Increasing Agricultural Resilience through Better Risk Management in Zambia

WORLD BANK GROUP

Increasing Agricultural Resilience through Better Risk Management in Zambia

Increasing Agricultural Resilience through Better Risk Management in Zambia

Ademola Braimoh, Alex Mwanakasale, Antony Chapoto, Rhoda Rubaiza, Brian Chisanga, Ngao Mubanga, Paul Samboko, Asa Giertz, and Grace Obuya

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

1818 H Street NW, Washington, DC 20433
Telephone: 202-473-1000; Internet: www.worldbank.org

Cover photo: Climate-smart farming. Photo: © Dasan Bobo/World Bank

Cover design: Progressive Publishing Services

Contents

Boxes

Figures

Tables

Foreword

Better managing agricultural risks such as drought, floods, disease, and commodity price volatility offers opportunities to minimize losses and put agriculture on a stronger footing in Zambia. This report analyzes risks and identifies solutions to ensure greater food security for consumers, optimize the use of public resources, and promote income and investment among producers in an inherently risky sector.

Climate-smart agriculture and investment in practices and technologies that increase agricultural resilience are natural starting points that rely largely on a diversification of commodities in production to enable farmers to be responsive to, and when possible, capitalize on changing conditions. Much will rely on their access to and ability to apply practical information. Early warning systems to identify developments that may imperil food security can be employed to both ensure public health and substantially reduce the costs of maintaining the necessary safety nets.

A vital element of this climate-smart agriculture is placing production within a larger context of land use and conservation in which sources of livelihoods become more diverse and soil and water resources are purposefully managed and preserved.

Our hope is that the risk management options outlined in this report will increase the resilience of all actors in the agricultural value chain but especially the most vulnerable, rural households with few coping mechanisms of their own. Protecting smallholder farmers from falling into poverty in the event of climatic and financial shocks and giving them the tools to thrive are important objectives in the work of the World Bank and its partners in Zambia.

Juergen Voegele
Senior Director
Agriculture Global Practice
The World Bank

Paul Noumba Um
Country Director,
Zambia
The World Bank

Acknowledgments

This work drew from contributions from a range of experts working on agriculture, food security, climate change, and disaster risk management. We thank everyone who contributed to its richness and multidisciplinary outlook. The study team comprised Ademola Braimoh, Alex Mwanakasale, Antony Chapoto, Rhoda Rubaiza, Brian Chisanga, Ngao Mubanga, Paul Samboko, Asa Giertz, and Grace Obuya. The analytical work was prepared under the overall guidance of Paul Noumba Um, Ina-Marlene E. Ruthenberg, and Mark Cackler.

We are grateful for the contribution of the following colleagues: Mr. Julius Shawa, Mrs. Emma Malawo, Mr. Misheck Nyembe, and Mr Dingiswayo Banda (Ministry of Agriculture); Mr. Michael Isimwaa, Dr. Swithine Kabilika, Dr. Christine Yamba Yamba, and Dr. Gregory Bwalya (Ministry of Fisheries and Livestock); Mr. Patrick Chuni (Central Statistical Office); Mrs. Yizaso Musonda (Pensions and Insurance Authority); Mr. Dafulin Kaonga (Cotton Board of Zambia); Mr. Mweene Moonga (MayFair Insurance); Mr. Gilbert Kaimana (Zambia Sugar); Mr. Yotam Mkandawire (GTAZ); Mr. Humphrey Katotoka (Zambia National Farmers Union); Dr. Therese Gondwe (International Institute for Tropical Agriculture); and Mr. Joseph Intsiful (African Climate Policy Centre). We also acknowledge the input from traders, processors, and farmers interviewed in the Southern and Eastern Provinces that gave us practical insights on the various value chains, the participants in the Consultative Stakeholder Workshop for their constructive feedback on the preliminary findings, various government officials from the Zambia Metrological Department, Zambia Agriculture Research Institute, National Livestock Epidemiology and Information Centre, Disaster Management and Mitigation Unit, Zambian Commodity Exchange (ZAMACE), and development partners such as Consultative Group on International Agricultural Research, World Food Programme, and Food and Agriculture Organization.

The report benefited greatly from invaluable suggestions from peer reviewers: Willem G. Janssen, Niels B. Holm-Nielsen, Pablo Benitez, Zano Mataruka, and Stephen D'Alessandro (Senior Agriculture Economist, GFAGE). We also thank Holger Kray and Catherine Tovey for their invaluable suggestions. Finally, we thank Sateh El-Arnaout, Christine Heumesser, Mercy Chimpokosera-Mseu, Hellen Mungaila, Marie Lolo Sow, Clarisse Livia Isaias Nhabangue, Sombo Rachel Samunete, and Srilatha Shankar (World Bank) for assistance rendered at various stages of the project. Gunnar Larson edited the document.

Financial support for this work was provided by the Food Price Crisis Response (FPCR) Trust Fund.

Acronyms and Abbreviations

AEZ	agroecological zone
ASIP	Agricultural Sector Investment Programme
ASRA	Agriculture Sector Risk Assessment
Cat	DDO Catastrophe Deferred Drawdown Option
CFS	Crop Forecast Survey
CSA	Climate-Smart Agriculture
CSO	Central Statistical Office
DMMU	Disaster Management and Mitigation Unit
FAO	Food and Agriculture Organization (of the UN)
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FISP	Farmer Input Support Programme
FMD	foot-and-mouth disease
FND	Financial Development Agency
FRA	Food Reserve Agency
GDP	gross domestic product
GPV	gross production value
GTAZ	Grain Traders Association of Zambia
Ha	hectare
IAPRI	Indaba Agricultural Policy Research Institute
ICT	information and communication technology
IFC	International Finance Corporation
IMF	International Monetary Fund
MAL[1]	Ministry of Agriculture and Livestock
MoA	Ministry of Agriculture
MoFL	Ministry of Fisheries and Livestock
MSMEs	Micro, Small, and Medium Enterprises
MT	metric ton
NAMBOARD	National Agricultural Marketing Board
NUSFAZ	National Small-scale Farmers Association of Zambia
OIE	World Organisation for Animal Health (*Office International des Epizooties*)
OPV	open-pollinated variety
PFIs	Participating Financial Intermediaries
PRODIVA	Productive Diversification in African Agriculture
RALS	Rural Agricultural Livelihoods Survey

[1] Before September 2015, the Ministry of Agriculture (MoA) and Ministry of Fisheries and Livestock (MoFL) were both under the Ministry of Agriculture and Livestock (MAL).

SAP	Structural Adjustment Programme
UN	United Nations
VAM	Vulnerability Assessment and Mapping
WDI	World Development Indicators
WFP	World Food Programme
WRS	Warehouse Receipt System
ZAMACE	Zambia Commodity Exchange
ZIFLP	Zambia Integrated Forest Landscape Program
ZMW	Zambian Kwacha
ZNFU	Zambia National Farmers Union
ZVAC	Zambia Vulnerability Assessment Committee

All dollar amounts are U.S. dollars unless otherwise indicated.

Executive Summary

The objective of this report is to analyze the principal risks the agricultural sector faces in the Republic of Zambia and to identify pathways for how these risks are to be managed. *Risk* refers to the possibility that an adverse development will occur that negatively affects the performance of farms or the larger agricultural supply chain. A *risk event* refers to such a development when it actually occurs. Risk events were a major factor contributing to the decline in agriculture's share of Zambia's gross domestic product (GDP), which fell from 8.2 percent during the period between 2011 and 2015, to 5.3 percent in 2015 itself—a year that saw a variety of such events, including El Niño and attacks of fall armyworms.

In terms of the severity and frequency of adverse impacts, and how they affected food security, rural livelihoods, and the broader economy, these varied somewhat between agricultural subsectors and between different regions in Zambia. Drought, floods, and price volatility appear to be the principal risks affecting crop agriculture in the country. Drought and outbreaks of animal disease are the principal risks affecting livestock. Exposure to the consequences of these and other risks can be effectively limited through risk management systems tailored to the conditions prevailing in a country's agricultural sector. Agricultural risk in Zambia, as in other countries, can be usefully divided into *production*, *market*, and *enabling environment* risks.

Production Risks

Drought is the most significant risk facing Zambian agriculture. El Niño–related droughts in the 1990s led to severe agricultural losses, resulting in a 10 percent contraction in agricultural GDP. The worst drought took place in 1992 and led to crop losses worth $154 million, the highest recorded during the period studied. Drought events affected all commodities across the board except cassava and cotton. Severe droughts occur on average once every 20 years, whereas the smaller localized droughts and dry spells average once every 5 years. The rain-fed agriculture and high poverty rates characteristic of smallholders have increased their exposure to frequent weather shocks and limited their ability to cope with them.

Excess rainfall and floods led to the second highest production losses recorded during the period studied. In 2002, for instance, floods led to a 68 percent fall in cotton production, and about a third of groundnut and maize production. The resulting losses amounted to nearly $100 million.

Pests and diseases also caused significant losses. Pests included the fall armyworm and the maize stock borer. Outbreaks of diseases such as cassava mosaic disease also caused significant losses in maize production and cassava in the key cassava growing areas of the Luapula, Central, Western, and Northern Provinces.

Market Risks

Price volatility was the most significant market-related risk facing farmers and other players in the agricultural value chains in Zambia. Investing in productivity-enhancing and income-raising technologies and practices—which can be instrumental in enabling smallholders to overcome poverty traps—is inordinately risky in contexts in which output prices are highly unpredictable. Reductions in international prices are often rapidly transmitted into the local cotton market and affect production the following year. The volatility of maize prices from one year to the next has lessened dramatically since the early 1990s, except in those years when the government intervenes in a market. This happened in the 2017–18 marketing season, for example, when maize prices crashed. The export ban introduced the previous year led to a large carryover stock of maize, whereas the current year's harvest proved to be a bumper crop. This oversupply allowed farm-gate prices to collapse.

The unpredictable involvement of the Food Reserve Agency in procuring and disposing of strategic maize reserves tends to cause price uncertainty as well.

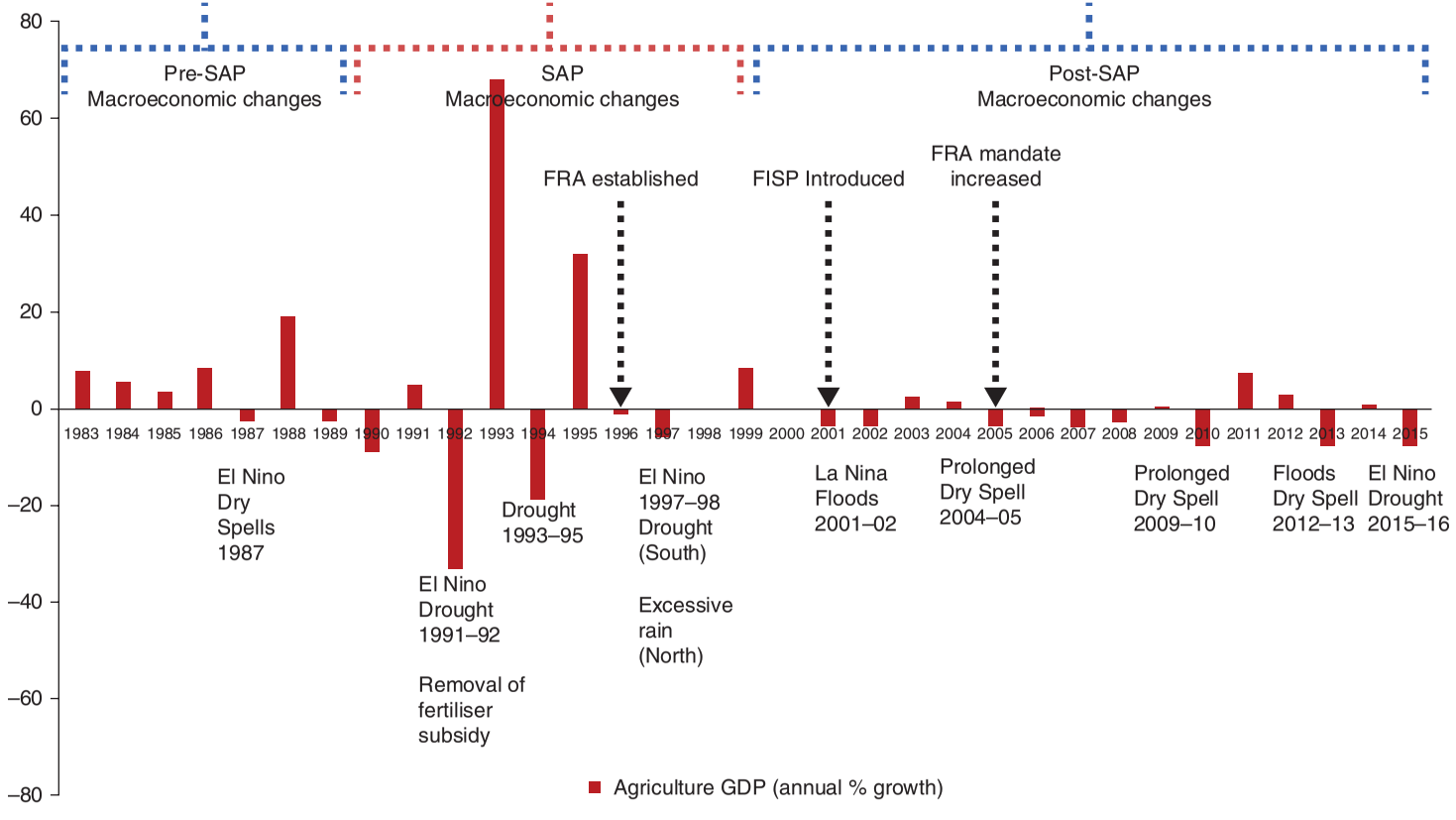
Enabling Environment Risks

The Structural Adjustment Program of the late 1980s and early 1990s led to major macroeconomic changes (figure ES.1). Together with other policy changes during the period, including the disbandment of input and marketing subsidies and the privatization of parastatals, this had an enormous impact on Zambia's agricultural GDP. The country's civil service was retrenched, including extension workers, and this affected all levels of the various commodity chains. Yet precisely quantifying the losses that resulted from the policies is not possible given the changes occurring throughout the country's macroeconomy, including dramatic fluctuations in the inflation rate and in exchange rates.

Prioritizing Risks

Prioritizing the risks that prevail in a certain country is the first step in managing them effectively based on the likelihood of a risk event taking place and the scale of the economic consequences that ensue when they do occur. In the

FIGURE ES.1 **Timeline of Major Shocks to Agricultural Production in Zambia (1983–2015)**



Source: Authors' compilation.

case of Zambia, the following three areas of risk management are found to warrant priority, with significant potential for synergizing actions undertaken across them:

- Strengthen early warning system to detect threats to food security.
- Develop climate-smart agriculture and increase resilience to climate-related shocks through diversification.
- Develop the Zambian Commodity Exchange (ZAMACE) and build a shock-responsive safety net.

Methodology for Risk Assessment

This report focuses on the risks affecting agricultural commodities that together account for 80 percent of the value of farm production in Zambia. These are beef, maize, sugarcane, cassava, tobacco, cotton, groundnuts, vegetables, chicken, and pork. Quantitative methods were used to estimate production losses and trade losses resulting from the export ban. Risks to the enabling environment were estimated qualitatively. Negative deviations from medium- to long-term yield trends that are greater than what can normally be expected in agricultural production are used to estimate production losses. The value of the losses is then estimated in local producer prices. Expert interviews and published literature were used to validate the key findings, and additional areas of risk management warranting further analysis were discussed at a workshop in the Chisamba District. The range of experts and stakeholders consulted in the study reflects the interdisciplinary set of issues at play in managing agricultural risk. These included public and private sector actors engaged in policy and planning, economics, livestock development, veterinary services, epidemiology and disease surveillance, agricultural research, irrigation and water, natural resource management, disaster risk management, meteorology, grain trading, and agricultural finance and insurance.

Agricultural Risk Management and the World Bank Agenda in Zambia

Agricultural risk management has been a focus of the World Bank's work throughout much of the developing world, and many of the lessons gleaned from one region apply to others. This risk management is an integral part of the Bank's larger program of work in the country, aimed at building resilience, principally through an agenda of climate-smart agriculture. This larger work program includes Productive Diversification in African Agriculture and Effects on Resilience and Nutrition (PRODIVA), which is designed to identify the drivers of and constraints to productive diversification in agriculture

at household, landscape, and country levels. The Zambia Integrated Forest Landscape Program (ZIFLP) is another innovative project that seeks to increase forest cover as an instrument of climate-smart agriculture, improved livelihoods and resilience, and reduced greenhouse gas emissions. The Community Markets for Conservation nonprofit enterprise in Zambia is another World Bank point of contact for climate-smart agriculture (CSA) in Zambia, and one that is actively developing supply chains featuring products that play a positive role in land management and rural income generation. Climate-smart agriculture through agroforestry, integrated soil fertility management, and conservation agriculture is a focus of an important World Bank partnership with the International Center for Tropical Agriculture and other partners to support the incorporation of climate-smart agriculture into national planning. These together are part of the larger context of this work on agricultural risk management in Zambia.

CHAPTER 1

Introduction and Context

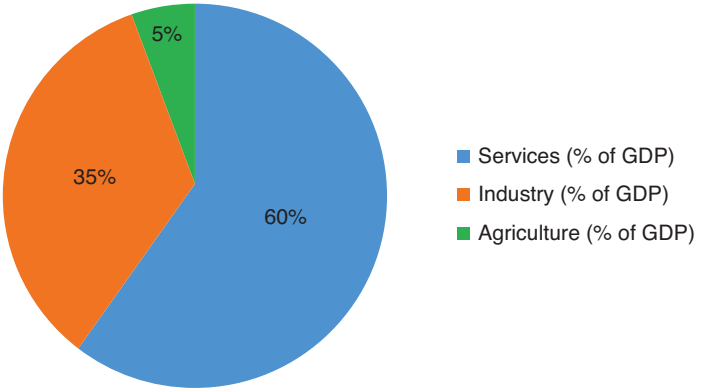
Zambia is a landlocked, lower-middle income country in southern Africa with one of the highest economic growth rates among the world's rapidly growing economies. Between 1960 and 1999, its gross domestic product (GDP) in real terms doubled from $4.6 billion to $9.5 billion. Between 2000 and 2015, its GDP nearly tripled, from $9.9 billion to $26 billion. Despite this growth, Zambia's GDP at market prices (constant 2010 U.S. dollars) has remained consistently below the Sub-Saharan African average. GDP per capita fell by nearly half between independence in 1964 and the mid-1990s, from $1,525 to $892. Since then, the country has recovered, and its estimated GDP per capita of $1,607 in 2015 is at par with the Sub-Saharan average of $1,660.

Agriculture is the main source of livelihood for some 1.5 million, or 60 percent of all households in the country. Yet despite its significance for livelihoods and employment, its share of overall GDP in Zambia is small relative to that in other Sub-Saharan countries, and has been diminishing over time—very much in line with development theory. In 2015, agriculture accounted for only 5.3 percent of the GDP (figure 1.1), down from an average 8.2 percent during the period from 2011 to 2015, when the sector accounted for about 9.6 percent of national export earnings (CSO 2015; World Bank 2016). In spite of its proportionately small share of the economy compared with services and industry, agricultural performance wields important effects on the larger macroeconomy. In 2013 and 2015, when the agricultural sector experienced negative growth because of extreme weather events, the economy slowed down by about 2 percentage points (figure 1.2) (World Bank 2017a).

The government of the Republic of Zambia has assigned priority to agriculture as one of sectors in which to diversify the economy and offset its overdependence on copper, which accounts for 77 percent of national exports (World Bank 2017b). Within the sector, the 2014–18 National Agricultural Investment Plan identified inclusive agricultural growth as the key to facilitating economic growth and poverty reduction for the 80 percent of Zambia's population whose livelihoods depend on agriculture (MAL 2013). The government's recognition of agriculture's significance is reflected in the increased budgetary allocations directed toward the sector, which now amount to nearly 10 percent of public expenditures. Approximately 80 percent of this amount is spent on input and marketing subsidies.

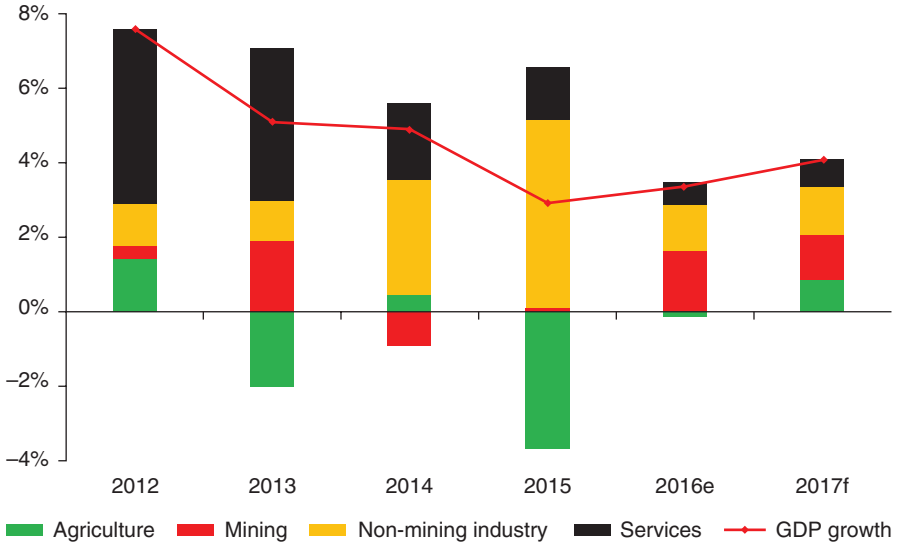
Despite the relatively high level of public investment in agriculture, rural poverty rates have remained persistently high. The rural poverty rate was 76.6 percent in 2015 according to the Central Statistical Office (CSO 2015).

FIGURE 1.1 GDP Composition (2015)



Source: WDI 2017.

FIGURE 1.2 Agricultural Growth versus GDP Performance



Source: World Bank 2017a.

Note: e = estimate; f = forecast.

Farmers also remain highly vulnerable to a myriad of agricultural risks, such as extreme weather events caused by El Niño and La Niña (World Bank 2017a). The Zambia Vulnerability Assessment Committee (ZVAC) reported that during the 2014–15 and 2015–16 seasons, there was a 38 percent and 41 percent reduction, respectively, in maize production. The committee also reported a decrease in water and pasture available for livestock, and increased incidence of disease outbreaks, particularly Newcastle disease in chicken. Responses to such matters tend to draw directly on scarce public

resources, diminishing what is available for public investment elsewhere. Nevertheless, the government and development partners draw on other resources to respond to crises.

The Food Price Crisis Response (FPCR) Trust Fund was established in 2008 as part of a multidonor facility to provide grant funding for low-income countries negatively affected by the impact of rising food prices. Its role included supporting governments in the design of sustainable policies that mitigate the adverse impacts of high and more volatile food prices on poverty, while minimizing long-term market distortions. With the support of the FPCR Trust Fund, supplemented by the Multidonor Trust Fund on Risk Management, the World Bank conducted a study titled *Increasing Agricultural Resilience through Better Risk Management* in Zambia. The study had three components: (a) Strengthening Agricultural Policies, (b) Agricultural Sector Risk Assessment (ASRA), and (c) Knowledge Exchange and Dissemination. This ASRA report is a combination of the first two components of the study. The third component will involve workshops and seminars to deliberate the findings of the study.

An Agricultural Sector Risk Assessment is "an orderly process to analyze, identify, and prioritize risk, which serves as the basis for the design of risk management strategies" (World Bank 2016). The objective of the Zambia ASRA is to identify, analyze, quantify, and prioritize risks of Zambia's agricultural sector, as well as to identify the areas of risk management solutions that need further scaling up and strengthening. The methodology incorporates quantitative and qualitative tools such as analysis of primary and secondary data, a desk literature review, interviews, and focus group discussions. The findings were presented and discussed, and recommendations were made for risk-solution interventions during an in-country stakeholder consultative workshop. Stakeholders consulted during this study included farmers, traders, processors, public officials, development partners, and civil society representatives.

To provide a sectorwide overview of the impacts of risk events, the commodities that contribute the top 80 percent of Zambia's agricultural production value (table 1.1) were assessed on three levels: production, market, and enabling environment. Although maize receives the most attention and has long been prioritized in agricultural public expenditures, beef contributes more to gross production value. Besides beef and maize, which together account for 43 percent of agricultural value, the rest of the commodities contribute 6 percent or less. In the context of agricultural risk management, *risks* are defined as "uncertain events that have the probability to cause losses." *Constraints* are "conditions that lead to suboptimal performance" (Choudhary et al. 2016). Figure 1.3 provides an overview of the World Bank's agricultural sector risk management process.

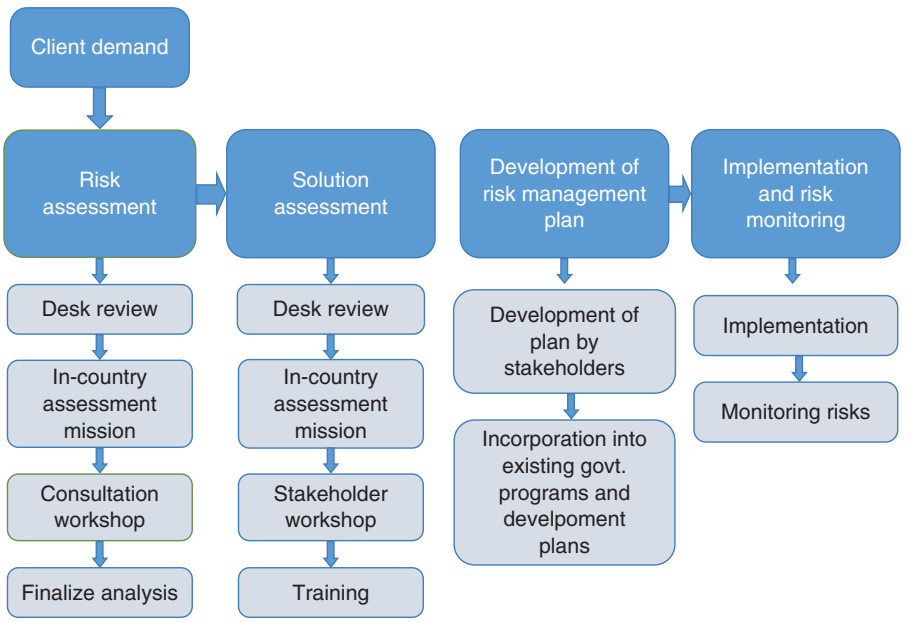
This study complements three key ongoing World Bank technical support operations designed to help build the resilience of the agricultural sector in

TABLE 1.1 Commodities Comprising the Top 80 Percent of the Gross Production Value (GPV)

Rank	Commodity[a]	Average GPV (constant 2004–06, US$, thousands)[b]	GPV (%)	Cumulative total of proportion of total agricultural value (%)
1	Meat indigenous, cattle	460,498	23	23
2	Maize	396,939	20	43
3	Sugarcane	124,781	6	49
4	Cassava	112,086	6	55
5	Tobacco, unmanufactured	97,599	5	60
6	Meat, game[c]	83,191	4	64
7	Cotton lint	82,365	4	68
8	Groundnuts, with shell	74,979	4	72
9	Vegetables, freshness	65,012	3	75
10	Meat indigenous, chicken	62,693	3	79
11	Meat indigenous, pig	56,277	3	81

Source: Food and Agriculture Organization Corporate Statistical Database (FAOSTAT).
a. Although the government considers fisheries to be under the agricultural sector, it was not included in the assessment because no single fishery's product falls within the top 80 percent production value.
b. Based on average agricultural GPV for 2011–13 using 2004–06 constant International dollar (I$). For the sector as a whole, GPV = $1,986,261,000.
c. Although game meat is in the FAOSTAT's top 80 percent of GPV commodities, the government considers it to be under the tourism sector; therefore, it is not part of the study.

FIGURE 1.3 Agricultural Sector Risk Management Process Flow



Source: Choudhary et al. 2016.

Zambia. The first is the Productive Diversification[1] in African Agriculture and Effects on Resilience and Nutrition (PRODIVA). The objective of PRODIVA is to analyze drivers of and constraints to productive diversification in agriculture at household, landscape, and country levels; to assess its impact on nutrition and resilience outcomes; and to make institutional and policy recommendations for agricultural diversification.

The second initiative is the Zambia Climate-Smart Investment Plan (CSIP), designed to build capacity of the Ministry of Agriculture to operationalize country climate commitments toward a productive, resilient, and low-emissions agricultural sector. The CSIP builds on the climate-smart agriculture (CSA) country profile for Zambia, which offers the entry point for how CSA can help the agricultural sector adapt to and mitigate climate change while achieving agricultural sector growth and poverty reduction. It also aligns objectives and goals across Zambia's agricultural and climate change strategies, policies, and tools and is expected to inform the preparation of the Second National Agriculture Investment Plan, in addition to providing opportunities for leveraging global partnerships for climate-smart agriculture development.

The third initiative is the Zambia Integrated Forest Landscape Program (ZIFLP), aimed at providing support to rural communities in the Eastern Province (EP) to allow them to better manage the resources of their landscapes to (a) reduce deforestation and unsustainable agricultural expansion; (b) enhance benefits that communities derive from forestry, agriculture, and wildlife; and (c) reduce their vulnerability to climate change. The project is an innovative mix of funding: an IDA credit of $17 million, a GEF grant of $8.05 million, and a BioCarbon Fund (BioCF) grant of $7.75 million. Its design follows the successful Landscape Management Project under which EP communities recently received carbon payments for their efforts in reducing deforestation and promoting climate-smart agriculture. ZIFLP implementation entails (a) creating an enabling environment to promote behavioral change in sustainable landscape management; (b) providing the incentives to shift from unsustainable farming and natural resources exploitation to sustainable alternatives; and (c) promoting climate-smart agriculture, sustainable forest management, improved wildlife management, biodiversity conservation, and sustainable livelihood options. The project will also prepare the groundwork for about $30 million of emissions reductions payments from the BioCF, to be processed as a World Bank operation within the next two years.

The remainder of this report is organized as follows. Chapter 2 provides an overview of Zambia's agricultural sector and the key constraints hampering

[1] *Diversification* typically refers to strategies and techniques to produce different agricultural products (*horizontal diversification*), engage in multiple value-added activities (*vertical diversification*), or exit the agricultural sector and engage in nonfarm activities.

its growth. Chapter 3 describes the data and methodology, and the nature of risks in agriculture. Chapter 4 examines the risks at production, marketing, and enabling environment levels of the supply chain. Chapter 5 quantitatively and qualitatively determines the impacts of the risks, and chapter 6 highlights stakeholders' perceptions of the risks and priorities for risk management.

CHAPTER 2

Zambia's Agricultural Sector

The Potential for Agriculture

Zambia has enormous agricultural growth potential. Of the estimated 74 million hectares (ha) of total land area, about 42 million ha (58 percent) are suitable for agriculture. Only 14 percent of the land suitable for agricultural production is being cultivated, and less than 30 percent of the land potentially suitable for irrigation has been developed. The available land per capita is higher than it is for most developing countries in southern Africa (table 2.1). About 6 hectares of land is available to each person, reflecting the country's low population density of 19.2 persons per km^2. The country also has sufficient water resources (ground, rain, and surface) available to support rainfed and irrigated agriculture. Combined, these natural endowments uniquely position Zambia to be the breadbasket of the southern and central African regions (Chapoto and Sitko 2015).

Zambia has three distinct agroecological zones (AEZs) that are distinguished by temperature, rainfall, and soil type (figure 2.1). AEZ I covers the southern and southeastern margin of the country. Annual rainfall is less than 750 mm and is normally erratic and of high enough intensity that drought and moisture stress are frequent. The cropping season is 60–90 days.

AEZ II stretches in a central band across the country, arching southwest from the Malawian border in the east to the Angolan border in the west. It has the most fertile soils. Rainfall in AEZ II ranges between 750 mm and 1,000 mm (medium rainfall) (figure 2.1). AEZ II has a growing season of 90–150 days. The zone is further subdivided into AEZ IIa and IIb based on differences in soil types. AEZ IIb has coarse, sandy soils with relatively low agroecological potential compared with AEZ IIa, but higher potential than AEZ I.

AEZ III covers 41 percent of the country and comprises leached and acidic soils with rainfall of 1,000–1,500 mm per year. The zone covers the Northern, Luapula, Copperbelt, and Northwestern Provinces and parts of the Central Province. It has the longest plant-growing season at 140–200 days.

Historical Context of Agricultural Policies

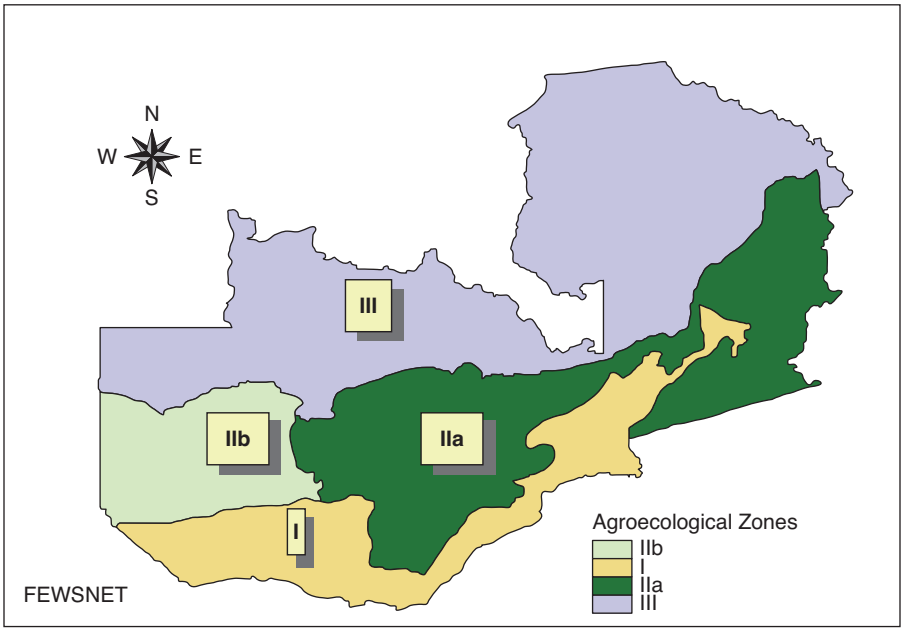
Historically, agricultural policies in Zambia can best be understood in the context of the four political phases or "Republics" that define the country's historical trajectory.

TABLE 2.1 Estimates of Land Availability (2011–35)

Year	Population	Arable land-to-person ratio (hectares/person)	Land-to-person ratio (hectares/person)
2011	13,100,000	3.1	5.7
2020	17,885,422	2.2	4.2
2025	19,900,000	2.0	3.8
2035	26,923,658	1.5	2.8

Source: Samboko, Kabisa, and Henley 2017.

FIGURE 2.1 Zambia's Agroecological Zones



Source: Department of Meteorology.

First Republic (1964–72). This period experienced two main agricultural policy decisions. The first was market support for maize at differential prices between farmers along the infrastructure corridor linking Livingstone in the Southern and Kitwe in the Southern Provinces and those in native reserves through the National Agricultural Marketing Board (NAMBOARD). The second agricultural policy entailed maize input subsidies through the Credit Organization of Zambia (COZ) established in 1966. The COZ was, however, marred with high default rates, whereas the administrative structure proved inadequate to efficiently allocate, distribute, and recover loans (Anderson 1968; Kydd 1986).

Second Republic (1972–91). This period witnessed the implementation of pan-territorial maize pricing through NAMBOARD in 1974, the ushering

in of the cooperative society movement, and increased provision of government-subsidized seeds and fertilizers through various schemes (Howard and Mungoma 1996). The government provided guaranteed markets for various crops, increasing the number of crops for which it set the producer and consumer prices (Kean and Wood 1992).

Several models of financing small-scale farmers with loans were tried but all faced the familiar challenges of poor loan recovery rates and high overhead costs. Perhaps the best known among these was the Lima Bank (Dodge 1977). This period generally witnessed increased agricultural spending, which led to the higher uptake of maize hybrids by smallholders and rapid expansion of the area under maize cultivation. Input subsidy provision and market support through NAMBOARD accounted for the largest share of the national budget, averaging 60 percent by 1986, and 15 percent by the late 1980s (Govereh et al. 2006; Tembo et al. 2009). The government faced such severe budget deficits that with the arrival of the subsequent government in in 1991, budget allocations to the agricultural sector declined by nearly 50 percent in 1992.

The government dissolved NAMBOARD in 1989 and all its functions were transferred to the Zambia Cooperative Federation, which was previously an agent of NAMBOARD through its member cooperatives. However, the lifting of fertilizer subsidies was to be gradual. The government had learned this lesson the hard way. In 1986, when it attempted to completely remove maize subsidies, the action sparked major food riots. The government was forced to abandon the reforms and reintroduce the subsidies in 1987 (Simatele 2006). Other food-related riots occurred in 1991, elevating the perception of maize as a politically dangerous crop and so withdrawing public support from it. This has continued to shape overall agricultural policy in Zambia (Chapoto and Sitko 2015).

Third Republic (1991–2001). The agricultural policy development during the first two years of the Third Republic was greatly influenced by the adoption of Structural Adjustment Programs (SAPs) of the International Monetary Fund (IMF) and the World Bank. This program fundamentally focused on three economic goals: (a) restore macroeconomic stability through monetary and fiscal reforms, (b) facilitate private sector growth by liberalizing price and exchange regulations and remove trade restrictions, and (c) remove the public monopolies in the industrial and agricultural sectors (Rakner 2003). The adoption of SAPs, coupled with climatic shocks such as the devastating drought of 1991/92, resulted in a 39 percent drop in agricultural output (World Bank 1994). Furthermore, there was a sharp increase in the nominal prices of agricultural commodities such that a 25-kg bag of maize meal increased from ZMW 225 to ZMW 1,800 (Seshamani 1996).

Between 1996 and 2001, the development of the agricultural sector was coordinated through the Agricultural Sector Investment Program (ASIP). The ASIP acted as a tool for implementing the government policy of maize market liberalization and market reforms of 1994 (Tembo et al. 2009). The

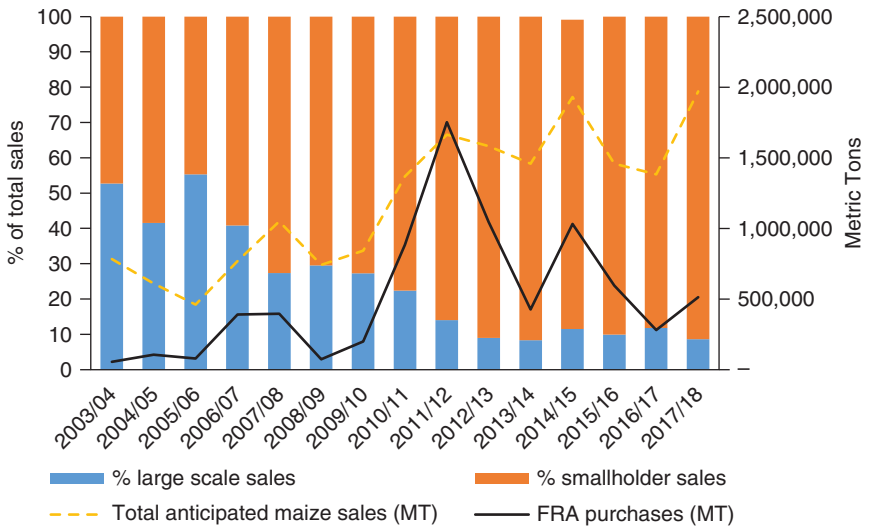
overall objective of the ASIP was to provide improved and sustainable agricultural services by promoting free-market development, reducing the public sector's role in commercial activity, and making the delivery of public services more efficient (MAFF 2001).

In 1996, the government established the Food Reserve Agency (FRA), with an original mandate of administering a national food reserve. The government amended the FRA Act in 2005 to expand its crop-marketing activities, and the FRA has since increased its participation in maize marketing over time (see figure 2.2), with purchases significantly higher in 2011.

Fourth Republic (2001–present). In 2002, the government replaced the previous credit schemes with the Fertilizer Support Program, a subsidy program for maize seed and fertilizer aimed at improving access to inputs for viable but vulnerable smallholder farmers. Accordingly, the government increased the share of the agricultural budget spent on maize marketing and input subsidies from below 40 percent in 2002 to as high as 90 percent in 2013 (figure 2.3).

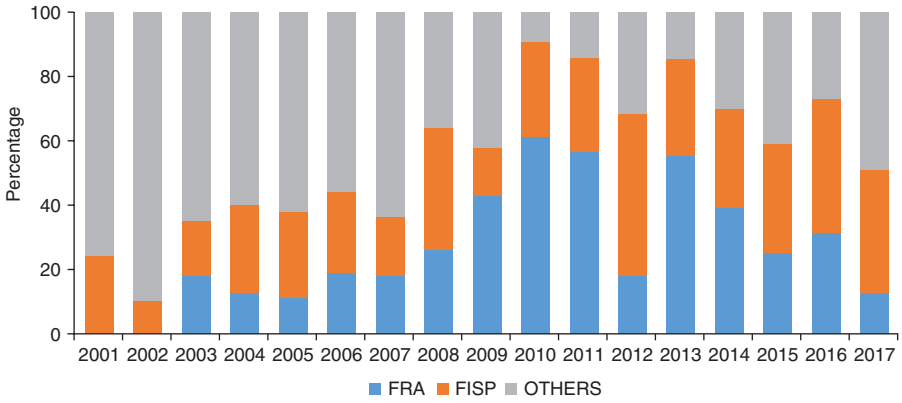
The Fourth Republic has also witnessed a fair share of ad hoc trade policies regarding maize. In December 2012, on the heels of a third consecutive bumper maize harvest, the government announced the suspension of maize exports because of rising mealie meal (maize flour) prices. In September 2013, Statutory Instrument No. 85 (SI No. 85) was signed once again to ban maize grain exports, although the ban was later lifted on maize bran through the 2014 Statutory Instrument No. 7 (SI No. 7). SI No. 85 was completely lifted in April 2014 through SI No. 3. The restriction of maize exports has been a recurring policy, with the most recent ban occurring in April 2016

FIGURE 2.2 Maize Sales and FRA Purchases in Zambia



Source: Central Statistical Office (CSO)/Ministry of Agriculture and Livestock (MAL), various years.

FIGURE 2.3 Share of the Agricultural Budget Spent on FRA/FISP (2001–17)



Source: Ministry of Finance and National Planning/MAL, various years.

amid fears that the country would run out of maize following high regional demand because of the 2014/15 El Niño phenomenon. The government has, however, through a statement given by the finance minister, the Honorable Felix Mutati, recommitted to maintaining open-border maize-trade policies (*Lusaka Times* 2017).

Current Agricultural Policies

Input Subsidies

The current agricultural policy framework in Zambia continues to be characterized by input subsidies and government intervention in maize marketing through the FRA. After several years of lobbying for Farmer Input Support Program (FISP) reform by various stakeholders in the country, in 2015 the government began piloting the e-voucher as a solution to the challenges in the traditional delivery of subsidies under the FISP. Initially, 13 districts were selected for the pilot during the 2015/16 agricultural season. This was expanded to 39 districts for the 2016/17 farming season (Kuteya and Chapoto 2017). In the 2017/18 agricultural season, the government intends to target 1 million farmers through the e-voucher. A major feature of the e-voucher is that it targets the poor associated with the traditional input subsidy program, giving farmers the freedom to choose inputs relevant to their farming operations. This, in turn, encourages diversification into other crops and livestock, encourages private sector participation in input supply, and reduces the cost of implementation as government cedes its procurement and distribution roles to the private sector.

Agricultural Marketing

Maize marketing policies have been erratic in recent times owing to the increased regional demand for maize resulting from El Niño impacts. Driven by fears of food insecurity, shortages in predominantly maize-producing areas, and very high regional demand for the surplus maize produced (Chisanga and Chapoto 2016), the government imposed a temporary ban on maize and maize meal exports in April 2016. Although this was initially planned to last until September 2016, it continued to May 2017. The government decided to open the borders upon realizing that most countries in the region produced enough maize in the La Niña year (that is, the 2016/17 agricultural season), with Zambia and South Africa producing record harvests. In addition to the export ban, during the 2017 national budget speech the finance minister also announced the introduction of a 10 percent tax on maize exports. The government intended this to increase value addition and create employment. However, for both policy pronouncements, exports were still restricted because the bulk of the maize was held by the private sector.

One positive development regarding commodity marketing warrants mention. The government provided support to fully operationalize the Zambia Commodity Exchange, or ZAMACE, as the agency responsible for implementing the Warehouse Receipt Systems (WRSs). ZAMACE became operational when the government signed the Credit Act on November 4, 2014. The Ministry of Agriculture and Livestock (MAL)[2] signed Statutory Instrument No. 59 (SI No. 59) authorizing ZAMACE to perform the functions of a Warehouse Licensing Authority (Chisanga and Chapoto 2016). ZAMACE has so far certified five warehouse operators with a total storage capacity of 425,000 metric tons (MT) for the WRS (ZAMACE 2017).

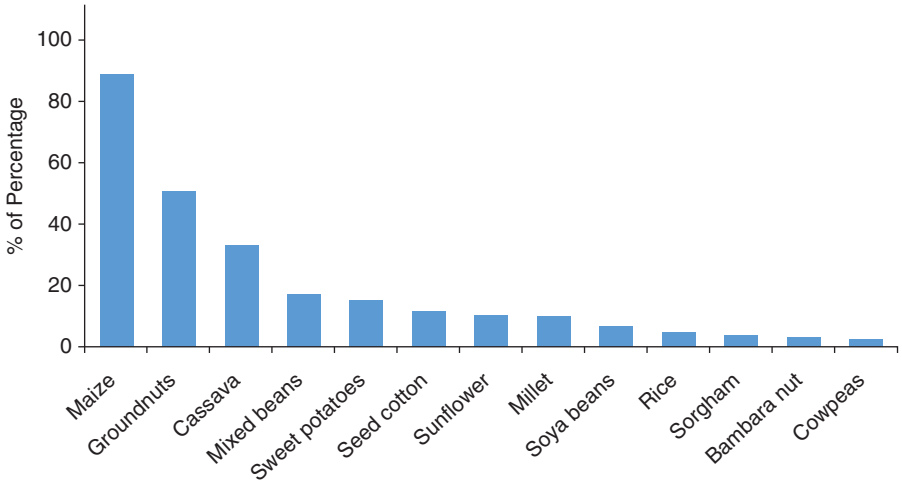
Agricultural Production System: Major Crops and Livestock

Ninety percent of smallholder farmers in Zambia grow maize as their main crop, reflecting the large subsidies that go into maize production (figure 2.4). Other major crops are groundnuts, cassava, mixed beans, and sweet potatoes produced by at least 15 percent of farmers. Other crops—seed cotton, sunflower, soya beans, rice, sorghum, Bambara nuts, and cowpeas—are produced by not more than 10 percent of farmers.

Figure 2.5 shows the livestock owned by smallholder farmers in Zambia. Village chickens are the largest livestock holding, followed by goats, cattle,

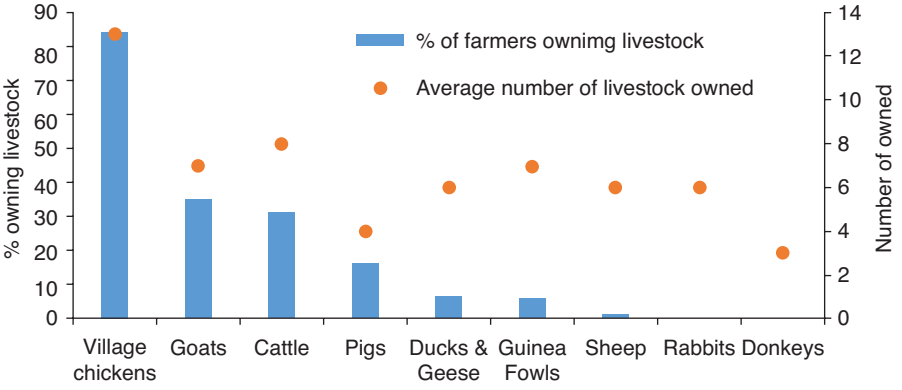
[2] At the time, the Ministry of Agriculture (MoA) and the Ministry of Fisheries and Livestock (MoFL) were under one ministry.

FIGURE 2.4 Main Crops Produced by Smallholder Farmers in Zambia



Source: RALS 2015.

FIGURE 2.5 Livestock Ownership among Smallholder Farmers



Source: RALS 2015.

and pigs. Other livestock shown in figure 2.5 are less common, with ownership of less than 10 percent. The 2015 Rural Agricultural Livelihoods Survey (RALS) indicates that the average smallholder household owns 13 village chickens, 7 goats, 8 cattle, and 4 pigs (IAPRI 2016) .

CHAPTER 3

Data and Methodology

Agricultural Risk

Agricultural risk can be usefully classified into three categories based on its scale of magnitude: micro-, meso-, and macrolevels. Microlevel risks apply to individual farms and farm households.

Mesolevel risks apply to entire communities or groups of farms, and are more difficult to contain. These include local droughts, floods, and outbreaks of contagious livestock disease, some of which are zoonotic and can be transmitted between animals and humans. Macrolevel risks refer to those that affect entire countries or regions and may very well apply to multiple countries. These often relate to the possibility of shocks that bring about sudden changes in global commodity prices and may result from policies that have unintended effects on markets.

Examples of various types of risks in agriculture are summarized in table 3.1.

Analytical Approach

The approach used in conducting the agricultural risk assessment follows Choudhary and others (2016). Focus group discussions with smallholder farmers in the Kalomo and Chipata Districts were undertaken together with a literature review on the risks faced by Zambian farmers and the coping strategies they use to manage those risks. Interviews were also held with traders, processors, and others in rural Zambia, as well as with government and agricultural extension staff. The focus on the smallholder farming community (those cultivating 20 hectares or less) was based on a recommendation by the Ministry of Agriculture. Typically, these are the most vulnerable to agricultural shocks; nevertheless, the proposed risk solutions in this report cover all farmer categories. Quantitative analysis was used to estimate the value of losses from agricultural risk events, focusing on production and on trade losses caused by export bans.

The most prominent agricultural risks are associated with events that lead to losses in production, such as droughts and disease or pest outbreaks—more so than market-related risks. It is useful to quantify the average annual loss for a crop over time to balance years in which yields meet or exceed expectations and years in which yields fall short of expectations. The following method was applied to calculate production losses in any given year: (a) A historical

TABLE 3.1 Risks in the Agricultural Sector

	Microlevel (idiosyncratic risk) Individual/Household	Mesolevel (covariant risk) Groups/Communities	Macrolevel (systemic risk) Provinces/National
Market or prices	Side-marketing behavior by contracted individual	Change in land price, new grades/standards, Chief banning off-taker or agrochemicals	National marketing or pricing policy change, import/export policy change, endogenous variability, exchange rate, state buying/not buying a crop, for example, maize, cotton
Farm production	Personal hazards affecting farm households, for example, illness or death of family head, important relative for which head is materially responsible, livestock deaths or illness	Localized weather, hailstorms, flooding, frost, whirlwind Contagious disease killing livestock within the village	Floods, droughts, widespread hail, red locust/fall armyworm national epidemic, contagious diseases, for example, cholera, AIDS
Financial activities	Change in family savings and income earnings from nonfarm sources, for example, head getting a wage job, lobola[a] cattle	Informal credit and savings club membership, solidarity burial insurance society	Changes in Central Bank policies, rise in base lending or savings rate, country risks, macroeconomic situation and policy, foreign exchange controls
Institutional/ legal	Change in social or legal liabilities	Changes in local policies, laws affecting internal savings and group savings and lending schemes	Change in national policies and regulations, for example, value added tax policy, council levies
	Examples		
Natural risks	Weather risks: drought, flood, erratic rainfall, hailstorm, and temperature variations		
	Other natural risks: landslides, earthquakes		
Biological/ environmental risks	Crop and livestock diseases and pests		
Market risks and challenges	Difficulties in accessing quality inputs and remunerative output markets and price volatility		
Risks from weak or missing institutional infrastructure	Weak or missing institutions for collection and timely dissemination of market-relevant information; ineffective regulatory oversight of participants in markets providing storage, insurance, and other finance-linked services		
Policy risks	Interventions in input markets and in output markets (including price setting and controls over exports/imports)		

Source: Adapted from Organisation for Economic Co-operation and Development (OECD) 2009.
a. Lobola literally refers to "bride price." It is property in cash or kind, which a prospective husband or head of his family gives to the head of the prospective wife's family in consideration of a customary marriage.

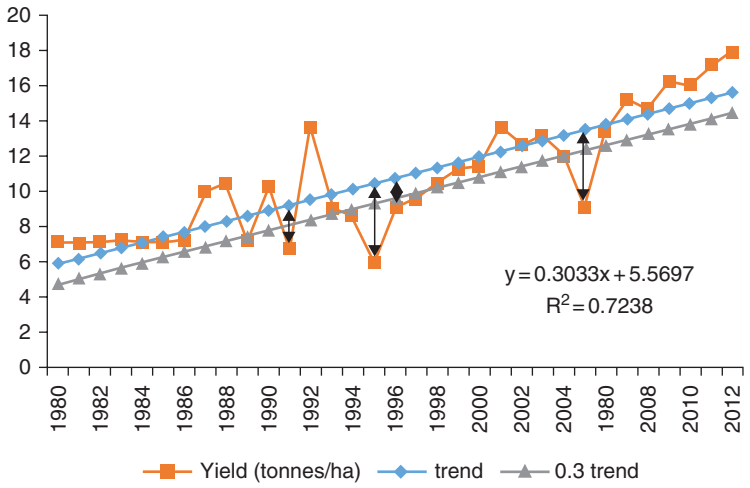
linear trend line for the yield of each crop was constructed. (b) A second linear trend line was drawn, representing one-third of the standard deviation of the crop yields. (c) Years of significant loss were identified as those in which actual yields were lower than the second linear trend line. (d) Production losses were calculated using the difference between the predicted value (the

original trend line) and actual yield. (e) Losses were added and divided by the total number of years examined to determine the average annual loss rate for a particular crop. (f) The annual quantity lost was converted into value terms by using the producer price for each crop. (g) Because producer prices are in local currency, the value was converted to U.S. dollars using the average exchange rate.

To make sure that these losses are from risks and not from a decrease in the size of cultivated land, the decrease in yield is first quantified and then multiplied by the area under production. The value is estimated at constant U.S. dollar prices. To determine how frequently production is affected by risk events, we look at a time series covering multiple years. The more years there are in the time series, the more reliably the frequency of production shortfalls can be estimated. For example, the production may be affected by negative impacts once in 3 years, or once in 5 years. The average cost of losses is estimated by adding up the value of losses over a given period and dividing by the total number of years in the given time series. Figure 3.1 shows the basis for estimating indicative losses. The orange curve is the yield, the blue dotted line is the long-term trend, and the grey line with triangular shapes marks one-third of the standard deviation. Losses are measured in years where they fall below this point (denoted by the arrows in figure 3.1).

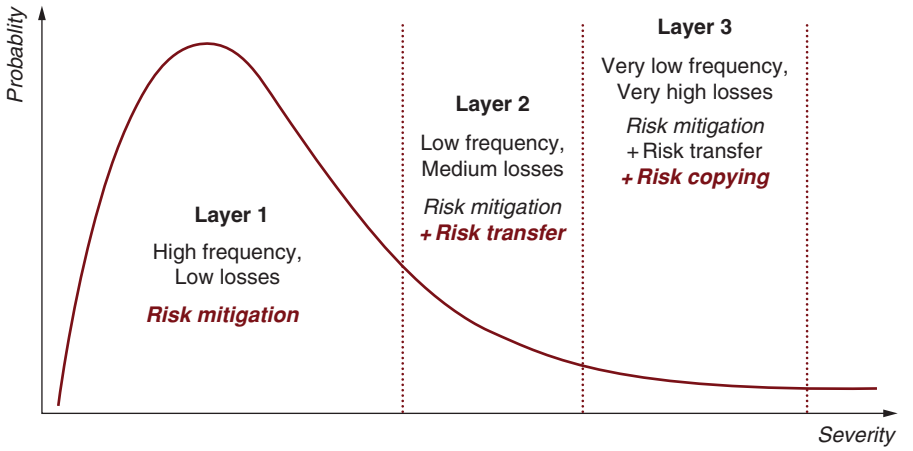
Results from the risk assessment were validated, and a risk prioritization exercise conducted with public and private sector participants at a consultative stakeholder workshop in the Chisamba District. Stakeholders' perceptions of how agricultural risks should be prioritized was based on the probability of an adverse event, and when it occurs, its expected impact on production

FIGURE 3.1 Example of How Indicative Losses Are Calculated



Source: Giertz et al. 2015.

FIGURE 3.2 Strategic Risk Instruments According to Risk Layers



Source: Giertz et al. 2015.

value, household food security and vulnerability, and the income of different stakeholders.

The appropriate risk management instruments depend on the probability of the risk and the severity of its impacts (figure 3.2). Three categories of instrument apply: *risk mitigation*, *risk transfer*, and *risk-coping*, all of which are elements of a larger risk management strategy. For risks associated with events that occur frequently but that have limited impacts, *risk mitigation* is the preferred approach. Risk mitigation includes measures that reduce the likelihood that an adverse event occurs and that offset the severity of the event when it does occur—for instance, the installation of water-draining infrastructure and the subsequent diversification of crops produced. For risks associated with events that are less frequent but that have higher impacts, those exposed to risks may opt to transfer the risk. *Risk transfer* refers to mechanisms such as an insurance, reinsurance, or financial hedging, in which a willing third party assumes all or part of the risk. In the event of the risk of events that seldom occur but that have very large impacts when they do, *risk coping* mechanisms may be required to enable those affected to manage, despite the losses they incur. Risk coping includes mechanisms such as public assistance to producers, debt restructuring, and scalable social safety nets. The mitigation, transfer, and coping all entail measures taken and budgeted for prior to the risk event.

CHAPTER 4

Agricultural Risk Assessment

This chapter focuses on risks affecting production, marketing, and the enabling environment and their occurrence over the past 30 years. The study found that droughts, floods, diseases and pests, extreme price volatility, macroeconomic changes, and unexpected policy changes were the most important risks facing the agricultural sector in Zambia. Other risks included input distribution delays, trade restrictions, political uncertainty, and ad hoc local government levies.

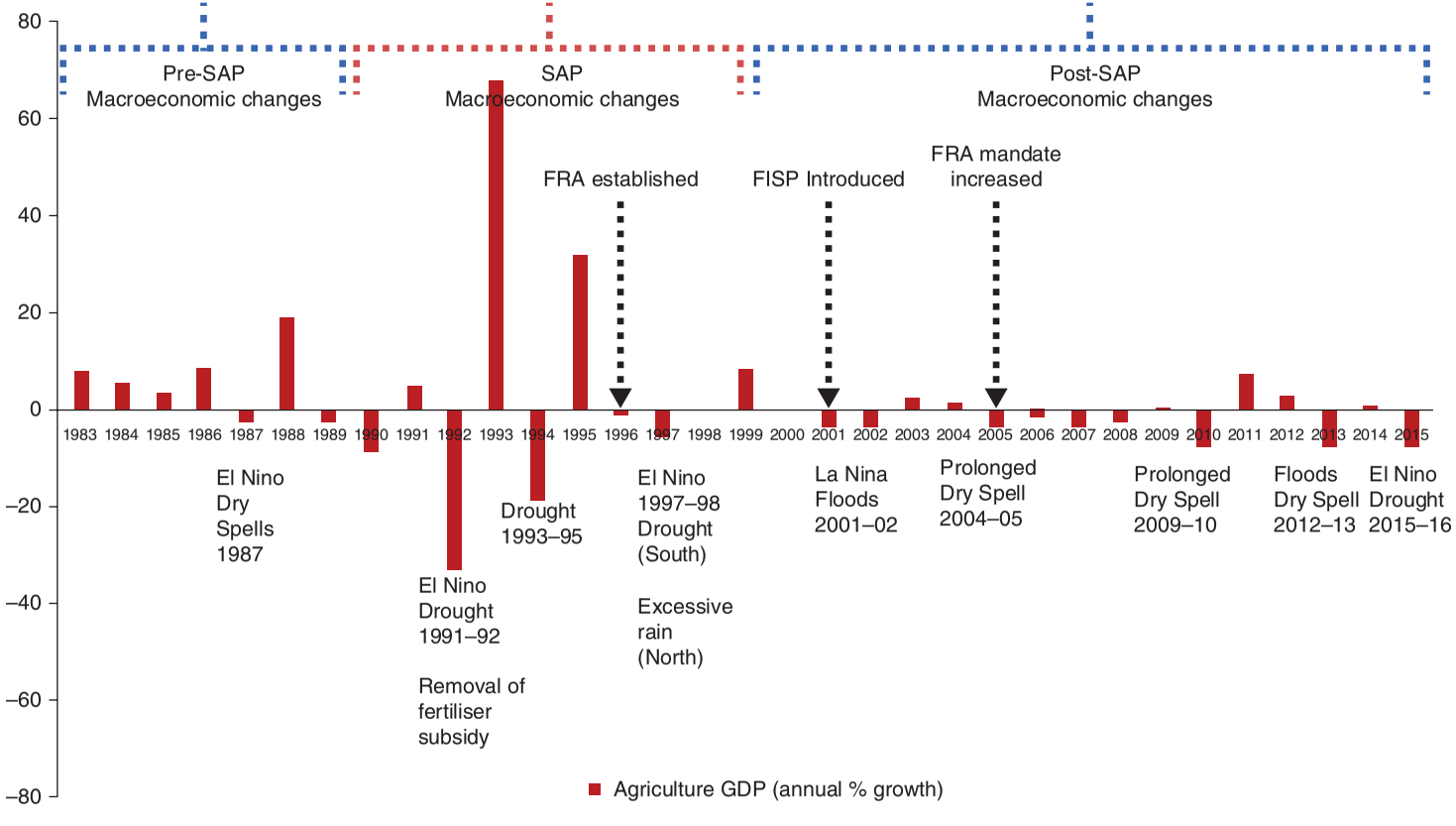
As in many other African countries, Zambia's structural adjustment program (SAP) was a defining event in its political economy. The study period can therefore be usefully categorized into (a) pre-SAP (1980s), (b) SAP (1990s), and (c) post-SAP (2000s) (figure 4.1).

Pre-SAP. During this period from independence to the late 1980s, Zambia became a one-party state in which the government controlled almost all aspects of the economy through parastatals, price controls, and inflows and outflows of goods and services. Government expenditure exploded. The value of input and marketing subsidies, for instance, were eight times in 1974 what they were at independence. Parastatals incurred heavy losses. The marketing board, for example, had incurred losses valued at 17 percent of the national budget by the late 1980s (Govereh, Jayne, and Chapoto 2008). A downturn in government revenues resulting from falling copper prices led to negotiations with the International Monetary Fund (IMF) for assistance. During the pre-SAP period, the major risk event was an El Niño–related prolonged dry spell in 1987, which significantly affected agricultural production.

SAP. Painful economic policy reforms were conditional for IMF loans. In 1989, the government finally agreed to the International Monetary Fund's (IMF) conditions and the SAP officially began in 1991. The economy was liberalized, price controls removed, parastatals privatized, government expenditures reduced, and the civil service sharply downsized (Govereh, Jayne, and Chapoto 2008). Inflation spiraled almost out of control, reaching a high of 183 percent in 1993.[3] In addition, exchange rates and interest rates were highly volatile. These macroeconomic changes coupled with extreme El Niño–related weather events. These included severe droughts in 1991–92 and 1993–95, as well as a drought that affected the south and excessive rains in the north in 1997–98. These crippled the agricultural sector during the 1990s. Following these risk events, recovery efforts were hampered by the private sector's

[3] WDI. http://databank.worldbank.org/data/reports.aspx?source=2&country=ZMB.

FIGURE 4.1 Timeline of Major Shocks to Agricultural Production in Zambia (1983–2015)



Source: Authors' compilation.

measured response to filling the gap left after government provision of inputs and advisory services ceased. As the macroeconomic situation began to improve, a few of the policy reforms were rolled back. A number of these major policy decisions are linked to elections being held around that time.

Post-SAP. Overall, the 2000s have had fewer and less severe shocks than the 1990s. The economy was stabilized, and growth took off. The major risk events during this period were weather-related: dry spells, excessive rain and floods, and the El Niño drought in 2014/15 and 2015/16. In addition to weather-related risks, exchange rate fluctuations in 2000 and 2016 also affected the agricultural economy.

Production Risks

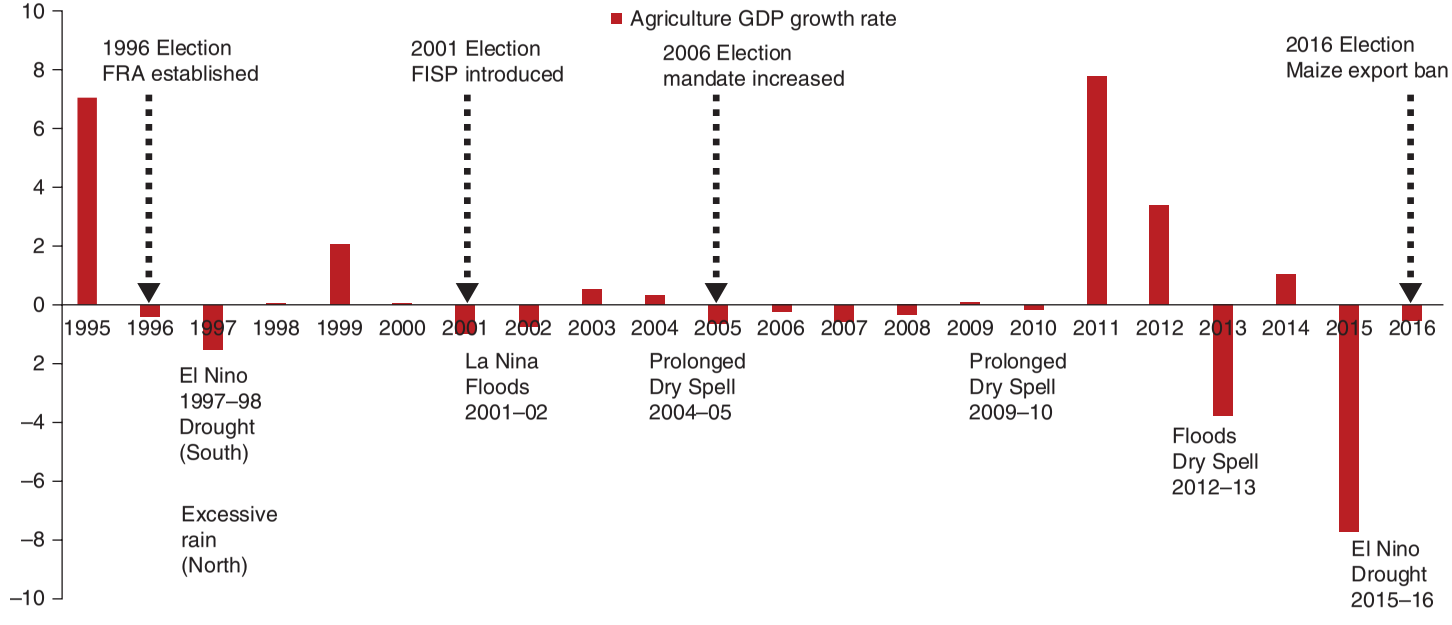
Weather risks were the most frequent and impactful risks to the agricultural sector in Zambia (figure 4.2). Between 1981/82 and 2016/17, all but five agricultural seasons experienced extreme weather events affecting one or more provinces (table 4.1). Most of these events were local in scale and production in unaffected areas offset the effects so that national agricultural performance remained on track. However, for affected districts, especially those in remote areas with poor access to markets, these events had an enormous impact on household food security and income.

Overall, excess rainfall occurs more frequently than drought, although the impacts of the latter are greater (figure 4.3). Looking at risk events at a national level conceals the disparities between agroecological zones (AEZs) and provinces. Although AEZ III receives the highest average rainfall, it is the most affected by extreme weather events, particularly the Northwestern and Luapula Provinces with 10 and 7 rainfall deficit years and 8 and 7 excess rainfall years, respectively. The Southern Province and AEZ I are often in the headlines because of drought. AEZ I has the lowest average rainfall (less than 750 mm annually), but it is a key maize production area for Zambia. Maize, the dominant crop in the zone, is highly susceptible to moisture stress (Chisanga et al. 2015). Rainfall deficits have a large impact on national maize production. Cassava, conversely, is drought tolerant and flood resistant and is the dominant crop in AEZ III. The choice of appropriate crop varieties has aided smallholders in the Northwestern and Luapula Provinces in mitigating and coping with weather risks.

Drought

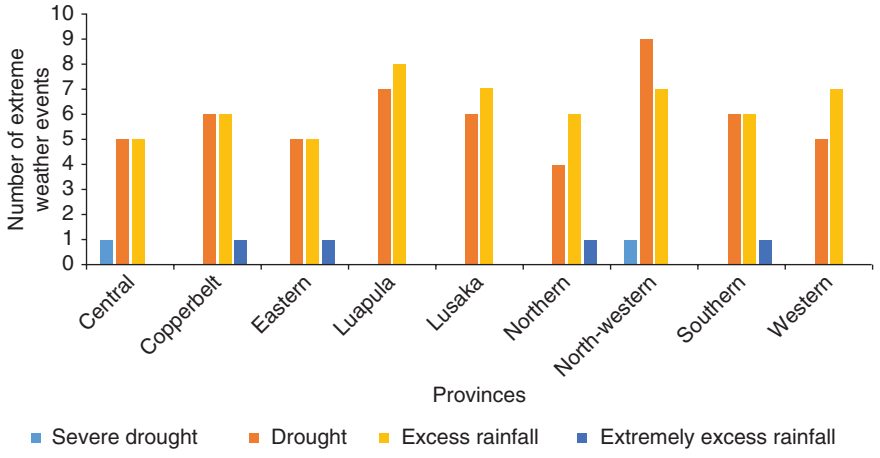
Research suggests that Zambia is experiencing the effects of climate change. In the Southern, Lusaka, Eastern, and Northern Provinces, farmers' perception of increasing temperatures were corroborated by empirical evidence, indicating that between 1960 and 2003, temperature increased by 1.3°C.

FIGURE 4.2 Timeline of Major Shocks to Agricultural Production in Zambia (1995–2016)



Source: Central Statistical Office (CSO), author's notes.

FIGURE 4.3 Extreme Weather Events by Province (1981/82–2016/17)



Source: World Food Programme (WFP) Vulnerability Assessment and Mapping (VAM).

TABLE 4.1 Major Drought Incidents in Zambia

Year	October–April rainfall (mm)	Provinces affected	Crops affected according to yield trends
1981/82	794	Copperbelt, Luapula, Northern, Northwestern, Southern, Western	Sugarcane
1991/92	770	Central, Copperbelt, Eastern, Luapula, Lusaka, Northwestern, Southern	Maize, sugarcane, groundnuts
1993/94	800	Central, Copperbelt, Eastern, Luapula, Lusaka, Northwestern	Maize, groundnuts
1994/95	764	Central, Copperbelt, Eastern, Luapula, Lusaka, Northwestern, Southern, Western	Maize, groundnuts
2001/02	848	Central, Lusaka, Northwestern, Southern	Cassava, maize, groundnuts
2014/15	862	Copperbelt, Luapula, Northern, Northwestern, Western	Groundnuts

Source: WFP, Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), CSO.

Farmers' perception of a decrease in rainfall in the Southern, Lusaka, and Northern Provinces was similarly backed up by empirical evidence that has shown a 2.3 percent decrease in mean monthly rainfall per decade since 1960. The future trends in the country are toward a higher average temperature, a possible decrease in total rainfall, and some indication of more intense rainfall events. The government estimates losses between $4.3 billion–$5.4 billion over 10–20 years as a result of climate change, of which the agricultural sector alone is expected to lose $2.2 billion–$3.1 billion (Mulenga and Wineman 2014; World Bank 2017b).

In this report, drought refers to occurrences of rainfall deficit during the growing season. It also encompasses dry spells, shortened seasons as a result of delays in the onset of rainfall, or early cessation. Drought manifests in different forms across the provinces. The Northwestern Province has the highest incidence of lower than average cumulative rainfall received during a season (1 in 4 years), whereas the Southern Province tends to experience more dry spells occurring during the season.[4] Between 1981/82 and 2016/17, Zambia experienced two severe droughts and five droughts in which more than 40 percent of the country was affected. Overall, severe droughts occur 1 in 20 years, whereas localized droughts occur 1 in 5 years. The major drought incidences are linked to El Niño events of 1991/92, 1993/95, and 2014/15.

Maize was the crop most susceptible to drought, losing over half of the expected national production in 1991/92. Farmers in the Kalomo District, Southern Province, reported losing, in some cases, their entire maize crop during the 2015/16 drought, although production was higher in most of the country in comparison to the previous year. The high losses experienced by maize can be attributed to its preponderance across the country, even in areas that are drought prone. Cotton and cassava are the only major crops that did not experience losses resulting from drought.

Both hybrid and drought-tolerant, open-pollinated varieties (OPVs) are available on the market, but adoption has been limited by the limited availability of OPVs, which smallholder farmers prefer over hybrids. Smallholders prefer OPVs because they can recycle the seed, which reduces the pressure to buy seed every year. More hybrid varieties have been widely available and for a longer period than OPVs. Additionally, seed companies prefer to market hybrid varieties. The government's Zambia Agricultural Research Institute has, over the last decade, focused on developing and releasing OPVs to meet growing demand, but distribution is limited as seed companies are reluctant to promote them (CIMMYT 2015). The Ministry of Agriculture (MoA) is also promoting other crops, particularly drought-tolerant varieties of legumes such as beans and cowpeas, to improve household nutrition as well as mitigate crop losses caused by drought.

In the livestock sector, drought was the most significant production risk. The droughts in 1994, 1998, and 2015, and a prolonged dry spell in which the Southern Province was particularly hard hit, led to considerable losses. During the 2015/16 El Niño drought event, farmers in the Eastern and Southern Provinces had to travel with their animals about 7 km to 25 km away from their homesteads in search of water and pastures. In the Kalomo District, Southern Province, 21 percent of focus group discussion participants lost animals to drought. One of the participants lost 22 animals because of lack of pastures. Abortions in goats were also reported by focus group participants.

[4] Dry spells occurrence based on anecdotal evidence received in interviews during the field mission.

Excess Rainfall and Flooding

Owing to Zambia's extensive river network, excess rainfall floods large areas of the country (table 4.2). The situation is worsened by insufficient flood control infrastructure. Excess rainfall and flood risk events are linked to La Niña, such as the 2001/02 floods. Cotton is highly susceptible to flooding because it is primarily grown in valleys and floodplains. As a result of the excess rain and flooding in 2002 and 2007, nearly 70 percent and 40 percent, respectively, of anticipated production were lost. Maize and groundnuts are also susceptible, and in 2001 more than a third of production was lost. Cassava and tobacco are more tolerant but still lost 10 percent and 17 percent of production, respectively, in 2001. Sugarcane, conversely, was virtually unaffected. Similarly, although the livestock sector was affected by excessive rainfall and flooding, the losses were not below the three standard deviation trend threshold and thus were not considered to be significant.

Excess rainfall and flooding risk events occur more frequently than drought. Localized events occur 1 in 5 years, whereas extreme events (large scale) occur on average 1 out of 10 years. However, not all localized events result in crop losses. The risk factors are related to farmer behavior, planting in flood-prone areas, and the management of flood-control infrastructure on private land.

Pests and Diseases

Agricultural pests and diseases also have large impacts on production. Farmers reported fall armyworm (*Spodoptera frugiperda*) and maize stalk borer (*Busseola fusca)* to be among the key pests affecting crop yields. A fall armyworm outbreak that started in Nigeria in early 2016 swept across Africa in 2017. By April 2017, it had been confirmed in 11 countries, and there were unconfirmed reports of the outbreak in 15 countries. The Centre for Agriculture and

TABLE 4.2 Major Excess Rainfall and Flooding Incidents in Zambia

Year	October–April rainfall (mm)	Provinces affected	Crops affected according to yield trends
1988/89	1,058	Eastern, Lusaka, Southern, Western	Sugarcane
1992/93	1,069	Central, Copperbelt, Northwestern, Western	Tobacco
1997/98	1,010	Luapula, Northern	Sugarcane, groundnuts
2000/01	1,125	Central, Eastern, Luapula, Lusaka, Southern, Northern, Copperbelt	Cassava, maize, cotton
2006/07	1,068	Eastern, Luapula, Northern, Northwestern	Cotton, groundnuts
2007/08	824	Central, Lusaka, Western, Southern	Cotton

Source: WFP VAM, FAOSTAT, CSO.

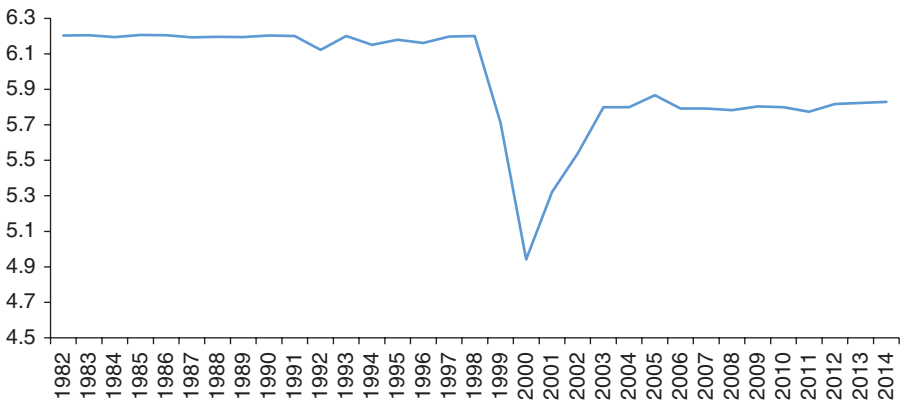
Biosciences International estimates the outbreak to have caused a 20 percent and 8 percent loss in maize and sorghum, respectively, and production valued at $3 billion and $827 million, respectively (Abrahams et al. 2017).

In the last quarter of 2016, a fall armyworm outbreak was reported in Zambia and the International Plant Protection Convention was officially notified in February 2017. At the time, the pest was estimated to have affected more than 130,000 hectares in six provinces. The government declared the outbreaks a national disaster and swiftly mobilized and spent more than $3 million to respond to them (FAO 2017). This swift response appeared to have curtailed the spread of the pest. However, Zambia still needs to remain vigilant as fall armyworm continues to ravage the rest of the continent and could thus easily attack again. The outbreak revealed gaps in the national early warning and extension systems that should be rapidly filled (Braimoh and others, 2018; Indaba Agricultural Policy Research Institute, IAPRI 2017).

Other notable pests include maize stalk borer, African armyworm (particularly the outbreak in 1996), and cowpea aphids. For the former two pests, farmers in Southern Province reported that they received pesticides from the government to manage the outbreaks.

Cassava mosaic disease is the most significant risk to the cassava value chain in Zambia. The disease was first reported in Zambia in the 1990s. As the disease spread, cassava yields fell sharply (figure 4.4), but as disease-resistant cultivars became available, yields recovered, although below previous levels. In a countrywide survey, it was found that adoption rates of disease-resistant cultivars were low and farmers preferred local cultivars even though they were susceptible to the disease (Chikoti et al. 2014). The study found that cassava mosaic disease affected fields in seven provinces, with the highest

FIGURE 4.4 Cassava Yields (MT/ha), 1982–2014



Source: FAOSTAT.

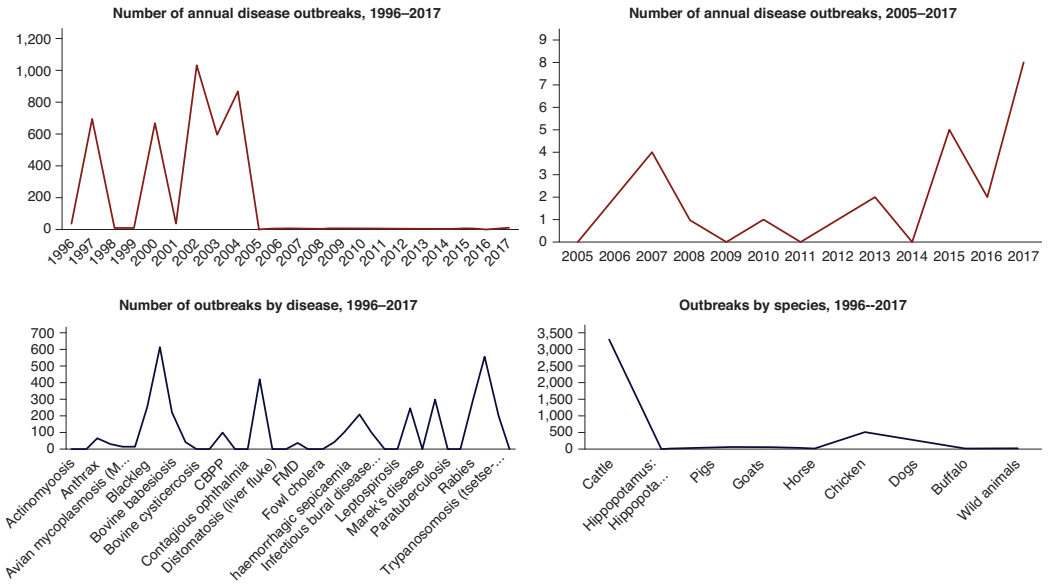
Note: MT = metric ton; ha = hectare.

incidence (71.2 percent) in the Northwestern Province. The disease has therefore evolved from a risk into a constraint that is affecting cassava productivity. It was noted that the disease symptoms were more severe in areas along major highways, suggesting that disease-affected cuttings might be transported from bordering countries affected by the disease (Chikoti et al. 2014).

According to the World Organization for Animal Health (*Office International des Epizooties*, OIE), 20 percent of livestock productivity losses are the result of disease. In this study, diseases were found to be the most significant cause of loss in each year over the period covered. Foot-and-mouth disease (FMD), contagious bovine pleuropneumonia, anthrax, lumpy skin disease, African swine fever, and Newcastle disease are the key OIE-listed diseases leading to outbreaks. East Coast fever, also known as Corridor disease, and other tick-borne diseases such as babesiosis and anaplasmosis, as well as trypanosomiasis (sleeping sickness, also known as nagana in cattle), which are endemic in Zambia, were constraints rather than risks because farmers deal with them on a day-to-day basis. They are also classified as management diseases by the Ministry of Fisheries and Livestock (MoFL) and, as such, government support to their control is not available, except for vaccinations and communal disease control infrastructure, that is, dips.

The number of outbreaks reported to the OIE has declined remarkably since 2005 (figure 4.5). However, this may be because of a change in the OIE's reporting system, which, since 2005, has given emphasis to notifiable diseases

FIGURE 4.5 Disease Outbreaks



Source: OIE.

rather than all disease outbreaks. Also, with the liberalization of the livestock extension services, there are several vacant positions at the veterinary camp level. It is important to note that veterinary camps (that is, areas covered by livestock extension workers) are, on average, six times larger than agricultural (crop) camps.[5] Their more extensive size means less reporting capacity. Moreover, government support is limited to notifiable diseases and thus they tend to be emphasized in the OIE reports. Nevertheless, livestock farmer focus group discussions revealed disease to be the second-highest risk factor after drought. Cattle are the livestock animals most affected by outbreaks; 81 percent of OIE-reported outbreaks are attributed to diseases of cattle.

Market Risks

Price and production risks are highly interrelated because variability in production can result in high food price instability. Abrupt deviations in a commodity's price or production are generally manifestations of some form of underlying risk, which may include production risks, exchange rate volatility, or market interventions by the government. Production responsiveness is low for annual crop commodities because planting decisions are made before prices for the new crop are known. These decisions depend on expected prices and not price realizations (Dana and Gilbert 2008). The vulnerability to price risks also depends on how integrated a market is with other markets. The less a market is integrated with others, the higher is the price instability stemming from variability in local production. In well-integrated markets on the other hand, price risks are easily transferred from one area to another. The downside of a well-integrated market is that price risks could affect producers more extensively (Antonaci, Demeke, and Vezzani 2014).

Zambia's agricultural price risks emanate from excessive market interventions by the government as well as from production risks. The interventions are mainly short-term measures aimed at maintaining stock levels within the country. This is more so for maize compared with any other crop and they include export bans/restrictions, strategic stockpiling, and price controls. These short-term measures are popularly used to mitigate against production-related risks but end up worsening the situation by increasing price volatility in the market (Chapoto and Jayne 2009).

Price Volatility

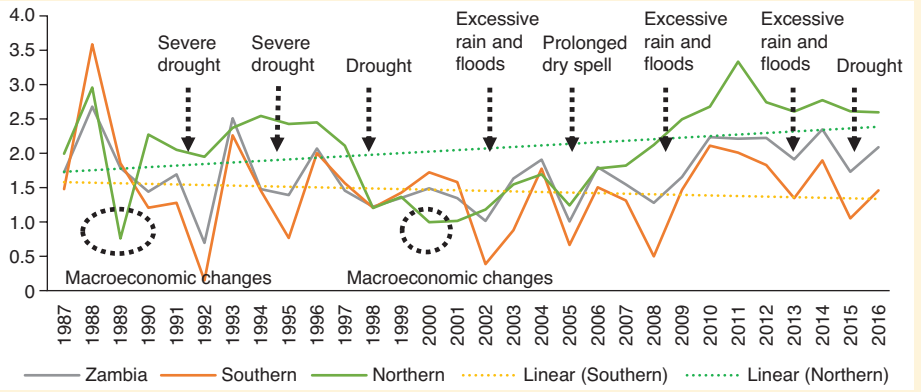
Price volatility in the agricultural sector affects different actors in different ways, depending on where they are positioned on the supply chain. For

[5] A camp is the area covered by an extension officer. It may consist of several villages (the smallest administrative unit).

BOX 4.1 Production Risks in the Northern versus the Southern Province

The Northern Province was severely affected by the removal of the input subsidies in 1989, mostly because it was not a high-production area for maize at the time. Over the past 10 years, maize productivity has been increasing in the Northern Province, whereas it has been on a downward trend in the Southern Province. Productivity in the Southern Province has been affected by the high frequency of weather-related risk events, drought averaging every 3 years, and excessive rainfall and flooding averaging every 5 years. Conversely, macroeconomic changes seem to have a higher impact on yields in the Northern Province, as seen in 1989 when yields fell nearly 274 percent, from 3 MT per ha to 0.8 MT per ha. The frequency of weather-related events in the Northern Province was lower, with drought every seven years; excessive rain and flooding is not an important hazard for the Province. Given the risks, government efforts should focus on diversifying into drought- and flood-tolerant crops in the Southern Province and on ensuring macroeconomic stability for the Northern Province.

FIGURE B4.1.1 Maize Yields (t/ha) in the Northern and Southern Provinces (1987–2016)



Source: Crop Forecast Surveys (CFSs).

example, a farmer's income is negatively affected by a sharp fall in producer prices, but a consumer sees lower food prices. A trader or a processor may lose out on a fall in retail prices or profit from an increase, depending on the timing of the price change. Although certain levels of intra- and inter-seasonal price volatility are acceptable in the market, it is the unpredictability of this volatility that presents a major price risk especially for smallholder farmers. Price volatility is a manifestation of the unpredictability in the policy space, including trade restrictions that can lead to extreme price shifts over and above what is expected and predictable, leading to huge unexpected

losses. For smallholders, extreme price volatility is a risk that affects household income and food security. Household income is directly affected when prices fall; however, for net food-buying households, sharp increases in food prices have significant impacts on food security. A study by IAPRI shows that a third of Zambian rural households are net maize buyers (Kuteya 2016). Additionally, sharp price drops negatively affect planting area and input investments, leading to yield drops and losses in production. Farmers plant a smaller area for the affected crop and reduce their level of investment in fertilizer and improved seed, thus reducing production of the crop the next season.

Cotton price volatility from one year to the next is among the highest among agricultural commodities in Zambia. Domestic cotton seed prices are determined by local supply conditions, as well as by international prices because most of the cotton lint is exported. The export of cotton lint transmits international prices directly into the local market, leaving cotton farmers susceptible to international cotton price movements. High international and domestic cotton prices in 2011 led to an increase in area planted and volume produced for the 2011/12 season. This led to a major price drop of 50 percent in 2012, and the losses incurred saw the burning of a number of trucks owned by cotton companies across the country.

The government has had limited involvement in the cotton sector since its liberalization in 1994. However, when the sector faced major price declines between 1999 and 2000, the sector almost collapsed, prompting government interventions. The Cotton Act was enacted in 2005, and the government also created a Cotton Fund aimed at stimulating production and trying to reduce incidences of side selling. The Cotton Fund provides support to cotton production through loans offered to both large and small ginning companies. The Cotton Association of Zambia was also created in 2005 to promote the interests of cotton farmers. In 2009, the Cotton Board of Zambia was created using the Cotton Act to regulate the sector. With the crop diversification agenda and a need to increase cotton production, the government decided to put cotton under the Farmer Input Support Programme (FISP). It distributed about 153 MT of fertilizer to cotton farmers in the 2016/17 season.

In the case of maize, the main sources of price volatility were local production conditions and international prices during the period when Zambia was a net importer of maize. In 2007–08, the world food price crisis was another driver of a maize price increase globally. In Zambia, the effect of the rising global food prices was not felt until late 2008 and early 2009. Failure by government and other stakeholders to quickly respond to the crisis was the leading cause for maize price escalation in the country rather than international developments (Chapoto 2012).

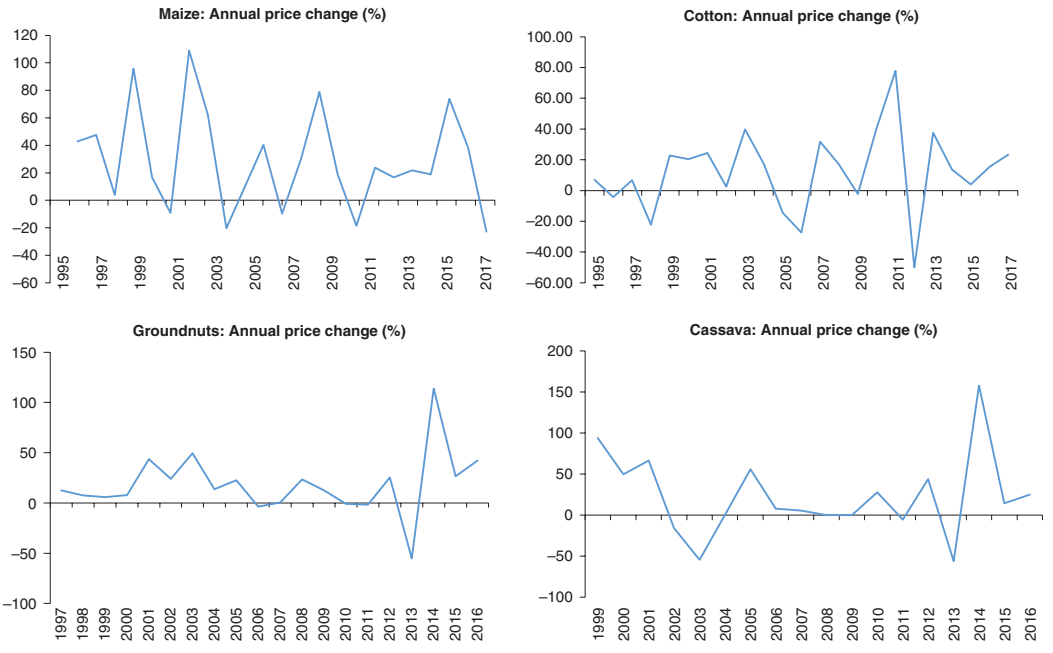
Although price volatility in maize lessened between 2011 and 2014, when there were large surpluses, weather shocks caused large price swings again in 2015 and 2016. With a more resilient production system, Zambia still

produced surplus maize even in 2016, which was an El Niño year. Yet high regional demand prompted the government to take drastic policy measures such as the imposition of an export ban that likely exacerbated the price volatility. Prices plummeted by almost 40 percent in 2017 mainly caused by the export ban that coincided with a bumper harvest. The country's huge carryover stock of 569,317 MT, plus the production of more than 3 million MT caused prices to crash. Such price swings disadvantage farmers and affect their ability to respond to shocks in the future as their income earning capacity is markedly reduced.

In the case of groundnuts, major price drops took place in 2000 and 2007, with 35 percent and 20 percent declines, respectively. These were associated with high levels of production in each of those years for the respective commodities. In comparison with the rest, cassava is relatively stable. We hypothesize that groundnuts are largely grown for consumption by smallholders but are not as widely consumed as is maize. Groundnut yield, moreover, is relatively stable because it is tolerant to most of the risks that affect maize and some other crops.

In comparison with crops, prices are relatively stable for livestock commodities, although farmers have reported them to have been depressed since 2008. Although beef price data were not available between 2000 and 2015, a downward trend for real beef prices had already been seen between 1993 and 1999, as shown in figure 4.6.

FIGURE 4.6 Annual Price Changes for Selected Crops

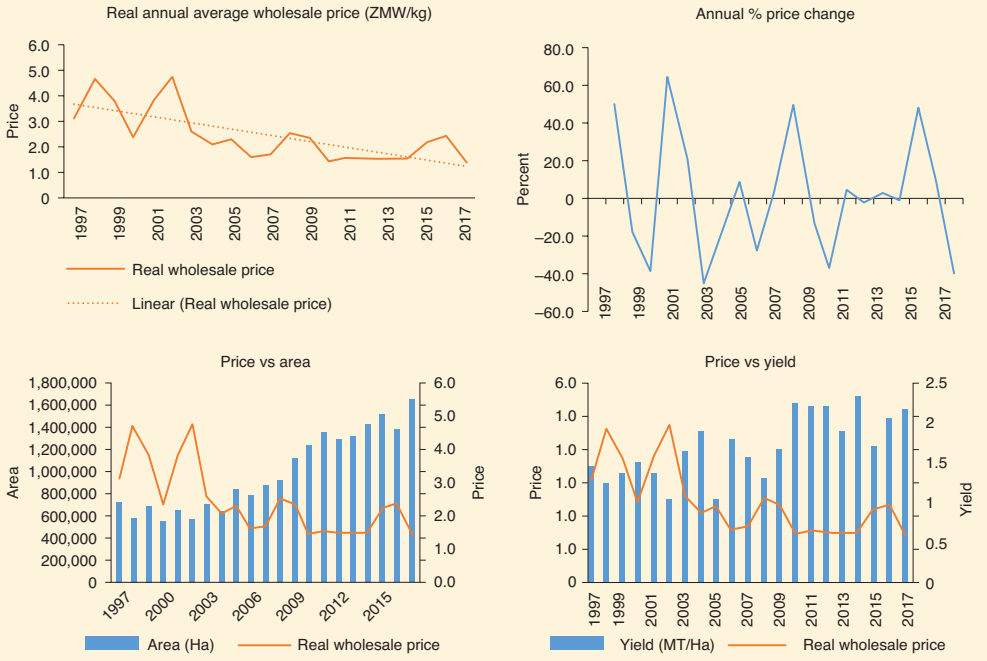


Source: Central Statistical Office Monthly Average Price Data.

BOX 4.2 Maize Price Volatility

Although maize was one of the commodities studied with the highest price volatility, since the 1990s, its inter-annual price volatility has lessened. In addition, a gradual reduction in prices over time was observed, which has been attributed to an increase in maize production as a result of several good years. For example, falling prices in 2000 and 2009 were associated with high production levels. A decline in prices one year influences farmers' production decisions the following year, including the area cultivated, which can decline by 59 percent. There was also a strong negative (60 percent) correlation between maize prices and yields. Anecdotal evidence suggests that price drops lead to reductions in investments in improving productivity such as input purchases and irrigation, resulting in lower yields. For staples such as maize, this has household income and food security implications.

FIGURE B4.2.1 Price Volatility of Maize



Source: MoA; Grain Traders Association of Zambia (GTAZ), and CSO.

BOX 4.3 Cotton Price Volatility

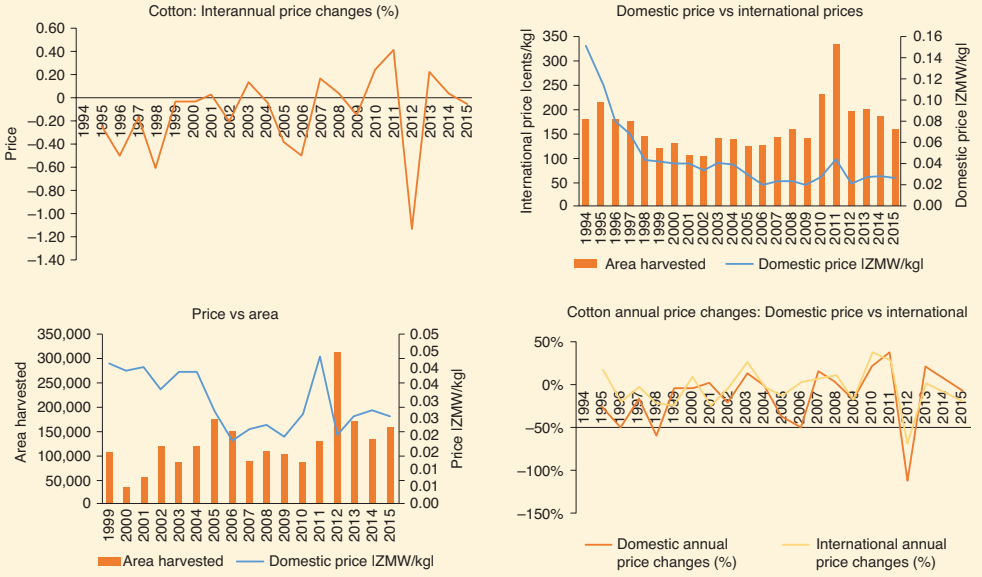
Cotton prices are highly volatile. However, since the liberalization of cotton's production and marketing, prices have come down considerably.

As prices have fallen, cotton has become more closely aligned to the direction of international prices. However, farmers seem to bear the cost of any declines in international prices, and when prices go up, they do not seem to benefit as much as would have been hoped.

As seen earlier with maize, when prices rise, the area under cultivation increases and vice versa.

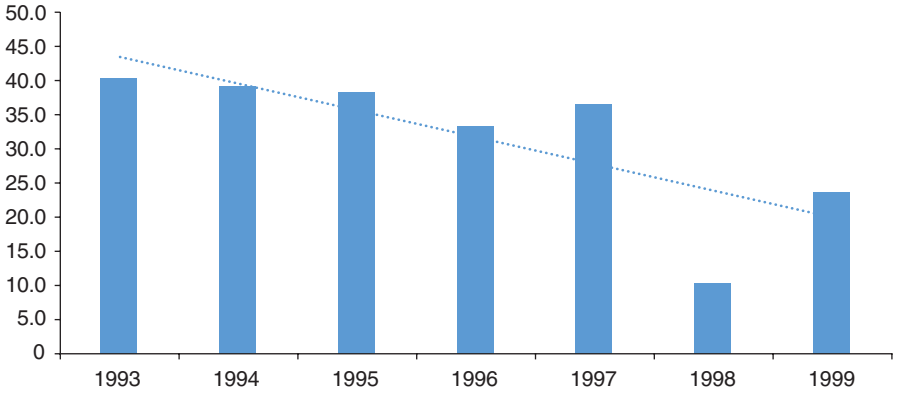
When farmers were asked about why they continue to grow cotton even though prices are depressed, they said it was because of the input loans they receive from ginning companies. The farmers use many of the inputs received on other crops. The depressed prices are one reason why counterparty risk is a big issue for cotton traders.

FIGURE B4.3.1 Price Volatility of Cotton



Source: IAPRI, FAOSTAT, and World Bank.

FIGURE 4.7 Real Beef Prices (ZMW/kg)



Source: CSO.

Exchange Rates, Interest Rates, and Inflation

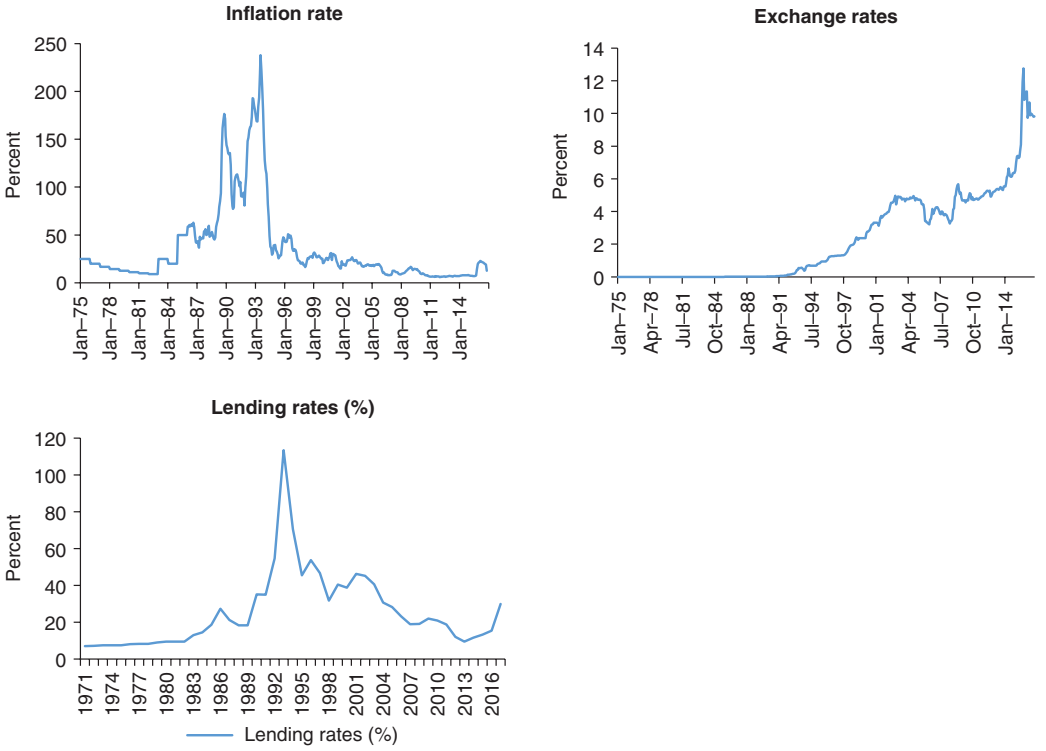
Rapid, unpredictable changes in interest rates, exchange rates, and inflation are major risk factors affecting the agricultural sector (figure 4.8). Some may result from economic policy decisions in Zambia or abroad, such as a change in monetary policy from the U.S. Federal Reserve that affects the dollar exchange rate. After the liberalization of the Zambian economy, interest rates began to rise, exceeding 100 percent by 1993. From 2001 to 2007, Zambia underwent economic stabilization so that lending rates had declined significantly, well below 20 percent by 2007. Lending rates, however, started increasing in 2015 and were approximately 30 percent in 2017. After the liberalization and removal of the exchange control in 1991, the Zambian kwacha experienced significant depreciation and only stabilized between 2002 and 2008, after which it began depreciating again. The Zambian kwacha further underwent depreciation in 2015 and 2016 but stabilized in 2017.

Enabling Environment

Macroeconomic Changes

For most of the 1980s, negotiations between the Zambian government and the IMF were on-again, off-again as economic conditions deteriorated until the need for IMF support outweighed the government's concerns about the loan conditions and terms. The structural adjustment program (SAP) officially commenced in 1991. The macroeconomic environment was turbulent in the 1990s as a result of the policy reforms implemented as part of the SAP. The impacts of some of the reforms made at the time are still being felt today.

FIGURE 4.8 Trends in the Rates of Inflation, Exchange, and Lending



Source: CSO/Bank of Zambia.

Extension services have yet to recover from the budget cuts and staff losses that occurred at the time. Livestock farmers have been particularly hard hit because veterinary camps are larger than agricultural camps. In some districts such as Chipata in the Eastern Province, livestock camps are six times larger, and not fully staffed. Private veterinarians have not picked up the slack, largely because they are concentrated in urban areas.

Zambia has remained politically stable and its stability makes it attractive to investors, including foreign direct investment. Changes in government in the recent past have been the result of the death of sitting presidents. The transitions from one administration to the next have been peaceful.

Through the subsidy programs, namely, FISP and the Food Reserve Agency (FRA), the area under maize cultivated has been expanded and Zambia has moved from being a net importer to a surplus maize producer. By recently implementing an e-voucher, the government has signaled to farmers that their production systems need to be diversified. The amendment of the Credit Act, which assigned the Zambia Commodity Exchange (ZAMACE) the implementation of Warehouse Receipt Systems (WRSs), implies that the government is willing to work with the private sector in developing credible,

structured markets as opposed to serving as the main player in agricultural marketing—with particular reference to maize.

The unintended consequences of government interventions in the market are at times an important source of agricultural risk. These interventions include ad hoc export bans and other export restrictions; the storage of large, strategic grain reserves, price controls through subsidies to millers; and government spending that is skewed toward maize, the main staple crop. During the El Niño weather risk event, Zambia banned exports of maize to neighboring countries at the very time when demand for maize was highest. The lifting of the export ban upon the announcement that Zambia would produce a bumper maize crop was untimely because the region was also expecting a good harvest. The resulting depression of local maize prices was a major disincentive for maize producers.

Input Delivery Delays

The input subsidies program in Zambia has been characterized by input delays. In 1997, input delivery delays coupled with disease outbreaks in livestock led to a 3 percent reduction in agricultural gross national product (GDP). The rains started earlier and occurred in the Western Province instead of the Northern Province as would be expected (FAO and WFP 1998). The government and farmers were unprepared. Even with seasons that start on time and in the areas anticipated, there have been delays in the delivery of inputs. The government therefore decided to restructure the program, piloting the e-voucher in the 2015/16 and 2016/17 seasons. However, the e-voucher also faced challenges, including delays.

Farmers interviewed stressed input delays as one of the key risks they face, both under the traditional and e-voucher systems of FISP delivery. Some of the issues reported included missing names of eligible farmers who had registered and paid their contribution, and so having to register two or more times; the government's contribution not deposited on registered eligible farmers' accounts (for two seasons running in some cases); and deposits being made late by the government, after the growing season had commenced. These issues contributed to late planting and resulting lower yields (Chisanga et al. 2015).

Counterparty Risk

Counterparty risk affects produce buyers, especially in the cotton supply chain. In the early 1990s, the cotton industry was liberalized and several players entered that could purchase cotton anywhere in the country. This led to intense competition between buyers. They provide inputs to farmers at the beginning of the season with the understanding that the farmers will sell them seed cotton at the end of the season. However, owing to intense competition

among buyers, farmers often end up selling to the highest bidder. Although the ginners often recoup their input loans in kind (seed cotton), they do not usually receive as much seed cotton as anticipated from their input investments.

The Role of Government in Risk Management

Policies, including agricultural support, trade, and social, fiscal, and macroeconomic policies, are the principal instruments government uses to manage agricultural risk (Antón 2008). A consensus surrounds the notion that governments should focus on managing catastrophic risks. Catastrophic risk events such as the global financial meltdown, pest and disease attacks, and extreme weather events occur infrequently, but have far-reaching consequences on the sector and people when they do. Facilitating information flows to the farmer requires public resources, as do investments in key drivers of agricultural growth such as feeder roads, research and development, and pest and disease control.

More often, funds to finance the management of such catastrophic shocks come from international sources such as the World Bank's Catastrophe Deferred Drawdown Option (Cat DDO). A Cat DDO is a contingent credit line that provides immediate liquidity to countries in the aftermath of a natural disaster, a time when liquidity constraints are usually highest. It is part of a broad spectrum of risk-financing instruments available from the World Bank Group to help borrowers plan efficient responses to natural disasters. Cat DDO is a comprehensive and proactive approach to manage disaster and climate risks. It helps to improve the capacity to effectively reduce disaster risks and improve management of the socioeconomic and fiscal impacts of disasters. Contingency financing provides important access to postdisaster liquidity to meet emergency and recovery needs.

Cat DDO has three key features. The first is the drawdown trigger for the loan, which is usually the declaration of a state of emergency resulting from a disaster. The second feature of the option is its revolving nature, which allows for amounts repaid prior to the closing date to be made available for subsequent drawdown. The last feature is the number of renewals that may be made up to four times for a total of 15 years. Renewals require that the adequacy of the macroeconomic framework and a disaster risk management program be reconfirmed and updated upon renewal.

Because risk management typically takes up public resources, the gains from utilizing a Cat DDO must be weighed against alternative government expenditures. A general equilibrium analysis can be used to assess the various alternatives.

The government recognizes the importance of the agricultural sector in driving economic development for the poor. To that effect, it has put in

place several programs to help deal with declining agricultural growth, persistently high rural poverty, and low agricultural productivity. These include the Farmer Input Subsidy Program (FISP), the Food Reserve Agency (FRA), and social protection programs including the social cash transfers and food security pack.

Having realized the impact of risk events on its investments, and the greater exposure to those risks by smallholders, the government created the Disaster Management and Mitigation Unit (DMMU) under the office of the vice president to spearhead the coordination, preparation, and response to disaster events. Additionally, the Zambia Vulnerability Assessment Committee, a technical platform that carries out seasonal assessments to identify food-insecure populations and communities and prepares appropriate responses, consists of various stakeholders, including government departments, civil society organizations, United Nations agencies, and bilateral and multilateral development organizations.

In 2011, the government established the Zambia National Climate Change Secretariat with the mandate to design and implement climate change mitigation and adaption initiatives such as the Pilot Program for Climate Resilience. Other existing agricultural risk management initiatives include the Integrated Production and Pest Management Project, focused on the cotton commodity chain, and the Conservation Agriculture Scaling Up (CASU) project under the auspices of the UN Food and Agriculture Organization (FAO); Livestock Development and Animal Health Project; Irrigation Development and Support Project; and Agriculture Productivity Program for Southern Africa under World Bank support.

Table 4.3 shows the 2017 budget allocations for various activities aimed at developing the agricultural sector. Most of the funds are for input subsidy provisions at $296 million. Irrigation development was allocated at $44 million in 2017; however, since 2011, an estimated $245 million has been allocated

TABLE 4.3 Value of Government/Donor-Financed Agricultural Projects by Type of Activity, 2017

Activity	Allocation (US$, millions)
Grain storage	18
Livestock disease control	4
Irrigation development	44
Social cash transfers	56
FISP through e-voucher	296
Extension services (crop and livestock)	3
Research	4

Source: 2018 National Budget (Ministry of Finance).
Note: FISP = Farmer Input Subsidy Program.

toward irrigation development. Besides irrigation, the other priority areas of the agriculture development expenditure are through social cash transfers, research, extension, and disease control. The government also embarked on a project to expand grain storage from about 800,000 MT in 2011 to 2,000,000 MT at a cost of about $18 million.

The expenditure on social cash transfers is an important intervention for households vulnerable to agricultural risks. Effective targeting of vulnerable households is key, so that households with productive capacity are targeted through other means such as e-voucher FISP or other mechanisms.

The government also has a unique role in increasing farmers' awareness of risks and risk management through communication channels at its disposal. Using Information and Communication Technologies (ICTs) such as mobile phones, which many farmers use, government can communicate early warning information and raise awareness about effective methods to mitigate risks.

The government can also catalyze private investment in cost-effective irrigation systems that are well-suited to communal farmers (Ngoma et al. 2017). Cost-effective irrigation technologies help smallholder farmers improve their livelihoods by allowing for a more efficient use of inputs in the following ways: (a) use less water to grow the same amount of crops; (b) reduce the amount of fertilizer needed per plant, dissolving nutrients in the irrigation water for uniform application; (c) reduce energy use through lower water use; and (d) decrease the amount of time required to provide water to a crop area by regulating the flow of water in the irrigation operation.

Although Zambia has witnessed a number of large irrigation projects, it is largely smallholder farmers who irrigate their gardens, and these are located mostly in the *dambos* (wetlands). Field crop irrigation is almost nonexistent. Participation in communal smallholder irrigation schemes is limited by poor organization of farmers and the very small size of such schemes (Ngoma et al. 2017). Smallholders can benefit from cost-effective irrigation technologies.

Several factors are necessary to unleash these positive impacts: (a) Farmers' initial awareness of and knowledge of how to use irrigation resources. This includes the suitability of the farmers' land, their choice of crops, the level of intensity of cropping practices, and proper maintenance of the equipment. (b) Access to water, the availability of reliable roads to transport crops to markets, and access to storage facilities. (c) The government's role in ensuring that appropriate regulations are in place to support smallholder agriculture (without crowding out the private sector) and to ensure farmers' access to technology. (d) Availability and quality of the other agricultural inputs used by the farmer, such as seeds, fertilizer, pesticides, and machinery. (e) Access to markets. (f) Access to finance to purchase efficient irrigation equipment.

CHAPTER 5

Impacts of the Risks on the Agricultural Sector

Overall Agricultural Losses

This chapter attempts to quantify the impacts of risk events in terms of the magnitude and frequency of the losses and the stakeholders affected. The impacts are expressed in terms of losses in crop and livestock production and trade losses resulting from export bans.

Table 5.1 shows the cumulative and average annual losses from production risks for selected crops. Between 1982 and 2016, the crop subsector experienced a total of $1.3 billion of risk-related losses. This translates to $38 million in 2004–06 constant prices on average annually, or 2.43 percent of the total annual agricultural production value in Zambia. Of the crops analyzed, 35 percent of losses are from maize, suggesting a high impact of agricultural production risks on smallholder food security. Similarly, groundnuts and cotton account for 22 percent and 20 percent, respectively, of total annual losses. Sugarcane is an important part of the agricultural economy; however, because it is almost exclusively commercially grown under irrigation, smallholders are shielded from sugarcane production losses, which account for 13 percent of total agricultural losses.

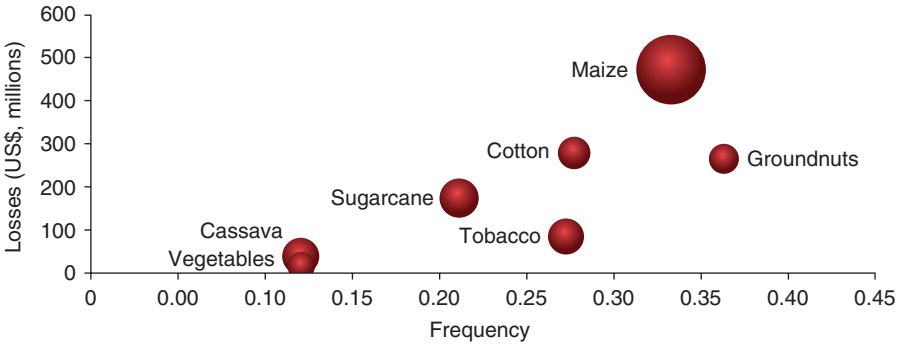
Although the average annual losses are high, the impacts of the individual shocks are even more devastating. Average figures are useful to understand the aggregate costs of production risk, yet they tend to conceal the catastrophic impacts that some shocks have on participants in the sector at the time they occur. Shocks have considerable impact on household and national food security, exhibit important fiscal repercussions, reduce the availability of foreign exchange, and have an overall macroeconomic destabilizing effect. Figure 5.1 shows the magnitude of losses for individual years, where the size of the circle depicts the losses as a share of total agricultural production value. The figure depicts the magnitude of the losses on the larger agricultural sector. Figure 5.2, conversely, shows the annual losses per hectare (ha) per commodity, illustrating the impact on smallholder income. Cotton, groundnuts, and tobacco are primarily grown for sale as commodities, and therefore macroeconomic changes such as inflation, exchange rates, and interest rates have a more significant impact on them than on crops such as maize and cassava that are primarily grown for household consumption. This has implications for policy makers about the types of risk management interventions that would be undertaken for the various commodities, as is described herein.

TABLE 5.1 Losses from Agricultural Production Risks (1982–2016)

Crop	Average annual losses (tons)	Average annual losses (US$)	Annual % loss of agricultural GDP (2011–13)	Total losses (tons)	Total losses (US$)
Cassava	10,246	1,030,125	0.06	358,613	36,054,360
Maize	89,469	13,460,611	0.84	3,131,422	471,121,397
Vegetables	1,423	427,008	0.03	49,818	14,945,283
Cotton	7,882	7,925,165	0.50	275,862	277,380,787
Sugarcane	22,128	4,952,933	0.31	774,483	173,352,661
Groundnuts	6,118	8,517,495	0.53	214,146	298,112,338
Tobacco	2,864	2,378,292	0.15	100,257	83,240,235
Total	140,131	38,691,630	2.43	4,904,601	1,354,207,060

Source: Authors' analysis from Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) and Crop Forecast Survey (CFS) Central Statistical Office (CSO).

FIGURE 5.1 Cumulative Value and Frequency of Losses per Crop (1982–2016)

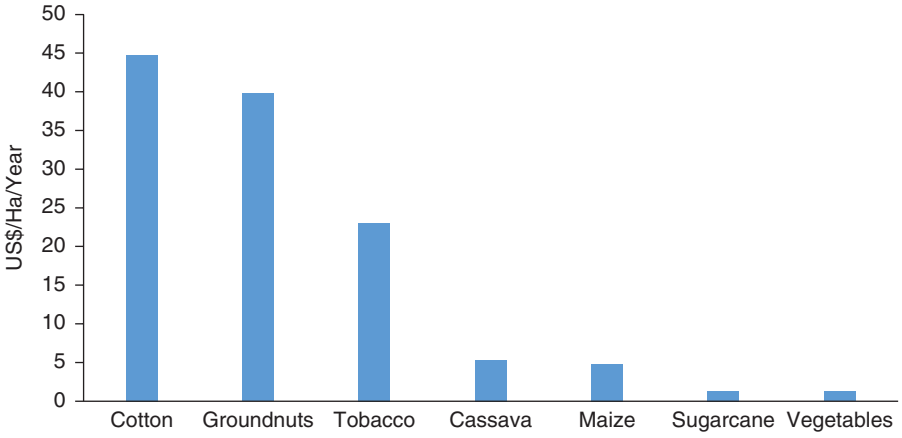


Source: Authors' compilation from FAOSTAT and CFS (CSO) databases.

Note: FAOSTAT data were not available for 2015 and 2016, whereas 20-plus-year CFS data were not available for all commodities. Therefore, FAOSTAT data were used for 1982–2014, whereas CFS data were used for 2015–16 to capture the impact of the recent El Niño event. The sizes of the balloons indicate the relative value of the losses across crops.

The losses, as a proportion of gross production value (GPV), were extreme for important crops such as maize, tobacco, and cotton, implying disastrous impacts on household incomes, food security, and well-being. Losses for maize as the national staple crop had particularly devastating impacts on household food security, whereas tobacco and cotton impacts had more effect on household income. Maize, groundnuts, and cotton have the highest average annual and the most frequent losses, making the farmers growing the crops highly exposed to shocks (figure 5.1). Cassava and cotton are drought tolerant; their losses were caused mainly by disease (cassava mosaic) and flooding especially in 2000 and 2002, respectively. Groundnuts have frequent but relatively small losses that add up over time. Sugarcane losses, although relatively small as a

FIGURE 5.2 Loss Value per Hectare (1982–2016)



Source: Authors' compilation from FAOSTAT and CFS (CSO) databases.

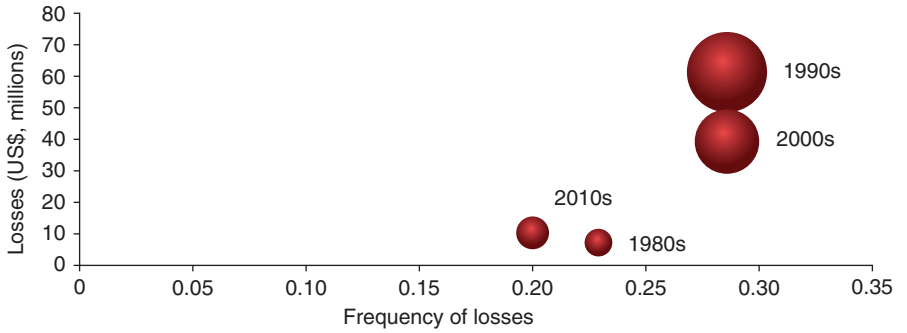
BOX 5.1 To What Do the Annual Losses per Hectare Translate?

Annual maize losses per hectare are US$4.8, which is equivalent to ZMW 48. According to farmers in the Kalomo District, Southern Province, this would translate to a bucket of mealie meal (about 20 kg), which would feed an average family for three weeks for net food buying households. In terms of grain, this is a loss of about a 50-kg bag of maize (0.7 ZMW/kg to 1.5 ZMW/kg) for net food selling households. However, most Zambian smallholder households are net food buyers (Chapoto and Sitko 2015).

proportion of its production value, becomes sizable because of its contribution to GPV when compared with other crops. With the exception of maize, crops with relatively high frequency of losses also tend to have high losses per hectare.

The highest frequency of major shocks to the agricultural sector were experienced in the 1990s, followed by the 2000s. The 1980s and 2010s experienced the least frequency of risk events. The highest frequency and magnitude of losses occurred in the 1990s and 2000s, which were a result of severe droughts and excessive rainfall and floods, respectively (figure 5.3). Clearly, the observed value of losses across the four decades is directly related to the frequency of exposure to risk events. Notable is the drought in 1992 in which $154 million was lost, equivalent to 10 percent of agricultural gross domestic product (GDP) (figure 5.4). There was consensus among the farmers and other stakeholders involved in the sector at the time that it was the worst risk event that Zambia had ever experienced. The government reached out to the

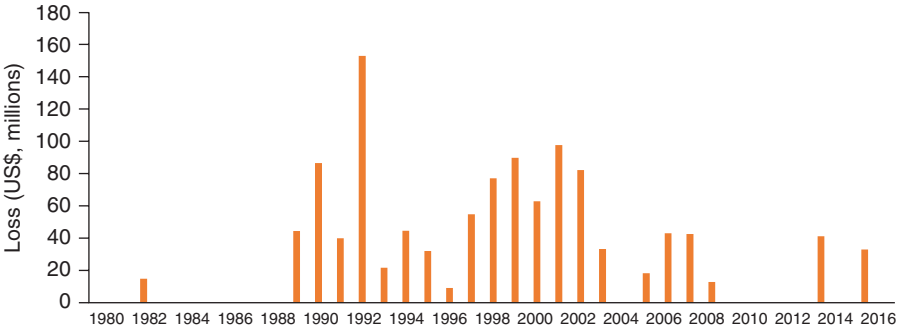
FIGURE 5.3 Average Annual Value and Frequency of Losses by Decade in Zambia (1982–2016)



Source: Authors' compilation from FAOSTAT and CFS (CSO) databases.

Note: The sizes of the balloons reflect the relative value of the losses across decades.

FIGURE 5.4 Annual Value of Losses



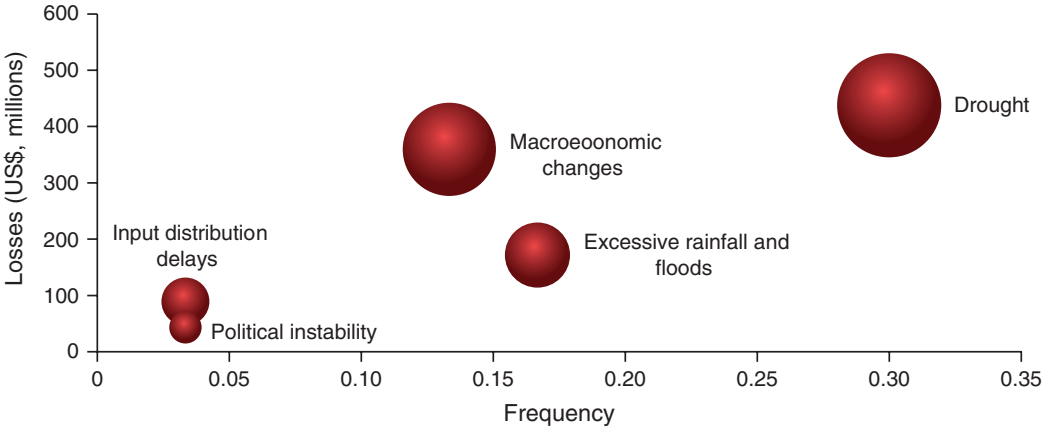
Source: Authors' compilation from FAOSTAT and CFS (CSO) databases.

international community for humanitarian assistance, and the country was supported with supplies of yellow maize.[6] In 2001, excessive rainfall led to flooding in most parts of the country and thus a $98 million loss, equivalent to 6 percent of agricultural GDP. The 2010s have so far not seen many losses, though only six years were analyzed, and thus the probability that a major risk event(s) may still occur is very real. Steps to prepare for that eventuality are discussed in the next chapter.

Overall, drought, macroeconomic changes, and excessive rainfall and floods had the highest impact on the agricultural sector with $438 million, $361 million, and $172 million, respectively (figure 5.5). As previously discussed, the definition of *drought* includes dry spells, localized events, and severe events,

[6] Zambians produce and consume white maize, and so the yellow maize distributed in the form of humanitarian assistance in 1992 is particularly notable.

FIGURE 5.5 Cumulative Value and Frequency of Losses per Risk (1982–2016)



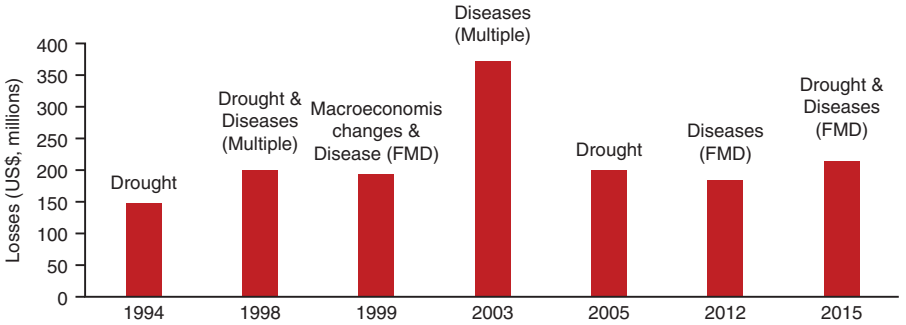
Source: Authors' compilation from FAOSTAT, CFS (CSO), and FEWSNET databases.

Note: The sizes of the balloons reflect the relative size of the losses by source of risk.

whereas macroeconomic changes include volatile inflation, exchange rate fluctuations, and volatile interest rates. Excessive rainfall and floods tend to go hand in hand. They were quite frequent but localized and therefore resulted in relatively small aggregate losses. Political uncertainty exemplified by riots and an attempted coup that led to multiparty democracy had a $45 million impact on crop production. Input delays were highlighted in 1997 in what would otherwise have been a good production year. Rains started early in the Western Province instead of in the North and South Provinces, as would be usual, but the government was unprepared for the early rains, resulting in late input distribution and a $90 million loss in production value.

For the livestock sector, the period studied was 1991–2015 because of data limitations (figure 5.6). During this period, a total of $1.3 billion is estimated

FIGURE 5.6 Livestock Losses



Source: Authors' compilation from World Organisation for Animal Health (*Office International des Episooties*) (OIE) and Post Harvest Survey.

to have been lost, of which 99 percent was attributed to the beef commodity chain. The hypotheses for the small losses in pigs and chicken are the following: (a) Pigs and chicken have significantly lower risks than cattle; (b) outflows from pig and chicken herds/flocks are not significantly different between risk event years and normal years; and (c) herd dynamics and livestock production (products) are not sufficiently captured with the available data. Because of data limitations, it was not possible to test these hypotheses.

Because of farmers' coping behavior in the event of drought, it is assumed that drought was the cause of the loss in years when droughts were accompanied by disease outbreaks. Communal grazing practices, where animals congregate around watering points during droughts, tend to lead to outbreaks (Hamoonga et al. 2014). Foot-and-mouth disease (FMD) was the single most important disease economically. It is estimated that the government spends $2.7 million annually on controlling FMD (Sinkala et al. 2014). Cumulatively, drought had the most significant impact, closely followed by disease. The other notable risk event is reported to have been inflation in 1999. The high losses in the livestock sector are attributed to the high value of the animals.

Trade Losses Caused by the Export Bans

Maize has the potential to boost Zambia's export revenue, especially when the economy is struggling from reduced export revenues as a result of falling copper prices. In 2015, Zambia earned $210 million from the exports of maize and related products. Zambia can increase its maize exports without undermining its own food security. Unfortunately, export restrictions imposed on the 2016 harvest meant that Zambia missed any opportunity to capitalize on its potential to maximize export earnings from maize. In 2015, this opportunity was lost to imports by countries such as South Africa, Zimbabwe, and Malawi.

Table 5.2 shows trade losses in terms of potential export earnings that could not be earned because of export bans and restrictions between 2008 and 2016. Note that this assumes that Zambia maintains a strategic grain reserve of 500,000 metric tons (MT) and that there is regional maize demand. Given the high export parity prevailing in the 2016/17 maize marketing season, Zambia had to forgo $270 million in export revenue. Over the period 2008 and 2016, Zambia may have forgone nearly $1.36 billion dollars because of export restrictions (table 5.3).

TABLE 5.2 Estimated Cumulative Losses to the Livestock Sector by Risk Event, 1991–2015

Risk	Estimated losses (US$)
Drought	686,105,072
Disease	521,496,781
Macroeconomic changes	173,743,381

TABLE 5.3 Value of Forgone Foreign Exchange Earnings as a Result of Limited Maize Exports (2008/09–2015/16)

Production Year	Production (1,000 MT)	Production + Carryover Stocks (1,000 MT)	Domestic Consumption (1,000 MT)	Expected Exports (1,000 MT)	Exported Formally (1,000 MT)	Not Exported Formally (1,000 MT)	Forgone Foreign Exchange Earnings through Trade (US$)
	A	B	C	D = B – C	E	F = D – E	G = F × Export Parity Price
2008/09	1,887	1,950	1,700	250	173	77	16,940,000
2009/10	2,795	3,094	2,000	1,094	3	1,091	240,020,000
2010/11	3,020	3,450	2,500	950	30	920	202,400,000
2011/12	2,853	3,550	2,500	1,050	358	692	152,240,000
2012/13	2,532	2,988	2,500	488	73	415	91,300,000
2013/14	3,351	3,948	2,500	1,448	231	1,217	267,746,329
2014/15	2,618	3,964	2,500	1,464	895	568	116,528,765
2015/16	2,873	3,541	2,500	1,041	221	820	270,567,279
Total							1,357,742,373

Source: Ministry of Agriculture and Livestock (MAL)/CFS, Common format for Transient Data Exchange (calculations of forgone foreign exchange based on authors' computation).

The Impacts of Agricultural Risks on Different Stakeholders

The impact of the risks is a function of variation in vulnerability, that is, sensitivity, adaptive capacity, and exposure. Sensitivity is described as "the degree of impact of the initial shock"—in other words, the changes in consumption levels in response to the shock. Adaptive capacity is "the ability of the household to access ex post coping strategies that helps it return to pre-shock welfare levels," whereas exposure is "the probability of a given shock materializing and affecting the household's assets" (Choudhary et al. 2016).

The more the value chain progresses from producers to exporters and processors, the higher the capacity to cope with the shocks described earlier. High poverty rates in rural areas leave smallholder farmers vulnerable and with low adaptive capacity to risks, especially to weather risks and price volatility. Most smallholders are not organized despite the best efforts by the government and nongovernmental actors. In cases in which farmer groups and association have been formed, this tends to result from them wanting to access to benefits from either a government or nongovernmental program. Hence, they are very weak and unable to advocate on behalf of their members. The Zambia National Farmers Union (ZNFU) is the largest farmer representative body in the country; however, it is largely subscribed to by commercial and medium-scale farmers and large agribusinesses. Although ZNFU has branches in virtually all districts in Zambia, the influence of smallholders

remains negligible. In response, another union to represent the smallholder farmers, the National Small-scale Farmers Association of Zambia (NUSFAZ) was formed in 2014. The impact of NUSFAZ has yet to be felt because they have yet to fully establish themselves countrywide. Commodity-specific farmer organizations have also been created, such as the Cotton Association of Zambia and the Tobacco Association of Zambia, but they are also too weak to represent the interests of the thousands of smallholder farmers.

Smallholders grow crops for various purposes. Staples such as maize and groundnuts are dual purpose. More than 50 percent is sold and the rest consumed by producing households. Cotton and tobacco are almost exclusively grown for market (99 percent), whereas cassava and vegetable production is primarily consumed by the household (only 22 and 36 percent, respectively, is sold) (Chapoto and Mbata-Zulu 2016). Smallholder livestock production also has multiple purposes—consumption, insurance, savings, income, and prestige. However, unlike crop farmers, livestock farmers will sell only if they must.

In bad seasons, the proportion of dual-purpose crops that is consumed by households increases. Therefore, the impact of the losses is felt both in terms of household food security and income. Own-produced food stocks in the drought-affected 2015/16 season were expected to last 3 months or less for most respondents, whereas in a good year, they would have been expected to last 11 months or more. In addition, access to the market to supplement own production is limited by lower income given the lack of surplus food for sale, thus reducing the adaptive capacity of smallholder households (Zambia Vulnerability Assessment Committee [ZVAC] 2016).

The ZVAC assessment of 2015/16 also found that the Food Consumption Scores were lower than those of the previous season as a result of adverse coping mechanisms such as reducing the number of meals consumed per day and the consumption of nutritionally less preferred foods. Risk solutions targeting smallholders should be a combination of increasing productivity and mitigating production losses. Furthermore, the level of commercialization at the provincial level differs. The Central, Eastern, Muchinga, and Copperbelt Provinces are more commercialized than the Western, Luapula, and Lusaka. Therefore, the former would have more market-oriented interventions, whereas the latter would benefit more from social protection and other interventions that protect household food security and increase their adaptive capacity.

Livestock is primarily a vehicle for savings and insurance among smallholder producers, who tend to sell off more animals during severe droughts. However, higher volumes in the market as well as poorer physical condition scores also tend to lead to lower prices. Livestock sales therefore tend to become a coping mechanism of last resort. The higher incidence of disease outbreaks during moderate and severe droughts further compounds the

adverse impacts of the risk events. Therefore, social protection interventions as well as increasing access to water, feed, and animal health services during severe droughts would be beneficial.

Medium-scale farmers produce primarily for the market. For example, results from the Rural Agricultural Livelihoods Survey (RALS) 2015 show that households that cultivated 10 hectares or more had the highest household commercialization index—65 percent. These households are highly exposed to market and enabling environment shocks such as price volatility and export bans, respectively. Interviews with stakeholders indicated that commercial and medium-scale farmers had better access to markets, finance, inputs, and technology and therefore had a higher adaptive capacity. Given their exposure to market risks, commercial and medium-scale farmers would benefit more from interventions that would bring about more stability on the market, for example, predictable and stable trade policies, capitalization of the Zambia Commodity Exchange (ZAMACE) and more robust Warehouse Receipt System (WRS).

Traders are usefully classified into small-, medium-, and large-scale operators. Small-scale traders buy directly from farmers at farm gate prices and operate at minimal margins. Their lack of storage facilities means they must sell commodities within a short period of time, making them less capable of taking advantage of seasonal price variations. This predisposes them to higher price risks. Medium-scale traders have access to some storage facilities and have higher stock turnover, and therefore have better risk coping mechanisms than do small-scale traders. Both small-scale and medium-scale traders are constrained in terms of access to credit for investing in storage facilities.

Large-scale traders consist of corporations, including multinational firms such as Cargill, NWK Agri-Services, and AFGRI Corporation. They have access to capital and credit, which allows them to invest in storage and to purchase large stocks of commodities in the market. Access to storage facilities allows them to take advantage of spatial and temporal price differences. In this regard, large-scale traders have well-developed risk-coping mechanisms. In addition, large-scale traders also sign forward contracts with large-scale farmers and processors as a way of mitigating price and other risks. However, these traders are more vulnerable to government policy interventions including ad-hoc import and export bans. They are also negatively affected whenever the Food Reserve Agency (FRA) offloads large quantities of maize stocks at below-market prices to millers because they cannot compete with the FRA at these prices. Policy consistency would help moderate the market and price risks. A fully functional commodity exchange would benefit these large traders, especially if the FRA utilizes such an exchange to procure or sell the strategic reserve stocks.

Traders and exporters are highly exposed to macroeconomic changes and government interventions in markets. Exporters though have greater adaptive

capacity than traders because of their access to risk transfer instruments such as hedging, insurance, and contingency loans (trade finance) and their ability to lobby and influence governments to reverse decisions that may have adverse impacts on their businesses through organizations such as ZNFU and the Grain Traders Association of Zambia (GTAZ).

Processors include maize millers producing mealie meal and stock feed. Most urban consumers depend on large commercial millers, whereas rural consumers use mostly hammer millers. Large-scale millers have significant leverage with government and throughout entire value chains because of the sensitivity that government attaches to retail food prices. With the increased maize purchases by government, millers have become increasingly dependent on maize from the FRA, often at below-market prices. Therefore, the market and price risks borne by millers are much lower than traders and producers.

Unlike most of the other actors in the value chain, input distributors did not face major risks. Input delays in the government program have been a boon for input distributors. Their main constraint was poor infrastructure, which increases their transport costs, and poor access to finance, especially for the small-scale distributors.

Financial institutions' role in the agricultural sector is changing. As agriculture's share of GDP has decreased, lending to agriculture has also decreased. It fell from 30 percent in 2004 to 13 percent in 2014 (Simpasa 2016). A survey by the African Development Bank found that the larger the financial institution, the more likely it is to lend to the agricultural sector. Commercial farmers and agribusinesses are most likely to have access because they are more likely to have sufficient collateral and the transactions costs are lower per loan than for those of medium scale and smallholders. The impact of agricultural risks has led to the sector having the highest proportion of nonperforming loans. The authors of the report observed that "47% of total loans by large banks in the agriculture sector were classified as doubtful or in default" (Simpasa 2016). Interventions to improve risk management in the agricultural sector as a whole are anticipated to have a positive impact on agriculture lending. With nearly 50 percent of farmers financially excluded, there is still room for growth in agricultural finance, particularly in developing appropriate products for agricultural producers whose income is seasonal.

Vulnerable Groups and Impact on Household Food Security

Though agricultural shocks were less frequent and had less impact in the past 10 years than in the two decades prior, high rates of rural poverty, among other factors, limit Zambia's capacity to cope with risk events. According to the Rural Agricultural Livelihoods Survey, most smallholders rely on their

own production for household food consumption, which is supplemented by income from cash crops such as tobacco and cotton. Production is rain fed, leaving rural households highly exposed to food insecurity in the event of a weather shock. Small landholdings, inability to expand the holdings, and low levels of fertilizer and manure use (25 percent and 6 percent, respectively) mean that optimal productivity cannot be achieved. With an average of 2.1 hectares cultivated per household using hand hoe or draft animals for tillage, individual production is often insufficient to meet household consumption needs. Therefore, price volatility and depressed prices for cash crops as well as poor transmission of marketing subsidies to consumers hamper food access for smallholders (Indaba Agricultural Policy Research Institute, 2016). Poverty is another contributor to vulnerability. Decline in well-being is higher for poor than nonpoor households experiencing the same shocks, making them more vulnerable to food insecurity (Giertz et al. 2015).

The sale of productive assets such as livestock is a key coping mechanism. From focus group discussions with farmers, the study noted that in cattle-keeping communities where cattle are a source of draft power, selling off cattle was the last resort in the face of a shock. Goats, pigs, chickens, and other household assets were more easily sold. Other notable coping mechanisms were the consumption of fewer meals or maize bran, remittances from relatives in urban areas, borrowing from other farmers, working on other farmers' fields in exchange for food, taking children out of school, and prostitution.

It is worth noting that smallholder profiles and their levels of exposure vary widely, depending on their cropping system, location, landholding size, gender, and household size, among other factors. Based on the livelihood profiles developed by the FAO and the Indaba Agricultural Policy Research Institute (IAPRI), five livelihood profiles or clusters have been identified based on income or the size of landholdings. The livelihood profiles provide a more nuanced picture of the typology of smallholder farming households in Zambia. Most of the 1.5 million smallholder farming households in Zambia fall into the cluster of *poor accessible* households (57 percent) followed by *poor remote* households (13 percent). *Wage-earning* households make up 4 percent, whereas *outgrowing households* make up 26 percent. *Market-participating* households make up less than 1 percent (Subakanya et al. 2017). About 70 percent of rural households belong to the "poor" clusters; typically, these have high rates of poverty and food insecurity. The other three household clusters are generally better off, either because they participate in wage employment, obtain credit for agricultural purposes or are market oriented (Subakanya et al. 2017). This means that interventions aimed at building climate resilience must take into account heterogeneity among smallholder farmers in Zambia.

CHAPTER 6

Risk Prioritization and Management

Agricultural risks vary in the severity, frequency, and distribution of their impacts on different agroecological zones, commodities, and the broader economy. Food security and rural livelihoods need to be considered at each of these levels.[7] To better utilize scarce resources, it is important to understand which risks cause major shocks to the sector in terms of losses and to observe the frequency with which they occur. This chapter summarizes the risks faced by the agricultural sector in Zambia and the possible solutions identified during the study. These were validated through a stakeholders' consultative workshop held in the Chisamba District in June 2017.

Risk Prioritization

Tables 6.1 and 6.2 summarize stakeholders' opinions regarding how agricultural risks should be prioritized, defined based on the probability of the event, and its expected impact in terms of production value, household food security, vulnerability, and income of different stakeholders. The tables list the most significant risks based on their potential to cause significant losses to the agricultural sector and the frequency of their occurrence. These corroborate in large measure the results presented in chapter 5.

In terms of prioritization, the following emerged as the most important risks to Zambia's crop subsector: (a) drought, (b) excessive rainfall and floods, and (c) price volatility. In the livestock subsector, the top risks are (a) drought and (b) disease outbreaks.

Risk Management Solutions

A long list of solutions was developed from stakeholder interviews, focus group discussions, and published literature on Zambia's agricultural sector (see appendixes A and B). The proposed strategies are a combination of risk-mitigation, risk-transfer, and risk-coping instruments. For risks that are frequent but with limited impacts, the best approach is to try to mitigate them.

[7] *Source:* Mozambique: Agricultural Sector Risk Assessment (World Bank 2015). http://p4arm.org/app/uploads/2015/02/Mozambique000A00risk0prioritization.pdf.

TABLE 6.1 Risk Prioritization—Crop Subsector

Probability of Event	Impact (Losses)			
Crops	Low (< 10%)	Moderately High (10%–30%)	High (30%–50%)	Critical (> 50%)
Highly Probable (1 year in 3)	• Crop levies ad hoc	—	• Price volatility	—
Probable (1 year in 5)	—	—	• Localized drought and dry spells	—
Occasional (1 year in 10)	—	• Inflation • Exchange rate fluctuation • Macroeconomic changes • Trade restrictions	• Floods	—
Remote (1 year in 20)	• Input distribution delays	• Political instability • Pests • Disease	• Postharvest losses	• Severe drought

Note: — = Not available.

TABLE 6.2 Risk Prioritization—Livestock Subsector

Probability of Event	Impact (Losses)			
Crops	Low (< 10%)	Moderately High (10%–30%)	High (30%–50%)	Critical (> 50%)
Highly Probable (1 year in 3)	—	• Ad hoc levies	• Price volatility • Input supply delay	—
Probable (1 year in 5)	—	—	—	—
Occasional (1 year in 10)	• Floods	• Macroeconomic changes	• Disease	• Drought
Remote (1 year in 20)	• Inflation	• Political instability	—	—

Note: — = Not available.

Risk Management Options

In this section, we provide risk management options followed by examples of their implementation in other countries. Implementing the risk management options involves coping with a number of constraints, including investment costs, transaction costs, operations and maintenance costs, scalability, and the knowledge-intensive nature of some of the solutions. For example, strengthening climate resilience for smallholder farming systems and improving early

warning systems (EWSs)[9] require substantial up-front investments (Braimoh and others, 2018). Financing agricultural risk in remote areas entails high transaction costs of reaching remote populations. It also requires robust technical and institutional capacity to design and deliver effective agricultural risk products and services.

Tables 6.3, 6.4, and 6.5 summarize the various risk management options for the agricultural sector in Zambia. The government can easily act on some risk solutions with few financial implications. For example, the risks emanating from price volatility can be addressed through improved agricultural trade policies, such as avoiding export bans, and by fostering private sector participation in the maize market.

Production risk and management options. Several options exist for addressing production risks affecting both the crop and livestock subsectors. Essentially, the proposed risk management solutions seek to improve access to and the quality of early warning systems to enhance decision making for both subsectors and improving the climate resilience of smallholder farming systems. Specific components of each risk management option and how it could work are presented in table 6.3.

Disease outbreaks and mitigation options. Managing the risk of disease outbreaks requires addressing existing gaps in livestock information systems to strengthen decision making for disease control. Table 6.4 provides details on how the proposed risk solution could work and the issues to consider.

Price and market risk and mitigation options. The main cause of price volatility among staple crops is unpredictability in the policy space, excessive government involvement in the maize markets, and the limited diversification of Zambia's agriculture. Proposed risk management options thus focus on (a) diversification to other crops such as cashews, soya beans, cassava, and rice and to a combination of crop–livestock production; and (b) trade policy stability to allow better private sector participation. Risk management options also include capitalization of the Zambia Commodity Exchange (ZAMACE) to ensure its sustainability. Specific components of the risk management options and how it could be operationalized are presented in table 6.5.

Table 6.6 summarizing the risk prioritization exercise suggests that risk management solutions tend to be more specific to the prioritized risks. Improved access to early warning information helps to improve decision making for managing weather risks and diseases. However, improved access to early warning information is a necessary but not sufficient condition for managing weather risks. Agricultural diversification and adoption of other

[8] An early warning system (EWS) is an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication, and preparedness activities systems and processes that enables individuals, communities, governments, businesses, and others to take timely action to reduce disaster risks in advance of hazardous events (United Nations Office for Disaster Risk Reduction).

TABLE 6.3 Weather Risk Management Options

Risk management solution	Elements requiring investments	Why is it needed?	Current state and challenges with the proposed risk solution	How to overcome the challenges	Impact of the intervention and scalability	Relative costs
Strengthening Early Warning Systems (EWS) (M, C)	-Automated weather stations, weather information system, and supporting infrastructure -Agricultural extension -Capacity building -These intervention elements target services that will benefit smallholder farmers.	-Enhance quality of decision making. -Increase awareness.	-Limited meteorological and hydrological weather stations (only 108 stations in 45 out of 107 districts). -Early warning information is not translated into the local language and may not be as useful at the subnational level as it is at the provincial level.	-Strengthen the technical capacity for data analysis, machinery operation at various levels in the ZMD and the DMMU. -Install additional infrastructure and leverage ICT.	-Highly scalable. -Contributes toward food security and poverty reduction, particularly among smallholder farmers, and the farming community in general through disaster risk reduction.	Low
Flood control infrastructure modernization	-Promote of the use of soil bunds, reduced tillage, agroforestry, and any such farming systems to attenuate flood risk at farm level (directly targeting the farmers). Facilities that do not directly target farmers include the following: -Retention basins -Dams/reservoirs -Diversion channels farmers	-To alleviate flood risk, protect areas and transport water.	-Low uptake among farmers because of limited finance to meet upfront investments and limited knowledge on how to appropriately implement the farming systems -Limited investments in dams and diversion canals to direct water flows away from agricultural lands	-Enhance knowledge transfer via extension and smart subsidies to enhance adoption of flood mitigating farming systems at farm level -Investments in dams/ reservoirs at community level to adapt flood mitigating farming systems to local contexts	-Scalable. -Positive impacts on sustainable natural resource management. -Potential to increase food security, reduce poverty through reductions in crop loss from flooding.	Moderate

Risk management solution	Elements requiring investments	Why is it needed?	Current state and challenges with the proposed risk solution	How to overcome the challenges	Impact of the intervention and scalability	Relative costs
Strengthen the climate resilience of smallholder farming systems (M, C)	-Awareness (extension) for smallholder farmers -Seed systems development and dissemination (targets both smallholder farmers and services that are indirectly linked to the smallholder).	-To minimize yield shocks in moisture stress years. -Sustainable agricultural production. -Minimize distance traveled by livestock in drought years.	-Poor adoption rates of conservation agriculture practices despite promotion for more than 15 years. -Farmers in the drought-prone areas are susceptible to weather shocks. -Weak seed systems, with limited public finance toward research and development.	-Understand the barriers to adoption. -Consider CSA benefits in form of avoided greenhouse gas emissions a public good. -Strengthen extension service delivery.	Highly scalable with positive impacts on food security among smallholders and within the country.	High
Increase access to risk financing (T, C)	Smallholder financial inclusion by expanding the availability of finance to the rural economy. - Strengthen rural financial institutions. -Provide adequate predictable contingency funding.	-Enable farmers to adopt new technologies. -Increase uptake of insurance. -Enable DMMU and other related government ministries and agencies to respond to extreme risk events in a timely manner.	-Low adoption rates of insurance products. -Agricultural financing remains low, with high interest rates and poor access to credit by farmers. -High transaction costs of reaching remote rural populations. -Higher perceptions of nonrepayment because of sector-specific risks, such as production, price, and market risks. -Financial institutions' lack of knowledge of agriculture-specific risks, effective means of managing transaction costs, marketing financial services to agricultural clients. -Government policies could create disincentives for private sector lending and provision of financial services to the agricultural sector. - DMMU and other government agencies scramble for resources in the event of large-scale events because of limited allocation to emergency fund, thus response takes longer and so increases the impact.	-Segment the smallholder farmers, identify their financial needs, and design products tailored to the needs. -Reduce the risk in agricultural finance by addressing both individual risks and systemic risks. -Raise awareness on insurance and other financial products. - Partner with appropriate institutions and delivery channels to reduce the costs of serving agricultural clients. - Utilize World Bank's Cat DDO option for extreme risk events to enable a rapid response while mobilizing additional resources.	Highly scalable with expected high impacts on profitable investments among smallholder farmers that could lead to increased food security and poverty reduction. -High impact and scalability that will improve timeliness of response and reduce impact for affected communities.	High Low

Risk management solution	Elements requiring investments	Why is it needed?	Current state and challenges with the proposed risk solution	How to overcome the challenges	Impact of the intervention and scalability	Relative costs
Expand social protection program I	-Integrate humanitarian relief and disaster risk management with national safety nets. - Integrated beneficiaries' registry. - Provide food but also seeds and other inputs for next season. - SCT scheme. - Build shock-responsive safety nets. -The intervention directly benefits the smallholder famers.	-To help households cope with exposure to agricultural risks.	- There is need to better integrate social protection, humanitarian and disaster risk management. -There is insufficient social protection at the expense of prioritization of ineffectual maize input and output subsidies. -The budget for SCTs was increased in the 2017 national budget, but is still very small in comparison with the input subsidy program.	-Reform the input and output subsidy programs in ways that lead to cost savings that can be channeled toward social protection.	High impact and scalability, with positive impacts on poverty reduction and food security.	Low
Improve management of rangeland and livestock resources (M, C)	-Watering points for livestock. -Production and dissemination of drought tolerant pasture seeds. -Awareness and training. -The proposed interventions directly and indirectly benefit the smallholder farmers.	-Increase production of drought tolerant pastures. -Raise awareness on drought-tolerant pastures and increase their adoption.	-Animals graze in communal pastures.	-Invest in watering points at the community level. -Enhance extension service delivery.	High scalability with a relatively high impact on food security and resilience.	Low

Source: Authors.
Note: M, T, and C stand for Risk mitigation, Transfer, and Coping, respectively; Project costs: Low implies < $100 million; Moderate, between $100 and $300 million; and High > $300 million. The cost estimates are based on similar World Bank interventions.
CSA = climate-smart agriculture; Cat DDO = Catastrophe Deferred Drawdown Option; DMMU = Disaster Management and Mitigation Unit; ICT = information and communication technology; SCT = scale-up social cash transfer; ZMD =Zambia Meteorological Department.

TABLE 6.4 Option for Managing Disease Outbreaks

Risk management solution	Elements requiring investments	Why is it needed?	Current state and challenges with the proposed risk solution	How to overcome the challenges	Impact of the intervention and scalability	Relative costs
Strengthening animal health systems (M)	-Technical support in form of disease forecasting, monitoring, and control. -Enhanced Animal Health Information systems for improved decision making. -Improved extension. -These interventions target services that will benefit the smallholder farmer.	-To enable the Ministry of Fisheries and Livestock to assess the levels of productivity, losses, impacts, and possible mitigation measures in the livestock sector. -To expand the coverage of vaccination programs, and access to dip services to more farmers. -To increase access to animal health information, and other agricultural information that promotes the use of climate-smart livestock practices and other improved technologies.	-Lack of sufficient information on the livestock subsector (for example, population, disease incidences). -Limited financial support to the sector.	-Ensure periodic collection of livestock information. -Increase budgetary allocations to the subsector.	-High scalability, and a high impact on food security. -Support should be targeted toward the Ministry of Fisheries for disease forecasting, monitoring and control, and Livestock, and the Ministry of Agriculture for extension.	Low

Source: Authors.
Note: M, T, and C stand for Risk mitigation, Transfer, and Coping, respectively; Project costs: Low implies < $100 million; Moderate, between $100 and $300 million; and High > $300 million. Cost estimates are based on similar World Bank interventions.

TABLE 6.5 Managing Price Volatility

Risk management solution	Elements requiring investments	Why is it needed?	Current state and challenges with the proposed risk solution	How to overcome the challenges	Impact of the intervention and scalability	Relative costs
-Agricultural production diversification. -Strengthen ZAMACE and the warehouse receipts system.	-Investment in climate-resilient crops other than maize. -Capitalization of ZAMACE. -Warehouse receipt systems. -Storage facilities. -Awareness -These services will indirectly benefit the smallholder farmers.	-Stabilize commodity prices. Increase private sector participation in markets. Minimize consumption and production shocks.	-The political economy of staple foods (maize) is the greatest challenge in achieving policy consistency. -Some positive steps that could contribute to production diversification through the electronic delivery system of input subsidies. But hybrid seeds other than maize need to be made available. -The WRS is operational; ZAMACE is also operational with two banks, six brokers, and five certified storage operators, with 800,000 MT in capacity and covering 18 districts. However, low trade volumes threaten sustainability.	-Increase confidence in stocks monitoring. Purchase the FRA food reserves through the commodity exchange. -Consumption and production diversification. -Raise awareness among policy makers on the importance of open borders. -Agricultural marketing reforms, including conducting a WRS needs assessment, increasing accessibility of WRS to smallholders, and encouraging more financial institutions to participate.	-High scalability with a high impact on food security.	-Agricultural production diversification can be implemented as part of climate-resilient farming (see table 6.3). -Strengthening ZAMACE and WRS can be implemented as part of increased access to risk financing or safety nets (see table 6.3).

Source: Authors.
Note: M, T, and C stand for Risk mitigation, Transfer, and Coping, respectively. Project costs: Low implies < $100 million; Moderate, between $100 and $300 million; and High > $300 million. Cost estimates based on similar World Bank interventions.
FRA = Food Reserve Agency; MT = metric ton; WRS = Warehouse Receipt System; ZAMACE = Zambia Commodity Exchange.

TABLE 6.6 Relevance of Risk Management Options to the Prioritized Risks

	Drought	Floods	Diseases	Price volatility	Priority score (%)
Early Warning System	5	5	4	2	80
Flood control infrastructure	1	5	1	1	40
Climate-resilient farming	5	4	4	3	80
Risk financing	3	4	1	3	55
ZAMACE and warehouse receipt system	4	2	3	5	70
Safety net programs	4	4	2	4	70
Agricultural diversification	4	3	3	4	70
Animal health systems	3	1	4	2	50
Rangeland and livestock management	4	2	3	2	55

Note: Relevance of management options is rated as 1 = Very low; 2 = Low; 3 = Moderate; 4 = High; and 5 = Very high. Priority score is the sum of the ratings of options over the prioritized risks divided by 20, the maximum score, and expressed as a percentage. It is an indication of the ability of a risk management option to address the range of agricultural risks in Zambia.
ZAMACE = Zambia Commodity Exchange.

climate-resilient farming practices are also crucial. The importance of diversification as a form of self-insurance to mitigate production, market, or enabling environment risks is reflected across the prioritized risks in table 6.6. Diversification functions as an ex post strategy to cope with shocks and to prompt agricultural households to reallocate labor to other opportunities. Climate-resilient farming is vital for building resilience by enhancing the absorptive, adaptive, and transformative capacities of the agricultural systems,[9] and an example for India is provided in the section "Examples of Projects Addressing Agricultural Risks."

Strengthening ZAMACE and the Warehouse Receipt System is the most effective means of addressing price volatility. It can potentially help to stabilize commodity prices, encourage private sector participation in markets, and minimize consumption and production shocks. Increasing access to risk financing can empower farmers to adopt climate-smart technologies to effectively manage price volatility and weather risks. The scaling-up of social safety net programs targeting the most vulnerable farmers who cannot produce enough to feed themselves is crucial for managing risks faced by this group. Such scaling-up will entail building a "shock-responsive safety net"—an adaptive social protection approach aimed at increasing the efficiency of social programs to deal with current and future risks climate protection and preventive measures. A shock-responsive safety net in Zambia can be

[9] *Absorptive capacity* refers to the ability to survive climate shocks; *adaptive capacity* is the ability to adjust in anticipation of climate shocks, without radically changing livelihood systems; and *transformative capacity* refers to the ability to prevent the impact of climate shocks through major transformation of livelihood systems.

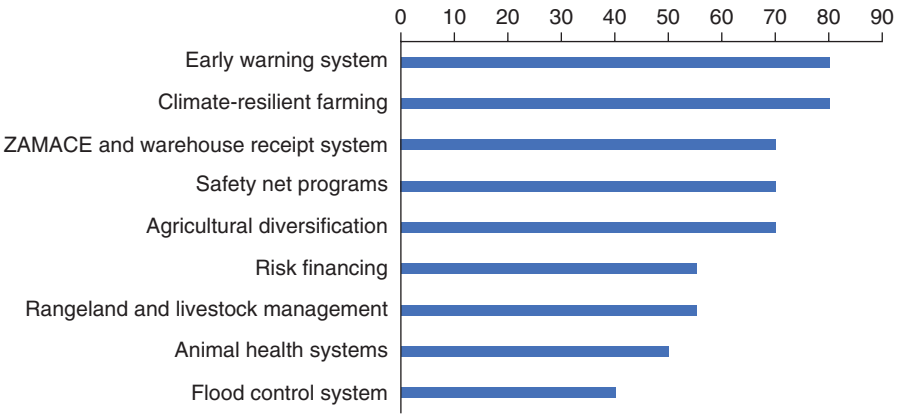
purposefully designed to integrate existing safety net, disaster risk management, and humanitarian responses that are often fragmented in the country. The implementation of the shock-responsive safety net could focus on increasing the coverage of the vulnerable populations, enhancing the institutionalization of the program with stronger focus on systems building, and improving delivery mechanisms. Animal health systems and improved rangeland management are specific to deploying improved management practices to enhance the productivity and resilience of the livestock subsector.

Table 6.6 and figure 6.1 indicate that five solutions can be prioritized to effectively manage agricultural risk in Zambia. These are an early warning system, climate-resilient farming, strengthening ZAMACE and the Warehouse Receipt System, a shock-responsive safety net, and agricultural diversification. The risk solutions have the most potential to address the prioritized risks confronting the agricultural sector in the country. As stated in tables 6.3–6.5, there is potential for synergy when some of the risk management interventions are combined—for instance, strengthening ZAMACE can be implemented together with risk financing to address price volatility and incentivize smallholder farmers to adopt climate-smart agriculture, or with shock-responsive safety net to address the needs of the most vulnerable.

Given the potential for synergy for implementing the prioritized solutions, the government may find it useful to prioritize the following options:

- Strengthen early warning system for food security.
- Develop climate-smart agriculture and increase resilience to climate-related shocks through diversification.
- Develop ZAMACE and build a shock-responsive safety net.

FIGURE 6.1 Priority Scores (%) for the Risk Management Options



Examples of Projects Addressing Agricultural Risks

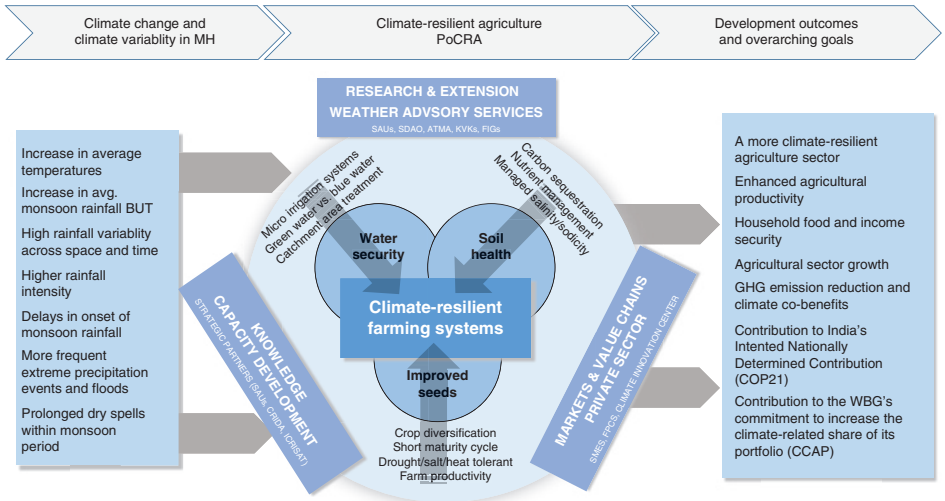
This section provides examples of risk management solutions that address agricultural risks similar to those in Zambia. The four examples taken from India, Mexico, Burkina Faso, and Rwanda are more reflective of the comprehensive investment needs in Zambia because they address the technical, financial, and institutional needs for effective risk management.

India: Maharashtra Project on Climate-Resilient Agriculture ($600 million)

The state of Maharashtra is one of the economic growth engines of India. Agriculture in Maharashtra grew at an annual average of 6.4 percent from 2004 to 2012, but growth in the smallholders-dominated sector fluctuates heavily because of highly erratic rainfall and rainfall variability over time. Severe consecutive droughts experienced in large parts of Maharashtra in recent years have considerably affected the state's agricultural performance and social fabric in rural areas, and have prompted the highest-level state authorities to declare "drought-proofing" of agriculture a key development priority for Maharashtra.

To address climate change vulnerabilities, Maharashtra is developing a project covering 18,700 villages, 12.5 million hectares (ha) of arable land, and an estimated 25.5 million beneficiaries (figure 6.2). The project seeks to (a) introduce transformational changes in the agricultural sector by promoting

FIGURE 6.2 The Maharashtra Climate-Resilient Agriculture Project Framework



PoCRA = Project on Climate Resilient Agriculture, CCAP = Climate Change Action Plan, GHG = Greenhouse Gas, MH = Maharashtra

short-term solutions at farm and catchment levels, (b) and provide longer-term solutions at institutional and policy levels to ensure the sustainability of the outcomes generated in the field.

To enhance the adaptive capacity of farming systems, the project promotes the transfer of already proven and field-tested agricultural technologies and agronomic practices that enhance climate resilience at farm and catchment levels (shorter-term solutions). To increase the absorptive capacity of commodity value chains for crops relevant to the climate agenda, the project strengthens Farmer Producer Companies and supports the seed supply chain for climate-resilient crop varieties. Finally, to improve the transformative capacity of institutions in rural areas, the project supports the mainstreaming of climate resilience in rural institutions as well as the generation and transfer of cutting-edge knowledge on climate change and its impact on key sectors (for example, agriculture, water) to provide strong analytical underpinnings for strategies and policies on climate adaptation and mitigation (longer-term solutions). The project components and costs are indicated in table 6.7.

TABLE 6.7 Maharashtra Project Components and Costs

	Components	Key activities	Cost (US$, millions)
1	Promoting climate-resilient agricultural systems	• Participatory development of mini-watershed plans • Promote transfer of on-farm climate-resilient technologies and agronomic practices • Climate-resilient development of catchment areas	457.60
2	Postharvest management and value chain promotion	• Promote Farmer Producer Companies • Strengthen emerging value chains for climate-resilient commodities • Improve the performance of the supply chain for climate-resilient seed varieties	54.92
3	Institutional development, knowledge and policies	• Sustainability and institutional capacity development • Establish Climate Innovation Center • Generate and disseminate cutting edge knowledge	33.51
4	Project Management	• Incremental operating costs • Project communication and public awareness • Integrated ICT for M and E • Weather advisories	53.98
Total			600.00

Note: ICT = information and communication technology; M and E = monitoring and evaluation.

Mexico: Expanding Rural Finance ($405 million)

Sound economic policies in Mexico during the past two decades have contributed to the attainment of stable macroeconomic conditions and resilience during the global financial crisis. However, like many Latin American countries, Mexico faces a productivity growth challenge. Over the past decade, the economy grew at 2.4 percent annually, well below the regional average of 4 percent. Low productivity growth depressed income growth and Mexico's per capita income has remained at about 30 percent of that of the United States. By comparison, East Asia Tigers' per capita income tripled over the past three decades and is currently about 60 percent of that of the United States. Poverty rates are much higher in rural than urban areas of Mexico. In 2012, extreme income poverty at 30.9 percent in rural areas was more than twice the 12.9 percent in urban areas. Despite a stable macroeconomic framework and a series of market-enhancing reforms, the financial market fails to provide adequate access to key segments in Mexico. A vibrant financial sector that identifies and funds viable business opportunities is an important microeconomic foundation for shared prosperity by supporting increased incomes while helping manage risks. Credit in general and (rural) agricultural credit is underdeveloped in Mexico, and the lack of credit is associated with limited rural economic activity. Credit constraints have been found to be pervasive in rural Mexico, limiting the investments and growth of rural enterprises.

To address this shortcoming, the Expanding Rural Finance Project (table 6.8) was launched to increase the availability of finance to the rural economy. The project beneficiaries are rural Financial Development Agencies (FND), Participating Financial Intermediaries (PFIs), and Micro, Small, and Medium Enterprises (MSMEs) borrowing from the PFIs. The project helps FND expand its activities and loan portfolio, reduce its operating costs relative to its portfolio size, and to strengthen its IT systems. The project supports lending for productive activities as opposed to consumption credit, helping PFIs reach more clients and grow their activities in rural areas. The capacity

TABLE 6.8 Project Costs for Expanding Rural Finance in Mexico

	Components	Subcomponents	Cost (US$, millions)
1	Expanding credit for rural MSMEs	A. Credit line through PFIs to MSMEs	365
		B. Supporting FND Pilots for Rural Finance	10
2	Strengthening institutional capacity for sustainable rural finance	A. Modernization of banking systems	25
		B. Strengthening rural financial institutions	5
	Total		405

Note: FND = Financial Development Agency; MSME = Micro, Small, and Medium Enterprises; PFI = Participating Financial Intermediaries.

of PFIs is developed, enabling them to offer sustainable finance in rural areas. Rural MSMEs benefit from improved access to finance and expanded economic activity.

The project is a financial intermediary loan, consisting of an IBRD credit line intermediated by FND through eligible PFIs serving rural borrowers. FND, the borrower and implementing agency for the project in turn on-lend/finance PFIs. The selected PFIs in turn subfinance private MSMEs in the rural economy. FND selects PFIs following well-established criteria; defines the characteristics of the loans to be provided from FND to PFIs; defines eligibility criteria for final borrowers; defines the characteristics of subloans eligible to receive funds; defines and implements a communication strategy; and defines and implements a monitoring and evaluation strategy between FND and the Bank. Table 6.9 summarizes the types of institutions with which FND works.

TABLE 6.9 List of Institutions Working with FND

Supervised institutions	Unsupervised institutions
Banks: Including both full banks and niche banks	**SOFOMES:** Public, limited liability companies offering lending services to the population. Only SOFOMES with ownership links to banks are supervised and FND has not traditionally worked with these.
SOFIPOS: Public limited liability companies offering both lending and deposit services.	**Producer associations**
Cooperative societies of savings and credit (*Cajas*): Both lend and take deposits and they are only supervised if their assets exceed about US$1 million. Currently, FND only works with supervised cooperatives.	
Credit unions: Member-based companies able to offer credit only to their members and can operate only in the industry group to which their members belong.	
***Almacenas generales de deposito* (warehouse deposit financing):** Serve to both store agricultural products and also lend to those using the warehousing facilities with stored products as collateral.	

Note: FND = Financial Development Agency.

Burkina Faso: Agricultural Diversification and Market Development Project ($150 million)

Burkina Faso's agriculture-based economy is still dominated by subsistence production systems characterized by low crop and livestock productivity, low diversification, and limited participation of formal private businesses in the development of agropastoral value chains. To take advantage of potential sources of growth, Burkina Faso needed to adequately address a series of constraints: (a) inadequate policy and institutional framework (trade policy, market efficiency); (b) poor infrastructure and high cost of public services and utilities; (c) limited capacity in the public and private sectors; and (d) weak producer/professional associations.

The Agricultural Diversification and Market Development Project was set up to increase the competitiveness of selected agricultural subsectors that

TABLE 6.10 Project Costs for Agricultural Diversification and Market Development in Burkina Faso

	Components	Activities	Cost (US$, millions)
1	Improvement of agro-silvo-pastoral supply chains performance	• Capacity building for professional organizations and agricultural trade associations • Investment for supply chain development	65.5
2	Development of irrigation and marketing infrastructure	• Irrigation infrastructure • Marketing infrastructure	60.6
3	Improving the business environment, regulatory framework, and provision of advisory services	• Improvement of the regulatory, legal, and financial framework • Capacity building for service providers • Project management and monitoring and evaluation	24.3
	Total		150.4

target national, subregional, and international markets, thereby contributing to shared agricultural growth for the country. The project also promoted businesses in rural Burkina Faso, where access to credit from commercial banks and microfinance institutions is markedly limited.

The project benefited more than 385,000 people, of whom 30 percent are women. It developed four targeted value-chains (meat/livestock, poultry, onion, and mango) whose professional organizations are now well structured and fully operational. Agricultural exports for the supply chains reached 206,000 tons, up from 6,500 tons, and 275,000 tons, up from 17,500 tons for subregional and international markets, respectively. The total amount of loans secured through local banks and microfinance institutions to support the financing of microprojects reached $4.3 million, linking smallholders to the banking system. About 162 successful microprojects were also transformed into small and medium enterprises and are fully operational.

Rwanda: Strengthening Social Protection ($80 million)

Social protection remains one of the government of Rwanda's main priorities for meeting its ambitious poverty reduction and human capital development goals. To further this agenda, Rwanda has started building an integrated social protection system to ensure a minimum standard of living and access to core public services, boost resilience to shocks, promote equitable growth, and strengthen opportunity through increased human capital development. The Strengthening Social Protection Project supports three key innovations: enhancing livelihoods package through skills training, asset transfers (productive and livestock), and referrals to other productive and social services;

TABLE 6.11 Project Costs for Strengthening Social Protection in Rwanda

	Components	Key activities	Cost ($ million)
1	Improving coverage, adequacy and effectiveness of the Vision 2020 Umurenge Program cash transfers	• Direct support cash transfer • Classic public works • Expanded public works • Refurbishment of infrastructure for quality community and home-based childcare	68.5
2	Enhancing access to human capital and economic inclusion services	• Nationwide sensitization and community mobilization • Improving parenting and childcare services for vulnerable groups • Enhancing livelihoods	6.5
3	Delivery Systems, Policy, and Program Management	• Evidence-based policy and program development • Institutional strengthening • Delivery systems	5.0
	Total		80.0

expanded public works (ePW) childcare for moderately labor-constrained households; and nutrition support grants. The estimated 321,861 beneficiary households include 105,000 households receiving direct support that provides unconditional cash transfers to eligible households under the Vision 2020 Umurenge Program; 141,361 households for classic public works; and 75,000 households under the ePW. The project cost and key activities are presented in table 6.11.

Bibliography

Abrahams, P., T. Beale, M. Cock, N. Corniani, R. Day, J. Godwin, S. Murphy, G. Richards, and J. Vos. 2017. "Fall Armyworm Status—Impacts and Control Options in Africa: Preliminary Evidence Note (April 2017)." CABI. http://www.cabi.org/Uploads/isc/Dfid%20Faw%20Inception%20Report04may2017final.pdf.

Anderson, R. 1968. "Crops: Premium for Maize." Memorandum by the Minister of Agriculture. Lusaka: Zambian Minister of Agriculture.

Antón, J. 2008. "Agricultural Policies and Risk Management: A Holistic Approach." In *Proceedings of the 108th EAAE Seminar on Income Stabilization*. Warsaw, February.

Antonaci, L., M. Demeke, and A. Vezzani. 2014. "The Challenges of Managing Agricultural Price and Production Risks in Sub-Saharan Africa." ESA Working Paper No. 14-09.

Binswanger-Mkhize, H. P., and S. Savastano. 2017. "Agricultural Intensification: The Status in Six African Countries." *Food Policy* 67 (2017): 26–40.

Braimoh, Ademola, Bernard Manyena, Grace Obuya, and Francis Muraya. 2018. *Assessment of Food Security Early Warning Systems for East and Southern Africa*. Africa Climate Business Plan series. World Bank, Washington, DC.

Chapoto, A., and T. S. Jayne. 2009. "Effects of Maize Marketing and Trade Policy on Price Unpredictability in Zambia." Food Security Research Project Working Paper 38. Lusaka: Zambia.

Chapoto, Antony, and Nicholas J. Sitko. 2015. *Agriculture in Zambia: The Past, Present, and Future.* Lusaka: Indaba Agricultural Policy Research Institute.

Chapoto, Antony, and Olipa Zulu-Mbata. "2015 Rural Agricultural Livelihood Survey Report." Lusaka: IAPRI. http://www.iapri.org.zm/images/Articles/RALS_Report.pdf.

Chikoti, Patrick C., Joseph Ndunguru, Rob Melis, Fred Tairo, Paul Shanahan, and Peter Sseruwagi. 2014. "Cassava Mosaic Disease and Associated Viruses in Zambia: Occurrence and Distribution." *International Journal of Pest Management* 59 (1): 63–72.

Chisanga, B., and A. Chapoto. 2016. "Maize Outlook and Regional Analysis." *Indaba Agricultural Policy Research Institute.* Issue no. 2. Lusaka: IAPRI.

Chisanga, Charles Bwalya, Elijah Phiri, Chizumba Shepande, and Henry Sichingabula. 2015. "Evaluating CERES-Maize Model Using Planting Dates and Nitrogen Fertilizer in Zambia." *Journal of Agricultural Science* (Canadian Center of Science and Education) 7 (3): 79–97.

Choudhary, V., S. P. D'Alessandro, A. Giertz, K. C. Suit, T. J. Johnson, T. Baedeker, and R. J. Caballero. 2016. "Agricultural Sector Risk Assessment: Methodological Guidance for Practitioners." World Bank Group. http://documents.worldbank.org/curated/en/586561467994685817/Agricultural-sector-risk-assessment-methodological-guidance-for-practitioners.

CIMMYT (International Maize and Wheat Improvement Center). 2015. "Maize in Zambia: An Example of Good Practice." *DT Maize* 4 (2). http://dtma.cimmyt.org/index.php/press-room/bulletins/doc_view/197-dt-maize-vol-4-no-2-june-2015.

CSO (Central Statistical Office). 2015. *2015 Living Conditions Monitoring Survey Report.* Lusaka: CSO. https://www.zamstats.gov.zm/phoca-download/Living_Conditions/2015%20Living%20Conditions%20Monitoring%20Survey%20Report.pdf.

Dana, J., and C. L. Gilbert. 2008. *Managing agricultural price risk in developing countries.* In *Risk management in commodity markets: from shipping to agriculturals and energy* (ed. Geman H.), pp. 207–307. Chichester, UK: Wiley Finance.

Dodge, Doris Jansen. 1977. *Agricultural Policy and Performance in Zambia: History, Prospects, and Proposals for Change.* Research Series No. 32. Berkeley: University of California, Berkeley Institute of International Studies.

FAO (Food and Agriculture Organization [of the UN]). 2017. *FAO in Emergencies.* FAO. http://www.fao.org/emergencies/fao-in-action/stories/stories-detail/en/c/469660/.

FAO and WFP (World Food Programme). 1998. *FAO/WFP Crop and Food Supply Assessment Mission to Zambia Rome.* http://www.fao.org/docrep/004/W8885e/W8885e00.htm.

FSD Zambia 2015. "FinScope Zambia 2015 Survey." FSD Zambia. http://www.fsdzambia.org/wp-content/uploads/2016/05/FINSCOPE-REPORT-2015.pdf.

Giertz, Åsa, Jorge Caballero, Diana Galperin, Donald Makoka, Jonathan Olson, and George German. 2015. "Malawi—Agricultural Sector Risk Assessment." World Bank Group. http://documents.worldbank.org/curated/en/802281467999353954/Malawi-Agricultural-sector-risk-assessment.

Govereh, J., J. Shawa, E. Malawo, and T. S. Jayne. 2006. "Raising The Productivity of Public Investments in Zambia's Agricultural Sector." FSRP Working Paper No. 20, Food Security Research Project, Lusaka. http://fsg.afre.msu.edu/zambia/wp_20.pdf.

Govereh, Jones, T. S. Jayne, and Antony Chapoto. 2010. "Assessment of Alternative Maize Trade and Market Policy Interventions in Zambia." http://ageconsearch.umn.edu/record/54492/files/wp_33.pdf

Government of Zambia. 2005. *Act No. 20 of 2005: An Act to Amend the Food Reserve Act.* http://www.parliament.gov.zm/index.php?option=com_docman&task=docdownload&gid=543.

Hamoonga, R., M. A. Stevenson, A. Allepuz, T. E. Carpenter, and Y. Sinkala. 2014. "Risk Factors for Foot-and-Mouth Disease in Zambia, 1981–2012." *Preventive Veterinary. Medicine* 114 (1): 64–71. doi: 10.1016/j.prevetmed.2014.01.014. PMID: 24486093.

Headey, D. D., and T. S. Jayne. 2014. "Adaptation to Land Constraints: Is Africa Different?" *Food Policy* 48 (2014): 18–33.

Hess, U., J. R. Skees, A. Stoppa, B. J. Barnett, and J. Nash. 2005. "Managing Agricultural Production Risk: Innovations in Developing Countries." Agriculture and Rural Development (ARD) Department Report (32727-GLB).

Howard, J., and C. Mungoma. 1996. "Zambia's Stop-and-Go Revolution: The Impact of Policies and Organizations on the Development and Spread of Maize Technology." MSU International Development Working Paper No. 61, Michigan State University, East Lansing.

IAPRI (Indaba Agricultural Policy Research Institute). 2016. "Rural Agricultural Livelihood Survey." *IAPRI.* Antony Chapoto and Olipa Zulu-Mbata. http://www.iapri.org.zm/images/Articles/RALS_Report.pdf.

———. 2017. "Fall Armyworm Outbreak In Zambia: Lessons Learnt to Avert Future Outbreaks." IAPRI. http://www.iapri.org.zm/images/Infographics/Army_Worm_Infographic_FINAL.pdf.

IPCC (Intergovernmental Panel on Climate Change). (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press.

Kean, S., and A. Wood. 1992. "Agricultural Policy Reform in Zambia: The Dynamics of Policy Formulation in the Second Republic." *Food Policy* 17 (1): 65–74.

Knight, F., 1921. *Risk, Uncertainty, and Profit.* Hart, Schaffner & Marx Prize Essays No. 31. Boston: Houghton Mifflin.

Kuteya, A. N. 2016. "2017 Agricultural Sector Budget Analysis." Paper presented at the Budget Breakfast Meeting Taj Pamodzi Hotel, Lusaka, November 22.

Kuteya, A. N., and A. Chapoto. 2017. "E-Voucher Performance and Recommendations for Nationwide Rollout during the 2017/18 Farming Season." Indaba Agricultural Policy Research Institute Policy Brief No. 89. Lusaka, IAPRI.

Kydd, J. 1986. "Changes in Zambian Agricultural Policy since 1983: Problems of Liberalization and Agrarianization." *Development Policy Review* 4 (3): 233–259.

Lusaka Times. 2012. "Cotton War: Irate Farmers Burn Cotton Belonging to Cargill Cotton Zambia. July 1. https://www.lusakatimes.com/2012/07/01/cotton-war-irate-farmers-burn-cotton-belonging-cargill-cotton-zambia/.

———. 2017. "No More Maize Export Bans, Government to Remove the 10% maize tax-Mutati". June 28. https://www.lusakatimes.com/2017/06/28/no-maize-export-bans-government-remove-10-maize-tax-mutati/.

MAFF (Ministry of Agriculture, Food, and Fisheries). 2013. *Agricultural Commercialization Programme 2002–2005*. Lusaka: Ministry of Agriculture, Food, and Fisheries.

MAL (Ministry of Agriculture and Livestock). 2013. *Zambia National Agriculture Investment Plan (NAIP) 2014–2018*. Lusaka: MoA.

Mulenga, Brian P., and Ayala Wineman. 2014. "Climate Trends and Farmers' Perceptions of Climate Change in Zambia." Indaba Agricultural Research Policy Insitute. http://fsg.afre.msu.edu/zambia/wp86_rev.pdf.

Nawa, Doreen Chilumbu. 2014. "Poor Prices Threaten Zambia's Cotton Sector." August 11. *Focus on Development* (blog). http://nawa-doreen.blogspot.co.ke/2014/08/poor-prices-threaten-zambias-cotton.html.

Ngoma, H., B. Hamududu, P. Hangoma, P. C. Samboko, C. Kabaghe, and M. Hichaambwa. (2017). *Irrigation Development for Climate Resilience in Zambia: The Known Knowns and Known Unknowns*. Lusaka: Indaba Agricultural Policy Research Institute. http://www.iapri.org.zm/images/WorkingPapers/wp_130.pdf.

OECD (Organisation for Economic Co-operation and Development). (2009). "Managing Risk in Agriculture: A Holistic Approach. Organisation for Economic Co-operation and Development." Paris: OECD. http://www.oecd.org/agriculture/agricultural-policies/45558582.pdf.

Rakner, L. 2003. *Political and Economic Liberalization in Zambia*. Uppsala: Nordiska Afrikainstitet.

Samboko, P. 2017. "Land Institutions in Zambia: Evolution and the Determinants of the Extent of Land Titling." Indaba Agricultural Policy Research Institute Working Paper 122, Lusaka.

Samboko, P. C., M. Kabisa, and G. Henley. 2017. "Constraints to Biofuel Feedstock Production Expansion in Zambia." WIDER Working Paper 2917/62, UNU-WIDER, Helsinki.

Seshamani, V. 1996. *Employment and Labour Markets during Adjustment: The Case of Zambia*. Lusaka: University of Zambia.

Simatele, M. 2006. "Food Production in Zambia: The Impact of Selected Structural Adjustment Policies." AERC Research Paper No. 159. Nairobi: African Economic Research Consortium. http://dspace.africaportal.org/jspui/bitstream/123456789/34218/1/RP159.pdf?1.

Simpasa, Anthony, and Laureline Pla. 2016. "Sectoral Credit Concentration and Bank Performance in Zambia." Working Paper Series No. 245, African

Development Bank Group, Abidjan. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/WPS_No_245__Sectoral_credit_concentral_and_bank_performance_in_Zambia.pdf.

Sinkala, Y., M. Simuunza, D. U. Pfeiffer, H. M. Munang'andu, M. Mulumba, C. J. Kasanga, J. B. Muma, and A. S. Mweene. 2014. "Challenges and Economic Implications in the Control of Foot and Mouth Disease in Sub-Saharan Africa: Lessons from the Zambian Experience." *Veterinary Medicine International* (2014): 373921.

Subakanya, M., M. Hichaambwa, A. Chapoto, M. Kangasniemi, and M. Knowles. 2017. "Quantitative Livelihood Profile Analysis of Rural Households in Zambia." Working Paper No. 132, IAPRI, Lusaka.

Tembo, G., A. Chapoto, T. Jayne, and M. Weber. 2009. "Fostering Agricultural Market Development in Zambia." Food Security Research Project Working Paper No. 40, FSRP, Lusaka.

World Bank. 1994. "Zambia Poverty Assessment." World Bank Report No. 12985-ZA. World Bank, Washington, DC.

———. 2016. "Agricultural Sector Risk Assessment: Methodological Guidance for Practitioners." World Bank, Washington, DC.

———. 2017a. "Zambia Economic Brief, June 2017: Reaping Richer Returns from Public Expenditures in Agriculture." World Bank Group, Washington, DC. https://openknowledge.worldbank.org/handle/10986/27521.

———. 2017b. *Zambia Integrated Forest Landscape Project: Project Appraisal Document.* Washington, DC: PAD, Agriculture and Environment and Natural Resources Global Practices, World Bank Group.

ZAMACE (Zambian Commodity Exchange). 2015. "Trade Your Grains through the Zambian Commodity Exchange." http://www.zamace.co.zm.

———. 2017. "The Role of ZAMACE in Grain Marketing." Paper resented at the Consultative Forum on Development of a Competitive Agricultural Commodity Marketing System, Lusaka, Zambia.

ZVAC (Zambia Vulnerability Assessment Committee). 2015. *In-Depth Vulnerability and Needs Assessment Report.* Lusaka: ZVAC.

———. 2016. *In-Depth Vulnerability and Needs Assessment Report.* Lusaka: ZVAC.

APPENDIX A

Risk Strategies for Crops Subsector

Risk Solution	Mitigation	Transfer	Coping
Strengthen early warning systems.	Improve weather infrastructure.	—	Improve access to early warning information for improved decision making.
	Provide flood control/protect infrastructure in flood-prone areas.	—	Improve FISP e-voucher management.
Strengthen the climate resilience of smallholder systems.	Strengthen extension and advisory system.	—	Improve FISP e-voucher management.
	Improve climate-smart water and soil management.	—	Promote tree-based cropping systems (agroforestry).
	Increase awareness and promote use of improved varieties and technologies.	—	—
Increase access to risk financing.	—	Upscale crop insurance	Increase allocation to emergency fund–input safety nets.
	—	Hedging and WRSs	—
Medium- to long-term policy options for the maize sector	Limit FRA's role in maize marketing. Capitalize the commodity exchange by buying strategic reserves through ZAMACE.	—	—
	Government should promote private sector storage by eliminating pan territorial and seasonal pricing.	—	—
	Enact Agricultural Marketing Act.	—	—
	Moderate price volatility through trade. Maintain an open border maize policy to make Zambia a reliable supplier.	—	—
	Enact Agricultural Marketing Act.	—	—

Note:— = Not available; FISP = Farmer Input Support Programme; FRA = Food Reserve Agency; WRS = Warehouse Receipt System; ZAMACE = Zambia Commodity Exchange.

APPENDIX B

Risk Strategies for Livestock Subsector

Risk Solution	Mitigation	Transfer	Coping
Improve early warning systems.	Climate-sensitive disease outlooks: Provide long-term projections of disease trends so that disease control and mitigation efforts can be integrated into long-term planning.	—	Early warning systems: Provide short- to medium-term disease forecasting for appropriate interventions and mitigation efforts.
	Risk mapping: Identify areas of greatest threat and disease mitigation measures.	—	—
	Conservation of livestock feed resources: Increase awareness and provide training on conservation of animal feed resources, for example, hay and silage preparation.	—	—
Strengthen management of rangeland and livestock resources.	Drought-resistant fodder varieties: Distribution, awareness raising, and training on pasture management using drought-resistant fodder varieties.	—	Access to water: Increase number of watering points in drought-prone areas.
	—	—	Promote silvo-pastoral systems (integrating trees and shrubs in pastures with animals).
Strengthen animal health systems.	Expand access to dips: Increase the number of dips and spray races in livestock keeping communities.	—	—
	Expand existing vaccination programs: Coverage should be expanded to cover farmers who are not being reached.	—	—
	Increase access to animal health information: Fill veterinary camp level positions that are not filled.	—	—
	Increase access to inputs: Create and support programs that encourage the establishment of veterinary drugs shops/livestock kits.	—	—
	Strengthen extension and advisory system.	—	—

table continues next page

(continued)

Risk Solution	Mitigation	Transfer	Coping
Increase capacity and support to policy development.	Ensure consistent collection, analysis, and dissemination of livestock statistics.	Promote livestock insurance.	Encourage farmers to use flexible e-voucher.
	Support private veterinarians to offer animal health services in rural areas.	—	—
	Consistent budgetary allocation for animal health emergency fund.	—	—
	Improve monitoring of vaccination program, especially Newcastle disease vaccination.	—	—
	Centralize and harmonize livestock movement levies.	—	—

Note:— = Not available.

Appendix C

Ranking of Importance of Risk Solutions

Crops		Average
Strengthen early warning systems.	Improve weather infrastructure.	4.40
	Improve access to early warning information for improved decision making.	4.60
	Provide flood control/protection infrastructure to flood-prone areas.	3.60
Average of risk solutions		**4.20**
Strengthen the climate resilience of smallholder systems.	Improve climate-smart water and soil management.	4.30
	Promote tree-based cropping systems (agroforestry).	3.80
	Increase awareness of and promote use of improved varieties and technologies.	4.50
	Improve FISP e-voucher management.	4.10
	Strengthen extension and advisory system.	4.70
Average of risk solutions		**4.28**
Increase access to risk financing.	Upscale weather index insurance.	4.10
	Hedging and WRSs.	4.00
	Increase allocation to emergency fund–input safety nets.	3.70
Average of risk solutions		**3.93**
Medium- to long-term policy options for the maize sector	Enact Agricultural Marketing Act.	4.00
	Limit FRA's role in maize marketing. Capitalize the commodity exchange by buying strategic reserves through ZAMACE.	4.20
	Government should promote private sector storage by eliminating pan territorial and seasonal pricing.	4.10
	Moderate price volatility through trade. Maintain an open border maize policy to make Zambia a reliable supplier.	4.00
Average of risk solutions		**4.08**
Livestock		
Improve early warning systems.	Risk mapping: Identify areas of greatest threat and disease mitigation measures.	4.40
	Climate-sensitive disease outlooks: Provide long-term projections of disease trends so that disease control and mitigation efforts can be integrated into long-term planning.	4.20
	Early warning systems: Provide short- to medium-term disease forecasting for appropriate interventions and mitigation efforts.	4.50

table continues next page

(continued)

Crops		Average
Average of risk solutions		**4.37**
Strengthen management of rangeland and livestock resources.	Access to water: Increase number of watering points in drought-prone areas.	4.50
	Conservation of livestock feed resources: Increase awareness and provide training on conservation of animal feed resources, for example, hay and silage preparation.	4.00
	Drought-resistant fodder varieties: Distribution, awareness raising, and training on pasture management using drought-resistant fodder varieties.	3.90
	Promote silvo-pastoral systems (integrating trees and shrubs in pastures with animals).	3.80
	Livestock stocking and restocking.	4.50
Average of risk solutions		**4.14**
Strengthen animal health systems.	Expand access to dips: Increase the number of dips and spray races in livestock-keeping communities.	4.30
	Expand existing vaccination programs: Coverage should be expanded to farmers who are not being reached.	4.40
	Increase access to animal health information: Fill empty veterinary camp–level positions.	4.20
	Increase access to inputs: Create and support programs that encourage the establishment of veterinary drugs shops/ livestock kits.	3.90
	Strengthen extension and advisory system.	4.30
Average of risk solutions		**4.22**
Increase capacity and support to policy development.	Ensure consistent collection, analysis, and dissemination of livestock statistics.	4.40
	Promote livestock insurance.	3.90
	Consistent budgetary allocation for animal health emergency fund.	4.00
	Improve monitoring of vaccination program.	3.80
	Centralize and harmonize livestock movement levies.	3.20
	Encourage farmers to use flexible e-voucher.	4.00
	Support private veterinarians to offer animal health services in rural areas.	4.10
Average of risk solutions		**3.91**
Policy Recommendations		
Policies that promote modernization of the agricultural sector (for example, mechanization, irrigation, increased use of ICT).		4.60
Openness to trade in food and investments led by the private sector (especially food staples).		4.30
Policy stability: To attract private sector investment. Government funds alone are not enough to meet the rising demand.		4.60
Crowd in private sector, both local and international.		4.10
Regulations that promote competition and more innovation.		4.30

table continues next page

(continued)

Crops	Average
Consumption diversification provides a key to helping vulnerable households deal with food price shocks.	3.80
Move away from maize centric policies.	4.50
Focus public investment into areas that stimulate growth instead of private goods: Subsidies should not crowd out private sector participation.	4.10
Provide investment incentives (for example, tax breaks) to both local and international investors.	3.90
Average of risk solutions	**4.24**

Note: Importance of management/solution options is rated as 1 = Very low; 2 = Low; 3 = Moderate; 4 = High; and 5 = Very high.
FISP = Farmer Input Support Programme; FRA = Food Reserve Agency; ICT = information and communication technology; WRS = Warehouse Receipt System; ZAMACE = Zambia Commodity Exchange.

APPENDIX D

Focus Group Discussions: Farmer Profiles and Coping Strategies

Farmer Focus Group Discussions: Profile

	Kalomo District	Chipata District
Participants	14	15
Farmer type	Smallholders (< 10 acres), except for two medium-sized farmers	Smallholders, except for one emerging farmer (15 acres)
Farming system	Mixed crop–livestock systems	Mixed crop–livestock systems
Risks	Drought, fall armyworm (1996, 2012), aphids	Drought, fall armyworm (2016/17), spike in input prices in 2015
Ranking of risks	Drought	Drought, price volatility
Worst drought	1992	1992
Effects of drought	Maize dried up (in one case, at knee height) • Pastures dried up • Streams dried up • 3 of 14 lost their animals (one lost 22 animals because of lack of pasture) • Goats aborting because of hunger	In 2014, harvested 10–15 bags of maize less than average

Farmer Focus Group Discussions: Coping Strategies

Kalomo District (Southern Province)	Chipata District (Eastern Province)
1. Moved their animals to the Kalomo River	1. Took animals to dam, 15 km away
2. Sold livestock, primarily goats	2. Sold livestock, especially goats and pigs
3. Bought maize meal	3. Tilled other farmers fields
4. Consumed fewer meals a day	4. Bought mealie meal (maize flour) and maize
5. Dug boreholes and fenced off their land	5. Consumed bran
6. Dug shallow wells near Kalomo River	6. Consumed vegetables only
7. Fetched water in 240-liter drums	7. Depended on remittances
8. Conservation agricultural practices helped reduce crop losses because of dry spells.	8. Borrowed from within the village
	9. Input credit from tobacco companies, inputs spread to other crops
	10. Took children out of school
	11. Engaged in prostitution

A proper understanding of the risks faced by the agricultural sector and effective strategies to manage those risks is vital to creating a diversified and resilient economy for sustained growth and economic transformation. *Increasing Agricultural Resilience through Better Risk Management in Zambia* provides a rigorous analysis of the production, marketing, and enabling environment risks faced by Zambia's agricultural sector and prioritizes solutions to manage the risks. In terms of the severity and frequency of adverse impacts, the analysis shows that droughts, floods, price volatilities, and trade restrictions are the principal risks affecting agriculture in the country. Exposure to the consequences of these and other risks can be effectively limited through risk management systems tailored to the country's context. Three areas of risk management are found to warrant priority, with significant potential for synergizing actions undertaken across them:

- Strengthen early warning system to detect threats to food security;
- Develop climate-smart agriculture and increase resilience to climate-related shocks through diversification; and
- Develop the Zambian Commodity Exchange (ZAMACE) and build a shock-responsive safety net.

WORLD BANK GROUP