Platform
for Agricultural
Risk Management

Managing risks
to improve farmers'
livelihoods

Risk Assessment

PARM
PLATFORM FOR AGRICULTURAL RISK MANAGEMENT

Ethiopia

Agricultural Risk Assessment Study

Full Report December 2016

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AGRICULTURAL RISK
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Study Conducted by
Natural Resources Institute,
University of Greenwich, United Kingdom

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). The German cooperation supports PARM through an agreement KfW-NEPAD. Current work supports ARM assessment and policy process in Cabo Verde, Cameroon, Ethiopia, Liberia, Mozambique, Niger, Senegal, Zambia and Uganda.

This Risk Assessment Study is part of the ARM process in Ethiopia. The report was coordinated by **Dr Gideon E. Onumah** from the Natural Resources Institute (NRI, University of Greenwich). The study has benefited from analysis and support from Dr Ilaria Tedesco (NRI) and Hanneke Lam (NRI). Robel Daniel (an independent consultant) and Elias Gossaye (of ATA), both based in Ethiopia, were instrumental in obtaining valuable data from national institutions.

The Government of Ethiopia and, in particular, the **Agricultural Transformation Agency (ATA)**, has also contributed to this report with inputs and suggestions. PARM thanks the engagement of the ATA and the Ministry of Agriculture and Natural Resources (MANR), and in particular Laketch Mikael (Senior Director for Environmental Sustainability and Inclusive Growth at ATA) and Dr. Wagayehu Bekele (Director for Climate Change Adaptation and Mitigation at ATA) for their useful suggestions and active role in this study and in leading the organization of the Agricultural Risk Management Validation Workshop in Addis Ababa on the 16-17 December 2015. Amen Geleta Dankul provided very valuable support in the organization of this workshop, during which many stakeholders were able to contribute to this report through their active participation in the discussions.

Preface

Ethiopia has embarked on a process of agricultural growth and transformation which envisages accelerated and sustainable growth and greater integration of the sector into national and global markets. Nevertheless, because smallholder agriculture, which comprises over 90% of agricultural production in Ethiopia remains exposed to various risks (variable weather, livestock disease outbreaks, crop pests and diseases, agricultural output price volatility and uncertainty in input-output price ratios), farmers' capacity to manage such risks must be developed if agricultural transformation is to be realized. As such, promotion of better Agricultural Risk Management (ARM) is considered to be a key aspect of agricultural transformation in Ethiopia. The study of sources of risk and related tools as well as the methodical prioritization of action as provided in this Risk Assessment Study is an important input to defining action within the Agricultural Transformation Agenda to unlock systemic bottlenecks and catalyze fundamental change in the sector

The Ethiopian Agricultural Transformation Agency (ATA); a government of Ethiopia's initiative established with primary aim of promoting agricultural sector transformation has collaborated with the Platform for Agricultural Risk Management (PARM) to develop a roadmap for promoting ARM in Ethiopia with its first important action represented by a comprehensive analysis of agriculture risks affecting smallholder farmers. This report provides the main findings of such an analysis undertaken by the National Research Institute (NRI) of the University of Greenwich (UK). ATA appreciates this comprehensive risk assessment that has served as a spring board for further consideration of the issue and planning of Transformation Agenda interventions in the country as they relate to ARM. ATA would also like to extend gratitude to PARM for coordinating and supporting the realization of this study.

Khalid Bomba
CEO, Ethiopian Agricultural Transformation Agency (ATA)

Addis Ababa, December 2016

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List of acronyms

AEZ	Agroclimatic Ecological Zone
AfD	Agence Française de Développement
AISCO	Agricultural Input Supply Corporation
AISE	Agricultural Inputs Supply Enterprise
AMSAP	Advanced Maize Seed Adoption Program
APHLIS	African Postharvest Losses Information System
APHRD	Animal and Plant Health Regulatory Directorate
ARM	Agricultural Risk Management
ATA	Agricultural Transformation Agency
BFCU	Bacho Farmers' Cooperative Union
BoA	Bureau of Agriculture
CAADP	Comprehensive Africa Agriculture Development Programme
CBE	Commercial Bank of Ethiopia
CBO	Cooperative Bank of Oromia
CBPP	Contagious Bovine Pleuropneumonia
CCPP	Contagious Caprine Pleuropneumonia
CGIAR	Consultative Group on International Agricultural Research
COMPETE	USAID Compete Project
CRED	Centre for Research on the Epidemiology of Disasters
CSA	Central Statistical Agency
DFID	Department for International Development
DRMFSS	Disaster Risk Management and Food Security Sector
DRMFSS	Disaster Risk Management and Food Security Sector
EACWE	Ethiopia Agricultural Commodities Warehousing Enterprise
EC	European Commission
ECEA	Ethiopian Commodity Exchange Authority
ECX	Ethiopia Commodity Exchange
EDRI	Ethiopian Development Research Institute
EEIG	European Economic Interest Group
EFSRA	Ethiopian Food Security Reserve Agency
EGTE	Ethiopian Grain Trade Enterprise
EIU	Economist Intelligence Unit
EM-DAT	Emergency Events Database
EMMA	Emergency Market Mapping and Analysis
EPA	Environmental Protection Agency
ERCA	European Root Certification Authority
ESE	Ethiopia Seed Enterprise
ESS	Ethiopia Socioeconomic Survey
FAO	Food and Agriculture Organization of the United Nations
FCA	Federal Cooperative Agency
FCUs	Farmers' Cooperative Unions
FEWS NET	Famine Early Warning Systems Network
FMD	Foot and Mouth Disease
GDP	Growth and Transformation Plan
GMO	Genetically Modified Organism
GoE	Government of Ethiopia
GTP	Growth and Transformation Plan
HARITA	Horn of Africa Risk Transfer for Adaption
ICE	Inventory of Conflict & Environment
IDA	International Development Association
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Center

IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
JSE	Johannesburg Stock Exchange
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
L/C	Letter of Credit
LAFCU	Lume Adama Farmers' Cooperative Union
LINKS	Livestock Information Network and Knowledge System
LMP	Livestock Master Plan
LSD	Lumpy Skin Disease
MANR	Ministry of Agriculture and Natural Resources
MDTCS	Micro Development Training and Consultancy Services
MEWIT	Merchandise Wholesale & Import Trade Enterprise
MFIs	Microfinance Institutions
MoA	Ministry of Agriculture
MoARD	Ethiopian Agricultural Research Institute
MoFED	Ministry of Finance and Economic Development
MoT	Ministry of Trade
NAISS	New Agricultural Input Sales System
NBE	National Bank of Ethiopia
NEPAD	New Partnership for Africa's Development
NER	Nominal Exchange Rates
NGOs	Non-Governmental Organizations
NISCO	Nyala Insurance Company
NRI	Natural Resources Institute
NVI	National Veterinary Institute
OECD	Organisation for Economic Cooperation and Development
OFDA	Office of Foreign Disaster Assistance
P4P	Purchase for Progress
PADETES	Participatory Demonstration and Training Extension System
PARM	Platform for Agricultural Risk Management
PPR	Pest des Petits Ruminants
PRIME	Pastoralist Areas Improvement through Market Expansion Project
RAS	Risk Assessment Study
RBoAs	Regional Bureaus of Agriculture
RER	Real Exchange Rates
RSDP	Road Sector Development Programme
RVF	Rift Valley Fever
SADC	Southern Africa Development Community
SAFEX	South Africa Futures Exchange
SMMEs	Small, Medium and Micro Enterprises
SNNP	Southern Nations, Nationalities, and Peoples
SNNPR	Southern Nations, Nationalities, and Peoples' Region
SREP	Scaling Up Renewable Energy Program in Low Income Countries
TIRR	Teff, Improved seed, Reduced seed rate, and Row planting
TOR	Terms of Reference
UAE	United Arab Emirates
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNSTATS	United Nations Statistics Division
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WFP	World Food Programme
WRS	Warehouse Receipt Systems

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Executive summary

This agricultural risk assessment study (RAS) is part of the process implemented in Ethiopia by the Platform for Agricultural Risk Management (PARM), a G8-G20 initiative hosted by the International Fund for Agricultural Development (IFAD). The evidence generated through the study will help in prioritising risks and in promoting relevant agricultural risk management (ARM) policies and tools.

Scope of study and country context

Scope of study and methodology

This report presents the evidence generated through the RAS. The methodology adopted in carrying out the study includes: review of relevant publications, official reports and other grey literature; field consultations with key stakeholders, including focus group sessions with smallholder farmers; analysis of identified agricultural risks using a range of statistical methods; and mapping of existing Agricultural Risk Management (ARM) initiatives. A Validation Workshop was jointly organised by the Ethiopian Agricultural Transformation Agency (ATA) and IFAD on 16-17th December 2015 to discuss emerging evidence and recommendations with stakeholders.

The country context

Agriculture continues to represent a dominant share of Ethiopia's economy, though its share of GDP has dropped from 52 percent in 2004/05 to 43 percent in 2013. The sector accounts for nearly 85% of exports and employs over 80% of the labour force. It is the main source of livelihood for most of the rural population and is dominated by smallholder farmers cultivating less than two hectares of land. About 31 percent of GDP growth recorded between 2011 and 2013 has been attributed to the sector, which recorded an average annual rate of 7.8 percent between 2005 and 2013. Effective management of identified agricultural risks will help in sustaining or improving this level.

Identification of agricultural risks: country risk profile

Range of risks

Farmers, especially smallholder farmers, in Ethiopia face a range of risks from pre-planting through to postharvest. Most of the major risks identified in this report include those reported in a recent survey by the Central Statistical Agency (CSA) and the World Bank[5]. The major risks are:

Weather risks

Precipitation-related risks which affect crop and livestock production in Ethiopia include drought, floods and unseasonal/erratic rainfall. Other natural hazards mentioned include landslides/avalanches and wildfires but these are ranked pretty low in importance by farmers and are also infrequent and their impact comparatively less severe. The country is ranked fifth (5th) in the world in terms of exposure to drought[6]. This affects not only crop production, especially in the southern regions of Oromia as well as northern and eastern regions of AFAR, but also the livestock industry as the feeding systems rely mainly on grazing and browsing of natural grass and bushes. Though the incidence of floods, including flash floods, is much higher than that of drought, the impact of the latter tends to be more severe. There is growing evidence about the effects of climate change in Ethiopia. In particular, rainfall is becoming less predictable as the onset and duration of the rainy seasons become more variable. The impacts of El Niño and La Niña are also becoming more prominent in the country.

5 Central Statistical Agency (CSA) and the World Bank (2015): "Living Standards Measurement Survey: Ethiopia", 2015.
6 Araya N. S. (2011) "Weather insurance for farmers: experience from Ethiopia", Paper presented at Conference on new Directions for Smallholder Agriculture, 24-25 January 2011, Rome IFAD HQ.

Biological and environmental risks

Crop damage and death of livestock occur on a regular basis in Ethiopia and lead to significant household income loss, though the scale is often under-estimated due to problems of under-reporting. The common plant diseases include leaf rust and wilt affecting coffee, maize and cowpeas. Corn leaf blight, maize ear rot and maize streak virus are also common. Incidentally, teff has proved resistant to most of the diseases affecting grains and is also known to be highly drought-tolerant. Common livestock diseases in Ethiopia include Rift Valley Fever (RVF), foot and mouth disease (FMD), contagious bovine pleuropneumonia (CBPP), contagious caprine pleuropneumonia (CCPP), *Pest des petits ruminants* (PPR), brucellosis in ruminants and lumpy skin disease (LSD). These are known to cause mortality but can also trigger export restrictions which lead to significant loss in foreign exchange earnings and household income for pastoralists. In analysing these risks, the focus has not been on the regular occurrence but rather epidemic scale events which tend to be uncertain. There is emerging evidence suggesting that climate change effects such as rising temperatures and more variable rainfall is causing increased uncertainty regarding the occurrence of these risks[7].

Inputs risks

The dominant role of the state in the distribution of inputs such as seed and fertiliser appears to have reduced the incidence of quality variability which was identified as an important risk in Uganda. Though some respondents in the CSA/World Bank survey published in 2015 cited rising prices of inputs as a problem, the reported number affected was low (representing only 6.3 percent of the total population surveyed) and refer mainly to fertiliser price risk. However, in the course of the Validation Workshop, many participants indicated that limited access to inputs credit posed a much more important challenge to farmers. Variability in output market prices also impacts on uptake of inputs such as fertiliser and seed (Section 3.4.1).

Output market risks

From the focus group discussions, reported in Chapter 5, farmers cited uncertainty about market access as well as price volatility among the shocks they face.

Policy and institutional risks

The risks cited, especially during the Validation Workshop, included the following: land policy – the evidence obtained shows that reforms based on The Federal Democratic Republic of Ethiopia Rural Land Administration and Land Use Proclamation No. 456/2005 produced tangible benefits. However, implementation challenges, including administrative capacity issues, appear to be causing tensions in some rural communities, especially where there is competition between crop farmers and pastoralists as well as where smallholder farmers are excluded as a result of allocation of land to commercial farmers or for large-scale infrastructure investments by the state. Other policy risks which were identified include export restrictions (maize) and price subsidies (wheat) as well as macroeconomic policies (interest rate and exchange rate controls).

Political and security risks

These risks were particularly highlighted during the Validation Workshop and include violence/conflicts, theft/robberies, involuntary loss of land and displacement due to Government development projects. The evidence available indicates that these risks are ranked quite low by smallholder farmers (cited by only 1.3 percent of respondents in the CSA/World Bank survey as important shocks).

Logistical and infrastructure challenges

Poor rural transport infrastructure tends to increase transaction costs in output markets and squeeze producer margins. Similarly, limited access to efficient storage facilities contributes to high postharvest losses, which exceeded US$ 430 million per year between 2005 and 2012, with the exception of 2006 when the total estimated losses was US$ 233.6 million. However, these are not uncertain events but are known challenges, which nonethe-less require attention.

7 Feyssa D H and D O Gemeda (2015) "Impact of climate change on production systems in semi-arid regions of Ethiopia ", Journal of Biological and Chemical Research Vol. 32 No. 2 pp.755-764.

Mapping of existing agricultural risk management policies and tools

Policy environment and institutional framework

The Ministry of Agriculture (MoA) is the lead agency responsible for overall policy actions in the sector. Other public organisations playing various roles include the Directorate of Crop Marketing in the Ministry of Trade (MoT) and the Ministry of Industry (which controls the Ethiopian Standards Institute). The Ethiopian Food Security Reserve Agency (EFSRA) and Ethiopian Grain Trade Enterprise (EGTE) work together in managing food security policy, whilst the National Bank of Ethiopia (NBE) and the Commercial Bank of Ethiopia (CBE) are involved in the supply of agricultural finance. The Federal Cooperative Agency (FCA) fosters collective action by farmers as well as inputs distribution and output marketing. The Agricultural Transformation Agency (ATA) is a strategy and delivery-oriented government agency created to help accelerate the growth and transformation of Ethiopia's agriculture sector, and is also focused on improving the livelihoods of smallholder farmers across the country.

Due to the multiplicity of institutions involved in sector policy interventions and programmes, there is apparent need for effective coordination of actions to promote ARMs in the sector through leveraging the strengths of various actors.

Risk management landscape

The main existing ARMs in Ethiopia include the following:

Initiatives to manage weather risks

These include ongoing pilots to promote agricultural insurance in Ethiopia (both indemnity-based and weather-indexed products). Uptake remains low due partly to low level of awareness among farmers and high cost (premiums, especially for weather-indexed products are high and variable). The need for the following refinements to the insurance products have emerged from the pilots: bundle insurance with farm credit; minimise basis risk and ensure cost-effective pricing of the products[8]. Government is also investing in small-scale irrigation projects (targeting households with less than 5 hectares). The scheme is intended to increase resilience against drought as well as raise household income through enabling farmers to diversify beyond staple foods.

Initiatives to mitigate biological and environmental risks

The MoA hosts research agencies responsible for breeding disease-resistant crop varieties. It also undertakes screening/trials of various pesticides through the Institute of Agricultural Research. The private sector is involved in the distribution of agrochemicals, especially for vegetables, making access relatively easy. Most of the traders are reported to be unlicensed and unable to provide reliable advisory services. In the livestock industry, diagnostic services, vaccination, vector control and treatment are mainly provided by public sector agencies. The private sector role is limited due to lack of capital. Consequently, some NGOs are filling the gap by providing community-based animal health services.

Initiatives related to inputs risk

The public sector dominates the distribution of inputs such as fertiliser and seeds as well as animal health service delivery. The risk of quality variability therefore appears low. However, uptake of available technology remains low among both crop and livestock farmers. Limited access to inputs finance has been identified as one of the constraints, for which reason ATA has been piloting the "New Agricultural Input Sales System" (NAISS) since 2013.

Initiatives to mitigate output market risks

Tools which are being developed to mitigate output market risks include the following:

- Forward contracting involving cooperatives, which has been demonstrated to help mitigate inter-year price risks.
- The Ethiopia Commodity Exchange (ECX) and the WRS linked to it – the focus of these have mainly been on export commodities and there has been limited utilisation in enabling producers to benefit from intra-seasonal price movement, especially for food crops. Scaling forward contracting and these tools can enhance access to finance to sector players.
- Use of food reserves to mitigate the effects of major food supply shocks.

8 Source: Van Asseldonk et al. (2014) "Is there evidence on linking crop insurance and rural credit?", FARMAF Policy Brief.

Information systems

The main sources of sector-relevant data include the Bureau of Agriculture and Rural Development, Disaster Prevention and Preparedness Bureau, the Bureau of Trade and Industry, EGTE, ECX, the Famine Early Warning Systems Network (FEWSNET) and the Ethiopian Meteorological Agency. ATA is piloting an initiative through which weather advisory information is provided to farmers through extension officers.

Traditional risk management tools

Despite the existence of these ARM policies and tools, available evidence suggests that most farmers rely on faith-based or traditional coping measures in responding to agricultural risks.

Risk analysis: systematic quantification of impacts and likelihood

The table below ranks agricultural risks in Ethiopia based on the weighted scores of average annual frequency and severity of the risks as well as impact during a worst case scenario.

Table 1: Ranking of agricultural risks in Ethiopia

RISK	AVERAGE ANNUAL SEVERITY	AVERAGE FREQUENCY	WORST CASE SCENARIO	SCORE
DROUGHT	HIGH	HIGH	VERY HIGH	4.25
LIVESTOCK DISEASES AND PESTS	MEDIUM	VERY HIGH	HIGH	3.90
PLANT DISEASES AND PESTS	MEDIUM	HIGH	VERY HIGH	3.85
PRICE RISK: FOOD CROPS	HIGH	MEDIUM	VERY HIGH	3.85
INPUTS RISK: RISING PRICES	MEDIUM	HIGH	HIGH	3.60
ERRATIC OR VARIABLE RAINFALL	MEDIUM	VERY HIGH	LOW	3.40
EXCHANGE RATES VARIABILITY	LOW	HIGH	MEDIUM	2.87
FLOODS	LOW	VERY HIGH	LOW	2.62
POLICY RISK: EXPORT BAN	VERY LOW	HIGH	HIGH	2.50
POLICY RISK: PRICE SUBSIDY	VERY LOW	VERY HIGH	VERY LOW	1.93
PRICE RISK: EXPORT CROPS	MEDIUM	MEDIUM	VERY LOW	1.55
INTEREST RATES VARIABILITY	VERY LOW	MEDIUM	VERY LOW	1.55
PRICE RISK: LIVESTOCK	VERY LOW	VERY LOW	VERY LOW	1.00
POLICY RISK: LAND POLICY	VERY LOW	VERY LOW	VERY LOW	1.00
INPUTS RISK: QUALITY VARIABILITY	VERY LOW	VERY LOW	VERY LOW	1.00
EARTHQUAKE	VERY LOW	VERY LOW	VERY LOW	1.00
VOLCANIC ACTIVITY, WILDFIRE ETC.	VERY LOW	VERY LOW	VERY LOW	1.00

Source: Data from EM-DAT, FAOSTAT, CSA and computations reported in Chapter 5.

The top six risks are listed below. Together the estimated average annual losses due to incidence of these risks is about US$ 276.4 million but the aggregate cost of the worst case scenarios for these risks is over US$ 2.25 billion.

a. Drought ranks as the highest priority as its average annual severity of is high (losses estimated at about US$ 78.35 million) and the incidence is highly frequent. The severity of the worst case scenario, which coincides with El Nino, is extremely high (with losses estimated at US$ 924.6 million).

b. Plant and livestock pests and diseases are ranked very high because the average annual severity may be medium for both (estimated at about US$ 49.2 million) but the frequency is high and the impact of the worst case scenarios can be quite severe – about US$ 570 million and US$ 210 million respectively. The estimates are based on the occurrence at epidemic levels reported in EM-DAT rather than normal incidence of diseases and pests.
c. Price shocks for crops and livestock in Ethiopia were analysed and it emerged that whereas prices tend to exhibit very low levels of volatility export crops and livestock, inter-year price variability is relatively higher for food crops – though intra-seasonal variation in prices is quite low. Price uncertainty has been measured in terms of variability around trends and focused on troughs which negatively affect farm incomes.
d. Inputs risks: it is apparent that variability in the quality and performance of inputs in Ethiopia is quite low. Rising inputs prices emerges as significant, but that is the case mainly for fertiliser and not so much for seed.
e. Erratic rainfall (delayed or late rainfall) scores high enough to be prioritised partly because of the high and rising frequency, even though the level of losses are relatively low (average annual economic losses are estimated at about US$ 9.5 million whilst the cost in the worst case scenario is about US$ 16.67 million).

Impact

It is evident from estimates of economic losses decline in output occasioned by these shocks can severely affect household incomes and well-being of farmers, especially when the worst-case scenarios occur. Most of the prioritised risks have nationwide effect but the incidence of drought and erratic rains is comparatively higher in regions like Afar, Amhara, Oromia, Somali, SNNP and Tigray.

Conclusions and recommendations

Institutional framework for promoting ARMs

Multi-stakeholders, including a number of public sector organisations are involved in various actions related to the development of various ARMs in Ethiopia. It is our view that ATA, by its remit, appears to be very well-placed to coordinate ARM development initiatives, leveraging the strengths of different actors.
Building capacity for ARM development: Sustained capacity building in ARM development is required at all levels, including service providers, policymakers/regulators, users (especially farmers) and extension officers, who may be disseminating information on ARM policies and tools.

Improved data collection and analysis

Dearth of data, including gaps in published data, sometimes hampered analysis of various risks. Investment in improved data collection, analysis and dissemination will benefit actors engaged in developing/improving ARM tools.

Risk reduction

Scaling up and fostering utilisation of ARM tools and practices such as intra-seasonal stockholding using WRS; and technologies like small-scale irrigation can enable farmers to reduce exposure to some of the prioritised risks. The specific pathways needs to promote these tools need to be examined further, but is beyond this study.

Risk transfer

The agricultural insurance market as well as tools for managing price risks are under-developed. In the case of the former, investment in actuarial capacity in the local insurance industry is seen as critical. The latter will require ECX to graduate towards trading futures contracts after years of successful spot trading (mainly for export crops). Additionally, forward contracting can be used farmers' cooperatives.

Risk coping

Currently, the main social safety nets have been developed around responding to drought on a catastrophic scale. The insurance industry is likely to be able to cope with mitigating the risk of floods, erratic rainfall and normal drought. Clearly demarcating the boundaries for state action may be helpful in fostering supply of private insurance.

PARM

PLATFORM FOR
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MANAGEMENT

Risk Assessment

Ethiopia

Agricultural Risk Assessment Study

1. Introduction

This report forms part of the requirements of the contract under which a consortium of AGRINATURA-EEIG institutes, led by the Natural Resources Institute (NRI), is to undertake an assessment of agricultural risks in Ethiopia on behalf of the International Fund for Agricultural Development (IFAD). It forms part of a programme of actions being implemented under the Platform for Agricultural Risk Management (PARM), a G8-G20 initiative hosted by IFAD with the aim of providing technical support to governments on Agricultural Risk Management. The PARM Secretariat is working on these actions in strategic partnership with the African Union's New Partnership for Africa's Development (NEPAD), through which African countries can be supported to mainstream agriculture and food security risk management into implementation of their Comprehensive Africa Agriculture Development Programme (CAADP). It is also anticipated that outputs from the risk assessment studies will provide an important reference guide for governments, other local stakeholders, donors, service providers and international organisations on work on agricultural risk management issues in each country.

Formulation and implementation of PARM is in response to recognition of the fact that agricultural risk management (ARM) can significantly contribute to improved resilience of vulnerable rural households by increasing their capacity to absorb and adapt to risks. The PARM process follows five phases in a given country: setting up of activities, risk assessment, policy dialogue, follow-up and implementation. The first substantial phase of the PARM process consists in assessing agricultural risks through a long-term vision and a holistic approach. The RAS process is expected to define the key agricultural risk problems as basis for identifying potential solutions not only through the study but also involving validation of emerging observations and conclusions at National Stakeholders Workshops. The outcome will feed into Policy Dialogue involving stakeholders as well as defining the range of capacity building support required to improve local stakeholders' awareness and knowledge of ARM as well as their capacity to manage and conduct appropriate institutional reforms. Following this process, the identified ARM tools will be the subject of different feasibility studies and policy dialogue, both of which are outside the TOR for this study. The final objective of the whole process is to facilitate adoption and implementation of a holistic risk management strategy which is mainstreamed into national policy and agricultural investment plans. The study reported on focuses on Ethiopia.

Agriculture everywhere tends to be risky and is even more so in African countries such as Ethiopia. Due to the fact that Africa's agriculture is predominantly rain-fed, farmers are exposed to major weather-related risks such as drought, floods, windstorms and hailstones. Emerging evidence suggests that the incidence and severity of these yield-reducing risks is increasing as a result of climate change in Africa[5]. Access to yield-enhancing inputs by smallholder farmers may be uncertain due to underdeveloped inputs markets as well as difficulties in obtaining timely production finance. They tend to be vulnerable to pre-harvest such as pests and diseases but at the post-harvest level, often encounter considerable challenges accessing markets. Postharvest losses tend to be very high[6] because of limited access to efficient storage and postharvest handling facilities and they may also be exposed high volatility in prices. Unlike farmers in developed economies, African farmers usually have little or no means to mitigate these risks.

Some of the risks faced by players in agricultural value chains in Africa are attributable to poor transport and storage infrastructure, missing or weak market-supporting institutions, disabling policies and poor public services delivery systems. They lack access to reliable and timely market information, thereby weakening their bargaining position. Uncertainty about marketing of significant surpluses tends to discourage farmers from adopting high return options such as improved farm technology. The perception that the farm sector is highly risky also makes the sector unattractive to financial intermediaries, thereby reducing private investment flows to the sector. The impact of these risks and challenges sometimes are covariant, affecting the livelihoods of entire communities.

Tools already exist that allow farmers in most advanced economies to manage farm risks. For instance they can

5 ECA Africa Review Report on Drought and Desertification (October 2007).
6 A recent study by the World Bank, FAO and NRI (2010) estimated the value of post-harvest grain losses in Sub-Saharan Africa at over $4 billion per year, almost equivalent to the value of annual cereals imports.

adopt technology to manage the impact of the forces of nature. They may also depend on public-funded systems as well as market-based instruments to mitigate the effects of various shocks. Such ARM tools are usually not available to African smallholder farmers, who have to rely on traditional ex ante risk minimisation strategies such as diversification of farm activities (e.g. mixed cropping and crop rotation) and ex post coping strategies such as maintaining reserves of inventories and financial assets. Quite often, these strategies do not optimise productivity and provide limited protection against severe negative shocks.

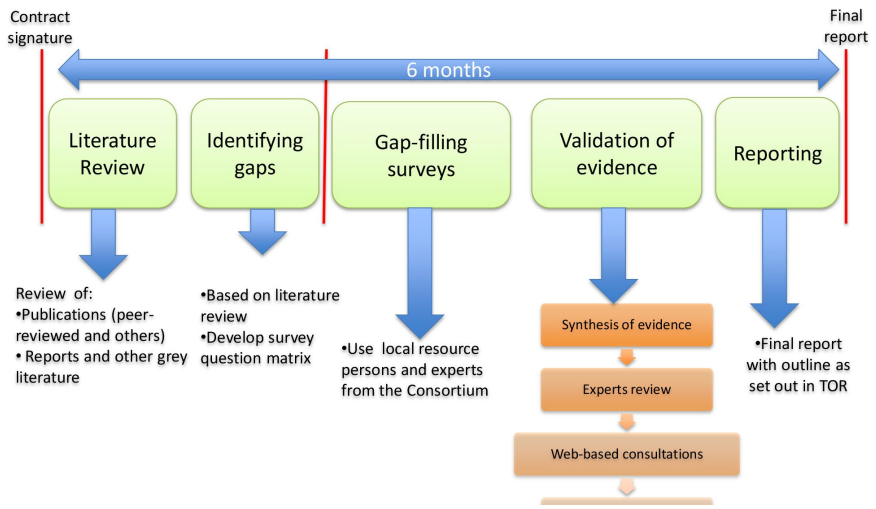
There have been efforts to promote sustainable and accessible ARMs in many African countries, including Ethiopia. It is apparent from reviews of such initiatives[7] that their success can be hampered or diminished by factors including the following limited understanding of the context in which the tools work; lack of clarity regarding private service providers in providing accessible tools; and disabling policy and regulatory environment.

The PARM approach is therefore premised on clear appreciation of risks and their impact of the farm sector. The RAS commissioned by IFAD under PARM is aimed at generating the evidence which makes the case for prioritising risk management actions clear. The evidence generated is expected to guide public and private sector players in not only prioritising risks but also in initiating viable actions to help farmers manage them.

The methodology adopted for the RAS in Ethiopia is based on the standard approach set out in the terms of reference (TOR) for the assignment. It includes the following steps and is summarised in the figure below:

- Literature review: what has been undertaken so far is a review of publications and documents which are available online. Further review of such documentation will be undertaken during field visit to Ethiopia and will focus in particular on reports and other grey literature sourced from public institutions, private sector organisations, donor missions, research institutions and organisations representing various actors in the agricultural value chains in Ethiopia.
- Based on the review of literature, we have begun to identify issues that need further clarification as well as gaps in knowledge which need to be filled in order to understand the problem of agricultural risk and potential solutions. The process of filling these gaps will involve interviewing and having consultations with various stakeholders including farmers' representatives, public policy makers and private sector actors. Semi-structured interviews will be conducted.

Figure 1: Consortium's Proposed Methodology



7 Include the following: Carlos E. Arce (2010) "Weather index insurance for agriculture: lessons learned", Presentation at Regional Workshop on Risk Management in African Agriculture at Lilongwe, Malawi 06-10 September 2010; Jonathan Coulter (2009) "Review of warehouse receipt systems and inventory credit initiatives in Eastern and Southern Africa" – study undertaken on behalf of UNCTAD, September 2009; and G. Onumah (2009) "Improving the efficiency of African agricultural marketing systems through promoting formalised exchange infrastructure: potential benefits, challenges and prospects" Paper delivered at AGRA-sponsored Conference on Priority Action for market development for African farmers, 13-15 May 2009, Nairobi, Kenya.

- The review of literature, was desk based and focused mainly on published reports and publications which are available online. Material synthesised included information on the country context in Ethiopia. This included the following:
  i. Overview of the agricultural sector, including trends in the overall contribution of the sector to national GDP and projected future trends; major commodities and production trends for crops, livestock, fisheries, and forestry, and their relative importance for vulnerable populations; demographic characteristics of producers and other key actors in agricultural value chains; incidence of poverty and malnutrition; factors affecting production and risk exposure (e.g. agro-climatic zones, farm size, share of subsistence farming, irrigation) in the sector; and the employment level and the share of small-scale farmers for each major commodity and zones.
  ii. Physical infrastructure such as transportation, telecommunications services, energy services, warehouses and storage facilities and weather stations and the extent to which they are accessible to players in agricultural value chains.
  iii. State of markets for services such as financial services (insurance, banking, investment and payments), including mapping of suppliers who are accessible to smallholder farmers, for example microfinance institutions (MFIs).
  iv. Institutional infrastructure including in particular those providing market information services as well as delivery of agricultural extension systems.
  v. Overview of the macro-economy, focusing on elements that impact on trends in pricing of agricultural inputs and outputs.

Additional information synthesised include the following:

- Natural risks that impact on agricultural production (including drought, floods, and crop pests and diseases and livestock diseases);
- Policy and regulatory risks, in particular as they affect trade in inputs and outputs (including domestic, regional and international trade, as applicable); and other risks affecting household income and food security (e.g. wages and non-farm income). Other policies examined include those which impact on private investments in agricultural production, trading and value addition
- Mapping of agricultural risk management (ARM) initiatives and tools in Ethiopia in order to be able to assess the extent to which they meet the needs of target stakeholders, especially smallholder farmers as well as. The mapping exercise will also enable the team to analyse the synergies between different tools and, including how they reinforce or crowd-out each other.
- Based on the assessment of these we propose to identify and consult stakeholders about risk prioritisation and recommendations regarding actions to enhance risk management in the agricultural sector in Ethiopia.

2. Ethiopia: country context

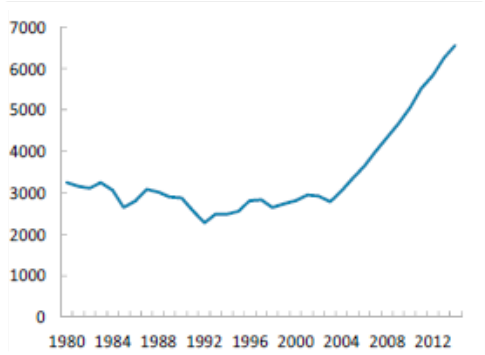
2.1. Introduction

Ethiopia is Africa's oldest independent nation-state and is also the second most populous country on the continent. In the past decade Ethiopia has emerged as one of the fastest growing economies in the world. The country recorded an impressive: average annual economic growth rate of over 10 per cent over the past decade and is forecast by the World Bank to sustain fast growth into 2017 (IMF 2014). It is apparent that rapid economic growth has produced positive pro-poor effects as a number of social indicators have improved. For example, the poverty headcount is reported to have fallen from 38.7 percent to 26.0 per cent between 2004/05 and 2012/13 (UNDP 2015). The agriculture sector made significant contribution to the country's growth performance and remains of strategic importance, partly because of its potential in helping to address some socio-economic challenges. The importance of agriculture to the economic fortunes of the country makes mainstreaming of agricultural risk management (ARM) relevant. It may be even more so because of the famine experienced by Ethiopia in the 1980s. To contextualise discussions on agricultural risks we begin with a brief overview of the country's macroeconomy followed by a review of the agricultural sector, including the main subsectors.

2.2. Overview of macroeconomic conditions in Ethiopia

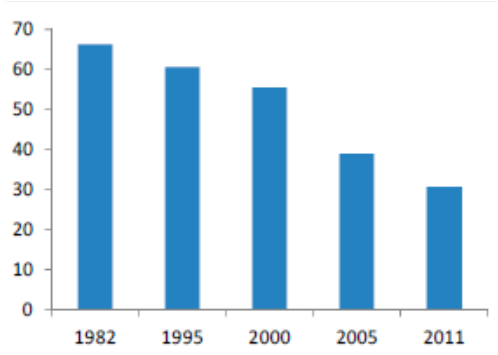
As noted by the IMF and other multilateral development agencies, Ethiopia out-performed countries in the Eastern Africa region in terms of GDP growth over the past decade. Between 2003/04 and 2013/14, its average GDP rate was 10.83 percent, more than double the average rate of 4.8 percent recorded by countries in the region[8]. Even with the dip in growth in 2013 to 7.0 percent (Table 1.1) Ethiopia still placed 24th in the world and its growth rate was well above levels recorded in most African countries.

Figure 2: Ethiopia: GDP per capita (in constant 2010 birr)



Source: IMF Staff Estimates.

Figure 3: Ethiopia: Poverty Headcount Ratio at US$1.25 a day (PPP) (in percent of population)



Source: World Development Indicators, WB.

8 Source: IMF Press Release No. 15/286 June 19, 2015.

Table 2: Ethiopia macroeconomic and other indicators (2013)

Indicator	2013*
Population	85.8 million
Population growth rate (annual %)	2.5
Land area (sq. km)	1,127,127
Agricultural land (% of land area)	37.0
Share of arable land under irrigation (%)	4.5
Population density (persons sq. km)	76.1
Population living in rural areas (%)	85.0
GDP Growth	7.0 percent
Contribution of agriculture sector to GDP (%)	43.0 percent
Agriculture sector growth	7.1 percent
Inflation	8.4 percent
Exports of goods and services to GDP ratio (%)	11.5
Imports of goods and services to GDP ratio (%)	29.3
Unemployment rate (%)	17.5

Source: World Bank, National Bureau of Statistics, UNDP Country Economic Brief – Analysis Issue No. 1/Feb.2014, and the Economist Intelligence Unit.
*Unless otherwise stated against indicator.

The average economic growth rate recorded is close to the target of 11 percent set by the Government of Ethiopia (GoE) in its Growth and Transformation Plan (GTP I) for 2010-2015. Figure 1 above depicts the impact of the rapid growth on per capita income. As economic growth outpaced population growth (estimated at 2.5 percent in 2013 – Table 2), per capita income rose steeply from around 2004 after stagnating for over two decades (Figure 2). Per capita income more than trebled between 2004 and 2013 at the same time as incidence of poverty (including food poverty) and illiteracy declined as shown in Table 3.

Table 3: Ethiopia: Comparison of basic indicators over time

Indicator	2004/05	2012/13
Per capita income (US $)	171	550
Poverty incidence (%)	38.7	26.0
Illiteracy rate (%)	71.0	53.3
Primary education coverage (%)	68.5	85.7
Basic health service coverage (%)	76.9 *(2005/06)*	94 *(2011/12)*
Food poverty (%)	38.0	31.8

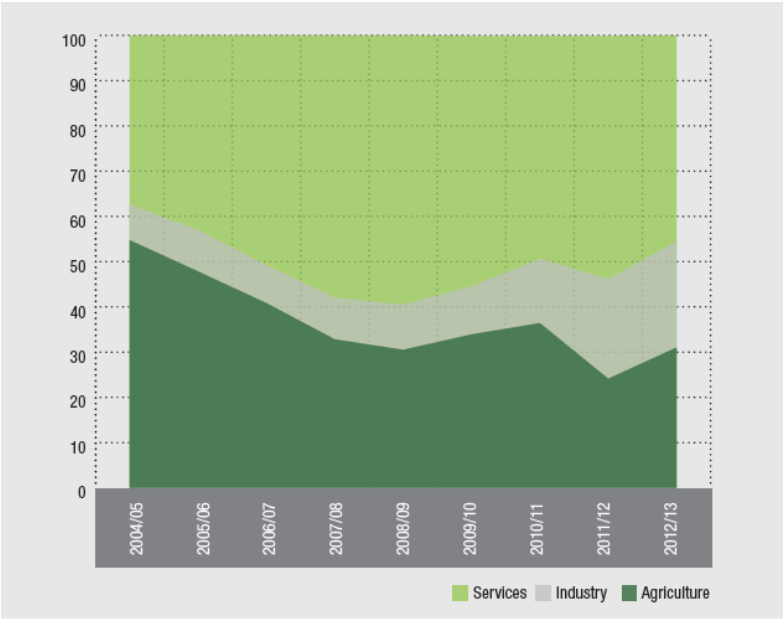
Source: UNDP (2015) National Human Development – 2014 Ethiopia

Primary education coverage as well as basic health service coverage also improved between 2004 and 2013. These improvements in the country's social indicators have been attributed partly to growth in the economy and high levels of pro-poor investment in social services by the Government (UNDP 2015).

2.2.1. Strategic contribution of agriculture to Ethiopia's economy

The agriculture sector made substantial contribution to Ethiopia's rapid economic growth. Data from the Ministry of Finance and Economic Development (MoFED), cited by the UNDP (2015), show that between 2005 and 2013, the sector grew by an average annual rate of 7.8 percent. As a consequence, 31 percent of GDP growth recorded in 2011/13 was attributable to the sector, having fallen from 54.7 percent in 2004/05. The fall in the contribution from agriculture to national output growth was largely due to better performance by industry and services sectors. The average annual growth rates recorded by these sectors between 2005 and 2013 were 13.0 percent and 14.5 percent respectively. The composition of Ethiopia's economy has, therefore, changed significantly since the mid-2000s. In 2004/05 the sector accounted for 52 percent of GDP, by 2013 this had dropped to 43 percent. The share of services and industry had both risen over the period as is illustrated by Figure 4.

Figure 4: composition of GDP by sector in Ethiopia



Source: UNDP (2015) National Human Development – 2014 Ethiopia

Despite the falling share of agriculture, it still remains a strategically important sector of the economy. It accounts for nearly 85% of exports and employs over 80% of the labour force. It is the main source of livelihood for most of the rural population and is dominated by smallholder farmers cultivating less than two hectares of land. The performance of the sector is also crucial if Ethiopia is to address the socioeconomic challenges it continues to face despite the very impressive economic growth record over the past decade.

For instance, though inflation has been contained below double digits during the period of rapid growth, a recent IMF assessment[9] indicates that a risk of potential build-up of inflationary pressures in the economy. The IMF (October 2014) further noted that due to the rather high impact of food prices on overall rate of inflation in the country, food production rather than tightening of monetary policy is likely to be more effective in ensuring price and macroeconomic stability. Furthermore, despite the improvement in social indicators mentioned above, about 25 million Ethiopians remain in poverty and are vulnerable to shocks and food insecurity[10]. Unemployment remains high – estimated at about 17.5 percent in 2012 (Table 1). As the largest employer, its performance will therefore impact on the employment generation capacity of the economy.

9 Source: IMF Country Report No. 14/303, October 2014.
10 Source: UNDP (2015) National Human Development – 2014 Ethiopia.

Furthermore, the UNDP (2015) reports challenges in the provision of health services and quality education, implying the need to sustain rapid but pro-poor growth. Growth in the agriculture sector, more than in any other sector, generates substantial benefits for the poor. It has been demonstrated, empirically, that for each percentage point growth in agricultural yields, the number of people living on less than US $1 per day is reduced by between 0.6 and 1.2 per cent (Thirtle et al, 2005).

The acknowledged linkages between the performance of the sector and the development of industry and services sectors is also one reason why is prioritised by the GoE. Reports by the Agricultural Transformation Agency (ATA) indicate that Ethiopia has, since 2003, invested an average of 14.7 percent of total government spending on the sector, exceeding the CAADP target of 10 percent. This investment yielded positive results. For instance, overall production of cereals has nearly doubled since 2006, while yields (output per hectare) have grown by about 22 percent.

Despite this success a number of challenges remain to be addressed. For example, though yields of the main staple crops have increased, they are still only 55 percent of the world average (ATA, 2014). The capacity of the predominant smallholder to manage agricultural risks need to be boosted if the sector is to be transformed. Ethiopia is often cited as an example of a country which is extremely susceptible to climate-related shocks, with references being made to the famines of the 1980's. However, as noted by Conway and Schipper (2011), institutional, social and economic factors tend to accentuate vulnerability to climate shocks. Furthermore, there is evidence that the types of shocks that threaten households are changing: weather shocks have been slightly less commonplace in recent years and are predicted to be less frequent in the future as well whilst price shocks have increased (World Bank 2015). The World Bank's Poverty Assessment (2014) lists food price hikes as the most frequently reported shock by households: in 2011 nearly one in five households had experienced food-related shocks; ten times as many as in 2005. Droughts were reported by one in twenty households in 2011; half of the number of households which experienced droughts in 2005.

2.3. Overview of Ethiopia's agriculture

The main food crops are maize, teff, wheat, sorghum, roots, pulses, and barley; whilst major agricultural exports include coffee, sesame, pulses and oilseeds as well as livestock products (FAO Ethiopia Country Profile, 2014). Ethiopia is a land-locked country, with total land area of 1,127,127 square kilometres (Table 1). Of this area, an estimated 37 percent is classified as agricultural land whilst an estimated 12 percent is forested (FAOSTAT, 2015). Only 4.5 percent of arable land is irrigated. Protected areas encompass 14 percent of Ethiopia's land area. The rural areas are reported to be amongst the most densely populated in Africa and it is estimated that on average people have access to less than 0.2 hectares of arable land for farming purposes (World Development Indicators 2014).

Table 4 provides an overview of some of the main crops produced in Ethiopia in 2013, as recorded by FAOSTAT in the Food Balance Sheets (2014). The reported figures for cereals correspond to some extent with the figures from the Central Statistical Agency (CSA), on which ATA has based their reporting as shown in Figures 2.2 and 2.3. Crop production contributes about 35 percent of GDP, and cereals account for 80 percent of crop production (in terms of both area and value). The consistent rise of cereal production – as illustrated in Figure 19 – has contributed to Ethiopia's improving food security. Oilseed production, while important for local consumption, is also expanding rapidly due to increasing exports to the Middle East and China. Ethiopia's coffee is in great demand in the European, the US and Japanese markets. Coffee remains one of the most important foreign exchange earners for the country, generating about 35 percent of the total export earnings with oilseeds and pulses adding another 25 percent.
There is a nascent floriculture and horticulture export industry is growing rapidly with exports of flowers mainly to European destinations (USAID, 2011). Ethiopia is also one of the largest livestock producers in Africa. Livestock accounts for nearly 10 percent of GDP and employs about 30 percent of the agricultural labour force. Livestock and meat exports to the Middle East have been an important source of foreign exchange in recent years. Smallholder farmers dominate the sector, cultivating about 90 percent of the total area under cultivation. They produce about 90 percent of cereals, pulses and oilseeds and production is almost entirely rain-fed. Yields are generally low as depicted in Figure 6.

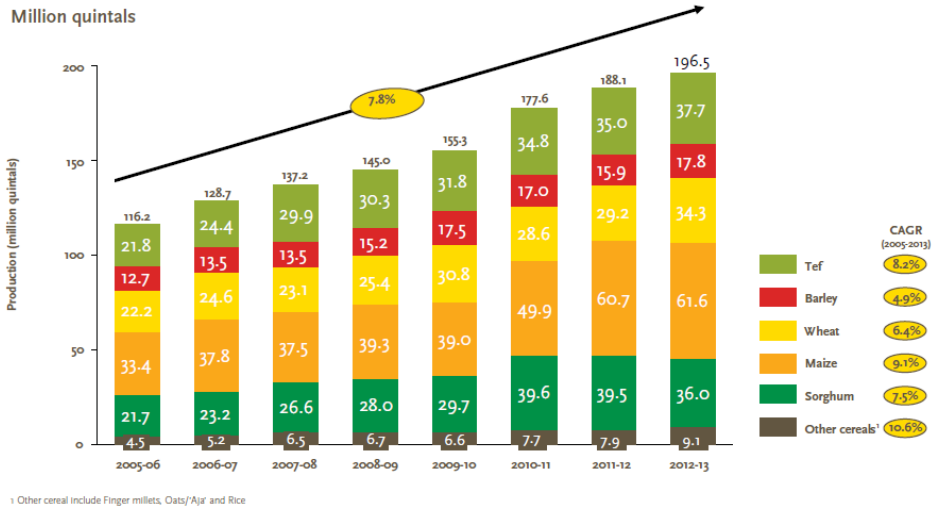
Total land area under irrigation is about 166,000 hectares, out of which about 64,000 hectares is cultivated by smallholder farmers. Small-scale traditional irrigation has been practiced for decades in the highlands, where small streams are diverted seasonally for limited dry season cropping. Medium and large-scale schemes are of more recent origin, particularly in the Rift Valley (FAO, 2003). The total irrigation potential of Ethiopia is estimated at around 3 million hectares, implying that only about 5.5 percent of its potential has been exploited (EPA, 1997).

Table 4: Main crops produced in Ethiopia (2013)

	Area Harvested, Ha	Yield, Kg/Ha	Production, 1000 t
Teff	3,483,000	1,268	4,418
Maize	2,069,267	3,225	6,674
Sorghum	1,847,265	2,348	4,338
Wheat	1,706,324	2,367	4,039
Sugar cane	23,000	119,565	2,750
Barley	1,047,532	1,845	1,933
Sweet potatoes	39,076	34,673	1,355
Millet	431,619	1,869	807
Potatoes	69,999	11,078	776
Peas, dry	300,797	1,341	404

Source: FAOSTAT, Food Balance Sheets, 2014 and Authors' computation from CSA data

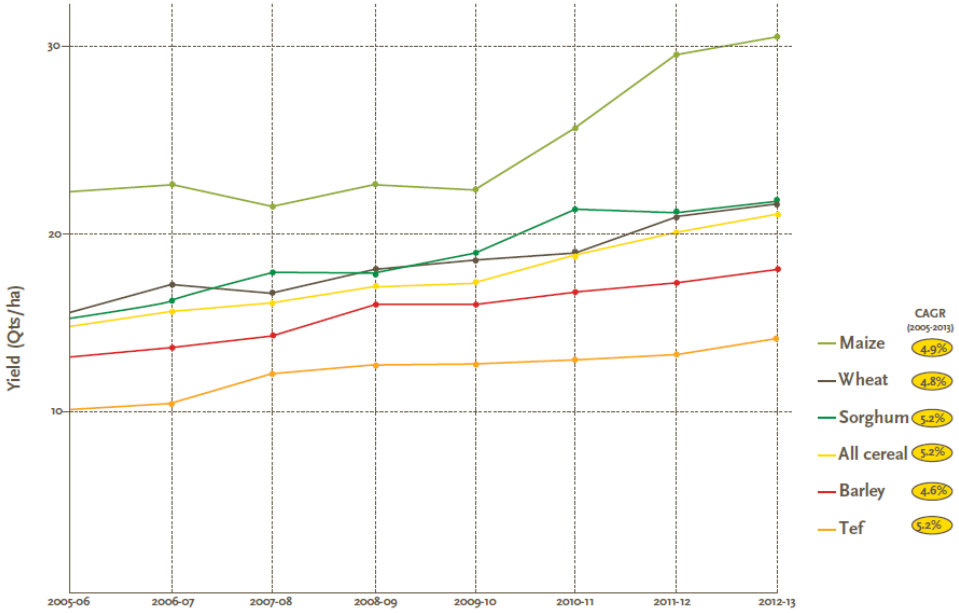
Figure 5: Annual cereal production, national level (million quintals)



1 Other cereal include Finger millets, Oats/'Aja' and Rice

Source: Central Statistical Agency Agricultural sample Surveys 2006-2013 (in: ATA, 2014)

Figure 6: Yields of key cereals, national level (Qts/ha)



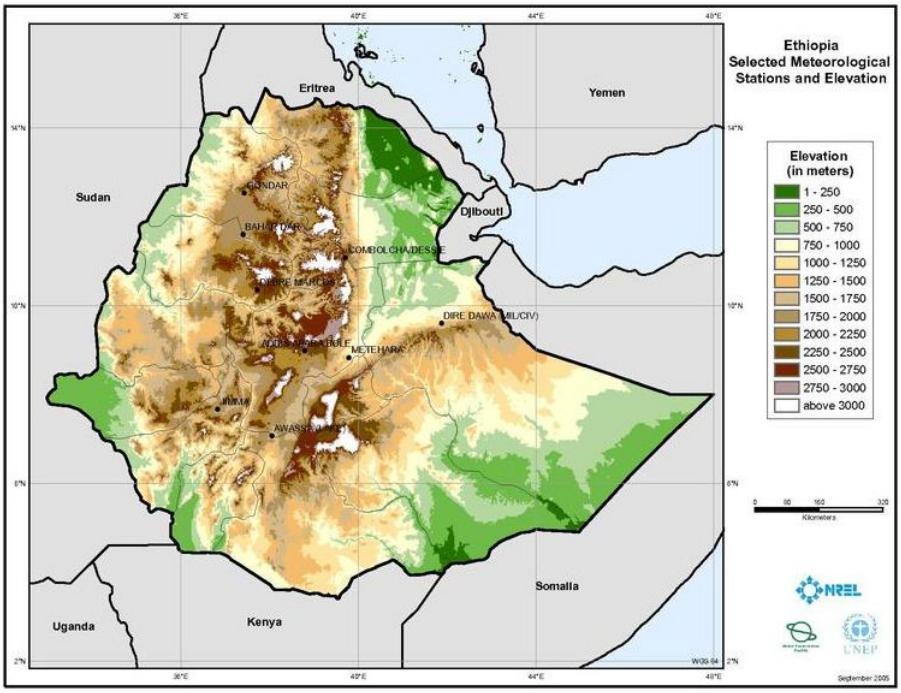
Source: Central Statistical Agency Agricultural sample Surveys 2006-2013 (in: ATA, 2014)

2.3.1. Climate and agro-ecological zones

Ethiopia has a wide variety of climatic features, due to its extensive altitude range and heterogeneous rainfall patterns. Temperature and rainfall are the most important climatic factors for agricultural production in the country. Altitude plays a role in climatic factors and land suitability, and influences the types of crops that are cultivated, growth rates, and natural vegetation. Temperature can vary between annual means of 34.5° C in the Dinakil Depression, to a mean of below 0° C in the Mt Ras Degen region (FAO, 2006). A comparison between Figure 6 (Ethiopia Elevation patterns) and Figure 7 (Ethiopia Precipitation map) shows that the more elevated parts of Ethiopia, and areas surrounding mountains, receive most rain. The lowlands, particularly the east, south east, and the north east, have much lower levels of precipitation.

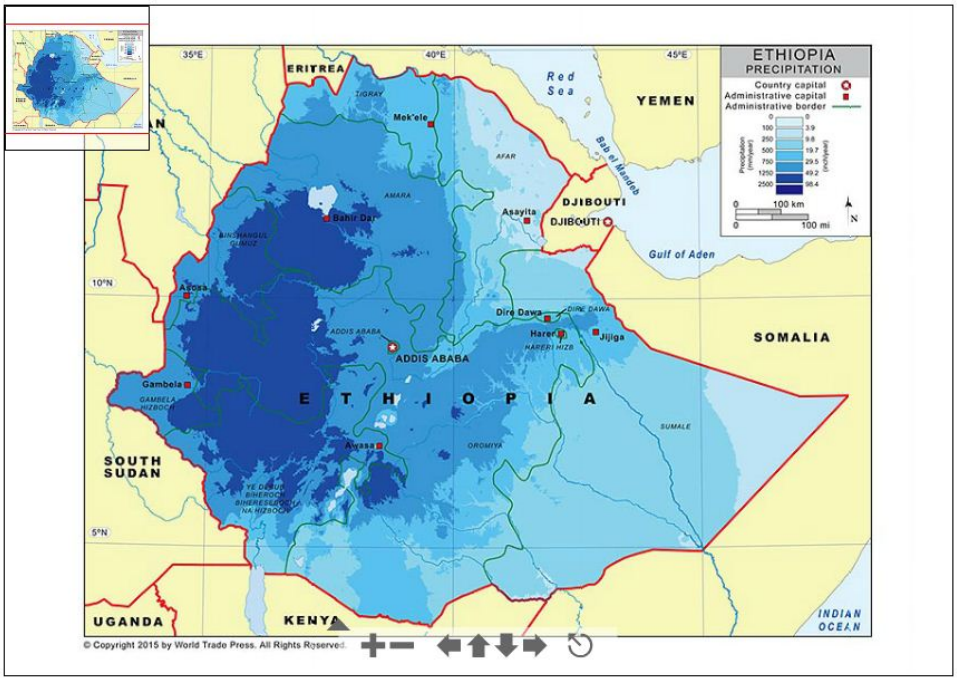
Climatic factors and soil types are reflected in the various agro-ecological zones of Ethiopia. They can roughly be categorised as Behera (<500 m), Kolla (500-1500 m), Weyna Dega (1500-2300 m), Dega (2300-3000 m), Wurch (3000-3700 m) and High Wurch (>3700 m). Most of these zones can be subdivided into dry, moist, and wet areas (see Figure 9). A schematic overview of the predominant farming systems in the different zones is shown in Figure 10, and Table 5 is an illustrative list of the types of crops found at the various heights and zones.

Figure 7: Ethiopia Elevation patterns



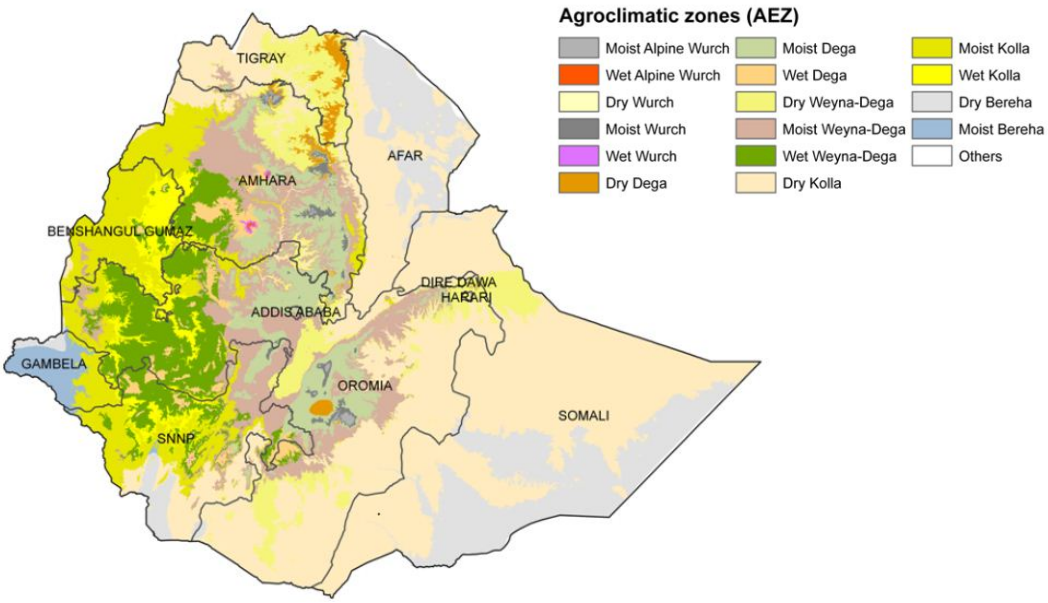
Source: NREL, 2005

Figure 8: Ethiopia precipitation map



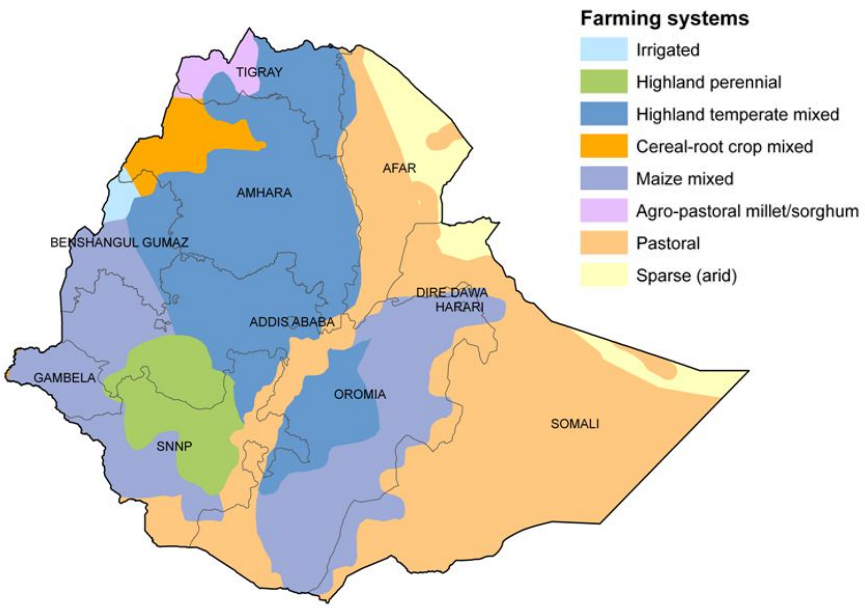
Source: World Trade Press, 2015

Figure 9: Ethiopia's Agro-climatic zones



Source: CAADP-CGIAR, 2015

Figure 10: Farming systems in Ethiopia



Source: CAADP-CGIAR, 2015

Table 5: Crop adaptation to elevation in Ethopia

Traditional name	Thermal zone	Elevation (m)	Crops cultivated
Bereha	T1	< 500	Not suitable for crop cultivation
Kolla	T2	500-1500	Millet, maize, sorghum, rice, cowpea, sunflower, safflower, sesame, haricot bean
Weyna Dega	T3	1500-2300	Millet, maize, sorghum, rice, wheat, barley, teff, oats, cowpea, sunflower, haricot bean, chickpea, lentil
Dega	T4	2300-3000	Wheat, barley, teff, oats, sunflower, chickpea, lintel, linseed, rapeseed
Wurch	T5	3000-3700	Wheat, barley, teff, oats, linseed, rapeseed
High Wurch	T6	> 3700	Barley, oats, linseed, rapeseed

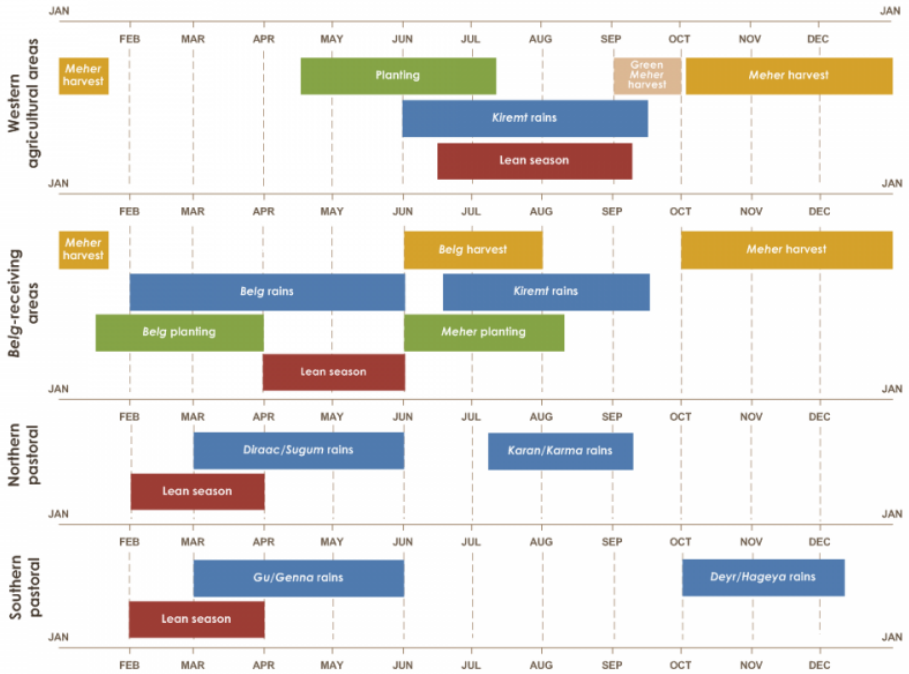
Source: Adapted from USDA, 2007

2.3.2. Cropping seasons in Ethiopia

Ethiopia's two main crop seasons are the belg and meher seasons. Belg receives rainfall from February to June and harvesting occurs between March and August. The rains for meher fall from June to October and harvesting is concentrated within the months of September and February (see Figure 11). In some highland regions, both seasons are merged into one extended growing period, allowing growth of both long cycle grains such as sorghum and maize as well as short cycle grains such as wheat, barley, and teff. Overall, the meher crop season produces the bulk of the country's cereals output (over 90 percent). The remainder is produced during the belg harvest (USDA, 2007).

The national Famine Early Warnings Systems Network (FEWS NET) as well as the Meteorological Department publish information regarding rainfall prior to the seasons. For instance, around the end of June 2015, FEWS NET in the Food Security Outlook warned for a well below average belg harvest in central Southern Nations, Nationalities, and Peoples' Region (SNNPR) due to late and little rain. This information can guide planting decisions by farmers as well as planning by policymakers to manage anticipated food crisis.

Figure 11: Ethiopia's seasonal calendar in a typical year



Source: FEWS NET, 2015

2.3.3. Land tenure and land rights in Ethiopia

Under Ethiopia's constitution, the state owns all land and provides long-term leases to farmers. Land use certificates are now being issued in some areas so that tenants have more recognisable rights to continued occupancy, thereby providing an economic incentive for producers to invest in land improvements. The certification of land use rights has been tested and expanded to millions of households nationwide. In general, the outcome of these interventions have reportedly been positive.

The Federal Government of Ethiopia has also had success in attracting foreign investors to the agricultural sector. These investors obtain long-term lease to land and water resources. While such investment holds promise for increasing agricultural productivity and rural job creation, there have been concerns that the livelihoods of the poor and disadvantaged may be threatened where their production systems are not integrated into those of the large-scale investors. FAO (2015) notes that periodic redistribution of land among farmers has been a strong disincentive against carrying out land improvements and/or erosion control measures. In addition, conflicting c*laims of pastoralists to land and pasture have sometimes led to violent clashes and/or loss of rights to grazing land by pastoralists (EIU 2008; UNSTATS 2007; Beyene and Korf 2008).*

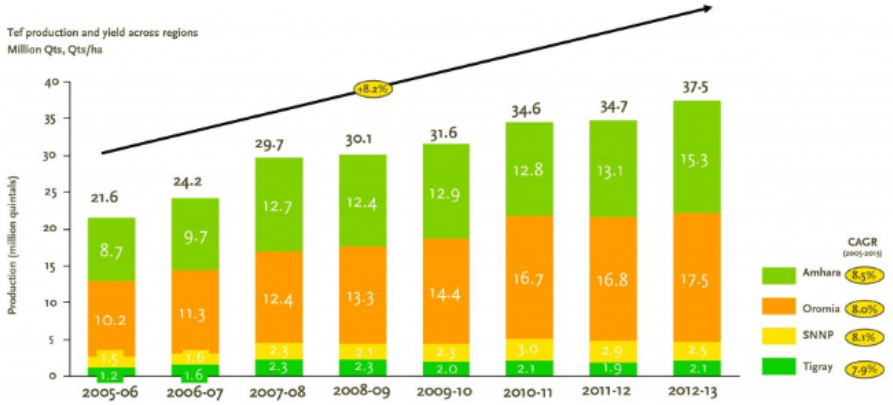
2.4. Major crops in Ethiopia

2.4.1. Teff production and marketing

Teff is grown almost exclusively in Ethiopia and Eritrea. In Ethiopia, it is the most important crop by area planted and value of production but also generates almost US$500 million of income per year for local farmers (the value of commercial surplus of Teff being equal to the value of the combined commercial surplus of the three other main cereals: sorghum, maize and wheat). It is grown by 6.5 million smallholder households in Ethiopia and is cultivated on more than 3 million hectares of land, which represents one-third of total cereal acreage and about one-fifth of the gross cereal grain production. Teff is a daily staple food for over 50 million Ethiopians, and accounts for 15 percent of total calories consumed (ATA, 2014).

Teff is highly nutritious and gluten free, and has a large potential as a new 'superfood', with a particular interest to serve the rising global demand for gluten-free products. For farmers, teff straw has as much value per hectare as the grain: it is used for fodder, bedding and as construction material. Until recently, little international attention was paid to teff, which is not widely grown outside of Ethiopia. Though it is a national staple, the production is concentrated in Oromia, Amhara, SNNP and Tigray regions (Figure 12). According to data from the Central Statistics Agency (2015), in during the 2014-2015 (2007 EC) Meher growing season 47.5 million quintals of teff were produced (1 quintal = 100 kg, same as a standard bag) by smallholder households.

Figure 12: Teff production and yield across regions in Ethiopia (million quintals, quintals/ha)



Source: Central Statistical Agency Agricultural sample Surveys 2006-2013 (in: ATA, 2014)

Compared to other cereals, teff has had far less research on breeding, agronomic practises, mechanisation and processing. This has resulted in yields that are significantly below their potential, and prices that are relatively high. An increase in yield and production of teff has the potential to improve the livelihoods of millions of smallholder farmers and rural households. The Agricultural Transformation Agenda envisions an efficient and well-functioning teff value chain, with increased productivity and profitability for smallholders. At the same time, ATA states that outputs should be of high quality and affordable to consumers. ATA, in collaboration with the Ministry of Agriculture (MoA), the Regional Bureaus of Agriculture (RBoAs), and other stakeholders, has developed the Teff National Working Strategy as a roadmap for addressing key sector challenges. The strategy targets will be aligned with those in the GTPII.

ATA reports that since 2013, when an improved technology package TIRR (Teff, Improved seed, Reduced seed rate, and Row planting) was prioritised for pilot farmers in the extension system, yields across the country increased significantly. A sample analysis by ATA showed that compared to the control group, the users of the TIRR package achieved 44% higher yields (26.6 qtl/ha compared to 18.4 qtl/ha). This was even 74% higher than the national forecast of 15.3 qtl/ha by the CSA. For 2015, a scaled-up target of five million farmers is planned for 2015, with not only access to the TIRR package but also increased access to improved inputs, credit, agronomic training, and market linkage support. There are also plans to improve access to blended fertilisers and pre- and post-harvest technologies such as machinery (tractors, planters, harvesters, etc) (ATA, 2014). CSA reports an average yield of 15.75 Qt/ha (1.58 t/ha) for the 2014-2015 season (CSA, 2015). Crop trials have shown that teff looks likely to flourish in a double cropping system with chickpeas, where the latter is planted directly after the former's harvest. This system increases the production of both crops, and can restore nutrients in the soil.

The average marketable surplus of teff ranges between 26 and 75 percent of the harvested crop. This is lower than levels recorded for other cereals, except wheat. Farmers sell the bulk of the crop during the months of December and January/February, which is the period immediately after the *Meher* harvest. The period between December and January/February coincides with the time when teff prices bottom out. The price difference between the harvest season and when prices peak in July/August is estimated between 15 and 40 percent (Fufa et al, 2011).

Rising levels of milling of the grains for household preparation of *injera* partly contributes to this development. Direct sale of cereals is therefore reported to be declining in part because of the emerging modern retail sector which markets Teff flour in supermarkets. Minten et al (2013) have noted that over the last decade quality demands are rising and there are important shifts from the cheap red varieties to the more expensive white ones. However, poorer urban households have responded by mixing white with cheaper red Teff or other cereals. Export of Teff grain is banned but there is growing, although still limited, export of the flour. Few women are directly involved in value addition in Teff; they represent 5 and 15 percent respectively of rural wholesalers and urban retailers. Urban wholesalers are exclusively men.

The main pre-harvest risks to which teff producers are vulnerable are weather-related plant stress (due to drought), plant diseases and pest as well as lodging which occurs in particular where varieties planted are thin and tall. These can lead to losses of between 10 percent and 30 percent of average output (Fufa et al. 2011). In addition, shattering can cause losses estimated about 2-5 percent. The following postharvest losses can also occur as a result of these eventualities: losses due to rodents, birds, termites etc. when drying occurs on-farm; losses during transportation to threshing sites; threshing using traditional methods; and winnowing. These losses add up to between 8 percent and 15 percent of total teff output. Storage losses, though much lower than estimates for other grains due to the nature of teff, are estimated at about 1.9 percent of output.

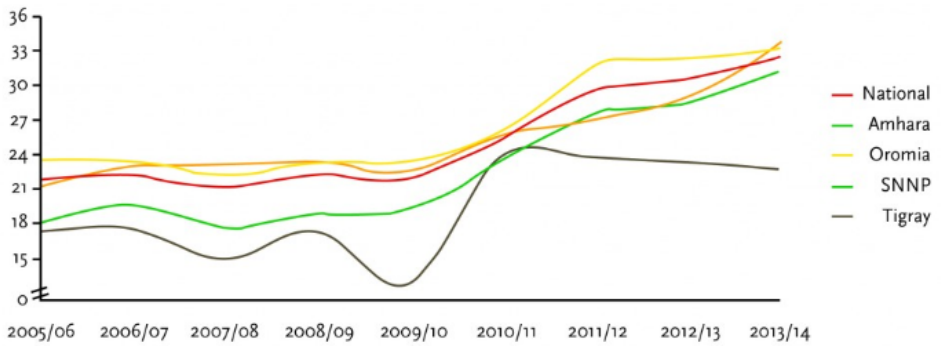
There are potential technology solutions which farmers can adopt to mitigate the risks identified above and/or minimise their impact on household income. These include adoption of improved planting materials and inputs such as fertiliser. Evidence from a recent study on adoption of a new teff variety (the *Quncho* – DZ-Cr-387) shows that farmers can have multiple motivations. Though higher yields is listed among reasons encouraging adoption, they also cite lower seed rates and stronger stem (therefore lower risk of lodging) among the advantages of the new variety. They also cite the premium prices that *Quncho* – a white teff variety – attracts. Uptake is, however, hampered by supply uncertainty. The same study observed that one of the main reasons constraining utilisation of chemical fertilizer is lack of finance. The same reason hinders uptake of available postharvest technologies including modern threshing, drying and storage facilities.

2.4.2. Maize production and marketing

Maize is Ethiopia's leading cereal in terms of volume produced. Over half of all farmers grow maize, mainly for subsistence. It is the cheapest source of calories and provides 20.6 percent of per capita daily calorie intake. In 2013/4, about 6.5 million tonnes of maize was produced by 8.8 million farmers cultivating over 2 million hectares of land. It is estimated that about 61 percent of the maize produced in Ethiopia is consumed by farm households whilst 25 percent is marketed. Of the remainder, 2 percent is reserved for seed and 12 used for informal transactions including payment of farm wages, gifts and for rural barter trading.

Ethiopia is the largest maize producing country in East Africa, and the fourth in the whole of Africa. It produces the type of maize preferred in neighbouring markets (white non-GMO maize). Domestic per capita consumption of maize in Ethiopia is much lower than in many countries in the region and, therefore, the country has significant potential for regional export of the crop (ATA, 2014). Partly because of this, maize has been selected as one of the priority crops for development as part of Ethiopia's agricultural transformation programme. The other reasons include the opportunities the crop offers for commercially viable agro-processing and for assuring food security.

Figure 13: Annual maize yield by region in Ethiopia



Source: Central Statistical Agency Agricultural sample Surveys 2006-2013 (in: ATA, 2014)

Maize production doubled between 2000 and 2013 due to generally rising yield per hectare (Figure 13) and area under cultivation (ATA, 2014). The rise in maize yield to an average of 3.2 tonnes per hectare (based on data from CSA) has been achieved through a technology package consisting of yield-enhancing inputs, farm credit and training in agronomic practises. In 2014, about half a million farmers were reached with the package across 50 pilot *woredas* in the Amhara, Oromia, SNNP, and Tigray regions. In 2015 the package is expected to reach a target of over 1 million farmers in 70 *woredas* in the four regions (ATA, 2014).

The involvement of the World Food Programme (WFP) in maize procurement in Ethiopia is helping to develop a structured formal market, which can benefit smallholder maize producers. In 2012-2013 it bought over 18,600 tonnes of maize from 16 farmers' cooperative unions under its Purchase for Progress (P4P) initiative. The following year this increased to 33,100 tonnes from 27 unions. For 2014-2015 the aim is for WFP to source 40,000 tonnes from 30 unions. The procurement of maize and other food for relief purposes by WFP entails compliance with grain quality standards which in turn require farmers to adopt postharvest handling practices that can reduce losses.

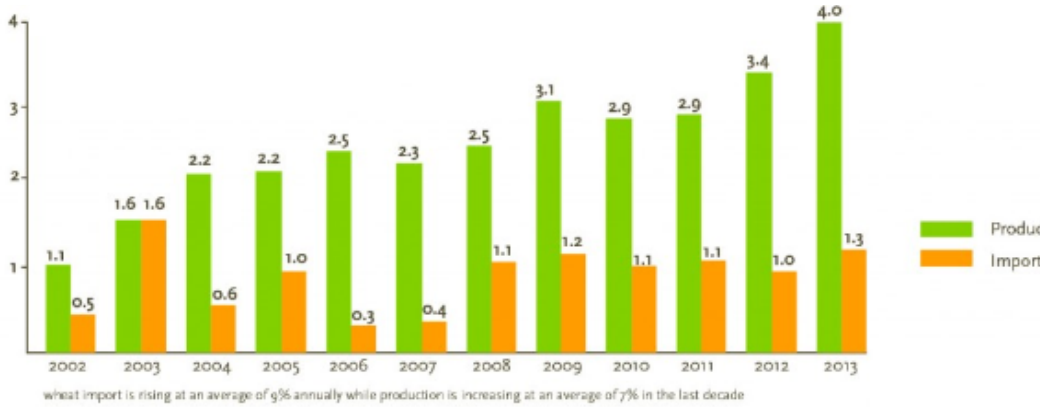
The main risks faced by smallholder maize producers in Ethiopia include weather-related risks, predominantly flood and drought. The challenge for the farmers, most of whom are engaged in rain-fed agriculture is not only limited to vulnerability to these weather events but also that the timing of the rains is becoming uncertain, hence affecting their decisions regarding when to plant. Various studies confirm that production instability in subsectors such as maize is due more to erratic weather than to variability of area planted (Alemu 2005). Estimates by DFID (2000) suggest that a 10 percent decline in rainfall below its long-term average reduces national output of grains such as maize by about 4.4 percent. As is the case for teff, weather does not only impact on maize output directly but also tends to increase the risk of field pest and disease damage.

Since 2001 a total of 28 improved maize varieties which are adaptable to various ecological zones have been released to farmers by agencies such as the Ethiopian Agricultural Research Institute (MoARD 2008). However, outreach has been low – farmers planting these varieties cultivate about 200,000 hectares or only 10 percent of the area under maize cultivation. Lack of finance is cited as one of the factors limiting uptake by farmers (USAID/COMPETE 2013). Furthermore, though some of the new varieties have the potential to increase farmers' productivity in both high-potential areas and areas with moisture stress, some are more susceptible to higher levels of insect damage during storage (Hodges and Stathers 2012).

2.4.3. The wheat subsector in Ethiopia

Between 2008 and 2014, the yield and production of wheat grew annually by an average of 8.4 and 11.6% respectively (ATA, 2014). Last year, about 4.7 million farmers produced 39 million quintals of wheat on 1.6 million hectares of land. According to available data from FAOSTAT, Ethiopia is a net importer of wheat. As shown in Figure 14, imports represent about one-third of current total production (FAOSTAT, Food Balance Sheets 2014). This is despite rising output in recent years. Demand from the over 200 wheat mills outstrips production.

Figure 14: Ethiopia wheat production and imports from 2002-2013 (Million MT)



Source: CSA Agricultural Sample Survey, ERCA import data (in: ATA, 2014)

The Agenda for transforming the subsector envisions not only national self-sufficiency but also aims to position the country to become a major exporter to the regional wheat market. The aim is to increase productivity by at least 50 percent in the high potential growing areas by improving agronomic practices and providing better access to technologies and markets. Figure 15 shows wheat yield in the major producing regions in Ethiopia. As part of the transformation package, Government plans to facilitate access to financial services as well as to high quality inputs. Market linkages will also be fostered with millers and EGTE.

The subsector plan, which aims to reach one million farmers by the end of 2015, is targeting the Oromia, Amhara, SNNP and Tigray regions. It is important, however, that in addition to improving access to resources, attention is paid to promoting tools with wheat farmers can manage price risk as the wheat market is characterised by high price volatility. This can include promoting access to a structured marketing system, the feasibility of which is likely to be enhanced by the large number of formal buyers (the wheat mills).

Figure 15: Annual wheat yield by region

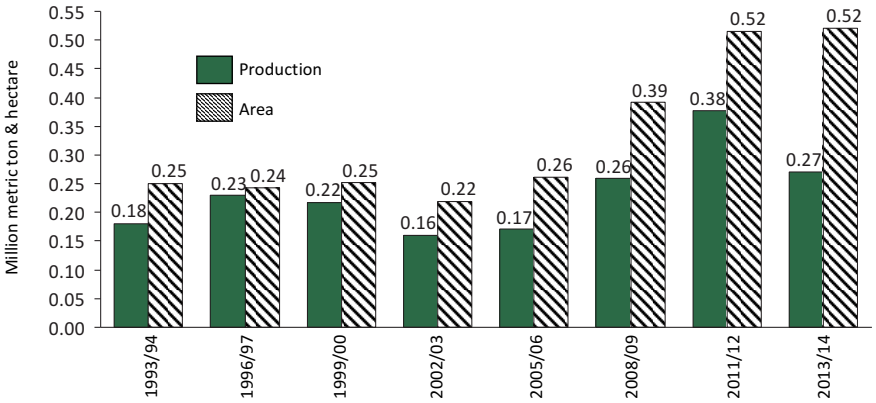
Source: Central Statistical Agency Agricultural sample Surveys 2006-2013 (in: ATA, 2014)

2.4.4. Coffee production and marketing in Ethiopia

Ethiopia – considered the birthplace of coffee - is Africa's leading coffee producer and the fifth largest in the world. The country produces high-quality Arabica coffee for the domestic and international markets. USDA estimates that about 15 percent of the country's population derive their livelihood from coffee. About 95 percent of Ethiopia's coffee is produced by an estimated 4 million smallholder farmers, predominantly in the southwest and southeast, on plots of land with an average size of 0.5 hectares (so-called 'garden coffee').

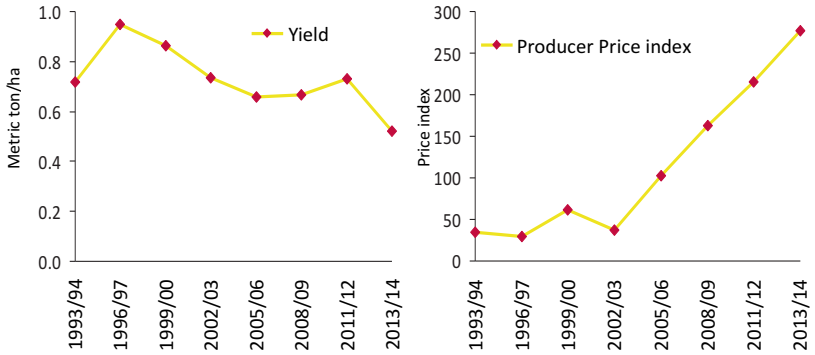
Coffee production in the country has risen over the last decade but only marginally as depicted in Figure 4.6. This is partly due to low yields (0.7-0.8 tonne per hectare) even though domestic coffee prices have risen over the past decade (Figure 16). The GoE has announced its intention to quadruple coffee production over the next five years as part of the second Growth and Transformation Plan (GTPII). This is largely because coffee is the primary source of export revenue for the country, accounting for 25-30 percent of total export earnings. Optimism in achieving the goals set under GTP II is premised on evidence that farmers are adopting new technologies which improve coffee productivity. For instance, a study by the Ethiopia Development Research Institute (EDRI 2015) noted increase in adoption of composting and weeding by farmers over the last decade. Improved harvest and post-harvest practices have also been adopted by coffee producers over the same period. They report that, whereas 10 years before their survey, 35 percent of farmers reported using stripping methods for harvesting, the practice had declined to 5 percent. Previously almost 60 percent of farmers would dry their cherries on the bare ground but at the time of their survey only 17 used this practice for drying cherries. The improved drying methods are known to contribute to better quality coffee.

Figure 16: Ethiopia Coffee production and area under cultivation (1993-2014)



Source: Based on FAO data (2014)

Figure 17: Coffee yields and producer prices in Ethiopia (1993-2014)



Source: FAO data 2014

The coffee marketing system has also changed significantly, including in particular, the emergence of the Ethiopia Commodity Exchange (ECX) as the main platform for domestic trading of coffee meant for the export market. Farmers' cooperatives are actively involved in this trade, acting as channels through which aggregated supplies from smallholder farmers are sold to exporters through the exchange. The study by EDRI (2015) concluded that the coffee marketing system was becoming more transparent, from farmers' perspective. More farmers (53 percent) expressed trust in weighing equipment and procedures than 10 years earlier (42 percent). More farmers also reported receiving a premium for quality coffee than was the case previously. Farmers were also taking advantage of the emergence of wet mills to become more flexible in marketing their crop. For instance, over the 10 intervening years between their surveys, the number of farmers selling red cherries to the wet mills rose from 28 percent 43 percent.

However, price variability, largely originating from the international market, remains a challenge. In addition, ECX has been unable to expand inventory engaged in the coffee trade – an issue which is discussed in more depth in the next chapter. They also observed that farmers remain vulnerable to the following shocks: plant diseases and weather shocks such as poor rainfall patterns, hail, or frost. These affect output and productivity negatively but, surprisingly, their impact is not significant at conventional statistical levels.

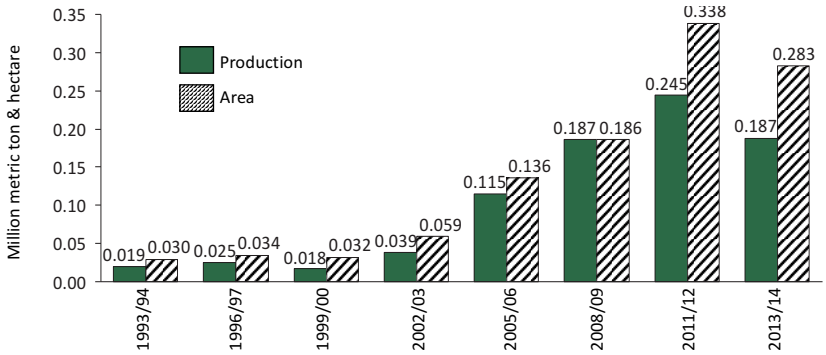
A rather interesting finding by EDRI (2015) is how underdevelopment of the rural financial system is constraining marketing by coffee farmers. For instance, lack of reliable savings facilities appears to encourage farmers to continue to "save" in the form of coffee beans. This is to ensure household liquidity throughout the year. Better

access to savings facilities by formal and semi-formal financial institutions is likely to encourage higher adoption rates for washed coffee practices, and subsequently lead to higher export earnings for the country (EDRI 2015). Furthermore, it will also enhance the intermediation capacity of rural financial institutions, thereby potentially easing access to finance for both productive investment and consumption smoothing in rural communities.

2.4.5. Pulses and oilseeds production in Ethiopia

In terms of land use and production levels, pulses and oilseeds are respectively the second and third most important crop types in Ethiopia (ATA, 2015). In 2013-2014, 28.6 million quintals of pulses were produced as against 7.1 million quintals of oilseeds. Sesame, in particular, is of strategic importance, being the second highest earner of foreign exchange after coffee. Production of sesame has generally been rising, especially since 2005 as shown in Figure 18.

Figure 18: Sesame production in Ethiopia (1993-2014)



Source: FAO data 2014

Ethiopia's strategic goals for the pulses and oilseed sector are not only aimed at increasing production for food security and improved incomes, but also to contribute to environmental sustainability by intercropping pulses with cereals. This is partly because pulses and oilseeds provide an affordable source of protein and are, therefore, important in improving household nutrition security. These crops also produce important agronomic benefits when intercropped with cereals – increasing soil fertility as well as reducing incidence of plant diseases and pests, thereby leading to higher cereal yields and lower soil fertilisation costs. Oilseeds contribute about 16 percent of the value of Ethiopia's agricultural exports and have the potential to become an important driver of the development of domestic agro-industries, in particular for edible oils and seedcakes.

The transformation agenda for the subsector aims to enhance capacity to process in-country. This will not only foster value addition but also employment generation and a reduction in the country's spending on edible oil imports – Ethiopia currently imports edible palm oil, valued at about US $350 million per annum. This occurs whilst sesame seeds are exported mainly as raw grains.

2.5 Livestock: production and marketing in Ethiopia

Ethiopia is home to Africa's largest livestock population and is the continent's top producer and exporter of livestock and livestock products. According to the GoE agricultural survey in 2012, the country has 52.1 million cattle, 24.2 million sheep, 22.6 million goats, and over 987,000 camels. The livestock sector represents one fifth of GDP.

ATA (2014) estimates that approximately 11 to 13 million rural and peri-urban households are engaged in one or more forms of livestock keeping. Most of these households practise subsistence farming, hence the average productive and reproductive capacity of the livestock is reportedly below African and global averages. According to ATA, the number of livestock has doubled since 1995, but the coverage of grassland available has halved due to overgrazing. As a consequence, farmers have had to turn to alternative sources for feed, such as crop residues.

In 2014, a new livestock trading bill was passed, designed to tighten the fragmented livestock market and increase value by eliminating middle men, unregulated animal markets, and illegal cross-border trades. Under the new law, all traders must be licensed, all animals will be registered an all livestock markets will be identified and classed as primary or secondary. Regional and city authorities will administer auction markets, while trading of livestock outside unlicensed markets has been made illegal. The new regulations are expected to contribute to better control of quality of meat and livestock – thereby addressing a problem which was the basis of a trade ban imposed by major importers (Saudi Arabia, Egypt and UAE) from 2007 to 2010 (Newsome, 2014).

Ethiopia has developed a national Livestock Master Plan (LMP) which aims to resolve identified constraints in the sector and strengthen the capacity of institutions and other stakeholders involved in the implementation of interventions. Some of the identified bottlenecks include the following:

- Rising cost of feed driving prices of animal products up;
- High and costly losses in livestock production and reproduction due to preventable diseases;
- Weak integration with crop production and natural resource management;
- Lack of aggregation and value addition of perishable livestock;
- Lack of product standardization and quality control of services;
- High transaction costs in the delivery of services such as extension, animal health services and supply of feed;
- Weak entrepreneurship of livestock keepers and lack of viable business models;
- Unreliable and inconsistent supply of water, feed and fodder for livestock;
- Inefficient herd/flock structures and costly maintenance; and
- Lack of timely market information for livestock keepers.

3. Identification of risks in Ethiopia's agricultural sector

3.1. Introduction

The discussions in Chapter 2 showed how the performance of the agricultural sector affects attainment of growth and poverty reduction goals in Ethiopia. Though agricultural output in the country has been on the increase, it tends to be variable from year to year as illustrated in Section 2.2. The impact of this variability in output on household income and food security can be negative, especially for rural households who depend principally on farm-related activities for their livelihoods. A number of constraints and risks contribute to variability in agricultural output in Ethiopia. Constraints in agricultural value chains may be construed as known conditions which hinder the activities in the chains and lead to suboptimal outcomes. Examples include physical infrastructure constraints such as poor rural roads, lack of efficient storage facilities, and under-developed market-supporting institutions. Agricultural risks, on the other hand, are uncertain events which can lead to losses, for example in farm output as well as household income and food security.

The focus of discussions in this chapter is on identifying risks which are prevalent in the agricultural sector in Ethiopia based primarily on a review of relevant literature and reports. The identified risks include weather risks as well as uncertain access to yield-enhancing inputs, biological and environmental risks (e.g. plant and animal diseases and pests), unreliable access to markets and price risks. The evidence synthesised in this chapter is complemented with detailed analysis of the identified risks and reported in Chapter 5.

3.1.1. Overview of agricultural risks in Ethiopia

Table 6 summarises the perception of risks to which households in Ethiopia are exposed. It is based on the recent Ethiopia Socioeconomic Survey (ESS) of 2013/2014 conducted by CSA and the World Bank. Food price shocks ranks very high among the list of household risks, behind only to illness among household members. Though its importance appears to be linked to household consumption concerns, it is also apparent that as producers the households also worry about the effects of decline in producer prices on their livelihoods.

Among the natural hazards cited by respondents in the survey, drought ranks as the most important shock. The surveyed households also reported such weather risks as flood, unseasonal rainfall which prevents work. Other natural hazards mentioned include landslides/avalanches and wildfires but these together are ranked most important by only 0.4 percent of the respondents.

Biological and environmental risks such as crop damage and death of livestock are mentioned in the survey and ranked as the most important shock by a total of 12.8 percent of the households surveyed. As far as inputs risk is concerned, it is only rising prices of inputs which is cited. Variability of inputs quality is not reported. Respondents who cited rising inputs prices as the most important shock only 6.3 percent of the total surveyed. However, it rises sharply on the scale when ranked as the second most important shock – cited by 13.7 percent of respondents and second only food price shocks. Rising inputs prices become the most cited shock when they are ranked as the third most important, over 30 percent and well ahead of all other risks.

Security risks such as violence/conflicts, theft/robberies, though cited by nearly 1 percent of the respondents, rank quite low. Similarly, some respondents cited land access-related shocks such as involuntary loss of land and displacement due to Government development projects. However, these rank quite low, with a combined total of 1.3 percent of respondents citing it as the most important shock and its ranking declining to 0.1 percent as the third most important shock. The risks identified in the survey and others from secondary sources are discussed in this chapter.

Table 6: Survey of households experiencing shocks in last 12 months (2014)

		Most import shock reported (%)		
Type of shock	% of hh surveyed experiencing shock	1st most important	2nd most important	3rd most important
Price raise of food item	13.9	9.1	28.7	14.2
Illness of household member	10.3	27.2	9.9	13.9
Increase in price of inputs	8.8	6.3	13.7	30.3
Drought	7.3	17.4	7.4	5
Other crop damage	3.6	8.1	6	4.5
Price fall of food items	3.6	5.6	12.8	5.5
Great loss/death of livestock	3	4.7	5.3	7.4
Flood	2.1	2.4	2.3	5.1
Death of household member	1.6	3.8	1.4	0.1
Heavy rains preventing work	1.2	3.3	1.8	3.4
Loss of non-farm job of household member	0.9	2	0.2	0.6
Theft/robbery and other violence	0.6	0.3	1.5	1.4
Violence/conflict	0.3	0.2	1.5	1.6
Involuntary loss of house/farm	0.3	1	0.2	0.1
Landslides/avalanches	0.2	0.4	0	0.8
Fire	0.2	0	0.8	0
Displacement (due to gov dev project)	0.1	0.3	0.3	0
Other	1.8	4.4	0.8	2.7

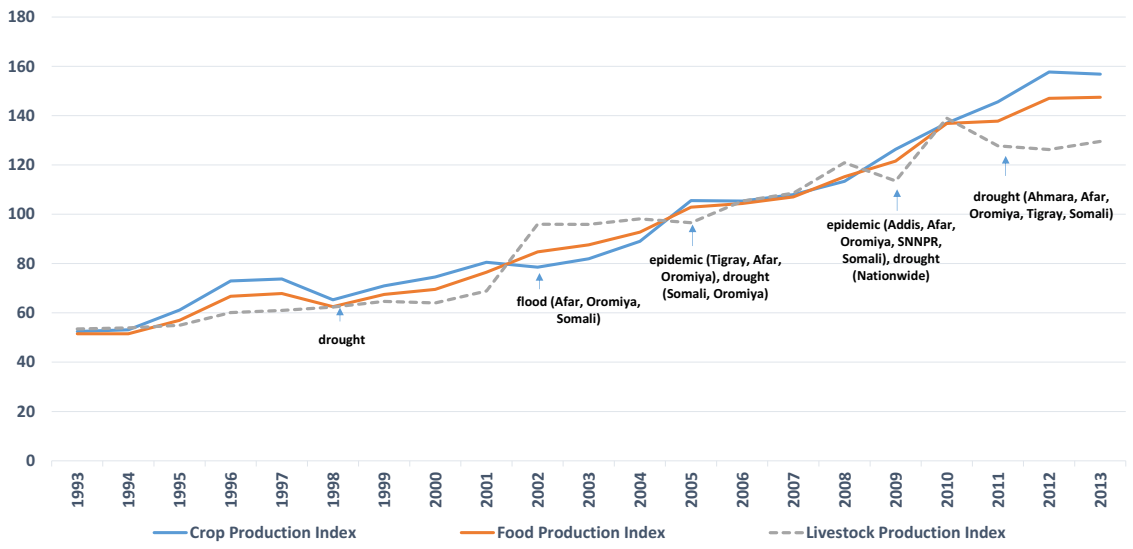
Source: Ethiopia Socioeconomic Survey (ESS) 2013-14, CSA and LSMS World Bank, 2015

3.1.2. Overview of effects of natural hazards on agriculture in Ethiopia

Figure 19 depicts a general upward trend in crop and livestock production in Ethiopia (based on an output index, where aggregate output in 2004 = 100). This is consistent with discussions in Chapter 2 which show that the agricultural sector has been growing steadily over the past two decades and contributed positively to Ethiopia's rapid economic growth. The figure also shows that agricultural output growth in Ethiopia is affected by natural hazards such as weather events (drought and floods) as well as biological and environmental risks (e.g. crops and livestock diseases and pests). The worst years for Ethiopia in term of the incidence of these disasters, as depicted in Figure 19, were 1999, 2000, 2005 and 2008.

Other natural hazards are comparatively infrequent and their impact is less severe than the weather risks. For instance, data from EM-DAT show that from 1900 to 2012, there were only three reported cases of landslides which affected 194 people. Over the same period there were three volcanic eruptions affecting 1,100 people and one major forest fire affecting five people. No significant losses in the agricultural sector were associated with these events. There were also seven incidents of earthquake over the same period and 585 people were affected with losses estimated at just over US$ 7 million.

Figure 19: Crop, food and livestock production indices and natural risks linkages in Ethiopia (1991-2013) (2004=100)



Source: Author's elaboration on World Development Indicators and EM-DAT

3.2. Weather risks

Weather risks are precipitation-related risks which can adversely affect crop and livestock production. They include what may be construed as extreme events such as drought – a prolonged period of abnormally low rainfall, which persists long enough to damage crops and threaten livestock – as well as floods. It also includes unseasonal early or late onset of rains which can affect planting, irregular rainfall distribution during the rainy season and unseasonal rains during the harvest season. Additional weather events which are relevant in Ethiopia include hailstorms and landslides which are triggered by heavy rains. In this section we discuss the incidence of drought and floods in Ethiopia, following that up with reviewing variability in rainfall patterns in the country, attributable in part to climate change.

3.2.1. Incidence of drought and floods in Ethiopia

Drought is considered the most critical weather risk in Ethiopia, not only because of its frequency but also as it impacts on many households. Based on official statistics, Araya (2011)11 ranked the country fifth (5th) among the 184 countries in the world which are most exposed to drought. Various studies confirm that production instability for especially the staple grains is due more to erratic weather than to variability of area planted (Alemu 2005). As shown in Table 7, between 1980 and 2008, Ethiopia experienced five major incidents of drought on a national scale, affecting over 6 million households in each case. Most of the affected households required emergency food relief because of the effects of drought on food and livestock production. Figure 20 further illustrates the link between the incidence of drought in the country and demand for food aid.

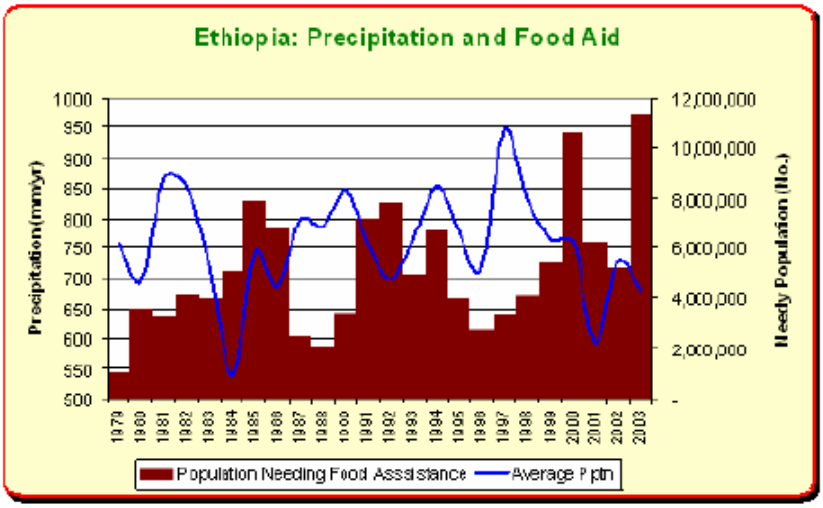
11 Araya N. S. (2011) "Weather insurance for farmers: experience from Etthiopia", Paper presented at Conference on new Directions for Smallholder Agriculture, 24-25 January 2011, Rome IFAD HQ.

Table 7: Households affected by drought in Ethiopia: 1980-2008

Disaster	Year	Number of people affected
Drought	1980	7,000,000
Drought	1983	7,750,000
Drought	1989	6,500,000
Drought	1997	986,0000
Drought	1999	4,900,000
Drought	2003	12,600,000
Drought	2005	2,600,000
Drought	2008	6,400,000

Source: Ethiopia Disaster Statistics (2008) www.preventionweb.net

Figure 20: Precipitation and food aid provision in Ethiopia

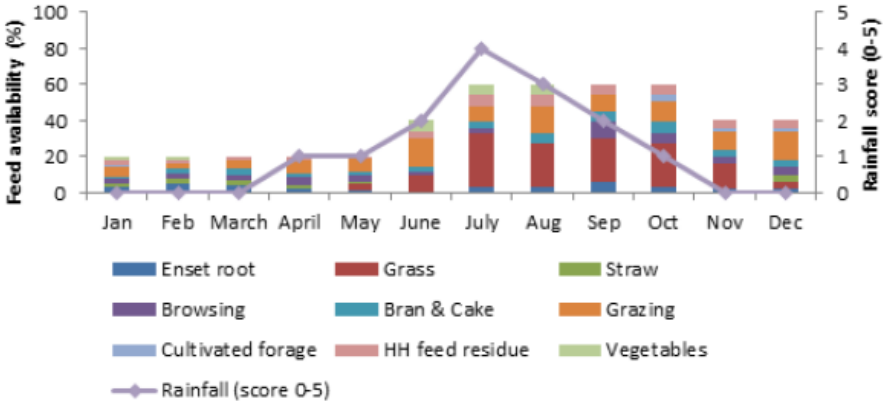


Source: Ethiopia Climate Risk Factsheet, World Bank (2008)

Studies by the World Bank (2007) show that the southern regions of Oromia as well as northern and eastern regions of AFAR are very prone to drought. So also is the Somali region. The western parts of Amhara, Tigray and SNNPR have relatively low risk of drought exposure but the eastern parts of Amhara, Tigray, certain parts of SNNPR and eastern Oromia face moderate to high risks of drought. The moderate to high risk regions are also major livestock producing regions, dominated by pastoralists and smallholder farmers engaged in mixed crop/livestock farming. The feeding system for the animals relies mainly on grazing and browsing of natural grass and bushes. Hence, feed availability depends to a large extent on rainfall, as depicted in Figure 21. Farmers and pastoralists provide supplementary feeding only during the dry seasons, usually in the form of crop residue (from cereals and pulses)[12].

12 Legese G. et al. (2014) "Sheep and goats value chains in Ethiopia: a synthesis of opportunities and constraints", ILRI 2014.

Figure 21: Rainfall and feed availability for livestock in Doyogena, Ethiopia



Source: Legese G. et al. (2014).

There are far more reported incidents of floods than drought in Ethiopia. These include general and flash floods. Data from the Emergency Events Database (EM-DAT) show that between 1900 and 2012 there were only 15 reported cases of drought. In comparison, there were 37 reported cases of flood (6 flash floods and 31 general floods). However, the impact of droughts were far more severe. Whilst the floods affected a total of 2,194,756 people and resulted in total losses over the period valued at about US$ 16.1 million, the respective figures for drought were 66,941,879 people and US$ 92.6 million[13].

3.2.2. Climate change and rainfall variability in Ethiopia

There is growing evidence that climate change is already occurring in Ethiopia. For instance, mean annual temperature in Ethiopia has risen by about 1.3 degrees Celsius between 1960 and 2006[14] – not far off the rise of between 1.8 and 4.0 degrees Celsius in global surface temperature predicted to occur by 2100 by the Inter-Governmental Panel on Climate Change (IPCC)[15]. The increase in minimum temperatures is reportedly higher than maximum temperatures over the past decade[16]. Furthermore, the rise in temperature in Ethiopia is more pronounced during –May-June and has occurred along with significant increase in the frequency of hot days as well as hot nights[17]. It is projected that rising temperatures will lead to more frequent extreme weather events such as drought and floods and also intensify their impact[18].

In addition to extreme weather events becoming more frequent, rainfall variability is predicted to increase, making rainfall less predictable[19]. A recent analysis of climate trends in Ethiopia reported in FEWSNET (Fact Sheet 2012 -3053) that between 1960 and 1989 total land area which received annual rainfall in excess of 500 mm per season during the *Belg* season was over 215,000 square kilometres. This level of rainfall is considered sufficient for viable food crop and livestock farming. However, over the past two decades total land area receiving this level of rainfall during the Belg season has contracted by about 16 percent. The regions which were reported to have been particularly affected were Oromia and SNNPR. For the Belg rains decline in rainfall of between 50-150 mm is reported to be occurring in the south-central and eastern parts of the country. Incidence of similar decline during the *Kiremt* season is reported to be concentrated in the western and southern parts of Ethiopia[20]. Estimates by DFID (2000) suggest that a 10 percent decline in rainfall below its long-term average reduces national output of grains by about 4.4 percent.

13 EM-DAT: the OFDA/CRED International Disaster database (www.emdat.be) – in Amha (2014).
14 Source: Climate Risk and Adaptation Country Profile: Ethiopia (2011).
15 IPCC (2007) "Climate change: the physical science basis" contribution of Working Group I to the Fourth Assessment report of IPCC, Cambridge University Press, UK and New York, USaA.
16 Keller M (2009) "Climate risks and project development: assessment report for a community-level project in Guduru, Oromia", Bread for All, November 2009.
17 Source: Climate Risk and Adaptation Country Profile: Ethiopia (2011).
18 Feyssa D H and D O Gemeda (2015) "Impact of climate change on production systems in semi-arid regions of Ethiopia ", Journal of Biological and Chemical Research Vol. 32 No. 2 pp.755-764.
19 Netherlands Commission for Environmental Assessment (2015) "Climate change profile: Ethiopia", July 2015.
20 FEWSNET (Fact Sheet 2012 -3053)

There is also evidence showing that the onset and duration of the rainy seasons is becoming more variable as a result of climate change[21]. The moderate to high risk zones in terms of vulnerability to drought include Afar, Amhara, Oromia, Somali and SNNPR which are also the areas of concentration in the production of staple grains such as maize and teff. Partly because of this household food consumption in rural households tends to decline by an estimated 16 percent as a result of drought shocks (World Bank 2007). Price hikes for major staples resulting from national food supply deficits makes poor urban households vulnerable to such shocks.

These climate-related developments are expected to have direct and indirect impacts on crop and livestock production in Ethiopia. For instance, the land area suitable for coffee production in the country is likely to be reduced significantly as temperatures rise because the crop typically does well at temperatures of 22 degrees Celsius and below[22]. Crop yield is generally expected to be more variable, especially as rainfall variability increases[23]. In particular, climate change is expected to exert severe adverse impact on livestock production in the semi-arid regions of Ethiopia[24]. The effects will be through direct reduction in milk yields due to rising temperature as well as decline in grazing material due to lower and more variable rainfall. It is not only adverse income effects which are anticipated but also rise in social tensions as competition for declining forage increases, including from pastoralists from neighbouring countries such as Djibouti, Somalia and Northern Kenya[25].

3.3. Biological and environmental risks

Biological and environmental risks include plant and animal diseases and pests which directly affect output and/or quality of crop or animal (thereby impacting on the marketability and/or value of the product). Though important in terms of impact on household income and food security, dearth of information and data tends to make assessment rather difficult. This is partly due to under-reporting, as noted by Eshte et al. (2015). Dealing with the known animal pests and diseases identified in this section poses a challenge for most smallholder farmers. However, rising temperatures as well as declining and more variable rainfall is expected to increase their incidence but also uncertainty regarding their occurrence[26].

3.3.1. Plant diseases and pests in Ethiopia

The common plant diseases which affect major crops in Ethiopia are listed in Table 8 below. Interestingly, teff has not only proved to be one of the most drought-tolerant cereals but it is also resistant to most of the diseases which affect the commonly-grown grains in Ethiopia.

Table 8: Some common diseases and pests of major crops in Ethiopia

Crop	Disease	Pests
Maize	Maize leaf rust	Busseola fusca
	Northern corn leaf blight	Chilo partellus
	Maize ear rot	
	Maize streak virus	
Sorghum	Anthracnose	Busseola fusca
	Head smut	Chilo partellus
		Contarinia sorghicola
		Atherigona soccata

(Continued)

21 Source: Climate Risk and Adaptation Country Profile: Ethiopia (2011).
22 Source: http://perfectdailygrind.com/2015/12theprice-of-climate-change-on-ethiopia-extinction-of-wild-arabica-by-2080/.
23 Netherlands Commission for Environmental Assessment (2015) "Climate change profile: Ethiopia", July 2015.
24 Feyssa D H and D O Gemeda (2015) "Impact of climate change on production systems in semi-arid regions of Ethiopia ", Journal of Biological and Chemical Research Vol. 32 No. 2 pp.755-764.
25 UNDP (2011) "Ethiopia framework for UNDP country climate change, environment and disaster risk management portfolio" UNDP 2011.
26 Feyssa D H and D O Gemeda (2015) "Impact of climate change on production systems in semi-arid regions of Ethiopia ", Journal of Biological and Chemical Research Vol. 32 No. 2 pp.755-764.

(Continued) Crop	Disease	Pests
Coffee	Coffee wilt disease	
	Coffee leaf rust	
	Coffee berry disease	
Cowpea	Cowpea leaf rust	
	Anthracnose	
Teff		Erlangerius niger
		Macrotermes subhyalinus
		Mentaxya ignicollis
		Decticoides brevipennis
		Delia arambourgi

Sources: Based on Eshte et al. (2015); Shibabaw et al. (2013) and http://ethiopia.ipm-info.org/

Common insect pests which affect major crops in Ethiopia are listed in Table 8 above. Lack of data makes it difficult to assess their impact on specific crops and locations. In addition, farmers face crop losses due to rodents, birds, termites and other pests. Borga, Naziri and Emana (2014)[27] estimated losses due to these as ranging from 8 to 15 percent of output, especially for the important food security crops such as teff and maize.

3.3.2. Livestock diseases and pests in Ethiopia

Reports from the Animal and Plant Health Regulatory Directorate (APHRD) indicate that the most common livestock diseases in Ethiopia include Rift Valley Fever (RVF), foot and mouth disease (FMD), contagious bovine pleuropneumonia (CBPP), contagious caprine pleuropneumonia (CCPP), Pest des petits ruminants (PPR), brucellosis in ruminants and lumpy skin disease (LSD). As shown in Table 9, there is a generally low level of treatment of the affected animals. The problem is further compounded low levels of reporting. For instance, the APHRD reports that in 2010/11 almost 2700 disease outbreaks were reported, in which 77153 cases and 14864 deaths were encountered. However, this represented an overall reporting rate of only 29.16 percent for the year. That level of reporting was also lower than the 40.41 percent recorded in 2009/10 as well as for the preceding five-years – with an average rate of 32.92 percent.

Table 9: Animals affected by various diseases and proportion treated (2003-12)

Animal	Number affected	Percentage treated (%)
Cattle	7,286,463	46
Sheep	4,996,616,	25
Goats	4,052,056	20
Horses, donkeys and mules	859,663	38
Camels	73,272	24
Poultry	13,093,874	8

Source: CSA (2003-12)

27 Borga F, D. Naziri and B Emana (2014) "Report on role of innovative finance in creating conditions to scale up adoption of technologies to reduce waste and spoilage in agricultural value chains in Ethiopia", Report produced as part of multi-country study commissioned by AGRA/Rockefeller Foundation.

The impact of these diseases on farm households is not only seen in terms of income loss when animals die but also marketing challenges which arise when major importing countries impose bans as a result of the outbreak of diseases. For example in 1998, a ban was imposed on exports through the port of Berbera in Somaliland, which is a major a major export point for Ethiopian livestock. The result was a steep fall in exports between 1997 and 1998, with the loss estimated at over US$ 100 million. Local prices in Ethiopia also fell by about 30 percent. In 2000, an outbreak of RVF occurred in Saudi Arabia and Yemen – the first recorded cases outside of Africa. In response, the two countries, along with four others (Bahrain, Oman, Qatar and the UAE) ban imports from the Horn of Africa. The ban remained in place for five years, leading to loss of export earnings estimated at about US$ 211.1 million per annum. The exports consist of both live animals (70 percent) and meat sales (30 percent). Cattle exprts constituted 46% of live animal sales followed by sheep with 35%. Chilled shoats' constituted about 80% of the volume of exported carcasses.

3.4. Risks in inputs and output markets

The survey report summarised in Table 6 shows that farmers have concerns about inputs prices as well as fluctuations in producer prices. These are discussed in this subsection.

3.4.1. Inputs markets risks in Ethiopia

Table 10 illustrates one of the challenges in efforts to transform agriculture in Ethiopia – the significant gap between average yields obtained by farmers and the potential which can be achieved with the use of improved/higher-yielding varieties. The gap ranges from 36.4 percent for wheat, through 44.6 percent for teff to 58.1 percent for maize. A report by ATA (2013) shows that yields are already increasing where farmers have improved technology under the Teff, Improved seed, Reduced seed rate, and Row planting (TIRR) programme. Comparing a control group to users of the TIRR package, it emerged that the latter achieved 44 percent increase in yields (26.6 quintal/hectare compared to 18. quintal/hectare). However, uptake of improved seed remains low – estimated by IFPRI (2011) at about 3 percent in terms of adoption per area under cultivation.

Table 10: Potential and current yields for major crops in Ethiopia (1993-2008)

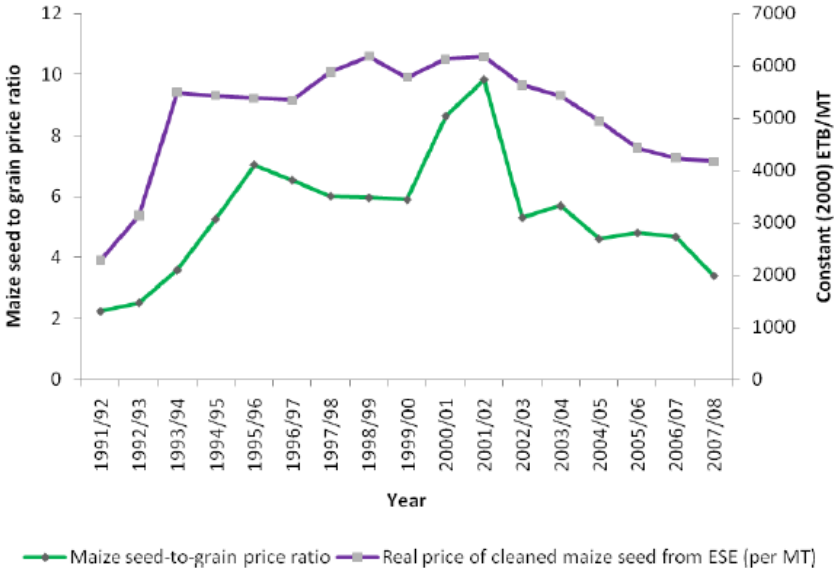
Crop	Yield for improved varieties introduced by:		Current yield (tonnes/hectare)
	SG 2000 (tonnes/hectare)	NAEIP (tonnes/hectare)	
Maize	4.60	4.73	1.98
Wheat	2.31	2.93	1.47
Sorghum	2.08	2.79	1.4
Teff	1.62	1.43	0.93
Barley	-	2.15	1.19

Source: Data from IFPRI (2011) Study on Seed, Fertiliser and Agricultural Extension in Ethiopia

This situation exists despite the fact that, as depicted in Figure 22, real seed prices have been stable or declined after sharply rising in the early 1990s. It is reported that some farmers who participated in the Participatory Demonstration and Training Extension System (PADETES) discontinued using the seed-fertiliser package which was promoted under that initiative. The bulk of farmers therefore use saved seeds (estimated at about 12 percent of own output) or seed from relations or "known"[28]. The performance of the seed material is therefore variable.

28 PRIME (Pastoralist Areas Improvement through Market Expansion Project) – Emergency Market Mapping and Analysis (EMMA) of Agricultural Input Supply and Extension Service in Pastoralists and Agro-pastoralist Areas of Ethiopia, May 2013.

Figure 22: Real hybrid maize seed and seed-to-grain prices in Ethiopia (1991-2008)



Source: IFPRI (2011) Study on Seed, Fertiliser and Agricultural Extension in Ethiopia.

Fertiliser uptake appears much higher than the level of adoption of improved seed. The volume of fertiliser imported by the country has risen by about 60 percent from 250,000 tonnes in 1995 to 400,000 in 2008 – a growth rate which is reportedly unsurpassed in Sub-Saharan Africa (Spielman et al. 2012)[29]. However, reports cited by these authors suggest that level of uptake is between 32 and 39 percent of households surveyed.

The marketing structure for both improved seed and fertiliser has public enterprises at the centre and involve an important role for cooperatives in the supply to farmers (IFDC 2012)[30]. For instance, the Agricultural Inputs Supply Enterprise (AISE) and cooperative unions constitute the dominant segment of the fertiliser distribution chain. The state-owned Ethiopia Seed Enterprise (ESE) is also the predominant supplier of seed, though some private sector actors are in the market but often choose to sell ESE rather than directly to farmers. Partly as a result of inputs subsidies, it is reported that an informal market for re-packaged fertiliser has emerged, causing uncertainty about the quality of inputs being distributed.

However, it appears that quality uncertainty is not the most critical factor influencing uptake of the inputs. An important factor for many farmers is access to inputs credit. In the past, regional governments provided 100 percent guarantee to the Commercial Bank of Ethiopia (CBE) for inputs credit. The cooperative unions acted as distributors as well as financial intermediaries with responsibility to enforce loan repayment. Loan recovery was very poor, partly because of the cooperative organisations weak loan collection systems as well as diversion of recovered loans for working capital financing for cooperatives[31]. Consequently, the regional governments disengaged from their involvement in inputs financing, leaving a gap which microfinance institutions are yet to fill properly.

Variation in the relative profitability of the use of inputs may be another factor influencing uptake of yield-enhancing inputs. For example, Figure 22 above shows that between 1991 and 2008 the maize seed to maize grain price ratio was variable from year to year. A study by IFPRI (2011) summarised below in Table 11 also shows that the profitability of fertiliser application by farmers in Ethiopia can vary for different years, even if Table 11 does not include consecutive years to check year to year variations.

29 Spielman D.J, D. Kelemework and D. Alemu (2012) "Seed, fertiliser and agricultural extension in Ethiopia" IFPRI/EDRI Research Note 12.
30 IFDC (2012) "Ethiopia fertiliser assessment" in support of Africa Fertiliser and Agribusiness Partnership.
31 Reported in ATA (2014) "New agricultural inputs sale system", November 2014.

Table 11: Value cost ratios for fertiliser in Ethiopia (1992-2008)

Crop/Zone	1992	1997	2004	2008
Teff:				
Shewa	3.96	1.67	1.92	1.91
Gojam	3.66	1.66	2.12	1.99
Arsi/Bale	3.60	1.63	1.85	1.69
Across country	3.74	1.69	2.02	1.91
Maize:				
Shewa	4.44	1.48	2.30	2.28
Gojam	4.24	1.41	2.69	2.42
Walega/Kefa	3.84	1.28	1.81	1.83
Gamu Gofa/Sidamo	4.13	1.38	1.73	NA
Across country	4.24	1.41	2.12	2.18

Source: IFPRI (2011) Study on Seed, Fertiliser and Agricultural Extension in Ethiopia

The value cost ratio, reported in Table 11, measures incremental income from fertiliser application against the cost of the fertiliser used. The rule of thumb is that a ratio of 2.0 and above denotes profitability in the use of fertiliser. The Table 11 shows variation in the profitability of fertiliser application for two major cereal (teff and maize) across different zones. It is also apparent that the profitability of fertiliser application may vary in different years. This may be due to steep increase in fertiliser prices but that cannot be said to be the case in Ethiopia as they remained relatively stable between 2003 and 2011/12, only rising sharply 2012/13 (Figure 5.6). The other potential cause of variation in the profitability of fertiliser use is in variation inter-year output prices, an issue which is analysed and reported in Section 5.7.2.

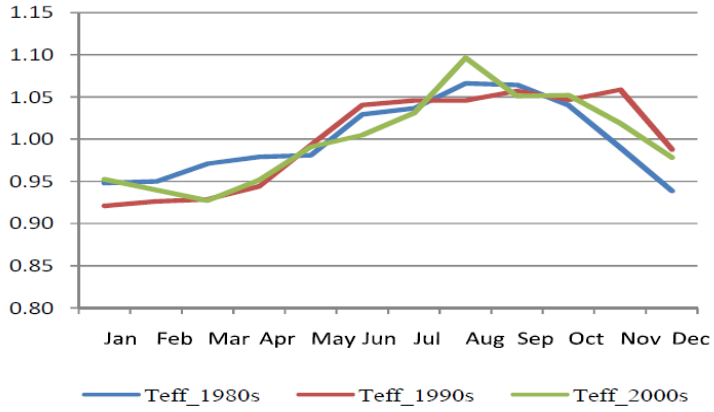
3.4.2. Output market uncertainties

It emerged from focus group discussions reported in Chapter 5 that farmers sometimes face challenges in marketing their produce. This appears to be a particularly notable risk for farmers producing non-traditional staple foods such as vegetables especially for urban markets. However, price risk is one of the most cited risks (including in Table 6). The predominance of informal marketing systems creates uncertainty for both producers and traders. The multiple layers of small and medium-scale traders tends to increase transaction costs and so squeeze margins for producers (Gabre-Mahdin 2001[32]).

Lack storage facilities as well as access to trade finance often limit the capacity of traders to absorb surplus produce, especially at harvest. The result sharp decline in prices at harvest but rising 4-5 months later. For example, as shown in Figure 23 the period December and January/February coincides with the time when teff prices bottom out. The price difference between the harvest season and when prices peak in July/August is estimated at between 15 and 40 percent (Fufa et al, 2011). This is a historical pattern that most farmers are familiar with and so, by definition, does not represent a risk. It is information that should be factored in their marketing strategies. However, most are unable to benefit from that knowledge. Fufa et al (2011) estimate that if farmers are able to spread the sale of their produce to take advantage of intra- seasonal price increase, households can obtain incremental income of between 26 and 39 percent – this issue is analysed in more depth in Section 5.7. Data from Ethiopian Grain Trade Enterprise (EGTE) indicate that wholesale prices are less variable than farmgate prices, implying that traders may be smoothing consumer prices through storage.

32 Gabre-Mahdin E. (2001) "Of markets and middlemen: transforming Ethiopia's agricultural marketing system", IFPRI, 2001.

Figure 23: Seasonal variability of teff wholesale prices



Source: Rashid and Asfaw (2011)

3.5. Policy-related risks in the agricultural sector in Ethiopia

The Government is maintaining strong presence in inputs and output markets in the agricultural sector in Ethiopia. In particular, it is driving innovations in the sector through the Ethiopia Agricultural Transformation Agency (ATA). Some of the policy actions taken by Government have enhanced the capacity of smallholder farmers to manage agricultural risks. For example, the National Bank of Ethiopia (NBE) has been involved in creating a supportive policy and regulatory framework to foster microfinance and micro-insurance, which benefit smallholder farmers and other value chain actors. The proactive role of Government in the development of the flagship Ethiopia Commodity Exchange (ECX) has been widely acknowledged (Coulter 2012). The Government of Ethiopia did not only contribute significantly to the equity of ECX but the policy directive to channel domestic trading of export commodities through the exchange helped to attain breakeven volumes within a rather short time frame. These cases are further discussed in Chapter 4 which focuses on a review of existing agricultural risk management (ARM) tools in the country. Note is, however, taken of the fact that implementation of some policy actions by Government may increase uncertainty faced by farmers. These actions, which are briefly discussed in this section, include land policies, restrictions on commodity exports (e.g. maize) and subsidies on imported wheat.

3.5.1. Land policies in Ethiopia

As stated in Section 2.3.3 the state owns all land in Ethiopia and is allocated to farmers. The Government of Ethiopia in 2005 launched major land reforms, a major part of which involved implementation of a land certification programme under which usufruct right was assured to parties to whom land is allocated, including farmers. This programme is enshrined in the country's new land law – *The Federal Democratic Republic of Ethiopia Rural Land Administration and Land Use Proclamation No. 456/2005*. The land certification programme and other authors, including Gebremedhin (2006)[33] and Holden et al. (2009)[34]. However, as shown in reviews reported in Section 5.8.1, there are social and administrative challenges which are impeding its implementation.

33 Gebremedhin B (2006) "Land tenure security, land rights and land investment in the highlands of Northern Ethiopia", IFPRI Environment and Production Technology Discussion Paper, 2006.
34 Holden S T, K Deininger and H. Ghebru (2009) "Impact of low-cost land certification on investment and productivity", *American Journal of Agricultural Economics*, No. 91 Vol. 2, 359-373.

3.5.2. Restricting maize exports in Ethiopia: a risk to producers and exporters

As stated in Section 2.4.2, maize has been selected as one of the priority crops for development as part of Ethiopia's agricultural transformation programme, partly because of the country's potential to export the preferred white, non-GMO maize into the regional markets. However, the development of sustained regional export trade relations tends to be truncated by policy interventions which restrict or ban exports. For instance, in January 2006, Ethiopia banned export of all grains including maize indefinitely[35]. This ban was intended to help contain huge food price hikes. For similar reasons, a ban on maize exports was imposed in 2011, just seven months after an existing export ban was lifted, the decision to re-impose the restriction driven mainly by upward pressures on food prices[36].

A review by Demeke (2012)[37] concluded that banning maize exports weakened producer incentives and hampered efforts to encourage growth in output and productivity. Furthermore, the interventions tend to be ad hoc because they are largely driven by variability in domestic market prices. Consequently, exporters who may be keen to invest in the regional export chains face considerable uncertainty and are therefore discouraged from such investments. Woldie and Siddig (2009)[38] estimate that the overall welfare loss resulting from the ad hoc export bans may be close to US$ 150 million. They therefore argue for adoption of alternative measures to curb soaring food prices, other than the imposition of restrictions on exports.

3.5.3. Uncertainty resulting from distribution of subsidised wheat in Ethiopia

Wheat is the largest imported grain in Ethiopia. Domestic production is predominantly by smallholder farmers in the highlands and mainly under rain-fed conditions. Despite output rising by over 30 percent between 2004/05 and 2010/11, Ethiopia remains a net importer of wheat. Imports are restricted to the state sector as the private sector is excluded. The rise in domestic wheat output over the seven year period (2004/05 to 2010/11) is dwarfed by the growth performance in teff (72 percent), maize (108.3 percent) and sorghum (130.8 percent)[39]. Demeke (2013)40 reports that wheat yields in Ethiopia are below what pertains in Kenya (by about 32 percent) and South Africa (by about 39 percent).

It is sometimes argued that the maintenance of a regime of subsidised prices for wheat is among the factors holding back growth in output and productivity in the subsector as the subsidies tend to depress domestic prices in real terms (Rashid 2010)[41]. This is partly because the benchmark prices which are used to compute selling prices for the imported wheat are based on exchange rates which are not determined by market forces. This contributes to uncertainty regarding producer incentives as the pricing process is somewhat administrative. Furthermore, access to the subsided wheat by beneficiaries in rural communities may be discouraged from investing in food production but rather opt for "rent-seeking" – there are anecdotes suggesting that some beneficiaries in both rural and urban communities sell their allocation of subsidised wheat (and cooking oil) close to the distribution centres.

3.6. Macroeconomic and other risks affecting the agricultural sector

Macroeconomic risk factors include inflation and exchange rate developments which impact on the pricing of agricultural inputs and services as well as income generated from the sale of farm produce. This implies that the macroeconomy influences incentives within agricultural value chains. From the brief review of Ethiopia's macroeconomy in Chapter 2 (Section 2.2) it is apparent that the rapid economic growth achieved by the country over

35 Source: http://www.reliefweb.int/rw/RWB.NSF/db900SID/VBOL-6LJGSV?OpenDocument
36 Ethiopian Times – 19th March 2011.
37 Demeke M (2012) "Analysis of incentives and disincentives for maize in Ethiopia", FAO-MAFAP, 2012.
38 Woldie G A and Siddig K (2009) "The impact of banning export of cereals in response to soaring food prices: evidence from Ethiopia", MPRA Paper No. 18241, November 2009.
39 Based on data from CSA.
40 Demeke M (2013) "Analysis of incentives and disincentives for wheat in Ethiopia", FAO-MAFAP 2013.
41 Rashid S (2010) "Staple food prices in Ethiopia", Paper presented at COMESA Policy Seminar, Maputo Mozambique, 25-26 January 2010.

the past decade has been against the backdrop of a stable macroeconomy. For instance, inflation has generally been in single digits. These developments have encouraged private investment in service industries such as banking and insurance, which support investment in the agricultural sector. It has also encouraged investment in industries dependent on agricultural raw materials, including private investment in the breweries which, for example, is driving up the development of the barley subsector. In the rest of this section we review how this apparent stability translates into cost of financial services as well as foreign currency-denominated earnings in real terms as these considerations impact on investment decisions.

3.6.1. Availability and cost of agricultural finance

As in most African countries, Ethiopia's financial sector is segmented into informal and formal sectors. Informal financial services providers include social groups such as *Iqqub* and *Idir* which offer savings and loans products. The informal financial sector also includes private money lenders, whilst friends, relations and trade partners are often a major source of finance, especially in the rural areas. The formal sector is dominated by the banking industry, which accounts for about 95 percent of total assets in the financial sector. The state sector dominates the banking industry in Ethiopia, consisting of the Development Bank of Ethiopia (DBE), the Commercial Bank of Ethiopia (CBE) and the Construction and Business Bank (CBB). Reforms initiated by the Government in the 1990s – including Proclamation Number 84/1994 – allowed entry by private banks into the industry. Since then, the number of private banks has doubled to 16 (from 8 in 1999/2000) and contributed to an almost ten-fold rise in the number of bank branches (from 267 branches in 1999/2000 to 2,208 branches in 2013/14) and a sharp fall in the average population per bank branch from 224,719 to less than 40,000. During this same period, the number of insurance companies operating in the country nearly doubled from 9 to 17 and the network of Microfinance Institutions (MFIs) rose from 16 in 1999/2000 to 31 in 2013/14. The CBE is the single most dominant, with over 40 percent of the network of branches. As at the end of the 2013/14 financial year the state-owned banks accounted for 64.9 percent of total loans advanced by domestic banks. The share of total lending by CBE in 2013/14 was about 53.7percent (NBE, 2015).

Interest rates controls by the central bank have kept both deposit and lending rates unchanged over the period of 2010 to 2014 as shown in Table 12. As a consequence, real deposit rates have been negative throughout this period and is in all probability stifling deposit mobilisation by the banks. NBE also influences allocation of credit into priority sectors and maintains credit caps, especially on private banks, which are required to purchase government bonds to the value of 27 percent of their loan portfolio. The combined effect of this and the rather low yields on Government debt instruments, including treasury bills, is to blunt incentives for lending by the private bank. It is, therefore, not surprising the levels of excess reserves (beyond the statutory requirements by the NBE) remain quite high – 69.16 percent in 2013/14.

Table 12: Selected financial sector indicators in Ethiopia (2010-2014)

Particulars/Years	2010/11	2011/12	2012/13	2013/14
Average savings deposit rate (%)	5.38	5.38	5.38	5.38
Average lending rate (%)	11.58	11.58	11.58	11.58
Real savings deposit rate (%)	-3.39	-3.75	-3.33	-3.09
Real lending rate (%)	3.11	2.75	3.17	3.41
Excess reserves/reserve requirements ratio (%)	22.4	20.52	80.72	69.16
M2/GDP (%)	28	25	27	28
Currency ratio (%)	22.4	20.3	19.4	17.9

Source: National Bank of Ethiopia Annual Report (2014)

Growth in the number of banks and non-bank financial intermediaries, including the rising number of private financial intermediaries, appears to be spurring increase in the supply of diverse financial products in the Ethiopian market. Box 1 provides a list of some the available financial products (by no means exhaustive). However, most

smallholder farmers as well as small, medium and micro enterprises (SMMEs) in agricultural value chains cannot access these products. Lack of suitable collateral and their high risk profile are some of the factors which discourage lending by formal financial intermediaries to the SMMEs (Amha 2014).

Box 1: Available financial products offered by Ethiopian banks

Most banks offer short-term loans with maturity ranging between 1-3 years, usually to finance working capital needs. Medium-term (up to 5 years) and long-term loans (over 5 years) may be granted to finance acquisition of fixed business assets and for new projects, including expansion of existing business. Average lending rates charged by the state-owned commercial banks is about 9.5 percent per annum whilst the private banks charge interest rates ranging between 11.5 and 15 percent. The Cooperative Bank of Oromia (CBO), whose major shareholders are primary cooperatives and unions, typically charges a lower interest rate (12%).

Agricultural inputs loans – which are short-term loans granted to farmers unions for the purchase of fertilizers, agro-chemicals and improved seeds. These loans used to be provided by the state-owned Agricultural Input Supply Corporation (AISCO) and were guaranteed by the regional governments. High levels of loan default led the regional governments to scale back their involvement, leading to MFIs becoming the main source of finance for acquisition of agricultural inputs.

Special truck loans – mainly short-term loans granted to coffee and sesame exporters to help ease pre-shipment transportation problems. Eligible exporters should have earned at least earned USD 4 million or equivalent of other currencies during twelve months preceding the application date. The vehicle has to be a dry cargo truck and trailer with minimum loading capacity of 300 quintals.

Purchase order finance – is available in Ethiopia but almost exclusively for export crops such as sesame. WFP purchase orders are among the most popular for banks in Ethiopia.

Pre-shipment export credit facility – CBE offers this facility for export crops, including sesame. It is a short term loan which is usually granted to customers who are able to present receipts of export proceeds of at least US $300,000. The reliability of the foreign buyer is of paramount importance in evaluation of the loan application and the advance rate ranges from 70 to 90 percent depending on the type of goods to be exported (e.g. 70 percent for sesame). The facility is available for a maximum of one year and the lending interest rate is 7.5%. One of the main incentives of the bank is to secure access to foreign exchange.

Revolving export credit facility – is an advance extended by the CBE to exporters upon presentation of acceptable export documents except bill of loading. Borrowers are required to submit export documents including, for example, an irrevocable letter of credit (L/C), waybill, insurance contract and other documents specified in the L/C. The maximum advance rate is up to 80 percent of the value of the goods to be exported and the facility is available for a maximum of one year and at lending rate of 7.5 percent.

Financial lease can enable small-scale processors and commercial investors acquire durable goods such as equipment. In Ethiopia this form of financing is permitted under Proclamation No. 103/1998 and the Capital Goods Leasing Business (Proclamation No. 807/2013) which enables the NBE to license financial lease and hire-purchase business activities.

Source: Authors.

Microfinance institutions (MFI) appear well-positioned to fill the financing gap left by the formal banking industry. However, it is acknowledged that the concentration of their activities is skewed in favour of urban areas. For instance, as reported by NBE (2012) about 50 percent of MFIs network are located in Addis Ababa, which also accounts for 40.4 percent of the total credit disbursed compared to Tigray 20.1 percent, Amhara 16.4 percent and Oromia 11.8 percent. It is estimated that, currently, MFIs meet nearly 20 percent of potential demand for finance by micro, small and medium-scale enterprises (MSME), including smallholder farmers. The bulk of the financing they offer are short to medium term loans at interest rates ranging from 11.5% to 24% - and averaging 18 percent – well above the average in the banking industry.

In the past regional governments guaranteed credit supplied to farmers through cooperatives. High levels of default led to substantial losses against these guarantees, leading to regional governments discontinuing those schemes. The consequence has been even more uncertainty regarding access to inputs finance by smallholder farmers. Government through ATA has responded by piloting a new inputs financing schemes. The pilot is reviewed in Chapter 4 of this report. What is apparent though is that any sustainable inputs financing scheme requires not only efficient delivery institutions but also the incorporation of effective measures to mitigate agricultural risks which tend to accentuate the problem of high loan default in the rural economies.

3.6.2. Exchange rates and producer incentives for export commodities

As reported by Demeke (2013) Ethiopia maintains a managed floating exchange rate regime with strong government control and the domestic currency has been relatively stable over the past decade. This stability did not reflect higher levels of inflation in the country relative to levels in the major trading partners of Ethiopia. For instance between 2005 and 2008, the country recorded double-digit inflation rates but the nominal exchange rates rose by a mere 13 percent over that period. The consequent over-valuation of the domestic currency adversely affected incentives for exports and also weakened price competitiveness of locally-produced substitutes for imports (Kassie 2015)[42]. Anecdotal evidence which emerged in the course of this study suggest that some exporters of Ethiopia's traditional agricultural exports such as coffee opted for a "loss-leading" export marketing strategy with the primary intent of generating foreign exchange which they directly use to finance imports.

3.7. Infrastructure constraints affecting Ethiopian agriculture

3.7.1. Transport infrastructure

Cost of transport impacts significantly on the cost of inputs – for instance IFDC (2012) notes that transport costs alone account for about 70 percent of the wholesale price of fertiliser in the country[43]. Gabre-Mahdin (2001) also noted that poor rural transport infrastructure tends to increase transaction costs in output markets, leading to higher distribution margins which squeezes producer margins[44].

The Government of Ethiopia has, through implementation of the Road Sector Development Programme (RSDP) between 1997 and 2007, invested heavily in rural road construction. As a result, the length of rural roads (dirt roads) increased almost five times between 1992 and 2008. Over the same period, the length of asphalt and gravel roads in the country increased at growth rates of between 60 percent and 71 percent (Rashid and Negassa, 2011).

Investments in rural road infrastructure is being sustained. For instance, the International Development Association (IDA) is supporting continuation of the Road Sector Development Project with a loan of US$ 245 million to expand and maintain the road network in Ethiopia. This loan was approved in 2009 and implementation of the project will continue until 2016. In addition to the construction and/or upgrading of four hundred asphalt roads, the project also seeks to strengthen the capacity of the Ethiopian Roads Authority as well as other agencies (World Bank, 2015).

Despite these investments, the state of rural roads pose a challenge in the marketing of agricultural produce. Rashid and Negassa (2011) note that because rural (dirt) roads are not all-weather-proof, transportation of produce during the rainy seasons can be difficult and costly. They add that this also tends to put increased pressure on producers and traders to transport produce to consumption centres when the conditions are right, thereby putting urban marketing infrastructure under pressure.

42 Kassie N M (2015) "Assessment of real effective exchange rates and external sector development of Ethiopia", International Journal of Business and Economic Research, No. 4 Vol. 4: 64-70.
43 IFDC (2012) "Ethiopia fertiliser assessment" in support of Africa Fertiliser and Agribusiness Partnership.
44 Gabre-Mahdin E. (2001) "Of markets and middlemen: transforming Ethiopia's agricultural marketing system", IFPRI, 2001.

3.7.2. Storage infrastructure

Lack of efficient storage infrastructure, which is accessible to smallholder producers is contributing high post-harvest losses as well as limiting farmers' choice in terms of marketing strategies which optimise household farm incomes. Box 2 provides brief information on the availability of storage infrastructure. Responding to this need the Government is exploring options to assist cooperative unions to invest in storage infrastructure in order to meet about 80 percent of their projected warehousing needs through long-term contracts with either public or private-sector suppliers.

Box 2: Availability of storage infrastructure in Ethiopia

An assessment of storage infrastructure conducted by WFP in 2013 explains that the major stores and warehouses in Ethiopia are owned by Government, public enterprises, private commercial companies, and individual traders. The major owners of storage facilities are: The Ethiopian Grain Trade Enterprise (EGTE). EGTE has a total store capacity of approximately 800,000 t throughout the country; EGTE is the biggest store owner in Ethiopia. Many of its warehouses are in Addis Ababa, Nazareth, Dire Dawa, Shashemene, Mekelle are leased to WFP, EFSRA and ECX.

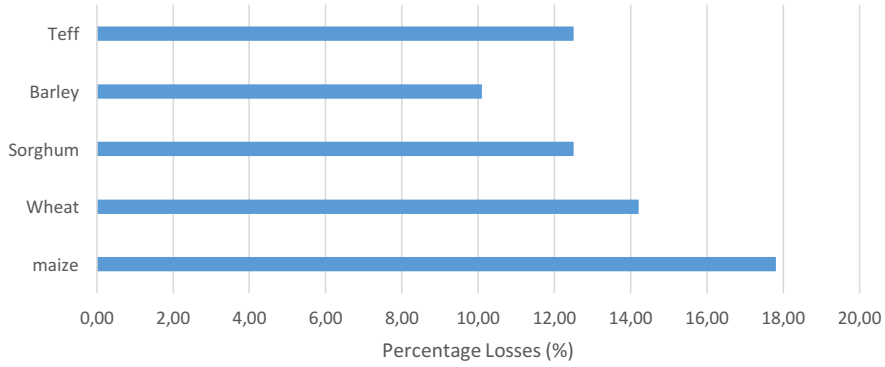
- The Ethiopian Food Security Reserve Administration (EFSRA). The second biggest store owner in the country, EFSRA has a total of 322,000 t warehouse capacities in 7 strategically located sites.
- The Disaster Risk Management and Food Security Sector (DRMFSS).
- The Merchandise Wholesale & Import Trade Enterprise (MEWIT). This is a governmental enterprise engaged in importing and distributing consumer goods like vegetable oil, pasta, wheat flour, sugar, cement, etc. MEWIT owns warehouses throughout the country, many of them are leased to NGOs, WFP, and other companies.
- The Agricultural Input Supply Enterprise (AISE). This is a state enterprise, engaged in importing and distributing mainly fertilizers and agricultural inputs. It has stores throughout the country. WFP leased one of its warehouses in Mekelle.
- The Ethiopian Seed Enterprise (ESE), has warehouses in some locations. In Kombolcha, one of ESE's warehouses is leased to WFP.
- Bureau of Agriculture (BoA), has warehouses at regional level. Farmers' Cooperative Unions: FCU's own and lease stores to store their produce, agricultural inputs etc. throughout the country.
- As is apparent from the above, the bulk is owned by the state. Warehouses with a total of approximately 300,000 t capacity are owned by private owners mainly in towns and cities like Addis Ababa, Nazareth, Dire Dawa, Shashemene, Gondar and Mekelle. The factors restricting private investment in warehouses and silos for storing agricultural commodities will be examined during the field studies. Related to this will also be an examination of capacity building needs of storage and commodity handling personnel in the country, especially those in areas where there is surplus production of the focal commodities.

Source: WFP (2013)

3.7.3. Infrastructure constraints and high postharvest losses

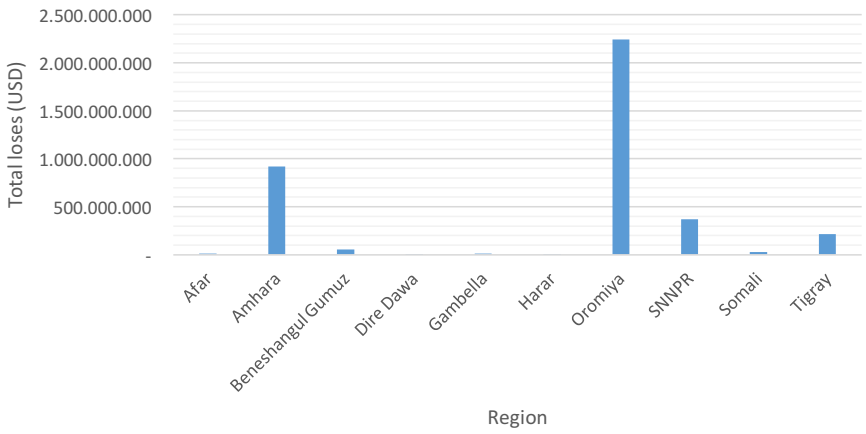
Postharvest losses in the crop subsectors in Ethiopia is high, ranging from about 10 percent for barley to close to 18 percent for maize (Figure 24). The average loss for teff is estimated at about 13 percent. The value of these losses represents quite a substantial income loss to farm households and the agricultural economy as a whole. Between 2005 and 2012, the value of postharvest losses for major grains (maize, barley, sorghum and wheat) exceeded US$ 430 million per year for each year except 2006 when the total estimated losses was US$ 233.6 million. The loss is computed in terms of both volumes lost as well as value loss due to quality deterioration – in this case though the food may be available for farm households they stand to lose revenue due to difficulties in marketing substandard produce.

Figure 24: Average post-harvest losses for Ethiopia (2005-2013)



Source: from APHLIS data.

Figure 25: Total Postharvest Losses (USD) per province for grains (Maize, Wheat, Sorghum and Barley) (2005-2012)



Source: Based on data from APHLIS

Table 13: Estimated annual revenue loss (USD) from grain postharvest loss in Ethiopia (2005-2012)

Commodities	2005	2006	2007	2008	2009	2010	2011	2012
Maize	85,512,041	93,216,570	204,734,830	242,300,712	191,022,481	141,655,594	136,226,043	271,590,034
Wheat	404,708,064	79,894,593	154,044,894	195,941,446	147,424,248	133,364,569	124,581,993	169,946,441
Sorghum	28,586,321	33,096,957	28,832,954	130,951,361	115,119,672	88,680,736	118,919,212	158,359,852
Barley	24,864,855	27,395,786	50,492,707	66,658,505	56,600,717	53,050,292	45,276,573	57,334,665
Total losses	**543,671,280**	**233,603,905**	**438,105,384**	**635,852,025**	**510,167,118**	**416,751,190**	**425,003,820**	**657,230,991**

Source: Based on data from APHLIS

As shown in Figure 25, the incidence of high postharvest losses is concentrated in Oromia, Amhara, SNNP and Tigray, which are also highly vulnerable to weather risks. Lack of efficient postharvest facilities, including limited access by smallholder farmers to storage infrastructure contributes to this problem. However, sub-optimal decisions by farmers can also lead to variations in the scale and severity of postharvest losses. For instance, as noted by IFPRI (2011)[45], limited access to and low levels of uptake of extension and appropriate pre-and postharvest technologies contribute to the high losses – Table 14 shows available simple technology options to reduce postharvest losses but lack of finance limits uptake.

Table 14: Description of teff production and postharvest losses in Ethiopia

Harvesting	Shattering – occurs when crop starts to dry and during harvesting Can lead to losses estimated at 2-5 percent (valued at US$ 10-25 million)	May be minimised by harvesting the crop while it is still green but this may affect the quality of the grain – an issue which is growing in importance in the urban markets. Solution lies in uptake of harvesting tools which allow for timely harvesting while minimizing shattering losses.
Postharvest handling: On farm drying	Losses due to birds, rodents, animals and termites Losses estimated at 1-2% (FAO 1999) and valued at US$ 5-10 million	Use of recently-introduced portable mechanical threshers but reported cost may be an issue for smallholder farmers (about Birr 38,000 of US$ 2,000) in 2010,).
Transportation to threshing site	Transporting to threshing sites (about 2-10 kilometres) Can lead to losses estimated at 2-4 percent (FAO) valued at US$10-20 million.	Improved harvesting, drying and storage technology will help reduce these losses significantly.
Threshing	Manual threshing – losses due to shattering, spillage in threshing area and eaten by treading animals (FAO). Losses estimated at 4-6 percent (US$20-30 million).	
On-farm winnowing	Traditional winnowing Can lead to losses estimated at between 2-5 percent (US$ 10 – 25 million)	
Storage losses	In-store losses comparatively lower than most cereals due to nature of the crop (FAO). Storage losses estimated at 1.9 percent (FAO) and valued at US$9.5 million.	

Source: Borga et al. (2014) [46]

Based on the recent estimates from the African Postharvest Losses Information System (APHLIS) which have been discussed above, it is apparent that reducing postharvest losses can lead to significant increase in food availability and household income without any major investment in agricultural extensification or intensification. This challenge is, however, taken as a risk and so is not prioritised in Chapter 6. It is evident, though, that potentially huge benefits can be gained by farm households and the agricultural economy as a whole if it is tackled by policymakers.

45 IFPRI (2011) Study on Seed, Fertiliser and Agricultural Extension in Ethiopia
46 Borga F, D. Naziri and B Emana (2014) "Report on role of innovative finance in creating conditions to scale up adoption of technologies to reduce waste and spoilage in agricultural value chains in Ethiopia", Report produced as part of multi-country study commissioned by AGRA/Rockefeller Foundation.

4. Mapping available risk mitigation tools in Ethiopia

4.1. Introduction

In the preceding chapter we discussed agricultural risks in Ethiopia. These included pre-harvest risks which impact on farm output as well as postharvest risks which affect farm-related household income and household food security. The risks may be idiosyncratic (i.e. directly affecting individual households) and therefore potentially insurable or covariant (i.e. shocks which affecting a large number of people), thereby limiting the scope for private insurance. Though the focus is on the effects of these risks on farmers, it is notable that they also impact on the livelihoods of other actors in agricultural value chains. Hence, fostering effective risk management in the agricultural sector requires a range of tools. In this chapter we review the existing agricultural risk management (ARM) systems in Ethiopia including traditional coping mechanisms as well as public and market-based tools.

4.2. Traditional agricultural risk coping mechanisms in Ethiopia

Table 15 summarises the main coping strategies adopted by smallholder farmers in Ethiopia. Oromia, which is the focus of the study through the information in Table 15 was generated, is particularly vulnerable to the major agricultural risks identified in Ethiopia. It is evident that the coping strategies are mainly ex-post in nature, that is, they are measures which are taken in order to cope with the impact a risk event which has occurred. In contrast, ex-ante risk management strategies are adopted before the risk event takes place.

Table 15: Ranking of rural households' risk coping mechanisms Oromia and SNNP

Regions participants	First	Second	Third	Fourth	Fifth
Oromia (cereal producers)	Faith and prayer	Selling property	Dependence on relatives	Saving	Dependence on government
Oromia (pastoralists)	Faith and prayer	Social network	Saving and migration	-	-
SNNP (coffee producers)	Iqub and Insurance	Loan from bank	Iddir	Saving	-

Source: Wolday (2014) citing: MDTCS (2009) Micro-insurance demand study for Ethiopia. A report submitted to Oxfam America. Addis Ababa

There is a rather high ranking given by respondents to "faith and prayer" as a coping strategy (Table 15). This may illustrate the limited tangible options households have in managing risks rather than how religious they are. Many of the respondents in the cited report depend on social networks and relatives – including 37.9 percent of them borrowing from these sources for consumption smoothing purposes. However, this strategy may not be reliable especially when the risk is covariant and many households have little or no spare resources to support others. Selling assets such as livestock represented the main option for 26.3 percent of the respondents while 17.8 percent coped by depleting savings. In general, as noted by Jaffee S., P. Siegel and C. Andrews (2008[47]) such options do not only offer insufficient protection against severe negative shocks but can also undermine the future wellbeing and coping capacity of households as productive assets are sold. Recent studies by Wolday Amha and Peck (2010)[48] and Oxfam America (2011)[49] confirmed the inadequacy of the traditional risk coping strategies adopted by most rural households in Ethiopia.

47 Jaffee S., P. Siegel and C. Andrews (2008) "Rapid Agricultural Supply Chain Risk Assessment: Conceptual Framework", Agriculture and Rural Development Department, World Bank.
48 Wolday Amha and D. Peck (2010) "Livestock insurance demand in Ethiopia", Study conducted for piloting livestock insurance for smallholder/commercial farmers by Nyala Insurance Company.
49 OXFAM America (2011) HARITA Quarterly Report: January-March 2011.

4.3. The agricultural insurance market in Ethiopia

In Chapter 3 (Section 3.2) we identified weather risks, in particular drought and flood, as highly critical risks facing crop and livestock farmers in Ethiopia. Insurance offers a formal means by which farmers can transfer this risk to a better-capitalised entity (an insurance company) by paying a predetermined price (a premium). Table 16 presents a list of insurable risks identified by households in Oromia and the SNNP. However, as in most African countries, the market for agricultural insurance in Ethiopia is severely under-developed.

Table 16: Insurable risks identified by rural households in Oromia and SNNP

Region and participants	Risks
Oromia (cereal producers)	Death and sickness of family members, crop failure, and livestock loss
Oromia (pastoralists)	Loss of livestock
SNNP (coffee producers)	Loss of coffee and Inset, loss of stored coffee, property loss, death, fire, and motor accident

Source: MDTCS (2009) Report of study on micro-insurance demand in Ethiopia[50].

Currently, there are fifteen insurance companies in Ethiopia and the industry is dominated by the private sector as there are only two state-owned insurance companies: Ethiopian Insurance Corporation and Nice Insurance Corporation (Table 17). The market share of the private insurance companies, in terms of branch network, is 74.4 percent.

Table 17: Insurance companies and branches in Ethiopia (2015)

No	Insurance name	Branch number	Market Share (%)
1	Ethiopian Insurance Co	46	17.9
2	NILE Insurance Co	21	8.17
3	Nyala Insurance Co	20	8.17
4	Nice Insurance Co	19	7.39
5	Awash Insurance Co	32	12.45
6	United Insurance Co	24	9.34
7	NIB Insurance Co	22	8.56
8	Africa Insurance Co	13	5.06
9	Gloal Insurance Co	10	3.89
10	Lion Insurance Co	14	5.45
11	Oromia Insurance Co	19	7.39
12	Abay Insurance Co	3	1.17
13	Berhan Insurance Co	6	2.33
14	Tsehay Insurance Co	5	1.95
15	Ethio Life & General Insurance Co	3	1.17
	Total	257	100

Source: NBE Annual Report, 2015.

50 Cited in Wolday Amha (2014) "Agriculture and food security risks in Ethiopia: risk profiles, management and harmonization of interventions", study commissioned by FAO, Rome 2104.

In general there is not much appetite in the industry to supply agricultural insurance products. The main exceptions are Nyala and Oromia Insurance Companies, which offer the following products:

Crop micro-insurance:
- Multi-Peril Crop Insurance
- Named Peril Crop Insurance
- Weather Index Crop Insurance

Livestock micro-insurance:
- Multi-Peril Livestock Insurance
- Weather Index Livestock Insurance

4.3.1. Commercial supply of indemnity-based multi-peril insurance products

The multi-peril insurance products cover for damages due to events such as drought, flood, hail or frost. Being indemnity-based products, claims are paid based on assessment by skilled assessors, who evaluate losses incurred by individual farmers. The premiums charged range between 4-5 percent. Uptake of these products is still very limited and predominantly by large-scale farmers, especially those engaged in producing high-value crops such as sesame. Smallholder farmers who access these products are reached through cooperatives, which also act as the first line of technical assessment of losses (i.e. prior to claims being submitted to the insurance companies).

Though the cover is for multiple perils, the claims appear to be concentrated in particular perils during a season. For instance, most of the claims in 2010 and 2012 were by maize and peas producers for damages suffered as a result of hailstorm. In 2011 the majority of claims were by wheat farmer for losses due to yellow rust. Compensation for weather-related losses include drought which affected soya beans and sesame farmers in 2012. In 2014 the predominant claims were by chicken peas producers whose output suffered as a result of excessive rain during the harvest season. The concentration of claims was location-specific.

Table 18: Crop insurance claims paid by private insurer in Ethiopia (2010-14)

Year	Crops affected	Total claims (Birr)	Location/zone	Reason for claims	Claims/Gross premium ratio
2010	Maize	560,781.00	East Showa	Hailstorm	100%
2011	Wheat	71,755.00	West Showa	Yellow rust	
2012	Peas	12,425.00	South West Showa	Hailstorm	100%
2012	Soya beans and sesame	514,171.00	East Wollega	Rainfall deficit (drought)	80%
2013	-	-	-	-	0%
2014	Chicken peas	58,522.00	Oromia Special Zone	Excessive rain during harvest time	10%

Source: Oromia Insurance Company, Ethiopia.

Judging by the ratio of total claims to gross premium earned (last column in Table 18) it is apparent that supply of indemnity-based insurance products is financially sustainable. Lack of industry-wide data made it difficult to assess this beyond a single case. The main concern for the providers, however, is how the product will fare if the insured events occur on a catastrophic in scale.

4.3.2. Piloting weather-indexed insurance products

Unlike the multi-peril indemnity-based product above, weather-indexed insurance links pay-outs to an index which is highly correlated to local yields, usually rainfall. Several pilots have been implemented in Ethiopia since the mid-2000s. These include:

a. A pilot at the macro-level involving the World Food Programme (WFP and the Ministry of Agriculture) initiated in 2006 and targeting five million people previously identified by the Government's Productive Safety Net Programme as transiently food insecure and directly affected by drought. According to Araya (2011)[51] this pilot was discontinued because rainfall was sufficient, making pay-outs unnecessary.

b. Pilot project involving the World Bank and Ethiopian Insurance Corporation launched in 2008 and subsequently discontinued due to the premium being perceived as too high and no drought/flood occurred to trigger pay-outs.

c. In 2009 Nyala Insurance Company (NISCO) added weather-indexed crop insurance to its multi-peril, indemnity-based product which was launched in 2008. The weather-indexed product initially targeted 137 haricot bean farmers, who had their farmer's union paying the premium[52]. This pilot involved Oxfam America and funding by the Rockefeller Foundation. Also involved in the partnership were Swiss Re, the Relief Society of Tigray, Dedebit Credit and Savings Institution and Africa Insurance Company under the Horn of Africa Risk Transfer for Adaption (HARITA) Program which was launched in 2007. In 2012 rainfall in the target communities was lower than the predetermined threshold, triggering pay-outs of US$ 322,772 to 12,200 farmers in 45 villages in Northern Ethiopia[53]. The pay-out represented half of the total insured amount and the drought was determined using satellite technology rather than rain gauges. It was observed, however, that basis risk was evident because yield losses varied greatly among beneficiaries (Degefa 2010[54]).

d. WFP, supported by USAID joined the partnership in 2011 and expanded HARITA, transforming it into "Rural Resilience Initiative" to help poor farmers protect their crops and livelihoods from the impacts of climate variability and change, including drought[55].

NISCO currently sells weather-indexed insurance through the Lume Adama Farmers' Cooperative Union (LAFCU) and Bacho Farmers' Cooperative Union (BFCU). These two unions together reach approximately 60,000 clients[56]. The unions supply inputs to farmers on credit, which includes upfront payment of the insurance premiums. Uptake is reportedly low, at about 10 percent of the membership. NISCO also collaborates with the unions to educate farmers on the insurance product, including how the rainfall deficit computation panels (a tool to settle claims) works and when pay-outs will be triggered.

Just as is the case with NISCO, Oromia Insurance Company also offers weather-indexed insurance and indemnity-based products through cooperative unions. The latter are offered as commercial products whilst the weather-indexed products are all provided under various donor-funded projects. For example, it provides cover under a JICA-funded project under which farmers pay a premium of 0.1 percent, even though it earns 21 percent of the sum assured as administrative costs. It also provides weather-indexed insurance at variable premiums, depending on the level of cover provided to the farmer. For instance, if the cover represents 85 percent of the sum assured (which covers production cost), then the premium charged in 13 percent. The premium drops to 10 percent if the insurance covers 80 percent of the production cost and 7.5 percent if 70 percent of the production cost is insured. These rates compare with an average of 4.5-5.5 percent for the indemnity-based product it offers – though it covers a broader range of perils than the single-peril index-based insurance.

51 Araya N. S. (2011) "Weather insurance for farmers: experience from Ethiopia", Paper presented at IFAD Conference on New Directions for Smallholder Agriculture" 24-25 January 2011, IFAD HQ Rome.
52 Hazell P, J. Anderson, N. Balzar, A. Clemmensen, U. Hess and F. Rispoli (2010) "Potential for scale and sustainability in weather index insurance for agriculture and rural livelihoods", IFAD/WFP.
53 Source: http://www.oxfamamerica.org/press/largest-weather-index-insurance-payout-for-small-scale-african-farmers-triggered-by-satellite-technology/
54 Degefa T (2010) "Evaluation report on weather index-based pilot insurance project, College of Development Studies, Addis Ababa University. Addis Ababa.
55 Nielsen T (2012) "A qualitative assessment of weather-indexed crop insurance in Ethiopia", Department of Agricultural Economics and Social Sciences in the Tropics and Subtropics< University of Hohenheim, Germany.
56 Was reported to be 47,000 in 2009 by Meherette E (2009) "Providing weather index and indemnity insurance in Ethiopia" IFPRI Focus 17 Brief 8 December 2009.

Uptake of agricultural insurance products – both indemnity-based and weather-indexed products – remains low in Ethiopia. A number of studies put the blame on low level of farmers' awareness, high premiums (especially for the weather-indexed products) and uncertainty regarding pay-outs57. However, experience from elsewhere – global and from other parts of Africa – suggest that the following also matter in promoting uptake of such products: effective bundling of insurance with farm credit; minimisation of basis risk; and cost-effective pricing of the products58. These factors need to be taken into account in efforts to scale up and/or develop new insurance products targeting farmers in Ethiopia.

4.4. Managing output market risks in Ethiopia

Formal, structured trading systems offer a means by which uncertain access to markets as well as price risks can be mitigated. Some of these systems already exist in Ethiopia and are reviewed in this section. They include collective marketing through farmers' organisations, forward contracting, commodity exchanges and warehouse receipt systems (WRS).

4.4.1. Collective marketing involving cooperatives in Ethiopia

Collective marketing has proved critical in facilitating access by smallholder farmers to formal markets in Africa, especially for staple grains (Onumah 2013a). In Ethiopia the most common form of collective marketing is through cooperatives, which have historically been engaged in providing members with services such as inputs supply and credit provision. Cooperatives continue to play a central role in agricultural and rural development and growth strategies (Bernard and Taffesse 2012). For instance, under the current Agricultural Transformation Agenda and the two Growth and Transformation Plans (2011-2015 and 2016-2020) it is anticipated that cooperatives will produce about 50-60 percent of agricultural output over the next decade. Box 3 and Box 4 show how are engaging in emerging crop marketing arrangements which provide increased certainty regarding market access as well as prices In so doing the cooperatives appear to be improving smallholder farmers' access to resources at the pre-harvest level, including finance, which have the potential to promote pro-poor growth in rural communities (Bernard and Spielman, 2009).

Box 3: Boosting formal grain marketing through cooperatives-based trading

Since 2010 the World Food Programme (WFP) has, as part of it Purchase for Progress (P4P) Programme been leveraging its purchasing capacity to promote broader development in the grains subsectors in Ethiopia. P4P forms part of WFP's local procurement programme. It is funded by the Bill and Melinda Gates Foundation and in Ethiopia is being implemented in collaboration with ATA. Procurement under P4P is expected to be directly from smallholder farmers' organisations and from 2010 has constituted between 6 percent and 14 percent of total local grain procurement by WFP in Ethiopia. The main grains bought under the system are maize, sorghum, wheat and beans (white and red). During the 2012/13 harvest season, WFP bought a total of 19,000 tonnes of grains under this system from smallholder farmers. As a result of its success, WFP in 2014 contracted with 29 cooperative unions to purchase a total of 40,000 tonnes. The programme started in 2010 with seven cooperative unions but by 2013 number of unions had doubled to 14.

57 These include: Nielsen T (2012); Meherette E (2009); Wolday Amha (2014); and Bryla E and J Syroka (2007) "Developing index-based insurance for agriculture in developing countries", UNDESA Sustainable Development Innovations Brief, Issue No. 2, March 2007.
58 Source: Van Asseldonk et al. (2014) "Is there evidence on linking crop insurance and rural credit?", FARMAF Policy Brief.

The process involves training and capacity building for participating farmers in postharvest handling of grains, quality control and agribusiness management. WFP (August 2014) reported that over 280,000 farmers benefited from the training. The cooperative unions are assisted to construct warehouses which are equipped with equipment for postharvest grain handling including shellers and cleaning equipment as well as moisture meters and weighing scales for quality and quantity assurance. The grains bulked by the cooperative unions are bought by WFP against forward contracts. Participating farmers were able to obtain financing of US$ 1,442,105 by the Commercial Bank of Ethiopia (CBE) and facilitated by ATA. The main collateral against which CBE's lending has been secured is the forward contract between WFP and the cooperative unions. The financing facilitated uptake of new maize varieties under the Advanced Maize Seed Adoption Program (AMSAP).

Sources: Eva Gálvez-Nogales and Jorge Fonseca (2014) "Institutional procurement of staples from smallholders: the case of purchase for progress in Ethiopia", FAO, 2014; and Purchase for Progress Update (August 2014) http://documents.wfp.org/stellent/groups/public/documents/communications/wfp217476.pdf

There is potential for the above benefits of this system to be increased if large-scale private buyers can be targeted. As reported by Eva Gálvez-Nogales and Jorge Fonseca (2014), local procurement by WFP in Ethiopia represents only 5.5 percent share of the formal grain market in the country. It is followed by the Ethiopian Grain Trade Enterprise (EGTE), the second largest domestic grain buyer with an estimated market share of 5.0 percent. They add that large-scale private buyers of staples are reported to handle about 59 percent of the national marketed surplus.

The case summarized in Box 4 below also shows the potential benefits from scaling up structured commodity trading involving the private sector and cooperatives. Though the specific case cited focuses on barley, it is anticipated that cooperatives and agribusiness can mutually benefit, especially as investment in formal grain processing capacity expands making it even more important to develop stable supply channels which assure delivery of required volumes and quality consistency.

Box 4: Brewery buys barley through farmers' cooperative in Ethiopia

Diageo's Meta Brewery in 2011 introduced a system to procure malt barley under forward contracts with farmers' cooperative unions. The contracts allow the cooperatives to sell malt barley at pre-determined prices to the breweries and so create certainty in terms of market outlet and price for the farmers. Though the volume marketed is rather low, with cooperatives accounting for only 6 percent of total marketed surplus of barley (estimated at 230,000 tonnes per annum), the number of participants is rising (Rashid et al. 2015). Four other breweries are participating in the system which currently involves an estimated 23,000 smallholder farmers. (Rashid et al. ibid) report that the contracts renewable on yearly basis, allowing farmers to switch buyers if the terms are considered unfavourable. They further report that participating farmers obtain a higher share of the final price of malt barley – ex-factory gate price – compared with non-participating farmers. For instance farmers in North Gondar who market through the cooperative union obtain a price which represents 65 percent of the final price (delivered to the brewery) whilst the share obtained by their non-participating counterparts in Arsi is about 54 percent. In addition, participating farmers are able to obtain production credit which enables them utilise double the volume of inputs such as improved seed and fertiliser than their non-participating counterparts.

As is the case in the P4P procurement programme reported in Box 3, this system makes it possible for produce quality to be assured to the buyers. There is also less uncertainty regarding available volumes and farmers are similarly more certain about who to sell to and for what price. It is anticipated that this model will be scaled up as local sourcing for malt barley grows to an estimated 100,000 tonnes per annum.

Sources: Media report (http://www.4-traders.com/DIAGEO-PLC-4000514/news/Diageo--Ethiopias-barley-farmers-wake-up-to-smell-the-beer-21034480/); Kaso T and G. Guben "Review of barley value chain management in Ethiopia" Journal of Biology, Agriculture and Healthcare Vol.5, No.10, 2015; and Rashid D., G.T. Abate, S. Lemma, J. Warner, L. Kasa and N. Minot (2015) "The barley value chain in Ethiopia" REAP/IFPRI 2015.

Despite the potential benefits that cooperatives can offer, membership rates throughout Ethiopia are low (IFPRI, 2015). Bernard et al. (2013) estimate that on average, about one-third of smallholder farmers participate in an agricultural cooperative. The percentage varies across regions, from more than half in Tigray to just over ten percent in SNNP. Interviews with stakeholders during the NRI team visit confirms low membership, but suggests that levels are slowly growing. According to the Federal Cooperative Agency (FCA), there are currently 67,591 primary cooperatives, comprising 11.6 million members (household heads). Roughly two-third of these cooperatives are agricultural cooperatives that focus on services as such as inputs supply, output marketing, food crops production and dairy production. Roughly 20-25 percent of the cooperatives are savings and credit cooperatives. Factors contributing to this situation, which emerged through consultations with stakeholders during this study[59], include inadequate funding; human resource constraints; inadequate marketing infrastructure, including storage facilities; and lack of flexibility in their operations which limits their capacity to compete with private traders in inputs distribution (IFPRI 2011) and output marketing (Rashid et al. 2015).

These challenges need to be addressed simultaneously if cooperatives are to become effective vehicles in fostering contracting opportunities which can enable farmers to minimise uncertainty in accessing formal markets as well as the producer prices they receive. As demonstrated in the two cases discussed above, it is evident that the development of such trading systems can improve access to finance and yield-enhancing inputs to the benefit of producers.

4.4.2. Ethiopia's commodity exchange: how is it transforming commodity trading

Following liberalisation of agricultural markets in the 1980s most African countries set up commodity exchanges a decade later. Ethiopia came into this much later, establishing the Ethiopia Commodity Exchange (ECX) in 2007 under Proclamation 550/2007. However, it has leapfrogged many African countries as ECX is currently the most advanced exchange on the continent with the exception of the South Africa Futures Exchange (SAFEX), which has been taken over by the Johannesburg Stock Exchange (JSE). Prior to the launch of ECX, Earlier in 2003, the Government promoted a Warehouse Receipt System (WRS) under Proclamation No. 372/2003.

The keen interest in setting up commodity exchanges in Africa in the 1990 – indeed some countries such as Ghana and Zambia had more than two privately-owned exchanges[60] – stemmed from the following anticipated benefits:

a. Exchange trading, by creating certainty regarding the quality, quantity and location of commodities to be traded, reduces transaction costs, which may be in the form of: cost of sourcing produce for traders and processors as well as the cost of accessing markets for farmers, especially for premium quality produce. One way an exchange-based trading system achieves is by avoiding the high-cost and time-intensive process of

59 Consultations with cooperatives, which was undertaken as part of this study, included focus group discussions with three primary producer cooperatives and their members (Enseno and Habemus Gebeya Cooperatives in the Meskan Worweda, and Goto Cooperative in the Silti Worweda). Most of the farmers consulted cultivated maize and wheat, though some also produced vegetables for the market. In addition, representatives of the Walta Farmers' Cooperative Union (comprising 3 zones and 27 primary producer cooperatives) were interviewed. Also consulted were officials of FCA as part of a process to validate what was emerging from the respondent consulted during the field studies.

60 Coulter J and G. Onumah (2002) "The role of warehouse receipt systems in enhanced commodity marketing and rural livelihoods in Africa", Food Policy, 27 (2002) 319-337.

physical sampling of goods before buying (as occurs in the informal agricultural trade). An exchange guarantees delivery of and payment for traded commodities, implying avoidance of costly enforcement of trade contracts, especially where court litigation is not only time consuming but also expensive.

b. Exchange trading improves collection and dissemination of market information to all players. Prices on the exchange, discovered through a transparent process, are widely disseminated. Brokers, who are expected to facilitate trade and provide market advice to their clients, receive and analyse price-sensitive market information, thereby assisting buyers and sellers in making trade decisions.

c. The exchange represents a transparent and often reliable means by which lenders can liquidate collateralized commodities in the event of default by the borrower. Therefore it facilitates financing of the agricultural trade and the subsector in general. In addition, as it matures from a spot to a futures market, an exchange makes it possible for market players to hedge price risks. By so doing, they reduce credit risks, further improving access to finance and bringing much-needed liquidity to the market to the benefit of all players.

d. The WRS, which may be developed to underpin exchange trading (as a delivery mechanism), ensures that agricultural produce is stored in well-run facilities, thereby reducing post-harvest losses. That system also makes it possible for producers, who so desire, to defer sale during the harvest season, when prices are low and to gain from seasonal price increase. It also allows smallholder farmers to aggregate – sometimes facilitated by inventory finance – and sell directly to processors and large traders, rather than through intermediaries. By shortening the distribution chain through this means, the system creates opportunities for producer margins to increase without necessarily increasing the cost of agricultural raw materials for processors.

e. Using inventory finance to stockpile during the harvest can potentially reduce seasonal variability in the supply and prices of agricultural commodities to the benefit of consumers and processors. This has the potential of encouraging investment in agro-processing.

The ECX is owned by the Government of Ethiopia, which funded the initial capitalisation of about US$20 million, with some contribution by external partners. However, membership of the exchange is private – consisting of individual seat-owning trading members who trade on their own account, as well as intermediary members who act as brokers for other parties (Coulter, 2012). The Exchange is managed by an independent board and regulated by the Ethiopian Commodity Exchange Authority (ECEA) under Proclamation No.551/2007.

Its trading platform involved the use of open outcry but an electronic trading system was launched on 21 September 2015. This is expected to expand the volume of transactions which can be handled by the exchange during a trading session by more than 10-fold. The main commodities traded by ECX are coffee, sesame and beans (white pea beans and red kidney beans). Trading of grains such as maize, wheat and teff is yet to pick up. Currently, all contracts are for immediate delivery of the physical commodities, but in its next Five-year Development Plan which is being developed, ECX anticipates trading futures contracts. Brokers on the exchange include cooperative unions representing over 3.4 million producers. These unions trade on behalf of the members as well as other farmers.

The standard ECX contract specifies the following:

- Commodity – type and grade
- Standard lot size is five (5) tonnes.
- Price quotation and contract quote basis (e.g. cost and freight included)
- Mode of payment and delivery – all contracts are quoted as "arrived Addis Ababa" and a locational differentials (discount or premium) are applied based on transport tariffs from Addis to the actual delivery location.
- Delivery period.
- Weight or quality or other tolerance from agreed terms
- Arbitration terms in case of dispute
- Any other terms agreed with the exchange.

Until late 2015, ECX owned, operated and monitored the operations of warehouses it had licensed under its WRS and which acted as delivery locations for the exchange. Though the exchange is entitled to operate its own warehouses and to certify third party warehouses, in practice it stuck to its own facilities – 17 delivery locations with 55 warehouses throughout the country. In addition it run 20 remote terminal centres in major market centres. The warehouses were leased from the state-owned Ethiopian Grain Trading Enterprise (EGTE). This physical infrastructure underpinned and electronic receipts system.

The all-encompassing role of the ECX in the WRS could potentially create conflict of interests between its operational functions and regulatory role. Despite this, there were no reported cases of non-delivery by the designated warehouses, though Coulter (2012) reported complaints from especially exporters about challenges such as access delays when depositing or taking delivery. This may have contributed to the recent change. Promulgation of the Warehousing Proclamation (Regulation Number 331/2014) established and independent warehouse operator – the Ethiopia Agricultural Commodities Warehousing Enterprise (EACWE). The remit of the EACWE is to construct, own and run warehouses. However, ECX retains the authority to licence and inspect the EACWE warehouses which operate as delivery points for the exchange. It is expected to set up a Licensing and Inspection Department for this purpose. It is also expected that ECX will be able to license private warehouses but, as at the time of this study in September 2015, no private operator had expressed interest in being licensed.

The Government of Ethiopia made it mandatory to trade coffee through the ECX. Only large cooperative unions such as the Oromio Cooperative Union as well as the large coffee estates (e.g. Horizon Plantations and Ethiopia Agricultural Services) were allowed to export directly without using the ECX. Later sesame and beans were added to the "mandatory crops". For instance, ECX became a mandatory channel for sesame trade in 2010 under Regulation No. 178/2010 – its Article 18.2 allowed producers to export sesame directly, though they were required to register and grade their commodities with the ECX.

Box 5: ECX – a great African success story

Trading on the ECX floor is on the basis of warehouse receipts issued by ECX operated warehouses, thereby guaranteeing delivery and the quality of the products. Standardized ECX contracts specify the grade, delivery location, lot size, and other contract terms. They are mainly for immediate delivery (as it is a spot market). ECX maintains electronic price tickers in rural areas to disseminate constantly changing market prices. The exchange also maintains an arbitration tribunal with licensed arbitrators to assure speedy and professional resolution of any commercial disputes that arise. In additionally, it has a system of market surveillance under which experts monitor the behaviour of market actors to protect the market from manipulation, excessive speculation, fraud and other malpractices.

Within six years of its launch ECX was trading substantial volumes of export commodities. In fiscal year 2013 the total traded volume of commodities reached 586,164 t at the end of the 2013 fiscal year, which represents a nine percent increase compared to 2012. The vast majority of commodities traded consists of the following:

- Coffee – 239,778 tonnes
- Sesame – 280,552 tonnes
- White peas – 65,702 tonnes
- Mung beans and wheat – 132 tonnes

It is evident that the mandatory crops dominate trading on the exchange as the volume traded of wheat, maize and teff is negligible (ECX, 2014). The market value of the commodities traded was in that year was Birr 26.2 billion (about US$ 1.33 billion). From the trading activities, the Exchange in 2013 generated total revenue of Birr 327 Million (equivalent to US$ 16.27 million), which exceeded its planned target by 22 percent. Total expense for the period was Birr 222 Million (about US$ 11.04 million), thus generating profit before tax of Birr 105 million (about US$ 5.22 million). It is no surprise therefore that the value of membership "seats" rose from Birr 50,000 (US$ 5,100) in 2008 to Birr 1.35 million (US$ 80,000) in 2011.

The exchange also contributed significantly to improved Government revenue generation as it offered a system under which exported volumes of commodities could be transparently tracked.

Source: Rashid and Negassa (2011), Coulter (2012), Meijerink G. et al. (2013) and pers. comm. (COO of ECX, September 2015)

It is evident from Box 5 that ECX has been an outstanding success story as far as the record of commodity exchanges in Africa is concerned. Most exchanges on the continent, with the exception of SAFEX/JSE, have either survived with donor resources or ended up being virtually non-functional (Onumah et al. 2013). It is particularly impressive that it ECX broke even so quickly, leading to the dramatic rise in value of the equity of the members. For instance, in June 2015 a membership seat was auctioned for Birr 1.9 million (US$ 91,125), which represented 38 times the original value[61]. Transfer of membership seats can only be done through an open tender process by the ECX.

There is consensus, including among the authors cited in Box 5, that mandating trade of specified commodities through the Exchange contributed in no small way to its success. However, despite this impressive record, it is apparent that, when judged against the benefits promoters in general anticipated (as briefly outlined in this subsection) that there is much more that ECX needs to do. For instance, it is important for it to develop strategies which will enable it trade non-mandated grains such as wheat and maize, which dominate the trade on SAFEX/JSE, as well as teff. A potential entry point for this is in taking on trading of grains such as maize and barley between farmers' cooperatives and the large formal buyers including WFP. Having demonstrated credibility in delivering against spot contracts, ECX needs to explore the possibility of transitioning to futures trading. That will produce price risk management opportunities for players in Ethiopia's agricultural value chains.

There is also a dearth of inventory-backed financing under the WRS linked to the ECX. As noted by Coulter (2012), this has not occurred as a result of non-delivery by designated warehouses – which would have undermined lenders' confidence in the system. It will appear that trading commodities which exporters need to further process before exporting may be one of the factors hindering scaling up of financing against the stocks held under the WRS. The exporters have ready access to pre-shipment finance which negates the need for direct financing against the warehoused stocks. In contrast, in Tanzania, where it is export-grade processed coffee which is traded on the Moshi Coffee Auction, depositors including especially farmers' groups and cooperatives can utilise receipt-backed financing to aggregate and process. Producers doing so can earn incremental income of up to 74 percent compared to when they sell unprocessed coffee to private buyers (Onumah et al. 2013).

4.4.3. Management of food reserves in Ethiopia

Ethiopia has a multi-agency system with which it manages food crises which are usually triggered by severe drought. Independent reviews of the system, including one undertaken by IFPRI (2011), acknowledge the model as successful. The function of procuring and holding food reserves under this system is performed by the Ethiopia Grain Trade Enterprise (EGTE). The EGTE owns storage facilities across the country with capacity of over 800,000 tonnes and can also utilise infrastructure owned the Ethiopia Food Security Reserve Administration (EFSRA), with estimated storage capacity of over 320,000 tonnes. Though it is the EGTE which holds stocks, management of the release of reserves and relief operations in general is the responsibility of the EFSRA. The Disaster Risk

61 Source: ECX Press Release, June 2015 http://www.ecx.com.et/downloads/PressRelease/20150623154747107ECX%20Press%20Release%20Seat%20Transfer.pdf

Management and Food Security Sector (DRMFSS) coordinates interventions by the ESFRA and collates information which underpins the actions through its Early Warning System (Woldermariam 2013). A National Policy and Strategy on Disaster Risk Management developed in 2013 guides the actions of the players involved in these actions. This is due in so small measure to the effectiveness of the decentralised but well-coordinated governance system which has been instituted.

Despite evidence of success in managing severe food crises, there have been doubts about the efficacy of the system in stabilising market prices – i.e. moderate inter-year price hikes (Mauder 2013). This may be partly due to difficulties in minimising the potential adverse impact of market interventions on the development of efficient output marketing systems in the food sector, as stressed by Tostao and Tschirley (2010). This issue needs to be taken into account as the Government of Ethiopia implements plans to scale up available storage capacity dedicated to holding public food reserves. Furthermore, it may be worthwhile to explore strengthening links between the public food reserve system and the formal grain marketing system which is emerging in the country around the WRS and ECX trading systems. Steps taken to enhance private stockholding around these systems can boost food availability without further strain on fiscal resources.

4.5. Technology-based initiatives to reduce output variability

Evidence cited in Section 2.4 of this report indicate that there is potential to increase farm productivity as well as reduce yield variability if the right technology package is adopted by farmers. Part of the Government's technology-based transformation strategy is to boost investment in irrigation (Box 6).

Box 6: Boosting small-scale irrigation capacity

As part of the agricultural transformation agenda, the MoA and ATA are implementing a programme to promote small-scale irrigation – defined by Wolday Amha (2014) as irrigation scheme which cover less than 5 hectares and not more than 10 households. The programme is intended to help smallholder farmers to increase household and improve household food security as well as to catalyse pro-poor growth in rural communities. Such a scheme will, for instance, make it possible for farmers to diversify beyond growing traditional food staples under rain-fed agriculture into growing high-value crops like vegetables during the dry seasons. Wolday Amha (2014) estimate that by so doing smallholder farmer households can generate additional household income of between US$ 147/hectare to US$ 323/hectare per year. He projects that over 600,000 farm households with almost 5 million people can double household income as a result of implementation of such schemes. , promoting food security, and catalyzing growth in their communities. Government's plan to achieve the above objectives focuses on improving existing and developing new irrigation infrastructure; strengthen on-farm irrigation water and crop management practices; enhance research on irrigated agriculture; strengthen input supply, credit and marketing system; and promote knowledge management and information systems (MoA 2011). It will be important to monitor implementation of such schemes as part of any programme to promote agricultural risk management in the country.

The Government is also pursuing a strategy to enhance the development of the seed sector (Box 7). This reflects evidence reported by ATA (2014) showing that teff farmers who participated in the TIRR (Teff, Improved seed, Reduced seed rate, and Row planting) package obtained 44 percent increase in yield compared to non-participants. Maize production doubled between 2000 and 2013 due to generally rising yield per hectare as farmers benefited from a technology package consisting of yield-enhancing inputs, farm credit and training in agronomic practises. A study by EDRI (2015) also concluded that adoption of better agronomic practices including composting and weeding as well as improved drying methods by farmers over the last decade led to higher coffee yields and better quality coffee.

Box 7: Seed sector development strategy

In Section 3.4.1 of this report it was noted that uptake of improved seed by farmers in Ethiopia is rather low. This is despite evidence that adopting improved varieties can, for instance, increase output of maize by over 60 percent as well as other self-pollinated crops by over 30 percent. In response, the ATA and MoA have developed a Seed System Development Strategy (2013-2017) to encourage adoption of improved planting materials by Ethiopian farmers. The strategy includes technical, institutional and policy interventions which aim to improve supply of and access to the seed. The key elements include:

- Technical interventions such as promoting breeding high quality seed varieties;
- Reforms which impinge on the roles of public and private seed producers, including creating a market environment both public and private sector seed producers to effectively distribute seed through multiple, decentralised channels;
- Improving informal farmer-based seed production systems; and
- Setting up robust systems to assure seed quality at all levels in the production and distribution system.

Though there is no evidence to suggest that the quality of certified seed is compromised anywhere along the virtually-centralised distribution system in the country, evidence from Uganda indicate that as the system is decentralised and with increased private sector participation seed quality assurance can be an issue which needs to be addressed. We also add, based on discussions in Section 3.4.1, efforts to encourage adoption of improved seed need to go along with output market developments which will enhance economic incentives for uptake.

Despite these initiatives technology uptake by most crop farmers remains low, as confirmed in various studies including those on the barley subsector by Rashid et al. (2015), and Mulatu and Lakew 2011). The experience is similar in the livestock sector, where uptake of veterinary and other animal health services is low among pastoralists and other livestock farmers (Legese and Fadiga 2014). Discussions in Section 3.4.1 and 3.4.2 showed that output market conditions, including especially output prices, tend to influence uptake of farm technology. However, it has also been concluded that lack of finance limits the capacity of farmers to take up even proven technologies.

It is in recognition of the impact of financing constraints on uptake of yield-enhancing inputs that ATA made it central to the "New Agricultural Input Sales System" (NAISS) which it has piloted since 2013. The design of the NAISS identified the following problems with the input credit system which it is replacing:

- Regional governments offered 100 percent credit guarantees for the inputs credit provided to farmers by the Commercial Bank of Ethiopia (CBE). High levels of loan default therefore put the finances of the regional governments under severe strain and they could not sustain the credit programme.
- Cooperatives acted as channels for inputs credit delivery as well as loan recovery. They were reportedly ill-equipped for these functions which they performed along with inputs supply.
- In ATA (2014) it is further noted that some of the cooperatives retained loans recovered from farmers for operational purposes, leading to rising levels of reported loan default.

The NAISS model places microfinance institutions (MFI) at the centre of credit delivery and loan recovery whilst the cooperatives focus on supply of inputs against vouchers issued to the participating farmers. The MFIs are encouraged to bundle the inputs credit with agricultural insurance (Section 4.3) in order to minimise default risk arising from, for example, weather-induced crop failure. The use of inputs vouchers as part of the financing arrangements is to minimise the risk of diversion of funds ("for unintended purposes by farmers"), which can increase the risk of loan default.

The system was piloted in 2013 in five woredas, two in West Gojam (Metcha and South Achefer) and three in East Gojam (Gozamin, Dbre Elias and Basoliben). In the course of the pilot 150,000 farmers were able to access farm inputs. Out of these 114,000 procured inputs on cash basis whilst the remaining 36,000 bought with credit amounting to Birr 52 million (about US$ 2.5 million). The loans were advanced by the ACSI (a MFI). Lessons emerging from the pilots are to be taken into account in reforming the programme and scaling it out reach an estimated 1.8 million farmers.

Another innovative financing programme which is being developed to encourage lending by private banks in Ethiopia to SMEs is loan guarantee scheme due to be financed by the World Bank/IFC under the Scaling Up Renewable Energy Program in Low Income Countries (SREP). This programme (SREP) is one of the World Bank's Climate Investment Funds. It will involve the use US$ 10 million to guarantee loans provided by private banks to SMEs that intend to invest in the clean energy sector. The IFC has partnered with a local private commercial bank to use a similar approach to mobilise local finance in the coffee sector. With a view to helping cooperatives produce premium coffee for the market, IFC extends risk guarantee to those cooperatives which are first strengthened through capacity building activities.

While the design of this initiative looks promising, it is facing problems which were not foreseen at the design stage because most local banks at that time had excess liquidity. However, at the time of implementation some of the banks were facing liquidity problems. As a result, even with the loan guarantee, the banks are unable to lend to the target enterprises. An alternative which was considered was for the release of the US$ 10 million to the banks as an on-lending facility. This is, however, problematic as local banks are not allowed to borrow in foreign currency for local use. IFC is reported to be discussing this issue with central bank[62].

4.5.1. Crop and livestock disease management

The dominant role of the public sector in the distribution of inputs such as fertiliser and seed, including undertaking research to promote disease-resistant plant varieties, in Ethiopia has been discussed in Section 3.4.1 and also illustrated in Box 7 (on the seed system in the country). Provision of crop protection services is also dominated by the state sector. For instance, the Ministry of Agriculture hosts research agencies responsible for breeding disease-resistant varieties as well as assessing the efficacy of pesticides which can be applied to control pests and diseases. The Institute of Agricultural Research undertakes screening and trials of various pesticides and its work in this area is sometimes complemented by the Desert Locust Control Organisation for Eastern Africa. Training of farmers in the application of agrochemicals is usually by public sector extension personnel. There is, however, space for involvement of the private sector in the distribution of agrochemicals, especially for farmers growing vegetables (Mengistie et al. 2015). Mengistie et al. (2014) characterised the private trade in pesticides as largely informal as most of the traders are unlicensed and are not inspected by regulatory authorities. They add that the network of traders makes access to the inputs relatively easy. However, as noted by Amera and Abate (2008), the private distribution system is unable to provide reliable advisory services on pesticide application to farmers. Hence, they report high levels of inappropriate application and low levels of compliance with, basic health and safety procedures when applying the agrochemicals.

The public sector also dominates the provision of animal health services in Ethiopia. Its role includes disease surveillance, eradication campaigns, vaccine production, drug and vaccine quality control and quarantine as well as food hygiene and inspection measures. Evidence from a study by Bayissa and Bereda (2009) shows that surveillance activities are often prioritised when epidemics occur and this they partly attribute to limited human and financial resources. Ethiopia has public-run emergency preparedness plans for major diseases such as Rinderpest, Rift Valley fever and Highly Pathogenic Avian Influenza. The plans, which have been in place since February 2000, have two fundamental components: early warning of disease epidemics; and early response capability (Kebede et al. 2014). These interventions are seen as important not only in containing epidemics but also in reducing the risk of imposition of bans by importing countries in response to outbreak major livestock diseases. The National Veterinary Institute (NVI), established in 1963, is responsible for training veterinary personnel. It used to be under the Ministry of Agriculture until 2000, when it gained the status of an enterprise and started operating on a cost recovery basis. Since then it has been involved in producing veterinary vaccines as well as providing quality control services for laboratories in other African countries. Inadequate manpower is, however, cited by Bayissa and Bereda (2009) as well as Mengistie et al. (2015) as critical constraints in the animal health delivery system in Ethiopia.

Diagnostic services, vaccination, vector control and treatment are provided by both public and private service providers. The limited role of the private sector in animal health service delivery in the country is attributed to lack of capital for the private providers as well as affordability of the drugs and services leading to the emergence of some NGOs in filling the gap by providing community-based services (Admassu 2003).

62 Source: http://www.iied.org/ethiopia-must-rethink-finance-achieve-2025-vision.

4.6. Information systems

The main sources of information for actors in the agricultural value chains in Ethiopia include the following:

- The Bureau of Agriculture and Rural Development
- Disaster Prevention and Preparedness Bureau
- Agricultural Marketing Agencies in the regions
- Bureau of Trade and Industry
- Ethiopia Grain Trade Enterprise (EGTE)
- Central Statistical Agency (CSA)
- ECX – covering mainly current and historical prices on traded commodities (coffee, sesame, white pea beans and mung beans as well as reference prices for non-traded commodities such as maize, wheat, sorghum and haricot beans). The price information is disseminated via its website as well as through electronic price tickers in rural areas.
- Famine Early Warning Systems Network (FEWSNET) – established in 1985 to provide early warning analysis of food insecurity to enable policymakers plan actions to manage food and related humanitarian crises. Box 8 illustrates this process in Ethiopia.

Box 8: Early warning and response analysis in Ethiopia – August 2015

Based on the results of analysis of weather and other data as well as lessons from previous experiences, Ethiopia's National Meteorological Agency, warned of an El Niño episode this year. This is not only expected to affect food production but also deplete pasture for livestock. The national outlook is reinforced with information and data collected at regional levels and forms the basis of the response by Government and international development partners to avoid food insecurity and nutrition disaster. In August 2015 estimates of humanitarian requirements, including relief food requirements for the period running into 2016 had been computed as a basis for commitments from Government and agencies such as World Food Programme (WFP). The Disaster Risk Management and Food Security Sector (DRMFSS) coordinates this process – having integrated early warning and response coordination under one roof (Woldermariam 2013). The National Policy and Strategy on Disaster Risk Management developed in 2013 provides the framework to guide this process, which seeks to promote not only a centralised approach in disaster management but also to strengthen capacity at community levels to respond.

Sources: Woldermariam M (2013) "policy and institutional framework for effective disaster risk management in Ethiopia", August 2013; National Policy and Strategy on Disaster Risk Management, Federal Democratic Republic of Ethiopia, July 2013; Early warning and response analysis August 2015 – Early Warning and Response Directorate, DRMFSS, Ministry of Agriculture (info@dppc.gov.et).

- LINKS (Livestock Information Network and Knowledge System) which provides information on prices and volume traded in major livestock markets in Ethiopia as well as in Kenya and Tanzania. The system also provides information which is relevant to pastoralists and livestock farmers on forage conditions, disease outbreak, conflict and water supply. The information provided is also important for traders, including the middlemen. It is disseminated via SMS (on request), email, radio and the internet. The livestock covered are cattle, goats, sheep, camel and donkey. It is seen as part of the national early warning system partly because when there is food crisis, livestock-owning households tend to respond by selling their livestock to maintain consumption.

A brief review of the information systems undertaken by Wolday Amha (2014) reveal that the institutions involved rarely collaborate and/or coordinate their activities; the price data collected is disseminated to the public without much trend analysis; there is lack of continuity, especially when government institutions are restructured; difficulty in reaching main targets – the farmers and other market participants and, as a result, lack of interest, especially among traders and other players who can sustain such systems if they are willingness to pay for accessing the information. These challenges are quite common across Africa.

4.7. Institutional framework

The Ministry of Agriculture (MoA) is the lead policy agency in the sector in Ethiopia. It has ministerial oversight of the agricultural sector and plays a central role in the formulation and implementation of sector policies. The Ministry runs one of the largest agricultural extension systems in the world, with nearly 40,700 staff countrywide and approximately 3 000 subject matter specialists at the federal level. These personnel have an important role in disseminating technology-based information on agronomic as well as postharvest practices which farmers can adopt to minimise output variability. In addition, they can provide advice on risk management practices and systems which exist or may be developed.

The Agricultural Transformation Agency (ATA) has a mandate to support the MoA in addressing challenges in the agricultural value chains in Ethiopia. ATA is governed by the Agricultural Transformation Council, which is chaired by the Prime Minister and has representation from the MoA as well as Ministries of Finance, Water and Energy as well as heads of Regional Bureaus. It formulates various solutions to the challenges in the sector through evidence-based analysis and has also been involved in piloting some solutions including actions to improve inputs distribution transformation of the rural finance system. ATA is also working closely with the cooperatives to enhance their role not only in inputs distribution but also in output marketing, including formulating actions to increase investment in storage infrastructure. Agricultural risk management has emerged as an important area of focus for the ATA. Other government agencies with involvement in the agricultural transformation include the following:

- The Ministry of Trade (MoT) which has a Directorate of Crop Marketing which supports the development of output markets for strategic crops such as coffee, oilseeds and pulses. The Ethiopian Standards Institute, which is under the MoT, is responsible for ensuring that weighing and grading equipment used by the ECX-licensed warehouses are properly calibrated.

- The Ministry of Industry controls the operations of food processors, particularly privately- owned companies involved in processing agricultural produce.

- The Ethiopian Food Security Reserve Agency (EFSRA), which manages strategic food reserves. A feature which distinguishes this agency from similar organisations in Africa is that it is not directly involved in procurement and storage of the strategic stocks. That is the sole responsibility of ETGE. The EFSRA is responsible for decisions regarding withdrawal and distribution of relief food stocks in response to early warning assessments (see above). As noted by Rashid et al. (2011), this division of responsibilities is one of the reasons why Ethiopia's management of strategic reserves is considered one of the most efficient in Africa. In addition, Maunder (2013) stresses that linking maintenance of strategic reserves to social safety net programmes such as Food for Work and School Feeding programmes can increase the benefits of the reserves programme by triggering sustained growth in domestic demand in the domestic formal market segment.

- The Ethiopian Grain Trade Enterprise (EGTE) is a leading actor in the formal segment of the grain trade in the country. Its share of the market, estimated at about 5 percent is only slightly lower than that of WFP which 5.5 percent. It was established in 1999 under Proclamation No. 58/1999. Its objectives include buying and exporting grains and other export commodities such as coffee; and contributing stabilisation of domestic grain prices through releasing stocks. It owns storage facilities with total storage of over 800 000 tonnes and leased some of these facilities to the ECX for its operations.

- The role of the National Bank of Ethiopia (NBE) is critical in improving access to agricultural finance as it is responsible for regulating and promoting microfinance institutions. It also enforces Government policy interventions which aim at mobilising private funds for investment in strategic infrastructure development. The NBE is also actively involved in promoting micro-insurance as it has a specific division which is responsible for regulating the supply of micro-insurance products in the country.

- The Commercial Bank of Ethiopia (CBE) is a state-owned bank which at the forefront of bank-based financing of the agricultural sector. It provides on-lending facilities which enable MFIs to meet the needs of farmers and other players in agricultural value chains.

- The FCA, which is accountable to MoA, supports the development of the cooperative movement in the country through strengthening the capacity of structures at the woredas, zones and regional levels. The technical support it provides to the cooperatives includes training in cooperative proclamations and directives. It also facilitates access to domestic and export markets for the cooperatives as well as in fostering linkages with MFIs and commercial banks. The FCA perceives output marketing constraints as critical in transforming the agricultural sector. However, it stresses that its efforts are constrained by inadequate warehouse infrastructure (an issue on which it is collaborating with the ATA and Government to resolve). In addition, it notes that cooperatives have major human resource and skills gaps. Financing constraints also hinder the operations of the cooperatives in inputs distribution and output marketing. The FCA is also of the view that sector policies pursued by the Government are fragmented[63].

63 These issues came out during an interview with the Director General of the FCA in August 2015.

5. Risk analysis and implications in Ethiopia

5.1. Introduction

The main pre-harvest and postharvest risks affecting agricultural value chains in Ethiopia were identified in Chapter 3. These include weather risks such as droughts, floods and hailstorm as well as biological risks such as plant and animal diseases and pests. Also identified are uncertainties in inputs and output markets which lead to variability in farm output and household income, in part because they impact on farm household investment decisions. Other risks such as policy uncertainty and challenges such as infrastructure constraints were also identified. In this chapter the identified risks are analysed, focusing in particular on their severity and frequency as well as their impact at the sector-wide, regional and household levels, depending on the available data.

The analysis reported in this chapter provides a basis for recommendations on prioritisation of risk management actions in Ethiopia in Chapter 6. It begins with an overview in Section 5.2 of the perception of risks in the agricultural sector by stakeholders, including views from farmers consulted during focus group discussions organised during this study and also from stakeholders who participated in a validation workshop organised in Addis Ababa in December 2015[64]. In Section 5.3 the main natural hazards affecting the agricultural sector in Ethiopia are briefly discussed and details on analysis of weather risks in the country is reported and discussed in Section 5.4. This is not limited to the two main extreme hazards – drought and flood – but also includes erratic or variable rainfall during the two main rainy seasons. In Section 5.5 the main biological risks – plant and animal diseases and pests are analysed followed by analysis of inputs risks in Section 5.6. Analysis of price risks in output markets is reported in Section 5.7; policy risks in Section 5.8; and key macroeconomic risks mentioned by stakeholders during the validation workshop analysed in Section 5.9. Finally, we summarise the outcome of the risk in Section 5.10.

5.2. Stakeholders perception of agricultural risks in Ethiopia

In the course of undertaking this study, focus group discussions were conducted involving with three primary producer cooperatives. This methodology, which is a form of qualitative research, was adopted in order to obtain information from smallholder farmers about their perceptions on the main risks they face in the agricultural sector in Ethiopia. The adoption of this methodology, which is used widely in research in the social sciences (as noted by Freitas et al. 1998[65]), is intended to generate qualitative evidence which can be used to validate available evidence from both primary and secondary sources.

Participants in the focus group discussions were members of the Enseno and Habemus Gebeya Cooperatives in the Meskan Worweda as well as the Goto Cooperative in the Silti Worweda. The respective membership of the three cooperatives are: 360, 741 and 1,410. They are all members of the Walta Farmers' Cooperative Union (comprising 3 zones and 27 primary producer cooperatives). The first two cooperatives had six (6) representatives and third had seven (7) representatives at the focus group meetings. The Cooperative Union was represented by three (3) officials during a wrap-up session to discuss the emerging findings, including those related to the capacity of the cooperatives.

64 PARM-ATA-NEPAD National Stakeholder Workshop on Agricultural Risk Management, 16-17 December, 2015, Capital Hotel, Addis Ababa.
65 Freitas H, M. Oliveira, M. Jenkins and O. Popjoy (1998) "The focus group: a qualitative research method", ISRC Working Paper 010298, February 1998.

Box 9: Farmers' perception of risks and challenges in Ethiopia's agricultural sector

A total of 19 farmers representing three primary cooperatives participated in three separate focus group discussions held on 19th and 20th August 2015. The participating cooperatives were: Enseno Producer Cooperative (with 360 members) and Habemus Gebeya Producer Cooperative (with 741 members), both in the Meskan Worweda. The third is the Goto Producer Cooperative in the Silti Worweda, with 1,410 members. The three are all members of the Walta Farmers' Cooperative Union, which consists of 27 primary producer cooperatives in three zones. The Enseno Producer Cooperative and Habemus Gebeya Producer Cooperative had six (6) representatives each at the respective focus group discussions, whilst Goto Producer Cooperative had seven (7) representatives. The participants mentioned the following as the main risks which they face:

- Weather risks: the specifics include cold weather, late/delayed rains and inadequate rainfall during the season. In addition, they have noted that that inadequate rains tend to increase the incidence of plant diseases and pests.
- Plant diseases: cited in particular household income loss due to diseases affecting vegetables.
- Access to affordable inputs e.g. seeds, pesticides and fertiliser remains uncertain.
- Access to markets can be uncertain, especially when the cooperatives lack sufficient funds to procure farmers' produce and also where perishability of crops (e.g. vegetables limit capacity to store).
- Uncertain produce prices, especially farmers sell to private traders.

Challenges cited by the farmers:

- Poor state of rural roads and lack of storage facilities.
- Lack of finance, especially for procuring farm inputs.
- Lack of modern equipment for harvesting and for efficient postharvest management of produce. This situation tends to limit farmers' marketing options.
- Capacity constraints facing the cooperatives, which in turn affect the quality of services they provide to the farmers.

Source: Focus group discussions conducted in Meskan and Silti Woredas during RAS in Ethiopia (19th and 20th August 2015)

Background information provided by the participants showed that members of the participating cooperatives predominantly cultivate maize and wheat, though most of them also grow vegetables. They usually sell maize through the Cooperative Union to WFP as part of its Purchase for Progress (P4P) Programme. Wheat, which is also marketed through the Union, is sold in local markets as well as to local millers. This marketing function is seen as one of main benefits from membership of cooperatives. The respondents reported that they obtain comparatively higher prices for their produce than when they sell directly to traders. However, they do not sell vegetables and livestock through the cooperatives. Though the volume of produce sold by members varies – depending sometimes on the size of the farm household – the respective average volume of produce sold maize per household is about 2.0 tonnes of maize and between 0.95 tonnes and 2.04 tonnes of wheat. Participants also reported that they are able to access inputs sold through the cooperatives.
The main agricultural risks identified by the participants and summarised in Box 9 include weather risks, crop pests and diseases, and uncertainty in accessing inputs and in marketing their produce. They also highlighted some of the underlying challenges which contribute to the occurrence and/or severity of these risks, including state of rural road infrastructure, lack of efficient harvesting equipment and storage facilities, and capacity constraints facing the cooperatives, which affect the quality and reliability of the services they provide to members.

The results of preliminary analysis of these risks were discussed with stakeholders in Addis Ababa during a two-day workshop on 16-17th December 2015. Participants in the workshop were drawn from 45 organisations representing: farmers (mainly from primary cooperatives and unions), insurance companies, microfinance institutions (MFIs), banks, commodity traders/exporters, public institutions, local and international research institutions and donor missions/agencies involved in various programmes in agricultural value chains in Ethiopia.

The top four priority risks as recommended on the basis of the preliminary analysis undertaken under the RAS are reported in the second column of Table 19. These were weather risks (drought and floods), crop and livestock diseases and pests, inputs risk, and output market uncertainties (access to markets and price risk). The broad range of stakeholders who participated in the workshop endorsed the recommended risk priorities but stressed the need to explore other risks as in the third column of Table 19. The analysis reported in the rest of this chapter covers as many of these risks as possible, depending on availability of data.

Table 19: Preliminary prioritisation of agricultural risks in Ethiopia

Risk category	Proposed prioritised risks	Stakeholder views/inclusions
Natural disasters	Drought	Validated but need to look beyond these extreme events and add below:
	Floods	
		Climate change effects
		Variability in rainfall (late or uneven)
		Temperature variability
		Hailstorm
		Landslides, land degradation
		Loss of water bodies and biodiversity
Biological and environmental risks	Crop diseases and pests	Validated.
	Livestock diseases and pests	
Market-related risks	Inputs risks	Add lack of credit as binding constraint
	Uncertain market access	Distinguish between effects in structured and unstructured markets
	Price risks	Validated and same as above.
Macroeconomic risks		Inflation
		Volatility in exchange rates
Policy and institutional risks		Uncertainty of land access
		Price subsidies targeting consumers (e.g. wheat)
		Impact of disaster management schemes
Other risks		Security risks
		Weather information – timeliness, clarity and reliability

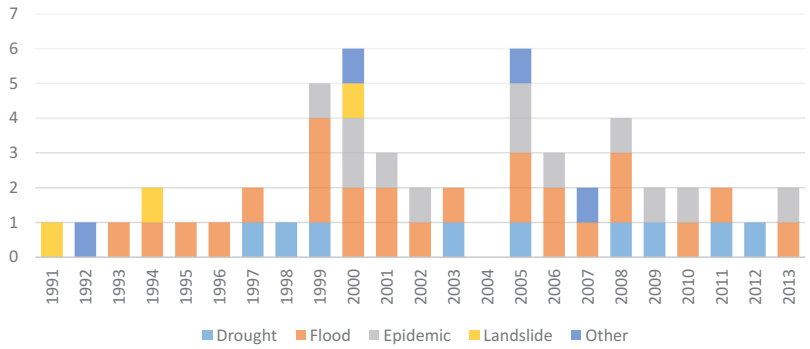
Source: NRI Presentation on Risk Prioritisation at National Stakeholder Workshop on ARM (2015)

5.3. Natural hazards affecting agriculture in Ethiopia

As discussed in Section 3.2 and, in particular, illustrated in Figure 3.1, agricultural output growth in Ethiopia is affected by natural hazards such as weather events (drought and floods) as well as biological and environmental risks (e.g. crops and livestock diseases and pests). Indeed, figure 3.1 shows that though the agricultural sector has been growing steadily over the past two decades (as noted in discussions in Chapter 2), there have been dips which coincide with the incidence of these risk events.

Figure 5.1 shows the occurrence of natural hazards affecting the agricultural sector in Ethiopia over the period 1991 to 2013. It reveals that that multiple risks can occur during the same year – for example floods and drought during the same year in different parts of the country. This graph also appears to confirm anecdotal evidence obtained during consultations with farmers (reported in Box 9) – indicating possible links between natural risks such as floods and drought and the incidence of epidemics (plant and livestock diseases and pests). The outcome of analysis of these and other agricultural risks are reported in this chapter. Furthermore, as captured in Table 20 and depicted in Figure 5.2, by far the most frequent of the natural hazards occurring at a national scale are drought and floods. Together they account for nearly 80 percent of the recorded natural risk events in terms of frequency. In terms of the incidence of risks, plant and livestock pests and diseases account for 5 percent whilst earthquakes represent 8 percent.

Figure 26: Frequency of natural disasters (1991-2013)



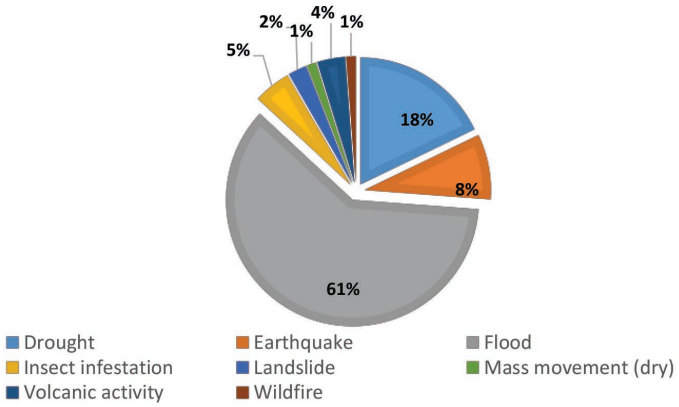
Source: Author's elaboration based on EM-DAT data

Table 20: Summary statistics of the occurrence of disasters

Risk category	Risk	Incidence	Human losses	Reporting period
Weather risks	Drought	15	402,367	1965-2013
	Flood	51	1,976	1968-2013
Biological and environmental risks	Plant diseases/pests	7	NA	1986-2013
	Livestock diseases and pests	10	NA	1986-2013
Other natural hazards	Earthquake	7	24	1906-2013
	Landslide	2	NA	1994-2013
	Mass movement	1	NA	1991-2013
	Volcanic activity	3	NA	1977-2013
	Wildfire	1	NA	1900-2013

Source: Author's elaboration on EM-DAT data

Figure 27: Frequency of natural risks as share of total events (1906-2013)



Source: Author's elaboration on EM-DAT data

5.4. Frequency and severity of weather risks in Ethiopia

Among natural hazards, extreme meteorological conditions – drought and flood – represent the most notable threats to agricultural activities in Ethiopia, though as reported in this section, erratic rainfall (delayed or late rains) pose significant risk to farm output. These three risks are analysed in this section.

5.4.1. Frequency and severity drought and flood in Ethiopia

During the reporting period – 1965 to 2013 – 15 cases of drought were reported in Ethiopia (Table 20). However, drought was most severe – that is where the drought affected more than 90,000 people – only in four years (2002, 2004, 2006 and 2008 as shown in Table 21). The effects also varied for crops and livestock (Table 21).

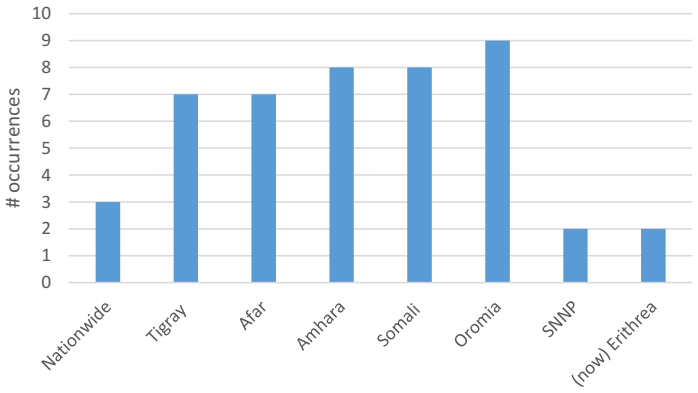
Table 21: Crop damage and cattle deaths following droughts in Ethiopia (1996-2009)

Year	Crop damage (hectares)	Livestock deaths
1996		325
1997		4,700
2000	9,882	-
2002	33,250	-
2003		326
2004	67,547	-
2005	1,600	-
2006	106	2,542,450
2007		1,824
2008	151,356	4,022
2009	1,516	-
Total	265,527	2,553,647

Source: DRMFSS (2012)

Though the effects of severe drought is nationwide, Figure 5.3 shows that the most affected regions are Oromia, Somali and Amhara regions. Tigray and Afar are also regions where the occurrence of drought is above national average, whilst in SNNP the occurrence of drought has been well below the national average over the past 50 years. It is also apparent that the worst cases of drought coincide with El Nino (Box 10).

Figure 28: Occurrence of severe droughts by geographical areas (1965-2013)



Source: Author's elaboration on EM-DAT data

Based on the data from DRMFSS we estimate economic losses suffered in the agricultural sector as a result of severe drought over the period 1996-2009 at over US $1,018.6 billion. Out this about US $924.6 million is attributable to livestock mortality due to drought (especially loss of cattle) and the remainder of US $93.68 is due to crop damage. Over the period more 151,356 hectares of cultivated land was damaged. Over the reporting period (1996-2009) the average annual economic loss due to drought is estimated at US$ 78.35 million. The most severe impact of drought occurred in 2006 when more than 2.5 million animals died.

It has to be stressed that the estimated cost of the drought-related losses reported above do not take into account human costs including deaths, the cost of internal displacement of affected populations nor the social conflicts which are triggered, especially in pastoralist communities as a result of intensified competition for sharply declining forage and water resources. What is also not captured here is loss in household income as livestock farmers are compelled by drought to sell animals at sharply discounted prices.

Box 10: El Nino effects on weather risk in Ethiopia

El Nino is known to accentuate weather risks in Ethiopia, including causing extremes of drought and flood. It is triggered by the warming of the surface of the Pacific Ocean, thereby affecting air pressure and related wind and rainfall patterns across large parts of the tropics and sub-tropics. It occurs every three to seven years and over the past three decades (1983 to 2013) there have been nine El Nino events with variable effects. In most cases in Ethiopia El Nino usually causes drought in the northern regions and flooding in the south and south-eastern regions. For instance, FEWSNET predicted the weather-related effects of the El Nino in 2015 in Ethiopia include the following:

- Below normal *Meher* rains in Eastern Amhara and Tigray regions (e.g. only 33-50 percent of normal rains in Southern Tigray). Crop output in *Meher* in these regions projected to be between 33 to 41 percent of average output. Only 15 to 20 percent of Belg output anticipated as a result of dry spell.
- *Belg* and *Meher* crop production in Central Oromia and SNNPR are projected to decline by between 30 to 40 percent due to drought and delayed rains (for about five weeks and requiring many farmers in these communities to replant two times).
- Livestock production in these vulnerable regions will decline as a result of reduced availability of pasture and water for the animals. As a result, forced sale of animals is anticipated to lead to over 40 percent fall in livestock prices, thereby adversely affecting household food security and nutrition.
- Over 10.2 million people are expected to be affected by the effects of El Nino in 2015, including 48,750 people affected by floods in parts of Afar, Gembella, Oromia and Somali regions as over 11,000 hectares of agricultural land is damaged in the worst-affected areas[5]. The total humanitarian assistance required for responding to these effects is estimated at over US $1.4 billion[6].
- Evidently, the severity of these El Nino-related events (affecting wide geographic areas and causing very high economic and human costs), make private insurance doubtful. Public programmes to mitigate the impact of these events have therefore been mainstreamed in Ethiopia and are discussed in Chapter 4.

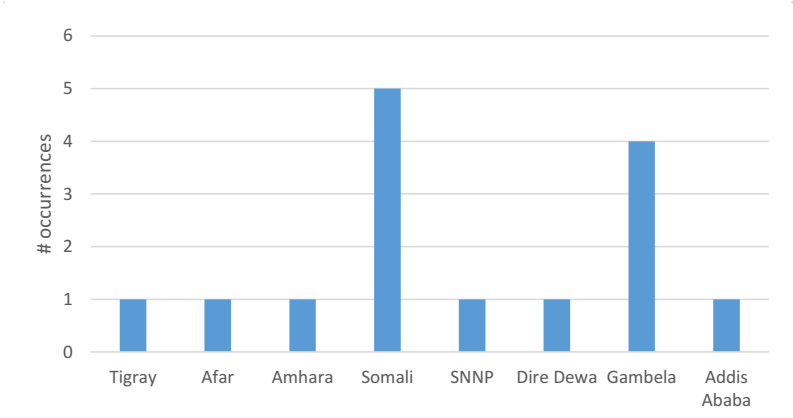
Source: Authors

5 Source: UN Office for Coordination of Humanitarian Affairs (UNOCHA)
6 Source: Government of Ethiopia and United Nations (2015) "2016, Ethiopia Humanitarian Requirements, 11th December 2015.

5.4.2. Frequency and severity of floods in Ethiopia

As reported in Table 20, over the past 45 years (1968-2013), Ethiopia has been hit by more than 50 flood events. The most flood-prone parts of the country Somali, Gambella and the western parts of SNNP as well as parts of Amhara and Tigray regions[66]. However, as shown in Figure 5.4, between 1968 and 2013, the most severe floods, affecting more than 90,000 people per event, occurred mainly in the Somali and Gambella regions and about 15 incidents during the reporting period.

Figure 29: Occurrence of severe flood by geographical areas (1968-2013)



Source: Author's elaboration on EM-DAT data

Flooding is also more common in the river basins such as the Awash River Basin, the Wabi-Shebelle River and the Baro-Akobo/Sobat River. Flooding leads to human and animal losses and deaths, damage to private and public property, destruction of crops, and deterioration of infrastructure. To illustrate, in 2010, heavy flooding in Amhara, Oromiya and Gondar affected more than 53,200 households with close to 10,000 households being internally displaced. Crops planted on about 6,100 hectares of land was also washed away[67].

66 DRMFSS (2010) "Flood Contingency Plan", August 2010.
67 Source: IRIN Report, August 2010 (http://www.irinnews.org/news/2010/08/25)

Based on EM-DAT data we estimated total economic losses associated with severe floods at about US$ 19.2 million, implying average annual severity of about US$ 1,280,000. Losses which occurred during the worst case scenario is estimated at US$ 2,745,000.

5.4.3. Frequency and severity erratic rainfall

In addition to extreme weather hazards (severe drought and floods) discussed in the preceding sections, farmers in Ethiopia also face variability in rainfall during rainy seasons: Meher and Belg. Unpredictable rainfall takes the form of delayed rains during the planting season; very intense rains or unseasonal dry spells during the gestation of crops; and late rains close to the harvesting season. Delayed planting season rains can lead to poor seed germination or wilting of the germinated crop whilst intense rainfall which cause flash floods can impact negatively on crop yields. Yield reduction can also occur as crop development is hampered as a result of unseasonal dry spells prior to the maturity of crops. Late rains close to or during the harvesting season can also cause significant crop losses.

The most vulnerable regions in which these evets occur are the Northern parts of Somali, Amhara and Tigray regions as well as Central and Eastern Oromia and the lowlands in SNNPR[68]. Based on EM-DAT data, the probability of occurrence of these events in any particular season is estimated at 42.1 percent – a rather high risk in the vulnerable farming communities. Quantifying the losses associated with poor germination or wilting due to delayed rains, it is presumed that farmers replant rather than take total crop loss. The estimated cost of replanting is about US$ 9.15 per tonne of output (for grains), excluding the labour cost incurred in replanting. Losses during harvest due to unseasonal rainfall ranges between 1 and 2% of output[69].

Assuming about 5 percent of the area under cultivation is affected by variable rains, we estimate the aggregate household costs of replanting at close to US $10.78 million and per affected household at about US $22.87. We further estimate the value of losses during harvest as a result of unseasonal rains at US $5.89 million, bringing the total average annual economic losses due to variable rains to US$ 16.67 million.

As discussed in Chapter 3 (Section 3.2.2) there is evidence of a long-term trend resulting from climate change, as mean annual temperature in Ethiopia has risen by about 1.3 degrees Celsius between 1960 and 2006[70]. This is not only causing contraction in total land area receiving less than 500 mm per season during the rainy seasons but also increasing variability in the onset and duration of the rainy seasons. It is projected that, losses due to erratic rains, in the worst case scenario can reach US $256.28 million if effective remedial action is not taken[71]. The remedial actions include timely replanting when the onset of rains is delayed and/or adoption of off-farm drying technology when late rains hamper field drying of crops, thereby causing quality losses[72].

5.5. Frequency and severity of biological and environmental risks in Ethiopia

The biological and environmental risks to which the agricultural sector in Ethiopia is exposed are identified in Section 3.3 of this report. These include crop and livestock diseases and pests which directly affect output and/or quality of crops or animals. Stakeholders consulted during focus group discussions undertaken during this study (summarised in Box 9) rank these risks second only to weather risks in general. This perception of the importance of these risks was validated during a stakeholder workshop to review recommendations on risk prioritisation in Ethiopia[73].

68 Based on reports by FEWSNET.
69 Borga F, D. Naziri and B Emana (2014) "Report on role of innovative finance in creating conditions to scale up adoption of technologies to reduce waste and spoilage in agricultural value chains in Ethiopia", Report produced as part of multi-country study commissioned by AGRA/Rcokefeller Foundation.
70 Feyssa D H and D O Gemeda (2015) "Impact of climate change on production systems in semi-arid regions of Ethiopia ", Journal of Biological and Chemical Research Vol. 32 No. 2 pp.755-764.
71 Source: Climate Risk and Adaptation Country Profile: Ethiopia (2011).
72 Borga F, D. Naziri and B Emana (2014) "Report on role of innovative finance in creating conditions to scale up adoption of technologies to reduce waste and spoilage in agricultural value chains in Ethiopia", Report produced as part of multi-country study commissioned by AGRA/Rcokefeller Foundation
73 The workshop was organised by IFAD/ATA in Addis Ababa on 16-17 December 2015.

Data reported from surveys in 17 Weredas in Benishangul Gumz reveal that crop and livestock diseases and pests are occur far more frequently than any other agricultural risks. The data further showed that crop diseases and pests represent 25.02 percent of reported exposure adverse agricultural events whilst livestock diseases constitute 28.4 percent of their exposure. This far dwarfs exposure to adverse weather events such as drought, floods, storms and erratic rains, which together accounted for 10.56 percent of incidents reported by respondents. Although almost all crops produced in Ethiopia are vulnerable to diseases and pests, the incidence appears to be highest for maize, sorghum and sesame[74]. Between them these three crops account for 83.9 percent of the reported cases of plant diseases and pests recorded in the Weredas surveyed by the DRMFSS in Benishangul Gumz. Teff, barley, millet and peas appear to be the least vulnerable.

Dealing with the known animal pests and diseases poses a major challenge for most smallholder farmers. Rising temperatures as well as declining and more variable rainfall is expected to increase their incidence[75]. However, the focus of analysis in this section is not where the occurrence of diseases and pests is routine but at an epidemic scale, where large sections of the farming population/communities are affected. Quantifying the economic cost of plant diseases and pests in Ethiopia is rather difficult partly because of a dearth of data (Eshte et al. 2015[76]). Borga, Naziri and Emana (2014)[77] estimate losses due to crop diseases and pests as ranging from 8 to 15 percent of national output of the crops. For the major food security crops such as teff and maize, the economic cost based this level of loss is estimated at about US$ 43.85 million per annum.

Livestock diseases rank even higher than crop diseases and pests in terms of incidence in the livestock producing regions in Ethiopia. The most commonly occurring livestock diseases are contagious bovine pleuropneumonia (CBPP), trypanosomiasis and lymphangitis. Reported incidents recorded in the survey by DRMFSS in Benishangul Gumz show that the respective proportion of households whose animals had been affected by these diseases were: 32.21 percent, 29.48 percent and 14.85 percent. Animals reported to have been affected by livestock diseases between 2003 and 2012 is over 13 million. The consequent reported cattle deaths is 14,864[78]. The estimated average annual cost of losses due to livestock diseases to farm households is about US $5.35 million.

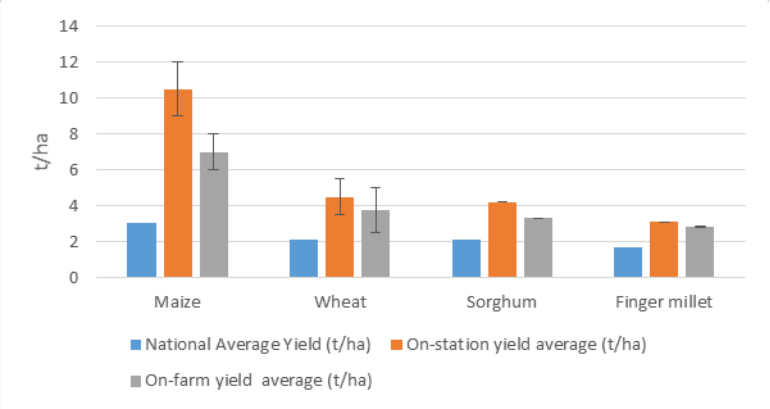
The cost of epidemic-scale incidence of crop diseases and pests can be very high. At the most severe, that is the worst case scenario, the cost is estimated at over US $570 million (based on crop output data for 2014/15). Similarly, livestock diseases can lead to very high economic losses. This is not only due to the direct impact of reported mortality but also because sometimes the outbreak of diseases can lead to the imposition of restrictions on access to traditional export markets. For instance, in 1998 Ethiopia lost over US$ 100 million in export revenues due to a ban on imports imposed by countries in the Middle East. The ban also depressed domestic livestock prices by about 30 percent. A similar ban in 2000, due to an outbreak of RVF, which remained in place for five years, lead to loss of export earnings estimated at about US$ 211.1 million per annum. This estimate represents the cost of the worst case incidence of livestock disease outbreak in Ethiopia in any particular year.

74 Source: DRMFSS Survey report, 9th May 2015.
75 Feyssa D H and D O Gemeda (2015) "Impact of climate change on production systems in semi-arid regions of Ethiopia ", Journal of Biological and Chemical Research Vol. 32 No. 2 pp.755-764.
76 Eshte Y, Misganaw M and W. Shiferaw (2015) "Assessment of Important Plant Disease of Major Crops (Sorghum Maize, Common bean, Coffee, Mung Bean, Cowpea) in South Omo and Segen Peoples Zone of Ethiopia", *Current Agriculture Research Journa*l Vol. 3(1), 75-79.
77 Borga F, D. Naziri and B Emana (2014) "Report on role of innovative finance in creating conditions to scale up adoption of technologies to reduce waste and spoilage in agricultural value chains in Ethiopia", Report produced as part of multi-country study commissioned by AGRA/Rockefeller Foundation.
78 Source: CSA (2013) Report on livestock diseases and proportion treated in Ethiopia.

5.6. Inputs risks in Ethiopia

It emerged from discussions in Chapter 3 (Section 3.4.1) that average yields of major crops produced in Ethiopia are far below their potential. This is validated in Figure 5.5, which compares average yields obtained from on-station on-farm plots in Ethiopia. There is potential to reduce this yield gap through uptake of available yield-enhancing technology adoption such as high-yielding, drought-resistant seeds)[79].

Figure 30: Gap between average yield from on-station and on-farm experiments



Source: Author's calculation based on yieldgap.org

5.6.1. Analysis of inputs quality variability risk

In Uganda, a major cause of yield variability is uncertainty regarding the quality of inputs marketed to farmers. This is largely attributed to inputs markets in that country being liberalised and lacking robust quality assurance systems (IFAD 2015[80]). Ethiopia, on the other hand, has a centralised inputs marketing system dominated by state-owned enterprises and cooperatives. Quality uncertainty does not therefore appear to be the key issue hindering uptake. Smallholder farmers who took part in focus group discussions organised in the course of this study ranked access to affordable inputs as third on the list of the identified risks they face (Box 9). Participants at the recent stakeholder workshop[81] on assessment of agricultural risks in Ethiopia validated this and added that a major binding constraint in the uptake of inputs is uncertain access to finance.

5.6.2. Frequency and severity of inputs price risk

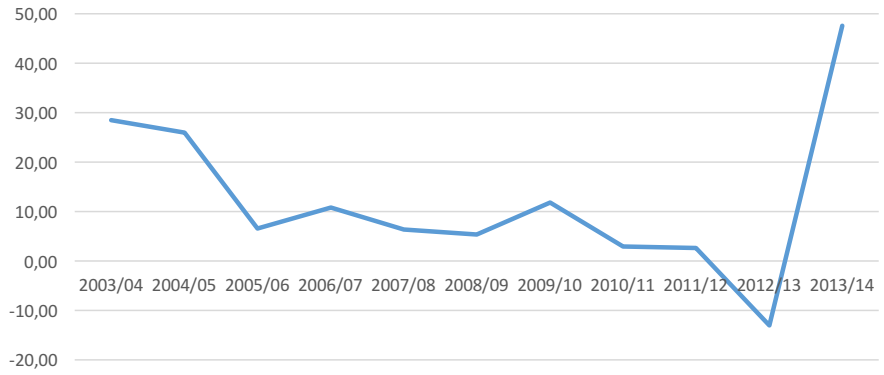
Analysing price data from CSA (2015) it emerged that over the period 2002 to 2014, fertiliser prices rose by an average rate of 12.3 percent, an increase which is slightly below the average inflation rate for the period (about 15.0 percent). The generally low rise in fertiliser prices masked two major spikes between 2004 and 2005 as well as a very steep rise of 47.2 percent in 2013. No such price hikes occurred for seeds. We estimate average annual losses arising from yield decline as farmers cut back on uptake of inputs in response to the price shocks to be just over US$46.0 million. This estimate takes account of the fact that just about 35 percent of smallholder farmers use inputs such as fertiliser. In the worst case scenario, as occurred in 2013, the estimated yield and consequent income loss to farm households is estimated at about US $139.8 million.

79 Source: http://www.yieldgap.org/ethiopia
80 Report on Uganda Risk Assessment Study, IFAD October 2015,
81 Workshop organised by IFAD/ATA in Addis Ababa on 16-17 December 2015.

5.6.3. Factors affecting fertiliser prices in Ethiopia

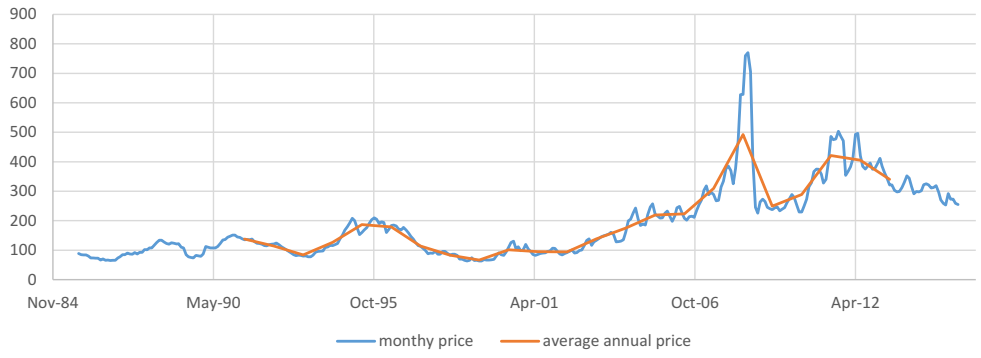
The fact that Ethiopia imports the bulk of fertiliser used in the country implies that domestic price volatility can be largely triggered by volatility in the global markets. Examining domestic market trends, as depicted in Figure 5.6, it is evident the period between 2006 and 2012 when there was considerable volatility in global prices for urea and phosphate(as shown in Figures 5.7 and 5.8) the domestic price of fertiliser was rather stable. The dominant role of the state in the importation, pricing and distribution of fertiliser appears to have limited the transmission of volatility in the global markets to Ethiopian farmers. The steep spike in fertiliser price which occurred in 2013, following the rise in global prices in 2012, may reflect increased exposure to global price volatility and may be worth monitoring in terms of its impact on farmers' decisions on the use of the input.

Figure 31: Change in fertiliser prices (2003-14)



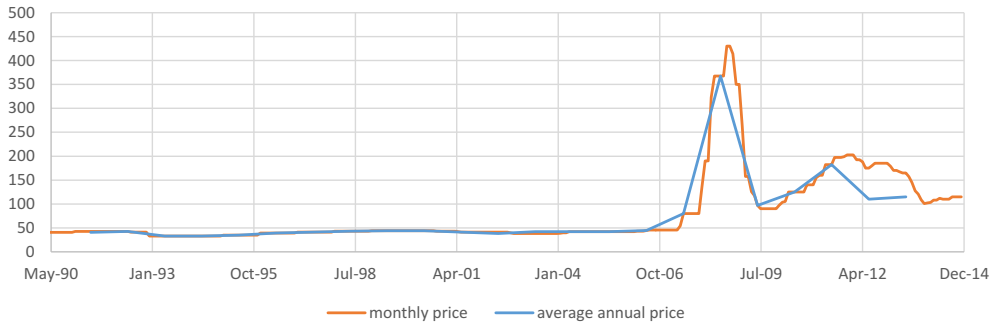
Source: Authors computation based on data from CSA (2015)

Figure 32: Monthly price fluctuation for urea (1985-2013)



Source: Index Mundi

Figure 33: Monthly price fluctuation for phosphate (1991-2013)



Source: Index Mundi

5.6.4. Other factors contributing to uncertain access to inputs

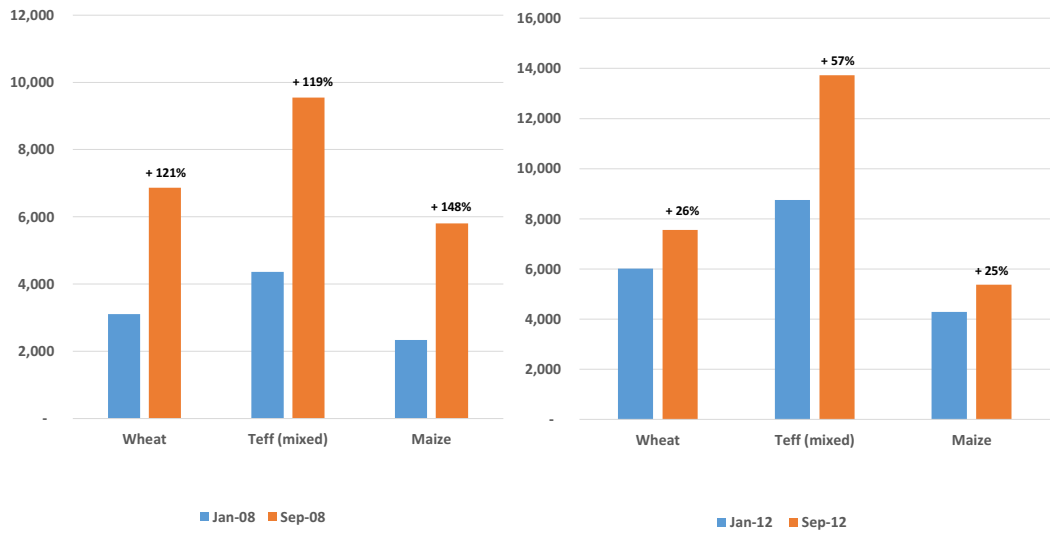
In Section 3.4 it was noted that access to inputs credit by smallholder farmers has positive impact on uptake. This was confirmed during the consultations with farmers (Box 9) and also by participants at the stakeholder workshop. It is for this reason that Government, through ATA[82], continues to explore innovations which will enhance access to inputs finance, especially after regional governments discontinued their involvement in inputs credit guarantee schemes. Dearth of data made it difficult to directly assess this linkage empirically. However, we found evidence, discussed below in Section 5.7.3, of a link between variability in output prices and uptake of inputs. This is consistent with evidence outlined in Section 3.4 suggesting that output market prices which affect the relative profitability of inputs use does influence farmers' uptake decisions.

5.7. Price risk in Ethiopia's agricultural markets

In Section 3.4.2 uncertainty in output prices is identified as a major risk to which farmers in Ethiopia are exposed. Vulnerability to this risk at the household level goes beyond its potential negative income effects but also, as noted in the discussions in the preceding section, on how it impacts on household investment decisions on uptake of yield-enhancing inputs. In this section the variability of prices for major agricultural commodities in Ethiopia is analysed. The measure of variability adopted here is the coefficient of variation (see OECD, 2011)[83]. Illustrated with the case of teff, rice risk as discussed in Chapter 3 focused on intra-seasonal price variation. This is a recurring phenomenon with which most farmers and other players in agricultural value chains in Ethiopia are generally familiar with. Prices of agricultural produce tend to bottom-out at the peak of the harvest season and peak about 4-6 months later. However, Figure 5.9, which presents a snapshot of price levels for major cereals in Ethiopia in 2008 and 2012, shows that these prices do not only vary within seasons but also from year-to-year. This is demonstrated by further analysis of intra-seasonal and inter-year price variability in the agricultural sector in Ethiopia, which is reported below in this section.

82 Reported in ATA (2014) "New agricultural inputs sale system", November 2014.
83 OECD (2011) "Managing risk in agriculture: policy assessment and design", OECD Publishing.

Figure 34: Variability of grain wholesale prices (Birr/tonne) in Addis (2008 and 2012)



Source: Author's calculation based on FAOSTAT

5.7.1. Intra-annual price variability for agricultural commodities

Table 22 summarises the outcome of analysis of monthly price variation for cereals (teff, maize and wheat), export crops (coffee and sesame) and livestock in Ethiopia. It shows that, on the average, crop prices bottom-out in January whilst for livestock the lowest average prices occur in May. The peaks differ: May for teff, June for maize and July for wheat. Coffee prices on the average peak in March whilst for sesame the peak tends to be in September.

This will suggest that grains producers seeking to maximise gains from seasonal price increase may have to delay sale by 5 to 7 months from the harvest.

Table 22: Average monthly price deviation for major crops in Ethiopia (2003-2012)

	Peaks			Troughs			Cumulative increase (trough to peak - %)
	Period	Average	Max. shock	Period	Average	Min. shock	
Teff	May	3.37	6.66	January	-6.17	-16.67	34.25
Maize	June	5.82	8.56	January	-5.41	-11.38	44.89
Wheat	July	3.49	6.01	January	-4.43	-15.92	30.88
Coffee	March	4.88	12.76	January	-8.72	-19.79	41.11
Sesame	September	8.63	20.06	January	-10.39	-25.12	57.07
Livestock	June	2.61	7.94	May	-3.04	-7.01	-

Source: Authors' calculations from CSA data (2015)

Table 23: Inter-year price variation for major crops in Ethiopia (2003-2012)

	Spikes						Troughs					
	Low		Moderate		High		Low		Moderate		Severe	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
Teff	8	5.45	4	20.20	-	-	5	-3.01	3	-18.66	-	-
Maize	2	4.03	4	23.57	4	77.26	4	-3.74	5	-18.75	1	- 31.63
Wheat	8	4.84	3	20.21	-	-	4	-3.02	5	-14.91	-	-
Coffee	4	6.97	8	23.32	3	56.33	4	-2.15	-	-	3	- 39.75
Sesame	4	4.40	4	17.37	6	50.95	1	-0.01	5	-17.99	-	-
Livestock	2	6.79	6	20.21	2	41.96	-	-	-	-	-	-

Source: Authors' calculations from CSA data (2015)

*Low = below 10%; Moderate = 10-30%; Severe = above 30%.

Average monthly variation in producer prices for all the subsectors are rather low and even the maximum shocks, in terms of decline in producer prices, are within the order of low to moderate (medium) as shown in Table 22. The sharpest intra-seasonal price variation occurs in the export crops subsectors (coffee and sesame) but even for these the levels remain low to moderate. Similarly, for livestock, average intra-seasonal price variation, and even worst case shocks, are very low. These trends are depicted in Figures 5.10 and 5.11 below.

Figure 35: Intra-Seasonal Price Variations For Major Crops in Ethiopia (2003-2012)

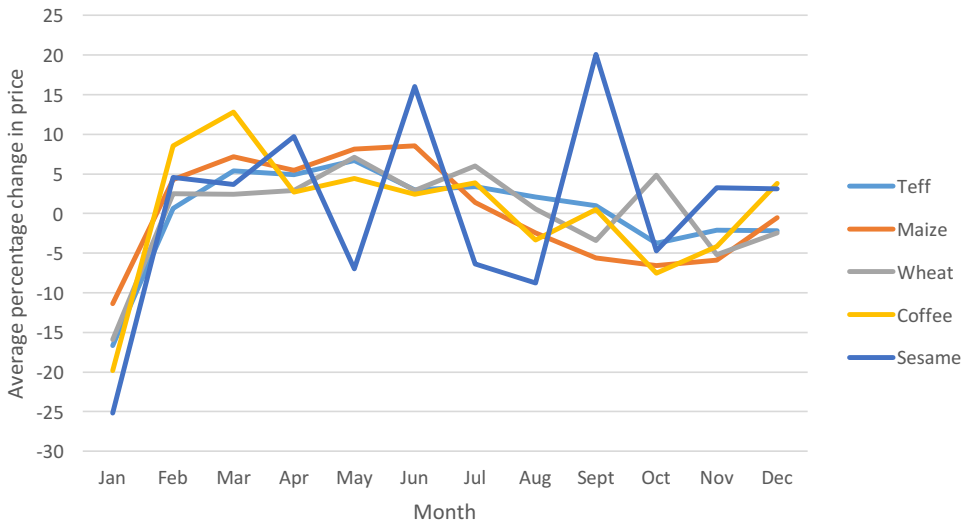
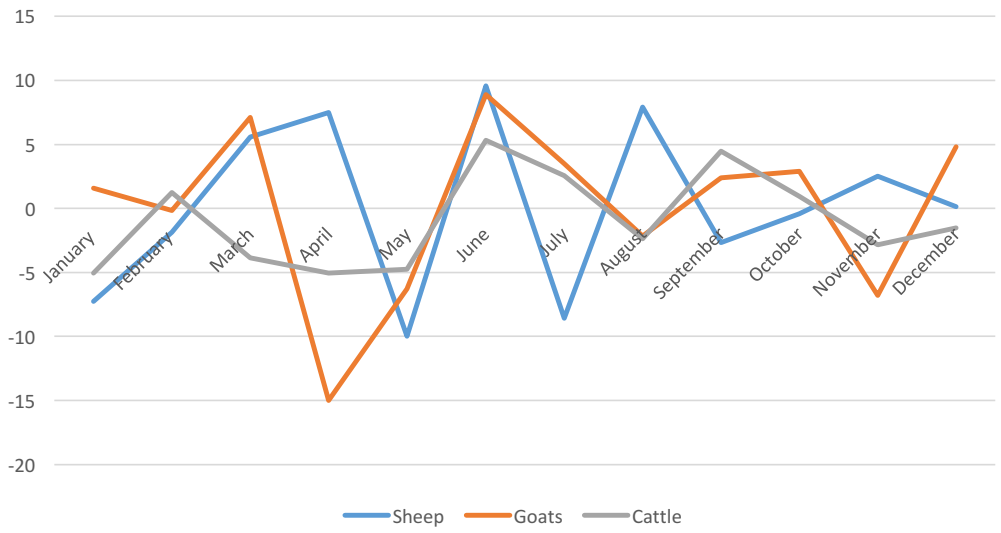


Figure 36: Intra-seasonal livestock price variation in Ethiopia (2003-14)



The cumulative average increase in producer prices of staple grains in Ethiopia (reported in Table 23) ranges from about 31 percent for wheat and 34 percent for teff to almost 45 percent for maize. This is the seasonal rise in price from the trough to the peak. It represents an opportunity for farmers and other value chain players to gain from inter-temporal arbitrage through delaying sale of produce beyond the harvest season. However, any such potential income gains have to be offset against the high levels of postharvest losses (noted in discussions in Section 3.5) as one of the systemic challenges in Ethiopia's agricultural. Estimated average annual postharvest losses ranges from 12.5 percent for teff; 14.2 percent for wheat to 17.8 percent for maize. These losses can be substantially reduced if storage occurs in well-run facilities, but even then estimating the net gains from intra-seasonal stockholding should include taking account of associated carrying costs (storage fees and interest charges for use of any inventory credit taken) as well as the cost of conditioning the produce for storage (including sorting and grading to meet minimum storage standards, bagging and transport to the storage facility).

For coffee the steep rise of 41 percent is over the rather short period of January to March after which the average monthly price increase cannot justify intra-seasonal stockholding, except by exporters as part of their contract performance strategies. Sesame appears to have the highest level of cumulative intra-seasonal price increase – about 57 percent. However, this occurs nine months from the harvest and is punctuated by significant price dips (Figure 5.10).

5.7.2. Inter-annual price variability for agricultural commodities

Inter-year variation in agricultural commodity prices, as reported in Table 23, is higher than the intra-seasonal variation discussed above. Whereas average intra-seasonal price shocks are generally low, incidents of moderate to severe shocks in producer prices occur for all the crops though for livestock they are relatively rare. Evidently, producer prices for agricultural commodities have risen significantly since 2005. For instance, between 2005 and 2012, the producer price of coffee doubled in real terms whilst the price of teff rose by 1.5 times in real terms over the same period. This is illustrated graphically in the Methodological Appendix. Though such price increase may adversely affect food-deficit rural households as well as urban consumers, it was not the focus of the price risk analysis as it is expected to incentivise increased output by producers. In similar vein, the focus was not on recorded price hikes but on the moderate to severe troughs which occurred even as prices generally trended upwards. These troughs are reported in Table 23[84] and also illustrated in the Methodological Appendix.

Table 24 below presents estimated coefficient of variation of inter-annual prices[85] of various crops in Ethiopia. The levels are generally high with the exception of vegetables (e.g. onions) and sweetpotatoes. Analysing inter-year producer prices between 2003 and 2012, it emerges that incidents of severe shocks occurred mainly in the maize subsector and was comparatively more frequent and highest in the coffee subsector. The relatively higher level of price volatility in the coffee subsector maybe indicative of the exposure of Ethiopian producers and traders to price instability in international markets and for which they lack effective hedging instruments. In the maize subsector, policy actions such as ad hoc bans on regional exports (discussed below) may be one of the factors contributing to the relatively higher level of volatility in prices.

Whilst intra-seasonal price variation can be managed if facilities exist for efficient stockholding, opportunities for managing inter-annual price risk tend to be limited to forward contracting which, as noted in discussions in Chapter 4, is only beginning to emerge in the country. Below we discuss some of the implications of vulnerability to price volatility.

Table 24: Coefficient of variation of inter-annual prices and yields (1993-2013)

Crop	Prices	Yelds
Teff	0.68	0.22
Wheat	0.68	0.22
Maize	0.66	0.29
Coffee	0.41	0.20
Sesame	0.79	0.19
Barley	0.66	0.24
Sorghum	0.70	0.25
Potatoes	0.64	0.15
Sweetpotatoes	0.39	0.64
Sugarcane	0.64	0.13
Onions	0.17	0.20
Bananas	0.65	0.14
Lemons and lime	0.71	0.42
Millet	0.68	0.30

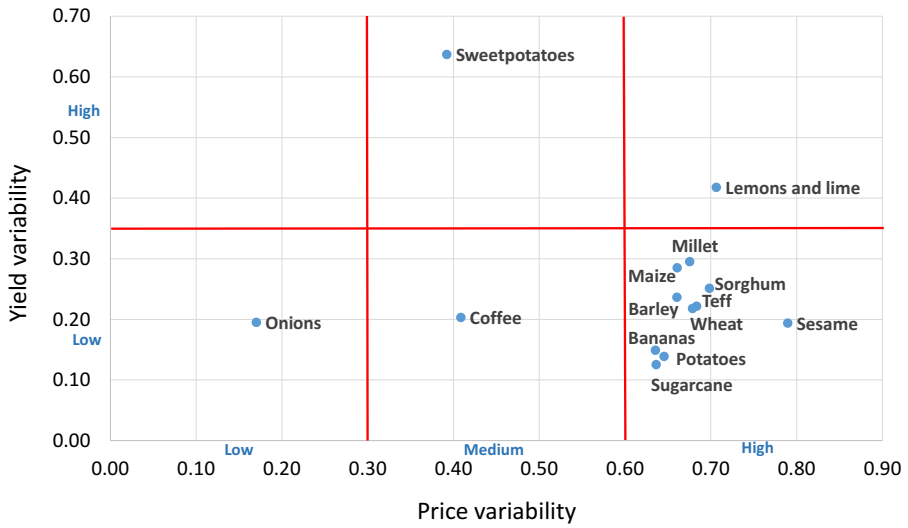
Source: Author's calculations on FAOSTAT
Note: teff and some other commodities do not have the entire time series

84 The average moderate inter-annual price decline ranges from 14.9 percent for wheat to 18.75 percent for maize. The average for teff is 18.6 percent. Severe price fall over the period, occurring mainly for wheat and coffee averaged 31.63 percent and 39.75 percent respectively.
85 See OECD (2011) "Managing risk in agriculture: policy assessment and design", OECD Publishing.

5.7.3. Links between inter-year price volatility, yield and other variables in Ethiopia

In Table 24 we report the variability of prices and yields for major crops produced in Ethiopia. The results show that the calculated variability of prices is, in general, larger than the variability of yields for all commodities, except for sweetpotato and onions. This analysis reflects the aggregate (national) level only and does not necessary imply that at farm level yields cannot be more variable than market prices.

Figure 37: Price and yield variability (CV) for selected commodities



Source: Author's calculations on FAOSTAT

Figure 5.12 makes it possible to explore the relationship between price uncertainty and variability in crop yields. The selected commodities are classified into six main groups. The first category of crops (those in the bottom-right corner of Figure 5.12) have high price variability but relatively low yield variability. That category contains the bulk of crops produced in Ethiopia. Coffee and onions respectively have medium and low price variability but both also are characterised by low levels of yield variability. It is only lemon and lime which experience both high price and yield variability whilst the sweetpotato subsector is associated with medium price variability but high yield variability. What is apparent from the above discussion is that the scope for farmers to cutback output in Ethiopia is far less than the level of variation in prices to which they have to respond. This is reinforced from data in Table 25 suggesting that adjustment in area under cultivation for selected major crops is substantially lower than variability in prices. Rather, what farmers tend to reduce is the level of yield-enhancing inputs which they use – a result which is consistent with the outcome of analysis of the impact of rising inputs prices (Section 5.6.2).

Table 25: Coefficient of variation of prices and other variables (1993-2013)

Crop	Prices	Yields	Area cultivated	Fertiliser used
Teff	0.68	0.22	0.17	0.93
Wheat	0.68	0.22	0.26	0.86
Maize	0.66	0.29	0.16	0.87
Coffee	0.41	0.20	0.34	0.74
Sesame	0.79	0.19	0.25	0.70

Source: Author's calculation based on CSA data

Though it has not been possible to establish causality between yield and price variability on the basis of robust statistical analysis, we surmise that for the major staple crops, relatively low variability in yield can trigger comparatively high price variability. This has important national food security implications beyond the impact on farm household income. We estimate the average annual economic loss triggered by inter-year price volatility for food crops at about US $93.35 million – this is based on the assumption that farmers are able to manage low to relatively moderate levels of volatility (where the inter-year variation is up to 15 percent). The average annual severity for export crops is much lower, estimated at just over US $1.05 million. The respective economic costs during worst case scenarios are US $389.54 million for food crops and US $2.82 million for export crops.

Whilst intra-seasonal price variation can be managed if facilities exist for efficient stockholding, opportunities for managing inter-year volatility tend to be limited. Forward contracting is one option which is discussed in Chapter 4, especially where the contracts negotiated include a firm floor price. However, it is only beginning to emerge in the country, especially for barley and maize.

5.8. Policy-related risks in the agricultural sector in Ethiopia

These risks were not identified by smallholder farmers consulted during the focus group discussions (Box 9) but were rather highlighted by participants during the stakeholder workshop held in Addis Ababa in December 2015[86]. The specific policy-related risks identified by the stakeholders were uncertainty regarding access to land and Government interventions in output markets, including price subsidies (e.g. in the wheat subsector) and export restrictions (e.g. in the maize subsector). As the analysis of policy risks reported below in this section show, significant levels of uncertainty observed in terms of ad hoc restrictions on maize exports to regional markets as well as access to land, especially in pastoralist communities (though this is due less to the deleterious effects of the land policy but more to its administration). Exchange rates appear to be stable in nominal terms but significant volatility is observed in terms trends in real exchange rates, which impact on export incentives. Other policy factors including interventions in wheat output marketing as well as interest rates controls, affect incentive structures in the agricultural value chains but do not exhibit significant variability.

5.8.1. Land policies in Ethiopia

Due to lack of quantitative data to analyse the frequency and severity of land access risk, we rely on reported evidence from a review by the Millennium Challenge Corporation (summarised in Table 26) as well as case briefly reported below. Table 26 shows that there has been improvement in land access and land use in Ethiopia. This observation is consistent with conclusions from reviews by UNECA (2010)[87], suggesting that the Government's land certification programme has been beneficial in terms of reducing the marginalisation of the poor and women in access to land. The UN agency also observed that implementation of the programme was done in a cost-effective manner. Gebremedhin (2006)[88] reports that improved security of tenure resulting from the land certification programme encouraged farmers to invest in conservation and other yield-enhancing technologies. Holden et al. (2009)[89] further add that, as a probable result of the investments in land improvements, farmers with certificates obtain higher yields than those who did not have the land certificates[90].

86 PARM-ATA-NEPAD National Stakeholder Workshop on Agricultural Risk Management, 16-17 December, 2015, Capital Hotel, Addis Ababa.
87 UNECA (2010) "Land policy in Africa: Eastern Africa Regional Assessment", AUC-ECA-AfDB Consortium, December 2010.
88 Gebremedhin B (2006) "Land tenure security, land rights and land investment in the highlands of Northern Ethiopia", IFPRI Environment and Production Technology Discussion Paper, 2006.
89 Holden S T, K Deininger and H. Ghebru (2009) "Impact of low-cost land certification on investment and productivity", *American Journal of Agricultural Economics*, No. 91 Vol. 2, 359-373.
90 Lack of data made it difficult for the authors to confirm this.

Table 26: Ethiopia: Land tenure indicators (1981 – 2009)

Indicator/source	Range	Score
Gini Concentration of holdings (1981-1990) – IFAD Rural Poverty Report, 2001	0 – 1 (0 =equal distribution)	0.47
Access to land (2007) – IFAD Rural Sector Performance Assessment, 2007	1 – 6 (1 = access unsatisfactory)	3.2
Land rights access – Millennium Challenge Corporation Scorebook, 2009	0 – 1 (1 = best)	0.613
Property rights – World Economic Forum's Global Competitive Index 2008/09	1 – 7 (1 = poorly defined or not protected by law)	4.3
Physical Property Rights Score – International Property Rights Index, 2009	0 – 10 (0= worst)	4.3
Legal structure and security of property rights – Economic Freedom of the World Index, 2008	0 – 10 (= lowest degree of economic freedom)	4.66
Protection of property rights – Economic Freedom of the World Index, 2008	0 – 10 (= lowest degree of protection)	5.23
Regulatory restrictions of sale of real property - Economic Freedom of the World Index, 2008	0 – 10 (= highest amount of restrictions)	6.72

Source: Millennium Challenge Corporation (2015) "Land variable figures, Country Scorebook, 2015.

Despite these positive outcomes, it is apparent from the scores reported in Table 26 that implementation of the land reforms in Ethiopia face complex social problems as well as administrative capacity constraints. The following cases illustrate this:

- Cesar and Ekbom (2013)[91] report that in parts of Afar in Northeast Ethiopia conflicts have arisen when pastoralists have lost access to grazing land and watering resources previously governed by traditional kinship and clan systems which ensured cooperation between pastoralists and crop/mixed farmers. In some communities the land certification programme has led to conflicting claims between pastoralists and other farmers over loss of access to grazing land. For example, tensions have arisen where land allocated to large-scale farms has been fenced off restricting access to pasture and watering sources (as cited by Hershkowitz A 2005)[92].
- Gizachew et al. (2015)[93] add that in Gambella over 535,000 hectares of land has been re-allocated to 15 large-scale investors and the affected local population resettled. Insufficient awareness creation among the local population reportedly led to some resentment over the resettlement.
- Bekele Hundie (2010)[94] reports similar concerns in communities in Afar, where about 375,000 hectares of rangeland was reallocated by the state for commercial farming or as wildlife reserves.

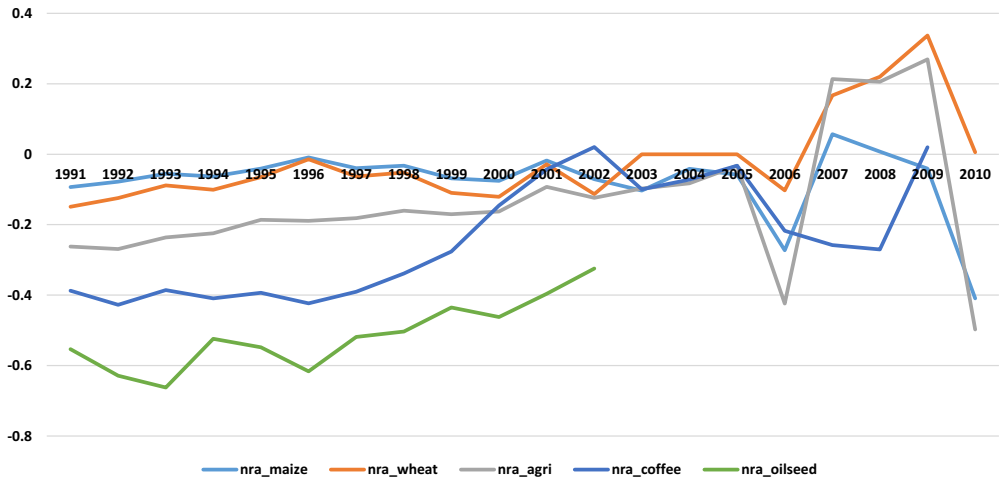
These cases point to the complexity of issues which need to be managed in implementation of land allocation and redistribution in the country. In addition, there are also administrative capacity issues affecting the implementation process. As reported by the Ministry of Finance and Economic Development (MoFED 2013)[95] as a result of capacity constraints the land certification programme was implemented in only 13 percent of the target Woredas in 2011/12.

91 César E. and A. Ekbom (2013) "Ethiopia Environmental and Climate Change policy brief", SIDA Helpdesk for Environment and Climate Change (www.sidaenvironmenthelpdesk.se).
92 Hershkowitz A. 2005. *Violence in Southern Ethiopia: the Borana and farmers clash over land use*. ICE Case Studies. The Inventory of Conflict & Environment (ICE). Washington, DC, American University.
93 Gizachew A. Abebe; Tigistu G. Abza; R.M Bennett (2015) "Implementation challenges of the rural land administration system in Ethiopia: issues for land certification and information systems", Paper prepared for presentation at the "2015 World Bank Conference on Land and Poverty, Washington DC, March 23-27, 2015
94 Hundie B (2010) "Conflicts between Afar pastoralists and their neighbours: triggers and motivations" *International Journal of Conflict and Violence*, Vol. 4 (1) pp. 134-148.
95 Ministry of Finance and Economic Development (MoFED 2013) "Growth and Transformation Plan, Annual Progress Report (2011/12).

5.8.2. Uncertainty caused by direct policy interventions (e.g. in grains subsectors)

In Ethiopia Government policy interventions include those in both inputs and output markets in the agricultural sector. These include inputs subsidies, output price subsidies targeting consumers, and trade restrictions such as imposition of bans on exports into regional markets. The net effects of these policy actions can be assessed by computing the nominal rate of assistance (NRA) for various crops. NRA is defined as the percentage change by which government policies raise (or lower) gross returns to farmers relative to returns without the interventions by government (Anderson 2008)[96]. It takes account of both price and income support. Based on data from a secondary source (Anderson and Nelgen (2013)[97], we computed changes in NRA from 1991 to 2011 for maize and wheat (subject of subsequent discussions on specific policy interventions in this subsection) as well as for export crops (coffee and sesame). The results are depicted in Figure 5.13.

Figure 38: Ethiopia: nominal rate of assistance for selected commodities (1991-2011)



Source: Anderson and Nelgen (2013), Estimates of Distortions to Agricultural Incentives, 1955-2011, World Bank (data for oilseed not available after 2002).

The results show that, until after 2007, producers in the agricultural sector did not obtain net gains from government support, indicating implicit taxation of the sector. Between 2007 and 2009 the sector made net gains from the support provided by government but dipped rather sharply after that. NRA for the maize and wheat subsectors follow this trend. Analysing the volatility of NRA for the sector based on the OECD (2011) methodology as applied elsewhere in this report[98], it is apparent that the NRA is not only variable but its volatility increased after 2005. So whilst net benefits from Government actions may have increased, policy uncertainty was also heightened.

One specific policy intervention which is characterised by significant uncertainty is ad hoc imposition of bans on maize exports, mainly into the regional markets. Between 2005 and 2012, the ban was imposed on three occasions: in January 2006[99]; then in late 2010 and re-imposed in 2011, just seven months after the ban was lifted[100]. Though the frequency appears high, there is dearth of data to quantify average annual severity of this policy action. However, evidence reported by Woldie and Siddig (2009)[101] indicate that in the worst case scenario the welfare loss to producers resulting from the ad hoc export bans may be about US$ 150 million. It is ad hoc nature of these interventions which heightens uncertainty for actors in the maize value – the imposition or removal of the ban is difficult to predict.

96 Anderson K (2008) "Distorted agricultural incentives and economic development: Asia's experience", Paper presented at the Inaugural Annual Asia Lecture at Kuala Lumpur Campus, University of Nottingham, 16 January 2008.
97 Anderson and Nelgen (2013), Estimates of Distortions to Agricultural Incentives, 1955-2011, The World Bank.
98 OECD (2011) "Managing risk in agriculture: policy assessment and design", OECD Publishing.
99 Source: http://www.reliefweb.int/rw/RWB.NSF/db900SID/VBOL-6LJGSV?OpenDocument
100 Ethiopian Times – 19th March 2011.
101 Woldie G A and Siddig K (2009) "The impact of banning export of cereals in response to soaring food prices: evidence from Ethiopia", MPRA Paper No. 18241, November 2009.

Government subsidises wheat consumers in Ethiopia and, as noted by Rashid (2010)[102], can depress domestic producer prices and, therefore, stymie output and productivity growth. It has not been possible to quantify the welfare losses associated with this policy regime, leading to its prioritisation in Chapter 6 being quite low.

5.9. Macroeconomic and other risks affecting the agricultural sector

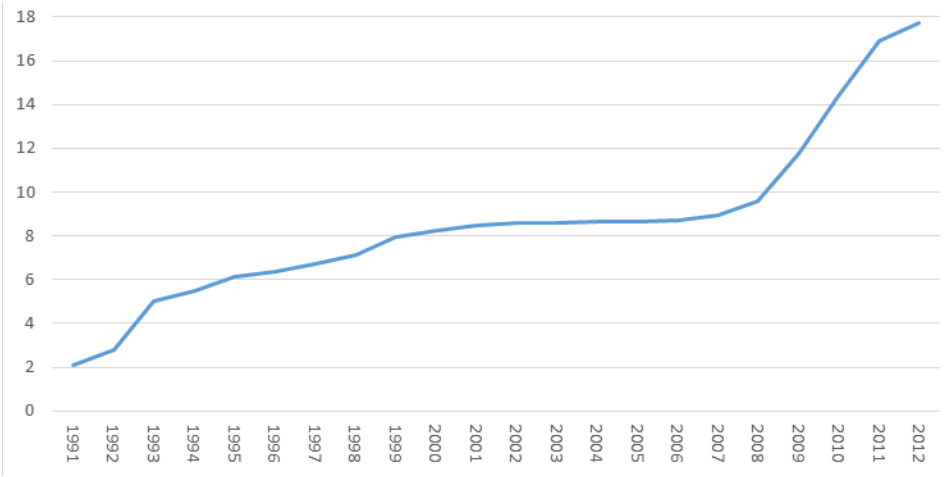
The main macroeconomic risk factors which stakeholders identified during the validation workshop in Addis Ababa[103] are exchange rate and inflation. These impact directly on the pricing of agricultural inputs and services as well as income generated from the sale of farm produce. Exchange rates have been fairly stable in nominal terms as have interest rates. We however report in this section the volatility of real exchange rates as well as real interest rates in the country, as these can respectively impact on the foreign currency-denominated earnings in real terms and on incentives for delivering financial services.

5.9.1. Volatility in exchange rates

It is evident from Figure 5.13 that between 1993 and 2008 exchange rates in Ethiopia were quite stable – the domestic currency depreciated by just about 90 percent over the 16 year period. This stability did not reflect the higher levels of inflation in the country relative to levels in the economies of Ethiopia's major trading partners (US used as proxy). For instance between 2005 and 2008, the country recorded double-digit inflation rates but the nominal exchange rates rose by a mere 13 percent over that period. The consequent over-valuation of the domestic currency adversely affected incentives for exports and also weakened price competitiveness of locally-produced substitutes for imports (Kassie 2015)[104]. However, over the four-year period between 2008 and 2012, the currency depreciated by close to 100 percent in nominal terms. During this period Ethiopia, as noted by Demeke (2013), maintained a managed floating exchange rate regime with strong government control but greater flexibility in adjusting exchange rates.

In analysing volatility of exchange rates, we have not limited ourselves to just nominal rates but also paid attention to movements in the real rates. This is because the latter has implications for incentives for players in, especially, agricultural exports trade. Nominal exchange rates usually indicate the number of domestic currency units which can be exchanged for another (a foreign currency). However, real exchange rates give some indication about the volume of goods which can be procured from other countries for an equivalent in the domestic currency. The formula for computing real exchange rates is set out in Box 11 and the results of the analysis depicted in Figure 5.14.

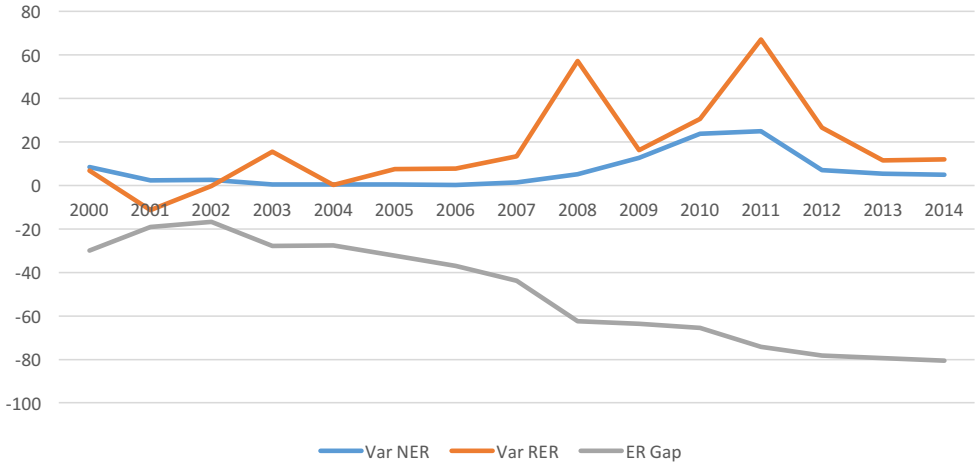
Figure 39: Official exchange rates in Ethiopia (birr per USD), 1991-2012



Source: National Bank of Ethiopia and World Development Indicators (the World Bank)

102 Rashid S (2010) "Staple food prices in Ethiopia", Paper presented at COMESA Policy Seminar, Maputo Mozambique, 25-26 January 2010.
103 National Stakeholder Workshop on Agricultural Risk Management organised by IFAD/ATA in Addis Ababa on 16-17 December 2015.
104 Kassie N M (2015) "Assessment of real effective exchange rates and external sector development of Ethiopia", International Journal of Business and Economic Research, No. 4 Vol. 4: 64-70.

Figure 40: Variability in nominal and real exchange rates in Ethiopia (2000-14)



Source: National Bank of Ethiopia and World Development Indicators (the World Bank)

Box 11: Assessing real exchange rates in Ethiopia

Real exchange rates take account of relative price levels between a country (in this case Ethiopia) and its major trading partners (e.g. the US considering that the bulk of its international trade is denominated in US Dollars). The formula for calculating real exchange rate is:

$$rer_{i,t} = e_{i,t} \times \frac{p_t}{p^*_{i,t}}$$

Where p_t is the price level of Ethiopia, $p^*_{i,t}$ is the price level in US, and $e_{i,t}$ is the nominal exchange rate between the currencies. The volatility of these rates are then calculated using the standard methodology as in OECD (2011)[5] adopted in this study.

Source: Ellis L (2001) "Measuring real exchange rates: pitfalls and practicalities", Research Discussion Paper 2001-04, Economic Research Department, Reserve Bank of Australia.

5 OECD (2011) "Managing risk in agriculture: policy assessment and design", OECD Publishing.

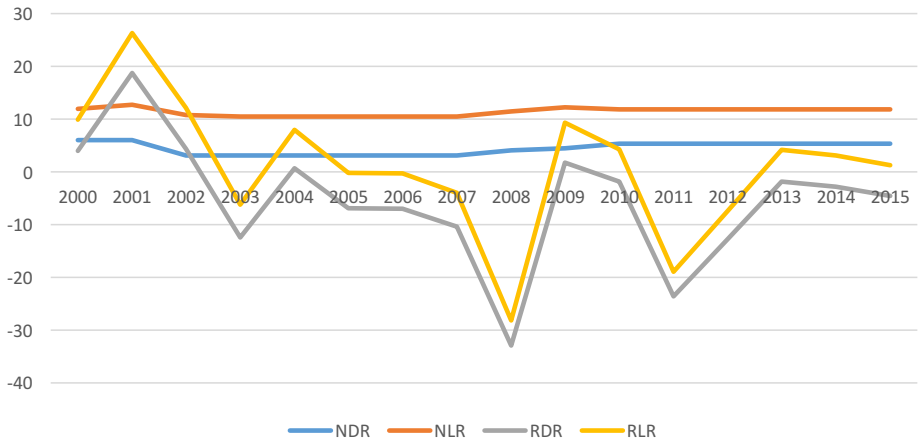
It is evident from Figure 5.15 that whilst nominal exchange rates (NER) remained relatively stable, real exchange rates (RER) in Ethiopia were comparatively more volatile. Over the period during which the two indicators analysed (2000-2014) the highest nominal exchange real shock was recorded was a 25.0 percent in 2011, a rather moderate increases. In contrast, there were spikes of 57.2 percent in 2008; 30.7 percent in 2010 and 67.2 percent in 2011. Non-adjustment of the nominal rates to reflect the sharp real depreciation led to a widening gap between the real and nominal rates – an indication of the level of over-valuation of the domestic currency and the relative competitiveness of the export sector.

Exporters and producers of agricultural exports lose out when nominal rates are not appropriately adjusted. The estimated annual economic losses occasioned by the severe real depreciation in the domestic currency which occurred between 2000-14 is about US $2.63 million and the severity of the worst case scenario which occurred in 2011 is estimated at US $59.69 million. These costs and the frequency of this risk place it well within the range of priorities that policymakers need to pay attention to (as discussed in Chapter 6).

5.9.2. Volatility in the cost of finance in Ethiopia

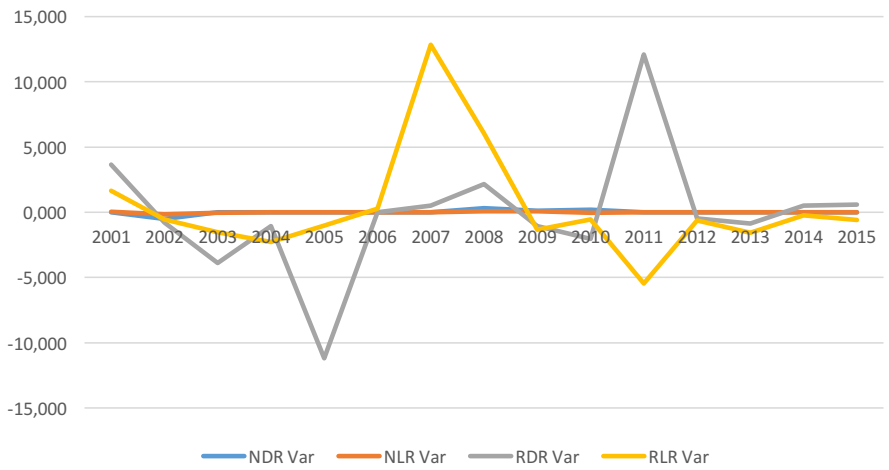
As discussed in Chapter 3 (Section 3.7.1), the National Bank of Ethiopia (NBE), the country's central bank, directly controls interest rates in the formal financial sector. It is evident from Figure 5.15 that both deposit and lending rates barely changed in nominal terms over the period of 2000 to 2014, mirroring a trend which dates back to the 1990s. An immediate effect of this policy regime is that real deposit rates in the country have most years during the period under consideration (i.e. 10 out of the 16 years) been negative. The situation for real lending rates closely mirrors that of real deposit rates. Conventional financial development theory stresses the importance of positive real interest rates. Odhiambo (2011)[105] validated this from a study of four countries in the Southern Africa Development Community (SADC). His conclusion affirmed that a flexible interest rates regime which allows for real interest rates to be positive can contribute to economic growth through fostering effective mobilisation and efficient allocation of financial savings to finance investments.

Figure 41: Nominal and real interest rates in Ethiopia (2000-2015)



Source: Authors' computations based on data from National Bank of Ethiopia (2015)

Figure 42: Variability in nominal and real interest rates in Ethiopia (2001-2015)



105 Odhiambo N. M. (2011) "The impact of financial liberalisation in developing countries: experience from four SADC countries", Organisation for Social Science Research in Eastern and Southern Africa (OSSRESA), 2011.

We further analysed the volatility of the interest rates (nominal and real) based on the measure of variability adopted in this study (OECD, 2011). The results, depicted in Figure 5.17 show that nominal interest rates have generally been very stable with no significant variation. However, real interest rates have been 7.5 to 16 times more volatile over the period under review. This shows that though interest rates may have appeared very stable in nominal terms, considerable volatility remains in pricing financial assets (savings and loans) in the country. The peaks and troughs in the variability of real interest rates is within the boundaries of low to average, suggesting that the impact of this policy regime may not represent a high risk to market players, including those in the agricultural sector. Nonetheless, negative real deposit rates imply unattractive returns on financial savings and, therefore, hamper mobilisation of savings by banks and non-bank financial institutions. Furthermore, negative real lending rates can blunt incentives for prudent lending by formal financial intermediaries.

Methodological challenges, including attribution to agricultural output, makes it difficult to estimate the cost associated with this particular risk. Despite this, it could be worthwhile for policymakers to pay attention to reforms which improve incentives for effective financial intermediation – making savings mobilisation and prudent lending more attractive. This needs to complement ongoing supply-side efforts to enhance access to finance in the agricultural sector in the country.

5.10. Summary of frequency and severity of agricultural risks in Ethiopia

The emerging evidence on the frequency and severity of risks analysed in this chapter is summarised in Table 27 below. By quantifying and assigning scores to the frequency and severity of the risks, it becomes possible to rank them on a relatively objective basis for purposes of prioritisation in Chapter 6. It is evident from the table that natural hazards such as weather risks as well as biological and environmental risks pose the highest level of risk to farmers and other players in the agricultural sectors. The ranking process also makes it possible to isolate specific risks from the broad categories, for example assessing the relative importance of drought, flood and erratic rainfall in terms of their impact on activities in the agricultural sector.

An important issue to note is that the scope of the assessment has been limited by availability of quantitative data. For instance the low overall score for some of the risks analysed is due partly to paucity of data to determine the level of average annual losses or costs in the worst case scenarios. This is the case for example with the scoring for consumer price subsidies on wheat and also incidence of inputs quality variability. Furthermore, owing to dearth of data, it has not been possible analyse risks such as physical security, including civil strife, affecting agricultural production in Ethiopia, though it is suggested as worth consideration during the recent stakeholder workshop. For this reason, though these risks may score low they may still require further attention by policymakers and reviews when additional data is available.

There are also some challenges which impact on various risks and can contribute income uncertainty in farm households. These include difficulties in accessing transport in rural communities. As discussed in Section 3.8, it is known to increase distribution margins and squeeze producer margins and rural household incomes (Gabre-Mahdin 2001). Another example is lack of efficient storage infrastructure, which contributes to high postharvest losses as well as limit farmers' choice in terms of optimum marketing strategies. Postharvest losses generally represent an important concern for farm households in Ethiopia. It is a common challenge faced by producers of all crops and in all regions in Ethiopia. The average annual postharvest losses for all crops is estimated at a very high US $482.55 million. Quite often it attributed to lack of storage facilities but, as noted in Section 5.4.2, late rains which occur during the harvest season can also increase postharvest losses. Other weather risks such as drought can also increase the incidence of pests (see Section 5.3) which contribute to higher postharvest losses. These challenges occur regularly and with certainty and are, therefore, not the focus of analysis of agricultural risks in this report. However, the scale of their effects suggest that it will be worthwhile for policymakers to pay attention to them as part of broad sector transformation strategies and programmes.

Table 27: Summary of frequency and severity of agricultural risks in Ethiopia

Risk category	Risk	Average annual severity		Frequency of shock		Worst case scenario		Overall Score
		Value (US$)	Score	Value[1]	Score	Severity (US$)	Score	
Weather risks	Drought	78,353,846	4	4	4	924,600,000	5	4.25
	Floods	1,280,000	2	Annual	5	2,745,000	1	2.62
	Variable rainfall	9,500,000	3	Annual	5	16,670,000	2	3.40
Biological and environmental risk	Plant diseases/pests	43,846,150	3	1.9	4	570,000,000	5	3.85
	Livestock diseases	5,350,000	3	2	5	210,000,000	4	3.90
Price risk	Food crops	93,350,489	4	7[2]	3	389,540,483	5	3.85
	Export crops	1,055,586	1	7	3	2,823,496	1	1.55
	Livestock	-	1	-	1	-	1	1.00
Policy risks	Land policy	-	1	-	1	-	1	1.00
	Export ban[3]	-	1	3	4	150,000,000	4	2.50
	Price subsidy[4]	-	1	Annual	5	-	1	1.93
Macroeconomic risks	Interest rates	-	1	8	3	-	1	1.55
	Exchange rates	2,634,859	2	4	4	59,690,353	3	2.87
Inputs risk	Rising prices[5]	46,045,972	3	4	4	139,777,905	4	3.60
	Quality variable	-	1	-	1	-	1	1.00
Other natural hazards	Earthquake	320,000	1	15	1	-	1	1.00
	Volcanic activity, wildfire etc.	-	1	37	1	-	1	1.00

1 Number of years it takes for risk event to recur.
2 Volatility differs for the food crops and is very low for teff.
3 Mainly affecting the maize subsector.
4 Affects mainly the wheat subsector.
5 The analysis focused on fertiliser price increase.

6. Prioritisation of agricultural risks and risk management options

6.1. Introduction

As stated in the Introduction to this report (in Chapter 1), the outcome of the agricultural risk assessment study (RAS), is ultimately to facilitate the adoption and implementation of a holistic strategy to manage agricultural risks in Ethiopia. The process included identification of agricultural risks in the country, based primarily on a review of relevant literature and publications (the focus of discussions in Chapter 3). In Chapter 4, the existing agricultural risk management (ARM) tools were reviewed, also based on desk reviews complemented by additional information collected during field visits to the country. The purpose of that review is to provide a basis for policymakers and stakeholders in general to explore options which can be scaled up or developed to complement existing ARMs in order to manage the most critical risks facing players in the agricultural value chains.

Since the agricultural sector in Ethiopia, as in many other developing countries, faces a wide range of risks, mainstreaming of effective ARMs which are also accessible to the most vulnerable people, requires prioritisation of risks. The risks identified (in Chapter 3) were therefore analysed, using a predominantly quantitative approach (reported in Chapter 5), which is complemented with some anecdotal evidence collected during the study. The quantitative analysis focused on assessing the severity and frequency of the identified risks and relied on available official data (from national and international sources). It is important to stress, however, that paucity of data sometimes constrained the quantitative analysis, thus making the qualitative information collected relevant in understanding the relative importance of the risks to players in the agricultural value chains.

This chapter reports on the prioritised risks based on evidence which emerged from the risk analysis in Chapter 5. In prioritising risks, the key considerations were the frequency of the risks; severity in terms of average annual losses due to these risks; and the value of losses associated with the worst case scenarios when they occur. The assessment is, however, weighted (75 percent) in favour of the first two criteria (frequency and average annual severity) and the remaining 25 percent assigned to effects from the worst case scenario. The chapter is structured as follows:

- Prioritisation of risks in Section 6.2, including evidence on the effects of the priority risks on various commodity subsectors and also the most vulnerable regions.
- In Section 6.3 the ARMs required to manage the prioritised risks agricultural sector are discussed, based on the review of existing ARMs undertaken in Chapter 4.
- The main conclusions are set out in Section 6.4.

6.2. Risk prioritisation

The objective basis we adopted in prioritising identified agricultural risks in the country involved ranking these risks according to the weighted scores from assessment of average annual severity, frequency and severity during a worst case scenario. This is reported in Table 28 below.

Table 28: Scoring of agricultural risks in Ethiopia

RISK	AVERAGE ANNUAL SEVERITY	AVERAGE FREQUENCY	WORST CASE SCENARIO	SCORE
DROUGHT	HIGH	HIGH	VERY HIGH	4.25
LIVESTOCK DISEASES AND PESTS	MEDIUM	VERY HIGH	HIGH	3.90
PLANT DISEASES AND PESTS	MEDIUM	HIGH	VERY HIGH	3.85
PRICE RISK: FOOD CROPS	HIGH	MEDIUM	VERY HIGH	3.85
INPUTS RISK: RISING PRICES	MEDIUM	HIGH	HIGH	3.60
ERRATIC OR VARIABLE RAINFALL	MEDIUM	VERY HIGH	LOW	3.40
EXCHANGE RATES VARIABILITY	LOW	HIGH	MEDIUM	2.87
FLOODS	LOW	VERY HIGH	LOW	2.62
POLICY RISK: EXPORT BAN	VERY LOW	HIGH	HIGH	2.50
POLICY RISK: PRICE SUBSIDY	VERY LOW	VERY HIGH	VERY LOW	1.93
PRICE RISK: EXPORT CROPS	MEDIUM	MEDIUM	VERY LOW	1.55
INTEREST RATES VARIABILITY	VERY LOW	MEDIUM	VERY LOW	1.55
PRICE RISK: LIVESTOCK	VERY LOW	VERY LOW	VERY LOW	1.00
POLICY RISK: LAND POLICY	VERY LOW	VERY LOW	VERY LOW	1.00
INPUTS RISK: QUALITY VARIABILITY	VERY LOW	VERY LOW	VERY LOW	1.00
EARTHQUAKE	VERY LOW	VERY LOW	VERY LOW	1.00
VOLCANIC ACTIVITY, WILDFIRE ETC.	VERY LOW	VERY LOW	VERY LOW	1.00

Source: Data from EM-DAT, FAOSTAT, CSA and computations reported in Chapter 5.

It is apparent from the evidence in Table 28 that prioritisation based on broad categories of risks may miss out important differences within categories. This may not be so evident when considering a category such as Biological and Environmental risks because diseases and pests among livestock and plants both rank very high – first and third respectively on the overall score. However, significant differences exist in terms of the impact of price risk on various subsectors. For instance, it is ranked very high for food crops and low-to-moderate for export crops. Price risk is rather low in terms of overall effects within the livestock industry. Even within specific risks, it may be important to isolate specific effects. For instance, as noted in the analysis in Section 5.7, inter-year price uncertainty is a greater risk than seasonal price variation. It may also be more difficult to address than the latter. These nuances need to be factored into ARM development strategies based on the prioritising emerging from the risk scoring in Table 28.

6.2.1. Priority agricultural risks in Ethiopia

Considering that the analysis in Chapter 5 on which Table 28 is based scored for various criteria from 1 (very low) to 5 (very high), we have proposed to prioritise risks which have an overall score above 2.5, implying medium to high risk vulnerability. Based on this, the following emerge as the agricultural risks to be prioritised in Ethiopia:

a. Drought ranks as the highest priority as its average annual severity of is high and the incidence is highly frequent. Furthermore, the severity of the worst case scenarios of drought in the country, which tend to coincide with El Nino, is extremely high.

b. Crop and livestock pests and diseases: these are ranked top and joint-top on the overall score reported in Table 28. Though annual average severity is medium for both, the comparatively high frequency as well as high to very high severity of the worst case scenarios account for the high scoring. It is apparent from Figure 3.1 that the incidence of these risks (jointly classified under EM-DAT as epidemics) impact negatively, especially on the livestock production index in Ethiopia.

c. Prioritisation of price risks, as noted above, depends on the specific subsector. The overall rating is high enough to be prioritised for food crops, though not so for export crops and for livestock. The focus in addressing price risks in food crops subsectors, however, needs to take account of the evidence in Section 5.7 and also in the Methodological Annex II which indicate that inter-year price uncertainty is relatively higher than intra-seasonal variation in prices.

d. Inputs risks: lack of quantitative evidence made it difficult to analyse the uncertainty regarding the quality and performance of inputs in Ethiopia. However, rising inputs prices (mainly fertiliser and not seed) was not only reported as a risk by farmers consulted during this study (see Section 5.2) but this was validated when the severity and frequency of this risk was analysed.

e. Erratic rainfall (delayed or late rainfall) scores high enough to be prioritised partly because of the high frequency. Flooding, on the other hand, is ranked only above exchange rate variability though its frequency is high. This is largely due to the low level of severity in terms of average annual losses and the low cost associated with the worst case scenario.

f. As reported in Section 5.9, exchange rate variability, in terms of severe episodes of over-valuation of the domestic currency as it depreciates steeply in real terms, represents an important risk for export crops.

Though the above list represents those which have to be prioritised in mainstreaming the development of ARMs in the country, it is important that the other identified risks are not totally marginalised. For instance, a policy risk such as export ban, which falls just below the benchmark we adopted, may have significant implications for the Government strategy to promote maize production targeting exports to the regional markets. This will be particularly important in ensuring that players in the maize value chains as well as other agricultural produce with export potential obtain optimum benefits from a policy regime which minimises shocks from steep over-valuation of the domestic currency. In addition, it is apparent that maintenance of subsidies on output prices for a crop such as wheat may be weakening producer incentives, though the effects appear relatively low.

Indeed, the low scores for some of the identified risks, is party due the dearth of data for effective quantification of their severity and frequency. For example, it has not been possible to obtain sufficient data to analyse the severity and frequency of the implementation of the land policy in the country. There are also methodological difficulties with isolating the effects of interest rate changes (especially in real terms) on output in various subsectors.

6.2.2. Subsector and geographical incidence of agricultural risks in Ethiopia

The effects of the identified agricultural risks across various subsectors are summarised in Table 29 below. It is apparent that the prioritised risks such as diseases and pests, drought and erratic rainfall affects all crops and livestock subsectors. Price risk affects players in food and export crops subsectors, though the impact may vary. The only prioritised risk which are subsector-specific are exchange rates risk, affecting mainly export crops; and the output price subsidy risk, which currently affects only the wheat value chain.

Table 29: Subsector vulnerability to agricultural risks in Ethiopia

Risk category	Risk	Food crops	Export crops	Livestock
Weather risks	Drought	🔴	🔴	🔴
	Floods	🟡	🟡	🟢
	Variable rainfall	🟡	🟡	🟡
Biological and environmental risks	Livestock diseases and pests	NA	NA	🔴
	Plant diseases and pests	🔴	🔴	NA
Inputs risks	Rising inputs prices	🔴	🔴	🔴
	Quality variability	🟢	🟢	🟡
Price risk	Food/export crops and livestock	🔴	🟡	🟢
Policy risks	Export ban	🔴	🟢	🔴
	Price subsidy	🔴	🟢	🟢
	Land policy	🟡	🟡	🟡
Macroeconomic risks	Exchange rates	🟢	🟢	🟢
	Interest rates	🟢	🟢	🟢
Other natural risks	Earthquake	🟢	🟢	🟢
	Volcanic activity, wildfire etc.	🟢	🟢	🟢

Source: Data from EM-DAT, FAOSTAT and computations reported in Chapter 5.

Table 30 depicts regional vulnerability to identified agricultural risks in Ethiopia. Most of the identified agricultural risks have nationwide effect but the incidence of some of the prioritised risks such as drought and erratic rains is comparatively higher in regions like Afar, Amhara, Oromia, Somali, SNNP and Tigray. Due to the largely commodity-specific nature of some policy actions (e.g. output price subsidies and ad hoc export bans) the incidence of these risks are concentrated in the regions in which the production of wheat and maize are concentrated. Based on available information, it appears that Afar and Gambella are the regions in which the incidence of risks associated with land policy implementation in Ethiopia are concentrated. We add, however, that access to additional information may lead to revision of this observation.

As is illustrated in Figure 6.1, the regions which are most susceptible to the prioritised risks (Afar, Amhara, Oromia, Somali, SNNP and Tigray) are also dominant in the production of food and export crops. For instance, according to CSA's agricultural survey (2014-15), Oromia, Amhara and SNNP alone account for 94 percent of total national agricultural production[106]. The same survey also shows that Oromia and Amhara produce 75 percent of national output of oilseeds and pulses as well as 31 percent and 38 percent respectively of coffee and root crops production. Fruit crops, vegetables and sugarcane are grown predominantly in SNNP.

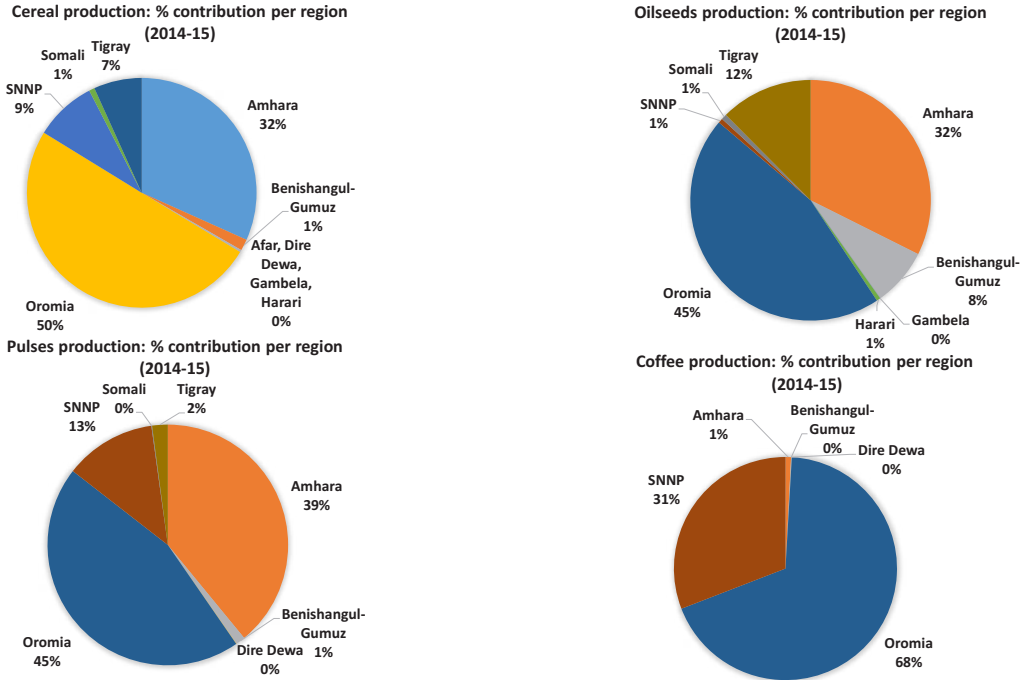
106 Source: Agricultural Sample Survey 2014-2015 CSA (Volume 1).

Table 30: Geographical exposure to agricultural risks in Ethiopia

Risk category	Risk	Geographical (regional) exposure to risks	
		High risk	Moderate/low risk
Weather risks	Drought	● Afar, Amhara, Oromia, Somali, SNNP and Tigray	●
	Flood	● Gambella	● Afar, Amhara, SNNP, Dire Dewa and Tigray
	Delayed/late rains	● Northern parts of Somali, Amhara, Tigray, Central/Eastern Oromia and SNNP lowlands	
Biological and environmental risks	Plant pests and diseases	● All regions	
	Livestock diseases	● All regions	
Inputs risk	Rising prices	● All regions	
	Quality variability		● All regions
Price risk	Food crops	● All regions	
	Export crops		● All regions
	Livestock		● All regions
Policy risks	Land policy risk		● Across all regions; highest in Afar and Gambella
	Ban on exports		● Maize-growing regions
	Price subsidies		● Wheat-growing regions
Macroeconomic risks	Exchange rate risk		● All regions
	Interest rate risk		● All regions
Other natural risks	Landslide		● All regions
	Wildfire		● All regions
	Earthquake		● All regions
	Volcanic activity		● All regions

Source: Data from EM-DAT, FAOSTAT, CSA and computations reported in Chapter 5.

Figure 43: Main crop contribution per region (2014-2015)



Source: Based on Agricultural Sample Survey 2014-2015 CSA (Volume 1)

Evidence from the Ethiopia Socioeconomic Survey (ESS) 2013/2014, reported in Table 31 also show that very large populations are involved in agricultural production in the regions which are most vulnerable to agricultural risks.

Table 31: Number of farming households involved in the production of selected crops by region (2014-2015)

Region	cereal	pulses	oilseed	vege-tables	roots	fruit crops	chat	coffee	hops	sugar cane
Afar	11,183		962	1,275		1,685				
Amhara	4,184,532	2,522,194	1,313,898	1,407,199	1,561,507	413,180	257,903	412,639	1,479,581	93,782
Benishangul-Gumuz	214,838	73,166	129,124	51,229	57,388	92,087	17,724	27,889	13,835	6,809
Dire Dewa	25,808	11,424	5,164	1,610	10,539	6,241	12,239	5,138		
Gambela	34111	5,500	824	10,119	13,153	23,458	3,766	15,737	3,670	9,623
Horari	26,808		12,846			10,262	2,253		3,835	26,918
Oromia	5,413,126	2,895,053	1,134,471	2,107,973	2,168,808	1,355,757	1,640,814	1,790,042	517,526	352,343
SNNP	2,413,723	2,086,765	94,047	1,964,595	1,994,865	1,982,156	1,084,249	2,470,309	184,373	811,744
Somali	103,994	13,335		8,071	7,985	9,866	19,038			
Tigray	914,450	327,033	238,785	219,260	93,256	68,168		14,843	182,810	1,681

Source: Based on Agricultural Sample Survey 2014-2015 CSA (Volume 1)

6.3. Improving effectiveness and uptake of agricultural risk management tools

Agricultural risk management (ARM) tools which exist in Ethiopia have been reviewed in Chapter 4 of this report, showing clearly that traditional risk management strategies adopted by most smallholder farmers are inadequate. For instance, many of them opt for ex-ante risk management strategies which entail diversification, including inter-cropping and mixed farming. These options may mitigate household vulnerability to risks but global evidence suggests that they do not represent an investment strategy which optimises household earnings from farm-related activities (World Bank 2005[107]). They also tend to adopt informal ex-post risk coping strategies, including sale of assets and reallocation of farm labour for non-farm activities, which reduce their capacity to sustain on-farm yield-enhancing investments. In this section we review available formal ARMs in Ethiopia (Table 31), including technology-based options and infrastructure investments, market-based ARMs and public-based tools.

6.3.1. Investment in technology-based solutions and infrastructure

As noted in Chapter 4, technology can potentially be deployed in managing natural hazards such as weather risks as well as plant and livestock diseases and pests, whilst investment in storage and rural transport infrastructure can enable stakeholders to better manage marketing and price risks. Available options in the country, reviewed in Chapter 4, include the following:

- **Irrigation:** It is acknowledged that irrigation can help in flood control and improved water access for crops and livestock when precipitation is below normal, but only 10 percent of irrigable land in Ethiopia is currently under irrigation (representing about 4 percent of total land under cultivation) [108]. Expanding area under irrigation will require: innovative financing (including cost recovery) to bridge funding gaps[109] as well as institutional capacity building and regulatory reforms which should address issues such as water fees, water rights, conflict resolution and better collaboration between relevant local, regional and federal agencies[110].

- **Improved control of plant and livestock diseases and pests:** Susceptibility to plant and livestock diseases and pests can be reduced through accessing public-based systems which supply improved planting materials and livestock breeds to farmers. Marketing systems have also been developed around the cooperatives to enable farmers to access inputs to control plant diseases. The public sector also provides veterinary services for animal health purposes. The evidence reviewed in Chapter 4, however, shows that uptake of these technologies remain low and contribute to the high incidence of plant and livestock diseases and pests in the country. Limited access to finance has been identified as one of the factors constraining uptake of available technology by smallholder farmers and pastoralists.

- **Investment in infrastructure:** The Government of Ethiopia (GoE) is implementing plans to expand the rural road and rail transport network in the country. It is, in particular, expected that increased reliance on rail links to the sea ports rather than on road haulage will reduce the overall cost of imported inputs such as fertiliser and so boost uptake by farmers. There are also ongoing initiatives to invest in additional storage infrastructure for cooperatives. As noted in Chapter 4 mobilising public funding for these investments may be a challenge and therefore options to encourage complementary private investments need to be explored, especially in storage infrastructure.

107 World Bank (2005) "Managing agricultural production risk: innovations in developing countries", Report No. 32727-GLB, The World Bank, Washington DC.
108 Awulaches S.B et al. (2007) "Water resources and irrigation development in Ethiopia", International Water Management Institute, Working Paper No. 123.
109 Awulaches S.B et al. (2007) "Water resources and irrigation development in Ethiopia", International Water Management Institute, Working Paper No. 123.
110 Haile G.G. and A.K. Kasa (2015) "Irrigation in Ethiopia: a review" *Academia Journal of Agricutural Research* 3 (10) pp.264-269, October 2015.

6.3.2. Market-based tools

The market-based ARM tools reviewed in Chapter 4 include options to manage pre-harvest risks such as crop and livestock insurance and tools which enable value chain actors to mitigate postharvest risks including market access and price risks. Evidence emerging from the review of these tools is summarised below:

a. Insurance

Ethiopia is one of the trailblazers in the development of crop and livestock insurance products targeting smallholder farmers and pastoralists. However, the review in Chapter 4 noted that uptake of agricultural insurance products (both indemnity-based and indexed products) remains low in the country. It is evident that the GoE is committed to scaling these schemes, which involve government and donors as well as private insurance companies and to achieve this objective it will be crucial not only invest in awareness creation among farmers but also address the following issues:

- High premiums charged especially for the weather-indexed products and uncertainty regarding pay-outs[111];
- Foster more effective bundling of insurance with farm credit[112];
- On the technical design side, minimise basis through improved access to weather information and related extension advice on farmers' response to anticipated weather risks (discussed further below);
- Enhance collaboration between insurance industry, information providers and MFIs[113]; and
- Strengthen local actuarial capacity in order to improve quality of insurance products.

b. Contracting

Interesting examples of forward contracting are emerging in Ethiopia, including for staple grains involving WFP (under its P4P programme) and for barley by private breweries including Diageo. One of the gains for farmers, as noted in Chapter 4, is improved capacity to manage price risks, not only intra-seasonal price variation but also the more challenging volatility in inter-year prices for most crops produced in Ethiopia. Evidence discussed in Chapter 4 shows that the greater predictability of household income resulting from the assured producer prices has improved access to finance for the participating farmers with consequent positive impact on uptake of yield-enhancing inputs, increased farm productivity and output as well as household income.

A key emerging lesson from the successful pilots is that effective collective marketing is critical if smallholder farmers are to benefit. For that reason, strengthening the capacity of cooperatives is critical and should cover not only training but include regulatory measures to improve governance in order to engender confidence in collective trading systems. Furthermore, there is need to invest in physical infrastructure and build capacity among primary-level farmers organisations to enforce commodity grading standards which will facilitate aggregation of stocks to be marketed.

c. Fostering modern market institutions

Two institutional innovations to improve commodity marketing, which have been piloted in Ethiopia and are closely linked are the commodity exchange and warehouse receipt system (WRS). The Ethiopia Commodity Exchange (ECX) has emerged as one of the most successful exchanges in Africa. For instance, it is one of the few exchanges on the continent which have achieved financial sustainability through trading volumes well over what it requires to break even. However, in order to optimise benefits from the facilities it offers, consideration needs to be given to the following:

- Take steps to increase volumes of "non-mandated" crops, especially the staple grains. This will make it possible for large-scale processing companies to procure agricultural raw materials more efficiently as they can source bulked stocks directly from known locations (as opposed to relying on small-scale agents who often have liquidity constraints). In addition, EGTE can procure grains for relief and strategic price dampening operations in a transparent and non-distorting manner if ECX trades staple grains.

111 These include: Nielsen T (2012); Meherette E (2009); Wolday Amha (2014); and Bryla E and J Syroka (2007) "Developing index-based insurance for agriculture in developing countries", UNDESA Sustainable Development Innovations Brief, Issue No. 2, March 2007.
112 Source: Van Asseldonk et al. (2014) "Is there evidence on linking crop insurance and rural credit?", FARMAF Policy Brief.
113 Source: Berhane G (2015) "Key lessons from weather-indexed crop/livestock insurance pilots in Ethiopia" Presentation at PARM-ATA-NEPAD National Stakeholder Workshop on Agricultural Risk Management, 16-17 December, 2015, Capital Hotel, Addis Ababa.

- Explore the possibility of trading futures and options contracts which will enable market players to hedge price risk. This can improve access to trade finance for cooperative and other traders – indeed ECX has not been particularly effective in facilitating access to finance for market players.
- Divesting warehousing operations from its core trading functions, as has happened recently, can reduce perceptions of conflict of interest and potentially improve efficiency in the management of licensed warehouses. However, the possibility of licensing private warehouse operators may be worth exploring as it can catalyse private investment in storage infrastructure. That option can also sharpen regulatory enforcement for the licensed operators as the competition created will avoid the situation where sanctioning a single operator, as is currently the case, may lead to uncertainty regarding availability of storage services.

6.3.3. Public ARM tools

Safety nets:
These involve provision of relief supplies targeting especially vulnerable households. They are often crucial in filling gaps where private insurance is unlikely to be sustainable because risk covariance the cost of coverage and breakeven premiums too high. In this context, Ethiopia can be said to be one of the better-placed countries as it has a well-structured disaster relief management (DRM) programme which can potentially be linked with private insurance against natural hazards. Reviews of the GoE's DRM model by IFPRI (2011) concluded that it has been very successful, especially when compared with models which exist in many African countries. Critical to its success, and therefore worth learning from are the following:

- Clear delineation of responsibilities for holding food reserves (EGTE); management of relief operations by EFSRA; and collection and sharing of early warning information for action (DRMFSS).
- The programme also includes linkage between relief operations and other non-emergency welfare programmes such as the school feeding programmes. This linkage, as noted some reviewers, has the potential to sustain growth in formal domestic demand for produce staple grains.

Based on our review in Chapter 4 we propose consideration of the additional measures below:

- Linking EGTE procurement to ECX trading involving cooperatives. This is likely to boost volumes of staple grains traded through the formal segment of the market and by ECX. It is also likely to improve the viability of the WRS which underpins its delivery system.
- Expanding scope for private participation in warehousing linked to ECX can, as stated in Section 6.3.1 encourage private investment in storage infrastructure and ease the fiscal burden on GoE in expanding storage capacity to accommodate additional stocks of food reserves.

Information systems:
The review of market information systems (MIS) reported in Chapter 4 mirrored conclusions by Amha (2014) showing the need for strengthening to improve timeliness and reliability of information as exists in many African countries. The DRMFSS's Early Warning System and how it underpins advance planning to manage major disasters is, however, worth acknowledging. The principle of utilising information on identified risks to manage actions by key players is burgeoning in pilots such as the Agro Met Advisory Project – which makes it possible for farmers at specific locations to be provided not only weather information but also extension advice on how to manage the anticipated risks. The advisory information is channelled through the GoE extension agents. Though the pilot is at an early stage, from our review in Chapter 4, it is apparent that sharing information with insurance companies and MFIs servicing the target farmers can be beneficial.

Fostering access to finance:
Access to agricultural finance is not only important in improving uptake of yield-enhancing technology by farmers but also in improving liquidity in commodity trade to all players in the value chains. Public actions to foster this included replacing unsustainable loan guarantee schemes with on-lending by CBE through MFIs. It is anticipated that participating MFIs will take advantage of crop and livestock insurance schemes being developed

to manage their exposure to default risk arising natural hazards. However, as noted in Chapter 4, most MFIs who participated in the recent stakeholder workshop[114] on agricultural risk management have not taken up this option. This is worth further examination. Similarly, the analysis of macroeconomic risks reported in Chapter 5 shows that maintaining low interest rates may appear to minimise shocks in the nominal pricing of credit but does not overcome variability in incentives for formal financial intermediaries to actively mobilise domestic financial savings for lending. It is therefore a policy issue worth revisiting.

6.4. Conclusion

Farmers and other value chain actors in Ethiopia face agricultural risks which fall into seven main categories: weather risks (drought, flood and erratic rains); environmental risks (predominantly crop and livestock diseases and pests); inputs risk (including rising inputs prices and quality variability); price risk (intra-seasonal and inter-year); macroeconomic and policy risks and other natural hazards. The risks identified in Chapter 3 were analysed in Chapter 5 using a quantitative approach which allows for risk prioritisation with a focus on the frequency and severity of risks (average annual severity as well as losses associated with the worst case scenarios when the risks occur).

To determine required actions in mainstreaming the development of ARMs in Ethiopia, in particular to address the priority risks, the existing tools in the country are reviewed (see Chapter 4). From that review it is apparent that traditional risk management and coping strategies are inadequate and alternative options are needed. The options include investment in technology (irrigation, systems to control crop and livestock diseases and in storage and transport infrastructure). There are also market-based risk sharing or risk transfer tools which stakeholders can use to manage diverse risks (natural hazards and market risks including price risk). These include crop and livestock insurance, forward contracting and use of innovative market institutions such as the ECX and the WRS which underpins its delivery system. Public-based ARM tools including safety nets which are deployed especially when natural risks occur on a catastrophic scale as well as information systems which are crucial in sustaining both public and private ARMs. Also reviewed are initiatives to improve access to finance, which have implications for farmers' capacity to take up available technologies by which they can minimise exposure to some of the identified risks. It is apparent that, considering the number of public sector institutions as well as private enterprises and donors involved in the development of ARMs, effective coordination and leadership may prove critical.

114 PARM-ATA-NEPAD National Stakeholder Workshop on Agricultural Risk Management, 16-17 December, 2015, Capital Hotel, Addis Ababa.

Bibliography

Admassu B. (2003) "Primary Animal Health Care in Ethiopia: the story so far", Presentation at Workshop on Primary Animal Health Care in the 21st Century: Shaping the Rules, Policies and Institutions, 2003.

Amera T. and A. Abate (2008) "Assessment of pesticide use, practices and hazards in the Ethiopian Rift Valley" Report of study undertaken in 2007 on behalf of Institute of Sustainable Development, Ethiopia and Pesticide Action Network of the U.K.

Amha W. (2014) "Agriculture and food security risks in Ethiopia: risk profiles, management and harmonisation of interventions" Report produced for FAO, Rome, November 2014.

Araya N. S. (2011) "Weather insurance for farmers: experience from Ethiopia", Paper presented at Conference on new Directions for Smallholder Agriculture, 24-25 January 2011, Rome IFAD HQ.

Anderson K (2008) "Distorted agricultural incentives and economic development: Asia's experience", Paper presented at the Inaugural Annual Asia Lecture at Kuala Lumpur Campus, University of Nottingham, 16 January 2008.

Anderson and Nelgen (2013), Estimates of Distortions to Agricultural Incentives, 1955-2011, The World Bank.

Araya N. S. (2011) "Weather insurance for farmers: experience from Ethiopia", Paper presented at IFAD Conference on New Directions for Smallholder Agriculture" 24-25 January 2011, IFAD HQ Rome.

Awulaches S.B et al. (2007) "Water resources and irrigation development in Ethiopia", International Water Management Institute, Working Paper No. 123.

ATA Ethiopian Agricultural Transformation Agency, 2015. Pulses and Oilseeds. Value Chains Programme Component http://www.ata.gov.et/programs/value-chains/pulses/

ATA Ethiopian Agricultural Transformation Agency Annual Report 2013-2014

Bayisa B and Bereda A. (2009) "Assessment of veterinary service delivery, livestock disease reporting, surveillance systems and prevention and control measures across Ethiopia/Kenya border", Report produced on behalf of Care and CIFA, Ethiopia, December 2009.

Berhane G (2015) "Key lessons from weather-indexed crop/livestock insurance pilots in Ethiopia" Presentation at PARM-ATA-NEPAD National Stakeholder Workshop on Agricultural Risk Management, 16-17 December, 2015, Capital Hotel, Addis Ababa.

CSA Agricultural Sample Survey 2014-2015 (Volume 1).

Bernard, T., Abate, G., Lemma, S. (2013) Agricultural cooperatives in Ethiopia: Results of the 2012 ATA Baseline Survey. International Food Policy Research Institute (IFPRI), Washington DC.

Bernard, T. and Spielman, D.J. (2009) Reaching the rural poor through rural producer organisations? A study of agricultural marketing cooperatives in Ethiopia. Food Policy 34 (2009) 60-69

Bernard, T. and Taffesse, A.S. (2012) Returns to Scope? Smallholders' Commercialisation through Multipurpose Cooperatives in Ethiopia. Journal of African Economies, Vol. 21, No3, pp 440-464.

Beyene H. and B. Korf (2008) "Unmaking the commons: Collective Action, Property Rights, and Resource Appropriation among agro-pastoralists in Eastern Ethiopia", CAPRi Working Paper No. 88 June 2008

Black Rhino Group, 2015. Thought leadership blog. Ethiopia's Growth and Transformation Plan (GTP). http://blackrhinogroup.com/ethiopias-growth-and-transformation-plan-gtp/

Borga F, D. Naziri and B Emana (2014) "Report on role of innovative finance in creating conditions to scale up adoption of technologies to reduce waste and spoilage in agricultural value chains in Ethiopia", Report produced as part of multi-country study commissioned by AGRA/Rockefeller Foundation.

Bronikowski, A. and Webb, C. (1996). Appendix: A critical examination of rainfall variability measures used in behavioural ecology study. Behaviour Ecology Sociobiology 39: pp.27-30

Bryla E and J Syroka (2007) "Developing index-based insurance for agriculture in developing countries", UNDESA Sustainable Development Innovations Brief, Issue No. 2, March 2007.

Carlos E. Arce (2010) "Weather index insurance for agriculture: lessons learned", Presentation at Regional Workshop on Risk Management in African Agriculture at Lilongwe, Malawi 06-10 September 2010

Cespedes, L. (2011) Ethiopian livestock market information system: Using ICT to deliver information to rural communities. E-agriculture blog, 2011.
http://www.e-agriculture.org/blog/ethiopian-livestock-market-information-system-using-ict-deliver-information-rural-communities

Central Statistics Agency (CSA) (2013) Agricultural Sample Survey 2012/2013 (2005 E.C.). Volume I. Report on Area and Production of Major Crops (Private Peasant Holdings, Meher Season). Statistical Bulletin 532, Addis Ababa

Central Statistics Agency (2015) Agricultural sample Surveys 2006-2013

César E. and A. Ekbom (2013) "Ethiopia Environmental and Climate Change policy brief", SIDA Helpdesk for Environment and Climate Change

CSA and the World Bank (2015) "Living Standards Measurement Survey: Ethiopia", 2015. Legese G. et al. (2014) "Sheep and goats value chains in Ethiopia: a synthesis of opportunities and constraints", ILRI 2014

CSA (2013) Report on livestock diseases and proportion treated in Ethiopia.

Conway, D. and Schipper, L.F. 2011. Adaptation to Climate Change in Africa: Challenges and opportunities identified from Ethiopia. Global Environmental Change 21 (2011) 227-237

Coulter, J. (2012). Review of Agricultural Warehouse Receipting Initiatives in Ethiopia.

Coulter J. (2009) "Review of warehouse receipt systems and inventory credit initiatives in Eastern and Southern Africa" – study undertaken on behalf of UNCTAD, September 2009Deressa, T.T., Ringler, C., Hassan, R.M., 2010. Factors affecting the choices of coping strategies for climate extremes: the case of farmers in the Nile Basin of Ethiopia. ACCFP Report.

Coulter J and G. Onumah (2002) "The role of warehouse receipt systems in enhanced commodity marketing and rural livelihoods in Africa", *Food Policy*, 27 (2002) 319-337.

Degefa T (2010) "Evaluation report on weather index-based pilot insurance project, College of Development Studies, Addis Ababa University. Addis Ababa.

Demeke M (2012) "Analysis of incentives and disincentives for maize in Ethiopia", FAO-MAFAP, 2012.

Demeke M (2013) "Analysis of incentives and disincentives for wheat in Ethiopia", FAO-MAFAP 2013.

Desta A.H. (2015) "Major constraints of veterinary services delivery system and its solutions in pastoral areas of Ethiopia", *International Journal of African and Asian Studies*, 12 (1) pp.5-11.

DRMFSS (2015) Survey report, 9th May 2015.

DRMFSS (2010) "Flood Contingency Plan", August 2010.

ECA (2007) "Africa Review Report on Drought and Desertification", UNECA, Addis Ababa, Ethiopia, October 2007.

ECX Ethiopian Commodity Exchange, 2014. ECX Achieves Record Performance. http://www.ecx.com.et/downloads/whatsNew/20140715164117916ECX%20Achieves%20Record%20Performance%20(News).pdf

Ellis L (2001) "Measuring real exchange rates: pitfalls and practicalities", Research Discussion Paper 2001-04, Economic Research Department, Reserve Bank of Australia.

Environmental Protection Authority (1997) "The Conservation Strategy of Ethiopia" Volume 1. EPA, Addis Ababa, Ethiopia.

Eshte Y, Misganaw M and W. Shiferaw (2015) "Assessment of Important Plant Disease of Major Crops (Sorghum Maize, Common bean, Coffee, Mung Bean, Cowpea) in South Omo and Segen Peoples Zone of Ethiopia", Current Agriculture Research Journal Vol. 3(1), 75-79.

Eva Gálvez-Nogales and Jorge Fonseca (2014) "Institutional procurement of staples from smallholders: the case of purchase for progress in Ethiopia", FAO, 2014;

Freitas H, M. Oliveira, M. Jenkins and O. Popjoy (1998) "The focus group: a qualitative research method", ISRC Working Paper 010298, February 1998.

Feyssa D H and D O Gemeda (2015) "Impact of climate change on production systems in semi-arid regions of Ethiopia ", *Journal of Biological and Chemical Research* Vol. 32 No. 2 pp.755-764.

FAOSTAT (2014), Food Balance Sheets, 2014

FEWSNET Famine Early Warning Systems Network, 2015. Ethiopia Food Security Outlook Update. USAID, 2015. http://www.fews.net/east-africa/ethiopia

FAO's Agricultural Stress Index System (ASIS) – http://fao.org/climatechange/asis/en/

F.A.O. (2006) Ethiopia Country Pasture and Forage Resource Profile. http://www.fao.org/ag/AGP/AGPC/doc/counprof/ethiopia/ethiopia.htm.

Food and Agricultural Organisation of the United Nations (FAO) 2015 Country Profiles, FAOSTAT Ethiopia. http://faostat.fao.org/CountryProfiles/Country_Profile/Direct.aspx?lang=en&area=238

Food and Agriculture Organization of the United Nations, FAOSTAT database, available at http://faostat.fao.org/site/362/DesktopDefault.aspx?PageID=362

Ministry of Agriculture and Rural Development (MoARD) "Crop Variety Registers: 1998-2011", MoARD, Addis Ababa, Ethiopia.

Gabre-Mahdin E. (2001) "Of markets and middlemen: transforming Ethiopia's agricultural marketing system", IFPRI, 2001.

Gebremedhin B (2006) "Land tenure security, land rights and land investment in the highlands of Northern Ethiopia", IFPRI Environment and Production Technology Discussion Paper, 2006.

Gizachew A. Abebe; Tigistu G. Abza; R.M Bennett (2015) "Implementation challenges of the rural land administration system in Ethiopia: issues for land certification and information systems", Paper prepared for presentation at the "2015 World Bank Conference on Land and Poverty, Washington DC, March 23-27, 2015

Government of Ethiopia (2007) Ethiopia Commodity Exchange Authority Proclamation. Proclamation No 551/2007. Federal Negarit Gazeta of the Federal Democratic Republic of Ethiopia. No. 62, 4 September 2007

Haile G.G. and A.K. Kasa (2015) "Irrigation in Ethiopia: a review" *Academia Journal of Agricutural Research* 3 (10) pp.264-269, October 2015.

Hazell P, J. Anderson, N. Balzar, A. Clemmensen, U. Hess and F. Rispoli (2010) "Potential for scale and sustainability in weather index insurance for agriculture and rural livelihoods", IFAD/WFP.

Hershkowitz A. 2005. *Violence in Southern Ethiopia: the Borana and farmers clash over land use.* ICE Case Studies. The Inventory of Conflict & Environment (ICE). Washington, DC, American University.

Hodges R. and T. Stathers (2013) "Facing the Food Crisis: How African Smallholders can Reduce Postharvest Cereal Losses by Supplying Better Quality Grain", *Outlooks on Pest Management,* Volume 24 (5), October 2013, pp. 217-221.

Holden S T, K Deininger and H. Ghebru (2009) "Impact of low-cost land certification on investment and productivity", *American Journal of Agricultural Economics*, No. 91 Vol. 2, 359-373.

Hundie B (2010) "Conflicts between Afar pastoralists and their neighbours: triggers and motivations" International Journal of Conflict and Violence, Vol. 4 (1) pp. 134-148.

IFAD (2015) Report on Uganda Risk Assessment Study, IFAD October 2015,

IFDC (2012) "Ethiopia fertiliser assessment" – in support of Africa Fertiliser and Agribusiness Partnership.

IFDC (2008). World fertilizer prices drop dramatically after soaring to all-time highs. Fertilizer prices suddenly collapse in late 2008. International Fertilizer Development Center http://www.eurekalert.org/pub_releases/2008-12/i-wfp121608.php

IFPRI, 2015. Research for Ethiopia's Agricultural Policy (REAP) Cooperatives website http://reap.ifpri.info/current-research/cooperatives/

IFPRI (2011) Study on Seed, Fertiliser and Agricultural Extension in Ethiopia, IFPRI 2011.

IFDC (2012) "Ethiopia fertiliser assessment" in support of Africa Fertiliser and Agribusiness Partnership.

IICD (2012) Ethiopian Agriculture Workers Discuss Digital Farming Solutions. http://www.iicd.org/articles/ethiopian-agriculture-workers-come-together-to-discuss-digital-farmers-information-solutions

IMF (2014) Ethiopia Country Report No. 14/303, October 2014.

IMF (2015) Press Release No. 15/286 June 19, 2015.

IPCC (2007) "Climate change: the physical science basis" contribution of Working Group I to the Fourth Assessment report of IPCC, Cambridge University Press, UK and New York, USA.

Jaffee S., P. Siegel and C. Andrews (2008) "Rapid Agricultural Supply Chain Risk Assessment: Conceptual Framework", Agriculture and Rural Development Department, World Bank.

Kaso T and G. Guben "Review of barley value chain management in Ethiopia" Journal of Biology, Agriculture and Healthcare Vol.5, No.10, 2015;

Kassie N M (2015) "Assessment of real effective exchange rates and external sector development of Ethiopia", International Journal of Business and Economic Research, No. 4 Vol. 4: 64-70.

Kedebe H, A Melaku and E. Kebede (2014) "Constraints in animal health service delivery and sustainable improvement alternatives in North Gondar, Ethiopia", *Ondersteoort Journal of Veterinary Research* 81 (1) pp.713-723.Odhiambo N. M. (2011) "The impact of financial liberalisation in developing countries: experience from four SADC countries", Organisation for Social Science Research in Eastern and Southern Africa (OSSRESA), 2011.

Keller M (2009) "Climate risks and project development: assessment report for a community-level project in Guduru, Oromia", Bread for All, November 2009.

LINKS Livestock Information Network Knowledge System.
http://www.lmiset.net/Pages/Public/Home.aspx

Maunder N. (2013) "What is known about the impact of emergency and stabilisation reserves on resilient food systems?", ODI Report for BMZ and GIZ, March 2013.

Meherette E (2009) "Providing weather index and indemnity insurance in Ethiopia" IFPRI Focus 17 Brief 8 December 2009.

Meijerink G., E. Bulte and D. Alemu (2013) "The Interaction of Formal and Informal Institutions in Development: The Ethiopian Commodity Exchange and Social Capital in Sesame Markets".
Government of Ethiopia and United Nations (2015) "2016 Ethiopia Humanitarian Requirements, 11th December 2015.

Mengistie B.T., A. P. J. Mol and P. Oosterveer (2015) "Pesticide use practices among smallholder vegetable farmers in Ethiopian Central Rift Valley", *Environment, Development and Sustainability,* 2015, DOI: 10.1007/s10668-015-9728-9

Mengistie B.T., A. P. J. Mol, P. Oosterveer and B. Simane (2014) "Information, motivation and resources: the missing elements in agricultural pesticide policy implementation in Ethiopia", *Journal of Agricultural Sustainability*, 13 (3) 240-256.

MDTCS (2009) Report of study on micro-insurance demand in Ethiopia

Millennium Challenge Corporation (2015) "Land variable figures, Country Scorebook, 2015.

Ministry of Finance and Economic Development (MoFED 2013) "Growth and Transformation Plan, Annual Progress Report (2011/12).

Netherlands Commission for Environmental Assessment (2015) "Climate change profile: Ethiopia", July 2015.

National Bank of Ethiopia (2014) Annual Report, NBE, Ethiopia.

NBE Annual Report, 2015

Newsome, M. (2014) Ethiopia tries to crack down on livestock black market. Global meat news, Addis Ababa, 11 February 2014. http://www.globalmeatnews.com/Industry-Markets/Ethiopia-tries-to-crack-down-on-livestock-black-market

Nielsen T (2012) "A qualitative assessment of weather-indexed crop insurance in Ethiopia", Department of Agricultural Economics and Social Sciences in the Tropics and Subtropics< University of Hohenheim, Germany.

Onumah G.E., C. Baine, S. Mashauri and H. Lam (2013) "Review of current Warehouse Receipts System (WRS) in Tanzania towards proposing recommendations on linkages between the WRS and proposed Tanzania Commodity Exchange", Report on study undertaken on behalf of Bank of Tanzania and the World Bank, June 2013.

Onumah G.E. (2013a) "Empowering smallholder farmers in markets: the case of KENFAP in Kenya" in Proctor F. and Ton G. Ed. (2013) Empowering smallholder farmers in markets: experiences with farmer-led research for advocacy", CTA-AGRINATURA-LEI, pp.58-67.

OECD (2011), Managing Risk in Agriculture: Policy Assessment and Design, OECD Publishing. http://dx.doi.org/10.1787/9789264116146-en

PRIME (Pastoralist Areas Improvement through Market Expansion Project) – Emergency Market Mapping and Analysis (EMMA) of Agricultural Input Supply and Extension Service in Pastoralists and Agro-pastoralist Areas of Ethiopia, May 2013.

Rashid S and S Lemma (2010) "Strategic grain reserves in Ethiopia: institutional design and operational performance" IFPRI Discussion Paper 01054

Rashid S (2010) "Staple food prices in Ethiopia", Paper presented at COMESA Policy Seminar, Maputo Mozambique, 25-26 January 2010.

Rashid, S. and Negassa, A. (2011) Policies and Performance of Ethiopian Cereal Markets. Ethiopia Strategy Support Programme II Working Paper No. 21. Development Strategy and Governance Division, International Food Policy Research Institute, May 2011, Ethiopia

Rashid S., G.T. Abate, S. Lemma, J. Warner, L. Kasa and N. Minot (2015) "The barley value chain in Ethiopia" REAP/IFPRI 2015.

Rashid S (2010) "Staple food prices in Ethiopia", Paper presented at COMESA Policy Seminar, Maputo Mozambique, 25-26 January 2010.

Shibabaw A., G. Alemayehu, Y. Desalegn, E. Adgo, Y. Tewodros, J. Gerner, F. Asch, Y. Merene and B. Freyer (2013) "Exploratory Survey on Climate Change Effects, Value Chain Processes and Supportive Services: Case Study from Potato Based Farming System of Awi-Zone, Ethiopia", International Journal of Agriculture Innovations and Research Volume 2 (4), pp. 2319-1473

Shiferaw, B., Hellin, J., Muricho, G. (2011) Improving market access and agricultural productivity growth in Africa: what role for producer organisations and collective action institutions? *Food Security* (2011) 3: 475-489

Spielman D.J, D. Kelemework and D. Alemu (2012) "Seed, fertiliser and agricultural extension in Ethiopia" IFPRI/EDRI Research Note 12.

Tadesse, G., and Bahiigwa, G. (2015). Mobile Phones and Farmers' Marketing Decisions in Ethiopia. World Development, Volume 68, April 2015, p. 296-307. doi:10.1016/j.worlddev.2014.12.010

Thirtle C., J. Piesse and M. Gouse (2005) "Agricultural technology, productivity and employment: Policies for poverty reduction", *Agricultural Economics Research, Policy and Practice in Southern Africa,* 44 (1) pp.37-59.

Tostao E. and D. Tschirley (2010) "On the role of government in food staples markets: perspectives from recent research and implications for Mozambique", MSU Report No. 62154.

The World Bank, 2015. Ethiopia country overview
http://www.worldbank.org/en/country/ethiopia/overview

The World Bank, 2015. Ethiopia-Road Sector Development Program APL4 project page. http://www.worldbank.org/projects/P106872/fourth-roads-sector-development?lang=en

The World Bank. World Development Indicators Ethiopia, 2015
http://databank.worldbank.org/data//reports.aspx?source=2&country=ETH&series=&period=

The World Factbook 2013-14. Washington, DC: Central Intelligence Agency, 2013
https://www.cia.gov/library/publications/the-world-factbook/index.html

Ton, G. and Meijerink, G., 2015. Organisational intelligence in collective action. Farm Risk Management for Africa (FARMAF) Policy Brief, Natural Resources Institute, UK, 2015

UNDP (2011) "Ethiopia framework for UNDP country climate change, environment and disaster risk management portfolio" UNDP 2011.

UNDP (2015) National Human Development – 2014 Ethiopia

UNECA (2010) "Land policy in Africa: Eastern Africa Regional Assessment", AUC-ECA-AfDB Consortium, December 2010.

USAID (2011) Ethiopia Country Profile. Property rights and resource governance. http://usaidlandtenure.net/sites/default/files/country-profiles/full-reports/USAID_Land_Tenure_Ethiopia_Profile.pdf

USAID (2015) Agricultural Knowledge, Learning Documentation and Policy (AKLDP) Project, Ethiopia – Technical Brief September 2015.

USDA (2007) Commodity Intelligence Report Niger, Burkina Faso, and Ethiopia.

USDA, 2015. Ethiopia Coffee Annual. USDA Foreign Agricultural Service, U.S., 2015 http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Coffee%20Annual_Addis%20Ababa_Ethiopia_6-5-2015.pdf

Van Asseldonk et al. (2014) "Is there evidence on linking crop insurance and rural credit?" FARMAF Policy Brief.

WFP World Food Programme, 2012. Ethiopia Monthly Market Watch

Wolday (2014) citing: MDTCS (2009) Micro-insurance demand study for Ethiopia. A report submitted to Oxfam America. Addis Ababa

Wolday Amha and D. Peck (2010) "Livestock insurance demand in Ethiopia", Study conducted for piloting livestock insurance for smallholder/commercial farmers by Nyala Insurance Company.

WFP (2014) Purchase for Progress Update (August 2014)

Woldermariam M (2013) "Policy and institutional framework for effective disaster risk management in Ethiopia", August 2013

Woldie G A and Siddig K (2009) "The impact of banning export of cereals in response to soaring food prices: evidence from Ethiopia", MPRA Paper No. 18241, November 2009.

World Bank Group, 2015. Ethiopia Poverty Assessment 2014. Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/21323 License: CC BY 3.0 IGO

World Bank, World Development Indicators database, available at: http://data.worldbank.org/data-catalog/world-development-indicators

World Bank, NRI and FAO (2011) "Missing Food: The case of postharvest grain Losses in Sub-Saharan Africa", Report No. 60371-AFR, The World Bank, Washington, DC.

World Bank (2014) "World Development Indicators 2014", The World Bank, Washington, DC, May 2014.

World Bank (2008) "Ethiopia Climate Risk Factsheet", the World Bank, Washington, DC, 2008.

World Bank (2005) "Managing agricultural production risk: innovations in developing countries", Report No. 32727-GLB, The World Bank, Washington DC.

World Bank (2014) "Ethiopia Poverty Assessment 2014". The World Bank. FAO (2014) Ethiopia Country Profile, 2014.

Yield Gap (2015) http://www.yieldgap.org/ethiopia

Methodological Appendix

Notes on calculations of frequency and severity

For purposes of quantifying the severity and frequency of shocks data from multiple sources were used. In most cases only national aggregate data was available, making it difficult to analyse differences in the incidence of risks in particular geographical locations. It was also noted that available time series data had considerable gaps, thereby making the analysis more challenging and also posing a risk of either overestimating or underestimating the effects of particular risks. Despite these problems the outcome of the analysis provides useful insights regarding the frequency and severity risks in the agricutural sector in Ethiopia. The specific methodology used for the risks analysed are summarised below.

Analysing weather risks

The main sources of data for analysing weather risks were EM-DAT, the Central Statistics Agency (CSA) and the Disaster Risk Manangement and Food Security Sector (DRMFSS) of the Ministry of Agriculture and Rural Development, including recent publications from its Wereda Disaster Risk Profiling Programme. as the databased produced by the Prime Minister's Office. The data obtained provides details of the aggregate effects of weather risks on crops and livestock subsectors, including data on crop losses estimated in terms of area cultivated which is affected as well as recorded livestock mortalilty. The available data made it possible to isolate and analyse the impact of the occurrence severe events rather than the more regular occurring weather events. It has to be stated that the data from DRMFSS covers a rather short period of 14 years (1996-2009) compared to EM-DAT, which goes back much further but has more reporting gaps. Indeed, there are issues under-reporting, especially of livestock mortalities (see Section 3.3.2).

In addition to the above, data and observations from secondary sources including reports, especially by Government and donor agencies as well as academic publications, were also consulted in the course of the analysis – attribution is made to the relevant sources cited in the reference list. In computing the value of losses associated with the weather events, we used price data from CSA to determine the value per unit of livestock (mainly cattle) and of revenue foregone per area under cultivation which is affected.

Pests & diseases

Estimates of the economic impact of crops and livestock diseases and pests as well as analysis of the frequency of their occurrence is based on data from similar sources above (used for analysis of weather risks). Hence the same methodological challenges and caveats as in the above applies in the case of the reporting on these risks. It has to be stressed again that the focus of analysis is on the reported impact of these events when they occur on an epidemic scale rather than the normal (year-to-year) exposure of farmers to crop and livestock pests and diseases.

Postharvest losses

Postharvest losses can be very high in Ethiopia, with annual losses valued at between US$ 233.6 million in 2006 to over US$ 650 million in 2012. The value of these losses are based on weight loss estimates provided by the Africa Post Harvest Loss Information System (APHLIS). The discussions in Section 3.7.3 reveal that this is a pretty regular challenge faced by farmers, the only year-to-year variation being the scale of the losses. Hence, it is deliberately excluded from the risks for which severity and frequency are analysed in Chapter 5. This, however, does not detract from the need to address this challenge as it is associated high household income losses and also has significant food security implications. In most of the literature, the cause of the high losses is attributed to lack of suitable storage infrastructure. Evidence from focus group discussions and also from published sources indicate that weather variability, including eratic rainfall, can increase the level of postharvest losses. This evidence is noted in discussions on weather risks though quantification of the link was difficult due to lack of required data.

Price risk

Analysis of the volatility of agricultural prices involved calculating the coefficient of variation (CV), which is a standardized measure of dispersion of a probability or frequency distribution and it is computed with the formula below as the ratio of the standard deviation (σ) to the mean (μ):

$$CV = \frac{\sigma}{\mu}$$

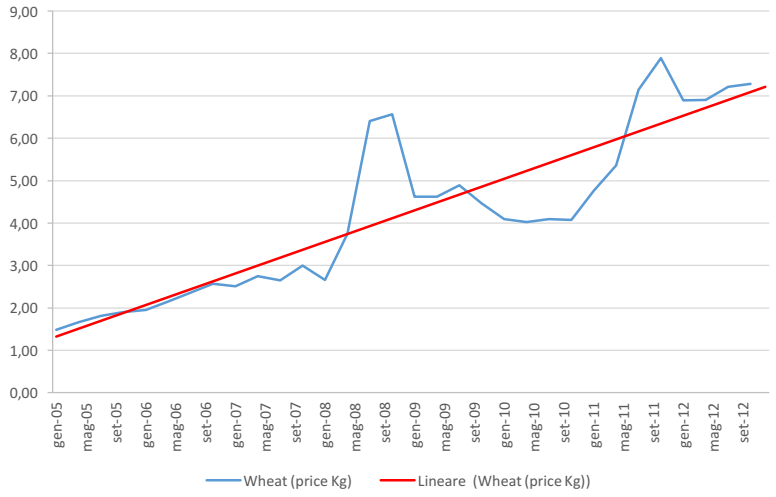
where $\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$

Price variations within seasons (i.e. intra-seasonal price variations) as well as year-to-year (or inter-year) variations were between the years. Intra-annual variability is calculated for the 12 months of each year whilst computation of inter-annual variability covers a 10-year period (from 2003 to 2013) – based on price data from CSA. It has to be noted that in some cases gaps in the data created difficulties in the analysis. For calculation of intra-seasonal variations the peaks and troughs were analysed for various crops and for livestock. This includes estimates of average and maximum shocks which occur during the peaks as well as the average and minimum shocks during the troughs. The results are reported in Table 22. For inter-annual price variation, reported in Table 23, the frequency and scale of spikes are reported is also done for the troughs. The spikes or trough are considered low if they are of the order of up to 10%; moderate if the range is between 10% and 30%; and severe if in excess of 30%. As data on actual volumes sold per month or even per season is difficult to obtain, the average severity and frequency of shocks is computed using the average production volume and average price for each crop and for livestock (using cattle prices as proxy) for the period 2003-2012. The graphs below depict the trends which emerged from the analysis – mainly for food crops (due to problems of missing data for the others). The CV, the troughs and the spikes have been calculated with respect to this trend, to avoid confusing trends with fluctuations.

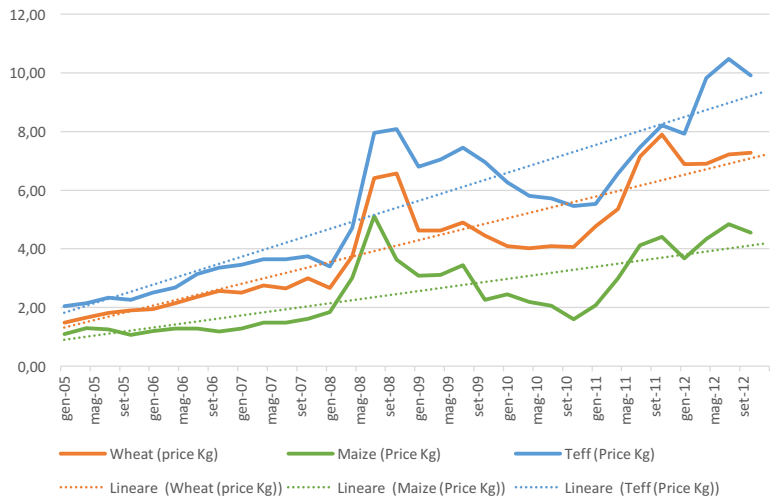
Average price of Teff (2005-2012)

Average price of Maize (2005-2012)

Average price of Wheat (2005-2012)



Average price of Teff (2005-2012)



Notes on risk scoring

The risk scoring was based on two factors, the average annual losses and the worst case scenario. The points system below, borrowed from the RAS undertaken in Uganda, was used in the risk scoring. The scores were weighted with 0.7 for average annual losses and 0.3 for worst case scenario to reflect the greater importance of average losses as a better indicator of the long-term cost of risk.

Points system for agricultural risk scoring in Ethiopia

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

Taking account of stakeholder perception of agricultural risks

Evidence on the perception of agricultural risks among key stakeholders was collected at two stages in the study. At the beginning of the field study farmers focus groups were organized to generate evidence on the risks they perceived as critical. The groups were organized by cooperatives in two weredas and the interaction led by a resource person from the study team. She was guided in the discussions by questions aimed at farmers providing relevant information based on memory recall. There was no depth of quantification of the information provided. Towards the end of the study a workshop was organized in Addis Ababa which attracted participation from a wide range of actors, including farmers, private sector actors, government agencies and donor missions. Their views were relevant in validating identified risks as well as risk prioritization proposed in the study.

PARM

PLATFORM FOR
AGRICULTURAL RISK
MANAGEMENT

Risk Assessment

Ethiopia

Country Risk Profile

Country Risk Profile

This risk profile is not part of the Risk Assessment Study and it is included as Annex for information.

The profile has been conducted by PARM with the support of Darryl Jones, international consultant.

Risk Assessment

Ethiopia

Agricultural Risk Profile

What are the key findings?

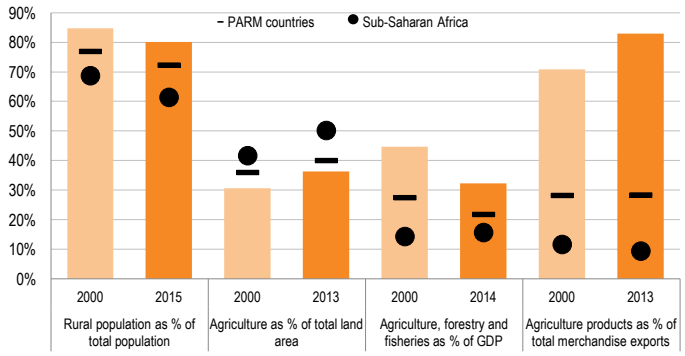
- Droughts are identified as the greatest agricultural risk.
- Temperature levels are rising fast, and erratic rainfall patterns are observed.
- Many livestock diseases are endemic, and along with crop diseases and pests, are identified as high-level risks for Ethiopia.
- Yams and sesame seeds are the crops most affected by yield losses.
- Food crops are most affected by output price risks.
- The rising price of imported inputs is also a high-level risk, along with exchange rate variability.
- Political stability is poor and worsening.

What are agricultural risks?

Agricultural risks are uncertain events that cause farmers significant financial loss or other adverse outcomes. They are different from constraints, which are predictable and constant limitations. Risks can negatively affect rural employment and assets, increase food insecurity, and lead to inefficient private and public sector investment. The purpose of the profile is to provide a high-level quantitative analysis of selected risks. It uses a common methodology, drawing on easily available information. As annual national averages are used, local and seasonal variations cannot be observed. This may underestimate production risks as compared to output price risks. The scope of the analysis is also limited by the lack of output data for livestock products. Further, production and price data for Ethiopia only go back as far as 1993 and 1994 respectively. A detailed country risk assessment requires a much fuller investigation.

What role does agriculture play?

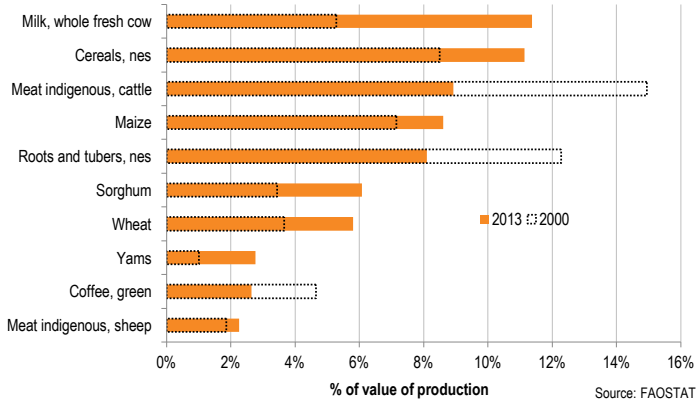
About 80% of the total population of 99.4 million is rural, higher than the Sub-Saharan Africa and PARM countries averages. Agriculture contributes to more than 80% of export earnings and 30% of GDP, far more than most other African countries.



Source: FAOSTAT

What products are most important?

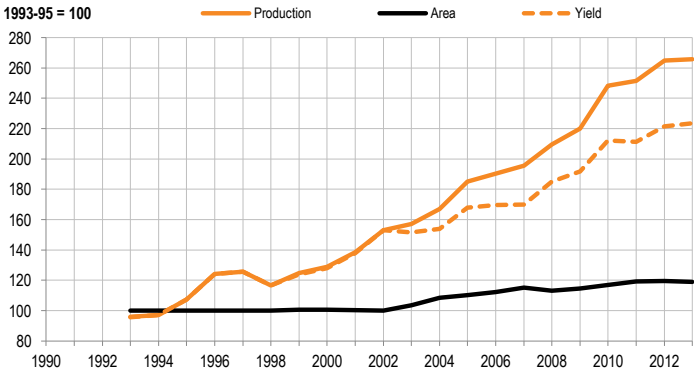
Cows milk, cattle meat and maize are the three most important commodities. The top ten products represent 68% of production in 2013, with all crops accounting for 70%. Production of most of the top ten commodities has increased in since 2000.



Source: FAOSTAT

How has the sector grown?

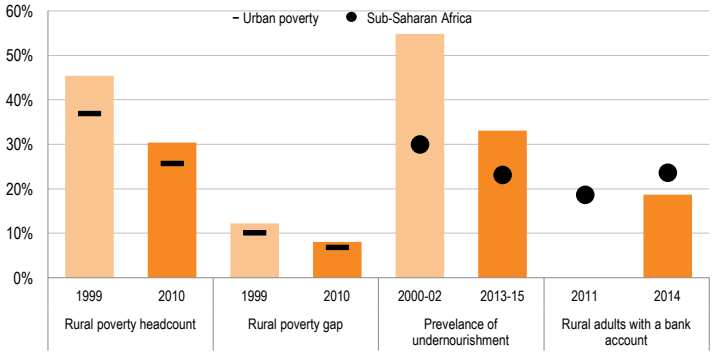
Between 1993 and 2013, agricultural output increased by 160%, an average increase of 5.4% per annum. This is primarily due to rising yields, which have grown 4.5% per annum. Crop and livestock output have both risen at similar rates (5.8% and 5.0%).



Source: FAOSTAT

How vulnerable are people to risks?

Both the incidence and level of rural poverty has fallen since 1999, and is very close to urban levels. The prevalence of undernourishment has more than halved but remains above the Sub-Saharan average. Access to credit is also below average.



Sources: World Bank and FAOSTAT

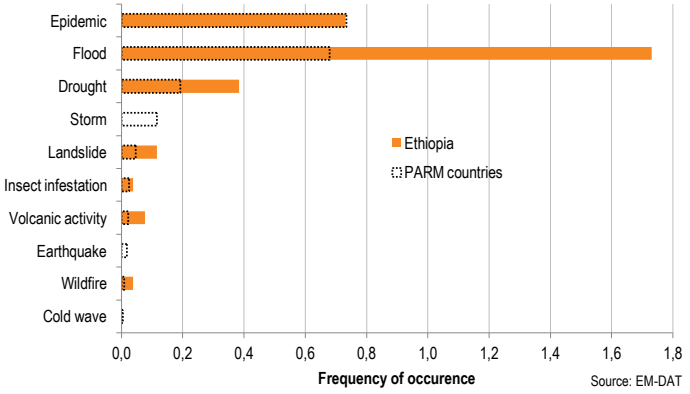
Production risks

What are production risks?

A large number of risks affect agricultural production. These include climate related events (such as droughts, floods and cyclones), outbreaks of pests and diseases, and damage caused by animals, windstorms or fire. The geographic and temporal spread of these impacts can vary significantly. Production risks are mostly associated with yield reductions but can also affect product quality.

How often do major disasters occur?

In the period 1990-2015, floods were the most frequent disaster to affect Ethiopia, often occurring twice a year. Landslides can accompany these. A drought event occurs once every two and a half years. Volcanic activity occurs, but no major storm events.



What is the likely impact of future climate change?

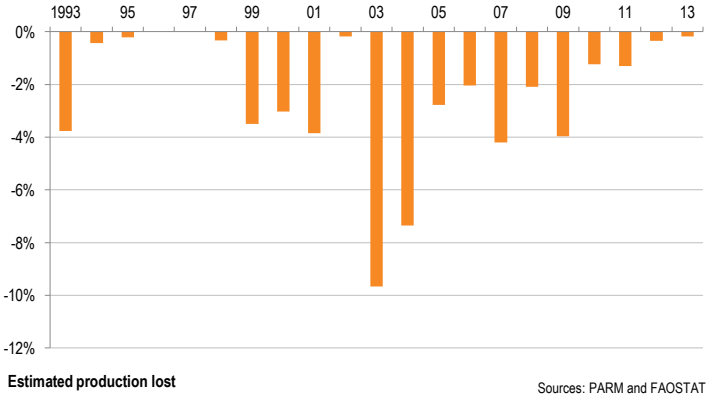
The IPCC 5th assessment report concludes that land temperatures over Africa are likely to rise faster than the global land average, particularly in the more arid regions. Mean average temperatures are likely to be 2°C higher than experienced in the late 20th century.

Projected rainfall change over most of sub-Saharan Africa is uncertain due to complex topography. Rainfall is likely to increase in the Ethiopian highlands. Future precipitation projections show that extremes (droughts and floods) may become more frequent.

Increasing temperatures and changes in precipitation are very likely to reduce cereal crop productivity, and could also adversely affect high-value perennial crops. Pest, weed, and disease pressure on crops and livestock is expected to increase.

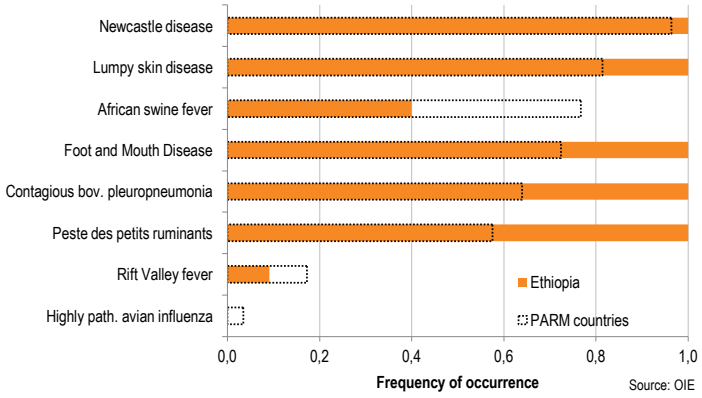
Has the risk varied over time?

Totalling the annual value of production losses for the 12 crops provides an indicative production risk profile for the period. Annual production losses averaged 3%, ranging from 0-10%. The largest estimated losses occurred in 2003 and 2004.



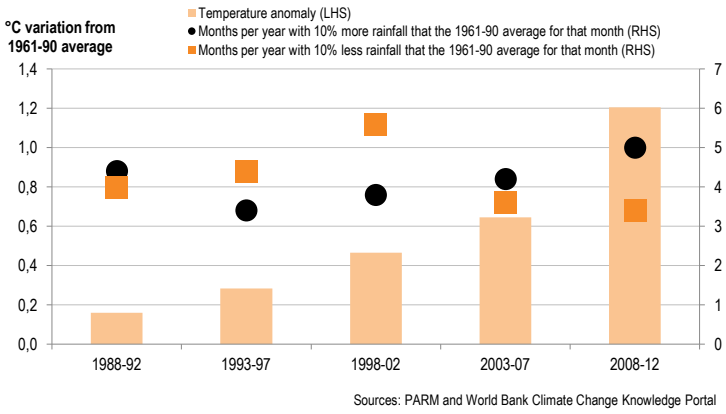
What animal diseases are present?

Of the eight animal diseases analysed over the period 2005-2015, five could be considered as being endemic in Ethiopia. Highly pathogenic avian influenza is the only one that has never been reported as occurring.



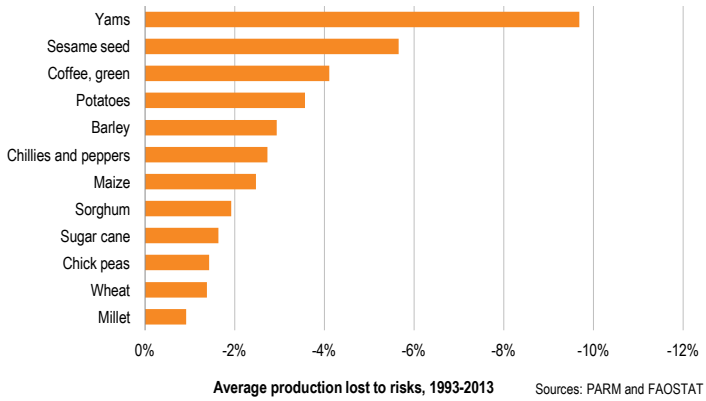
Are weather anomalies increasing?

Temperature levels are rising, with the 2008-12 average 1.2°C warmer than the 1961-1990 average. There is no clear change in rainfall patterns although a rise in the number of wetter, and a fall in the number of drier, than average months is observed.



Which crops appear most at risk?

Yams is the crop most affected by yield losses as estimated by the impact on production. Annual yield losses averaged 10% of production for yams (an average loss of 29% once every three years). Sesame seed and coffee averaged losses of more than 4%.



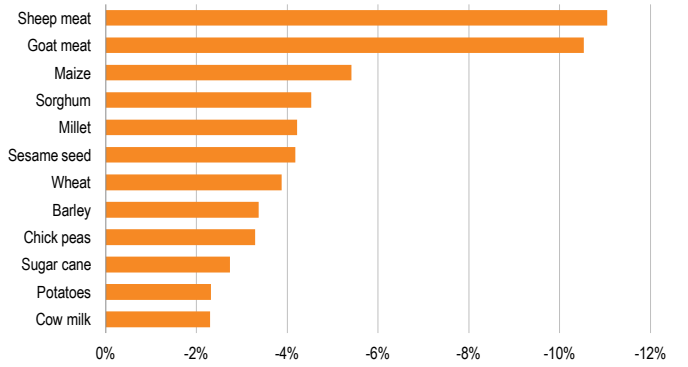
Market risks

What are market risks?

Market risks are issues that affect the price and availability of outputs and inputs. Commodity markets can have a high degree of volatility caused by changing local and global supply and demand. Producers are concerned about low prices (reducing their income); consumers are worried by high prices (raising their expenditure). Other market risks include exchange rate volatility, which can affect the price of outputs and inputs.

Which products appear most at risk?

Over the period 1994-2012, sheep meat and goat meat appear to be the commodities most affected by output price risks. These two products have an annual average price loss of greater than 10% (an average loss of 25-30% occurring every two and a half years).



Annual average expected price loss ratio, 1994-2012

Source: PARM and FAOSTAT

How are the product and temporal risks estimated in this profile?

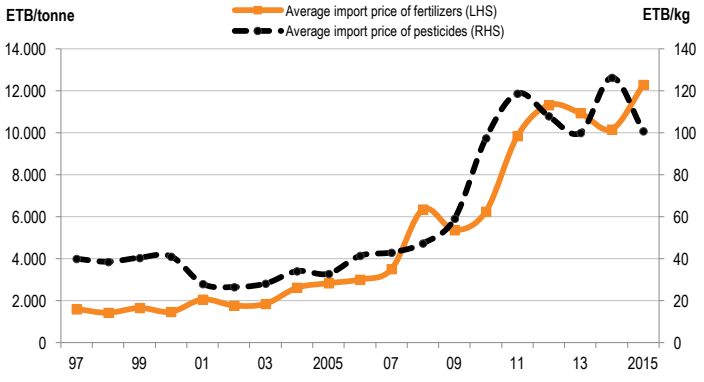
Indicative estimates of production and output price risks are calculated in a similar way. A loss threshold of 0.33 times the standard deviation below the trend value in either yield or prices is calculated to set a benchmark for identifying the losses resulting from production and market risks respectively.

To calculate product specific risk values, the average yield or price loss below the threshold level (severity) and the frequency of these occurrences are multiplied to obtain average production and price loss ratios. This is done for the 12 most important crop and livestock commodities for which data was available.

To calculate the risk profile over time, the individual loss for each respective year are added together across the crop commodities only

How variable are input prices?

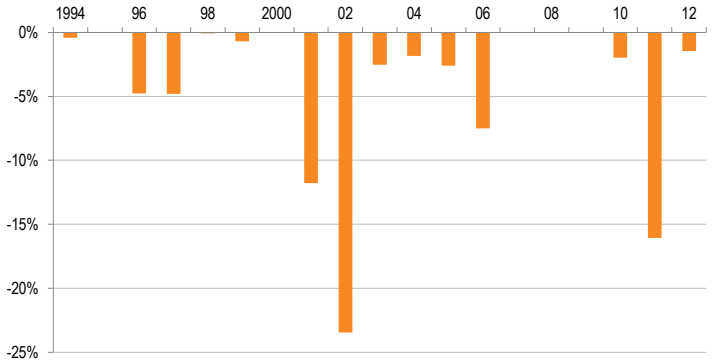
The rise in annual average import prices rather than variations is likely to imposing input risks on farmers. The average import price of fertiliser in 2015 is more than six times higher than in 2003, while pesticide prices have risen by 250%.



Sources: PARM, UN Comtrade and World Bank

Has price risk changed over time?

Totalling the estimated revenue lost due to output price risk for crop commodities provides an indicative market risk profile for the period. The average annual revenue loss is 4%, with losses over 15% in 2002 and 2011. No trend over time can be observed.

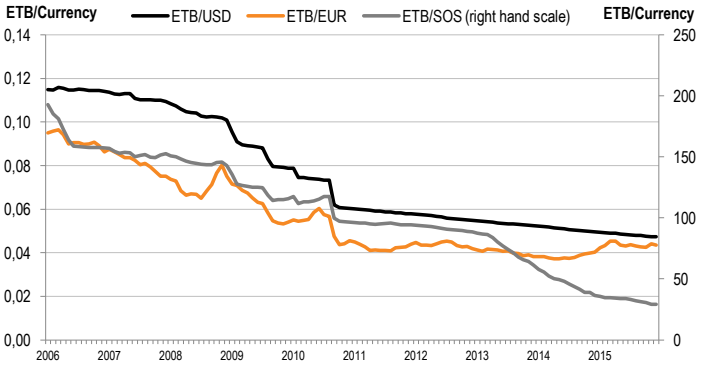


Estimated revenue lost

Source: PARM and FAOSTAT

Is there an exchange rate risk?

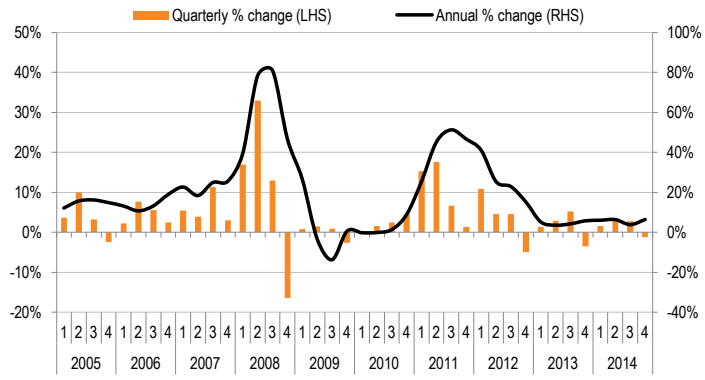
Over the past decade there has been a significant depreciation of the Ethiopian birr (ETB) against the USD, Euro and the Somali shilling, it's main African export market. As it has become weaker, the effect of variation has become larger.



Source: OANDA

Do food prices vary for consumers?

Over 2005-14, the food component of the consumer price index recorded an average annual increase of 20%. The highest annual rate of 81% was recorded in September 2008. Prices have risen more slowly since 2010 and fluctuate less.



Source: ILO

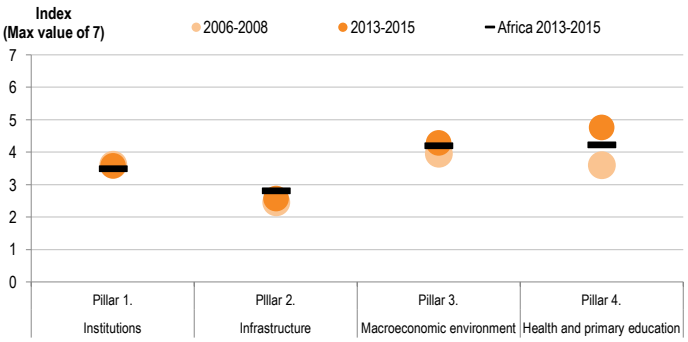
Macro level risks

What are macro level risks?

Macro level risks cover unexpected changes in the broader economic environment in which agriculture occurs. It can include changes in government or business regulations, fiscal and monetary policy settings, external trade restrictions, political instability, corruption, regional conflict and domestic unrest.

Are basic requirements in place?

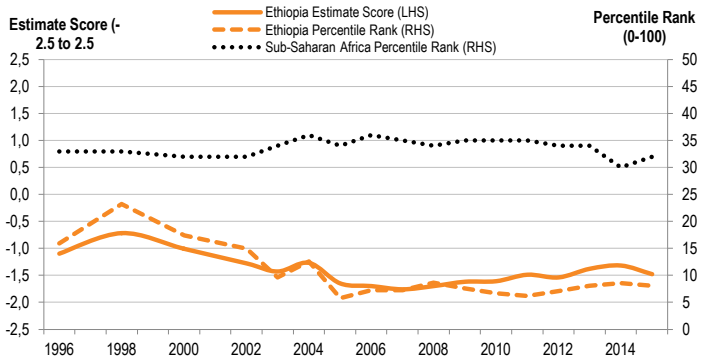
Index scores for the basic requirement pillars place Ethiopia very close to the African average across all four pillars. Index scores have lifted for three, with a particular improvement in health and primary education, lifting it above the African average.



Source: World Economic Forum, Global Competitiveness Index

Is the political environment stable?

Ethiopia scores well below the Sub-Saharan Africa average in the political stability and absence of violence index. Its ranking has deteriorated markedly since 1998, falling from a percentile ranking of 23 to below 10.



Source: Worldwide Governance Indicators

Overall risk assessment

The PARM process

A detailed risk assessment is carried out as part of the PARM process, in partnership with NEPAD and the relevant African government. It is a rigorous consultation process involving a risk assessment report drafted by international and local experts, followed by a national validation workshop with the participation of stakeholders including farmers, private sector companies and government. Risks are identified at a detailed level, e.g. droughts, raids, etc.

A risk assessment study and a national validation workshop have been completed for Ethiopia. Droughts have been identified as the major risk for Ethiopian agriculture. The next four high-level risks are: livestock diseases and pests, crop diseases and pests, price risks for food crops, and rising input prices

What are the main agricultural risks?

RISK	AVERAGE FREQUENCY	AVERAGE SEVERITY	WORST-CASE SCENARIO
DROUGHTS	HIGH	HIGH	VERY HIGH
LIVESTOCK DISEASES & PESTS	VERY HIGH	MEDIUM	HIGH
PLANT DISEASES & PESTS	HIGH	MEDIUM	VERY HIGH
PRICE RISK: FOOD CROPS	MEDIUM	HIGH	VERY HIGH
INPUT RISK: RISING PRICES	HIGH	MEDIUM	HIGH
ERRATIC OR VARIABLE RAINFALL	VERY HIGH	MEDIUM	LOW
EXCHANGE RATES VARIABILITY	HIGH	LOW	MEDIUM
FLOODS	VERY HIGH	LOW	LOW
POLICY RISK: EXPORT BAN	HIGH	VERY LOW	HIGH
POLICY RISK: PRICE SUBSIDY	VERY HIGH	VERY LOW	VERY LOW
PRICE RISK: EXPORT CROPS	MEDIUM	MEDIUM	VERY LOW
INTEREST RATE VARIABILITY	MEDIUM	VERY LOW	VERY LOW

What are the linkages between risks?

Managing risks in agriculture is particularly challenging, as many risks are highly correlated, resulting in whole communities being affected at the same time. Impacts on yield that are widespread and have a significant impact on total market supply can have profound affects on market prices. In Ethiopia, drought is a clear example of one risk that can trigger others, aggravating some pests and diseases (additional production risks), leading to spikes in food prices (market risks) and even stimulating conflicts over water and pasture (macro level risks).

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 developing nations and development partners to make risk management an integral part of policy planning and implementation in the agricultural sector. PARM operates a process to achieve this through risk assessment, policy dialogue, tools assessment and capacity development.

PARM Secretariat International Fund for Agricultural Development (IFAD)

Via Paolo di Dono 44 - 00142 Rome (Italy) parm@ifad.org www.p4arm.org @parminfo

PARM
PLATFORM FOR AGRICULTURAL RISK MANAGEMENT

Contacts

PARM Secretariat

International Fund for Agricultural Development (IFAD)

Via Paolo di Dono 44 - 00142 Rome (Italy)

parm@ifad.org
www.p4arm.org
@parminfo