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EVALUATION OF SANITARY AND PHYTOSANITARY (SPS) TRADE POLICY CONSTRAINTS WITHIN THE MAIZE, SOYA, AND GROUNDNUT VALUE CHAINS IN SOUTHERN AFRICA

LEO
Leveraging Economic Opportunities

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The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

CONTENTS

FOREWORD

The Southern Africa Assessment of Trade Opportunities and SPS Challenges within the maize, soya and groundnut value chains in Southern Africa took place from June to August 2016 as a task order under the USAID/Leveraging Economic Opportunities (LEO) project. The Southern Africa study is the third of three LEO reports on this topic, following those of East Africa and West Africa. The study involved field missions to four Southern African countries—Malawi, Mozambique, South Africa, and Zambia—from June 22 to July 14, and extensive background reading of prior studies.

The assessment aimed to develop recommendations for USAIsD and other development partners on how to improve each countries' capability to respond to plant health and food safety threats in the maize, soya bean, and groundnut (peanut) value chains. These crops are the targeted Feed the Future (FTF) commodities in the four target countries.

ACDI/VOCA managed the activity, under the direction of Hayden Aaronson, with logistical support by Amanda Muncil. The interdisciplinary study team included:

--Daniel Joseph Plunkett, team leader and principal writer, based in Portland, Maine

--Jennifer Rathebe, regional SPS expert, based in South Africa

--Kevin Kabunda, expert on Southern Africa regional trade, based in Botswana

--Sophie Walker, chief of party for the USAID/Kenya AflaSTOP Project, investigating aflatoxin in storage and drying

--Catherine Mungoma, maize seed expert, based in Zambia

--Kingsley Chanda, country analysis contributor for Zambia

--Frederico Sarguene, country analysis contributor for Mozambique

The team wishes to thank the public and private sector stakeholders who met with us in each country, as well as the members of the public participating in the survey of awareness of aflatoxin found in Annex 3. The team also wishes to thank the officials at the COMESA and SADC Secretariats; the USAID officials of the Southern Africa regional office in Pretoria, South Africa; officials at the bilateral USAID missions in Lilongwe, Malawi, Maputo, Mozambique, Pretoria, South Africa, and Lusaka, Zambia; participating USDA/APHIS officials; and other bilateral and multilateral donors.

ACRONYMS AND ABBREVIATIONS

ACP	African, Caribbean and Pacific Countries (trade partnership with EU countries and U.K.)
ACTESA	Alliance for Commodity Trade in Eastern and Southern Africa (COMESA)
AfricaAIMS	Africa Aflatoxin Information Management System (under PACA)
AFSTA	African Seed Trade Association
AMU	Arab-Maghreb Union
APHFS	Agriculture Production, Health and Food Safety (South Africa)
APHIS	USDA Animal Plant Health Inspection Service
ARC	Agricultural Research Council (South Africa)
ARIPO	African Regional Property Organization for Plant Variety Protection
ARSO	African Regional Standards Organization
APTECA	Aflatoxin Proficiency Testing for Eastern and Central Africa
AU	African Union
AUC	African Union Commission
CAADP	Comprehensive Africa Agriculture Development Program
Codex	Codex Alimentarius Commission
CAMA	Consumer Association of Malawi
CEN-SAD	Economic Community of Sahelian States
CFTA	Continent Free Trade Area
CIMMYT	International Maize and Wheat Improvement Center
CISSCO	Capacity Improvement of the Seed Sector in the COMESA Region program
COMESA	Common Market for Eastern and Southern Africa
CSB	Corn-soy Blend
DAFF	Department of Agriculture, Forestry and Fisheries (South Africa)
DFID	U.K. Department for International Development
DRC	Democratic Republic of Congo
EAC	East African Community
EC	European Commission

ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EU	European Union
FDA	U.S. Food and Drug Administration
FEWS NET	Famine Early Warning Systems Network
FTF	Feed the Future
FRA	Food Reserve Agency (Zambia)
GMOs	Genetically Modified Organisms
HACCP	Hazard Analysis Critical Control Point
HS	Harmonized System
IAPSC	Inter-African Phytosanitary Council (AU)
IARC	International Agency for Research on Cancer
IBM	Integrated Border Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IGAD	Inter-Governmental Authority on Development
IIAM	National Agricultural Research Institute (Mozambique)
IITA	International Institute of Tropical Agriculture
INNOQ	Mozambique National Institute for Normalization and Quality Assurance
IPPC	International Plant Protection Convention (at FAO)
ISTA	International Seed Testing Association
ISSBs	International Standard Setting Bodies
MoAIWD	Ministry of Agriculture, Irrigation, and Water Development (Malawi)
MAPAC	Malawi Aflatoxin Prevention and Control project
MAZ	Millers Association of Zambia
MBS	Malawi Bureau of Standards
MCMV	Maize chlorortic mottle virus
MDMV	Maize Dwarf Mosaic Virus
MICF	Malawi Innovation Challenge Fund
MLN	Maize Lethal Necrosis

MCMV	Maize Chlorotic Mottle Virus
NEPAD	New Partnership for Africa's Development
NPPO	National Plant Protection Organization (Malawi)
OECD	Organization for Economic Cooperation and Development
OIE	Organization for International Epizootics
PACA	Partnership for Aflatoxin Control in Africa
PAN-SPSO	Participation by African Nations in Sanitary-Phytosanitary Standards Organizations
PEA	Political Economy Analysis
PEDSA	Mozambique's Strategic Plan for Agricultural Development
PICS	Purdue Improved Cowpea Storage bags
PPECB	Perishable Products Export Control Board (South Africa)
PQPS	Plant Quarantine and Phytosanitary Service (Zambia)
PRA	Pest Risk Analysis
REC	Regional economic communities
RSA	Republic of South Africa
RUTF	Ready-to-Use Therapeutic Food
SACU	Southern African Customs Union
SADC	Southern African Development Community
SADCAS	SADC Accreditation Service
SADCSTAN	SADC Standards Body
SAGL	Southern African Grain Laboratory
SAGM	South Africa Groundnut Marketing
SANAS	South Africa National Accreditation Service
SANSOR	South African National Seed Organization
SAPReF	Southern African Pesticide Registrar's Forum
SAQM	Standards, Quality Assurance, and Metrology (also called SQMT)
SATH	USAID Southern Africa Trade Hub
SCCI	Seed Control and Certification Institute (Zambia)
SCMV	Sugar Cane Mosaic Virus

SEARCH	Southern and East African Regulatory Committee for Harmonization
SPEED	USAID Support Program for Economic and Enterprise Development in Mozambique
SQMT	Standards, Quality Assurance, Metrology, and Testing
SPS	Sanitary and Phytosanitary Standards
STDF	WTO Standards and Trade Development Facility
TASAI	The African Seed Access Index
TBT	Technical Barriers to Trade
TPR	WTO Trade Policy Reviews
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USDA	U.S. Department of Agriculture
WEMA	Water Efficient Maize for Africa
WTO	World Trade Organization
ZABS	Zambia Bureau of Standards
ZARI	Zambia Agriculture Research Institute
ZASTA	Zambia Seed Trade Association

1. EXECUTIVE SUMMARY

The Southern Africa Assessment of Trade Opportunities and SPS Challenges within the maize, soya and groundnut value chains in Southern Africa took place from June to August 2016 as a task order under the USAID/Leveraging Economic Opportunities (LEO) project. This study involved field missions to four Southern African countries—Malawi, Mozambique, South Africa, and Zambia—from June 22 to July 14, and extensive background reading of prior studies. This study is one of three regional trade and SPS (sanitary and phytosanitary) assessments carried out in East, Southern, and West Africa.

The purpose of the study was to develop recommendations for USAID and other development partners regarding how to improve each country's capability to respond to plant health and food safety threats in the maize, soya bean, and groundnut value chains. These crops are among the targeted Feed the Future (FTF) commodities in the four target countries.

The study had three objectives:

1. Assess SPS systems and trade constraints within targeted value chains
2. Identify SPS-related investment opportunities
3. Assess trade impacts

Following the description of the study objectives, methodology, and approach, this report contains a summary of the regional SPS frameworks, including the role of various regional economic communities (RECs) and a description of the SPS control systems and relevant plant health and food safety laws in each of the four target countries. The next section contains a summary of the maize, maize seed, groundnut, and soya bean value chains, including intra-regional trade flows, followed by the study's conclusions. The six annexes contain:

i) references;

ii) the list of persons met or interviewed;

iii) three tables reviewing past and present interventions of the U.S. and other bilateral donors, international organizations, and the RECs;

iv) the full list of recommendations;

v) the results of our rapid survey of food processors in each country;

vi) the list of the members of the general public responding to our assessment of awareness about aflatoxin.

SPS IMPACTS ON TRADE

There are a number of known SPS barriers to trade in the region, including when countries choose to selectively enforce the common SADC standards for specific food products. When countries operate standards at different risk tolerance levels, the potential for SPS barriers to emerge can grow in contagious fashion, with one country responding with its own new barriers in the event a partner country blocks trade.

For Malawi, Mozambique, the Republic of South Africa, and Zambia, the greatest plant health and food safety threats to the maize, groundnut, and soya bean value chains are the mycotoxin, aflatoxin; the relatively

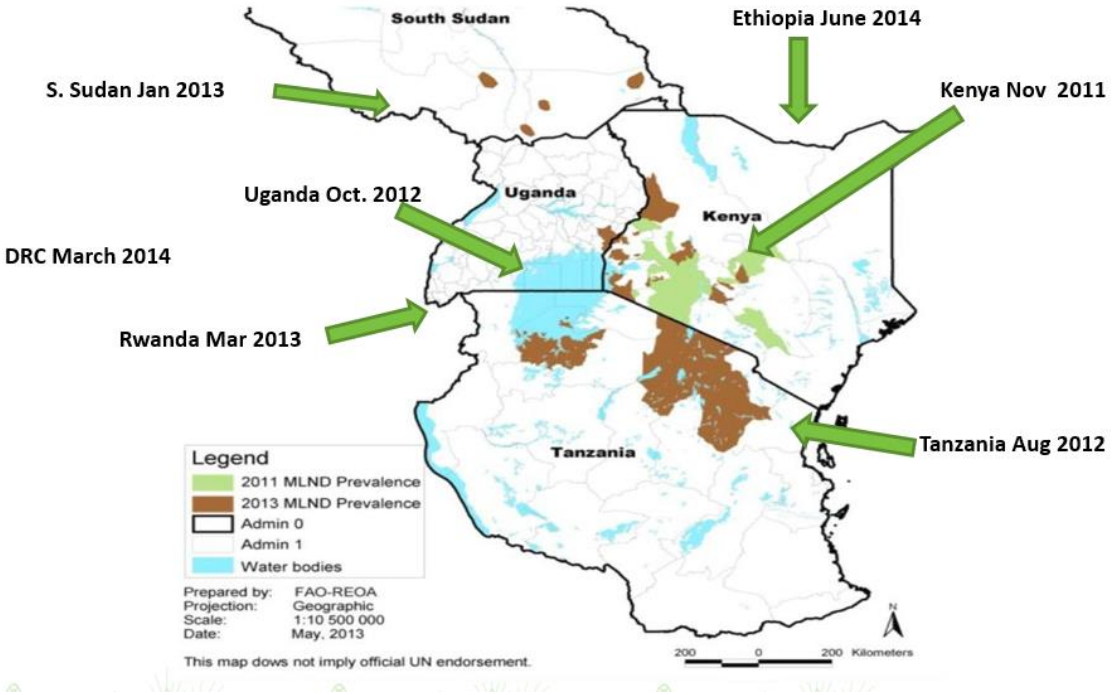
new plant disease Maize Lethal Necrosis (MLN); and other mycotoxins such as fumonisin (a by-product of *Fusarium* activity). Based on field interviews and existing research, Table 1 provides a summary assessment of the top plant health and food safety issues identified in each country. Following the table, the text discusses each threat in more detail.

Table 1. Top plant health and food safety issues in each country for maize, groundnuts, and soya

	Plant Health	Food Safety	Key priorities
Malawi	Maize Lethal Necrosis Aflatoxin in maize Aflatoxin in groundnuts	Aflatoxin in groundnuts Aflatoxin in maize Fumonisin in maize	Strategies for preventing MLN Improving testing capacity Solutions to address the problem of MLN
Mozambique	Maize Lethal Necrosis Aflatoxin in maize Aflatoxin in groundnuts	Aflatoxin in groundnuts Aflatoxin in maize	Public awareness about the benefits of lowering aflatoxin levels, and how National Action Plan for mitigating the effects of MLN
South Africa	Maize Lethal Necrosis Fumonisin in maize	Aflatoxin in groundnuts Aflatoxin in maize	Better integration of smallholder farmers into existing representative associations
Zambia	Maize Lethal Necrosis Aflatoxin in groundnuts	Fumonisin in maize Aflatoxin in groundnuts	Improving testing capacity for MLN and aflatoxin Greater coordination in SPS committee

MAIZE LETHAL NECROSIS (MLN) affects maize production. According to reports, MLN destroys everything in the field and farmers cannot grow maize in the field for the next three years. Figure 1 below shows the countries in Eastern and Central Africa (Kenya, Tanzania, Uganda, South Sudan, Rwanda, DRC, and Ethiopia) where MLN has been observed, including the date of appearance. While there is still only limited basic agronomic research on MLN, the primary vectors for transmission are believed to be infected seeds moving from one area to another and pest infestation. Despite the attention-grabbing word "lethal" in its name, MLN poses no human health risk. The four target countries have not detected MLN, although nearly all have received shipments of maize from MLN-endemic countries (Kenya and Tanzania). MLN poses a major threat to intra-regional trade in maize, as some countries (Malawi) already require that the phytosanitary certificate provide proof that each maize shipment is MLN-free.

Figure 1: Spread of Maize Lethal Necrosis (MLN in East Africa)



Source: FAO REOA (Aisja Franken).

The potential trade impacts from MLN are difficult to quantify, given that intra-regional or cross-border trading often goes unrecorded. Official COMTRADE data shows South Africa's trade with the three other target countries totaling about $6 million in 2015, based on $4.9 million worth of maize imports (including seed) from Zambia, and South African maize exports to Zambia of $618,000. Malawi imported about $420,000 worth of maize from South Africa in 2015, but there are no trade data between Mozambique and South Africa in either direction.

AFLATOXIN refers to a by-product produced during the growth of toxic strains of the *Aspergillus fungi.* Ingestion can lead to aflatoxicosis, of which the worst outcome is rapid death, such as the 125 people who died in Kenya in 2004. Chronic ingestion can potentially lead to stunting, where children do not reach the appropriate height, and has been associated with increased vulnerability for the immune system (Probst, Niaupau and Cotty 2004). Aflatoxin affects groundnuts and maize in all four of the target countries. Pregnant women and children and those suffering immune problems are perhaps the most effected, given the prevalence of these commodities as weening food and their status as a primary source of carbohydrates and protein. The level of aflatoxin contamination in a farmer's harvested maize depends on the crop year, how much stress the plant experienced due to water shortage, and potentially to other plant diseases (Cotty and Jaime-Garcia, 2007). Further contamination occurs during the post-harvest period when practices such as drying cobs and shelled maize on the ground, and wetting groundnut shells prior to shelling, often increase aflatoxin contamination levels. Therefore, supporting improved post-harvest practices can reduce some proportion of post-harvest contamination.

High levels of aflatoxin contamination have led to disruptions in trade from time to time, particularly for groundnuts from Mozambique and Zambia entering South Africa. At present, only commercial exporters test shipments of groundnuts or maize in Southern Africa for aflatoxin in order to meet the import requirements of target markets.

FUMONISIN is a type of mycotoxin that results from the growth of *fusarium* on plants. The International Cancer Research Center classifies it as a Category 2 carcinogen, with links to throat cancer, spinal defects in newborns, and poor growth outcomes. The specialist stakeholders interviewed in South Africa and Zambia cited fumonisin as a major problem, while the Agricultural Commodity Exchange (ACE) in Malawi includes it as part of the grading criteria for maize. High levels of fumonisin contamination could disrupt maize trade in Southern Africa, but tests to detect fumonisin are not routine.

PLANT HEALTH AND FOOD SAFETY SYSTEMS

The national administrations in each country have undertaken many activities to combat plant health and food safety problems in the maize, groundnut, and soya bean value chains, often with the help of development partners. These activities prioritized boosting basic research on these topics, raising public awareness of these threats, and improving each country's institutional and regulatory capability to prepare for and respond to these and future threats. One of the identified weaknesses from our field research was the prevalence of overlapping competencies across the ministry of health, ministry of agriculture, and the bureau of standards in each country. One of the simplest ways to conceptualize the division of labor is that the ministry of agriculture is responsible for plant contamination while the ministry of health is responsible for food infestation.

> *Generally, most of the acts and regulations of SADC Member States are unable to adequately deal with emerging SPS issues and the process of updating them is cumbersome.*
> USAID SATH 2014

HUMAN CAPACITY. Generally speaking, officials in each country's ministry have the requisite knowledge to implement sound SPS systems for these value chains. The framework for coordination among the range of different stakeholders on the national SPS committees is technically in place—they are supposed to work together—but in practice officials often "work in silos," content to cover their own individual responsibilities without a broader perspective in which the sharing of information is prized and seen as effective. Limited budgets mean that the national SPS committees lack logistical and secretariat support, making it difficult to conduct necessary travel to various offices within each country, and to regional-level meetings of COMESA or SADC.

LABORATORIES. Each country has laboratories capable of testing for aflatoxin and fumonisin, although few of these laboratories are accredited to do so. Outside of South Africa, one laboratory after another that we visited described how they had the proper equipment, but typically lacked the "consumables," or testing strips and re-agents, needed to perform the tests. There is no germ plasm MLN-testing capability in Malawi, Mozambique, South Africa, or Zambia. Officials must send samples to Kenya, which is acceptable given that there is no outbreak yet and the cost of necessary equipment is substantial.

THE DESTRUCTION OF FOOD contaminated with overly high levels of aflatoxin contamination was a pressing concern for our field research team. Public health officials offer clear guidance to incinerate contaminated maize and groundnuts. Past approaches such as feeding it to livestock, burying it in the soil, or dumping it in the ocean or lakes only prolong or enhance the problem. Even if identified as having excessively high aflatoxin levels, the contaminated lots often end up seeping out of the very-limited control system and consumed by those living in poverty. Yet destroying the contaminated food results in a deadweight economic loss for the owner of the food, with no compensation, and incineration can cost three or four times the value of the food per ton. Priority Recommendation #5 calls for a wide-ranging reflection on how to address this conundrum, including proposals for alternative methods such as controlled blending of over- and under-lots in peanut butter, and controlled experiments integrating over-lots into compound feed for animals.

Our assessment for these countries, again excepting South Africa, is that external influences can play a highly positive role in upgrading and improving the national SPS systems. The best approach for disseminating public goods is typically through regional and multilateral entities who champion a cause and provide long-term support to complex multifaceted issues. An example of such long-term support is the development of the biocontrol product Aflasafe with support from the USDA, USAID, and the Bill & Melinda Gates Foundation. Bilateral donors such as U.S. agencies (USAID, USDA/APHIS, and USDA/ARS), the European Commission (EC), and a range of others have undertaken many activities in this area. Multilateral donors and international agencies have also been active, often with a single bilateral donor supporting a multilateral activity. For example, Austria's development aid agency helped to finance UNIDO's activities on laboratories in Mozambique. The RECs to which our four target countries belong, specifically the Common Market for Eastern and Southern Africa (COMESA), the Southern African Development Community (SADC), and the continent-wide African Union (AU), have also been active. Three tables in Annex III detail these activities.

VALUE CHAIN SNAPSHOTS

MAIZE is a human staple and a major input into animal feed in the four target countries, with many value-added opportunities and brisk intra-regional trade. Official COMTRADE figures show the four countries exporting over $550 million in 2014, although this figure may not account for even half of total exports because much intra-regional and cross-border trade goes unrecorded. Levels of aflatoxin contamination and other mycotoxins, such as fumonisin (particularly in Zambia), vomitoxin, and diplodium afflict a proportion of the region's maize. The threat of the spread of MLN to any target country could severely disrupt domestic production and maize trade. Among the target countries, only Zambia does not have a national maximum aflatoxin tolerance level for maize, but uses the COMESA standard. Intra-regional trade could be severely disrupted if countries start to enforce aflatoxin standards on imports, especially since testing for aflatoxin is not commonly performed. There is a significant risk of contaminated truckloads from Malawi and Mozambique.

MAIZE SEED is a dynamic part of the Southern African maize market. South Africa and Zambia are both leading producers among African countries, with those countries exporting about 3,000 tons and 25,000 tons respectively in 2015. Maize seed industries have growth opportunities due to the "continent's heavy dependence on domestic seed producers" (World Bank 2013), but face the same phytosanitary threats as maize. However, the cost of losses due to plant diseases is substantially higher as maize seed is a sophisticated, value-added product. MLN could potentially disrupt maize seed trade for South Africa and Zambia.

GROUNDNUTS are an essential food and a key source of protein in rural and poor consumers. The four target countries grow groundnuts, commercially eaten as roasted table nuts or in peanut butter. The main plant health and food safety threat to groundnuts is aflatoxin. This report identifies a range of post-harvest handling and storage techniques that have the potential to reduce aflatoxin increases and are easy to implement. See Box 7 in the main text below. Trade in groundnuts, both formal and informal, is brisk between these Southern Africa countries, although groundnut trade statistics are quite unreliable. Most of the four target countries both import and export groundnuts based on location and the time of year. Only Mozambique regularly reports on its groundnut trade to the U.N. system, showing exports of $1.65 million in 2014, excluding informal trade.

SOYA BEANS are a small but growing part of the crop mix in these four countries, with South Africa producing 948,000 tons in 2014 and the other three countries producing about half that volume combined. Plant health diseases such as MLN and food safety threats such as aflatoxin do not affect soya beans. Therefore, the soya bean value chain could present an alternative for producers and consumers. The main SPS concern is

soya bean rust, which is not a trade-related SPS issue, and will not block trade. Soya bean rust appeared in Zambia in 1998, Mozambique in 2000, South Africa in 2001, and Malawi in 2014. Although trade flows within Southern Africa are limited, Malawi often registers between $3 million and $8 million in official exports, while Zambia appears to export steadily to several countries, including Botswana. South Africa imports a great deal of soya beans and soya bean meal into Cape Town off world markets, and exports part of its own production through its northern borders.

IDENTIFIED INVESTMENT OPPORTUNITIES

One of the main outcomes of this study is a set of recommendations for U.S. government investments (and for other development partners) to combat plant health and food safety problems, raise public awareness of these issues, and improve the coordination of different actors with overlapping competencies within and between countries. The ultimate purpose of the recommendations is to reduce food insecurity through increased agricultural trade. This report proposes regional-level, country-specific, and private sector investment activities deemed to be fundable and cost-effective. Table 2 presents seven priority regional-level recommendations. Table 17 in Section 6 presents each recommendation in detail, describing the key counterparts and anticipated difficulties of each regional-level, bilateral-level, and private sector investment recommendation. The full list of recommendations is in Annex Four.

Table 2. Priority regional-level recommendations for investments

Key Constraint	Recommended Activity	Priority
Lack of knowledge of MLN, including how to formulate a multi-stakeholder national strategy to combat MLN.	**#1: Group Study Trip on MLN.** Organize a group study trip for experts from the ministry of agriculture and the national standards bureaus in each of the four target countries to learn about MLN and Kenya's efforts to combat it. Publish the findings for members of the public, in English and Portuguese.	High
Need for early warning of presence of MLN.	**#2: Broader Sampling for MLN.** Fund International Maize and Wheat Improvement Center (CIMMYT) sampling for MLN in Mozambique and South Africa, and repeat sampling in Malawi and Zambia.	High
Many different regional standards for aflatoxin, leading to confusion among public and private actors.	**#3: Adoption of Clear National Standards on Aflatoxin.** Encourage the national SPS committees in each of the four target countries to adopt and implement the SADC and COMESA standards for aflatoxin in both maize and groundnuts, or approve and implement a national standard following science-based standards.	High
Lack of public awareness about how to reduce aflatoxin contamination in groundnuts.	**#4: Public Information on Reducing Aflatoxin in Groundnuts.** Gather available evidence about post-harvest handling and storage techniques to reduce aflatoxin in groundnuts, along the lines of Table 7 (see section 5.1). Validate the findings with national ministries of agriculture, and translate into Portuguese. Produce a series of communications tools to expand public knowledge of these aflatoxin-reduction techniques: infographics, posters, laminated display rolls suitable for use in the field, laminated quick-reference cards mothers and other food preparers can keep handy. Develop visual, picture-based tools to inform people in rural areas with low levels of education and literacy about the effects of aflatoxin. These visual tools will address stunting and other problems, including information to mitigate those effects.	High

Table 2 cont

Key Constraint	Recommended Activity	Priority
Incineration of aflatoxin-contaminated food is difficult to ensure due to lack of compensation for the maize or groundnuts, high cost of incineration, and diversion of contaminated food to poorest populations.	**#5: Find Alternative Uses for Contaminated Food.** Commission multi-disciplinary report to develop recommendations for alternative uses for aflatoxin-contaminated maize and groundnuts. The report will examine: a) The ability of countries to deal with products that contain elevated levels of aflatoxin b) The capacity in each country to incinerate the contaminated food and the cost to destroy it c) The possibility of blending shipments of groundnuts with elevated (but not astronomically high) contamination levels with shipments of groundnuts with levels well below the tolerance level in order to produce a product (peanut butter) that meets the standard. Through SADC, develop a voluntary Code of Good Practice for the Disposal of Contaminated Food for individual countries and businesses.	Medium
Difficulty targeting areas with high-vulnerability to aflatoxin and their human populations.	**#6: Predicting High-Vulnerability Aflatoxin Areas.** Conduct a systematic analysis of aflatoxin prevalence in each of the four target countries, and in the neighboring East African and Southern African regions. Create a system to profile vulnerable areas in each country, and build monitoring systems and capabilities. Assist each country to develop a forecasting system to better target zones where aflatoxin contamination is likely to proliferate. Form an action committee that includes the national meteorological services, the ministries of agriculture and health, the national standards bureaus, and the office of the prime minister. Publish the results in local newspapers and broadcast on national TV and radio. As a comparison, research the U.S. system that monitors weather patterns to predict the location of aflatoxin outbreaks and the capabilities of Famine Early Warning Systems Network (FEWS NET) programs.	High
Lack of institutional vigor to address plant health and food safety issues	**#7: Support National SPS Committees.** Provide secretariat and logistical support to the national SPS committees comprised of a broad range of stakeholders, including the ministry of health for food safety issues, the ministry of agriculture for plant health issues, and the national bureau of standards for laboratory capacity, accreditation, and throughput. A lump sum of $20,000 per year per country would permit the national SPS committees, inter-ministerial in nature and open to participation by private sector operators and civil society stakeholders, to meet quarterly and to publish their conclusions and activities.	Medium

2. STUDY OBJECTIVES

USAID's Bureau for Food Security commissioned this study under the Leveraging Economic Opportunities (LEO) project. The study's aim is to identify key constraints to trade (focusing on SPS measures) within the maize, soya, and groundnut value chains in Southern Africa, and to gauge opportunities for potential SPS-related investments along these chains. The study includes an analysis focusing on SPS needs and issues within the value chain, bringing together a wealth of knowledge about the targeted value chains by inventorying key SPS constraints that prohibit value chain development and by prioritizing solutions to address identified SPS/value chain constraints.

OBJECTIVES

1) **Assess SPS impacts on trade**
   - Map current trade flows in and out of Malawi, Zambia, Mozambique, and South Africa for maize, maize seed, groundnuts, and soya beans (based on numbers from the last five years). Based on data collected in country and data available about neighboring countries, predict the potential impact on imports and exports if SPS issues around aflatoxin and MLN were enforced at borders.
   - Conduct a rapid survey at the main food processing points in each country's capital to establish their awareness of and concern about aflatoxin.

2) **Assess SPS systems within the targeted value chains**
   - Assess current SPS systems in the region, including SADC standards and how they are applied, availability and capacity of laboratories, and the use of SPS and other grades and standards in contracting across the focus FTF value chains. This will include assessing country capacity to carry out SPS inspections prior to commodity export, as well as whether the costs charged are sufficient to cover the costs incurred, including equipment depreciation.
   - Map the institutional profile of the value chains (public, private, and community-based) to identify key actors and determine their strengths and weaknesses.
   - While Maize Lethal Necrosis (MLN) is an emerging SPS issue, the main areas experiencing the disease are north of the four target countries. The first area of concern is the movement of maize seed. Therefore, assess the precautions that East Africa has put in place to prevent maize seed exposure to MLN and the potential application of these regulations in the SADC region. The assessment will also establish relevant officials' awareness of MLN and additional precautions already in place.

3) **Use existing assessments, analysis, and studies as basis for work**
   - Coordinate with the USAID South Africa Regional Mission and bilateral missions in the target countries to identify existing assessments, analyses, and studies.
   - Identify constraints along the value chain that impact regional trade of maize, soya, and groundnuts in Southern Africa. This will include looking at the impact of global and Sub-Saharan African markets on these value chains.
   - Assess and identify gaps in country and regional capacities to prevent/mitigate the introduction of aflatoxin, other mycotoxins such as fumonisin, and emerging threats such as MLN. Determine laboratories' capacities to test for aflatoxin and other toxins affecting food safety.

- Assess regional- and national-level detection and border inspection capacities and mitigation measures. Identify the gaps and constraints to help inform prioritization of potential investment opportunities.
- Assess the relative importance of SPS issues in constraining regional trade flows of these commodities.

4) Identify investment opportunities

- Map current initiatives relevant to addressing SPS barriers at the level of bilateral donors, international organizations, and the African RECs. Identify priorities among issue areas.
- Analyze SPS constraints to the development of FTF value chains and possible solutions. Recognize and map alternative investment efforts by other partners to the SPS constraints identified.
- Utilizing the gaps or constraints in the SPS systems identified for each value chain, identify and prioritize the options and opportunities (at both the regional and country level) relative to potential increases in investment, whether from private or public flows.

3. APPROACH AND METHODOLOGY

The methodology for this study relied on a combination of background reading, personal knowledge on the part of the field research team, and field interviews. As demonstrated in the Bibliography in Annex One, there is an extensive body of recent research studies and news articles published about plant health and food safety issues. Lessons from the prior LEO studies on trade-related SPS issues in East Africa and West Africa also informed this report.

The primary interlocutors for interviews in each country were the plant health directorates at the ministries of agriculture, the food safety directorates at the ministries of health, the national bureaus for standards and quality assurances, and the testing laboratories. The field research team also sought interviews with seed industry operators, food processors, traders, and representatives of the international donor community (European Commission, UNIDO, World Bank, World Food Program).

Table 3: Summary table of in-country interviews

	Number of respondents
Persons met or interviewed	78
Rapid survey of food processors	12
Survey of general public awareness	57

The scope of work also called for a rapid survey of awareness about aflatoxin among the main food processors in the capital cities of each country, as well as an assessment of general public awareness about the risks of aflatoxin in each country. Table 3 above shows that our field research team interacted with close to 150 people.

4. SOUTHERN AFRICA REGIONAL SPS FRAMEWORK

4.1 INTERNATIONAL ORGANIZATIONS & AGREEMENTS

Malawi, Mozambique, the Republic of South Africa, and Zambia have all signed a number of international agreements and belong to international organizations related to trade-related phytosanitary barriers in the maize, maize seed, groundnut, and soya bean value chains.

WORLD TRADE ORGANIZATION-RELATED CONSIDERATIONS

The **International Plant Protection Convention (IPPC)** located in Rome is the entity recognized in the WTO Agreement on Sanitary-Phytosanitary Measures (SPS) as the international standard-setting body for phytosanitary issues. Countries may develop their own standards, if equivalent or greater in protection than those of the IPPC, or adopt the IPPC standards.

The Codex **Alimentarius Commission (Codex)**, also located at FAO, is recognized as the international standard-setting body for food products. In 1962, the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) created Codex, with a global mandate to develop food standards for the protection of consumers' health and to ensure fair practices in food trade. Countries are become compliant with international norms by adopting Codex standards, and do not have to undertake additional risk assessment in developing their national standards. The FAO/WHO Coordinating Committee for Africa includes 48 countries, including all SADC members. Key concepts for these agreements are transparency, designation of **National Enquiry Points and National Notification Authorities for SPS and Technical Barriers to Trade (TBT)**. The WTO operates an SPS Information Management System (www.spsims.org).

A Southern Africa Trade Hub (SATH) report noted "the lack of awareness among African decision-makers to prioritize Codex and food safety activities in allocating national budgets. The basic elements of an effective national food control system are as follows: up-to-date standards, food laws and regulations that are based on Codex standards and guidelines; risk-based inspection services; competent laboratory services; education, communication and training programs; and appropriate food safety management systems at industry level" (USAID SATH 2014).

The WTO periodically studies each member country's economy, legislation, and regulatory structure in its **Trade Policy Reviews (TPR)**. The latest TPR for Zambia appeared in May 2016, for Malawi in March 2016, and for South Africa as part of a combined report on the Southern African Customs Union (SACU) in February 2016. The last TPR for Mozambique was in 2009, while the last single-country TPR covering South Africa appeared in 1998.

When adopting a new SPS regulation, countries are obliged to notify the WTO Secretariat, which then notifies the other 161 member countries. There is no existing comprehensive analysis of the number of SPS-related notifications by each of the four target countries. Zambia made only one SPS-related notification in 2000, signaling its acceptance of the code.

THE AFRICAN UNION (AU)

Headed by the African Union Commission (AUC), the African Union is the apex regional economic community (REC) comprised of the eight recognized component RECs[1] and non-affiliated countries (USAID BEAM 2012). The AU has 153 member countries, with Morocco a former member.

A specialized agency of the AU, the **Inter-African Phytosanitary Council (IAPSC)**, coordinates with the IPPC. The IAPSC, comprised of national experts with the AUC providing technical support, is an intergovernmental regional organization with 53 member countries.

The IAPSC also collaborates on the project **Participation by African Nations in Sanitary and Phytosanitary Setting Organizations (PAN-SPSO)**, financed by the European Commission, assisting seven RECs in Africa to facilitate effective involvement of African countries in the activities of the **Organization for International Epizootics (OIE)**, IPPC, Codex, and the WTO-SPS Committee. The **Standards and Trade Development Fund (STDF)**, which receives U.S. support, participates in the PAN-SPSO as a technical and strategic partner.

The AUC also houses the **Partnership for Aflatoxin Control in Africa (PACA)**, a coordinating body for the IITA's work on Aflasafe, active in Malawi, Mozambique, and Zambia. Also under PACA is the Africa Aflatoxin Information Management System (AfricaAIMS), a clearinghouse for countries to share aflatoxin-related information.

SADC

The four target countries in the study belong to the Southern African Development Community (SADC), a 15-country regional economic community (REC) (Table 4). The 2008 SADC SPS Annex to the SADC Protocol on Trade largely aligns with the WTO SPS Agreement, with the same principles and provisions (USAID SATH 2014).

Table 4. Country membership in regional economic communities (RECs)

	SADC	COMESA	Tripartite[1]	AU CFTA[2]
Malawi	X	X	X	X
Mozambique	X		Not actively	X
South Africa[a]	X		X	X
Zambia	X	X	X	X

[a] South Africa also belongs to the Southern African Customs Union (SACU), the oldest customs union in the world, dating from 1910. SACU is not one of the eight RECs recognized by the African Union.
[1] The Tripartite Free Trade Area represents an initiative launched in 2008 to bring together COMESA, the East African Community (EAC) and SADC in a 26-country trading zone covering "from Cape Town to Cairo." See DFID (2015).
[2] The African Union launched an ambitious plan for a Continent Free Trade Area (CFTA), aiming to build upon the regional integration efforts of the African RECs and to include all 54 African countries.

[1] Arab Maghreb Union (AMU), Economic Community of Central African States (ECCAS), Economic Community of Sahelian States (CEN-SAD), Common Market for Eastern and Southern Africa (COMESA), East African Community (EAC), Economic Community of West African States (ECOWAS), Inter-Governmental Authority on Development (IGAD), and the Southern African Development Community (SADC). Other RECs such as SACU are considered to be subsumed by the eight recognized RECs.

SADC does not have the legal framework to support the adoption of regional harmonized SPS standards. As a result, there is no SADC standard for aflatoxin. However, SADC legislation encourages member states to adopt the standards developed by the IPPC and Codex.

National SPS committees have not been able to meet regularly without operational budgets from their respective governments. The SADC SPS Coordinating Committee has a Food Safety Technical Committee, whose members participate in the national SPS coordinating committees (USAID SATH 2014).

The USAID Southern Africa Trade Hub (SATH)[2] issued a **comprehensive assessment of the status of implementation of the SPS Annex to the SADC Protocol on Trade**, finding that most SADC countries had made considerable progress towards compliance (USAID SATH 2010). In 2016, the USAID SPEED project conducted a study of Mozambique's degree of compliance with both the WTO SPS agreement and the SPS Annex to the SADC Protocol on Trade, concluding that Mozambique had largely fulfilled its obligations (USAID SPEED 2016).

Trade-related plant health and food safety considerations do not fall solely under the WTO and REC SPS agreements, but also under the agreements on technical barriers to trade. Required and permitted information on labeled food products crossing borders is but one example.

Laboratories testing for plant health or food safety threats have greater credibility when they receive accreditation from an outside body. The **Southern African Development Community Accreditation Service (SADCAS)**, set up under the SADC TBT Annex, is a REC-wide entity tasked with formulating and finding agreement on common accreditation standards and procedures. SADCAS, located in Botswana, is a subsidiary organization of SADC set up as a non-profit. SADCAS is responsible for the accreditation of laboratories (calibration/testing), certification bodies (management systems/product/personnel) and inspection bodies. National accreditation focal points help disseminate SADCAS materials. The Danish development agency DANIDA has worked with SADCAS to reduce regulatory barriers to trade and investment, targeting value chains of importance for poverty reduction and structural transformation (WTO 2013). SADCAS has accredited Intertek in Mozambique and Zambia's Bureau of Standards (ZABS) for certain procedures.

The SADC member countries issued a revised version of the SADC SPS Annex in July 2014 (SADC 2014). Article 9, **Adaptation to Regional Conditions, including Pest or Disease-Free Areas and Areas of Low Pest Prevalence**, provides mechanisms for countries to determine sub-national zones, as under the WTO SPS Agreement. Mozambique has one approved zone in the south of the country. However, the zone was declared ineligible for a period of time, with the present status uncertain.

USAID's Southern Africa regional mission has supported the drafting of both a **SADC Regional Strategy for Food Safety** and a **SADC Regional Strategy for Plant Health** (SATH 2014a and 2014b). As of mid-2016, the SADC Secretariat and member countries had not yet formally approved these draft strategies. The strategies detail the control, inspection, and approval procedures, with a robust component regarding stakeholder relations, communication, and SPS awareness. The draft SADC Regional Strategy for Food Safety called for strengthening the capacities of the national Codex committees and SPS committees. Further, the

[2] Also known as the Southern African Global Competitiveness Hub.

strategy proposed support for a regional network of laboratories on (i) microbiological risks, (ii) pesticide residues, (iii) heavy metals and trace elements, (iv) mycotoxins, (v) veterinary drug residues, and (vi) genetically modified organisms (GMOs), along with coordination and training activities (USAID SATH 2014a).

For seed markets, in which maize seeds play a central role, SADC countries have signed **Technical Agreements on Harmonization of Seed Regulations** in the SADC region, covering seed variety release, seed certification and quality assurance, and quarantine and phytosanitary measures for seed. SADC is developing integrated border management (IBM) systems (USAID SATH 2011).

COMESA

COMESA has 20 member countries. Malawi and Zambia both belong to COMESA and SADC, while fellow SADC members Mozambique and South Africa do not belong to COMESA. As with SADC, COMESA does not have the legal framework to support the adoption of unique regional harmonized SPS standards. However, COMESA countries have adopted the already recognized standards developed by the IPPC and Codex as the regional COMESA standard. For maize, the COMESA aflatoxin tolerance standard is 10 parts per billion (see Table 9).

One of COMESA's most dynamic initiatives in this area is the ongoing work on harmonized seed regulations, begun in 2008 (World Bank 2013). Once passed by the ministers of agriculture, natural resources and the environment, the draft COMESA regulations moved to the COMESA Council of Ministers at the end of 2013. The SADC and COMESA harmonized seed regulations follow the example of the seed schemes developed by the Organization for Economic Cooperation and Development (OECD) and the European Union (EU).

Assisted by the **Alliance for Commodity Trade in Eastern and Southern Africa (ACTESA)**, a specialized COMESA agency, each SADC member country is in the process of transposing the SADC regional directive into national law and developing capacity in several technical areas. These technical areas include the accreditation of seed laboratories to International Seed Testing Association (ISTA) standards, and the transparent and orderly licensing and registration of seed inspectors, seed samplers, and seed analysts (ACTESA 2013). The U.S. has long been a strong supporter of ACTESA. ACTESA is also helping COMESA member countries to launch the Capacity Improvement of the Seed Sector in the COMESA Region program (CISSCO). In 2013, the Zambia Climate Change Network conducted a study of relative awareness on the part of the region's private sector actors and the general public of the COMESA seed trade harmonization regulations (World Bank 2013).

Another COMESA-affiliated body is the **Southern and East African Regulatory Committee for Harmonization (SEARCH)**. In principle, the committee automatically registers agrochemicals registered in at least three SEARCH countries in the other countries. Whether this has actually facilitated trade in agrochemicals is uncertain.

TRIPARTITE FREE TRADE AREA

The Tripartite is an ongoing effort since 2009 to bring together COMESA, the EAC, and SADC into a free trade area covering Cape Town to Cairo. The Tripartite will also help resolve the thorny problem of overlapping membership in RECs, which is an issue for Malawi and Zambia.

Annex 8 of the Tripartite Agreement covers the technical negotiating area of Standards, Quality Assurance, Metrology and Testing (SQMT), directly relevant to this USAID LEO Southern Africa SPS study. A recent DFID study examined the international framework supporting this Tripartite negotiating area.

As with all three of its component RECs, the Tripartite is aiming to minimize the delays in the clearance of perishable products caused by phytosanitary border controls. The SATH has pointed out the need to streamline phytosanitary procedures to reduce the delays at ports of entry, most of which occur during laboratory testing because the samples must travel long distances to the testing facility while the truck and its produce wait in the sun. Most ports of entry do not have the required laboratory diagnostic equipment, expertise to conduct phytosanitary diagnostic testing, and verifications, and in some cases even lack the infrastructure for visual inspections by plant health inspectors (SATH 2014).

In terms of the donor-related activities already undertaken or underway, Annex Three provides a series of three side-by-side tables showing respective activities in the areas of plant health and food safety for maize, groundnuts, and soya bean. The first shows activities sponsored by the U.S. and other bilateral donors, broken out by regional-level and national-level interventions. The second shows activities by multilateral and international organizations, and the third shows activities by the applicable African RECs (AU, COMESA, and SADC).

4.2 KEY NATIONAL SPS BODIES AND SYSTEMS

This LEO Southern Africa SPS study aims to lay out the institutional and regulatory framework related to plant health and food safety issues in each of the four countries. Table 5 provides U.S. entities and other interested parties with a quick-reference guide of institutional mapping of regulatory responsibilities.

Table 5. Institutional mapping of regulatory responsibility on SPS-related issues

	Plant Health	Food Safety	Quality Assurance and Normalization
Malawi	Ministry of Agriculture	Ministry of Health	Malawi Bureau of Standards and the Phytosanitary Department of Ministry of Agriculture
Mozambique	Ministry of Agriculture	Ministry of Health	National Institute for Normalization and Quality Assurance (INNOQ), under the Ministry of Trade and Industry
South Africa	Department of Agriculture, Forestry and Fisheries (DAFF)	Department of Health (part); DAFF (part)	DAFF
Zambia	Responsibilities split between the Plant Quarantine and Phytosanitary Services and the Zambia Agriculture Research Institute (ZARI), both under the Ministry of Agriculture	Food and Drugs Control Laboratory, Ministry of Health	Bureau of Standards, under the Ministry of Commerce, Trade and Industry, with ZABS present both at borders and with a laboratory in Lusaka

ACTION ITEMS FOR SPS LABORATORIES

In general, the laboratories in Malawi, Mozambique, and Zambia would benefit from the action items for SPS laboratories specified below from the LEO East Africa SPS report. South Africa's laboratories more closely align to the desired standards, although greater public knowledge of the benefits of testing food for food safety risks could lead to properly testing a higher percentage of South Africa's food.

- Establish a laboratory quality management system involving proficiency testing and third-party accreditation
- Encourage the development of regional laboratories to meet the growing demand for export testing and disease surveillance
- Maintain close working relations and linkages between national laboratories and world reference laboratories (IPPC/FAO)*
- Send staff for short term training and refresher courses
- Build analytical capacity to undertake residue testing in foods of animal origin (meat, fish, milk, honey, etc.)
- Support departments to submit proper budget requests covering the full cost of sampling, testing, and issuing relevant certificates and results
- Promote the need to provide the required budget for departments to carry out their roles effectively
- Initiate cost recovery from the commercial sector to self-sustain quality laboratory services

Reference: USAID LEO East Africa SPS Project (2015), Table 7.

** The East Africa report mentions the OIE rather than the IPPC.*

The USAID Southern Africa Trade Hub, now completed, undertook an assessment of the testing facilities in Malawi, Mozambique, and Zambia (SATH 2015). The sections below reflect many of those findings, but readers desiring an in-depth look should refer to that report.

As noted in the USAID LEO East African report, "The goal is to build a plant health system prepared for any future eventuality… Government SPS regulators at county and national level would benefit from training in rapid field test kit use and surveillance methods. Further capacity building for plant health research and regulatory services diagnostics and risk assessment would improve disease detection and food safety. Training on regulatory rule making and disease control program implementation are needed" (USAID LEO 2015). Our field research showed the importance of relevant departments receiving the proper budgetary support so they can effectively fulfill their roles. Although they often have the required equipment, it may stand idle since there is no support for the cost of re-agents, staff to run the tests, or even the cost of fuel to go out and inspect goods.

BORDER CONTROLS AND CHECKPOINTS

The four target countries only apply SPS standards on exports determined by the importing country's maximum level, and on companies producing ready-to-use therapeutic food (RUTF) for the UN to treat malnourishment/stunting. Local businesses do not consider SPS issues. Formal cross border contracts require import documentation, including the exporting country's phytosanitary certificate. In many African countries, obtaining the phytosanitary certificate is a mere formality, as the inspectors are not always as rigorous as they should be.

The phytosanitary unit can easily detect insect infestation at the border. A fumigation certificate should accompany all imports with no live infestation. The phytosanitary unit should visually inspect the product for the presence of live insects (which is acceptable if samples are taken and inspected). The buyer will inspect local food at purchase, where he/she will accept the presence of live insects depending on the number, an

agreed discount in price, and how quickly the grain is used. One buyer's rejection means the grain will typically move to another buyer with lower quality requirements, ultimately ending up in animal feed.

The country-specific sections below address these institutional and regulatory frameworks and discusses each nation's laboratory testing capacity.

4.3 MALAWI

Malawi has a well-developed set of institutions related to SPS for the targeted value chains. The following institutions are responsible for ensuring food safety and quality control in Malawi:

- Ministry of Agriculture, Irrigation and Water Development (MoAIWD)
- Ministry of Health
- Malawi Bureau of Standards (MBS)
- Ministry of Commerce and Private Sector Development
- Pharmacy, Drugs and Poisons Board
- Local government assemblies (city, municipal, town, and district assemblies)
- Consumer Association of Malawi (CAMA)
- Ministry of Natural Resources and Environmental Affairs

Table 6 below provides an additional look at the roles and responsibilities of key institutions in Malawi.

Table 6. Additional breakdown of overlapping mandates in Malawian SPS institutions

Government Agency	Mandate	Task
Ministry of Health	• Disease control through surveillance	• Issue a health clearance certificate • Perform surveillance at points of entry
Malawi Bureau of Standards (Codex contact point, TBT enquiry point, and SPS enquiry point responsible for food safety. Serves as the secretariat for the national SPS committee)	• Formulates national standards • Conducts quality control and calibration measurements • Inspects imports covered by compusory standards • Implements a domestic quality scheme for commodities of potential public health, public safety, and environmental concern	• Test pre-shipment samples from exporting country • Document processing at points of entry • Physically inspect imports at points of entry
Ministry of Agriculture, Irrigation and Water Development (MAIWD)	• Ensure Malawi's participation in the WTO SPS Committee • The Chitedze Agricultural Research Station, under the Department of Agriculture Research Services (DARS), conducts research in all agricultural and related fields through seven research oriented commodity groups: (i) plant protection, (ii) cereals, (iii) grain legumes, oilseeds and fibers, (iv) horticulture, (v) livestock and pastures, (vi) soils and agriculture engineering, and (vii) technical services • Conduct mycotoxin research and regulation under soils and agricultural engineering in close cooperation with plant protection group	• Issue a phytosanitary certificate • Issue plant import permits • Issue non-GMO certificates • Conduct inspections

The national SPS committee includes all relevant ministries, chambers of commerce, the Malawi Export Promotion Council, and the Malawi Investment Promotion Agency. The committee also includes contact points in the Department of Animal Health and Livestock Development, under the MAIWD (contact point for the OIE and SPS enquiry point responsible for animal health) and the Department of Agriculture Research Services in the MAIWD (contact point for IPPC and SPS enquiry point responsible for plant protection). Nine phytosanitary inspectors work in Malawi, with four based in Lilongwe. The inspectors have the necessary qualification to carry out inspections at the border but are not equipped with the basic tools to carry out their role and function.

BORDER PROCEDURES

The Malawi Bureau for Standards (MBS) is responsible for implementing the import quality monitoring scheme. This scheme protects domestic consumers by monitoring the quality of imported goods to ensure that they do not cause safety or health hazards to humans and animals, or damage the environment. The MBS also seeks to "prevent Malawi from becoming a dumping ground for substandard products" (MBS website, www.mbsmw.org). All food products and most agricultural goods are subject to border controls by the MBS, including inspection (checking for labels and expiry dates) and the collection of samples for laboratory testing. Laboratories are not available at the borders (samples have to be sent inland for testing) so imported goods are generally cleared by the MBS once inspectors take samples, but before they obtain test results. Importers pay fees upfront, so there is often a MBS officer stationed at ports of entry to check for proof of payment before allowing cargo to clear the border. MBS controls are not risk-based and the MBS does not recognize test results provided by accredited laboratories outside Malawi because a mechanism to use such test results is not yet in place.

The MBS has standard specifications for maize grain, maize flour, and groundnuts. The MBS is currently harmonizing the standard for maize with regional standards for COMESA and EAC, and the Bureau as a whole is currently seeking accreditation from SADC. In order to learn the standards for a particular commodity, individuals must make a request to MBS and pay the requisite fee. The MBS catalogue lists these fees. For staple food crops, the document costs around $5 per crop for domestic purchase and $15 per crop for crops imported into Malawi. Standard inspection service is available at all points of entry, although the testing facilities are only in Blantyre.

The present MBS systems presents certain challenges for the facilitation of cross-border trade in staple foods. The MBS recognizes that the structure of the testing fees somewhat hampers cross-border trade for small traders, since the fees are the same regardless of the consignment's volume. Traders complained to our field research team about the lack of smallholder knowledge about quality specifications, affirming the need for sensitization campaigns to overcome this gap.

LABORATORY AND TESTING CAPACITY

A recent SATH report assessed the laboratory and testing capacity of public and private labs in Malawi, Mozambique, and Zambia. Three main conclusions and observations emerged:

1. Funding is one of the root problems for most laboratories in Malawi

2. Good laboratory management will assist laboratories to deliver proof of competency. A major focus must be on consistency in the supply of reliable test results within reasonable turnaround times in order to gain stakeholder confidence.

3. Laboratories in Malawi inevitably experience high running costs (USAID SATH 2015).

Interviews with laboratory personnel during the field research suggest that the fee structure for conducting testing does not recoup the actual costs. The laboratory charges US$20 per sample and can issue results within two days of receiving the sample.

Challenges identified during field interviews and literature research include accessing application forms. Exporters have to request forms for phytosanitary tests from the DARS (which is the official National Plant Protection Organization, or NPPO, within the context of the WTO) and forms for aflatoxin tests from the MBS. The phytosanitary test forms are available from NPPO regional offices at the Chitedze, Bvumbe, Lunyangwa, and Baka research stations and at the Mwanza, Mchinji, Dedza, Muloza and Songwe border posts, Chileka Airport, Kamuzu International Airport, and Kanengo Auction Floors. Exporters must collect the phytosanitary test forms in person, which are available in most districts, unlike the aflatoxin test forms, which are only available from MBS regional offices.

FOOD SAFETY LAWS AND REGULATIONS

Several laws and pieces of legislation govern issues of food safety in Malawi, including:

- Local Government Act, 1998
- The Standards Act (Malawi Bureau of Standards), 1972
- Public Health Act, 1948
- Consumer Protection Act, 2003
- Competition and Fair Trading Act, 1998
- Food By-laws, 2002
- Sanitary Arrangements By-laws
- Peddler's By-laws, 2002
- Pesticides Act, 2000
- Biosafety Act No. 13, 2002
- Fertilizers, Farm Feeds and Remedies Act No.43, 1989
- Plant Protection Act No. 11, 1969
- Malawi Bureau of Standards (Imports Quality Monitoring) Regulations, 2003
- Malawi Bureau of Standards (Exports Quality Monitoring) Regulations, 2003
- Import, export and transit regulations for GMOs, 2007

According to the authorities, draft bills on a new Plant Protection Act and a new Pesticides Act are under discussion in Malawi's Parliament. Malawi applies the harmonized application form for pesticide registrations, developed by the Southern and East African Regulatory Committee for Harmonization (SEARCH). Agrochemicals registered in at least three SEARCH countries would normally receive automatic registration in Malawi.

In 2008–2009, FAO initiated a five-year biosecurity project in Malawi, with a well-developed roadmap and ambitious goals. The field research team was unable to assess the effectiveness of this program, but the weaknesses in the SPS systems readily acknowledged by the public and private officials interviewed for this study demonstrate that much work remains.

4.4 MOZAMBIQUE

Mozambique has a similar bureaucratic structure for plant health and food safety to the structure shown in Table 6 above. While the national SPS coordinating committee represents these entities, their collaboration tends to be *ad hoc* rather than systematic in nature.

More so than in the other target countries, the government of Mozambique controls the seed industry (USAID SPEED 2016). For this reason, the registration of Aflasafe and MLN-resistant varieties figures as a pivotal issue, to ensure that Mozambique's farmers have access to products addressing the main plant health and food safety concerns.

ADDRESSING AFLATOXIN IN MOZAMBIQUE

Mozambique may have the greatest aflatoxin problem in both maize and groundnuts among the four target countries. This is partly due to the low-lying, humid climate, but also to low levels of knowledge of post-harvest and storage practices that can reduce aflatoxin levels.

Mozambique held a National Meeting on Aflatoxin Awareness and Management for Stakeholders and Interested Partners on June 18, 2015, with 45 participants (cited in Annex I: Bibliography under Mozambique Ministry of Agriculture and Food Security, 2015). Four working groups were formed to discuss: a) farmers' awareness; b) aflatoxin-related services; c) standards, quality control, and regional integration; and d) promoting public health.

The main recommendations by group were:

a) Farmers' Awareness
   i) Dissemination of good production and post-harvest practices
   ii) Development of an adequate communications strategy to deliver prevention messages that do not scare and do not discourage consumption of peanuts

b) Aflatoxin-related Services
   i) Development of an efficient network of laboratory diagnosis
   ii) Certification of national laboratories and/or development of accreditation agreements between national laboratories and those of destination of national grain exports
   iii) Promotion of laboratory testing in the field using mobile diagnostic kits

c) Standards, Quality Control, and Regional Integration
   i) Improvement of standards of testing/sampling protocols
   ii) Regulation of permissible levels of aflatoxin in products for domestic consumption
   iii) Strategic elimination of lots of grains diagnosed as infected

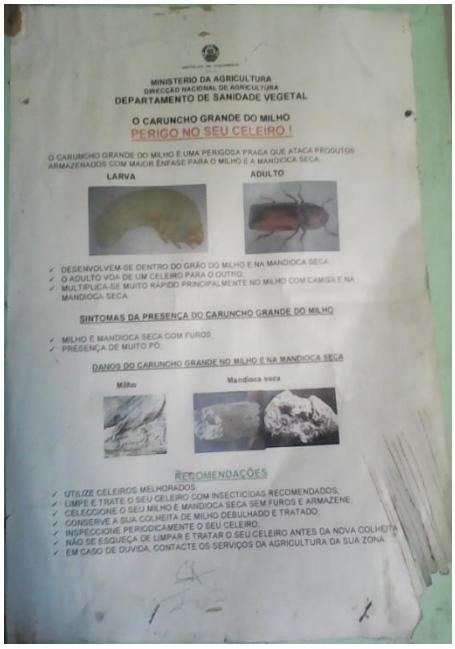
d) Promoting Public Health

i) Raising public awareness on the consequences of excessive exposure to aflatoxins

ii) Promotion of scientific studies on the prevalence of diseases related to the consumption of aflatoxin-contaminated foods

This 2015 meeting represents an excellent example of the type of countrywide, multi-disciplinary approach needed for an effective plant health and food safety strategy. It also represents what often happens afterwards. In subsequent interviews with many of the stakeholders that participated, it became clear that little else had been accomplished since the 2015 meeting. The meeting itself anticipated the need for follow-on activities, noting the need for "motivation and, if possible, material support to meetings between group members as well as of the plenary meetings for approval of recommendations to be submitted to decision-makers on changes to be made to control aflatoxins in Mozambique." Priority Regional Recommendation #7 in Table 2 of this LEO Southern Africa SPS study reflects this (see the Executive Summary).

Figure 2: Public Sensitization Poster at Mozambique Border Post



MOZAMBIQUE'S FOOD LAWS AND REGULATIONS

Under review or in process of writing up==ongoing

- Ministerial Diploma 180/2004 of 15th September—Regulation on Water Quality for Human Consumption
- Elaboration of the National Strategy on Food Safety

Existing and in force

- Good Practices Code on Food Handling
- Code of Good Practices for the Prevention and Reduction of Aflatoxin Contamination in Groundnuts
- Inspections Manual Regarding Food Hygiene
- Decree 15/2006, of 22nd June—Regulation on Hygienic and Sanitary Conditions for Production, Transport, Marketing, Inspection and Monitoring of Food Items
- Ministerial Diploma 88/87—Regulation on Pesticides
- Ministerial Diploma 80/87—Regulation on Imported Food Stuff
- Ministerial Diploma 100/87—Regulation on Food Additives
- Ministerial Diploma 51/84—Regulation on Hygienic Requirements for Food-Related Premises
- Ministerial Diploma 73/82, of 23rd June—Regarding Issue and Renewal Process of Hygiene Bulletin Instituted by Decree 5/80
- Decree 5/80—Regulation on Mandatory Possession of Hygiene Bulletin for People Handling Food Stuff

- Law 16/91, of 3rd August—Approving Law Water
- Decree 39/2006, of 27th September—Regulation on Quality of Bottled Water for Human Consumption
- Ministerial Diploma 180/2004, of 15th September—Regulation on Water for Human Consumption
- Law 8/82, of 23rd June—On Crimes Attempting Public Health

Source: Project research. Many thanks to Mozambique's Food Safety Office of the Ministry of Health for help with the status of legislation and validating of this table.

4.5 REPUBLIC OF SOUTH AFRICA

One of the most important aflatoxin-related events in South Africa's history was a food safety incident involving the school feeding program in the Eastern Cape region in the early part of the last decade. Peanut butter served to the students was found to have very high levels of aflatoxin (*SCIENCE* 2016). Since that time, the Primary Schools Nutrition Program has not included peanut butter in its menu. This is an example of how food safety scandals viscerally capture the attention of the general public. Given South Africa's improved laboratory capacity since that time, it may be worthwhile for South Africa to consider reintegrating peanut butter into its school feeding program, if the school authorities are sufficiently convinced that present testing procedures can ensure the food is safe.

In the Republic of South Africa, there are many shared responsibilities. The Department of Agriculture, Forestry and Fisheries (DAFF) is responsible for policy and regulatory development, agricultural trade promotion, and biosecurity. The other key role players in the South African agricultural regulatory landscape are:

- The National Agricultural Marketing Council Ministry of Health
- The Agricultural Research Council (ARC), which is responsible for all agricultural research
- The African Farmers' Association of South Africa (AFASA)
- AgriSA, which represents both commercial and small scale farmers and is made up of nine provincial and 24 commodity organizations
- Grain South Africa (GrainSA) is an independent voluntary association of grain producers whose aim is to represent the interests of farmers)
- The Agricultural Business Chamber, an association of agribusiness

In 2014, the 12 largest grain storage and handling companies established a fully-fledged and dedicated desk called Agbiz Grain within the Agricultural Business Chamber.

The Department of Health's Directorate for Food Control administers the sections of the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act No 54 of 1972) that relate to the manufacture, sale, and importation of foodstuffs. All imported food and agricultural products are required to comply with South Africa's food health and phytosanitary laws. In general, products cannot enter South Africa if they are a danger to human life or well-being, either directly or indirectly. South African Customs and Excise detains imported food for clearance by the port health authorities and may be inspected, sampled, and analyzed. In cases of non-compliance, the goods may require treatment prior to entering South Africa, or destruction outside South Africa. Regulations related to the hygienic handling of food and the inspection of food premises are promulgated under the Health Act (Act No 63 of 1977) and enforced by local authorities in their areas of jurisdiction. The Department of Health approves the maximum residue limits (MRLs) for pesticides, mycotoxins, other chemicals and metals that may be present in foodstuffs for both export and import.

The DAFF is the national contact point for the WTO SPS Agreement. The office on Agriculture Production, Health and Food Safety (APHFS) is responsible for administering SPS legislation and the management of risks associated with animal diseases and plant pests, ensuring compliance with the relevant regulatory frameworks and creating an environment for sustainable agricultural production. Within DAFF, direct control of SPS issues resides in three branches: plant production and health, inspection and quarantine services, and animal health.

Under the Agricultural Product Standards Act No. 119 of 1990, DAFF designated South Africa's Perishable Products Export Control Board (PPECB) to deliver inspection and food safety services. The PPECB has a statutory role in product quality inspection, food safety audits, sampling and laboratory analyses, and export certification. The PPECB also carries out inspections to ensure that all food business operators handling regulated agricultural products of plant origin that are intended for export comply with the standards and requirements. The PPECB laboratory in Pretoria carries out all official aflatoxin analysis of peanuts intended for export.

Eleven acts of parliament support SPS management in animal health, plant health, and food safety. Work is underway to review existing outdated legislation and to develop policy frameworks for food safety, animal health, and plant health to bring them in line with international best practice and the constitution.

SOUTH AFRICA'S FOOD LAWS AND REGULATIONS

- Agricultural Product Standards Act No. 119 of 1990 (APS Act)
- Health Act (Act No. 63 of 1977)
- The Foodstuffs, Cosmetics and Disinfectants Act No. 54 of 1972 and the Health Act No.61 form the legislative framework governing food safety, describing the official activities and tasks of the Department of Health
- The Agricultural Pests Act No. 36 of 1983
- The Fertilizers, Farm Feeds, Agricultural Remedies, and Stock Remedies Act No. 36 of 1947
- The Genetically Modified Organisms Act 15 of 1997, which provides measures for the *responsible* development, production, use, and application of genetically modified organisms
- Regulation 1047 of 2006, governing the maximum residue limits for pesticide residues in foodstuffs
- Notice R707 of 2005 on Food Safety and Hygiene Standards for food products of plant origin intended for export, applicable to the production of maize, groundnut, and soya bean products
- R918/1998 amended by R1125/2003, governing the general hygiene requirements for food premises and the transport of foods

DAFF has developed the following guidelines that go beyond these regulations:

1. A standard operating procedure (SOP) on sampling and analysis of grain, oilseeds, and groundnuts to determine mycotoxin levels and risk management as part of the export inspection and certification in terms of the APS Act
2. Operating guidelines for the traceability of regulated agricultural products of plant origin destined for export
3. An SOP on official export certification of regulated agricultural products that follows the APS Act No. 119 of 1990

In order to align South Africa's legislation with the constitutional framework and the country's obligations under the relevant international agreements, a draft plant health (phytosanitary) policy and food safety strategy are under consideration. Several pieces of legislation are also undergoing review.

SAMPLING AND LABORATORY TESTING

Nationally, there is an extensive network of private and public sector laboratories to service the groundnut, maize, and soybean sub-sectors.

The laboratories involved in the analysis of maize, groundnuts, and soya beans are:

i. Analytical Services North (Pretoria)—tests pesticide residues in maize

ii. The PPECB Laboratory (Centurion) —in 2014, DAFF extended the statutory mandate of this lab, recognizing it as an official testing site for the detection of mycotoxins in grain and animal feed for the export market. The laboratory recently introduced tests for fumonisin in maize-derived products and pesticides in groundnut-derived products.

iii. The Southern African Grain Laboratory (SAGL) in Lynnwood (Pretoria) is accredited to:

   a. Carry out multi-mycotoxin tests (aflatoxin, fumonisin, deoxynivalinol (DON), ochratoxin A,T2-toxin and zearalenone) in maize and soya using UPLC-MS/MS (Ultra performance liquid chromatography - tandem mass spectrometer)

   b. Grade white and yellow maize and soybeans in terms of government grading regulations

iv. The Food and Drug Assurance Laboratories, Pty Ltd. (Pretoria) can conduct tests for 12 mycotoxins, including aflatoxin, fumonisin, deoxynevalinol, nevalinol, ochratoxin A, T2-toxin, and zearalenone

In informal discussions with officials, the field research team learned that the official laboratories have adequate capacity in terms of equipment and skilled staff to monitor both the mycotoxin levels and to grade exports of maize, groundnuts, and soya beans. The challenge lies in the monitoring of imported commodities from trading partners in the SADC region, as well as rapid testing facilities/capability among smallholder farmers. This challenge is rooted in the fact that food safety policy is a shared responsibility between the DoH and DAFF.

Recent Testing at the Southern African Grain Laboratory (SAGL)

The SAGL conducts an annual maize quality survey at the request of the grain industry, with financial support from South Africa's Maize Trust. For the 2014/2015 survey, the SAGL collected 1,000 samples representing yellow and white maize from each production area. In terms of RSA grading standards, the maize crop produced in the 2014/2015 period was of good quality, with 70 percent of both white and yellow maize graded as maize grade 1. Out of the 350 samples tested for total aflatoxin (B1, G1, B2, G2), residues were detected in only two samples and B1 residues in only one sample since the SAGL laboratory began using the more sensitive UPLC-MS/MS technique. Over half (56 percent) of the samples tested positive for fumonisin, with an average level of 224μg/kg, higher than the previous season's average of 186 μg/kg.

Given that so few maize samples tested positive for aflatoxin, and that the level detected in the three samples was below the South African standard of 5 μg/kg (for aflatoxin B1) and 10 μg/kg (total aflatoxin), aflatoxins

in maize are not an SPS issue that could constrain South Africa's regional trade in maize. While the risk tolerance level for fumonisin is still under discussion at the Department of Health, the high levels detected by the SAGL suggest that, in addition to the non-acceptance of GMO-containing maize by many countries to the north of South Africa, fumonisin could become a key SPS constraint in South Africa's maize trade within the SADC region.

MLN and South Africa

Although there are no reports of MLN in South Africa yet, it is already high on the research agenda of the South African government. The Agricultural Research Council (ARC) at the Grain Crops Institute is working on MLN research projects funded by Water Efficient Maize for Africa (WEMA), ARC, and the South Africa's Maize Trust. This work includes a survey for existing viruses that may occur in the subsistence farming areas along the northern and eastern South African boundary areas. Sugar Cane Mosaic Virus (SCMV) and the closely related Maize Dwarf Mosaic Virus (MDMV) have been recorded on sugarcane and maize in South Africa, respectively. According to the researchers at the ARC, maize can be an alternate host to SCMV, but they did not detect SCMV in South African maize. The other viruses involved in the MLN complex have also not been detected in South Africa. However, since virus symptoms are extremely difficult to observe, it is impossible to conclude that they do not occur in South Africa. In order to address concerns about MLN, as a result of consultations between SANSOR, DAFF, and the ARC, new import requirements are now in place requiring that maize seeds are tested for the two viruses linked to MLN that have not been reported in South Africa.

4.6 ZAMBIA

In Zambia, the first thing mentioned by people who know about aflatoxin is that the country was an important supplier of groundnuts to the United Kingdom for many years, until the mid-1970s, when "that market was lost" because the UK began rejecting Zambian groundnuts for having aflatoxin levels exceeding their national standard.[3] As mentioned above, aflatoxin levels for groundnuts can be very high in Zambia, but the levels for maize are typically well below the national 10 parts per billion standard.

In 2016, Zambia's Food Reserve Agency (FRA) is aiming to purchase large volumes of maize and paddy rice for its reserves. The sole quality criterion mentioned is that the moisture content should not exceed 12 percent (*Times of Zambia* 2016). In interviews, FRA staff confirmed they do conduct aflatoxin testing for maize, so they are certainly aware of the issue. FRA sends samples to the Zambia Bureau of Standards (ZABS), but it is not clear what percentage of their purchases are tested or what they do with maize found to have elevated levels.

ZAMBIA'S APPLICABLE FOOD LAWS

- Plant Variety and Seeds Act CAP 236 originally 1967, now No. 21 of 1995
- Plant Pest and Disease Act CAP 233 originally 1958, now No. 13 of 1994
- Noxious Weeds Act CAP 231 originally 1953, now No. 13 of 1994
- Food and Drugs Act 303 originally 1972, now No. 13 of 1994

[3] According to those interviewed, the present EU standard, at least that required by importing companies, is considered to be 4 parts per billion. For Japan, it is 0 parts per billion.

Zambia's Plant Variety and Seeds Act recently underwent a review for alignment with the harmonized seed regulatory systems of SADC and COMESA. The draft bill does not mention organizations, and is generic in nature to recognize any future agreements signed by the country. Zambia's Ministry of Agriculture recently noted, "A comprehensive food and drugs act exists. However, the regulations that govern the food component of this act are yet to be implemented efficiently and effectively to ensure the quality and safety of food" (Zambia Ministry of Agriculture 2016).

SAMPLING AND LABORATORY TESTING

Zambia has five laboratories capable of carrying out aflatoxin testing. Two are at Mount Makulu Central Research Station in Chilanga, one at the Zambia Bureau of Standards in Lusaka, one at the Food and Drug Control Laboratory of the Ministry of Health, and a privately owned lab of the Eastern Province Farmer Cooperative Ltd., in Chipata (Zambia Ministry of Agriculture 2016). Two lab technicians completed training in India and at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Malawi (Zambia Ministry of Agriculture 2016).

The main challenges to increasing the proportion of each crop that is tested are distance, as most labs are located in Lusaka/Chilanga and not in major groundnut producing areas; and the high cost associated with testing, resulting in farmers' groups leaving it to the would-be exporter/processor. Labs do not test for aflatoxin on a regular basis for the purposes of external trade, unless it is a trade requirement. For example, the firm AFGRI's export permit to Namibia requires a certification of aflatoxin levels below 10ppb.

ZABS can test for aflatoxin and has signed a Memorandum of Understanding with the Botswana Bureau of Standards that the ZABS test will permit the export of Zambian groundnuts to Botswana. ZABS can conduct the test quickly, in two to three hours, depending on the queue of requested tests. There is no charge for public sector tests, and companies only must pay the cost of the "consumables," such as test strips and re-agents, for private sector requests.

The Zambia Agriculture Research Institute (ZARI) has a VICAM machine that is not operational at present due to lack of funds to purchase "consumables." The ZARI laboratory is not accredited. On the extensive grounds of the ZARI campus, there are roughly a dozen examples of maize-drying storage units designed for rural areas built at very low cost using wood and cement (see Figure 4). It remains to be determined, however, whether these types of storage huts reduce or increase aflatoxin contamination levels. This idea is in line with the LEO East Africa SPS study, which included a recommendation to "develop low-cost drying systems for on-farm use" to reduce aflatoxin levels.

Figure 3: Key institutions in Zambia

Figure 4: Prototype low-tech storage huts for grains in Zambia

Zambia's National Centre for Food and Drug Testing, under the Ministry of Health, has the capability to detect the presence of aflatoxin in food, using ultraviolet (UV) rays, but does not have the capability to determine the level of contamination, i.e., parts per billion. The lab has accreditation for proficiency testing. Three of the Centre's laboratory technicians received training on proper procedures at the Joint Food Safety and Quality Network, and a fourth trained in Zambia. As part of that training, they had formulated a list of their equipment needs, including:

- 2 VICAM Series 4 EX chromometric machines
- 4 ELISA Test Kits
- 4 Lateral Flow Test Kits
- Consumables such as test strips and re-agents

The National Centre for Food and Drug Testing, when asked about the greatest public health issues facing Zambia, pointed to the contamination of water outside Lusaka and Livingstone, and the lack of filtration systems for the borehole wells for residents in the city. Malaria also ranks as a more immediate threat to human health than aflatoxin. Zambia is unusual among the four target countries under study as fusarium fungal activity results in the toxin fumonisin being released and is considered to pose a greater human health risk than aflatoxin.

In 2016, Zambia had approximately 750 hectares treated with Aflasafe, including participation by 1,200 farmers. A laboratory at Msekera-Chipata in Eastern Province, where groundnuts are at the highest risk of contamination with aflatoxin, has been equipped and should be operational by the end of 2016.

In terms of public outreach, Zambia's Ministry of Health noted in a recent presentation that, "Due to recent awareness of aflatoxin, as a consequence of the USAID Feed the Future (FTF) program, the Zambian Government Citizen Economic Empowerment Commission recently ran an advert that it would finance an aflatoxin control business in Petauke (Eastern Province)… But this has not taken off" (Zambia Ministry of Agriculture 2016).

As for MLN, the International Maize and Wheat Improvement Center (CIMMYT) conducted testing in several regions of Zambia but found no evidence of the necrosis. The CIMMYT shipped the samples to Kenya, the location of the lone MLN testing machine in the region.

5. VALUE CHAIN SNAPSHOTS

Maize is the main traded staple in Southern Africa, and maize and groundnuts are the most important source of carbohydrates and proteins for the majority of the population. Soya beans have been growing in importance over the past decade, mainly for incorporation into animal feed. Soya beans are included in this study because they are priority value chains in USAID's regional-level and national-level Feed the Future (FTF) programs. In taking a value chain approach, this study considered upstream and downstream factors related to trade-related SPS issues, such as the need for more robust seed varieties of maize and groundnuts to better resist plant health diseases. Byproducts of these value chains, such as maize flour and peanut butter, also are part of the story.

5.1 Maize Value Chain Snapshot

For maize, the greatest plant health issue is the looming threat of MLN. For plant safety, the greatest issue is contamination with aflatoxin, except in South Africa and Zambia, where aflatoxin levels in maize are lower and contamination with fumonisin ranks much higher in terms of plant health and food safety concerns (see Table 1 in the Executive Summary).

COMMODITY DESCRIPTION

Maize is an important cereal crop for food (over 30 percent of calorie intake in the target countries) and income generation. Maize production hit a recent peak in 2014, with the four target countries producing an estimated 22.9 million metric tons. Due to the ongoing drought, maize production will fall drastically to an estimated 13.9 million tons in 2016 (FAOSTAT). South Africa, by far the largest producer, has suffered the worst, with output dropping by 49 percent, from 14.25 million to 7.3 million tons (estimate by DAFF's Crop Estimates Committee). Malawi's production has also fallen by 40 percent, from 3.9 to 2.4 million tons (FAOSTAT). Zambia has experienced a 15 percent decline, from 3.35 to 2.9 million tons, while Mozambique's maize production has remained relatively constant at 1.35 million tons (FAOSTAT). All countries except Mozambique are surplus countries except under unusual negative weather conditions, although in Malawi the current surplus is due in part to the government's subsidized fertilizer program. South Africa grows substantial volumes of both white maize (60 percent of the crop) and yellow maize. Farmers use yellow maize for animal feed production, particularly for poultry, and produce white maize for human consumption. It is important to note that approximately 85 percent of the maize grown in South Africa is GMO maize.

The formal animal feed industry is most highly developed in South Africa and Zambia and less developed in Malawi and Mozambique. In South Africa, the animal feed industry used 4.8 million metric tons of maize in 2014, with rapid growth expected for the near future. Poultry, pork, beef, and dairy producers are skilled and well informed about the nutritional requirements of their animals, making use of state-of-the-art equipment. The feed industry integrates maize by-products, such as hominy chop from white maize. Zambia devotes an estimated 245,640 metric tons of maize for animal feed for larger-scale producers, in addition to sizeable volumes used by the many large and small farmers who mix compound feed themselves for dairy and pork production. Poultry feed operations typically purchase processed feed, which accounts for 60 percent of total cost of production.

Value addition. South Africa is the only one of the four target countries with a maize starch industry. Malawi makes starch out of cassava, an industry that Zambia is currently establishing as well. South African firms

also make starch and starch-based products out of cassava, wheat, and potato. Zambia's ministry of agriculture estimates that about 115,500 tons of maize goes into the brewing industry. Malawi is the only country with an industry producing bio-ethanol from maize. The Ethanol Company Limited produces about 300,000 tons, with a blending mix of between 2–8 percent. South Africa's Biofuel Industrial Strategy of 2007 excluded the use of maize as ethanol feedstock, but did include soybeans for bio-diesel production with a blending rate of 2 percent.

FUNCTIONS, INSTITUTIONS, AND ACTORS.

While smallholder farmers dominate maize production in Malawi and Mozambique, South African and Zambian production is largely from commercial farmers who are well integrated into end-use markets. For example, in South Africa, approximately 8,000 commercial farmers are responsible for 90 percent of the maize production, while small-scale producers are responsible for the remaining ten percent, most of whom are in the Eastern Cape. Table 7 shows a profile of the different actors in the target countries' maize value chains.

Table 7: Profile of maize value chain actors by country

VC Function	Malawi	Mozambique	South Africa	Zambia
Production of maize	Mostly smallholder farmers, limited commercial	Mostly smallholder farmers	Mostly commercial farmers, smallholder farmers account for the minority of production	Mostly smallholder farmers, but significant share via commercial production
Mechanization	Virtually none	Virtually none	Commercial farms are mechanized; even smallholder farmers have high degree of mechanization	Increasing use of tractors at the smallholder level. Commercial mechanical
Harvesting	Mainly done by hand using sticks, but with an increasing number of shellers	Mainly done by hand using sticks, but some shellers	Commercial combines, smallholder methods not known	Commercial combines and shellers account for the bulk of output, but many smallholders still use traditional manual methods
Drying (not as big a problem as in East Africa)	Most drying done by spreading maize on ground, some use tarps	Mostly dried on the ground, some use tarps	If needed, commercial farmers use dryers at silos or on farm	Substantial share of drying done using tarps. Access to dryers by commercial operations not known
Storage	Producers use traditional on-farm storage, traders use small-scale storage facilities, large sellers use warehouses	Producers use traditional on-farm storage where existing, traders use the country's limited small storage capacity, some warehousing for large sellers	Commercial operations use silos and warehouses, smallholders use a mix of traditional and modern methods	Smallholders use on-farm storage, traders and commercial farmers use commercial warehouses

Table 7 cont

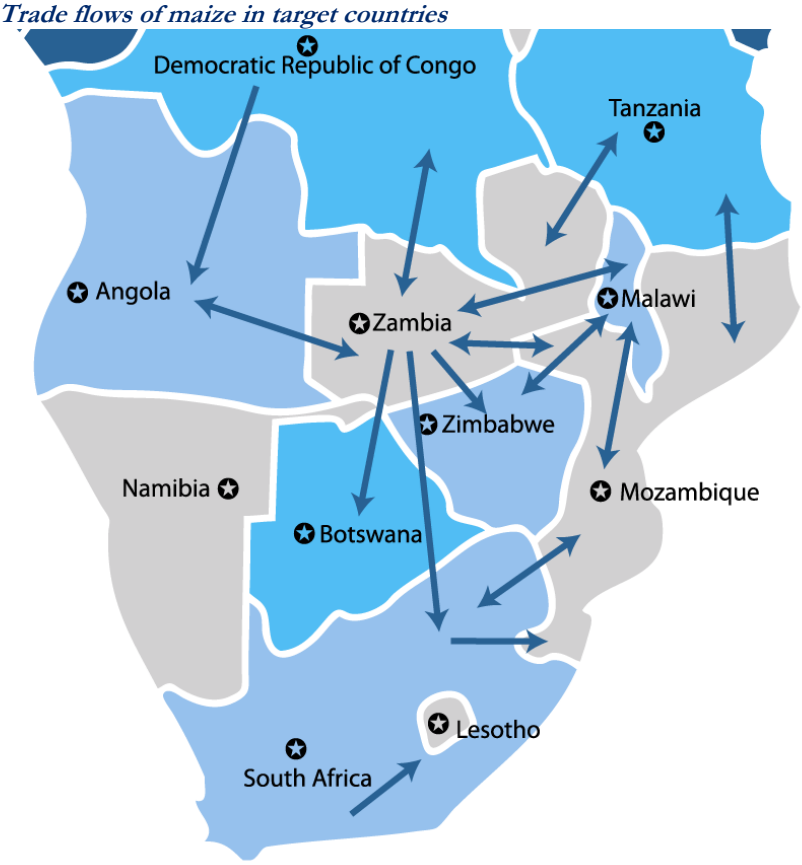
Trading	Large number of very small traders	Large number of very small traders	Small number of large traders	Small number of large traders, vigorous competition among small traders
Marketing	ACE - Agricultural Commodity Exchange	No central marketing exchange	SAFEX commodity exchange, linked accredited warehouses run by large operators like Afgri	ZamAce – Zambia Agricultural Commodity Exchange
Processing	Small informal local mills serve rural demand, some urban consumption supplied through informal millers, commercial processing in main urban centers	Small informal local mills serve rural demand, some urban consumption supplied through informal millers, commercial processing in main urban centers	Mostly commercial production, flour distributed from larger operations into rural areas	Small informal local mills serve rural demand, some urban consumption supplied through informal millers, commercial processing in main urban centers

Industry Associations. Each country has a number of representative associations involved in the maize value chain. In Malawi, these associations include the Poultry Industry Association, the Shire Milk Producers Association, the Central Region Milk Producers Association, and the Mpoto Milk Producers Association. In South Africa, the associations include the Agricultural Business Chamber, Agricultural Marketing Council, the African Farmers' Association of South Africa (AFASA), AgriSA, the Animal Feed Manufacturers Association, and Grain South Africa. In 2014, the 12 largest grain storage and handling companies established a fully-fledged and dedicated desk within the Agricultural Business Chamber to service the grain industry called Agbiz Grain. The Poultry Association of Zambia and the Dairy Association of Zambia are members of the Zambia National Farmers Union, a lobby and advocacy group providing outreach and services, while the Millers Association plays a role in processing for food and feed uses.

TRADE FLOWS OF MAIZE

Maize trade is quite vibrant within the region, where South Africa and Zambia are the biggest exporters. Figure 5 shows the direction of trade within the region. In the COMESA region, maize trades duty-free and quota-free, but borders remain closed if there is a perceived shortfall in the exporting countries (USAID SPEED 2016). Better monitoring and forecasting systems, including current stocks with the region, should help alleviate this problem. Much of maize trade is informal and never shows up in national statistics.

Figure 5: Trade flows of maize in target countries



Malawi. According to U.N. COMTRADE, Malawi had maize exports of $68 million versus imports of only $8 million in 2014. However, the 2014 export figures are identical to the 2011 figures, suggesting difficulties in accurate reporting, even of official trade.

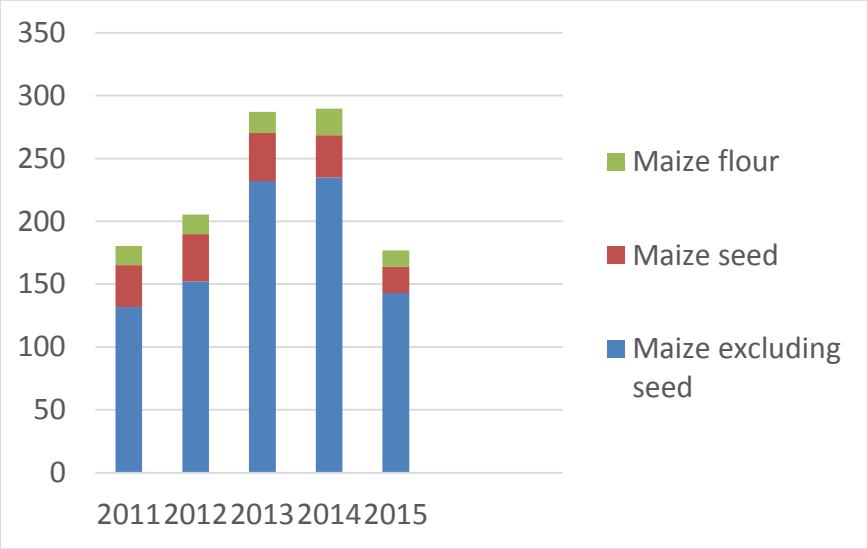
Mozambique. Official maize exports amounted to $7 million in 2015 versus $26 million in imports. Notably, Mozambique is a port of entry for maize in transit that is destined for Malawi, Zimbabwe and Swaziland, depending on the time of year. Not all maize in transit enters Mozambican ports sealed under Customs bond for transshipment (which would thus end up figuring in Malawi's official statistics, for example). Therefore, some of Mozambique's official imports—coming mainly through the maritime ports—are actually going to landlocked markets.

South Africa imported nearly $600 million of maize in 2015, of which $528 million was from Argentina. South Africa's official import numbers show highly variable quantities of maize coming from other SADC countries within the region, peaking at over $20 million in 2012, falling off substantially in 2013 and 2014, and rebounding to $6.2 million in 2015. Maize seed imports, probably from Zambia, are steadier than maize for other purposes or maize meal.

South Africa exports maize and maize seed to several dozen countries, mostly white maize to Angola, Botswana, Lesotho, Namibia, Swaziland, Zimbabwe, Kenya, Mozambique, Zambia, and Mauritius, and in some years to Japan. Official maize exports were $169 million in 2015, well below the $449 million in 2014, in large part due to the ongoing drought and because Zimbabwe has reduced its maize purchases from South Africa in recent years. Typically, half or more of South Africa's exports go to other SADC countries, with exports

departing from Durban harbor in KwaZulu-Natal province or through the Randfontein grain market in Gauteng province.

Figure 6: Composition of South Africa's maize exports to other SADC countries



Source: UN COMTRADE database. Converted to dollars at annual exchange rate.

Zambia also has a thriving trade in maize and maize seed, with official exports in 2015 at $46.5 million, well down from the recent peak of $175 million in 2012. Lower world prices for maize partly explain the sharp drop, but overall export demand was lower too, dropping from 614,000 tons to only about 10 percent of that figure over the period. Botswana is typically one of the largest customers. Due to the ongoing drought, Zambia imported about $2.7 million worth of maize in 2015, mainly from South Africa. This may be maize seed or processed maize products. Furthermore, cross-border trade typically goes unrecorded.

BARRIERS TO TRADE

There are a number of known SPS barriers to trade in the region, with countries choosing to enforce the common SADC standards for food products at certain times but not at others. When countries operate standards at different risk tolerance levels, the potential for SPS barriers can grow in contagious fashion, with one country responding with its own new barriers in the event a partner country blocks trade. Above all, there is a lack of knowledge among the different SPS institutions on what the risk tolerance levels should be, as in the case of the Malawi Strategic Grain Reserve.

CONSUMER TRENDS AND AWARENESS OF FOOD SAFETY ISSUES

Consumers exhibit a growing awareness about food safety issues in the four target countries, with niche markets developing for higher-value products that meet international standards. The field research teams observed this trend in supermarket outlets in the capital cities of each country. Per-capita consumption of maize and maize products, as per FAO data[4], show Malawi at about 130 kilograms per person, with Zambia closer

[4] In the FAO database, per-capita consumption is a residual of the other supply and demand variables in the food balance sheet, which means they should be seen as rough estimates, rather than the more precise estimates derived from a survey.

to 120 kg/pc. South Africa's consumption is about 100 kg/pc[5], while that for Mozambique is about 55 kg/pc.

GMO. An important issue affecting the maize value chain is the acceptance of genetically modified organisms (GMOs). While GMOs are not at heart a trade-related SPS issue, since they represent an agronomic-level production technique, we have included them in this study. GMO-containing foods are the subject of trade disputes touching on familiar SPS and TBT issues such as packaging and labeling. There is a wide divergence of opinion about GMOs in our four target countries, with Zambia perhaps the most "vehemently anti-GMO" country (as one Zambia-based respondent observed), and South Africa generally more accepting of GMOs, provided they have met the scientific approval standards for plant health and food safety. Table 8 below shows our field research team's assessment of national attitudes regarding acceptance of GMO-containing foods.

In times of emergency, Malawi and Mozambique appear willing to accept imports of GMO-containing foods. The WFP director in Mozambique noted that the country is presently at a 'red alert' level of food insecurity, but the government will not permit GMO imports until the emergency level rises to the next highest threshold. He noted that the Government of Mozambique permits WFP to import GMO-containing foods when no suitable alternatives are available, such as importing GMO-containing soya beans off the world market for the corn-soy blend (CSB), but that the approvals process requires at least 90 days and represents a hassle for them.

In Mozambique, segregated non-GMO maize is increasingly difficult to obtain and expensive (USAID SPEED 2016). In part, this is because the government levies maize imported from South Africa or the United States at 50 percent duty, which makes the local maize one of the most expensive in the world.

One of the key trade-related questions arising from this study is the potential for future trade conflicts if one of South Africa's SADC trading partners rejected its GMO-containing maize. Priority Recommendation #2 for South Africa is to conduct a political economy analysis (PEA) to anticipate the challenges ahead with South Africa being a GMO-accepting country in a region where Malawi, Mozambique, and Zambia, among other SADC and COMESA partners, prefer not to accept GMOs.

Table 8. Qualitative assessment of acceptance of GMO products

	Malawi	Mozambique	South Africa	Zambia
General public	Moderate to strong negative perception	Acceptance, but uncertainty about long-term impacts	General acceptance	Low acceptance and low level of awareness of what constitutes GMOs, some hold strong negative opinions
Official government position	The Government of Malawi gave the Bunda College of Agriculture permission to conduct confined filed trials on GMO cotton on August 19, 2011.	Not permitted for cultivation, imports permitted only in emergency situations	Permitted for cultivation	Biosafety Act enacted and National Biosafety Authority putting structures for regulation of research in GMOs

[5] Since South Africa's per-capita income is about four times that of the other three target countries, one can conclude that maize is seen as an "inferior good" in economic terms, for which the income elasticity of demand is negative above a certain threshold.

Table 8 cont

	Malawi	Mozambique	South Africa	Zambia
Public officials themselves	Scientists in Malawi are mainly pro-biotech and understand the issues. Policy makers need education.	General acceptance, but uncertainty as consumers themselves		General acceptance though mixed for food crops
Private sector operators in food marketing	Acceptance	Acceptance	Acceptance	Low acceptance. The cotton industry does not have a common position on the issue of GMOs. Opinions are diverse.

MAIZE LETHAL NECROSIS (MLN)

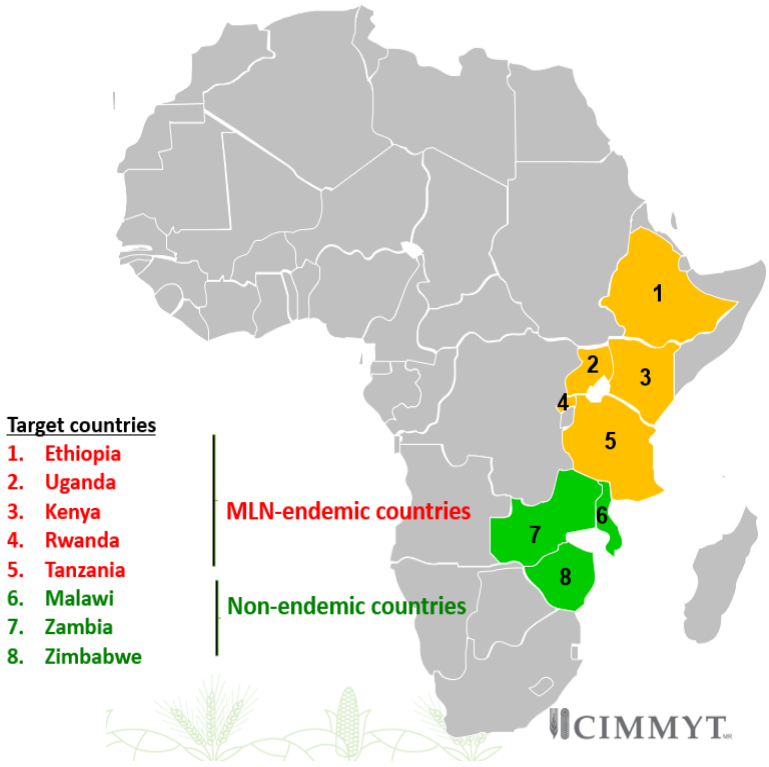
MLN is a new disease and scientists still do not fully understand its methods of transfer. Scientists are investigating insect vectors in particular maize thrips (*Frankliniella williamsi*) as well as aphids, environmental conditions, and the transfer through seed. It appears that hot spots occur where maize is grown continuously (season after season). The LEO Eastern Africa SPS study in this series noted that scientists believe that pest infestation transmits the MLN virus (USAID LEO 2015), but there may be other vectors as well. The national experts we spoke with in Southern Africa saw a clearer potent role played by the planting of MLN-contaminated maize seeds in new regions. Research is ongoing, although field tests for the presence of MLN in the Southern African region are still in the earliest phases. Currently, no reports have identified MLN south of Tanzania (CIMMYT 2016).

MLN develops from a synergistic coinfection of the Maize chlorortic mottle virus (MCMV) with one of the different viruses from the family Potyviridae in East Africa, most frequently the Sugarcane mosaic virus (SCMV) as described in Makete, Menge and Besweti (2014). MLN symptoms include:

- Significant yellowing of the growing plant (in particular the leaves), which restricts the plant's ability to enact photosynthesis and results in death of the same tissue
- Significant stunting or death of the plant and death of the leaves
- Plants often die before tasseling
- Plants that are infected late in development fail to be productive, with the maize cobs either failing to develop, or being small, partially filled, and with the outer covers malformed

The first severe outbreak of MLN in sub-Saharan Africa was in September 2011 in Kenya. By 2012, the same symptoms affecting maize appeared in Uganda and Tanzania. Subsequently, reports of the disease occurred in Rwanda, the Democratic Republic of Congo and more recently in Ethiopia and South Sudan. In Kenya alone, many MLN-afflicted fields suffered 90 percent crop loss, totaling an estimated 126,000 metric tons worth $52 million in 2012 alone. Affected fields can have productive losses ranging from 30 to 100 percent. Current economic losses per year in Kenya range from an estimate of US$52 to $77 million. Seed companies in MLN-endemic areas of East Africa have lost business. "We have had to shut down almost all our maize production sites in the endemic areas across Eastern Africa because of major losses attributed to MLN," said Kassim Owino from Seed Co., Kenya.

Figure 7: Incidence of MLN in Africa to date



An impact assessment by the LEO Southern Africa study team suggests that the impact of MLN on Zambia's maize value chain could be about $500 million in the first year alone. This estimate takes into account 2015/2016 maize production forecasts, the Zambia Food Reserve Agency's floor price vis-à-vis the prevailing market price, available information on the value added to the economy by maize milling, food processing, animal feed, brewing, ethanol and maize seed industries, and the assumption that MLN would wipe out 50 percent of Zambia's maize crop. The impact in subsequent years could be even greater, with ripple effects throughout the maize value chains. Experts assume that farmers should not grow maize in affected fields for the following three crop years, showing the need for planning for affected rural populations to shift into alternative crops and economic activities.

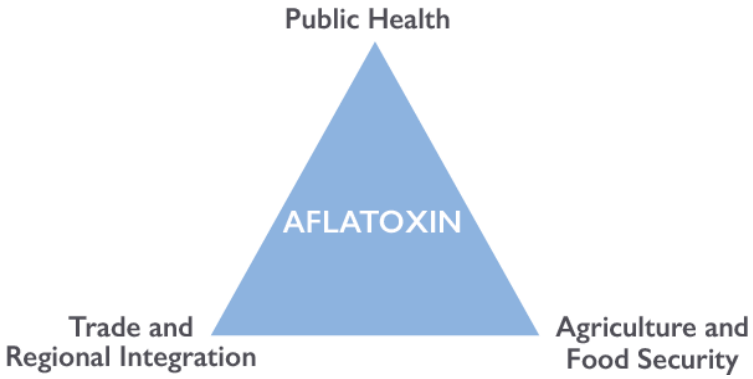
CIMMYT is leading East African research into the MLN issues, specifically developing and deploying MLN-resistant maize varieties, working with Ministry of Agriculture departments throughout the region to strengthen MLN surveillance and diagnostic capacity, and developing effective agronomic interventions. (Source for Figure 7: CIMMYT 2016.)

The International Agency on Cancer Research concluded that not only were aflatoxins and fumonisin causing acute poisoning and liver cancer, but also likely contributing to stunting in children in affected populations. Stunting and growth impairment make children more susceptible to other infectious diseases. When eaten, toxic strains of the plant pathogen *Aspergillus* are 'poisoning as natural means,' similar to consuming pesticide residues. The effect varies by the amount consumed, the regularity of consumption, age, health, and dietary status. Mycotoxicoses can heighten vulnerability to microbial diseases, worsen the effects of malnutrition, and interact synergistically with other toxins' (Bennett and Klich, 2003).

AFLATOXIN

The International Agency for Research on Cancer (IARC) classified aflatoxin as a group one human carcinogen. Aflatoxicosis has been associated with higher rates of stunting, various types of cancer, and overall immuno-suppression. Reducing the threat of aflatoxin to human health meets several key policy objectives of national governments, U.S. agencies, and other public and private actors (Figure 8).

Figure 8 - Overlapping Public and Private Objectives Related to Aflatoxin



Contamination of maize by aflatoxin suddenly attracted attention in 2004 when 125 people in Kenya died of acute aflatoxicosis, out of 317 reported cases (Probst and Cotty, 2004). Initially, investigators blamed poor storage and poorly prepared grain for storage for causing the problem. However, subsequent research demonstrated that the problem starts in the field (Bandyopadhy, Kumar and Leslie, 2007). Many studies show contamination levels often increase during storage, even when the maize is dried to below 13.5 percent moisture content. The problem is pervasive throughout the whole Tripartite FTA region, at least from Ethiopia to Swaziland. This LEO Southern Africa SPS report can confirm that aflatoxin is an issue in specific locations in Malawi, Mozambique, South Africa, and Zambia, in both maize and groundnuts, with Mozambique perhaps the worst afflicted among the four target countries due to its more humid climate.

Table 9. National and regional aflatoxin standards for maize and groundnuts

Country	Requirement by Entity or Purchaser			
Malawi	Bureau of Standards	Ministry of Agriculture	Strategic Grain Reserve	UNICEF
	10 ppb for maize[1] 15 ppb for groundnuts	20 ppb for maize	3 ppb for maize	10 ppb for maize
Mozambique	Ministry of Health	World Food Program		
	10 ppb for maize	20 ppb for maize		
South Africa	Department of Health	Department of Health		
	For groundnuts ready for human consumption, 5 ppb for aflatoxin B1 and 10 ppb total aflatoxin. For groundnuts intended for further processing, 15 ppb total aflatoxin	For maize, 5 ppb aflatoxin B1 and 10 ppb total aflatoxin		
Zambia	Bureau of Standards (ZABS)	Ministry of Agriculture		
	15 ppb for groundnuts[1]	10 ppb for maize[2]		

Table 9 cont

COMESA	10 ppb for maize	No COMESA aflatoxin standard for groundnuts		

[1] Malawi's standard as listed by the Agricultural Commodity Exchange for Africa (ACE) makes no mention of aflatoxin specifically, but makes provision for maize diseases: "Diseased maize means maize which is visibly infected with any disease, fungus or virus and which can usually be detected without opening the grain for examination."

[2] Based on presentation by Zambia's Ministry of Agriculture in April 2016, citing ZABS as its source.

[3] Zambia does not have a national standard for aflatoxin tolerance for maize and therefore is using the COMESA standard, according to those interviewed at the Zambia Agriculture Research Institute (ZARI).

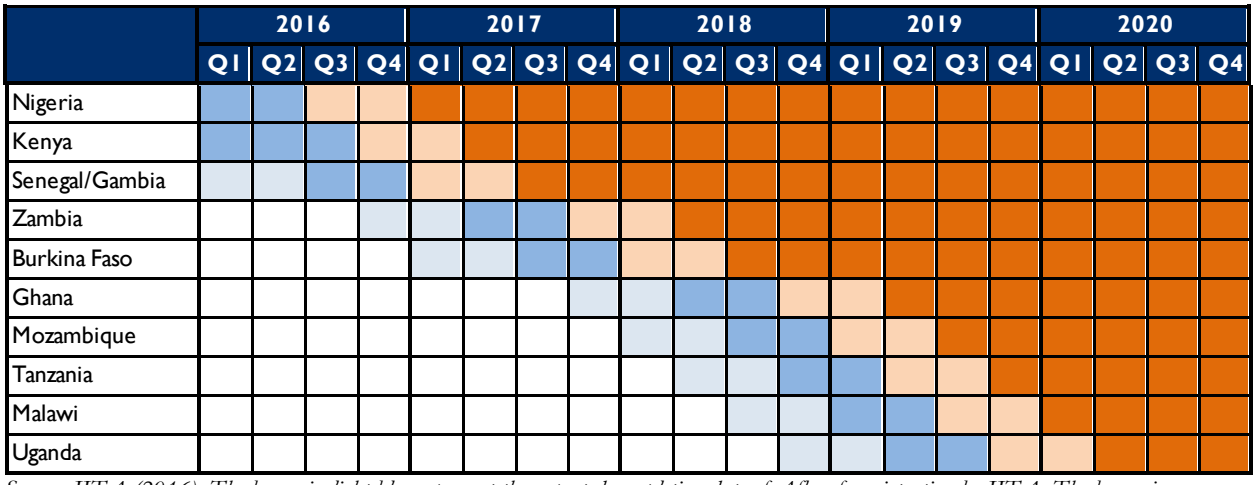
Ppb= parts per billion.

All countries have set national standards for groundnuts, and nearly all for maize. Even when a national standard does not exist, as is the case for maize in Zambia, there are internationally accepted, science-based standards for aflatoxin tolerance readily available. For example, COMESA harmonized adopted standards from the IPPC and Codex Alimentarius, the body recognized by the World Trade Organization as setting international standards for trade in food products.

Aflasafe. To combat aflatoxin problems along the maize and groundnut value chains, the International Institute of Tropical Agriculture (IITA) in collaboration with USDA's Agricultural Research Service (ARS) and other organizations developed two biocontrol products designated as Aflasafe ZM01 and Aflasafe ZM02. Aflasafe works by treating the soil with a heavy load of non-toxic strains that out compete the resident strains and prevent them from growing and releasing aflatoxin. These are a combination of inputs, including soil treatments and maize varieties with greater resistance to aflatoxin. Results of two on-farm efficacy trials showed that both products are highly effective in reducing aflatoxin concentration in the two crops by over 80 percent.

In Malawi, Mozambique, and Zambia, Aflasafe is undergoing efficacy trials in both groundnut and maize crops. There are two products undergoing testing in each country. Zambia is on the verge of registering the products after a three-year testing period (Table 10). In Mozambique and Malawi, one more year of testing

Table 10. Timetable for national registration of Aflasafe by IITA



Source: IITA (2016). The boxes in light blue represent the expected completion date of Aflasafe registration by IITA. The boxes in orange represent the expected data of product marketing to the public in each country. The boxes in pink represent a transition period to prepare for the product launch.

remains before the products are fully registered. Zambian will likely fully register the product by late 2016, and Malawi and Mozambique by mid-2017. In Malawi, however, the legislative process for ensuring biocontrol may delay supply of the product.

USAID's bilateral missions in Malawi, Mozambique, and Zambia, in collaboration with USDA/APHIS, have funded Aflasafe projects. DFID has been actively funding Aflasafe in Malawi as well.

Storage. One of the key critical control points for combating the hazard of aflatoxin in maize is in storage. Several proven techniques reduce the increase in aflatoxin contamination while in storage. The USAID AflaStop project in Kenya has produced results showing the benefits of hermetic storage (PICS, Grain Pro Grain Safe, Grain Pro Super bag, Metal Silo and Plastic silo). These methods produced a 95 percent reduction in the increase in aflatoxin levels compared to normal storage methods. Similarly, maize producers and traders in parts of Eastern Africa have adopted Purdue Improved Cowpea Storage bags (known as PICS bags), developed by Purdue University and successfully introduced under USAID programs into the cowpea sectors of Niger, Nigeria, and Burkina Faso. PICS bags provide hermetic storage with a set of two plastic bags inside the exterior bag made of jute, but up to 25 percent have holes from insect penetration after one season of use.

In Zambia, ZARI is promoting the adoption of aluminum storage units such as those in Figure 9 below, as an insecticide-free safe storage method. The large storage unit can hold over 2,000 kilograms, while the smaller 100-kilogram version is available as well, which one of the field team members purchased for her own crop. When completely filled, the aflatoxin-causing fungus cannot grow due to greatly reduced oxygen levels. Lighting a candle briefly inside the canisters also effectively depletes the oxygen.

Figure 9: Modern small-scale storage units for maize effective at preventing aflatoxin increases

Disposal of Aflatoxin-contaminated Maize

Currently, COMESA and SADC are promoting a single maximum aflatoxin level of 10 parts per billion (the Codex standard) in maize, with no accompanying provisions for alternative uses for crops with aflatoxin levels above this level. As maize is the main staple carbohydrate of the region, and consumers buy maize mostly through the informal market, lots above 10 parts per billion typically disappear back into the human food chain. There are few opportunities to divert aflatoxin-contaminated maize and groundnuts into alternative

uses, and these alternatives do not offer the same return as selling the food. Alternative disposal options include small-scale incorporation into feed for polygastric animals, limited blending into peanut butter in combination with low-level product, ethanol production, or biomass generation of electricity. Disposal is a food safety issue lost in the cracks between the national ministries of health and agriculture.

Significant investment would be required to handle contaminated grain. First, to manage the grain identified as contaminated (traceability), and secondly in systems to control how the contaminated grain goes into incineration or other process of disposal. Other countries do have systems to handle contaminated grain, particularly in the U.S. but they are complicated. Contaminated food cannot be sold in countries with regulated aflatoxin levels. In the U.S., maize with aflatoxin levels above 20 parts per billion cannot be sold across state lines, a regulation to prevent the contaminated food from moving into the food chain. However, it is possible to direct it into the animal feed chain if the contamination level is not too high.

In the future, the relevant government body will confiscated food identified as contaminated and schedule it for destruction. The most effective way of destroying contaminated maize is through an accredited incineration facility. However, incineration facilities in many countries in Africa are only set up to manage medical waste and cannot cope with larger volumes. Other solutions include burying the maize in large holes mixed with lime, and even burning it in the open air. Any proposed solution must consider environmental issues, and must prevent people from trying to recover what looks like good food. Recommendation #RL-5 in Annex Four proposes a study to assess a list of destruction options that considers cost, environment and control procedures, and proposes assisting SADC to agree on a voluntary code of conduct explaining suitable options for disposal of contaminated maize and groundnuts.

Alternative Uses for Aflatoxin- Contaminated Maize

Alternative use of contaminated commodities is an important aspect of mitigating the total economic loss of commodities found with aflatoxin levels above 10ppb in the future. A number of South African processors report that if they blanch peanuts, they can reduce the aflatoxin level from around 20ppb to below 10ppb—an acceptable level for consumption. However, this alternative will not be possible with a blanket low aflatoxin level. Given the invisible nature of the toxin, particularly in maize, the regulators' concern with contaminated food moving back into the food chain is understandable. Therefore, suitable tracking systems need to be developed to trace contaminated food lots rather than consign everything to destruction. A regionally imposed single level of 10ppb will limit alternative uses of contaminated food to specific countries. This could limit the potential to leverage much larger markets, such as South Africa and its large animal feed market, to potentially absorb the contaminated foods not good enough for direct human consumption but acceptable in beef cattle.

Moving Contaminated Food into Animal Feed

Depending on the type and amount of mycotoxin present, it is possible to move some contaminated products into animal feed. However, this results in poor growth rate and higher overhead costs. Therefore, the feed industry must carefully monitor the amount of contaminated food blended into a food mix, and will only use such product if they can demonstrate no ill effect on their economic returns. While the animal feed industry could theoretically absorb some volume of aflatoxin-contaminated grain, it is not likely. Currently, many sub-Saharan African animal feed producers are more aware of aflatoxin issues than producers of maize meal for human consumption.

Table 11: Acute toxicity of Aflatoxin B1 expressed as a single oral dose LD50

Species	LD50 mg kg (-1) bodyweight	Species	LD50 mg kg (-1) bodyweight
Rabbit	0.3	Baboon	2
Duckling (11 day old)	0.43	Chicken	6.3
Cat	0 55	Rat (male)	5.50 - 7.20
Pig	0.6	Rat (female)	17.9
Rainbow trout	0.8	Macaque (female)	7.8
Dog	0.50 - 1.00	Mouse	9
Sheep	1.00 - 2.00	Hamster	10.2
Guinea pig	140 - 2.00		

Different animal species have different tolerances to diets that contain aflatoxin. The effects of consumption of significant aflatoxin-contaminated feed by animals include stunted growth, an unhealthy aspect, or fatality. Table 11, produced by FAO, indicates the dose (LD %) that will cause the death of 50 percent of a statistically significant population. In these tests, species that are normally considered similar display very different sensitivity to aflatoxin poisoning, e.g., baboons and macaques.

Some contaminated food enters the animal feed chain. Dairy cows fed aflatoxin-contaminated feed will produce contaminated milk. Young animals are particularly at risk for poor development outcomes if fed contaminated food. Aflatoxin-contaminated feed also significantly affects the poultry industry. While it takes high levels of contamination to cause the death of the animal, very low levels are detrimental to growth and productivity if fed continuously. The U.S. Food and Drug Administration (FDA) sets acceptable levels of aflatoxin in maize fed to humans and animals based on a ratio of the amount of aflatoxin in the total food fed daily and the amount consumed compared with the weight of the animal consuming the food. The concentration level is a number linked to the total diet. Therefore, if an animal is being fed different foods (e.g., in the case of a beef cow, a supplementary feed plus hay) the lack of aflatoxin in the hay allows a higher aflatoxin level in the supplementary feed. The European Union under EC Directive 2002/32 lays out a more stringent limit to aflatoxin in animal feed.

An animal feed plant that handles contaminated products will need additional investments, including separate storage facilities for contaminated inputs. These inputs should first be carefully mixed, and then combined with the other products to ensure the lowest possible level of contamination. Constant testing of aflatoxin levels would be required at considerable expense. Aflatoxin levels often tend to continue to increase in storage, increasing the difficulty of making good use of the contaminated food. Hermetic storage reduces the increase in aflatoxin levels—an additional cost.

Ethanol Production

Ethanol producers can use maize with aflatoxin contamination, but it is not a total solution. While the ethanol will be aflatoxin-free, the remaining byproduct often moves into the animal feed markets, still contaminated and often at more-concentrated levels. A rough estimate shows the level of contamination in the byproduct to be a minimum of three times that in the original maize. Malawi produces 300,000 tons of ethanol derived from maize, but most of the region's ethanol contains sugarcane molasses. The Ethanol Producers of Southern Africa (EPSAS) is a grouping of seven major producers.

FUMONISIN

Fumonisin are a group of mycotoxins produced from fungi from the *Fusarium* species. Maize is the most commonly contaminated crop. *Fusarium* species often coexist with *Aspergillus* species, so both fumonisin and aflatoxin can contaminate the same maize. The field research team only heard about fumonisin being problematic in Zambia and South Africa, but it is probably present in the four target countries.

The IARC reports that while there is inadequate evidence in humans, there is sufficient evidence of carcinogenicity in experimental animal studies. Its overall evaluation is that Fumonisin B1 is possibly carcinogenic to humans and classifies the mycotoxin as Group 2B. Currently, the provisional maximum tolerable daily intake for all fumonisin has been determined at 2 μg/kg of body weight by the Joint FAO/WHO Expert Committee on Food Additives and the Scientific Committee on Food of the European Commission.

Fumonisin are carcinogenic to laboratory animals and linked to equine leukoencephalomalacia, porcine pulmonary edema, hepatic and renal toxicity, and sluggishness or poor performance. Human consumption of contaminated maize is associated with higher rates of esophageal cancer and neural birth defects.

Poultry feed with high levels of *Fusarium* contamination have been associated with poor growth performance and incidence of poor feed uptake, diarrhea, leg weakness, oral lesions, and high mortality (Ledoux *et al*, 2016). A study in Tanzania demonstrated that children with higher intake of fumonisin-contaminated maize correlated with infants at 12 months being 1.3cm shorter and 328 grams lighter than low-intake infants (Kimanya *et al*, 2010). The IARC Working Group report no 9 on Mycotoxin Control in Low and Middle Income Countries notes the need for more research in both fumonisin and aflatoxin to better understand the potential consumption risks and mitigation methods.

In a new report published by the IARC, a working group of experts investigated the health effects of fumonisin and aflatoxin. The panel concluded that not only were aflatoxins and fumonisin causing acute poisoning and liver cancer, but they likely contribute to stunting in children in affected populations, and that this stunting and growth impairment makes children more susceptible to other infectious diseases.

KEY FINDINGS

In our four target countries, aflatoxin is less of a problem in maize than in groundnuts. The major threat to the maize value chain comes from MLN, which could potentially wipe out a large share of the crop in all target countries. Both Zambia and South Africa cited fumonisin as a bigger problem than aflatoxin in maize.

Helping various stakeholders represented on the national SPS committees in each country coordinate their national response to MLN will be crucial in limiting the potential damage. Coordination at the regional level can help disseminate best practices and lessons learned.

5.2 Maize Seed Value Chain Snapshot

In recent years, both COMESA and SADC agreed upon harmonized seed regulations. While the intention is to simplify matters and permit increased seed trade, this effort resulted in the multiplication of different regimes, causing a certain amount of confusion among public and private sector operators alike. Table 12 updates each of the four target countries' progress toward adoption and implementation of the regional schemes.

Table 12. Target countries party to the COMESA and SADC harmonized seed regulatory systems

Country	COMESA scheme	SADC scheme
Malawi	YES.	YES. New Seed Act under review to align with SADC harmonized system.
Mozambique	NO.	YES. Its seed regulation aligns with the SADC Protocol on harmonized seed regulatory system. There is still need to improve the technical capacity to set up a quality assurance system.
South Africa	NO. Not a member of COMESA.	NO. The legislation providing for alignment to the SADC seed laws is in the publication process.
Zambia	YES.	YES. The draft bill aligning with both is with the Ministry of Justice undergoing the processes for enacting laws.

COMMODITY DESCRIPTION

Maize seed is a dynamic product in Southern Africa and at the heart of the maize value chain. Maize productivity throughout the region is low, partially due to low usage of quality seed of improved varieties. Seed is an overwhelmingly important input for crop production as it determines the yield potential. The seed carries various attributes bearing upon tolerance or resistance to biotic and abiotic stress of the crop. Seed is easily distributed to farmers, compared to other inputs that are required in larger quantities.

Table 13 shows maize seed production, import, and export figures for the study countries. In 2015, South Africa produced a total of 64,278 metric tons of maize seed worth $218.8 million, with an average price per ton of $3,404. Zambia is a seed hub with great potential for expansion. The country has expertise in seed production and a suitable environment that results in the best seed yields in the region. Zambia produced a total of 56,024 metric tons in 2015, of which an estimated 70 percent was grown using quality seed of improved varieties. The value of Zambia's produced seed was $67.2 million, with an average price per ton of $1,200. The most recent estimate for Malawi was for 2014, at 54,327 tons, and for Mozambique at 30,000 tons (FAOSTAT). Statistics are quite difficult to obtain as exporters and importers often mislabel maize seed as maize for human or animal consumption or processing. In mid-2016, seed companies in South Africa and Zambia contacted for our field research quoted a broad range of maize seed prices, including $700, $772, $1,800, $2,000 and $2,300 per ton.

Table 13. Maize seed production, imports, and exports in metric tons (2015)

Country	Maize seed produced	Maize seed imported	Maize seed exported
Mozambique	1,500	NA	NA
South Africa	64,278	NA	3,039
Zambia	56,024	4,340	24,753

Sources: Agribusiness and Marketing Department, Zambian Ministry of Agriculture; field interviews. NA=Not available. Data for Malawi not available.

MALAWI'S MAIZE SEED REGULATORY STRUCTURE

Malawi's commercial seed sector is active in variety development and release and the multiplication and marketing of improved seed. Commercial companies produce more hybrid seed varieties than open-pollinated varieties. Non-governmental organizations (NGOs) and government seed programs working with farmer associations produce the majority of open-pollenated varieties. Seed is marketed through informal seed channels (farmer-to-farmer sales), individual farmers (medium-scale), farmer associations with seed programs, and a segment considered the formal seed sector (seed company distribution through retail stores and other outlets). The government also operated a subsidy program to encourage farmer usage of improved seed and fertilizer. Over 70 percent of the seed used by the smallholder farmers is farm-saved seed, typically open-pollenated varieties purchased only once every few years. The Seed Trade Association of Malawi (STAM) formed in 2004 as a move towards making the seed industry work harmoniously between the private and public sector.

The Department of Agricultural Research Services (DARS), under the Ministry of Agriculture, Irrigation, and Food Security (MoAIWD), administers seed legislation in Malawi. The International Seed Testing Association (ISTA) accredited Malawi's main seed testing laboratory, which has satellite laboratories strategically located to serve smallholder farmers. Malawi is currently reviewing the 1988 Seed Act, amended in 1996 and 2005, which is undergoing stakeholder consultations. The draft bill aligns with the harmonized regional seed regulations of SADC. Malawi's Phytosanitary Inspection Service Unit, the National Plant Protection Organization (NPPO), ensures that seed imported or introduced into the country is pest-free. Other public and private sector organizations currently involved in the development and/or release of varieties include DARS, and a range of seed companies—SeedCo, Monsanto, Pannar Seed, Pioneer DuPont, Capstone Seed, Zamseed and MRI Syngenta.

There are many phytosanitary issues related to maize seed. Imported maize seed must be inspected during active growth and found to be free from MLN, or produced in an area that is free from MLN. Further, maize seeds must not be produced through genetic modification (GMO), contain any cytoplasmic male sterile lines, and must be inspected during active growth and found free from *Sclerospora saccharri, Xanthomonus stewartii*, and free from storage pests such as *Prostephanus truncatus* and *Trogoderma granarium.*

Malawi's plant protection and phytosanitary services, the Seed Services Unit (SSU), and the Ministry of Industry and Trade are jointly responsible for seed imports and exports. However, the focal point is the Ministry of Industry and Trade. The government permits importation of certified seed in case of unavailability of sufficient quantities. Officials at entry points inspect seed to ensure it is free of pests and diseases. Officials check and verify documents such as the ISTA Orange International Certificates, import permits, phytosanitary certificates, and fumigation certificates accompanying the consignment to ensure compliance with regulations. Certified seed exports require export permits from the Ministry of Trade and Industry, given after obtaining authority from MoAFS units for seed exportation.

MOZAMBIQUE'S MAIZE SEED REGULATORY STRUCTURE

Mozambique is party to the harmonized seed regulatory system in SADC but not COMESA. Its seed regulation underwent a review to align with SADC protocol on harmonized seed regulatory system. There is still need to improve the technical capacity to set up a quality assurance system.

In Mozambique, the public sector largely carries out variety development, through the National Agricultural Research Institute (IIAM). SEMOC, a public seed company that contracts medium-scale farmers, conducts seed production in the public sector. Marketing is outsourced to small-scale seed companies and agro dealers.

The Ministry of Agriculture also contracts seed companies to produce and market seed of hybrids and open pollinated varieties at subsidized prices. The basic seed unit (USEBA) within that IIAM produces sufficient basic seed for production of certified seed through grower schemes. Mozambique produces about 1,500 metric tons of seed (Table 13). Small seed entrepreneurs sell only 2 percent of the seed at commercial prices.

Government Agricultural Development Corporation (ADC) farms produce most of the hybrid maize in Mozambique. The government is also taking a greater role in the fertilizer industry with increased subsidies.

In Mozambique's private sector, Pannar and Mozseeds have breeding and selection programs. The informal sector is active in producing seed as well, but their output is not tested. Guaranteed seed (quality declared seed) is also available, which is not field inspected but undergoes testing for germination, purity, and moisture content. Some small seed companies produce and market seed, while other companies are only involved in marketing. Small seed companies sell seed through fairs and seed voucher systems. Demand for seed, timely supply, and acceptable prices in the absence of credit are all factors that prevent the effective use of improved seed by smallholder farmers. Seed stores are located far from high potential production areas. Lack of complementary inputs such as fertilizer and pesticides prevent the realization of the potential of the quality seed of improved varieties. Mozambique does not sell GMO seed. About 95 percent of farmers plant saved seed.

SOUTH AFRICA'S MAIZE SEED REGULATORY STRUCTURE

The seed sector in South Africa is very advanced and primarily serves the needs of commercial farmers. The sector is regulated through four primary acts: the Plant Improvement Act no. 52 of 1976 (as amended), Plant Breeder's Rights Act no. 15 of 1976 (as amended), Agricultural Pests Act no. 36 of 1983 (as amended), and GMO Act no. 15 of 1997 (as amended). The government assigns responsibility for maize seed certification, but conducts audits and serves a regulatory role on maize seed imports and marketing. South Africa is party to the harmonized seed regulatory system in SADC but not COMESA. The South African government is in the process of publishing legislation providing for alignment to the SADC seed laws.

The South African National Seed Organization (SANSOR), an association that represents all the interested parties in the South African seed industry, is responsible for variety registration and regulation. SANSOR works in close collaboration with the Agricultural Research Council (ARC). Seventeen multinational and local seed companies sell maize. Multinational companies, including Monsanto, Pannar, and Pioneer DuPont, account for at least 85 percent of the seed business. South Africa is the only country in the Southern African region that develops GMO varieties.

South Africa imports and exports seed within the Southern African region and beyond. Export of seed requires biosafety clearance in addition to export permits and phytosanitary and international seed quality documentation. Distribution and sale of locally marketed seed is through private sector seed merchants, agricultural supply outlets, cooperatives, and local government, though the agro dealer network is thin in rural areas. Seed inspection is mostly in house or by authorized seed inspectors certified by SANSOR. Roughly 55 percent of South Africa's maize farmers use "saved seed."

Both the public and private sector carry out variety development, with the latter dominating the sector (Table 14). The public institutions engaged in variety development are the ARC and South African universities. Seed companies develop the bulk of the maize varieties on the South African commercial market.

Table 14: Role of key players in South African formal seed sector

Role	Key Players
Research and Breeding	ARC; MNCs; local companies; universities
Variety registration and regulation	SANSOR
Breeders and foundation seed production	ARC; MNCs; universities; local seed companies
Seed production	SME seed companies; MNCs; ARC
Education, training, extension	Seed companies; NGOs; ARC; government
Distribution and sales	Private sector seed merchants; agricultural supply outlets; cooperatives; local government

Source: The African Seed Access Index. Key: ARC—Agriculture Research Council; MNC—Multinational Corporations; NGO—Non-Governmental Organizations; SANSOR—South African National Seed Organization; SME—Small and Medium Enterprises.

ZAMBIA'S MAIZE SEED REGULATORY STRUCTURE

In Zambia, commercial farmers usually produce hybrid maize seed, while small and commercial farmers produce seed of open-pollenated varieties. The Seed Control and Certification Institute (SCCI) is the Zambian certifying agency that registers seed multipliers for each growing season. The Plant Variety and Seeds Act (CAP 236) designated the SCCI as the national seed authority. Zambia's seed certification system aligns to OECD seed schemes, and the International Seed Testing Association accredits the national seed-testing laboratory.

Seed multipliers undergo training before they can be registered, and are inspected by SCCI or other licensed seed inspectors. More companies are expressing interest in seed testing laboratories, a good sign that the business is profitable. The SCCI also registers seed importers, clearing imported seed through verification of import documentation and/or sampling to establish seed quality or for reference purposes. SCCI issues seed sellers' licenses to seed warehouses in order to authorize and regulate seed marketing. The SCCI also performs physical inspections of trading premises to ensure that they meet stipulated standards for storage and to reduce the deterioration rate of seed quality.

In regulating the seed industry, the SCCI works in coordination with two other public institutions: the Plant Quarantine and Phytosanitary Service (PQPS), a unit under the Zambia Agriculture Research Institute (ZARI), and the Agribusiness and Marketing (ABM) Department, both under the Ministry of Agriculture. The PQPS is the National Plant Protection Organization (NPPO), and issues phytosanitary certificates and plant import permits. The PQPS conducts field inspections of seed crops for export, ensuring that exporting organizations adhere to stipulated input requirements and management practices. The PQPS also creates awareness about important pests and issues phytosanitary certificates. The following are the requirements for imports: pest risk analysis (PRA) to ascertain the level of pests of importance in the country of origin, issuance of plant import permits, and inspection of imported consignments at the border (port of entry). PQPS bases decisions on science, strives to not discriminate, and only keeps records of seed produced for export.

Zambia has drafted statutory instruments to manage new diseases and to avoid reviewing legislation each time a new pest emerged. MLN has become a great concern since the reported outbreak in Kenya in 2012. There is no task force in place yet as the disease is not present in the country. However, a statutory instrument already been drafted in case of an MLN outbreak. Zambia allows maize seed imports and exports in order to

maintain market equilibrium, with greater imports authorized when the national supply shows signs of tightening (higher prices), and greater exports authorized when supply is exceeding demand in relative terms (lower prices for seeds).

The public and the private sector both carry out variety development. In the public sector, the Maize Research Program under ZARI is responsible for maize variety development, maintenance breeding, and multiplication of basic seed. The private sector has a number of multinational, regional, and local seed companies dealing in the maize seed business. They operate under the Zambia Seed Trade Association (ZASTA), an association that represents seed companies and other interested parties. Some companies cover the entire value chain: variety development, seed production and marketing, while others produce and market varieties developed by their sister companies in the region as well as varieties developed by International Agricultural Research Centers such as CIMMYT and IITA. There are eight large companies involved in the maize seed business: Kamano, Klein Karoo, Monsanto, MRI Syngenta, Pannar, Pioneer, SeedCo, and Zambia Seed Company. Smaller seed companies also produce maize seed—Progene Seed, Steward Globe, Unity Seed, Capstone, and Advanta—as do NGOs and government institutions. Zambia imports a small quantity of seed of specific varieties in short supply and parental seed stock.

The local marketing structures include direct sales from the company premises, i.e., headquarters, warehouses, agents, seed warehouses, and containers distributed strategically throughout the country. Technical advice is available from marketing and sales officers, agronomists, brochures, calendars, production guides, TV and radio programs and ads, field days, and field demonstrations.

Zambia is part of the harmonized seed regulatory systems of both COMESA and SADC. The Plant Variety and Seeds Act aligns with the regional agreements with COMESA and SADC. The resulting draft bill is generic in nature to be applicable to future agreements the country may wish to enter.

TRADE IN MAIZE SEED

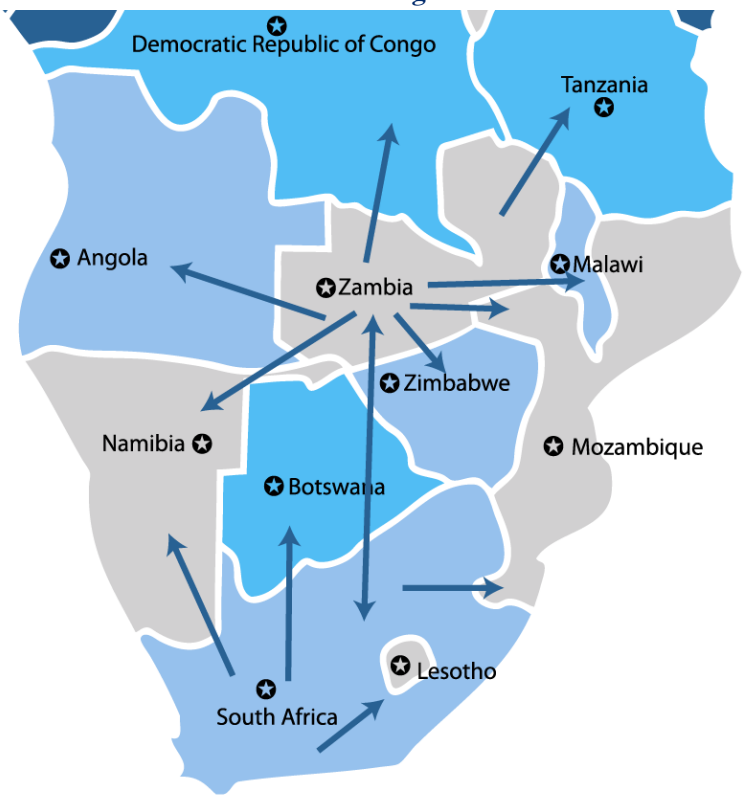
Maize seed is a premiere product for intra-African trade in the FTF value chains for many reasons. Maize seeds have a high value in relation to weight and transport, and thus other logistical costs tend to be less important. Maize seeds also require much greater documentation than other bulk products in these value chains. Between 2008–2011, South Africa, Zambia, Uganda, Malawi, Kenya, Tanzania, and Zimbabwe in that order accounted for almost 97 percent of sub-Saharan Africa's maize seed exports. Zambia was, however, the largest maize seed exporter to other countries in Africa, accounting for 41 percent of maize seed exports. Our field research team devised Figure 10 showing maize seed trade in Southern Africa based on anecdotal evidence and our combined knowledge of the maize seed markets the region.

According to The African Seed Access Index (TASAI), in the 2013–2014 period South Africa accounted for half of the formal seed trade in Africa (seed of all types). South Africa's formal seed trade exported some US$73 million worth of seeds and imported seeds with a value of US$89 million, with maize by far the largest share for both local consumption and export purposes. South Africa sells maize seed to many different countries, including outside Africa. In 2015, South Africa exported 3,039 metric tons of non-GMO maize seed.

According to TASAI, it is easier to import seed into South Africa from other countries in the SADC region because no GMO varieties are imported and therefore South African importers are not required to comply with biosafety regulations related to GMOs. However, exporting South African seed to other SADC countries requires biosafety clearance in addition to an export permit, a phytosanitary certificate, and international seed quality documentation. The export process is consequently much longer.

Zambia's maize seed is marketed locally and exported to Angola, Botswana, Democratic Republic of Congo, Kenya, Lesotho, Malawi, Mozambique, Namibia, Nigeria, South Africa, Rwanda, Swaziland, Switzerland, Tanzania, and Zimbabwe. In 2015, Zambia exported 24,753 metric tons and imported 4,340 metric tons. Imported seed was mostly specific varieties in shortfall and parental material.

Figure 10: Trade flows for maize seed in the target countries



MAIZE SEEDS AND MAIZE LETHAL NECROSIS

As maize seeds are potentially the most powerful vector for the transfer of MLN, the importance of properly testing all seeds entering a country from MLN-endemic areas cannot be underestimated. The impact on a country's economy can be devastating in terms of loss of maize production, but also loss of maize seed opportunities. During the course of the field research for this study, the team learned that the Minister of Agriculture in Rwanda lost her job because she authorized the import of seeds from Kenya, which introduced MLN to Rwanda in 2012.

Unlike aflatoxin-contaminated maize shipments, it is not necessary to incinerate MLN-contaminated shipments of maize seed. If found to contain MLN, the contaminated seeds could be milled and used for human consumption, if they have not received other seed treatments, as MLN is not dangerous in maize flour and people cannot plant maize flour. However, some experts are dubious about MLN-contaminated maize for human consumption, as the grain may contain secondary fungal infection and harmful mycotoxins.

All shipments for testing are sent to Kenya, where the only machine capable of detecting the combination of viruses that contribute to MLN is located. However, there are easy to use field tests for the main contributing

virus, Maize chlorortic mottle virus (MCMV). If MCMV is not present, then MLN is not present. Malawi and Zambia carry out surveys in this manner.

In addition to potentially helping spread MLN, maize seeds also play an important remediate role in combating MLN. One of the promising avenues of basic research is identification of MLN-tolerant maize germplasm. At ZARI, our team learned that CIMMYT is cataloguing the entire Mexican maize germplasm, covering hundreds of varieties, with the aim of identifying 14 varieties promising enough for field trials. However, these solutions are probably still years away.

The LEO Southern Africa SPS study team supports the recommendations made to prepare for and remediate the devastating effects of MLN made by the Eastern Africa team:

- Research on the epidemiology of MLN
- Development of MLN-resistant maize
- Further development of local capacity
- Strengthen SPS technical capacity and systems
- Assist in the review, revision, and implementation of national plant heath laws, regulations, and standards that are based on science, consistent with international standards (WTO and IPPC), and harmonized across the region
- Support local efforts with funding and technical guidance from organizations such as the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) on developing an integrated regional strategy and coordination of MRL efforts (USAID LEO 2015)

AFLATOXIN IN MAIZE SEEDS

Aflatoxin, classed as a mycotoxin, is a naturally occurring carcinogenic byproduct produced by toxic strains of the fungus species *Aspergillus,* found in the soil and on plant material. *Aspergillus* spores are present on maize seeds contaminated with aflatoxin. When farmers replant these 'saved' seeds the following year, the vicious cycle continues. Planting these contaminated seeds might even cause the contamination to spread to new plots, or further within the same plot.

KEY FINDINGS

One key finding for the maize seed value chain is the need for vigilance in testing imported seeds from MLN-endemic areas. More robust maize seeds are also a critical vector for reducing aflatoxin contamination, forming an integral part of the Aflasafe program. Each target country has well established maize seed regulatory and control systems that generally meet international norms, at least on paper.

5.3 Groundnut Value Chain Snapshot

Aflatoxin contamination is the primary food safety concern related to groundnuts, and is an economic issue as it affects the value of the crop.

COMMODITY DESCRIPTION

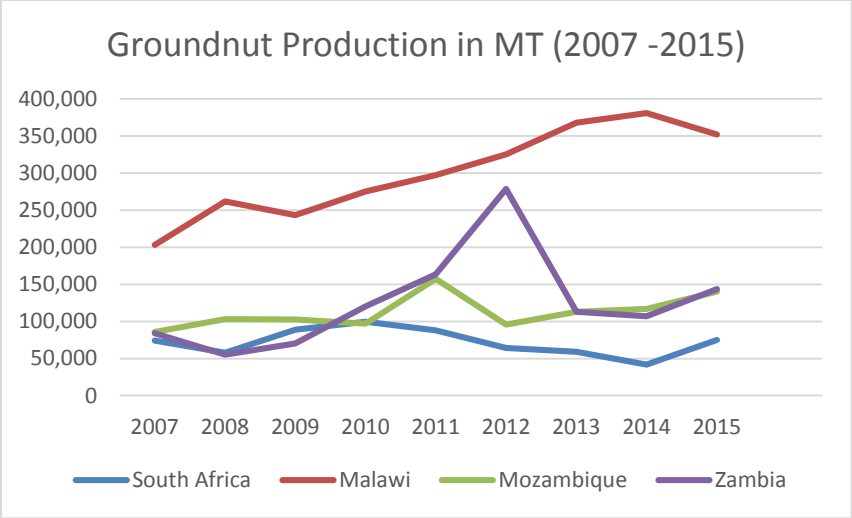
Much like maize, groundnuts (also known as peanuts), are an everyday staple food readily available to all income classes. Groundnuts are high in protein, easily storable, and relatively inexpensive. People prepare groundnuts by boiling fresh or dried nuts, and then roasted them. The main processed food product is peanut butter, which is a recommended weaning food for children in Zambia and other countries. Groundnuts can

also be processed into flour. People use dried nuts, groundnut flour, and peanut butter in vegetables, porridge and maize samp, and supplementary feeding programs use groundnuts to address degrees of malnourishment.

The four target countries in this study grow groundnuts, and there is vigorous trade, both formal and informal. In terms of gender considerations, one interviewee in Zambia noted that, "Groundnuts are a women's crop, in terms of production and harvesting. The men tend to jump in on the marketing, where the money figures in."

FAO estimates show groundnut production growing by about one-quarter between 2013 and 2015 in Mozambique, South Africa, and Zambia, but falling close to 5 percent in Malawi, the largest producer among the group (Figure 11). Output for these four Feed the Future target countries amounted to 710,715 tons in 2016, with Malawi accounting for half that total, Mozambique and Zambia both above 140,000, tons and South Africa at about 75,000 tons (FAOSTAT).

Figure 11: Groundnut in shell production

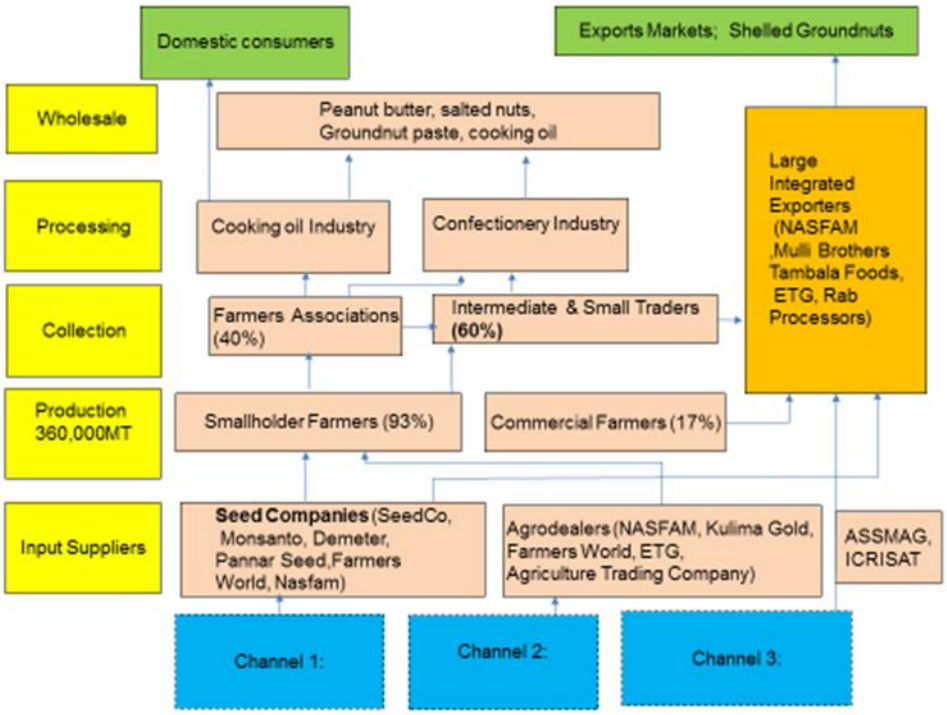


Source: FAOSTAT.

Groundnuts have become a less popular crop in South Africa, with output at only 20 percent of the level 30 years ago, according to a report published by the Bureau for Food and Agricultural Policy (BFAP 2012). The industry has lost the status and competitiveness that it once enjoyed in local and international markets for various reasons, one of which is the perception that groundnuts are one of the most difficult crops to cultivate. A number of the large producers, however, argue in the report that with new production practices, there should be no reason for producers not to plant groundnuts. One of the solutions they suggest is the publication of an updated production manual that gives systematic guidelines to cultivate top quality groundnut cultivars. The report suggests that these type of improvements could lead to gains of up to 0.2 ton/ha if done correctly, as well as a better grading for the groundnuts delivered and less risks for aflatoxin formation.

Figure 12 shows the groundnut value chain in Malawi.

Figure 12: Groundnut value chain in Malawi



FUNCTIONS, INSTITUTIONS, AND ACTORS

Nearly all farmers grow groundnuts in the four target countries. Generally, smallholder farmers dominate groundnut production, with fragmented organization among producers and a general lack of market governance. Groundnuts need to be dried to 12-percent moisture content. Hermetic PICS bags are not popular for groundnut storage, as groundnuts can go rancid during storage due to their high oil content. Research is ongoing in this area.

In Malawi, smallholders supply about 93 percent of groundnut production. Malawi's value chain has a number of different food processing outlets, but quality control suffers from the lack of end-product specifications filtering down from the end-use purchasers to the smallholder farmers. Nevertheless, Malawi's SPS requirements, including those for groundnut seed, are well established and relatively easy to find. This gap suggests the need for much greater public outreach and broad dissemination of the standards for staple foods.

Malawi's SPS Requirements for Groundnut Seed

1. The parent plants were inspected in active growth and found free from viral diseases
2. The consignment is free from *Carydon gonogra* and Khapra beetle *Trogoderma granarium*
3. The seed must be treated with an approved fungicide and insecticide before dispatch
4. Vegetative material are required to be quarantined

South Africa is a bit of an exception to this picture. While South Africa has many smallholder farmers growing groundnuts, there are a handful of larger farmers oriented towards higher-value export markets outside of Africa, such as Japan. For the larger farmers, the level of quality control is much higher, with greater knowledge of end-user requirements, whether size of the nuts, uniform quality, or percentage of broken nuts.

South Africa's Protein Research Foundation both supports its own members and conducts value chain research activities.

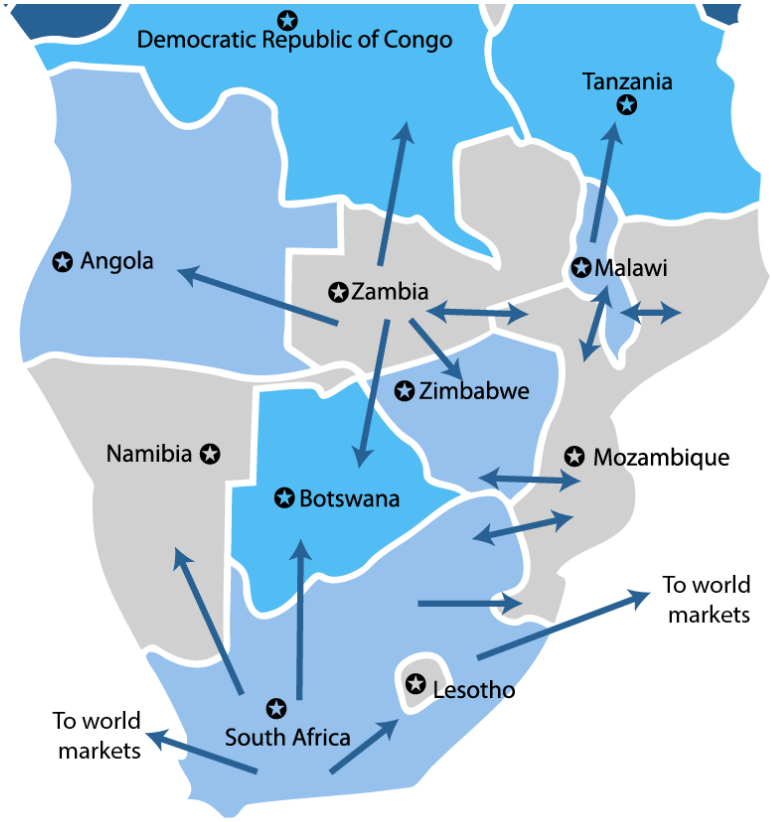
TRADE FLOWS OF GROUNDNUTS

Groundnuts flow across national borders in both directions on an ongoing basis. All four countries are quite active in groundnut trade, along with other neighboring countries (Figure 13).

Malawi. Being a landlocked country, Malawi's borders are porous and there are many informal entry and exit points used by traders from Mozambique, Zambia, and Tanzania. Malawi has a thriving trade in groundnuts, although the official statistics in COMTRADE only include the year 2011. Informants in Malawi estimated that each year between 50,000 and 100,000 metric tons of groundnuts go informally through the 'Burundi traders' to Tanzania, Kenya, Burundi, and DRC.

Mozambique. Official statistics show Mozambique's groundnut exports varying considerably from one year to the next, reaching a recent high of $1.65 million in 2014, but falling to less than a third of that level the following year. Mozambique's groundnut imports typically come from South Africa, and range from $100,000 to $220,000 annually. Recently, Mozambique has been the largest exporter of groundnuts to South Africa. It is highly possible that less than half of Mozambique's total exports and imports of groundnuts make it into official figures, as nearly every person crossing the country's land borders in both directions carry groundnut shipments.

Figure 13: Trade flows of groundnuts in target countries



South Africa. Over the last decade, South Africa has exported more groundnuts to Europe and Asia, particularly Japan, than to neighboring countries. Mozambique is the largest exporter of groundnuts into the South African market, followed by Malawi, Tanzania, and India. South Africa's official trade figures for groundnuts show exports to other SADC countries above $1 million for 2013 and 2014, reaching $4.4 million in 2015. South Africa's groundnut imports from other SADC countries peaked at $15.4 million in 2012, but imports have fallen steadily in step with growing exports.

Zambia. Similar to South Africa, Zambia's official export figures for groundnuts show total exports worth $626,000, with more than 90 percent registering as peanut butter. This implies that the greater part of Zambia's imports and exports of shelled and unshelled groundnuts fall outside official trading channels.

CONSUMER TRENDS AND AWARENESS

Groundnuts are a main component of the daily diets in both Malawi and Zambia, which register over seven kilograms per capita per year, according to FAO data. In Mozambique, the data show per-capita consumption of 1.1 kilograms, while South Africa registers at less than a kilo per person.[6] Groundnut oil consumption data show Malawi and South Africa at about 1.15 kg/pc, Mozambique at about 0.33 kg/pc, and Zambia at about 0.25 kg/pc.

One of this report's tasks was to gauge public and private sector stakeholders' level of awareness of aflatoxin, as well as the general public's knowledge. Table 15 shows considerable variation among these categories of respondents by country.

Table 15. Qualitative assessment of awareness of aflatoxin

	Malawi	Mozambique	South Africa	Zambia
General public	Low to medium	Low to medium	Low	Low
Public officials	Medium (predominantly knowledge of aflatoxin in groundnuts)	High	High	Medium to high for groundnuts and low to medium for maize. Awareness among public research and extension staff for groundnuts is relatively higher than other public officers, e.g., health or local government; awareness levels are quite low for maize
Private sector operators in food marketing	Medium (for the most part unknown in maize)	High	High	Medium to high for groundnuts and low to very low for maize. Awareness is higher for those in groundnut processing than for those dealing with raw groundnuts. With maize, awareness among millers and warehouse operators is generally very low

These four countries have populations with high birth rates and intensified urbanization, with some segments that have higher income. The need to provide safer food supported by sound SPS systems now complements

[6] As mentioned above, per-capita consumption data in the FAO database are not as reliable as survey data.

the traditional agricultural policy objective of finding labor-rich, value-added employment opportunities in the food and agriculture sector.

South Africa's Department of Agriculture, Fisheries and Forestries (DAFF) has provided guidance to groundnut producers, processors, marketers, and exporters about how to improve consumer confidence in their products (Table 16). As can be seen with the inclusion of GlobalGAP, Tesco, and the British Retail Consortium, this guidance pertains to groundnuts exported to Europe, but could also improve consumer confidence both within South Africa's domestic market and in other SADC countries.

Table 16: Marketing certificates for groundnuts recommended by DAFF as low-risk

Commercial certification	Primary production	On-farm-produce handling facilities	Off-farm produce handling facilities	Processing	Cold store	Container depot	Transporter	Silo
GlobalGAP	√	√	√(*)					
Tesco Natures Choice	√	√	√					
HACCP (with GMP basis/SABS requirements)		√	√	√	√	√	√	√
British Retail Consortium		√	√	√	√	√	√	√
ISO 22000:2005		√	√	√	√	√	√	√
AIB HACCP		√	√	√	√	√	√	√

Source: DAFF website. AIB is a private certification firm.
√=Acceptable as low risk, and to qualify for provisional exemption from an official food safety and hygiene audit by the PPECB.
√(*)=only applicable to off-farm produce handling facilities linked with GlobalGAP certification for primary production and not for commercial off-farm produce handling facilities associated with more than one farm.

AFLATOXIN IN GROUNDNUTS

Aflatoxin is the greatest plant health and food safety issue in the groundnuts value chain in the four target countries. The problem is widespread in Mozambique and Malawi, particularly severe in the Eastern Province of Zambia, and appears to be present in many areas of South Africa at different times. Recent estimates show that stunting affects43 percent of children in Mozambique and 47 percent in Malawi.

One of the regional-level recommendations (#RL-10 in Annex Four) calls for collecting information about the location of the most severe aflatoxin contamination in each country, permitting activities to be targeted to the source of the contamination before it passes through the value chain and spreads nationwide. Figure 14 below shows several areas in Malawi that demonstrate elevated levels of aflatoxin contamination. Traders and processors may wish to be more careful when purchasing groundnuts from those regions and more vigilant in testing. However, it is important to match increased awareness of the problem with solutions. Otherwise, traders and processors will stop purchasing from contaminated areas, or will purchase at much lower prices, reducing the income of smallholder farmers. Ultimately, each country should have models to link early season climate and ecological conditions to potential risk of increased *Aspergillus* activity and therefore increased levels of aflatoxin, in order to target treatments like Aflasafe in years with increased risk of contamination.

In Malawi, the 2010 ICRISAT study reported that 43 percent of all groundnut samples in farmers' households, 49 percent from local markets, 41 percent from warehouses, and 58 to 60 percent from shops and supermarkets had aflatoxin levels above the EU safe limit of 2ppb (USAID SPEED 2016). Furthermore, approximately 25 percent of all market samples of powdered groundnut had contamination levels above 100 parts per billion.

IITA includes maize and soya beans in its portfolio, but not groundnuts. However, the Aflasafe program is currently investigating whether the product will also work with groundnut cultivation.

A project called Increased Exports of Smallholder Groundnuts through Innovations in Storage Management, funded through the Malawi Innovation Challenge Fund (MICF), emerged as a particularly innovative project among those the field research team encountered. The project seeks to control and monitor aflatoxin during post-harvest storage through introduction of Ultra Hermetic Storage and Decentralized Aflatoxin Testing methods, as well as improving the tracking of groundnut stock to enable reliable monitoring of stocks along the route from field to export.

Figure 14: Incidence and degree of severity of aflatoxin contamination in Malawian groundnuts

Source: ICRISAT (2010). Scale measures parts per billion.

supporting the purchase of hermetically sealed bags, the purchase of manual hand shellers, and construction of storage warehouses at ExAgris Farm in Lilongwe and Salima. The project will conduct decentralized aflatoxin testing of groundnuts, using a Vicam testing machine, at Valid Nutrition. This project is potentially replicable in Mozambique, South Africa, and Zambia.

In 2013, the EU issued an alert about aflatoxin in groundnuts exported from Mozambique. During that year, the EU intercepted the last shipment of aflatoxin non-compliant groundnuts, sending back the contaminated nuts for destruction. According to COMTRADE data, it appears that Mozambique has not been exporting groundnuts to the EU in recent years.

KEY FINDINGS

For groundnuts, aflatoxin contamination is the greatest food safety concern, but does not necessarily affect crop yields or productivity.

The Aflasafe package of methods is one potential future option for mitigating aflatoxin in groundnuts. Aflasafe treats the soil and attempts to crowd out the toxic strains of *Aspergillus* by introducing non-toxic strains. IITA is currently evaluating if Aflasafe can be useful for reducing aflatoxin contamination in groundnuts.

In terms of actions in the near term, the best approach seems to be greater public awareness of how to reduce aflatoxin in groundnuts post-harvest, or how to prevent the aflatoxin contamination levels from increasing

once in storage. There are several easy-to-implement, potentially low-cost methods for reducing the increase in aflatoxin levels in groundnuts.

How to reduce aflatoxin in groundnuts

In the field	When harvesting	When de-shelling	During selection	For peanut butter	For table nuts
Treat with Aflasafe	*Dry in shell 3-4 weeks*	*Don't soak with water, Use mechanical sheller*	*Destroy discolored and shriveled nuts*	*Target sampling to high-risk lots*	*Blanch the nuts*

5.4 Soya Bean Value Chain Snapshot

COMMODITY DESCRIPTION

The U.S. is the leading producer of soya beans in the world, with a production of 108 million metric tons in 2014 (FAOSTAT 2015). In Southern Africa, the leading producer is South Africa with an estimated output of 1,070,000 metric tons in 2016 (FAOSTAT). The major producing areas in South Africa are Mpumalanga, the Free State, and KwaZulu-Natal (NAMC 2011). Zambia and Malawi produce substantial amounts, at 214,179 metric tons and 110,000 metric tons respectively in 2014 (FAOSTAT), while Mozambique produced an estimated 50,000 metric tons (Technoserve 2013). Inadequate and inaccessible improved seed, resulting in the use of recycled seed, characterizes soybean production. Farmers who have access to improved seed still tend to use recycled seed.

Each of the four target countries produces a small quantity of soya bean seed, but the data are patchy at best. Mozambique produced 5,000 metric tons of soya bean seed in 2014 (USAID Feed the Future, 2016), with an estimate of 50–65 percent of recycled seed reported by the World Bank (2012). South Africa produced 7,675 metric tons of seed in 2015/2016, with 95 percent of the commercial soya bean area in South Africa planted with GMO and 70 percent of the total area planted with recycled seed. In Zambia, farmers plant 70–80 percent of crops with recycled seed (Technoserve 2011).

The Southern African Trade Hub studied the region's soya bean value chain, finding soya bean yields are "very sensitive" to the farmers' agronomic practices, such as the timing of sowing, spacing of the crop rows, pest management systems, and timing of the harvest (SATH 2011a). Government subsidies for competing crops, mainly for maize in Malawi and Zambia, reduces the market incentives for smallholder farmers to plant soya.

Malawi. Malawi's market for soya beans will likely grow from 73,000 tons in 2010 to 131,000 tons by 2020, a 7 percent annual increase (NAMC 2011). Malawi's small surplus, which the country recently exported to neighboring countries such as Zimbabwe, will likely be devoted to local processing. The main value-added products made from soya beans are poultry feed, corn-soy blend, and cooking oil.

As of 2011, Malawi's soybean market was "self-sufficient." At that time, experts predicted that Malawi would become a net importer over the following decade.

Mozambique. Mozambique's market for soya beans has been growing rapidly, with smallholder farmers in the north and central regions leading the way (NAMC 2011). Smallholder farmers dominate soya bean production, with the value chain including the producer, the intermediary, and the final buyer, with a range of possible transport and logistics interventions (USAID SPEED 2016).

South Africa. The main usage for soya beans in South Africa is for animal feed, with about 60 percent of total consumption devoted to grinding full-fat soya beans for compound feed, particularly for the broiler and egg industries. About one-third of soya beans are ground for production of soya bean oil and soya bean meal cake. An estimated 8 percent goes directly into the food industry for human consumption. There are reports of complaints by local purchasers that domestically produced soya beans are lower in quality than imported soya products.

Zambia. As of 2011, Zambia's market for soya beans satisfied domestic demand, with 112,000 tons produced in 2011 versus 90,000 tons consumed. Zambia's soya beans are high quality, and much of Zambia's soya bean production and processing is vertically integrated with animal feed operations (NAMC 2011).

FUNCTIONS, INSTITUTIONS, ACTORS

In Malawi, Mozambique, and Zambia, soya bean production is mainly concentrated among smallholder farmers. In South Africa, larger farmers are responsible for more than half of all soya beans produced. Among these four countries, South Africa appears to have the only organized representative association for soya beans, which falls under the Protein Research Foundation. The Oilseeds Advisory Committee is another South African institution involved in policy formulation and market organization.

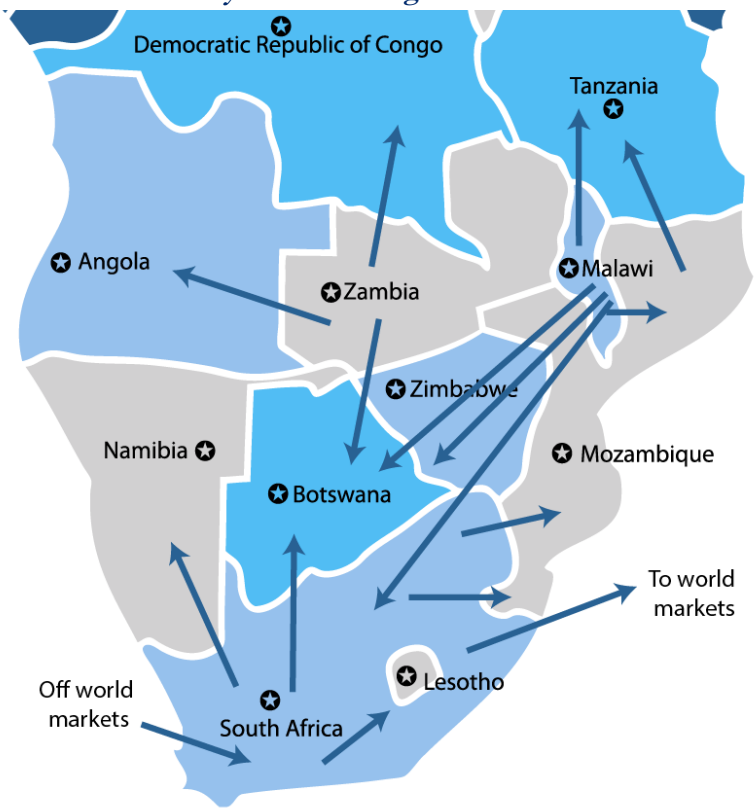
TRADE FLOWS IN SOYA BEANS

Official COMTRADE data does not reveal much about trade in soya beans within Southern Africa. Countries do not have good data on imports and exports, particularly on informal cross-border trade, which largely goes unrecorded. However, the region has a steady trade in locally grown soya beans. Based on the combined knowledge of the field research team, as well as the stakeholders and respondents interviewed, the team produced Figure 15 below, depicting both formal and informal trade flows of soya beans.

The SATH noted that Malawi imposed an administrative ban on soya bean exports in 2010, gauging that "this reduces production in the region and increases reliance on imports" (SATH 2010). In the years following, Malawi's official export data show $3 million in exports in 2011 and 2012, rising to $8.6 million in 2013. Botswana and Zimbabwe are the most frequent markets for Malawi's exports, although Mauritius purchased over a million dollars' worth in 2012. Malawi's imports peaked in 2012 at $3.4 million, but imports are typically much lower.

At times, Mozambique is an important importer of soya beans, typically from South Africa but also from Brazil. Imports peaked in 2012 at $2.8 million, but then fell below a million dollars in the two subsequent years, before reaching $2.3 million in 2014. Mozambique is a minor exporter of soya beans, peaking at $750,000 in 2014. Indonesia and Vietnam are frequent buyers. One probable scenario is that Mozambique will export soya beans grown in the northern and central regions to Malawi, Tanzania, and Zimbabwe, while continuing to import off the international market, including soya bean meal from South Africa.

Figure 15: Trade flows of soya beans in target countries



South Africa's soya bean exports have steadily risen in recent years, with soya bean meal exports to other SADC countries reaching $37.8 million in 2015, and soya bean flour exports to other SADC countries at $1.4 million. Soya bean oil exports to other SADC countries peaked at close to $100 million in 2014, falling to $81 million in 2015. South Africa imports large volumes of soya beans and soya bean meal from non-African countries, particularly Argentina. Imports off world markets enter South Africa at Cape Town and Durban for domestic use, while South Africa exports soya bean products grown in other parts of the country to neighboring SADC countries, often via informal trade. In 2011, soya bean meal imports, predominantly from Argentina, were forecast to grow by 9 percent annually through 2020 (NAMC 2011). While the data are largely unavailable, Zambia is the major exporter of soya bean products to South Africa in the SADC region, followed by Malawi and Zimbabwe, with minimal imports from Mozambique and Tanzania.

For Zambia, statistics from the Zambian Revenue Authority show soya bean meal exports at 11,822 tons, worth $6.8 million dollars. Zambia has been a net exporter of soya beans in recent years, with key export markets in Botswana, Zimbabwe, South Africa and the DRC (NAMC 2011). The SATH report notes that "Zambia frequently sets administrative restrictions on soya bean exports (based on lobbying by the poultry feed market) in an opaque way that does not allow farmers to plant based on export market potential. They therefore plant only to meet the domestic market, neglecting potential export to South Africa" (SATH 2010).

CONSUMER TRENDS AND AWARENESS OF FOOD SAFETY ISSUES

South Africa's per-capita consumption of soya bean oil is the highest in the region, at 5.1 kilograms per capita, with Malawi, Mozambique, and Zambia all around 1.2 kg/pc.

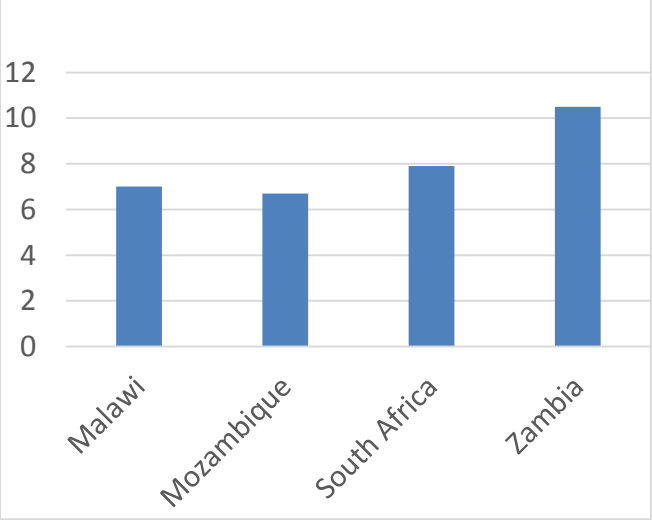
Few consumer SPS issues affect soya beans. Many increasingly consider soya bean products as healthier than meats or animal fats for human consumption. The most prominent issue related to food safety is consumers' perception of the acceptability of foods containing GMO soya beans. A high share of soya products imported off world markets, for example from the U.S. and Argentina, are produced with GMO seeds. The field research team could find no examples of complaints by consumers or public officials regarding GMO-containing soya beans, perhaps because the countries least accepting of GMOs (Malawi, Mozambique, and Zambia) mainly use soya beans for animal feed.

For South Africa, where 95 percent of locally produced soya beans are grown using GMO seeds, domestic food processors and animal feed operations readily accept GMO soybeans. Some consumers willingly pay a premium for non-GMO products. South Africa exports soya beans to neighboring countries, meaning that consumers in the other target countries use GMO soya beans.

Demographic trends would seem to be boosting the attractiveness of soya beans for producers and food processors. These four countries totaled close to 116 million people in 2015, with South Africa by far the largest at 54.5 million, Mozambique at about 30 million, Malawi at 17.2 million and Zambia at 16.2 million (FAOSTAT). All four are experiencing population growth between 1.6 percent and 3.1 percent per year.

Dampening the enthusiasm is that soya bean markets tend to do well when incomes are rising, which is not the case in our target countries. GDP per capita is highly disparate, with South Africa GDP per capita estimated at US$5,691in 2015, followed by Zambia ($1,307), then Mozambique ($525), and Malawi ($381).

Figure 16: Percentage growth in urban population, 2006–2015



Source: FAOSTAT.

On the other hand, all four countries are increasingly becoming urbanized (Figure 16), which suggests consumers will increasingly look to purchase processed food products and meats, both of which imply rising demand for soya beans as inputs. Furthermore, urban residents will have greater access to information about food safety issues, putting an increasing demand on food supply chains to comply with SPS requirements and produce safe food for both consumption and trade.

NOTHING BUT RUST

Following extensive background reading and field research, the field research team did not discover any trade-related plant health or food safety issues in connection to soya beans. However, the same SPS system

that governs the other commodities in this study applies to the import and export of soya beans. Therefore, weaknesses identified in national SPS capabilities, grades and standards, laboratory testing capacities, and quality issues that affect products such as maize and groundnuts will also certainly affect the competitiveness of a given country's soya beans.

Soybean rust caused by *Phakopsora pachyrhizi* is a major threat to worldwide soybean production (Phytopathological Society, 2008; Plant Pathology, 2015). Soybean rust, first reported in Japan in 1902, spread to other parts of Asia and Australia and finally appeared in Africa in 1997. The disease appeared in Zambia in 1998, Mozambique in 2000, South Africa in 2001, and Malawi in 2014. It appeared in the Americas in 2001 and in the U.S. in 2004.

Soybean rust attacks and destroys the leaves of the plant (Mukanga, personal communication, 2016). It is the most destructive soybean foliar disease, causing yield loss of up to 60 percent and losses of up to 90 percent (Pathology, 2015). The most common symptom of soybean rust is a foliar lesion, or noticeable wound to the leaf. On the upper leaf surface, initial symptoms may be small yellow flecks or specks in the leaf tissue, barely larger than a pinpoint. These lesions darken to a dark brown, reddish brown, tan, or grey-green. The lesions tend to be angular to somewhat circular in shape, and may be concentrated near leaf veins. Mature lesions may be somewhat larger, and lesions may merge or run together, killing larger areas of leaf tissue. Symptoms may be more prevalent and more severe on the lower leaf surface.

Cultivation practices, chemical control using fungicides, and use of moderately resistant varieties can control this disease. Recommended farming practices are: early planting, use of wider row spacing, use of early maturing cultivars, planting far from infected fields, and cleaning equipment after use in each field to avoid rust spore dispersal. In practice, fungicide is the most common treatment for rust. Development of resistant varieties has been difficult due to the presence of different populations of the fungus that vary in pathogenicity, virulence, and genetic composition (Pathology, 2015). Asian researchers developed moderately resistant varieties (Phytopathological Society, 2008). IITA researchers have developed combined rust-resistant and high yielding varieties (IITA, 2015), but it is unclear to what extent these varieties have transferred to the four target countries.

KEY FINDINGS

There are no identified SPS barriers that would prevent intra-regional trade of soya beans. Growing demand for poultry feed and expanded varieties of processed food products available to consumers in the four target countries suggest that there is room for expanded production of this commodity.

6. PRIORITY OPPORTUNITIES FOR INVESTMENT

After a wide-ranging and in-depth examination of the plant health and food safety threats facing the maize, groundnut, and soya bean value chains in Malawi, Mozambique, South Africa, and Zambia, we can safely conclude that a broad range of investments are needed. These investments include providing SPS-related equipment, increased testing for MLN and mycotoxins, internal coordination within each national SPS committee and among the national committees at the regional level, greater interaction between the public and private sector, and increased public awareness.

One respondent in Mozambique encouraged us to reflect on the difference between *preventative measures* and *corrective measures*. In evaluating the responses for the three main plant health and food safety threats identified during the course of this study, some rank as preventative in nature while others are corrective:

- Stringent testing of seed coming from maize lethal necrosis-endemic countries—preventative
- Aflasafe for maize and groundnuts—preventative
- Post-harvest handling and storage procedures to reduce aflatoxin contamination in groundnuts (Box 7)—corrective
- Hermetic storage for maize to prevent aflatoxin levels from increasing—corrective
- Destruction of maize and groundnuts contaminated by aflatoxin or fumonisin—corrective

In fact, ensuring plant health and food safety requires both types of response, as part of a comprehensive value chain approach, with traceability and quality assurance "from farm to fork." With aflatoxin contamination an everyday problem, and the looming threat of MLN, these countries need assistance to address these challenges.

Table 17 below builds upon Table 2 in the Executive Summary, providing greater options and a more in-depth discussion of our top dozen regional recommendations for potential investments, as well as our top recommendations for country-level and private sector-financed investments. Annex Four provides our full list of recommendations for potential investments.

Table 17: Broader view of priority recommendations for Southern Africa SPS investments by U.S. donors and others

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
Region-wide			
#REGIONAL-1: Group Study Trip Organize a group study trip for experts from the ministry of agriculture and the national standards bureaus in each of the four target countries to learn about MLN and Kenya's efforts to combat it. Publish the findings for members of the general public, in English and Portuguese.	SADC Secretariat, COMESA Secretariat, national ministries of agriculture and bureaus of standards, Kenya's ministry of agriculture and bureau of standards.	Will create 'champions' for the development of a national strategy for combating MLN in each country. Will greatly boost the knowledge level within each national administration and among members of the general public. Will improve knowledge of the methods to combat MLN.	Limiting size of group to no more than 20. Difficulties in getting participants to take ownership for the planning and subsequent follow-up implementing the findings of the study trip. Ensuring follow-on activities launch immediately upon return.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
REGIONAL-2: Broader sampling for MLN Fund CIMMYT to conduct field tests in all four countries, building on sampling done so far in Malawi and Zambia.	CIMMYT, National ministries of agriculture, national bureau for standards, DFID (funded testing in Malawi), World Bank (funded testing in Zambia)	Will increase the number of technicians familiar with the procedures for MLN field tests. Will permit greater testing in key production areas. Will contribute to momentum for formulating a national strategy to combat MLN in each country.	
REGIONAL-3: Adoption of Clear National Standards on Aflatoxin a) Encourage the national SPS committees in each of the four target countries to adopt and implement the SADC and COMESA standards regime for aflatoxin in both maize and groundnuts, or approve and implement a national standard along science-based standards b) Design and carry out a three-year enforcement program to bring national food supplies into greater conformity with the aflatoxin standard.	COMESA and SADC Secretariats, with national SPS committees of Malawi, Mozambique, South Africa, and Zambia	Will achieve greater transparency in the SPS system tasked with ensuring food supplies have safe levels of aflatoxin.	Lack of capacity. Lack of equipment. Lack of training. Lack of inter-ministerial coordination. Lack of top-level commitment. Lack of secretariat-type budget for national SPS committees to ensure local transport and other direct costs. Lack of ability to handle identified contaminated product.
REGIONAL-4: Comparative Health Profiles for Each Country Develop a comparative table for the SADC countries with the national health profile for aflatoxin-linked maladies (% of stunting, % of different cancers), publish it in each of the four countries, and update it every year in order to create awareness and spur competition to excel.	Ministries of health, national statistical services, World Bank for its Living Standards Measurement Study (LSMS) surveys, World Health Organization.	Difficult to say. Some stakeholders are likely to be motivated to take action to combat aflatoxin; others may see it as intrusive or belittling to point out levels of stunting. Comparing countries' performance in defined areas is a proven method in regional integration for greater attentiveness to the issue. Creating and updating such a table will definitely create a noticeable impact.	Questions about the reliability of data. Resistance to comparing countries' performance ("don't want to embarrass anyone"). Potential erosion of good working relationships with national ministries, if they experience criticism for collaborating on the comparative table.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
REGIONAL-5: Gather Techniques for Reducing Aflatoxin in Groundnuts Post-Harvest Gather available evidence about post-harvest handling and storage techniques for reducing aflatoxin in groundnuts, along the lines of Table 7. Validate the findings with national ministries of agriculture. Translate into Portuguese. Produce a series of communications tools to expand public knowledge of these aflatoxin-reducing techniques: Infographics, posters, laminated display rolls suitable for taking into the field, and laminated quick-reference cards that mothers and other food preparers can keep handy. To inform people in rural areas with low levels of education and literacy, develop visual tools with just pictures, demonstrating that aflatoxin can cause stunting (a picture of a tall youth next to a short one, for example, alongside an expectant mother) and other problems, and how to mitigate those effects.	SADC, COMESA, ministries of agriculture, ministries of health.	Wide-ranging and sustainable impact in terms of raising awareness about aflatoxin and reducing post-harvest contamination. This would be the first collection of helpful suggestions to reduce post-harvest aflatoxin contamination in groundnuts.	Difficulty in estimating the number of people reached by the communications tools. Relying upon ministries of health and ministries of agriculture to use existing networks for distribution of materials.
REGIONAL-6: Find Alternative Uses for Contaminated Food Commission multi-disciplinary report to develop recommendations for alternative uses for aflatoxin-contaminated maize and groundnuts, examining: a) The ability of countries to deal with products with elevated levels of aflatoxin; b) The capacity in each country to incinerate the contaminated food and the cost to destroy it; c) The possibility of blending shipments of groundnuts with elevated (but not astronomically high) contamination levels with shipments of groundnuts with levels well below the tolerance level, to arrive at a product that meets the standard.	SADC Secretariat; national ministries of health; national ministries of agriculture; national bureaus of standards.	Lower quantities of contaminated food in circulation. Safer destruction of the most highly contaminated food (fourth-quality groundnuts after selection), which might otherwise be eaten by the poorest segments of the population. Turning dead-weight economic loss (destruction of contaminated food) into economic gain through the potential for safe and controlled blending methodologies.	'Seepage' of contaminated food intended for incineration back into the food supply where the hungriest and most vulnerable will eat it. The findings on the high cost of incineration and the economic dead-weight loss of destroying contaminated food may discourage the practice of incineration.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
REGIONAL-7: Put SPS on National Single Windows and SADC Website Gain efficiencies of scale in promoting the transparency of applicable national SPS legislation and procedures by making them available on the National Single Windows and the SADC website.	The SADC Secretariat can play an organizing role to encourage the national SPS coordinating committees to keep their online materials, notifications, and bilateral equivalence agreements up-to-date and accurate, even encouraging competition among the member countries to see who can do the best job.	Lasting, visible impact at relatively low cost. A boost to importing and exporting as traders will be able to find the relevant national legislation easily. Greater knowledge of these regulations by a broader swath of national-level officials themselves.	Lack of regular updating of the regulations by national officials. Lack of incentives for SADC-level officials to induce national-level officials to keep the information up-to-date and accurate. Lack of Portuguese-language texts, placing Mozambican importers, exporters and government officials at a disadvantage.
REGIONAL-8: Innovation Activities Invest further in innovation activities, along the lines of Agriculture Economic Challenge Fund (AECF) and AgResults, sponsored by USAID, DFID, TradeMark South Africa, and UNIDO. The activity would offer cash prizes for the design and creation of high-performing, appropriate-technology machines or techniques. One example would be to offer a cash prize for the private sector to devise new types of sorting machines for groundnuts designed to reduce aflatoxin contamination and segment contaminated food. The contest could publish the aflatoxin levels observed with each company's submission, and offer a marketing campaign for consumers to learn about the innovation.	Donor organizations; SADC Secretariat; national ministries of health, agriculture, and trade and industry, national bureaus of standards, national business representative associations.	Enthusiasm generated among the local private sector and national polytechnic institutes for innovative applied research on SPS awareness and the mitigation of plant health and food safety risks. Potentially groundbreaking advances in technology and techniques to address specific SPS-related systemic weaknesses in production, handling, and processing. High-profile 'success stories' for the donors and recipients alike, favorable for inducing investment in the sector.	Failure to adopt technology as foreseen on the part of public and private sectors. Unclear boundary lines between 'public goods' created by the innovation initiative and 'private goods' created by the local private sector.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
#REGIONAL-9 Pest Risk Analysis Sponsor training on pest risk analysis (PRA) for the maize, groundnuts, and soya bean value chains in collaboration with SADC and COMESA in order to 'train the trainers' who will then launch a series of PRA trainings in each country. As part of the national-level and sub-national level trainings, recruit talented participants to update the 'pest lists' in each country and conduct national validation workshops. Hold a regional conference on the process for PRA and the 'pest lists,' with working groups to define further actions to promote pest reduction and increase trade. Provide for Portuguese-language materials throughout the process.	SADC, COMESA, national ministries of agriculture, IAPSC, IPPC.	Long-term impact greatly boosting the knowledge base about pests within each country and the potential threats for the spread of pests within the region. Greater transparency in terms of trade policymaking, as countries will have a common base of knowledge about the incidence and location of pests. Better targeting of pest-reduction programs.	High cost of each PRA by pest by country. Limited knowledge among members of the general public and policymakers about the utility and effective use of PRAs. Risk that the new round of PRAs will linger in the file drawers and computer folders of SPS stakeholders who ought to be acting upon their findings. Limited experience in region in translating PRAs into broadly supported action programs.
#REGIONAL-10: Blanching Groundnuts to Reduce Aflatoxin Analyze and publicize the utility and effectiveness of blanching groundnuts, which radically reduces aflatoxin levels, by means of a generic TV, radio, and billboard advertising campaign in each country, including in the Portuguese language in Mozambique. Work with existing vendors of blanching equipment, or those with existing excess capacity for blanching groundnuts, to encourage increases in throughput. Need to study the added cost and consumer impact.	Ministries of trade and industry, ministries of agriculture and health, groundnut processing associations—or the broader business associations to which they belong. Ministries of communication.	The leading firm in Malawi reported that half of all peanut butter samples were above the national aflatoxin tolerance level. This program would reduce that figure dramatically. Groundnuts for table consumption passing through commercial processors would be safer.	Added cost of blanching. Consumers may not like the new product if the color is substantially changed. Risk of processors raising their prices, relegating the peanut butter with higher levels of aflatoxin to the poorest consumers. Consumers may not like the groundnuts without skins for table consumption.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
#REGIONAL-11: Support National SPS Committees Provide secretariat and logistical support to the national SPS committees comprised of a broad range of stakeholders, A lump sum of $20,000 per year per country would permit the national SPS committees, inter-ministerial in nature and open to participation by private sector operators and civil society stakeholders, to meet quarterly and to publish their conclusions and activities. Seek to increase interaction between the private sector and the national SPS committee.	SADC Secretariat, national ministry of health on food safety issues, by the ministry of agriculture on plant health issues, and by the national bureau of standards on laboratory capacity, accreditation and throughput.	This is a proven method for ensuring that the national SPS committees "do their job" [see the example of the ECOWAS Common External Tariff in West Africa under USAID/WA]. The result will be each country ends up with operational national food laws, an MLN strategy, and review of the peanut butter advice for post-weaning children, and other critical plant health and food safety topics.	Resistance to funding a function that should come out of the national budget allocations (but does not). Potential diversion of logistical and secretariat support into "sitting fees," which are proscribed. Lack of donor control over the usage of the funds, beyond the initial budget spending agreement. Difficult to link spending into an evidence-based results framework.
#REGIONAL-12: Popular Culture Messages about Aflatoxin Hire local groups to produce the following communications materials in local languages related to the reduction of health risks associated with aflatoxin contamination: public service spots for community radio stations, a song about aflatoxin, a 15-minute theater play, a one-minute video for social media.	Ministries of health and agriculture to develop the message, ministry of communications for assistance in disseminating the products.	Huge leaps in public awareness about aflatoxin. Sustainability in public awareness due to the catchy beat of the song. Crowd-pleasing outreach tools for interacting with schools and community centers.	Attempting to launch this type of activity in four countries at the same time could lead to poorer quality outputs. Need for local 'champions.' Unintended consequences, such as differing interpretations of phrasing in local languages.
Malawi			
#MAL-1: Synthesize Health Advice for Feeding Young Children Groundnut Porridge Malawi's children lack protein, but the groundnut porridge recommended for post-weaning children is frequently high in aflatoxin contamination. Therefore, fund an activity to bring together Malawi's ministries of health and agriculture to synthesize the best practices recommended for feeding groundnut porridge to children, including information on the benefits of additional sorting of groundnuts to remove infected nuts before making the porridge.	Ministries of Health and Agriculture.	Greater public awareness of the dangers of feeding children groundnut-containing foods potentially contaminated with overly high levels of aflatoxin. A safer food supply and healthier children.	Limited budget for producing communications materials, such as flyers and radio spots. Limited staff in communications offices of Ministries of Health and Agriculture.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
Mozambique			
#MOZ-1: 7-Pronged MLN Strategy For the plant health officials at the Ministry of Agriculture, the top recommendation was to assist Mozambique to develop a seven-pronged strategy for combating MLN: 1) Multi-stakeholder study trip to MLN-afflicted countries 2) National workshops in various regions of the country 3) Listening sessions (Have farmers had this happen to them? What are the farmers' concerns?) 4) Conduct basic research and translate research conducted elsewhere into Portuguese language and disseminate 5) Develop national strategy to combat MLN 6) Fund surveillance activities in the field 7) Disseminate summary of activities, conclusions, and recommended 'next steps' to the general public	Ministry of Agriculture, INNOQ, Ministry of Trade and Industry, and others	Development of a national strategy to combat MLN. Substantial experience gained in mobilizing a multi-stakeholder group to address a plant health or food safety epidemic.	Extensive coordination required. Need to identify 'champions.' Budget limitations for national SPS committee. Little knowledge about MLN at the start of the initiative.
#MOZ-2: Field Test for MLN Work with CIMMYT to replicate Malawi and Zambia field tests to detect MLN in Mozambique.	CIMMYT, Ministry of Agriculture, INNOQ	Essential experience for the field testers. Progress towards an MLN risk map.	How to test for a plant disease not yet present Budget for fieldwork Budget for testing equipment
#MOZ-3: Equip INNOQ Mozambique's INNOQ, under the Ministry of Trade and Industry, requested that USAID purchase a machine that can test for aflatoxin (NewAgen, VICOM), a flourometric USM machine, and a three-month supply of test strips and re-agent to improve testing capability for aflatoxin.	INNOQ, equipment manufacturers	Expanded capacity for aflatoxin testing within a key standards-setting body.	Lack of an upfront plan for use of the equipment, the expected number of tests conducted per year, the impact on the INNOQ budget, potential future customers and fees.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
#MOZ-4: Challenge Fund for Improving Storage Make use of private-sector oriented innovation challenge funds to: a) Help upgrade the storage facilities associated with Mozambique's community trading markets b) Build several new storage facilities in regions lacking adequate facilities c) Commission a study comparing aflatoxin levels in the new aflatoxin-reducing facilities with those in the older facilities, publish the results, hold a national workshop, translate the materials into English, and publish articles about the initiative in the other three countries	Ministry of Agriculture, Ministry of Trade and Industry, INNOQ.	Real-world evidence in the commercial marketplace of the impact on aflatoxin contamination levels from adopting improved storage techniques. Business model for how to complement Mozambique's state-run storage facilities with a private sector component.	Bureaucracy and red tape. Economic viability of new facilities beyond the duration of donor funding.
South Africa			
#RSA-1: Field Test for MLN Replicate CIMMYT's Malawi and Zambia field tests to detect MLN in South Africa.	CIMMYT, Ministry of Agriculture, South African Bureau of Standards	Essential experience for field testers Progress towards an MLN risk map.	How to test for a plant disease not yet present? Budget for fieldwork. Budget for testing equipment.
#RSA-2: Analyze GMO Challenges Ahead Conduct a political economy analysis (PEA) on the implications of the Republic of South Africa being a market open to GMO-containing foods, whether for production or consumption, in a region where Malawi, Mozambique, and Zambia all prohibit the planting or importation of foods containing GMOs. Discuss production-level, food processing, and marketing aspects such as labeling and overlapping regulatory competencies. Estimate the impact of potential trade bans by South Africa's trading partners of South African processed food products containing GMOs.	Department of Agriculture, Fisheries and Food (DAFF), Department of Health, Department of Consumer Protection, Department of Trade	Greater public knowledge about the production, marketing, and trade of GMO-containing foods. Valuable literature review of public opinion, official statements and positions on GMOs in each the 4 countries, leading to political economic analysis	Limited budget for initiating new surveys. The danger of unintended consequences, i.e., greater awareness of GMOs may lead to greater fear and a shift in South African public opinion.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
Zambia			
#ZAM-1: Update and Enforce National Food Laws Phase 1: Zambia's National Agricultural Research Institute (ZARI) recommended consultant assistance in reviewing the national food laws (see Box 3) in order to update them, reducing plant health and food safety risks including aflatoxin. Conduct listening sessions, then propose a new draft and white paper, work with departments to validate the findings and the draft, then hold a national validation workshop. Phase 2: Work with Zambia's SPS committee and other relevant stakeholders to implement and enforce the revised food laws. Encourage the Government of Zambia and private sector and civil society stakeholders to identify 'champions' at the national and sub-national level to drive a process for change with local ownership. Provide logistical and secretariat support for a three-year enforcement campaign, including field testing, workshops to spur process change, food processing surveillance, consumer product sampling (peanut butter or mealie-meal for different strains of aflatoxin), and the publication of results.	Ministry of Agriculture, Ministry of Health, ZABS, other members of the national SPS committee, office of the Prime Minister, farmers groups, consumer groups, food processors and retailers, traders.	An up-to-date, coherent and comprehensive enabling environment to address plant health and food safety threats. Far-greater public awareness of the need to improve the safety of the food chain for humans and animals.	Large organizational effort, with some parties more interested in progress on one front but less on another. How to maintain momentum over a lengthy process? Limited national budget provision for SPS committee. Limited capability on the national SPS committee to provide logistical and secretariat support.

Table 17 cont

Recommended Activity	Key Counterpart Body	Estimated Impact	Potential Difficulties
#ZAM-2: Is Groundnut Porridge Safe Enough for Young Children? Based upon a suggestion by officials at Zambia's Ministry of Health, analyze the challenges and opportunities presented by the existing recommendation that children, once weaned off mother's milk, should be fed groundnut porridge. Collaborate with the Ministry of Agriculture to devise guidance to accompany the Ministry of Health groundnut porridge to parents, including groundnut sorting prior to making porridge.	Ministry of Health, Ministry of Agriculture.	Greater public awareness of the dangers of feeding children groundnut-containing foods potentially contaminated with overly high levels of aflatoxin. A safer food supply and healthier children.	Limited budget for producing communications materials, such as flyers and radio spots. Limited staff in communications offices of Ministries of Health and Agriculture. Parents may stop feeding their children groundnuts completely, significantly reducing their limited source of protein.
RECOMMENDED PRIVATE SECTOR INVESTMENTS			
#PS-1: Invest in mechanical shellers and sorters for groundnuts	Local input supply dealers Farmer cooperatives	Greatly reduced spread of aflatoxin in handling and processing. Greater throughput than shelling by hand.	High cost of machines. Reluctance to abandon traditional method of wetting the shell before processing.
#PS-2: Invest in blanching equipment to ensure table nuts or peanut butter with suitably low levels of aflatoxin	Groundnut processors	Higher-value groundnut products capable of fetching a premium price.	Uncertain length of time for amortization of investment.
#PS-3: Offer maize industry co-financing for field testing for MLN	National cereals associations, maize processing industry associations	Would show local private sector's commitment and buy-in to combating MLN. Possible to fund a greater number of field tests in more areas.	Only large operators might be willing to contribute. 'Free rider' problem within representative associations.
#PS-4: Publicize the human health benefits of foods containing soya beans	South Africa's Protein Research Foundation, consumer-ready food companies in Malawi, Mozambique, and Zambia	Better diversified diet in protein-deficient societies. Crop is less at risk for MLN or mycotoxins.	Government fertilizer subsidies currently support soya bean cultivation (other crops more attractive). Backlash from maize producers? Limited present supply capability.

Every child should be entitled to a diet that is plentiful, safe, and affordable. The mantra that it is better to eat something than go hungry should not be acceptable when there is sufficient correlating evidence that con-

sumption of aflatoxin (and other mycotoxins) is potentially linked to stunting, increased occurrence of malaria, diarrhea, and higher rates of cancer in the longer term. Addressing food safety is not a battle won in a few years, but a war that, in the case of aflatoxin, will probably take over a decade. After identifying solutions, the problem requires *local champions* to ensure that the issues receive attention in every relevant meeting. It requires an increased sense of responsibility by private sector companies and interventions at the farm level, including by poor, smallholder farmers.

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ANNEX II: LIST OF PERSONS MET

Name	Position
Malawi	
Yotamu Miti	Laboratory Technician, Chitedze Research Station
Tim de Borde	Chairman/CEO Exagris Africa Ltd
Jim Goodman	Exagris Africa Ltd
Isaac Gokah	Focal Point for PACA
Nasinuku D. Saukila	CEO, National Food Reserve Agency
Matildah Mdyetseni Chingwalu	Acting Head of Plant Health Services in Malawi, Chitedze Research Station
Martin Banda	USAID Malawi, Program Management Specialist (Agriculture)
Laura Schreeg	Bureau for Food Security
Fujiwara Kazuyuki	P4P Coordinator, World Food Program
Cuan Opperman	Team Leader, Malawi Oilseed Transformation (MOST)
Daniel Mwalwayo	Malawi Bureau of Standards; Aflatoxin Lab Manager
Dr D. Gondwe	Principal Agricultural Research Scientist at Makoka Research Station
J. Mabugwa	Researcher, MLN
Elisa D. L. Mazuma	Deputy Director, Department of Agricultural Research, Ministry of Agriculture
Felix Jumbe	Chairperson, Parliamentary Committee on Agriculture, Irrigation and Water Development
Candida Nankumwa	Director of Research, Policy and Partnerships, Farmers Union of Malawi (FUM)
Juan Vermuelen	CEO, Vermuelen/Aandele Trust
Dawid Burger	Plant Manager, Vermuelen/Aandele Trust
Rahael Banda	Plant Inspector, Ministry of Agriculture
Enock A. Kamwala	Scientific Officer, Food Chemistry
Andrew Chinguwo	Factory Manager, Valid Nutrition Malawi
Ellah Liwonde	Intern, National Resources College
Mozambique	
João Cabeça	Agricultural and Livestock Inspector, Zóbwe Border Post (Mozambique-Malawi border)
Ana Paula Cardoso	Head, Environmental Health Department, Public Health Directorate, Ministry of Health

LIST OF PERSONS MET (CONT)

Name	Position
John Irons	Agriculture, Economics and Business Office Head, USAID
Paula Pimentel	USAID Senior Agricultural Research & Technology Transfer Advisor
Almeida Zacarias	USDA Agricultural Specialist
Arlindo Mucone,	INNOQ Director
Faustino Mário,	INNOQ Certification Technician
Jaime Mavila	Head Markets Section, National Directorate of Trade
Mohamed Razak,	WFP Logistics Officer
Cláudia Santos	WFP Logistics Officer
Maria Nivalda Lázaro	Director, National Laboratory of Food and Waters
Manuel do Céu Gouveia	Analyst, National Laboratory of Food and Waters
Serafina Mangana	Head Plant Protection Department, Ministry of Agriculture
Anastácio Luís	Engineer, Plant Protection Department
Fidélio Rosse Salamandane	IPEX Senior Trade Officer
Ricardo Velho	Industrial Process Expert, UNIDO/Mozambique
Mark Lundell	Mission Director, World Bank Mozambique
Cristobal Aguilar	Livelihods Empowerment and Development (LEAD) ACDI/VOCA, Chief of Party
Daniel White	ACDI/VOCA Technical Director
Elsa Adélia Timana	Director, Quality Contral and Seed Certification, Ministry of Agriculture and Food Safety
South Africa	
Evans Chinembiri	Feed the Future Specialist on Trade and Investment, USAID/Southern Africa
Eddie Goldschagg	Technical Manager, South African National Seed Organization (SANSOR)
Neels Wegner	Product Specialist, Gauteng region, PPECB
Hein Engelbrecht	Laboratory Supervisor, Perishalbe Products Export Control Board (PPECB)
France MALANGA	Agronomist
Isabel Bezuidenhout	Phytosanitary officer, SANSOR
Dr. Bradley Flett	Researcher, Agricultural Research Counciil- Crop Grains Institute
Dr. Kingstone MASHINGAIDZE	Researcher, Agricultural Research Counciil- Crop Grains Institute

LIST OF PERSONS MET (CONT)

Name	Position
Dr. Marinda Visser	Manager, Grain Research and Policy Centre
Francois Minnaar	Grain SA
Gerhard Scholtemeijer	Chairperson, Protein Research Foundation
Zambia	
Prudence Yande	Head of Research and Planning, Disaster Management and Mitigation Unit – Vice Presidents Office
Bison Mtonga	Food Processing Industry Inspector, Zambia Buerau of Standards (ZABS)
Mlotha Damaseke	Agriculture Specialist, Acting Feed The Future Coordinator, USAID/Zambia
Harry Ngoma	Agriculture Specialist, USAID/Zambia
Ponde Chunga Mecha	ACDI/VOCA Deputy Chief of Party, PROFIT + USAID Feed the Future Program
John Keyser	Economist, World Bank
Mable Simwanza	Director, Seed Contraol and Certification Institute, Minsitry of Agriculter (MA)
Monde Zulu	Deputy Director, Zambia Agricultural Research Institute
Mweshi Mukanga	Plant Pathologist, Plant Protection and Quarrantine Division, ZARI
Mable Mudenda	Plant Health Inspector, Plant Quarrantine and Phytosanitary Services, , ZARI
Kabamba Mwansa	Maize Breeder, Research Program, ZAIR
Anayawa Mutemwa	Principal Agricultural Economist, Agribusiness and Marketing Department
Kalipochi Kawonga	Coordinator, SADC Seed Security Centre
John Mukuka	Seed Development Expert, COMESA
Watson Mwale	Executive Secretary, Zambia Seed Trade Association
Nath Verma	Research and Production Manager, Zamseed
Herbert Masole	Research Manager, SeedCo Zambia International Limited
Green Mbozi	Marketing Director, Kamano Seeds
Dominic Daka	Quality Manager, Klein Karoo Seed Zambia
Kevin Kleemann Wright	Managing Director, Pioneer DuPont
Munyaradzi Mutsvairo,	Managing Director, Pannar Seed
William Rutherford-Smith	Managing Director
Iain Morrell	Head- Production and Supply, Syngenta MRI SEED

ANNEX III: ACTIVITIES OF U.S. AGENCIES, OTHER BILATERAL DONORS, INTERNATIONAL ORGANIZATIONS, AND AFRICAN REGIONAL ORGANIZATIONS IN SOUTHERN AFRICA

Donor	Region-wide	Malawi	Mozambique	South Africa	Zambia
USAID	Funding COMESA SPS harmonization	SATH training	Soybean promotion program (Technoserve)	Harmonized Seed Release Project (HSRP), newly located in Pretoria since May 2016	HSRP to support seed trade
		USAID/Lilongwe project, Increased Exports of Smallholder Groundnuts through Innovations in Storage Management, via Malawi Innovation Challenge Fund (MICF)	Consultative meeting for awareness and management of aflatoxins, June 2015		SATH evaluation of interventions in groundnut sector, November 2015
			USAID/Maputo project on aflatoxins, including promotion of Aflasafe		Gender research in Chipata

ACTIVITIES OF ORGANIZATION (CONT)

Donor	Region-wide	Malawi	Mozambique	South Africa	Zambia
	Supported SATH studies on: a) SADC Regional Strategy for Food Safety, and b) SADC Regional Strategy on Plant Health		SATH seed industry needs assessment in 2015	SATH supports training at laboratory training center (Southern African Grains Laboratory)	Strategic Partnership Grant on groundnuts with South Africa Groundnut Marketing (SAGM) Jungle Beat
	Supported African Seed Trade Association		SATH gender analysis and training on quality assurance of groundnuts and soy sectors in 2015		SATH assisted Zambia Bureau of Standards to produce "Guide for the Referencing of Technical Standards in Zambia"
USAID (continued)	SATH builds capacity of national WTO Consultative Committees in 6 SADC countries	SATH helps form national Technical Barriers to Trade (TBT) Consultative Committee	SATH helps form national TBT Consultative Committee		SATH helps form national TBT Consultative Committee
	SATH transfers equipment to national WTO TBT Enquiry Points in 6 SADC countries	SATH helps harmonize national seed law with SADC Model Law	SPEED analysis of compliance with WTO SPS Agreement and SADC SPS Annex 2016		SATH helps Zambia's WTO TBT Enquiry Point re-open.
			SATH Good Standardization Practices workshop with INNOQ		SATH supports online seed lab
		SATH grant on improving grading	SATH grant on improving grading		SATH grant on improving grading
			SATH grant to Intertek Laboratories		SATH supports persuasive communication training for women entrepreneurs
			SATH supports aflatoxin management training, plus assessment of impact		SATH supports Zambian Seed Control and Certification Institute to reduce the costs for certification

ACTIVITIES OF ORGANIZATION (CONT)

Donor	Region-wide	Malawi	Mozambique	South Africa	Zambia
			SATH workshop on WTO TBT capability		SATH supports SAQM activities awareness workshop
			SATH supports standards awareness for private sector		SATH supports food safety awareness creation workshop, January 2016
			ANSI study (still underway)		Participated in awareness-raising workshop convened by Zambia Seed Trade Association on SADC harmonized seed regulations
			USAID/Maputo is setting up a laboratory in Nampula capable of testing for aflatoxin		
			USAID/Maputo participated in national MLN workshop in 2014		
USDA/APHIS			Participated in national MLN workshop in 2014		Inaugural Quality Awards program launched
USDA/ARS	Contributing to Aflasafe activities via IITA				

ACTIVITIES OF ORGANIZATION (CONT)

Donor	Region-wide	Malawi	Mozambique	South Africa	Zambia
European Commission (EC)/European Union (EU)	Finances PAN-SPSO to encourage participation in standards-setting bodies.	Provided equipment, including an Ultra High Performance Liquid Chromatography – Mass Spectrometry (UPLC-MS), post column derivatization system, two High Performance Liquid Chromatography (HPLC) systems, and a water purification system. The mass spectrometry system is equipped with an uninterrupted power supply (UPS)	Support to the national laboratories of water and food		
	Funded guidelines to accompany SADC SPS Annex on Food Safety under the Capacity in Residue Control (FSCBRC) project	Provided the ICRISAT laboratory with an ELISA system to screen seed samples for the presence of aflatoxin	30-million Euro value chain projects about to be launched in Zambezia focusing on quality and nutrition under National Indicative Program		
European Commission (EC)/European Union (EU)	Regional Economic Integration Support (REIS) Programme supported SADC's SPS development		Potential support to Quality Infrastructure to improve calibration and standardization		
	Supported ACTESA and African Seed Trade Association		Mapping of laboratories, training for INNOQ on ISO 17025 on the operation of laboratories		
	Through SADC, funded REIS project to expand laboratory testing capabilities				

ACTIVITIES OF ORGANIZATION (CONT)

Donor	Region-wide	Malawi	Mozambique	South Africa	Zambia
DFID	TradeMark SA (now ended); Support for Tripartite SPS negotiations.	Malawi Oilseeds Sector Transformation (MOST) project			
		2012 study on pulling aflatoxin out of human food chains			
		TradeMark Southern Africa support for UNIDO study, 2009-2010			
Austria			Aflasafe (IITA 2015b)		Aflasafe (IITA 2015b)
Denmark	Worked with SADCAS				
Switzerland	Helped finance SADC regional seed rules, 2008.				
Brazil and Germany			"Trilateral Project" on standardization and capacity building in metrology		
Italy			Support for National TBT Enquiry Point		
ITTA		Validation workshop for SADC guidelines	Validation workshop for SADC guidelines		Validation workshop for SADC guidelines
IPPC					
FAO and ILO		Biosecurity project, 2008-2014	Project on Decent Work and Food Security in Mozambique		

ACTIVITIES OF ORGANIZATION (CONT)

Donor	Region-wide	Malawi	Mozambique	South Africa	Zambia
			Support to Seeds Laboratory of Ministry of Agriculture and Food Safety; support to food hygiene and quality control labs; project Competir con Qualidade, improving national quality infrastructure systems		
UNIDO		Support for aflatoxin management in Malawi (with DFID funding). At Chitedze research station, provided aflatoxin analyzing equipment, staff training in sampling, analyzing and reporting techniques, and a business plan providing a cost-benefit analysis for the establishment of an accredited testing laboratory	Support to national quality institute INNOQ on metrology and training		Pilot project on ISO food safety standards
WTO Standards and Trade Development Facility (STDF)	Active in PAN-SPSO	Malawi Programme for Aflatoxin Control			
CIMMYT	Post-harvest handling and storage issues	CIMMYT financing fielding testing for MLN			
World Bank			Public health interventions to prevent stunting		
COMESA	Harmonizing SPS regulations across member countries				

ACTIVITIES OF ORGANIZATION (CONT)

Donor	Region-wide	Malawi	Mozambique	South Africa	Zambia
SADC	2009 SADC Guidelines for the Regulation of Plant Protection Products				
	2014 presentation to SADC SPS Coordinating Committee by IITA on Aflasafe				
	2014 draft Regional Strategy for Food Safety				
	REIS project to expand the range of national laboratories' testing capabilities				
Tripartite	SPS is one of the negotiating chapters, with discussions building on the experiences of negotiating the COMESA-EAC-SADC provisions				
African Union	Hosts Partnership for Aflatoxin Control in Africa (PACA)	PACA active in promoting Aflasafe	PACA active in promoting Aflasafe		PACA active in promoting Aflasafe
	Organizes Inter-African Phytosanitary Council	Malawi Aflatoxin Prevention and Control project (MAPAC)			
	Organizes NEPAD and CAADP				

ANNEX IV: RECOMMENDATIONS TO INCREASE TRADE WHILE IMPROVING PLANT HEALTH AND FOOD SAFETY

This annex presents valuable ideas for potential interventions collected during the team's background work, field mission research, and brainstorming to propose creative ideas, as called for within the scope of work. This annex contains the recommendations included in Table 2 in the Executive Summary and Table 17 in Section 6 on the Conclusions. This set includes regional-level interventions, through SADC and COMESA, country-level recommendations for Malawi, Mozambique, the Republic of South Africa, and Zambia, and private sector recommendations.

We were encouraged to propose recommendations in nine areas:

- Policy
- Infrastructure and other assets
- Human and institutional capacity building
- Financial services
- Market information systems
- Science and technology (including ICT)
- Conflict
- Market governance
- Global competitiveness

COMPREHENSIVE TABLE OF RECOMMENDATIONS FOR SOUTHERN AFRICA SPS INVESTMENTS BY USAID AND OTHER DEVELOPMENT PARTNERS

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
Regional Level		
#RL-1: Organize a group study trip for experts from the ministry of agriculture and the national standards bureaus in each of the four target countries to learn about MLN and Kenya's efforts to combat it. Publish the findings for members of the general public in English and Portuguese.	Human and institutional capacity building, Policy High priority	As soon as possible

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#RL-2: Working with the COMESA and SADC Secretariats: a) Encourage the national SPS committees in each of the four target countries to adopt and implement the SADC and COMESA standards for aflatoxin for both maize and groundnuts, or approve and implement a national standard following science-based standards.	Human and institutional capacity building, Policy High priority	As soon as possible; Southern Africa Trade Hub
#RL-3: Develop a comparative table for the SADC countries with the national health profile for Aflatoxin-linked maladies (% of stunting, % of different cancers), publish it in the four countries, and update it every year in order to create awareness and spur competition to excel.	Policy, market information systems Low priority	Start as soon as possible; long term activity
#RL-4: Conduct study gathering available evidence about post-harvest handling and storage techniques for reducing aflatoxin in groundnuts and maize, along the lines of that attempted in Table 7 in the main body of the text (see section 5.1 Maize Value Chain Snapshot). Produce a series of communications tools to expand public knowledge of these aflatoxin-reducing techniques: Infographics, posters, laminated display rolls suitable for taking into the field, laminated quick-reference cards that mothers and other food preparers can keep handy. To inform people in rural areas with low levels of education and literacy, develop visual tools with just pictures, demonstrating that aflatoxin can cause stunting (a picture of a tall youth next to a short one, for example, alongside an expectant mother) and other problems, and how to mitigate those effects.	Human and institutional capacity building, market information systems Medium priority	As soon as possible; potentially Southern Africa Trade Hub (SATH)
#RL-5: Commission multi-disciplinary report to develop recommendations for alternative uses for aflatoxin-contaminated maize and groundnuts, applicable to sub Saharan Africa, examining: a) The ability of countries to deal with products with elevated levels of aflatoxin; b) The capacity in each country to incinerate the contaminated food and the cost to destroy it; c) In peanut butter in particular, the possibility of blending shipments of groundnuts with elevated (but not astronomically high) contamination levels with shipments of groundnuts with levels well below the tolerance level, to arrive at a product that meets the standard. Promote policy level discussions to investigate how to incorporate alternative uses into the standards and market systems in each country. Assist SADC to develop a voluntary code of good conduct for national governments and businesses to adopt related to proper disposal of aflatoxin-contaminated food.	Policy, infrastructure, market information systems High priority	6 months

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#RL-6: Develop catalogue of best practices on plant health and food safety across overlapping competencies (bureaus of standards, ministries of agriculture, and ministries of health). Ensure that best practices overlap across ministries with the sharing of knowledge across competencies about SPS systems, aflatoxin, MLN, fumonisin, consumer rights, and other issues. As the scope of the activity reaches across these three entities, training programs must embrace the interests of all three entities. For example, the standards officials could lead the training for their agriculture and health colleagues, and vice versa. Hold validation workshops in each country about the catalogue. Phase 2: Develop suitable communications tools for each country (post-harvest covered in #RL 3), disseminate to members of the general public, including through consumers' groups, mothers' groups, and farmers' groups.	Human and institutional capacity building, market information systems High priority Medium priority	As soon as possible; potentially SATH
#RL-7: Provide technical assistance, including webmaster help, to integrate SPS-related agricultural issues and information into each national Single Window7 and the SADC website. Information could include fees for different procedures and approvals, waiting times for tests, procedures for sampling and laboratory procedures, plant health and food safety requirements, and tolerance levels. The objective is to insert an SPS-related component into each national trade facilitation portal.	Policy, science and technology (including ICT) High priority	As soon as possible; potentially SATH
#RL-8: Invest further in innovation activities, along the lines of the Agriculture Economic Challenge Fund (AECF) and AgResults, sponsored by USAID and UNIDO, which promote investments in solutions led by the private sector. The activity would offer cash prizes for the design and creation of higher performing, appropriate-technology machines or techniques. One example would be to offer a cash prize for the private sector to devise new types of sorting machines for groundnuts designed to reduce aflatoxin contamination and segment contaminated food. The contest could publish the aflatoxin levels observed with each company's submission, and offer a marketing campaign for consumers to learn about the innovation.	Infrastructure, market information systems, market governance, human and institutional capacity building High priority	By country, once Aflasafe is ready to be commercially offered

[7] In Mozambique, the Single Window is called the *Balcâo Unico*.

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#RL-9: Leverage private-sector-led knowledge and abilities to promote best practices and technical advances in SPS-related systems by bringing together large-scale, successful operators and associations and small-scale operators and associations to build capacity among the latter. This might involve: a) promoting collaboration between Grains South Africa and representative associations in Malawi, Mozambique, and Zambia to provide capacity-building and training in SPS systems and SPS awareness b) Working with Agritech Expo in Zambia to provide hands-on instructional materials (including in Portuguese) for small-scale trading operations (using the big guys' knowledge to build capacity amongst the small-holders) c) Practical work on the ground, where a large company provides coaching and advice on small-scale operators' business dealings.	Human and institutional capacity building Medium priority	Potentially SATH
#RL-10: Conduct a systematic analysis of aflatoxin prevalence in each target country and in the neighboring East African and Southern African regions. Create a system to profile vulnerable areas in each country, and build monitoring systems and capabilities. Assist each country to develop a forecasting system to achieve better targeting of zones where aflatoxin contamination is likely to proliferate, and form an action committee, to include the national meteorological services, the ministries of agriculture and health, the national bureaus of standards, and the office of the prime minister. Publish the results in local newspapers and broadcast on national TV and radio. As a comparison, research the U.S. system that monitors weather patterns to predict the location of aflatoxin outbreaks and the capabilities of the FEWS NET programs.	Science and technology (including ICT), market information systems High priority	As soon as possible; starting prior to Aflasafe registration
#RL-11: Hire local groups to produce the following communications materials in local languages related to the health risks associated with aflatoxin contamination and risk reduction: public service spots for community radio stations; a song about aflatoxin; a 15-minute theater play; a one-minute video for social media.	Human and institutional capacity building, market information systems Medium priority	By country when Aflasafe is ready to be commercially offered Linked to #RL-9
#RL-12: Provide secretariat and logistical support to the national SPS committees comprised of a broad range of stakeholders, headed by the Ministry of Health on food safety issues, by the Ministry of Agriculture on plant health issues, and by the national Bureau of Standards on laboratory capacity, accreditation, and throughput. A lump sum of $20,000 per year per country would permit the national SPS committees, inter-ministerial in nature and open to participation by private sector operators and civil society stakeholders, to meet quarterly and to publish their conclusions and activities.	Policy Medium priority	Potentially SATH

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#RL-13: Sponsor development of training modules on best practices to combat MLN, including the following elements: 1) Field surveillance 2) Stakeholder consultation and listening sessions 3) Development of national strategy to combat MLN 4) National validation workshop for national strategy 5) Quarterly meetings of MLN taskforce and reporting 6) Public sensitization campaign 7) Lessons learned from MLN to put into practice for future diseases.	Policy, human and institutional capacity building, market information systems High priority	As soon as possible, potentially SATH
#RL-14 Sponsor training on pest risk analysis (PRA) for the maize, groundnut, and soya bean value chains in collaboration with SADC and COMESA in order to 'train the trainers,' who will then launch a series of PRA trainings in each country. As part of the national-level and sub-national level trainings, recruit talented participants to update the 'pest lists' in each country and conduct national validation workshops. Hold a regional conference on the PRA process and the 'pest lists,' with working groups to define further actions to promote pest reduction and increase trade. Provide Portuguese-language materials throughout the process.	Human and institutional capacity building Medium priority	Potentially SATH
#RL-15: Conduct outreach to the region's tribal chiefs to create awareness and disseminate best practices related to combating MLN and reducing aflatoxin contamination. Use local systems to raise awareness, identify MLN at the earliest possible stage, and disseminate information about reducing the threats posed by aflatoxin.	Information systems Medium priority	Coordinated approach through the SATH, but at bilateral program level
#RL-16: To push public awareness of food safety issues, catalogue, publish, and carry out a public information campaign of food safety incidents in the four target countries over the past 20 years, along with "success stories" about how those problems can lead to positive change. Examples include: ▪ South Africa banning peanut butter in school feeding programs ▪ One hundred people sickened by porridge made from unsafe maize flour in Mozambique ▪ Sicknesses attributed to water with fecal contamination used in vegetable production ▪ Deaths resulting from excessive pesticide residues and adulterated homemade alcohol ▪ The discovery of fecal matter in informally produced maize meal in Kenya, which closed down informal mills and forced all mills to adhere to standards The activity should result in a proposal for an off-the-shelf mechanism or module to propose, evaluate, and implement reforms needed to combat future food-safety scandals.	Market information systems Medium priority	Once package of mitigation methods are available

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#RL-17: Verify and publicize the utility and effectiveness of blanching groundnuts, which reduces aflatoxin levels, with a generic TV, radio, and billboard advertising campaign in each country, including in the Portuguese language in Mozambique. Work with existing vendors of blanching equipment, or those with existing excess capacity for blanching groundnuts, to encourage increases in throughput.	Science and technology (including ICT), Market information systems High priority	As soon as possible. Link to work on national aflatoxin tolerance standards if viable.
#RL-18: Explore the trade-related SPS impacts of rust in soya beans and the benefits of promoting soya bean production and use as a "safe" food product with little risk of plant health or food safety threats.	Global competitiveness Medium priority	
#RL-19: Assist the four countries to domesticate the draft SADC SPS strategy, comprised of separate plant health, animal health, and food safety strategies. The objectives include: ▪ The inclusion SPS strategies in national law ("localization") ▪ Ensuring application and enforcement of SPS strategies ▪ Circular letters issued by ministries or prime minister's office instructing national officials to enact the new set of SPS measures and practices ▪ Ex-post evaluation to assess the degree of enactment and enforcement after one year ▪ The recommendation of additional steps to make the new SPS standards a reality in each national economy	Policy High priority	Potentially SATH
#RL-20: Build capacity in each country with the pertinent authority (bureau of standards) to develop, generate, and enforce agreed-upon country-level standards for aflatoxin tolerance levels, goals for testing percentages, and a plan for disposal of contaminated food. The country-level standards should take into account the Codex, COMESA, and SADC standards regimes.	Human and institutional capacity building High priority	Potentially SATH
#RL-21: Mozambique's INNOQ identified that Unulurio University has surplus capacity for aflatoxin testing and suggested an activity to help the university's laboratory to expand from solely teaching activities into conducting commercial aflatoxin testing. Based on this experience, explore the opportunities for how university laboratories in other countries can use their surplus capacity, for example at the University of Pretoria.	Human and institutional capacity building, infrastructure Medium priority	Once package of mitigation methods are available and awareness raising activities are commencing
#RL-22: Carry out a study in each country to determine availability, suitability, and cost-effectiveness of incineration methods for contaminated food and their impact on the environment. Fund compensation mechanism to the owners of contaminated maize and groundnuts for incineration. Fund incineration of contaminated food. [This regional-level recommendation is not necessarily intended for adoption by U.S. agencies, but instead for the broader group, including governments.]	Infrastructure High priority	

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#RL-23: Develop a comprehensive vision of how to upgrade the national laboratory capabilities of each country, and how to operationalize a more-effective system of testing in order to test a higher percentage of food. Carry out an applied economic analysis of the business model for laboratories in each country, reviewing the steps in the system, pricing structures, sources of funding, ways to make each laboratory more visible in order to attract more customers, and proposals to make the labs more economically viable.	Human and institutional capacity building Medium priority	Once package of mitigation methods are available and awareness raising activities are commencing
#RL-24: Study the example of the COMESA and SADC initiative bringing together a dozen countries to harmonize the plant health approach taken for 19 fruits, including ways to combat the fruit fly. Draw lessons for how the four target countries can organize themselves to combat aflatoxin contamination and MLN.	Human and institutional capacity building Low priority	
#RL-25: Use the existing SADC, COMESA, and African Union Peer Review Mechanisms to undertake peer reviews of the plant health and food safety strategies in each target country, for example with reviewers from Malawi, Mozambique, and South Africa conducting a peer review in Zambia. A peer review in each country would lead to information exchange and could provide common information for all four countries, including: • The extent to which the procedures for issuing phytosanitary certificates according to national regulations conform with the procedures actually in practice • The number of samples for aflatoxin testing collected each year and the percentage of the marketed crop represented • The percentage of samples above the national aflatoxin tolerance level • Information about the disposal of contaminated shipments	Human and institutional capacity building Medium priority	Potentially SATH
#RL-26: Develop a program targeting smallholder farmers' adoption of hermetic storage through farmers' groups and cooperatives to promote the usage of hermetic bags (e.g., AgResults Kenya storage pilot) for the hermetic storage of maize. Evidence shows that insects penetrate 25 percent of the bags within one season. As part of this activity, conduct research on techniques for reusing bags for a second season, for example by reversing the inside bags. Note: Hermetic storage of maize significantly contributed to post-harvest control of aflatoxin. If current research shows hermetic storage of groundnuts effectively controls aflatoxin, include groundnuts in recommendation.	Science and technology (including ICT) High priority	Include in current bilateral programming

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#RL-26: Use the diplomatic resources of U.S. Embassies to place aflatoxin mitigation and MLN on the agenda at the highest level. For example, by: a) A demarche to the organizers of regional summits and high-level meetings, such as the regional summits of Heads of State and Government held in Uganda on July 5, 2016, where Zambia participated. b) In each country, a request by the U.S. Ambassador to approach the Prime Minister to send a circular letter to all of the relevant stakeholders on national SPS committees. The letter would detail the need to work together in closer and concerted fashion to combat MLN, aflatoxin, and fumonisin.	Policy High priority	Immediate
#RL-27: Hold a regional sensitization workshop for peanut butter manufacturers about preventing the sale of contaminated product, perhaps offering technical assistance so they know exactly how and where to get their peanut butter tested, even offering that the first test be free.	Medium priority	Once package of mitigation methods are available and awareness raising activities are commencing
Malawi		
#MAL-1: Malawi's children lack protein in their diets, but the recommended groundnut porridge for post-weaning children can be high in aflatoxin contamination. Therefore, fund an activity to bring together Malawi's Ministries of Agriculture and Health to synthesize the best practices recommended for feeding groundnut porridge to children (good nuts for children, bad nuts for adults), including information on the benefits of additional sorting of groundnuts to remove infected nuts before making the porridge.	Human and institutional capacity building High priority	As soon as possible, bilateral program
#MAL-2: Provide training for personnel at Chitedze Research Station who can develop needed basic infrastructure and a proper document management system for the station's laboratory.	Human and institutional capacity building Low priority	Late 2017
#MAL-3: Support the transformation of the Valid Nutrition lab into an accredited independent lab to provide independent testing services.	Science and technology Medium priority	Late 2017
#MAL-4: Conduct an organizational and institutional assessment to support streamlining and reduce duplication of roles of SPS regulatory agencies. Provide recommendations for greater efficiency, ease of use, and methods to encourage the private sector to seek more regular testing.	Medium priority	Early 2017

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#MAL-9: Support participation by Malawi's public and private technicians in the International Food Safety Training Laboratory (IFSTL) to increase laboratory capacity and deliver laboratory-based training to scientists suitable for monitoring food safety compliance. The Joint Institute for Food Safety and Applied Nutrition (JIFSAN) runs the program to provide food safety technical assistance.	Low priority	
Mozambique		
#MOZ-1: For the plant health officials at the Ministry of Agriculture, the top recommendation was to assist Mozambique to develop a seven-pronged strategy for combating MLN: 1) Multi-stakeholder study trip to MLN-afflicted countries 2) National workshops in various regions of the country 3) Listening sessions (Have farmers had this happen to them? What are the farmers' concerns?) 4) Conduct basic research and translate research conducted elsewhere into Portuguese language and disseminate 5) Develop national strategy to combat MLN 6) Fund surveillance activities in the field 7) Disseminate summary of activities, conclusions, and recommended 'next steps' to the general public.	Policy, human and institutional capacity building, science and technology (including ICT) High priority	As soon as possible
#MOZ-2: Work with CIMMYT to replicate Malawi's field-testing procedures to detect MLN in Mozambique.	Science and technology (including ICT) High priority	As soon as possible
#MOZ-3: Mozambique's INNOQ, under the Ministry of Trade and Industry, requested that USAID purchase a machine that can test for aflatoxin (NewAgen, VICOM), a flormetric USM machine, and a three-month supply of test strips and re-agent to improve testing capability for aflatoxin.	Infrastructure, science and technology (including ICT) Low priority	
#MOZ-3: Purchase several hundred copies of Mozambique's national standards related to aflatoxin (NM 73 of 2008, NM 77 of 2008, NM 4 of 2009, NM 284 of 210, NM 5 of 2013) at roughly $45 per set, and distribute them to farmers' organizations, cooperatives, warehouse operators, and millers throughout the country.	Human and institutional capacity building Low priority	

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#MOZ-4: Make use of private-sector oriented innovation challenge funds to: a) Help upgrade the amenities at the storage facilities associated with Mozambique's community trading markets b) Build several storage facilities in regions lacking adequate facilities c) Commission a study comparing aflatoxin levels in the new aflatoxin-reducing facilities with those in the older facilities, publish the results, hold a national workshop, translate the materials into English, and publish articles about the initiative in the other three target countries.	Global competitiveness Low priority	
#MOZ-5: Partner with INNOQ to assist with the costs of monitoring aflatoxin levels in Mozambique's food supply, with the results published by region. (combine with above)	Human and institutional capacity building, science and technology (including ICT) High priority	Link with #RL-10
#MOZ-6: Assist Mozambique's Ministry of Health to educate its "ambulant doctors"—who go house to house in rural areas to provide interaction onsite—to spread the word about the health risks of aflatoxin and strategies to reduce the negative impacts.	Human and institutional capacity building, market information systems Medium priority	Once package of mitigation methods are available
#MOZ-7: For INNOQ, provide logistical support for a series of awareness-raising seminars targeting businesspersons in the capital, Nampula, Tete, and Beira on the health risks associated with aflatoxin and measures to reduce those risks, including Aflasafe and good agricultural practices. Target the private sector.	Human and institutional capacity building, market information systems Medium priority	Once package of mitigation methods are available and awareness raising activities are commencing
#MOZ-8: Record a song about the dangers of aflatoxin for children and expectant mothers. Translate into Portuguese and several local languages in Mozambique. Give the song to the Ministry of Health, and ask them to appeal to community radio stations for free airtime.	Market information systems Medium priority	Once package of mitigation methods are available
#MOZ-9: Write a 15-minute theater play in Portuguese about the dangers of aflatoxin for humans (a tall child, a stunted child, a pregnant mother), and showing some of the post-harvest handling and storage practices capable of reducing aflatoxin in the fields and during harvesting. Translate into at least three other local languages in each country. Recruit a local theater troupe to perform the play in different venues throughout the country, including in schools and mothers' clinics.	Market information systems Medium priority	Once package of mitigation methods are available

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
MOZ-10: Create a one-minute video in Portuguese on the dangers of aflatoxin, what it can do to human health, and post-harvest handling and storage practices to reduce contamination. Ask the Ministry of Health to distribute it to national and local TV stations. Launch a social media campaign with the assistance of local stakeholders already active in social media communications for agriculture or health purposes. Ask viewers to record their addresses, collect, and analyze feedback.	Market information systems Medium priority	Once package of mitigation methods are available
#MOZ-11: Given advances in knowledge and technology since 2008, evaluate the present-day accuracy of Mozambique's Code of Good Practices for the Prevention and Reduction of Aflatoxin Contamination in Groundnuts (NM 77 of 2008). Evaluate the impact of the code on actual practices in the field and storage facilities, the number of copies sold, and the methods used to increase public knowledge about the subject. Work with local stakeholders to determine whether to update NM 77 and how to increase public knowledge about the good practices contained in the code.	Market information systems Medium priority	Once package of mitigation methods are available
#MOZ-12: Mozambique's INNOQ identified that Unulurio University has surplus capacity for aflatoxin testing and suggested an activity to help the university's laboratory to expand from solely teaching activities into conducting commercial aflatoxin testing. Evaluate the University's interest and capacity and lay out a joint plan. Upon completion of the necessary statutory steps and after securing the needed regulatory approvals, assist the University to educate potential customers about the lab's new capacity, for example through open houses, study groups, and communications outreach.	Human and institutional capacity building, Infrastructure Medium priority	Once package of mitigation methods are available and awareness raising activities are commencing
#MOZ-13: Assist Mozambique's National Bureau of Standards and INNOQ to reproduce flyers and disseminate information about aflatoxin on radio and TV.	Market information systems Low priority	Once package of mitigation methods are available
#MOZ-14: Develop a program targeting smallholder farmers' adoption of hermetic hermetic bags for maize storage. Target farmers' groups and cooperatives (e.g., AgResults Kenya Storage pilot) to promote the hermetic storage of maize. Note: Hermetic storage of maize significantly contributed to post-harvest control of aflatoxin. If current research shows hermetic storage of groundnuts effectively controls aflatoxin, include groundnuts in recommendation.	Science and technology (including ICT) High priority	Include in current bilateral programming

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#MOZ-15: UNIDO observed that Mozambique has a unique problem related to the annual calibration of its food safety equipment, requiring the presence of a Portuguese-speaking calibration expert. Currently, an expert comes from Portugal's accreditation institute. For this reason, fund a small design-and-implement activity to consider several options: i. Funding for on-the-spot translators to accompany the available calibration technicians in Southern Africa, who evidently only speak English. ii. Creating a regional clearing-house for technicians who can calibrate the equipment with the aim of finding one or more who speaks Portuguese. iii. Collaborate with INNOQ and the polytechnic universities to groom a small cadre of new graduates to work first as apprentices in the calibration process, and then to secure the needed professional qualifications to conduct the calibration themselves.	Human and institutional capacity building Medium priority	
#MOZ-16: Based upon a recommendation by officials at Mozambique's Ministry of Agriculture, organize a workshop in Nampula targeting mothers' groups, to sensitize these key nutrition-providing people about the dangers of aflatoxin, and why throwing away shriveled groundnuts can help their children's growth. The Ministries of Health and Agriculture and the INNOQ will lead the workshop.	Human and institutional capacity building, market information systems Medium priority	Once package of mitigation methods are available
#MOZ-17: In Mozambique, UNIDO observed that the European Commission had formerly funded a full-time expert for two years to work with all of the national laboratories, coordinating progress in each one, and strengthening the institutional structure for the laboratories throughout the country. Could USAID fund an expert under a Personal Services Contract (PSC), based at UNIDO in Maputo, to follow on from the European-funded activity?	Human and institutional capacity building Medium priority	As soon as funding is available, linked to coordination with other facilities in neighboring countries
Republic of South Africa		
#RSA-1: Replicate CIMMYT's Malawi field-testing procedures to detect MLN in South Africa.	Science and technology (including ICT) High priority	As soon as possible
#RSA-2: Conduct a political economy analysis (PEA) on the implications of the Republic of South Africa being a market open to GMO-containing foods, whether for production or consumption, in a region where Malawi, Mozambique, and Zambia all prohibit the planting or importation of foods containing GMOs. Discuss production-level, food processing, and marketing aspects such as labeling and overlapping regulatory competencies. Estimate the impact of potential trade bans by South Africa's trading partners on processed food products containing GMOs.	Low priority	

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#RSA-3: Based upon a suggestion made by a member of Grains SA concerned about the ongoing divide between the traditional commercial farmers and more-disadvantaged smallholders, support aflatoxin awareness among female maize and groundnut farmers of color in South Africa's Mpumalanga province.	Market information systems Medium priority	Once package of mitigation methods are available
#RSA-4: Pay for newspaper articles in South Africa's Business Report on MLN and aflatoxin. Accompany this with training seminars for journalists, including those in secondary school and at university. Conduct media interaction workshops with stakeholders in plant health and food safety to empower them to express their opinions.	Market information systems Medium priority	Once package of mitigation methods are available
#RSA-5: Promote the development of the Southern African Grain Laboratory into a regional reference laboratory for grains.	Science and technology (including ICT) Low priority	
Zambia		
#ZAM-1: For Zambia's National Centre for Food and Drug Testing, under the Ministry of Health, purchase 2 VICAM Series 4 EX chromometric machines for aflatoxin testing, as well as 4 ELISA Test Kits, and 4 Lateral Flow Test Kits and accompanying "consumables."	Science and technology (including ICT) Low priority	Bilateral donor (EC?)
#ZAM-2: Phase 1: Zambia's National Agricultural Research Institute (ZARI) recommended consultant assistance in reviewing the national food laws (see Box 3) in order to update them, reducing plant health and food safety risks including aflatoxin. Conduct listening sessions, then propose a new draft and white paper, work with departments to validate the findings and the draft, then hold a national validation workshop. Phase 2: Work with Zambia's SPS committee and other relevant stakeholders to implement and enforce the revised food laws. Encourage the Government of Zambia and private sector and civil society stakeholders to identify 'champions' at the national and sub-national level to drive a process for change with local ownership. Provide logistical and secretariat support for a three-year enforcement campaign, including field testing, workshops to spur process change, food processing surveillance, consumer product sampling (peanut butter or mealie-meal for different strains of aflatoxin), and the publication of results.	Policy High priority	Potentially SATH
#ZAM-3: Based upon a suggestion by officials at Zambia's Ministry of Health, analyze the challenges and opportunities presented by the existing recommendation that children, once weaned off mother's milk, should be fed groundnut porridge. Collaborate with the Ministry of Agriculture to devise guidance to accompany the Ministry of Health groundnut porridge to parents, including groundnut sorting prior to making porridge.	Human and institutional capacity building High priority	As soon as possible, bi lateral program

COMPREHENSIVE TABLE OF RECOMMENDATIONS (CONT)

RECOMMENDATIONS	AREAS AND PRIORITY	SUGGESTED TIMING
#ZAM-4: Contract with Radio Phoenix or other youth-oriented outlets to make community radio spots disseminating issues related to aflatoxin in groundnuts. Target the 17 stations in Lusaka alone, and then expand the program to other localities.	Market information systems Medium priority	Once package of mitigation methods are available
#ZAM-5: Summarize and evaluate ZARI's approach to expand low-cost, or no-cost, appropriate technology storage methods in rural areas. Merge with information about preventing increases in aflatoxin contamination, and the benefits of modern hermetic storage of maize, both in warehouses and through the adoption of hermetic PICS bags. Publicize the results.	Science and technology, global competitiveness Low priority	
#ZAM-6: Pay for newspaper articles to appear on MLN, aflatoxin, and fumonisin in the Zambia Daily Mail and Zambia Times. Accompany this with journalist training seminars to "get the story right." Encourage U.S. project officials and others to write letters to the editor in response to the newspaper articles.	Market information systems Medium priority	Once package of mitigation methods are available
#ZAM-7: Study the example of Zambia's successful multi-stakeholder approach to combating Tuta absoluta disease affecting tomatoes, in order to apply the same best practices for inter-ministerial cooperation in combating plant diseases affecting maize, groundnuts, and soya beans.	Market information systems Medium priority	Once package of mitigation methods are available

ANNEX V: RAPID SURVEY OF AWARENESS ABOUT AFLATOXIN AMONG FOOD PROCESSORS

One of the tasks for this assignment was to conduct a rapid survey of the level of awareness among major food processors in the capital city of each of the four countries under study. Our team experienced some difficulty eliciting more than a handful of responses in each country. The team attributed this difficulty to the brevity of the fieldwork period in each country, and businesspersons' reluctance to participate in research given the day-to-day demands on their time, especially without tangible and immediate benefits for their participation.

To rectify this not wholly unexpected aspect of the field research, our team chose to expand upon the definition of a 'food processor' to include those involved in processing food for retail-level consumers, such as managers and chefs of restaurants and at deli counters in supermarkets. Table 6 shows our findings:

SUMMARY OF RAPID SURVEY OF AWARENESS

Country	Level of Awareness	Types of Food Processors Surveyed
Malawi	Medium	Food manufacturers
Mozambique	Medium to high	Baby corn processor, restaurant owner, restaurant chef
South Africa	Low	Restaurant staff, supermarket staff
Zambia	Low	Peanut butter processor, hotel manager, food preparers at hotel restaurant, food supplement manufacturer, restaurant manager

The level of awareness among the respondents varied considerably, ranging from very high awareness on the part of one Mozambican businessperson with a food science background, to a general lack of knowledge among restaurant workers in Zambia. Annex Four contains the list of the respondents to the rapid survey of food processors, while the box below offers some of the most interesting observations from the respondents.

SOME HIGHLIGHTS FROM THE RAPID SURVEY OF AWARENESS ABOUT AFLATOXIN AMONG FOOD PROCESSORS

Malawi

Staff at Valid Nutrition were highly aware of aflatoxin since their main buyer, the U.N., thoroughly tests for it.

Mozambique

Senhor Nunu, owner of a chain of Taverna restaurants in Maputo was aware and concerned about the quality of the food products he serves.

Doctor Jaime Muvala, owner of a baby corn growing and packaging company in Nampula == Very high awareness of aflatoxin and MLN.

Republic of South Africa

Aji Koffakkudigil, an employee at 1855 Restaurant in the Lynnwood Mall, Pretoria=Definitely aware of the presence of aflatoxin in some foods. Koffakkudigil has a secondary school education. He read about aflatoxin on the Internet and sought out additional articles.

Zambia

Paul Wagner, manager of Southern Sun Hotel, Lusaka. Wagner is a major restaurateur in Lusaka. Socially aware and eager to be seen as "green" and known for buying local. Wagner was not aware of aflatoxin, but will now instruct his upper-level management to request aflatoxin testing for the groundnuts served to guests at his hotel.

Gerard, a taxi man in Lusaka and the owner of a nutritional supplements mixing and retail business. Gerard was not aware of the dangers of aflatoxin, but showed great interest in increased greater public awareness that could boost his sales of Vitamin A, which mitigates the effects of aflatoxin.

ANNEX VI: GENERAL PUBLIC INTERVIEWED FOR SURVEY OF AWARENESS OF AFLATOXIN

Question: Have you ever heard of the plant disease aflatoxin in groundnuts and maize, considered to contribute to stunting and liver cancer?

Malawi

Taxi driver, Lilongwe, Malawi (has farm up-country)==**NO**

David, taxi driver, Lilongwe, Malawi==**NO**

Mozambique

Ministry of Trade and Industry==**NO**

Simba, fitness center employee at Hotel Avenida, Maputo, Mozambique==**NO**

Raquel Macinho, chamber maid at Hotel Avenida, Maputo, Mozambique==**NO**

Joâo, restaurant manager at Hotel Avenida, Maputo, Mozambique==**NO**

Inês Elciria Joâo Zunguze, VodaCom telecoms office employee, Maputo, Mozambique==**NO**

Alice, VodaCom telecoms office employee, Maputo, Mozambique==**NO**

Mercia Tembe, VodaCom telecoms office employee, Maputo, Mozambique==**NO**

Saquina Dos Santos, employee at National Museum of Natural History, Mozambique==**YES**

Euclides da Conceiçao, employee at National Museum of Natural History, Mozambique==**YES**

Senhor Nunu, owner of chain of Taverna restaurants, Maputo, Mozambique==**NO**

Carmen Almeida, employee at front desk of Hotel Avenida==**NO**

Dino, booking manager, Qatar Airways, Maputo, Mozambique==**NO**

Vasco, employee at fitness center, Hotel Avenida, Maputo, Mozambique==**NO**

Candide, head chef at Taverna restaurant (Italian one) in Maputo, Mozambique==**NO**

Darcy, waiter at Taverna restaurant (Italian one) in Maputo, Mozambique==**NO**

South Africa

Russell, manager of Mug & Bean, Johannesburg airport, South Africa==**NO**

Aphonia, employee at City Lodge, Pretoria, South Africa==**NO**

Monica, employee at City Lodge, Pretoria, South Africa==**NO**

Daniel, hotel manager at City Lodge, Pretoria, South Africa==**NO**

France Mahlangu, agronomist and taxi driver, Pretoria, South Africa==**NO**

Brenda, receptionist at Protein Research Foundation, Johannesburg, South Africa==**NO**

Johannes, taxi driver, Pretoria, South Africa==**NO**

Coenie, telecom shop employee, Pretoria, South Africa==**NO**

Mpho, Woolworth's supermarket employee, Pretoria, South Africa==**NO**

Michael, security guard, Lynnwood mall, Pretoria, South Africa==**NO**

Thabo, computer programmer, fellow passenger on Gautrain between Johannesburg and Pretoria==**NO**

A.J. Barnard, biotech engineer, Johannesburg, South Africa==**NO**

Five restaurant employees at The Diner, Johannesburg airport, South Africa==**NO**

Zambia

Immigration officer (name unknown), Lusaka airport, Zambia==**NO**

Foreign exchange office employee (name unknown), Lusaka airport, Zambia==**NO**

Albert, police officer, taxi driver when off-duty, Lusaka, Zambia==**NO**

Paul Wagner, Manager of Southern Sun Hotel, Lusaka, Zambia==**NO** (but the hotel does periodically send out the locally produced food it buys for testing)

Georges, patron at Southern Sun Hotel, Lusaka, Zambia==**NO**

John, pool guy at Southern Sun Hotel, Lusaka, Zambia==**NO**

Dean Sic, businessman with Locress Motors, former groundnut farmer==**NO**

Ivor Mulumba, Stewards Globe Ltd, also a maize and groundnut seed retailer==**NO**

Hellen Njovu, restaurant worker at Southern Sun Hotel, Lusaka, Zambia==**NO**

Wendy Wasamunu, unemployed hotel management graduate==**NO**

Peter, band leader at Southern Sun Hotel, Lusaka, Zambia==**NO**

Gerard, taxi driver, son of a female groundnut grower, Lusaka, Zambia==**NO** (he was quite interested, because he has a business formulating and selling vitamin supplements—told him he could do well selling vitamin A to combat aflatoxin)

Tsitsibe, restaurant manager at The Lodge at Sunset Villas, in Mkeli suburb of Lusaka, Zambia==**NO**

Rebecca, business center employee, Southern Sun Hotel, Lusaka, Zambia==**NO**

Luckness, restaurant employee at Southern Sun Hotel, Lusaka, Zambia==**NO**

Belia Daka, restaurant employee at Southern Sun Hotel, Lusaka, Zambia==**NO** (she said she has noticed and wondered about the high percentage of very-short people in Eastern Province, and also that people in the city are typically much taller)

Christine, restaurant employee at Southern Sun Hotel, Lusaka, Zambia==**NO**

Emmanuel, chef at Southern Sun Hotel, Lusaka, Zambia==**YES** (not sure he really understood the question, though)

Kaela, restaurant employee at Southern Sun Hotel, Lusaka, Zambia==**NO**

Elizabeth, restaurant employee at Southern Sun Hotel, Lusaka, Zambia==**NO**

Angela, restaurant employee at Southern Sun Hotel, Lusaka, Zambia==**NO**

Betty, restaurant employee at Southern Sun Hotel, Lusaka, Zambia==**NO**

Mulindi, public economics researcher, Lusaka, Zambia=**NO**

ANNEX VII: SCOPE OF WORK

Identifying Investment Opportunities within the Maize, Soya and Ground Nuts Value Chains in Southern Africa

SCOPE OF WORK

BACKGROUND

The goal of the Leveraging Economic Opportunities (LEO) project is to deepen and widen the capacity of USAID staff and its development partners to use evidence-based good practices to design new projects and activities that promote inclusive market development, effectively manage their implementation, and evaluate their results. LEO pursues the following objectives:

1. Advancing knowledge and evidence on frontier issues
2. Improving the quality of project and activity designs based on evidence
3. Improving project implementation
4. Improving methodologies for evaluating systemic change

LEO also includes two cross-cutting objectives:

- Advancing knowledge and practice on innovative approaches to integrating collaboration, learning, and adaptation (CLA)
- Building the capacity of USAID staff and development partners to apply evidence-based good practices in project/activity design, implementation, and evaluation

GOAL

USAID is requesting the services of LEO to identify key constraints to trade (focusing on SPS measures) within the maize, soya, and groundnut value chains in Southern Africa and to gauge opportunities for potential SPS related investments along the chain. This will be an analysis focusing on SPS needs and issues within the value chain, bringing together a wealth of knowledge about the targeted value chains by inventorying key SPS constraints that prohibit VC development and by prioritizing solutions to address identified SPS/VC constraints.

OBJECTIVES

1) Assess SPS impacts on trade

- Map current trade flows in and out of Malawi, Zambia, Mozambique, and South Africa for maize, maize seed, groundnuts, and soya beans (based on up to the last 5 years numbers). Based on data collected in country and data available about neighboring countries, predict the impact to imports and exports if SPS issues around aflatoxin and MLN were enforced at borders.

- Conduct a rapid survey at the main food processing points in the capitals of each country to establish the awareness and concern firms have on aflatoxin.

2) Assess SPS systems within the targeted VCs

- Assess the SPS systems in place in the region, including SADC standards and how they are applied, availability and capacity of laboratories, and the use of SPS and other grades and standards in contracting across the focus FTF value chains. This will include assessing country capacity to carry out SPS inspections prior to export of commodity, as well as whether the costs charged are sufficient to cover the costs incurred including depreciation on the equipment.
- Map the institutional profile of the value chains (public, private, and community-based) to determine who the key actors are and what are their strengths and weaknesses.
- MLN is an emerging SPS issue, so far the main areas experiencing the disease are in Kenya and Uganda, however there are notifications of it being in Ethiopia, Rwanda, and Tanzania—therefore moving closer to southern Africa. The first area of concern is the movement of maize seed. Therefore, it is important to understand what precautions East Africa has put in place to ensure maize seed has not been exposed to MLN and how these regulations could be applied in the SADC region. Additionally, the assessment will establish how aware relevant officials are of MLN and what additional precautions are in place.

3) Use existing assessments, analysis, and studies as basis for work

- Coordinate with Missions on the identification of existing assessments, analyses, and studies.
- Identify constraints along the value chain that impact regional trade of maize, soya, and groundnuts in Southern Africa. This will include looking at sub-Saharan African and global markets' impacts on these value chains.
- Assess and identify gaps in country and regional capacities to prevent/mitigate introduction of aflatoxin and other emerging threats, e.g., maize lethal necrosis (MLN), Larger Grain Borer (LGB), that are causing damage and limiting trade in sub-Saharan Africa and will sooner or later impact Southern Africa. What are the laboratories' capacities to test for aflatoxin and other toxins affecting food safety? USDA is doing some country level analysis. Is this analysis providing a comprehensive status of gaps and constraints to establishing internationally accepted food safety practices/systems? Is there a need to expand this analysis to other countries in the region? What is needed to gain a comprehensive understanding of the gaps and constraints to establishing internationally accepted regional food safety practices/systems?
- Assess regional and national level detection and border inspection capacities and mitigation measures, and identify the gaps and constraints to help inform prioritization of potential investment opportunities.
- Assess the relative importance of SPS issues in constraining trade flows of these commodities in the region.
- Reflect and link to Trade Africa expansion work underway in Zambia and Mozambique.

4) Identify investment opportunities

- Map current initiatives relevant to addressing barriers to investment identified under Objective 1, and identify priorities among issue areas.
- Analyze SPS constraints to the development of the sector and then look at possible solutions with the understanding there are other investment efforts through other partners. As much as possible map other partners' investments to the SPS constraints identified.

- Utilizing the VC gaps/constraints identified under Objective 1, identify and prioritize the options and opportunities (at both the regional and country level) relative to potential increases in investment (private and public) flows. Prioritized opportunities should be realistic, time sensitive, and take into account the relative impact on SPS barriers and the return on investment. Proposed investments to alleviate the identified constraints could fall in several categories such as:
  - Policy
  - Infrastructure and other assets
  - Human and institutional capacity building
  - Financial services
  - Market information systems
  - Science and technology (including ICT)
  - Conflict
  - Market Governance
  - Global Competitiveness

5) Assess Trade Impacts (time and resource permitting)

- Assess impacts of increased trade following (a) removal of SPS barriers, (b) improved detection and border inspection capacities, and (c) accelerated investment in the focus value chains and the subsequent affect and/or influence on employment of men, women, and youth.

TEAM COMPOSITION

The consulting team will consist of four Senior Technical Experts (including a Team Leader) and four regional experts to inventory constraints and potential investments within the maize, soya, and groundnut value chains in Southern Africa. This will include:

4 Senior Technical Experts (Trade and/or SPS): These individuals will conduct the analysis drawing on existing research and discussions with USAID missions (Malawi, Mozambique, Zambia, Southern Africa Regional) and other key stakeholders to determine constraints and opportunities in the targeted value chains. They will have experience working in the region, expertise on SPS issues and investment dynamics, and will have expertise in the field of Market Systems Development. They will be well versed in value chain analysis best practices. The team member/s working in Mozambique will be fluent Portuguese speakers. Experts should include plant pathologists as well as experts in food safety policy, regional trade policy, and WTO agreements.

The **Team Lead** will be selected from the technical experts. Beyond the responsibilities involved in carrying out the study, he/she will also be responsible for serving as the main point of contact to USAID, and drafting the report.

4 National Experts (Trade and/or SPS): We will identify target value chain commodity experts to support and conduct field research. These individuals will be familiar with the regional environment and will be able to guide and provide support to the senior technical experts. They will have experience in relevant technical value chains and will be knowledgeable of sector stakeholders. They will be familiar with research methodologies. They will gather any necessary information during the desk research phase, and will be able to carry out follow up in their field once the senior technical experts have departed from Southern Africa.

Each Senior Expert will be teamed with a National Expert to conduct field research in one of the designated four countries.

Technical Support—the team will receive support from ACDI/VOCA headquarters staff, who will be responsible for providing oversight and support to the team to ensure they are being responsive to USAID requirements and have all the tools they need to produce the report in a timely manner.

Administrative support—the team will receive administrative support from ACDI/VOCA headquarters as well as ACDI/VOCA field offices located in Maputo and Lusaka. Depending on the technical experts selected for the assignment, there may also be a need to hire translators.

SPECIFIC TASKS

The specific tasks of the assignment will be threefold: desk research, analysis, and report writing.

1. Information gathering

The technical experts will capture information through a two-pronged approach:

1. Desk research: The ACDI/VOCA team will identify relevant documents in consultation with USAID missions (Malawi, Mozambique, Zambia, and Southern Africa Regional) and Washington staff, including, but not limited to, assessments, reports, Feed The Future and other USAID bilateral and regional analyses including the Trade and Investment Hubs, as well as analysis produced by host country governments, academics, multi-lateral and bilateral donors, etc. While many of these will be available online and through the Development Clearinghouse, ACDI/VOCA will depend on expert identification of relevant studies/work and USAID will provide any additional documents that will contribute to the study.
2. Phone interviews: To build upon, clarify, and better inform the information gathered through the desk research, the team will follow up with one-on-one and small group interviews with persons along the VC (producers groups, processors, food sales/marketing, etc.), regional government officials/inspectors, USAID staff, implementing partner staff, and other key stakeholders (such as universities).

Based on the desk research and calls with USAID Mission staff, government, Regional Economic Community, and regional experts, the technical experts will provide a bibliography of the relevant documents identified and draft a comprehensive annotated outline of the final report for USAID's input and approval. This will clearly lay out the gaps in what has been learned, and enable the team to submit a detailed work plan for the field research.

2. Field Work

The field work will commence with a two-day introductory workshop to be held in Pretoria, South Africa, where the entire consulting team will meet to discuss the assessment approach, field research protocols, as well as have an in-brief meeting with the USAID Southern Africa regional mission and Trade and Investment Hub. The consultants will then split into teams to cover the four target countries—Malawi, Mozambique, Zambia, and South Africa—to validate findings and to gather more in-depth information through meetings with government representatives, private sector value chain actors, and other key value chain stakeholders.

3. Report

ACDI/VOCA will be responsible for submitting a final report that includes its major findings, suggested priorities for targeted assistance and engagement on policy, conclusions, and next steps. The report will include prioritized recommendations for investments that can be made at the regional and national levels. The report will be finalized based on feedback from USAID.

- The report should be accompanied by several 2 to 4 page briefers on the different topics so that key policy and organizational leaders and stakeholders who may not have time to read the entire report

will be able to take in the key findings and recommendations.
- There should be specific and actionable priorities to address along each VC.
- All reports and briefers will be done in Portuguese and English.

DELIVERABLES AND TIMING

The Identifying Investment Opportunities within the Maize, Soya, and Groundnuts Value Chains in Southern Africa analysis will begin on or around June 6. The final dates will be confirmed after consultation with USAID and team members.

Dates	Activities
Weeks 1-2: June 6–17	Desk research
	Draft outline of report
	Preparation for field work
	Travel to Pretoria, South Africa
Weeks 3-5: June 20–July 8	In-brief with the Southern Africa Regional Mission and bilateral missions
	Field research in Malawi, Mozambique, and/or Zambia
	Informal outbrief with bilateral missions
	Return travel to Pretoria
Week 6: July 11–15	Support preparation for Formal Outbrief
	Outbrief and presentation of findings to USAID Southern Africa Regional Mission
Weeks 7-8: July 18–29	Contribute to report writing for submission to ACDI/VOCA Integrate comments from ACDI/VOCA Submit complete draft to USAID
Weeks 9-10: Aug 1–12	Comments back from USAID
Week 11: Aug 15–19	Comments integrated and document finalized
Week 12: Aug 22–26	Final USAID Review
Week 13 & 14 Aug 29–Sep 9	Participate in two webinars to elicit feedback (English and Portuguese)

TERM AND SUPERVISION

The term for this assignment is June 6–September 9, 2016. The supervisor for this assignment will be the assigned Team Leader, Daniel Plunkett, ddjplunkett@gmail.com. The ACDI/VOCA headquarters technical backstop will be Hayden Aaronson - haaronson@acdivoca.org and the administrative backstop will be William Vu – wvu@acdivoca.org.

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