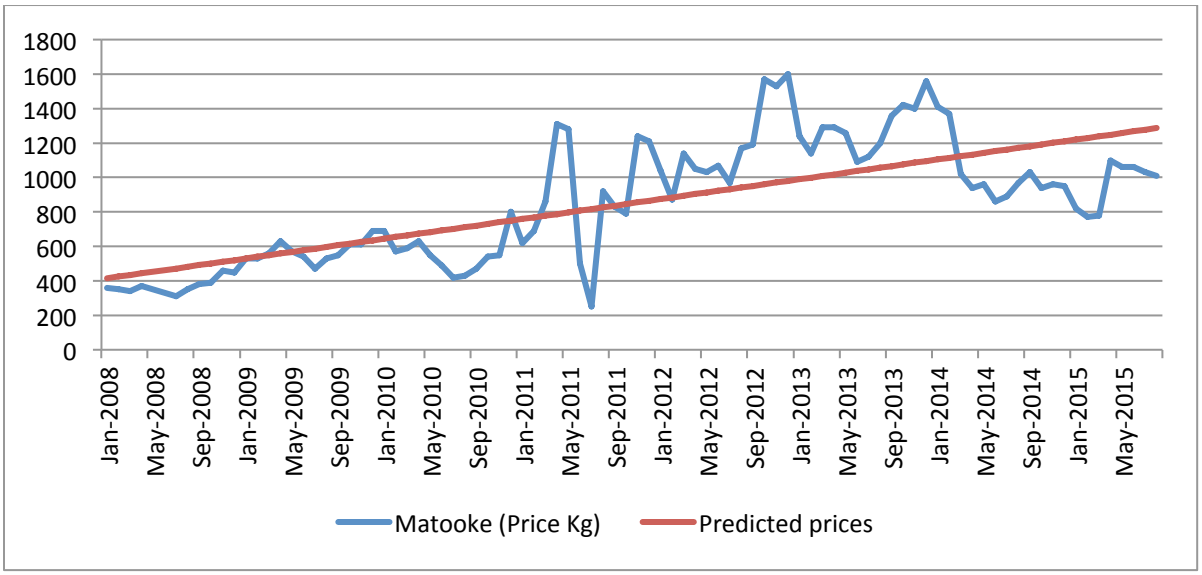


Figure 45. Maize (2008-2015)

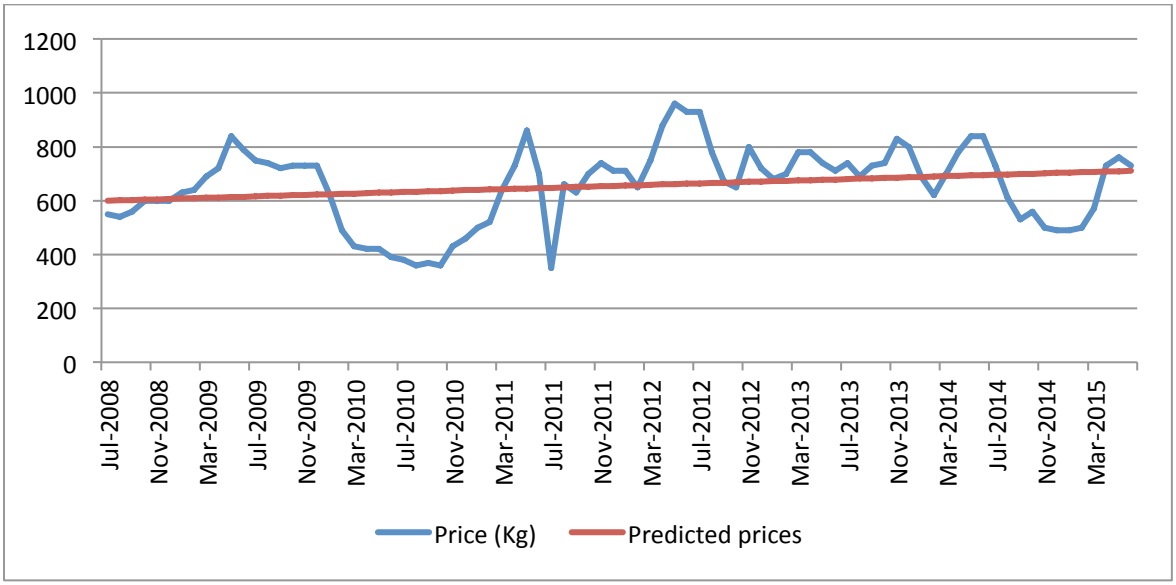


Figure 46. Fresh cassava (2008-2015)

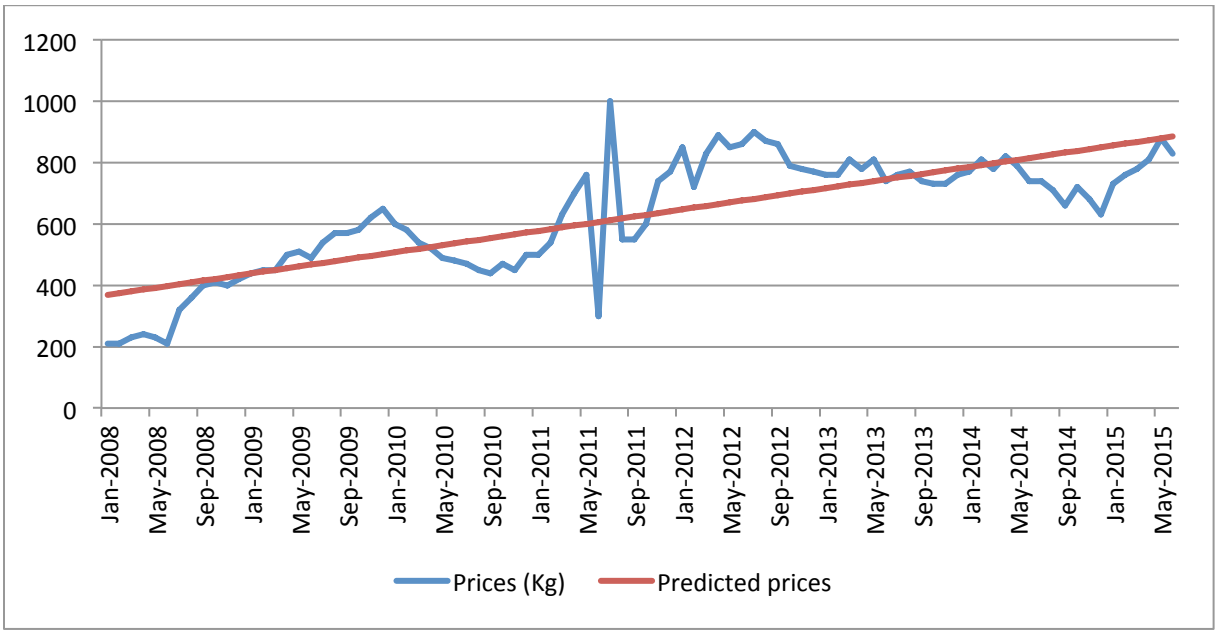


Figure 47. Coffee (2008-2015)

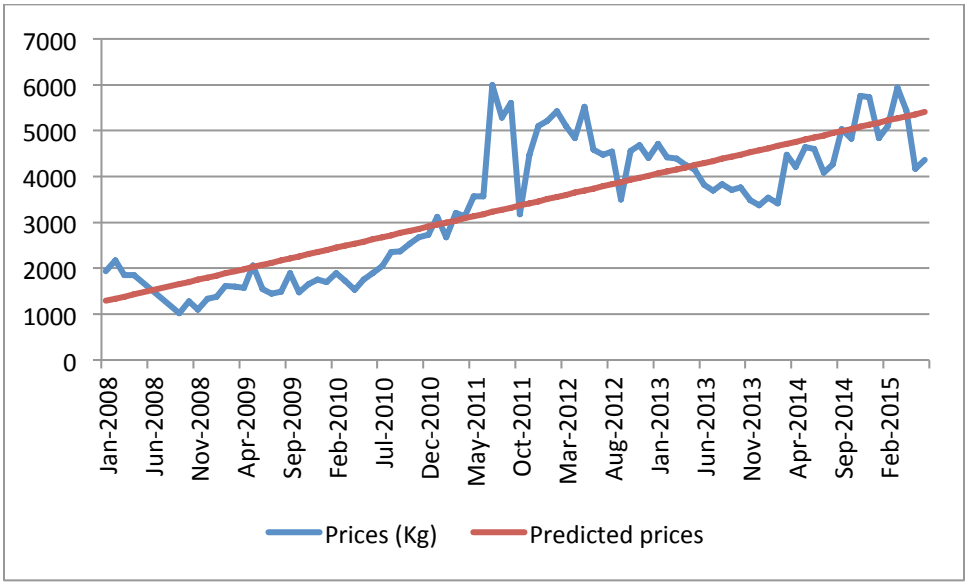


Figure 48. Yellow beans (2008-2015)

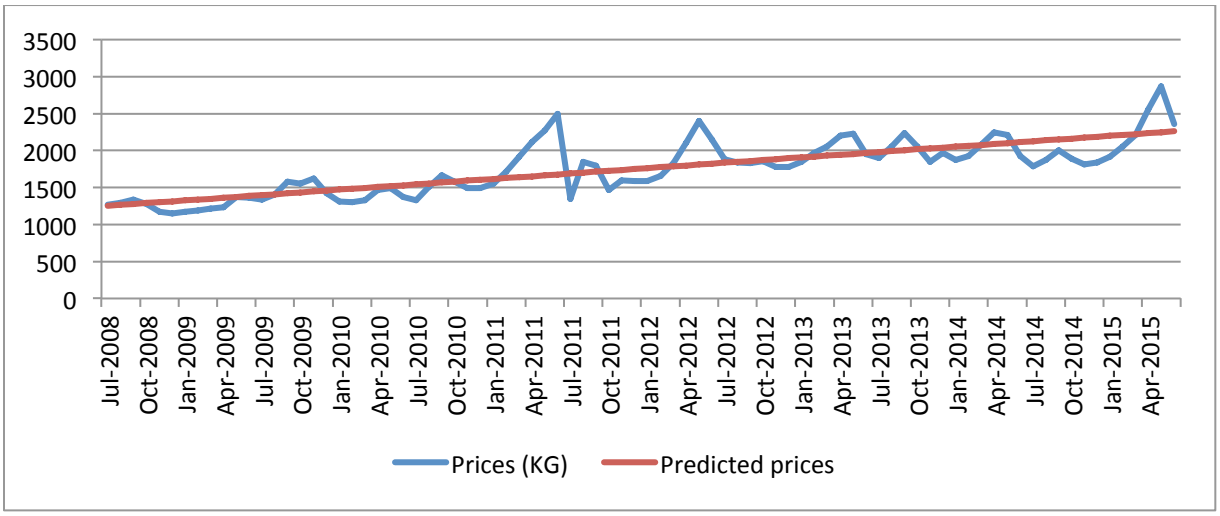


Figure 49.Upland Rice

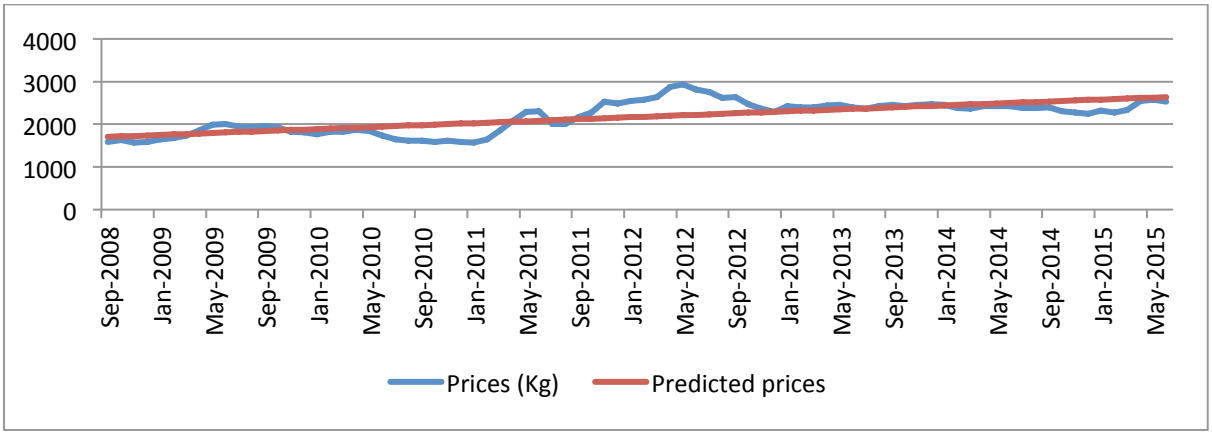


Figure 50. Cow Peas (2008-2015)

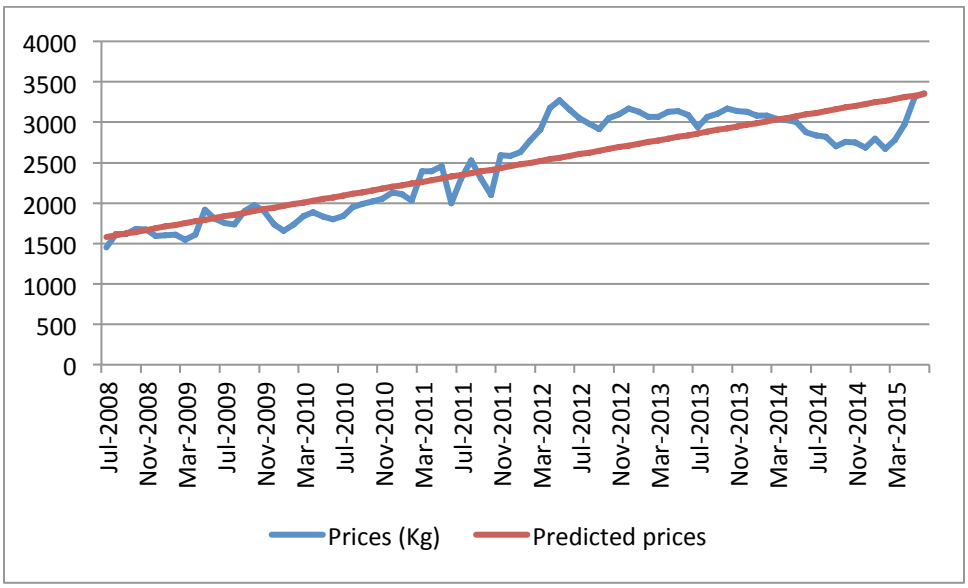


Figure 51. Tea (2008-2015)

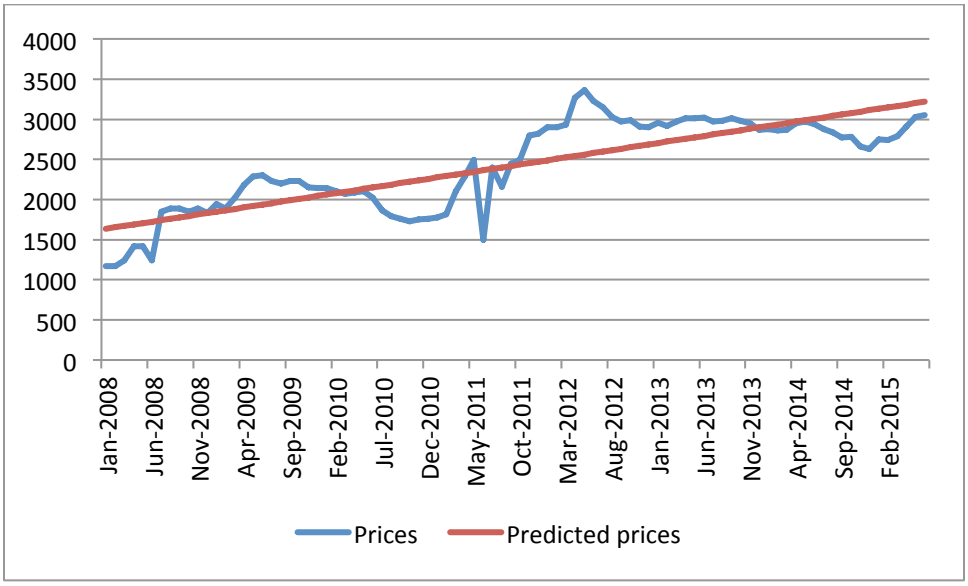


Figure 52. Sorghum (2008-2015)

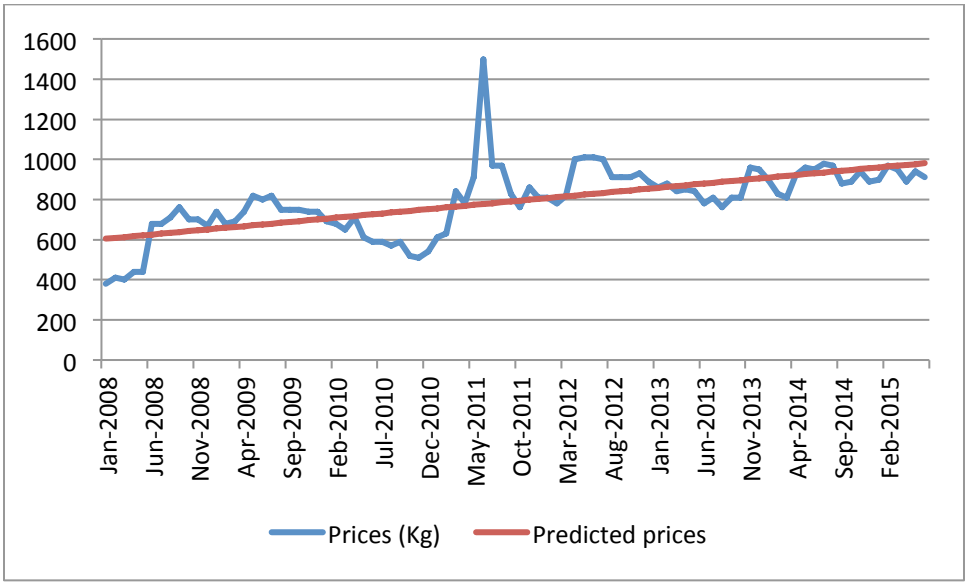


Figure 53. Sunflower (2008-2015)

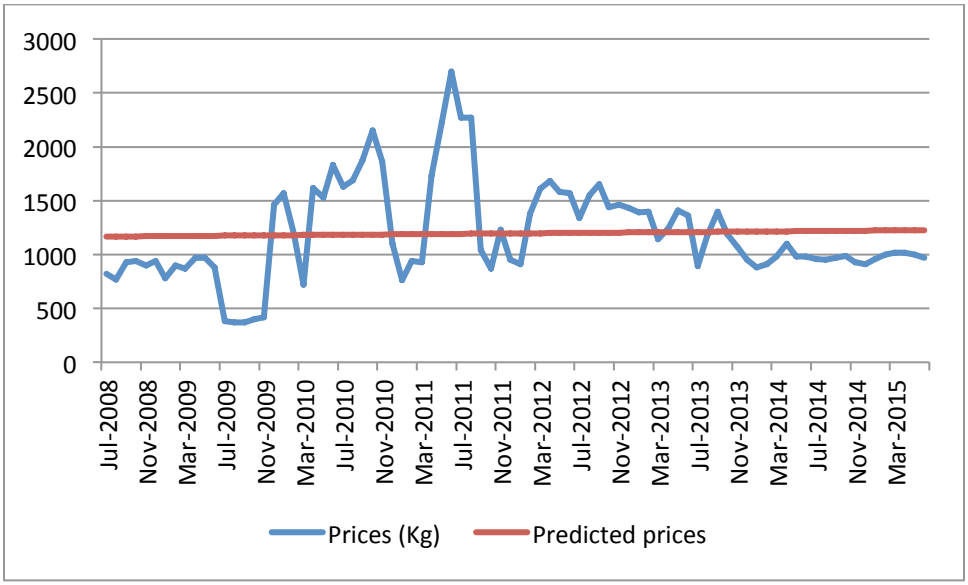


Figure 54. Soya beans (2008-2015)

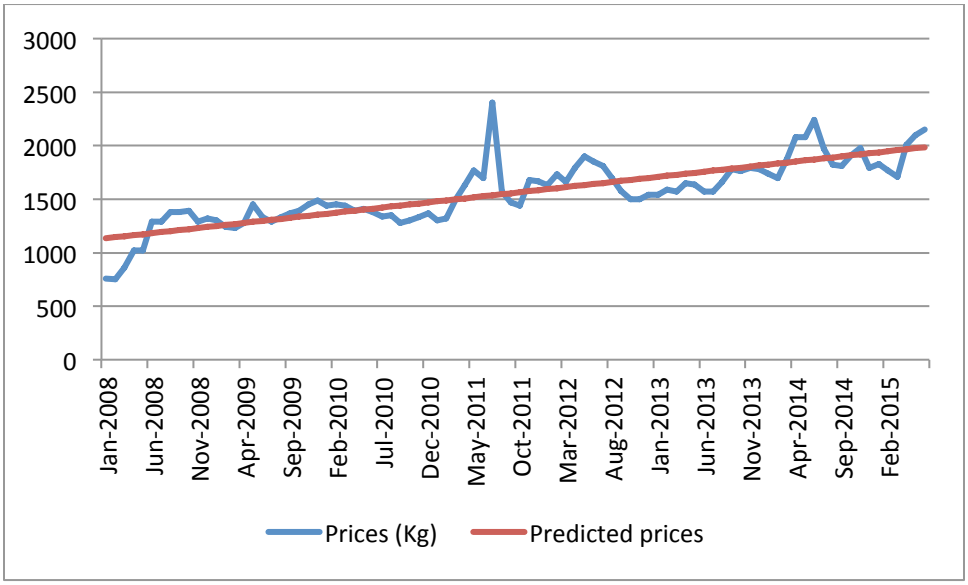


Figure 55. Groundnuts (2008-2015)

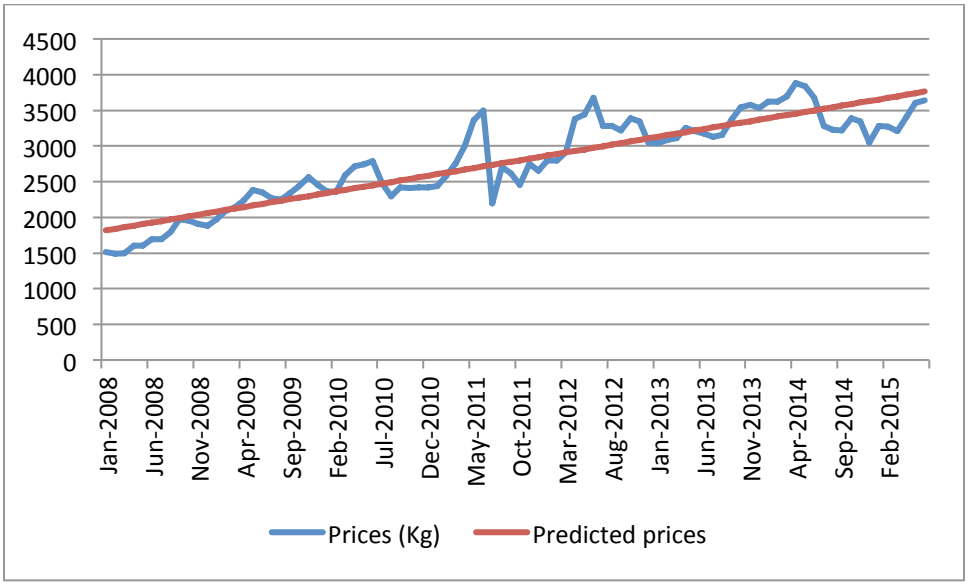
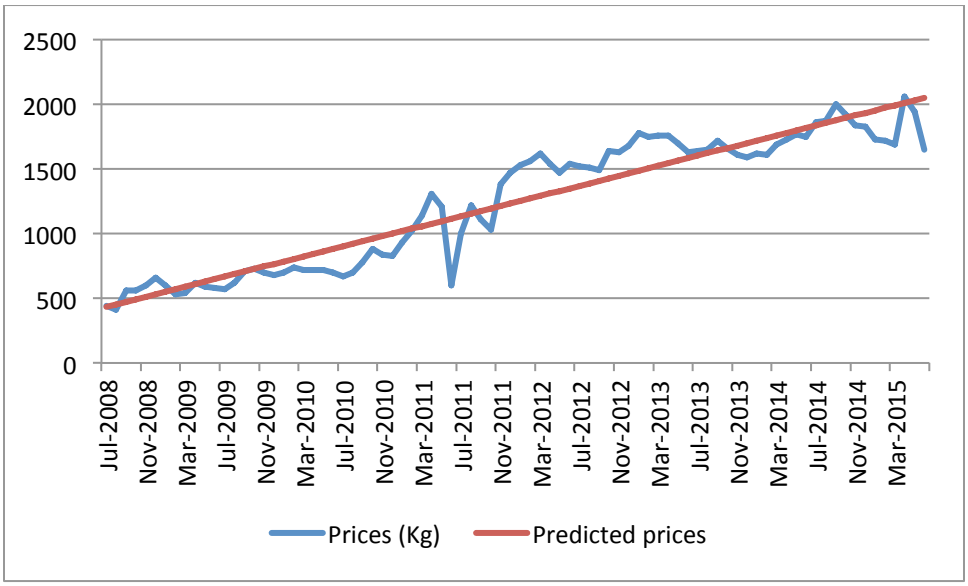


Figure 56. Apple Bananas (2008-2015)



What is PARM?

The Platform for Agricultural Risk Management (PARM), an outcome of the G8 and G20 discussions on food security and agricultural growth, is a four year multi-donor partnership between the European Commission, the Agence Français de Development, the Italian Government, the International Fund for Agricultural Risk Management and the New Partnership for Africa's Development (NEPAD) with developing nations to make risk management an integral part of policy planning and implementation in the agricultural sector, within the Comprehensive Africa Agriculture Development Programme (CAADP).

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