ZAMBIA EARLY GENERATION SEED STUDY

COUNTRY REPORT

June 2016

This publication was produced by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development

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Program Title:	**Early Generation Seed Systems Study, Feed the Future: Building Capacity for African Agricultural Transformation (Africa Lead II)**
Sponsoring USAID Office:	**USAID Bureau of Food Security**
Award Number:	**DAI Prime Cooperative Agreement No. AID-OAA-A-13-00085 for the US Agency for International Development, Feed the Future: Building Capacity for African Agricultural Transformation (Africa LEAD II) Program**
Subcontract:	**DAI subcontract No. ALB-2015-001 with Context Network**
Date of Publication:	**June 2016**
Author:	**Context Network**

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FOREWORD

The United States Agency for International Development (USAID) Bureau for Food Security (BFS) Early Generation Seeds (EGS) program, acting through Development Alternatives, Inc.'s (DAI) Africa Lead II project, will facilitate existing USAID Mission, BFS, and Bill & Melinda Gates Foundation (BMGF) partnerships to make significant seed system changes to break the bottlenecks on breeder and foundation seed, primarily in Africa. Many bottlenecks continue to hinder projects aiming to reach the great majority of small holder farmers in Sub-Saharan Africa, including the unsustainable supply of EGS. These include poorly functioning national variety release systems; policies, regulations, and misplaced subsidies that limit access to publicly developed improved varieties by private seed companies; and the continuing presence of obsolete varieties, as well as counterfeit seeds, in seed markets.

The overall EGS effort, which began in 2014 and will continue through 2017, is carried out in a complex, dynamic environment involving the USAID and BMGF partnership, several international and bilateral donors, as many as 12 African governments, several African regional organizations, and a plethora of public and private stakeholders. Over the past two years, the USAID and BMGF partnership has explored, with a large number of noted US, African, and international technical experts, how to address constraints in EGS systems. This exploration led to the Partnership's development of a methodology to analyze seed value chains, and to do this by specific market, crop, and economic dimensions. Applying this methodology leads to identifying actors and actions along the seed value chain that are required in order to produce an adequate supply of EGS on a sustainable basis. The methodology was vetted by technical experts from African regional organizations, research and technical agencies, and development partners.

USAID asked DAI through its Africa Lead Cooperative Agreement II to take this analytical methodology to the country level in selected Feed the Future countries, particularly in ways to change seed systems as they affect smallholders in the informal agriculture sectors. The lack of readily available and reasonably priced quality seed is the number one cause of poor agricultural productivity across much of the continent, particularly among smallholders. Africa Lead II selected and contracted with Context Network to execute EGS studies in Rwanda, Zambia, Kenya, and Nigeria as well as to lead a one-day EGS technical training on how to implement the study methodology with researchers from 11 countries in Addis Ababa, Ethiopia, on February 27, 2016.

With Africa Lead's guidance, the Context Network's work, both the technical training and the four country studies, requires careful consideration of appropriate private, public, donor, NGO, and informal sector roles in seed distribution to end users. In each country situation, the Context Network is identifying an inclusive set of stakeholders who stretch beyond a short "seed only" value chain (i.e., from breeder to foundation seed producers to producers of certified and Quality Declared seed) to end users, e.g., farmers in both the formal and informal agriculture sectors. Each study recognizes that needs and utilization will be shaped by gender differentiated roles in both crop production and trade (both formal and cross border). The Context Network country studies aim to better understand farmer requirements, i.e., demand, independent of the policy and technical parameters affecting EGS supplies.

The resulting EGS country studies are expected to have two additional medium-term impacts beyond the life of the Africa Lead contract with the Context Network. First, the studies will create incentives for greater government and private investment in the respective seed sectors, laying the basis for increased scale-up and adoption of more productive technologies. Second, and with some short-term increase in supply and quality of EGS, a number of policy or investment constraints will come into focus, coalescing stakeholders around the downstream changes required to address those constraints on seed quality and supply.

ACKNOWLEDGMENTS

This report was developed by a team at the Context Network led by Mark Nelson, a principal at the Context Network. Field research activities were conducted by Dave Westphal, Catherine Mungoma, and Watson Mwale.

The team is grateful for the support of DAI including David Tardif-Douglin, Charles Johnson, and Sonja Lichtenstein as well as guidance from BFS Senior Food Policy Advisors David Atwood and Mark Huisenga, and USAID Zambia's Harry Ngoma, Anna Toness, and Brian Martalus.

The team would also like to thank all key stakeholders in Zambia who participated in interviews for this study. Through the course of the study, a number of challenges have been identified. The report research team recognizes the government of Zambia is committed to improving EGS systems and addressing many of these recommendations. In interviews with government officials, the team repeatedly heard of the government's desire and focus to address many of these issues and recommendations, and thus the team looks forward to the Zambian government's continued efforts.

ACRONYMS

Abbreviation	Definition
BFS	Bureau for Food Security (USAID)
BLA	Better Life Alliance
BMGF	Bill and Melinda Gates Foundation
CAADP	Comprehensive Africa Agriculture Development Program
CGIAR	Consultative Group for International Agricultural Research
COMACO	Community Markets for Conservation
COMESA	Common Market for Eastern and Southern Africa
DAI	Development Alternatives, Inc.
DUS	Distinctness, Uniformity, and Stability
EAC	East African Community
EGS	Early Generation Seed
EGS-PPP	Early Generation Seed Public-Private Partnership
FAO	Food and Agriculture Organization of the United Nations
FISP	Farmer Input Support Program
FRA	Food Reserve Agency
GDP	Gross Domestic Product
GRZ	Government of the Republic of Zambia
MAL	Ministry of Agriculture and Livestock
MFI	Micro-Finance Institution
NAIP	National Agricultural Investment Plan
NAP	National Agricultural Policy
NGO	Non-Governmental Organization
OPV	Open Pollinated Variety
QDS	Quality Declared Seed
SADC	Southern Africa Development Community
SCCI	Seed Control and Certification Institute
USAID	United States Agency for International Development
VCU	Value for Cultivation and Use
WDI	World Development Indicators
ZARI	Zambia Agriculture Research Institute

TERMINOLOGY

Breeder seed: Breeder seed is produced by or under the direction of the plant breeder who selected the variety. During breeder seed production the breeder or an official representative of the breeder selects individual plants to harvest based on the phenotype of the plants. Breeder seed is produced under the highest level of genetic control to ensure the seed is genetically pure and accurately represents the variety characteristics identified by the breeder during variety selection.

Pre-basic seed: Pre-basic seed is a step of seed multiplication between breeder and foundation or basic seed that is used to produce sufficient quantities of seed for foundation or basic seed production. It is the responsibility of the breeder to produce pre-basic seed and production should occur under very high levels of genetic control.

Foundation or basic seed: Foundation seed is the descendent of breeder or pre-basic seed and is produced under conditions that ensure maintaining genetic purity and identity. When foundation seed is produced by an individual or organization other than the plant breeder there must be a detailed and accurate description of the variety the foundation seed producer can use as a guide for eliminating impurities (“off types”) during production. Foundation and basic seed are different words for the same class of seed. Basic seed is the term used in Zambia.

Certified seed: Certified seed is the descendent of breeder, pre-basic, or basic seed produced under conditions that ensure maintaining genetic purity and the identification of the variety and that meet certain minimum standards for purity defined by law and certified by the designated seed certification agency.

Quality Declared seed: In 1993 the Food and Agriculture Organization of the United Nations (FAO) produced and published specific crop guidelines as Plant Production and Protection Paper No. 117 Quality Declared seed – Technical guidelines on standards and procedures. The Quality Declared Seed (QDS) system is a seed-producer implemented system for production of seed that meets at least a minimum standard of quality but does not entail a formal inspection by the official seed certification system. The intent behind the QDS system is to provide farmers with the assurance of seed quality while reducing the burden on government agencies responsible for seed certification. The QDS system is considered by FAO to be part of the informal seed system.

Quality seed: In this report the phrase quality seed is at times used in place of certified seed or QDS to describe a quality-assured seed source without specifying certified or QDS.

Commercial seed: Any class of seed acquired through purchase and used to plant farmer fields.

Improved versus landrace or local varieties: Improved varieties are the product of formal breeding programs that have gone through testing and a formal release process. A landrace is a local variety of a domesticated plant species which has developed over time largely through adaptation to the natural and cultural environment in which it is found. It differs from an

improved variety which has been selectively bred to conform to a particular standard of characteristics.

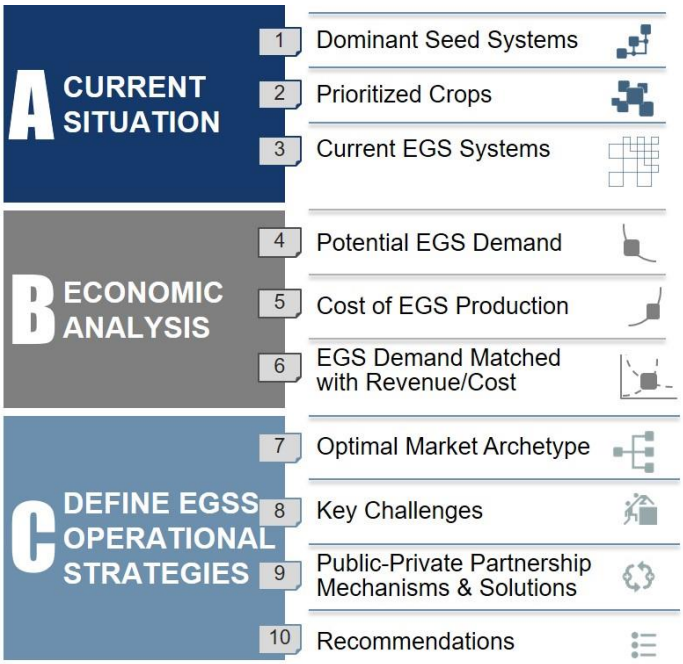
Formal seed system: The formal seed system is a deliberately constructed system that involves a chain of activities leading to genetically improved products: certified seed of verified varieties. The chain starts with plant breeding or a variety development program that includes a formal release and maintenance system. Guiding principles in the formal system are to maintain varietal identity and purity and to produce seed of optimal physical, physiological and sanitary quality. Certified seed marketing and distribution take place through a limited number of officially recognized seed outlets, usually for sale. The central premise of the formal system is that there is a clear distinction between "seed" and "grain." This distinction is less clear in the informal system.

Informal seed system: The informal system also referred to as a local seed system, is based on farmer saved seed or QDS. In Zambia there is limited use of QDS and the informal seed system is dominated by farmer saved seed where farmers themselves produce, disseminate, and access seed directly from their own harvest that otherwise would be sold as grain; through exchange and barter among friends, neighbors, and relatives; and sale in rural grain markets. Varieties in the informal system may be variants of improved varieties originally sourced from the formal system or they may be landrace varieties developed over time through farmer selection. There is no emphasis on variety identity, genetic purity, or quality seed. The same general steps or processes take place in the local system as in the formal sector (variety choice, variety testing, introduction, seed multiplication, selection, dissemination and storage) but they take place as integral parts of farmers' production systems rather than as discrete activities. While some farmers treat "seed" as special, there is not necessarily a distinction between "seed" and "grain." The steps do not flow in a linear sequence and are not monitored or controlled by government policies and regulations. Rather, they are guided by local technical knowledge and standards and by local social structures and norms.

METHODOLOGY

Building on previous studies and consultations with governments, private sector organizations, and partners, the USAID and BMGF partnership developed, tested, and widely vetted a methodology to identify country-specific and crop-specific options to overcome constraints in EGS supply (Monitor-Deloitte EGS Study sponsored by USAID and BMGF in 2015). As illustrated in Figure 1, this methodology includes ten-steps to define EGS systems, perform economic analysis, and develop EGS operational strategies.

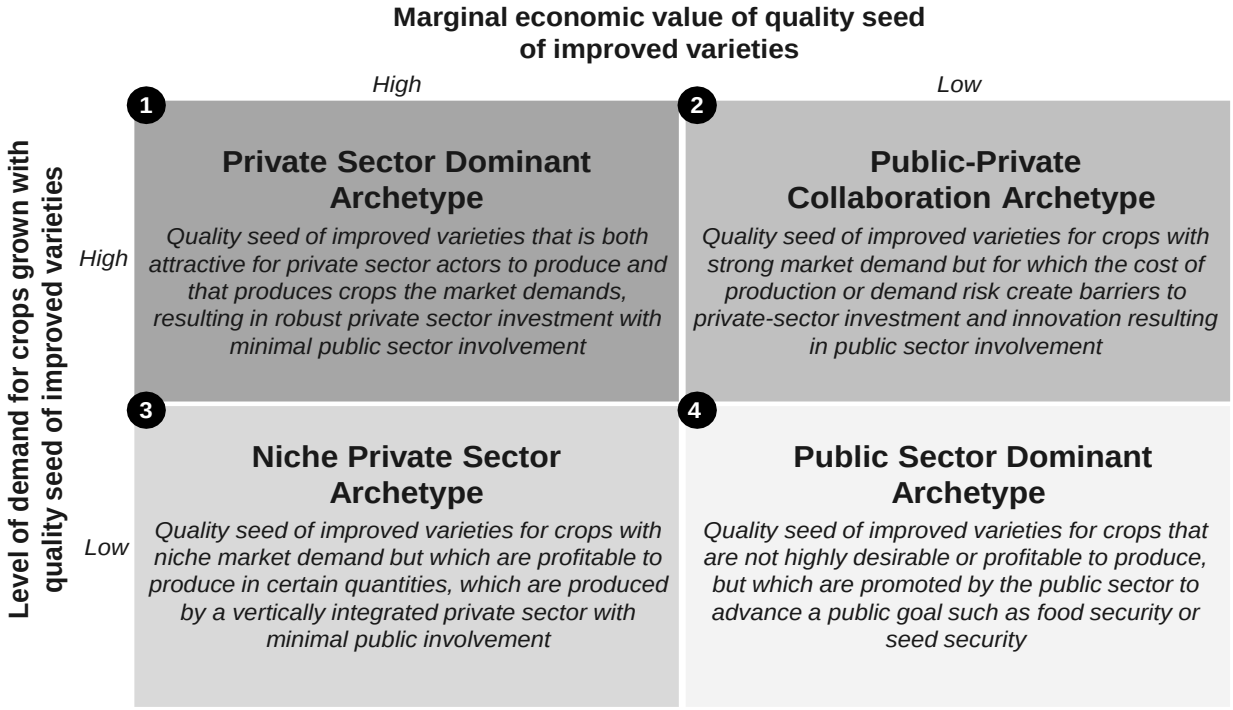
Figure 1: **EGS system ten-step process.**



Source: Ten steps based on process developed by Monitor Deloitte for EGS study prepared for USAID and BMGF (2015).

The first six steps of this ten-step process were used to analyze specific crops within Zambia in order to inform step seven, development of the optimal market archetype. The study commissioned by the USAID and BMFG partnership utilized a common economic framework to define public and private goods and applied it to EGS systems, as shown in Figure 2. Once the optimal market archetype for each crop was developed, steps eight through ten identified the key challenges to achieving the optimal market archetype, possible public-private partnership mechanisms and solutions, and final recommendations.

Figure 2: **Market archetype framework.**



Source: Framework developed by Monitor-Deloitte EGS Study sponsored by USAID and BMGF (2015).

This framework categorizes EGS systems of crops and crop segments within a specific country, based on marginal economic value of the quality of improved varieties and the level of demand for crops grown with quality seed of improved varieties. Several variables, as represented in Table 1, inform these two factors.

Table 1: **Variables that inform market archetype framework.**

Key Variable	Description	Examples
MARGINAL ECONOMIC VALUE OF IMPROVED VARIETIES		
Differential performance of improved varieties	Level with which improved varieties in the market have differential performance versus local varieties	Yield, quality, traits such as disease and drought tolerance
Frequency of seed replacement	Frequency with which quality seed must be bought to maintain performance and vigor of an improved variety	Yield degeneration, disease pressure, pipeline of new varieties being commercialized regularly
Differentiating characteristics	Existence of differentiating characteristics that command a price premium for improved varieties	Price premiums for processing, nutritional characteristics
Fragility of seed	Ability of seed to withstand storage and/or transport without significant performance loss	Hardiness/fragility of seed
Cost of quality seed production	Cost of producing quality seed	Multiplication rates, input costs, labor requirements, mechanization, macro and micro propagation technology
MARKET DEMAND FOR QUALITY SEED OF IMPROVED VARIETIES		
Total demand for seed	How much seed is required to meet the planting needs of a given crop	Area
Requirement for quality assurance	Requirement for quality assurance to realize variety benefits	Certification, Quality Declared, farm-saved seed
Farmer demand for specific varieties	Level of farmer demand for specific varieties	Mainly driven by agronomic performance
Market demand for specific varieties	Level of downstream demand for specific characteristics	Color, cooking quality, processing quality

Source: Based on variables developed by Monitor-Deloitte EGS Study sponsored by USAID and BMGF (2015).

STAKEHOLDER CONSULTATION

The selected crops for in-depth EGS system analysis were identified during a consultative process with BFS, USAID Zambia, and key seed system stakeholders in Zambia. Prior to launching field research activities, the research team facilitated a crop selection meeting in Zambia with 15 stakeholders from the public, private, NGO, and donor sectors. In advance of the meeting, the field research team developed a matrix of key indicators crossed with ratings definitions as the basis for discussions. These indicators created a framework to select crops that would have the largest impact on smallholder farmers and specifically women. To ensure that the EGS study encompassed both the formal and informal seed systems, the field research team interviewed more than thirty stakeholders from the public and private sectors, NGOs, associations and donors (see Annex C).

PRIORITY CROPS

Within Zambia, two crops were selected for analysis: groundnut and common bean.

EXECUTIVE SUMMARY

SEED SYSTEMS IN ZAMBIA

There are five identified seed systems predominant in Zambia, which include 1) farmer-saved, 2) NGOs and cooperatives, 3) Public-Private, supported by ZARI and local seed companies, 4) Private, supported by international seed companies, and 5) Private, supported by out-grower schemes for export commodities. In the informal farmer-saved system, farmers themselves multiply and exchange seed locally, both through barter and sometimes for cash. This system has no quality assurance measures for the landraces that are multiplied. In the second system, NGOs are assisting community groups or farmer cooperatives in seed multiplication and marketing. Smallholder farmers in Zambia who grow crops other than maize are nearly always acquiring seed through these two systems.

The country's agricultural focus on maize and other crops for export is similarly reflected in the three formal seed systems. The privately owned local seed companies focus on seed production and marketing, often of varieties and basic seed bred from the Consultative Group for International Agricultural Research (CGIAR) research institutions. International seed companies operating in Zambia are active in breeding (within and outside of Zambia), seed production, multiplication, processing, and distribution of hybrid maize and other high-value cash crops. The export commodities-driven seed system revolves around outgrower schemes for export crops such as cotton, tobacco, and sugar cane.

Adoption of improved varieties is low across Zambia for all crops but maize. The overwhelming majority of varieties released in the country have been maize, and as such, the formal channel has been better established in maize than other crops to release improved varieties. Agro-dealers mainly focus on supplying maize seed, and there are limited government and NGO programs to distribute groundnut and common bean seeds.

GROUNDNUT AND COMMON BEAN EGS SYSTEMS

The groundnut and common bean EGS seed systems are quite similar in terms of links in the formal and informal systems, key actors, supply bottlenecks, and demand constraints. It is estimated that only 4% of the groundnut planted area is supported by the formal seed system, and only 3% for common bean.

Within the informal seed system, experts estimate 10% of the total planted area for both groundnut and common bean are under a Quality Declared Seed (QDS) system, with the balance being a combination of farmer-saved seed, farmer to farmer exchanges, and trader to farmer transactions. Interviews with key stakeholders across the seed value chain, including cooperatives, farmer groups, agro-dealers, traders, and processors, almost unanimously suggest that demand far exceeds supply, and that lack of EGS supply is the critical issue keeping farmers to informal markets.

EGS SYSTEM BOTTLENECKS/CONSTRAINTS

There are numerous EGS supply bottlenecks as well as demand constraints identified in the groundnut and common bean seed system value chain. These include:

Supply bottlenecks

- Under-capacity of breeder seed production.
- Lack of private sector involvement in basic and commercial seed production.
- Resource-intensive and expensive seed certification system.
- Absence of an EGS market information system for demand.
- The Seed Control and Certification Institute (SCCI) has limited capacity to enforce the QDS system.

Demand constraints

- Smallholders lack awareness of improved varieties' benefits.
- Lack of crop grades and standards.
- Limited awareness of the business case to invest in improved varieties.
- Lack of credit at the seed producer and smallholder farmer levels.
- Lack of varietal improvement.

GROUNDNUT AND COMMON BEAN PUBLIC PRIVATE PARTNERSHIP

The most significant challenges confronting EGS groundnut and common bean in Zambia are lack of EGS supply due to an under-resourced public sector and limited interest from the private sector because of farmers' current practice of saving seed, which reduces annual purchases, thus lowering demand and limiting profitability. Furthermore, the Government of the Republic of Zambia's (GRZ) priority on maize production and hybrid maize seed production has shifted both public and private sector focus away from food security crops such as groundnut and common bean. This has disproportionately affected smallholder farmers in Northern and Eastern provinces where groundnut and common bean are key crops.

The similarities in groundnut and common bean present an ideal opportunity to develop an EGS public-private partnership (EGS-PPP) that encompasses both crops. The EGS-PPP would be formed by utilizing public and private actors, NGOs, and associations operating within the current legal framework and leveraging existing assets, facilities, and resources. The EGS-PPP would:

- Build upon the similarities in two legume crops grown in the same North and East regions of Zambia.
- Create the scale necessary to generate private sector investment in smallholder farmer food security crops often overlooked in a maize-dominated country.
- Provide opportunities to develop a QDS system designed specifically for lower margin crops such as groundnut and common bean (rather than maize), that is cost-effective and efficient.
- Attract private sector interest by anchoring the EGS-PPP on the larger groundnut crop that has more significant downstream opportunities for the private sector for processing and exports.

An EGS-PPP would have three primary objectives:

- Produce enough EGS to meet current and future demand.
- Produce seed at the lowest possible cost while continuing to meet quality standards.
- Stimulate demand for improved varieties and quality seed at the farm level.

Produce enough EGS to meet current and future demand: In order to increase the quantity of seed produced, the EGS-PPP would utilize resources such as land, personnel, technical know-how, and seed production infrastructure such as processing and packaging facilities from both the public and private sectors, according to their competitive advantages.

Produce seed at the lowest possible cost while continuing to meet quality standards: Currently, low profitability of producing and marketing groundnut and common bean have been key obstacles to increasing private sector participation in EGS. Critical factors contributing to low profitability have been low seed production yields, high certification costs, and a lack of an EGS and commercial seed demand forecasting system. The lack of demand data hinders seed producers from reaching economies of scale, without undue risk, which would in turn lower production costs. In order to address these constraints, the EGS-PPP would:

- Establish a central EGS demand information and forecasting system.
- Adopt QDS as the preferred class of commercial seed.
- Implement a localized seed production model.

Stimulate demand for improved varieties and quality seed at the farm level: While current demand for EGS exceeds supply, there remains a need to prove at the farm level the benefits of using improved in lieu of local varieties and buying QDS rather than saving seed that is not quality assured. In order to stimulate demand, the EGS-PPP would include the following:

- Expand farm level demonstration trials.
- Introduce and sponsor the widespread use of seed small packs.

The EGS-PPP will have a stimulating effect on demand for quality seed by building farmer trust in the quality seed system. While the EGS-PPP mechanisms and operating principles described above are innovative yet limited in application, the overarching model fits within traditional PPP approaches and existing laws.

RECOMMENDATIONS

The priorities for groundnut and common bean are highly aligned. We treat groundnut and common bean together because 1) they are critically important food security crops for smallholder farmers, 2) they are grown in similar regions 3) they suffer similar kinds of EGS supply constraints, 4) the technical solutions are similar for both and 5) combining the crops provides the scale necessary to attract private interest that has mainly been focused on the larger maize crop in Zambia. Done correctly, farmers would be motivated to invest in improved, high quality seed. In order to achieve these objectives, here following are specific recommendations:

Increase marginal economic value of groundnut and common bean

- Adopt QDS as the standard for groundnut and common bean.
- Establish commercial market grades for groundnut and common bean.
- Stimulate downstream higher value demand – develop varieties suitable for processors that meet farmers' needs.

Stimulate farmer adoption of improved varieties and quality seed

- Design and execute on-farm trials.

- Expand the Zambia Agricultural Research Institute's (ZARI) outreach service programs.
- Work with private lenders to increase credit for seed producers and smallholder farmers.
- Ensure QDS pack sizes have the right qualities to serve smallholder needs.
- Accelerate varietal improvements.

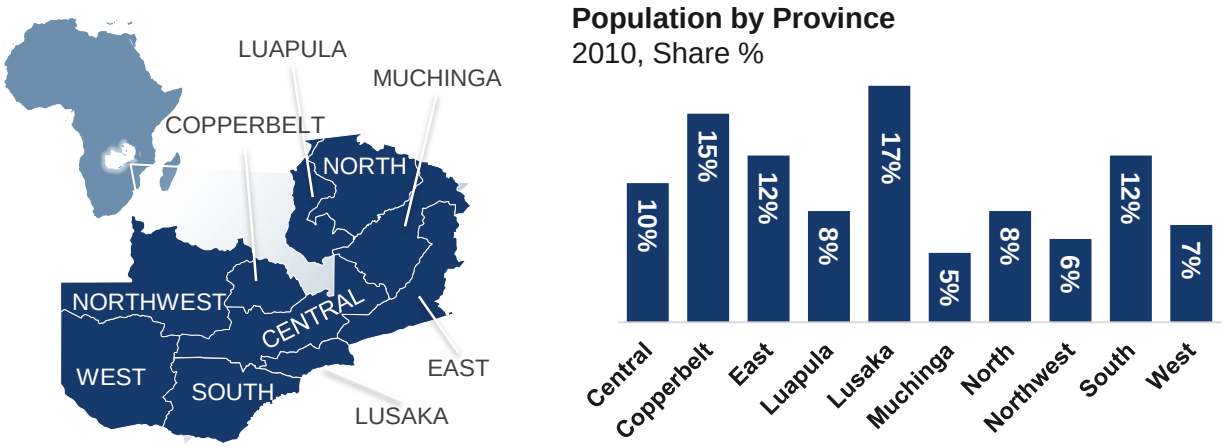
CHAPTER 1: CURRENT SITUATION – DOMINANT SEED SYSTEMS

1.1 COUNTRY OVERVIEW

Zambia is a landlocked country in southern Africa sharing borders with eight countries, the Democratic Republic of the Congo (DRC) to the north; Tanzania to the northeast; Malawi to the east; Mozambique, Zimbabwe, Botswana, and Namibia to the south; and Angola to the west. Its 15 million inhabitants live in 753,000 square kilometers (NAIP). Although there are 19 distinct ethnic groups, two groups make up roughly one-third of Zambia's population: Bemba, 21%, and Tonga, 14%.

As illustrated in Figure 3, Zambia is divided into ten provinces, with the largest populations concentrated in the Lusaka, Copperbelt, Eastern and Southern provinces (Zambia Census, 2010). The country's growth, starting in the 1990s, has been chiefly driven by high global copper prices, as it hosts some of the world's largest copper and cobalt deposits.

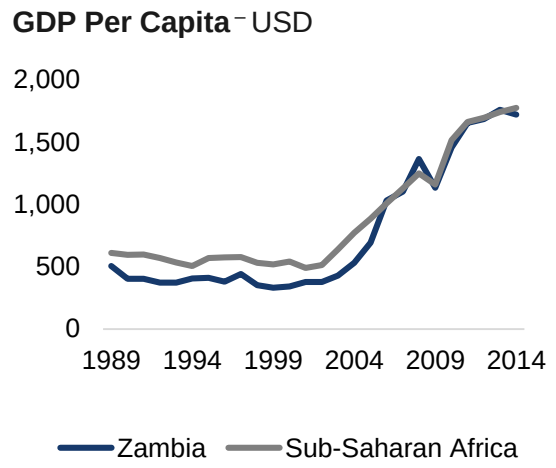
Figure 3: **Map of Zambia provinces and % population share.**



Source: Zambia Census (2010).

Zambia's per capita GDP, which started growing in the late 1990s and has averaged 5-6% during the last decade (as shown in Figure 4), is in line with the Sub-Saharan average. Despite the high GDP growth rate, however, poverty remains high, ranking 150 of 169 in the Human Development Index, according to Zambia's National Agriculture Investment Plan 2014-2018. High fertility rates, a dependence on copper prices, and relatively high AIDS/HIV rates continue as persistent development problems.

Figure 4: **Per capita GDP Zambia compared to Sub-Saharan Africa.**



Source: World Bank (2016).

The GRZ's development program (Revised Sixth National Development Program 2013-2016) focuses on the main themes of sustained economic growth and poverty reduction in the priority sectors of agriculture, livestock, fisheries, mining, tourism, manufacturing, commerce, and trade. Its objective is to renew the Vision 2030's goal for a prosperous middle-income nation by 2030.

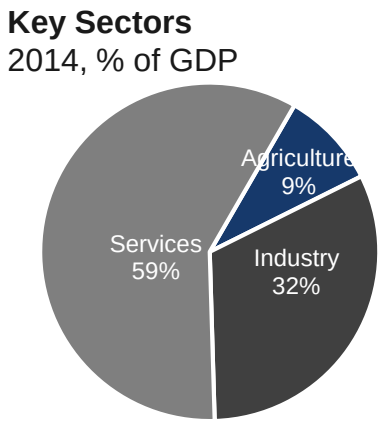
1.2 AGRICULTURE SECTOR

OVERVIEW

Currently, agriculture makes up approximately 9% of Zambia's national GDP, far less than in Rwanda (33%), Kenya (30%), and Nigeria (20%). Although agriculture contributes less than 10% to GDP, it accounts for at least 85% of the country's labor force. Other sectors that significantly contribute to Zambia's GDP are services and industry, as illustrated in Figure 5. While Zambia boasts the third-largest water reserves in Africa, estimates suggest that less than 20% of Zambia's arable land is currently utilized. Within the agriculture sector, 45% of GDP derives from agriculture itself, with forestry and fisheries garnering 38% and 17%, respectively,

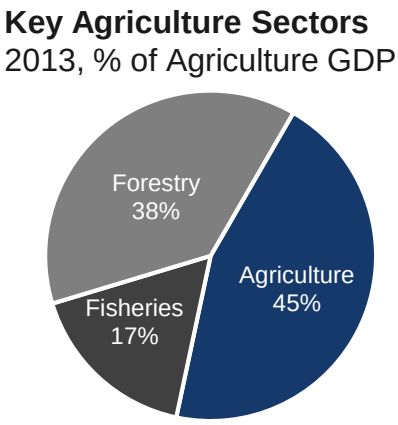
as shown in Figure 6. Maize is the main focus of agricultural investment, with Zambia a key hub for maize hybrid seed production and the export of seed to neighboring countries.

***Figure 5:* Zambia GDP composition (2014).**



Source: World Bank (2016).

***Figure 6:* Zambia agriculture GDP composition (2013).**

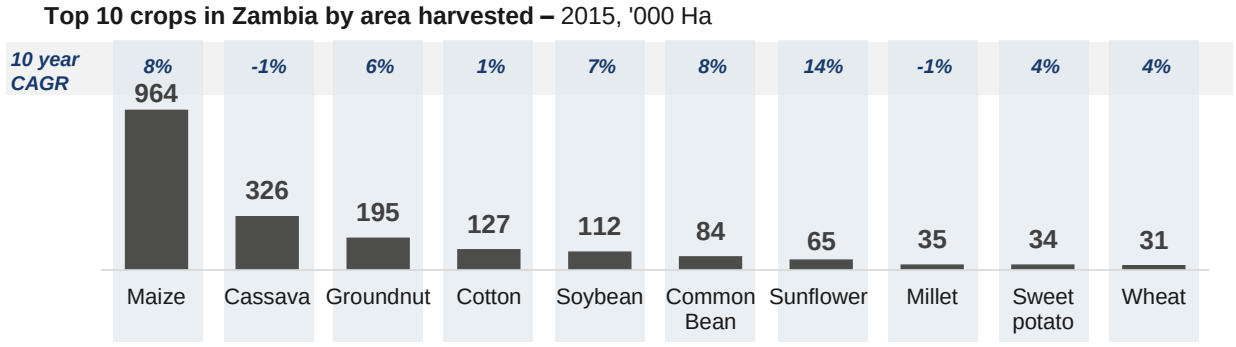


Source: World Bank (2015).

KEY CROPS

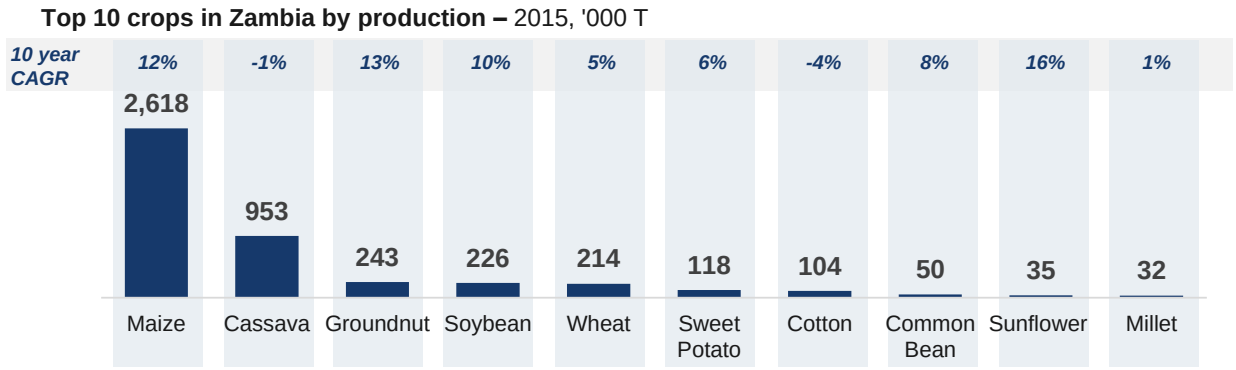
The top ten crops in Zambia in 2015, based on area harvested and production, are presented in Figures 7 and 8. Driven by the strong export market, maize far and away represents Zambia's largest crop by area, followed by cassava, groundnut, cotton, soybean, and common bean. Zambia is the second-largest exporter of maize in Africa, behind South Africa. Likewise, maize production is nearly triple that of cassava, the next largest crop. Of the major crops, production of maize and groundnut are growing fastest, with maize driven by hybrid yield improvement. Meanwhile, cassava production remains relatively flat, and cotton production has decreased over the past ten years.

***Figure 7*: Top 10 crops by area (2015).**



Source: Zambia Country Stat (viewed in February 2016).

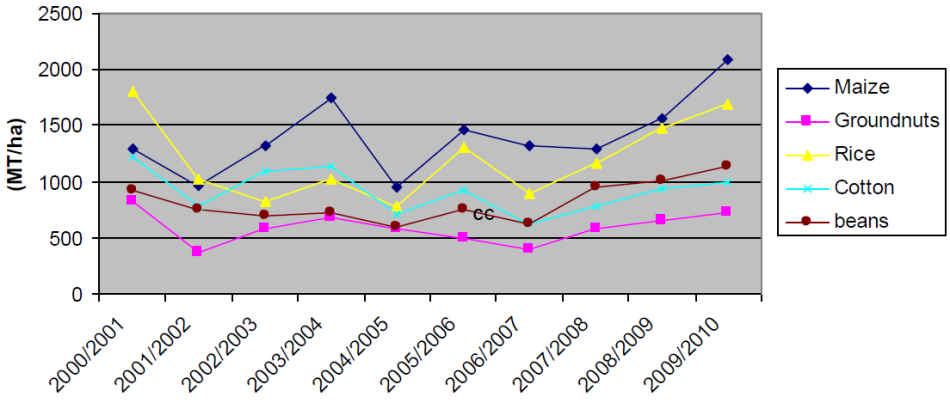
Figure 8: **Top ten crops by production (2015).**



Source: Zambia Country Stat (viewed in February 2016).

As evidenced in Figure 9, yields in maize have increased during the last 15 years as large growers have increased their use of improved hybrid varieties. However, yields for other crops, particularly common bean, have remained relatively flat over the same period. The stagnant yield for common bean correlates with limited private sector investment and involvement, scant research and development of improved varieties, and low adoption rates for those that have been introduced.

Figure 9: **Yields of select crops in Zambia.**



Source: Government of Zambia CSO Crop Forecast Surveys sourced from NAP (2013).

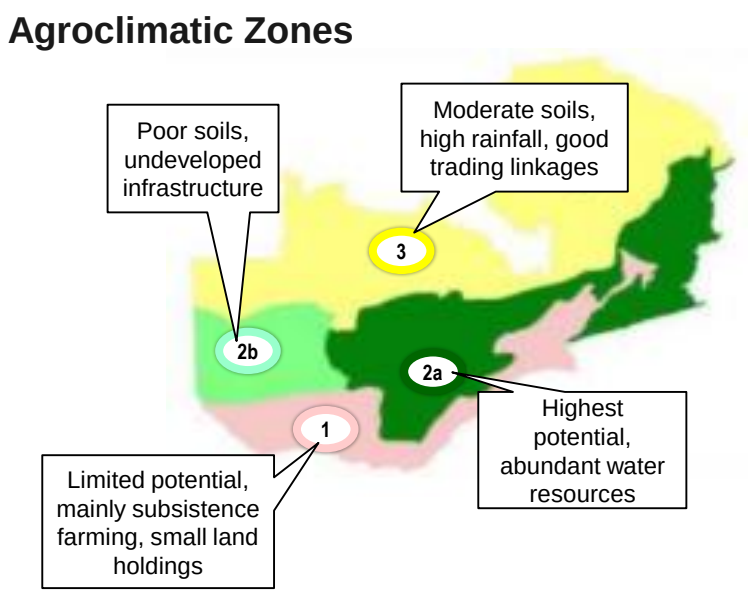
GROWING CONDITIONS

Zambia presents good growing conditions, with ample rainfall and arable land. The country has three distinct agroclimatic regions, namely Regions 1, 2, and 3, which are differentiated by the amount of rainfall and the quality of soils, as shown in Figure 10.

Region 1, covering parts of Southern, Eastern, and Western provinces, receives less than 800 mm of rainfall annually and constitutes 12% of Zambia's total land area. It consists of loamy to clayey soils on the valley floor to course to fine loamy shallow soils on the escarpment. This

region is suited to production of crops such as cotton, sesame, sorghum, groundnut, common bean, sweet potato, cassava, rice, and millet and has potential for production of irrigated crops.

Figure 10: **Agroclimatic zones.**



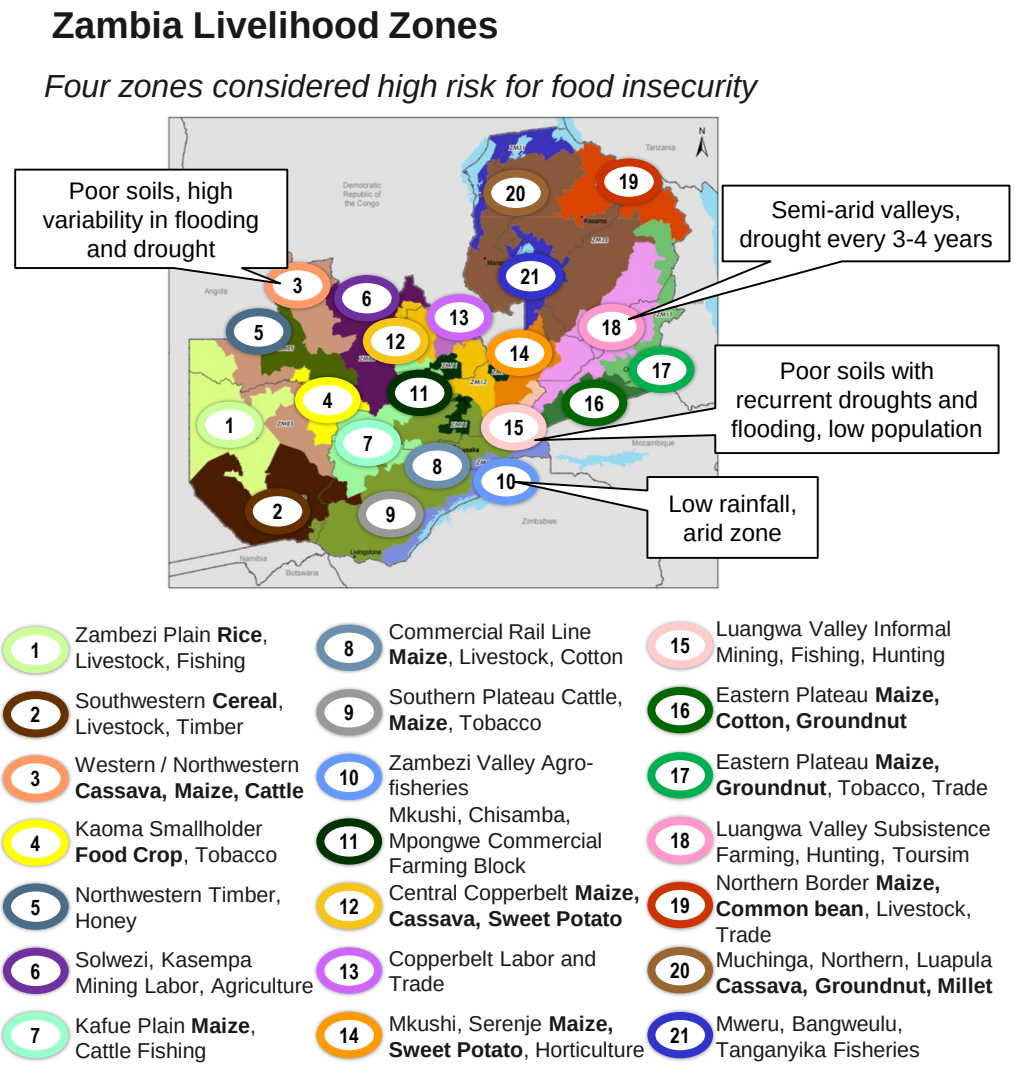
Source: NAIP (2014).

Region 2 covers 42% of the country and is subdivided into two sub regions. Region 2a, with its inherently fertile soils and established systems of agriculture, covers the Central and Lusaka provinces and parts of Southern and Eastern provinces. A variety of crops including maize, cotton, tobacco, sunflower, soybean, irrigated wheat, and groundnut are grown here. Region 2b covers part of the Western province and consists of sandy soils. It is suited to production of cashew, rice, cassava, millet, and vegetables.

Region 3 receives 1000 mm to 1500 mm of rainfall annually and constitutes 46% of Zambia's total land area. It spans the Copperbelt, Luapula, Northern, Muchinga, and Northwestern provinces. With the exception of the Copperbelt, soils in this region are highly leached and acidic. It has the potential for production of millet, cassava, sorghum, common bean, groundnut, coffee, sugarcane, rice, and pineapple.

USAID's Famine Early Warning System has identified 21 distinct livelihood zones, shown in Figure 11, offering opportunities to both ensure food security and produce a surplus for processing and export, despite diverse agroclimatic obstacles to production. There are four identified food-deficit zones. Among the agroclimatic challenges Zambia faces, particularly in southern and western portions of the country, are recurrent and highly variable cycles of drought and flooding, compounded by poor soil fertility.

Figure 11: **Zambia livelihood zones.**

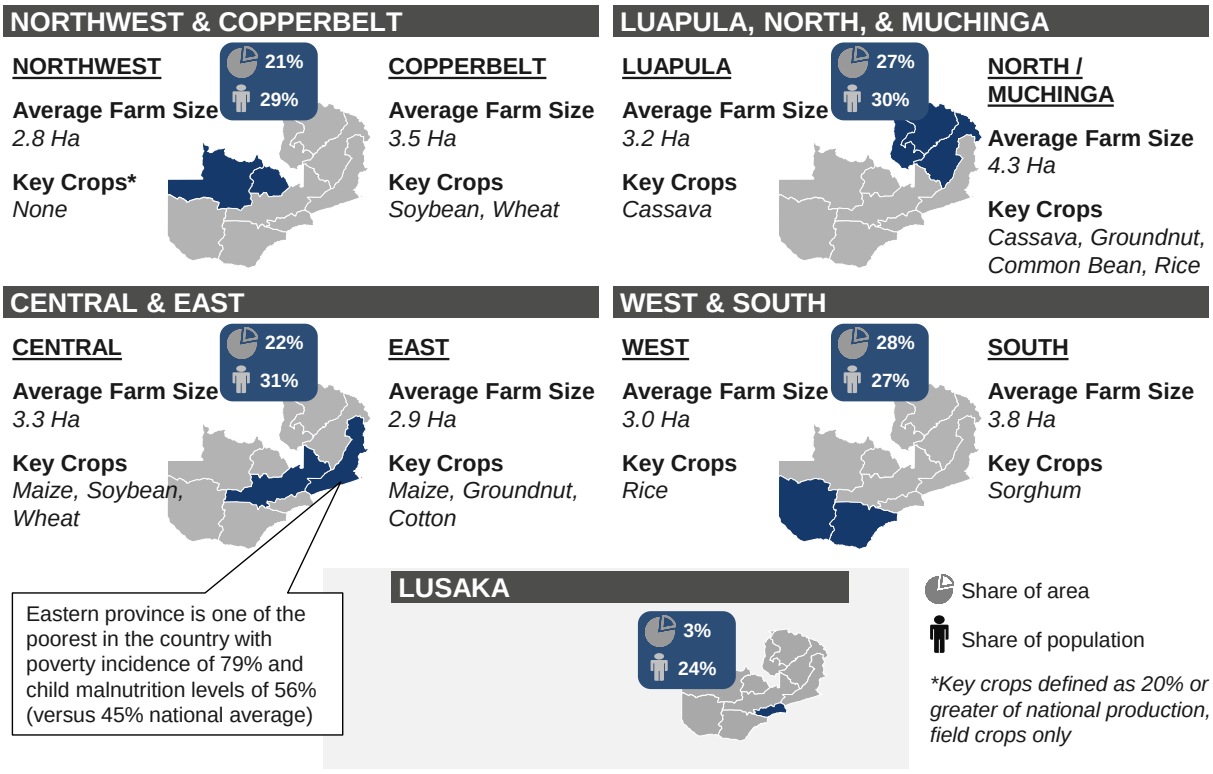


Source: Famine Early Warning Systems Network. (2014).

PROVINCIAL CROP PRODUCTION

Maize dominates production in Zambia's key regions including the Central and Eastern provinces, with groundnut production also notable in the Northern and Eastern provinces, and common bean in the Northern province. Figure 12 presents the key crops (defined as having at least 20% share of the national production) by province.

Figure 12: **Crop production and farm size by province.**



Source: Zambia Country Stat (2015), NAIP (2014).

Gender division of labor in Zambian agriculture tends to be by task and by crop, although this varies by household. As shown in Table 2, women are on average more active in the production of food security crops, most notably groundnut.

Table 2: **Gender roles in crop production.**

	Input decision	Crop production	Processing	Marketing
Maize				
Cassava				
Groundnut				
Cotton				
Common bean				

Source: Expert analysis based on field interviews, FtF Impact Evaluation of Groundnut Value Chain in Zambia (2015), Hamazakaza et al. (2014), Mofya-Mukuka et al. (2013), and Ross et al. (2012).

In general, women in Zambia are more involved in crops that are consumed on-farm, while men are more involved in the production of marketed, cash crops, Accordingly, women's role in maize depend on the role of maize in the household, as women tend to be more involved and more conservative in variety selection if the maize is for on-farm consumption. For cassava, women generally lead processing activities, while gender-specific roles in input decisions and crop production roles for cassava vary by household. Groundnut is viewed as a food security crop, and as such, input decisions and processing are

generally led by women, although men are increasingly involved in groundnut production. Both women and men are involved in all common bean activities, but women tend to be more involved in variety selection in Muchinga, while men are more involved in the Northern province. Gender roles in common bean are highly dependent on specific households. Given that cotton is a high-value cash crop, men generally make input technology decisions and marketing, while women are usually only involved in cotton picking.

With respect to accessing credit, women farmers are more disadvantaged than male farmers. Married women usually do not have property in their name, and as a result they often cannot provide the collateral required to access credit (USAID AgCLIR, 2011).

FARM SIZES

Average farm size varies significantly across Zambian provinces, with Northern and Muchinga province farms typically the largest, with Lusaka province hosting relatively smaller farms. According to the Central Statistics Office in Zambia, there are nearly 800,000 smallholder farmers in Zambia classified as having less than 5 Ha. Roughly 20,000 farms are considered medium size (5-20 Ha), while only around 2,000 farms are considered large, having more than 20 Ha (NAP), as shown in Table 3. Despite a recent emergence of larger farms in Zambia focused on contract growing of soybean and seed maize, more than 70% of farms in Zambia are under 2 Ha, and 40% under 1 Ha.

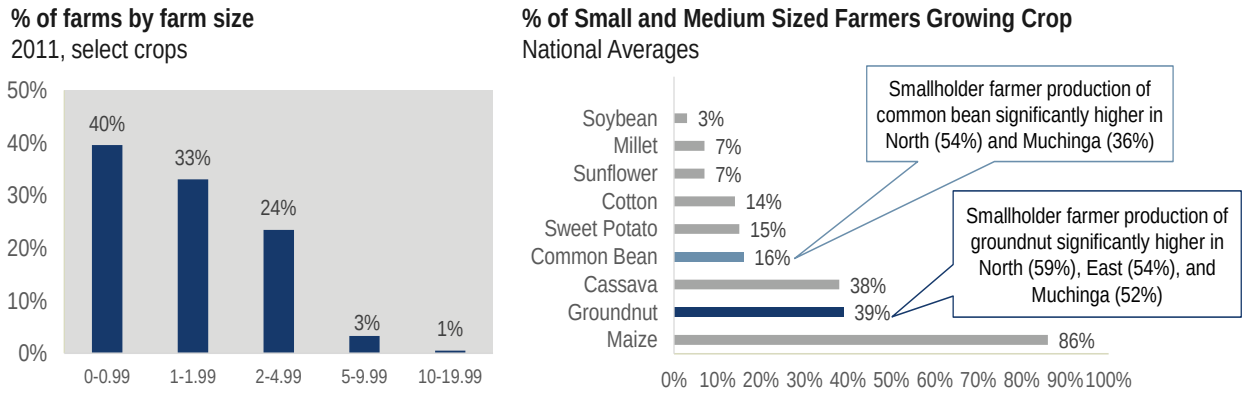
Smallholder farmers in Zambia tend to grow different crops than farmers with larger farms. Among smallholder farmers in the Northern and Muchinga provinces, for instance, common bean production is two to three times higher than in other provinces, as indicated in Figure 13. Groundnut is another crop factoring significantly in smallholder farmers' production, particularly in the Northern, Eastern, and Muchinga provinces, where 52-59% of smallholder farmers grow groundnut, well above the national average of 39%.

Table 3*:* Farm sizes in Zambia.

Types of Farmers	Farm Size	Number of Farmers
Small Scale	Less than 5 ha	792,212
Medium	5-20 ha	20,728
Large	Greater than 20 ha	2,052

Source: NAP sourced from CSO (2010).

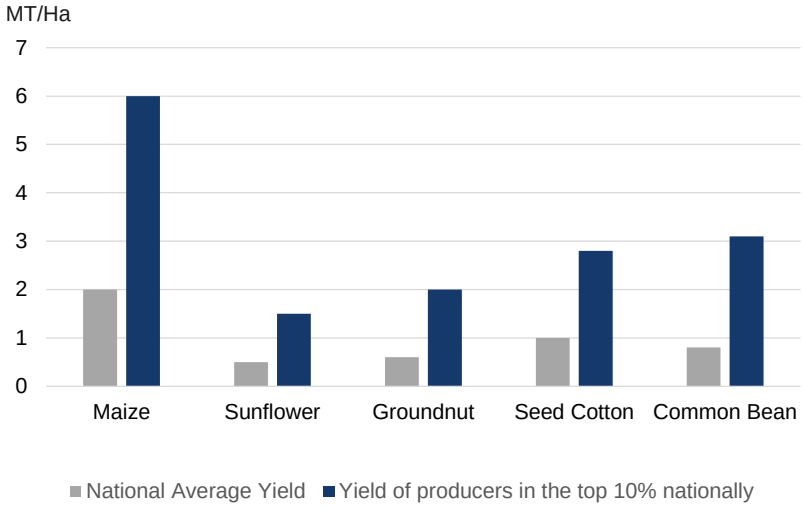
Figure 13: **Farm sizes in Zambia.**



Source: Indaba Agricultural Policy Research Institute (2013).

Yields tend to be low for smallholder farmers, across all crops. As a result, smallholders rarely produce enough crop surplus to sell. However, as Figure 14 illustrates, a small subset of farmers is achieving notably higher yields. These top 10% of growers are producing 1 to nearly 4 MT/Ha more than the average grower in Zambia, depending on the crop. This suggests that higher productivity on a much broader scale is attainable in the near term, if bottlenecks and constraints can be overcome to give more smallholder farmers access to high-quality seed and inputs, along with training in best agronomic practices.

Figure 14: **Five-year yield average: National versus top 10%, 2005-2010.**

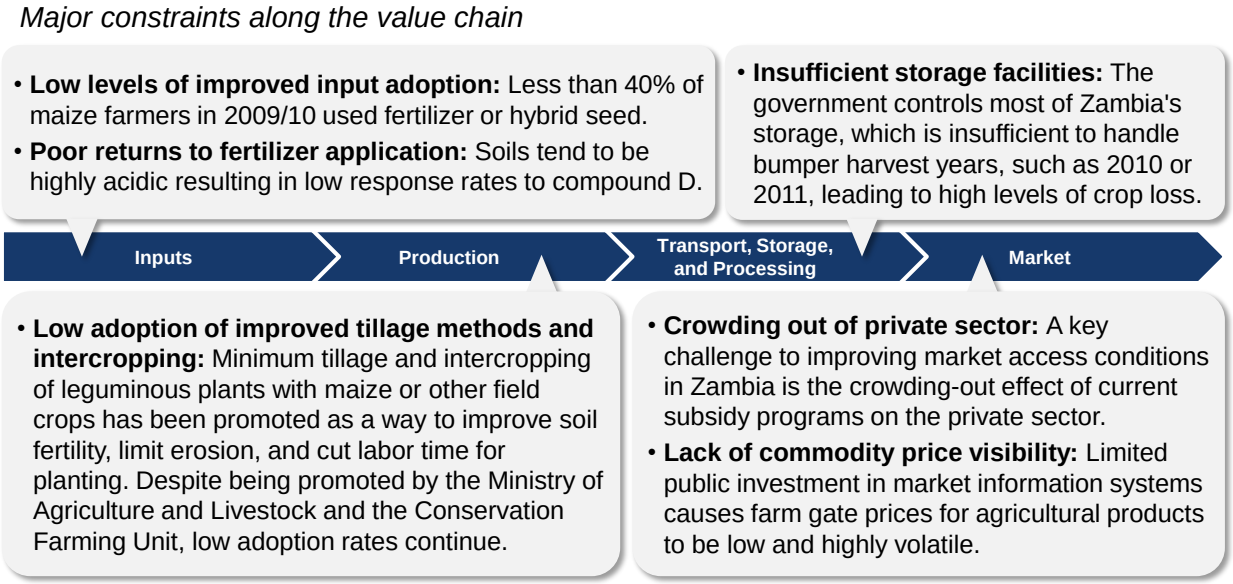


Source: National Crop Forecasting Survey sourced from NAIP (2014).

AGRICULTURE AND ENABLING ENVIRONMENT CONSTRAINTS

While this study focuses primarily on seed system related constraints, it's critical to review a more comprehensive set of constraints across multiple crop value chains to better inform the seed situation. Figures 15 and 16 provide a high-level but not exhaustive list of key constraints across the all agricultural value chains and the enabling environments in Zambia. These include low levels of improved input adoption, poor returns on fertilizer applications, and poorly developed storage facilities. These issues are compounded by constraints in the enabling environment and infrastructure deficits. Zambia's road networks are generally underdeveloped, contributing to difficult farmer access to inputs and markets and higher transportation costs, in turn lowering farmers' returns and driving up the cost of Zambian exports. Furthermore, policy unpredictability raises risks for private sector participants in the country's agricultural markets, and limited enforcement of quality standards curtails export opportunities.

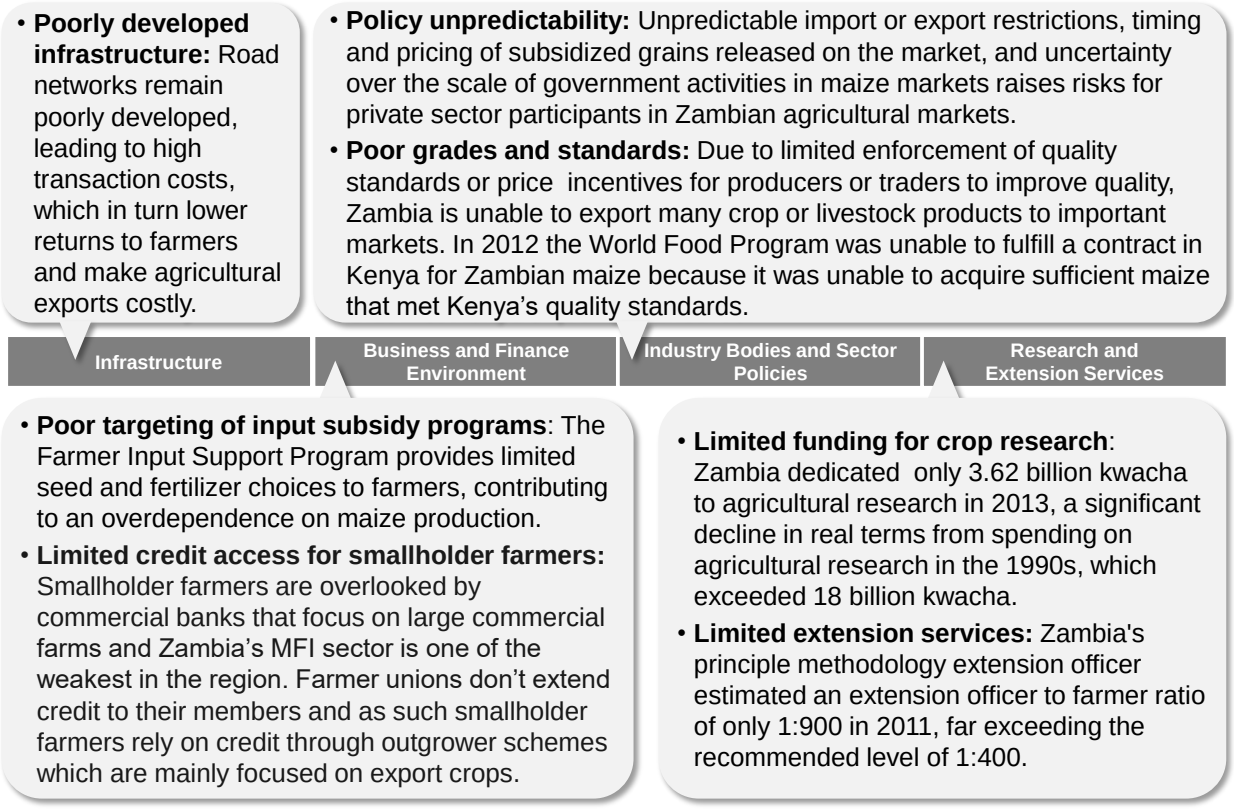
Figure 15: **Major value chain constraints.**



Source: NAIP (2014), field research team interviews (2016).

Figure 16: **Major Enabling Environment Constraints.**

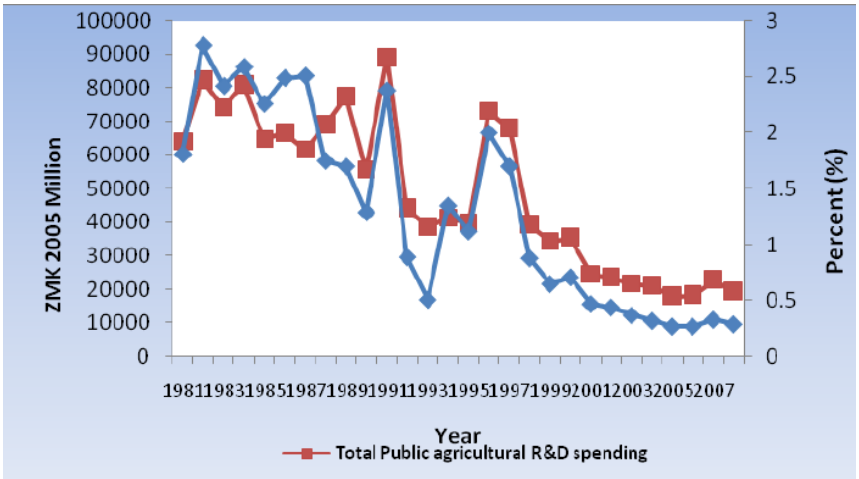
Constraints in the enabling environment and infrastructure



Source: NAIP (2014), field research team interviews (2016).

As noted in Figure 17, government spending on agricultural research and development is on a continuing downward trend, creating a critical challenge in Zambia. In 2008, for example, Zambia's spending on agricultural research and development paled in comparison to other African countries, hovering at 0.29% of agricultural GDP, in contrast to an African average of 0.5-0.6%. As a result of waning investment in agricultural research over time, the release of new varieties, inputs, and other technologies has withered accordingly.

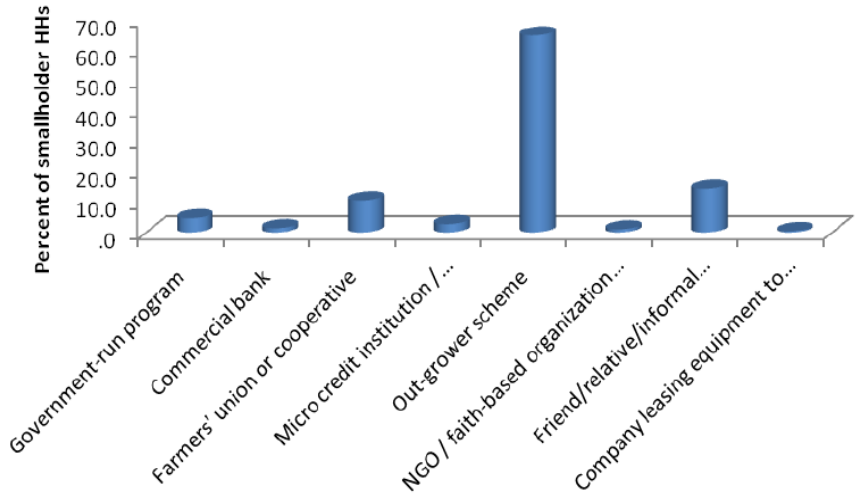
Figure 17: **Government spending on agricultural R&D.**



Source: Agricultural Science and Technology Indicators (2010-2011) sourced from NAIP (2014).

Another critical challenge specific to smallholder farmers is their limited access to credit. According to a 2011 Rural Agricultural Livelihoods Survey, only 13% of Zambian smallholder farmers had access to credit, most of this deriving from specific outgrower schemes rather than from commercial banks (Figure 18). Financing as part of an outgrower scheme, while helpful to farmers, focuses on a single crop within a single growing season, and therefore isn't a substitute for access to commercial credit. Furthermore, outgrower schemes tend to be targeted on specific export crops such as cotton and tobacco. The limited involvement of commercial banks stems from a lack of collateral among farmers, as most operate under land tenure systems in which land is held in common ownership with the community.

Figure 18: **Sources of credit among smallholder farmers 2010-2011.**



Source: RALS (2012) sourced from NAIP (2014).

However, there has been encouraging, albeit small-scale, progress recently in partnerships the Zambia National Farmers Union has helped forge between cooperatives and commercial banks in which the banks will consider a farmer's membership in a cooperative or union as a form of collateral. However, these unions do not actually extend credit to their members, but rather they help farmers pool and exchange information about availability of credit.

Zambia's microfinance sector is one of the smallest in the region, with an estimated portfolio in 2011 of less than $10 M (USAID AgCLIR, 2011). In addition to the microfinance sector being quite small, the existing MFIs have made very few loans for agribusinesses in Zambia relative to other African countries. In Senegal, for example the MFI sector accounts for half of all agricultural lending (USAID AgCLIR, 2011). This has constrained development of agro-dealers, seed companies, traders, and processors who all face difficulties accessing sufficient credit.

A key source of credit for smallholder farmers are Chilimbas, which are informal savings associations common in both rural and urban areas. Members of Chilimbas, who are often women, make regular, typically weekly payments, with one member being allowed to use all the payments during one cycle. Smallholder farmers do sometimes use Chilimbas for credit to purchase inputs, but equipment purchases are less common as Chilimbas are generally not large enough to support these loans (USAID AgCLIR, 2011).

NATIONAL AGRICULTURAL STRATEGY

Zambia signed the Comprehensive Africa Agriculture Development Program (CAADP) agreement in 2011. The main goal of CAADP is to help African countries to design policies and initiatives to accelerate economic growth, eliminate hunger, reduce poverty, and improve food security. CAADP is a voluntary program placing agriculture at the center of the development agenda. It has been instrumental in increasing investment (both government and donor) in the agricultural sector in the countries with signed compacts.

The Zambian CAADP compact is aligned to the four CAADP pillars: I) sustainable land and water management, II) rural infrastructure and markets, III) food supply and hunger, and IV) agriculture research and technology dissemination.

At the country level, the Sixth National Development Program, spanning 2011-2015, was subsequently updated as the Revised Sixth National Development Program, 2013-2016. Its objective is to renew Vision 2030's goal for a prosperous middle-income nation by 2030, with a thematic focus on sustained economic growth and poverty reduction through sectors that include agriculture, livestock, fisheries, mining, tourism, manufacturing, commerce, and trade.

The Zambian government has also established its National Agriculture Policy (NAP): 2012-2030 and the National Agriculture Investment Plan (NAIP): 2014-2018, which was developed by the Ministry of Agriculture under CAADP to operationalize NAP.

With focus areas spanning the sustainable use of the natural resource base; infrastructure and market access, food security and disaster management; and research and technology, NAP's three goals are to increase Zambia's annual growth rate of real GDP, increase the value and growth rate of export crops, and contribute to poverty reduction and food security.

Seen as a five-year roadmap for agricultural and rural development that identifies priority areas for investment and estimates the financial investment to be provided by the government and its development partners, NAP is anchored to and aligned with Zambia's national vision of becoming a middle-income country by 2030. Specifically, NAP's objectives are to:

- Promote a sustainable increase in agricultural productivity of major crops that have a competitive advantage.

- Continuously improve agricultural input and product markets so as to reduce the marketing costs of agribusiness, including small-scale farmers and farmer groups.
- Increase agricultural exports to preferential markets at regional (COMESA and EAC) and international (US, European Union, China, India, and others) levels.
- Improve access to productive resources (organize fertilizers, fertilizer blends, and liquid fertilizers) and services to small-scale farmers, especially women and young farmers.
- Continuously strengthen public and private sector institutional capabilities to improve agricultural policy implementation, resource mobilization, agriculture research, technology dissemination, and implementation of regulatory services.

To facilitate and support NAP, the Ministry of Agriculture developed the NAIP with the objective "to facilitate the development of a sustainable, dynamic, diversified, and competitive agricultural sector that assures food security at household and national levels and maximizes the sector's contribution to GDP" (NAIP, 2014). For the period of 2011-2018, NAIP is tracking progress on the following impact indicators:

- Reduce rural poverty from 77% to 50%.
- Increase agricultural exports as a percentage of non-traditional exports from 41% to 55%.
- Reduce chronic malnutrition of children under five from 45% to 30%.
- Reduce soil erosion per hectare loss from 20 MT to 10 MT per year.
- Increase annual cereals production from 3.2 MMT to 6.0 MMT.

1.3 DOMINANT SEED SYSTEMS IN ZAMBIA

SEED SYSTEMS OVERVIEW

There are five identified seed systems predominant in Zambia, as highlighted in Table 4. In the farmer-saved system, which is informal, farmers multiply seed, barter it, or sell and buy for cash. This system has no quality assurance measures for the landraces that are multiplied. In the second system, NGOs are assisting community groups or farmer cooperatives in seed multiplication and marketing. Smallholder farmers in Zambia who grow crops other than maize are nearly always acquiring seed through these two systems.

The country's agricultural focus on maize and other crops for export is similarly reflected in the three formal seed systems. These systems include: 3) Public-Private, supported by ZARI and local seed companies, 4) Private, supported by international seed companies, and 5) Private, supported by out-grower schemes for export commodities. The privately owned local seed companies focus on seed production and marketing, often of varieties and basic seed bred from CGIAR research institutions. International seed companies operating in Zambia are active in breeding (within and outside of Zambia), seed production, multiplication, processing, and distribution of hybrid maize and other high-value cash crops. The export commodities-driven seed system revolves around outgrower schemes for cash crops for export such as cotton, tobacco, and sugar cane.

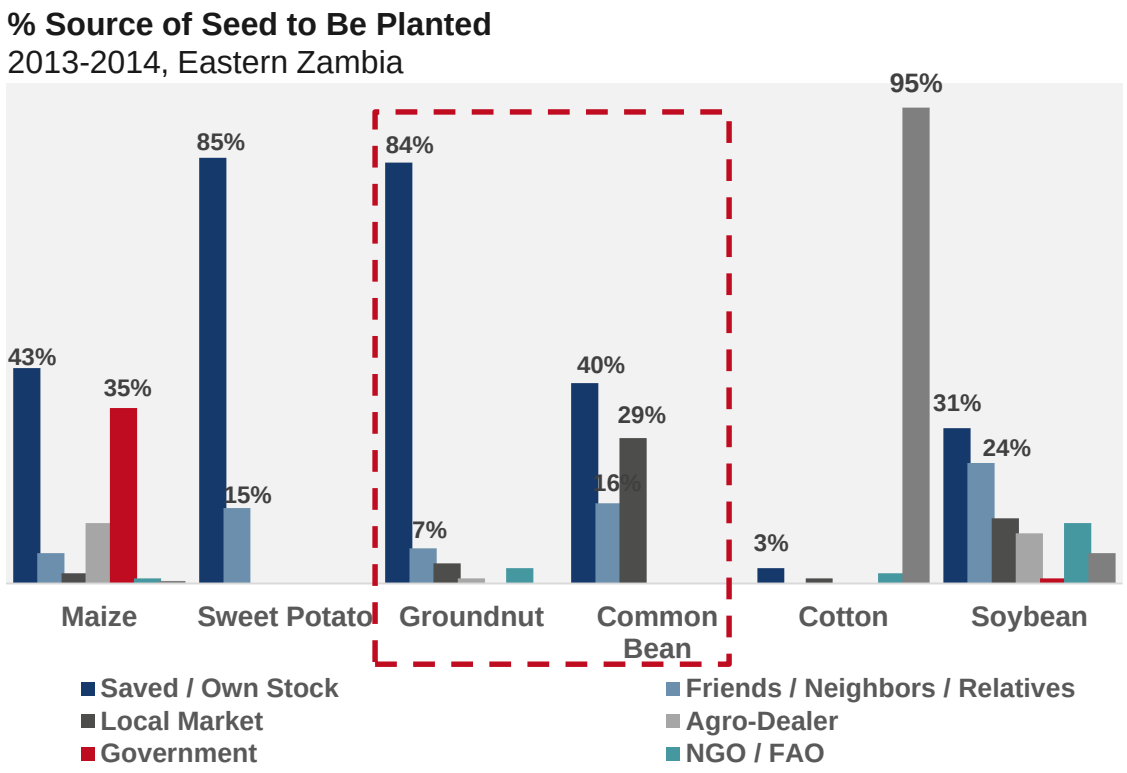
Table 4: **Dominant seed systems in Zambia.**

	Farmer-saved	**NGOs and Cooperatives**	**Public–Private** *Government and Local Seed Companies*	**Private** *International Companies*	**Private** *Export Commodities Out-Growers Schemes*
Description	Traditional, for food and subsistence crops (informal)	Development and community based targeting food security (intermediary)	Varieties and basic seed from public research; quality seed production and marketing (formal)	Own varieties and basic seed; structured quality seed production and marketing (formal)	Closed system with large export commodities (formal)
Type of crops	Local food crops	Food and cash crops	Major food and cash crops	High value crops	Cash crops
Crops	Common bean Sorghum Groundnut Rice Maize	Common bean Groundnut Soybean Millet Rice Cowpea Maize Cassava Sweet potato	Maize Common bean Soybean Groundnut	Maize Wheat Soybean	Cotton Tobacco Sugar cane Malt barley
Types of varieties	Local varieties	Improved OPVs	Improved varieties (Hybrids and OPVs)	Improved varieties (Hybrids for maize)	Improved varieties
Quality assurance system	Farmer-saved	Certified, Quality Declared	Certified, Quality Declared	Certified	Certified, Quality Declared
Seed distribution	Farmer-saved, exchange, barter and local markets	Local markets and exchange, with some marketing	Distribution through government and marketing	Distribution through government and marketing	Contractual market arrangements (closed chains)

Source: ISSD Zambia briefing note (2012), field research team interviews (2016).

Adoption of improved varieties is low across Zambia for all crops but maize, as depicted in Figure 19 and Table 5. The overwhelming majority of varieties released in the country have been maize which means the formal channel has been better established in maize than for other crops to release improved varieties. Agro-dealers mainly focus on supplying maize seed, and there are limited government and NGO programs to distribute groundnut and common bean seeds. For common bean, seed sources are typically split between farmer-saved, neighbors, and local markets. Almost all seed for groundnut is sourced from farmer-saved seed and neighbors.

Figure 19: **Farmer source of seed planted.**



Source: Alliance for a Green Revolution (AGRA) (2010).

Table 5: **Number of released improved varieties by crop.**

Crop	Total varieties released	First and last year of varietal release
Maize	+210	1984-2011
Soybean	36	1973-2012
Common bean	28	1970-2011
Groundnut	16	1954-2008
Sweet potato	8	1993-2003

Source: ZARI, International Center for Tropical Agriculture, and Michigan State University (2013).

FORMAL AND INFORMAL TRADE

Currently, formal trade revolves almost entirely around maize. According to the World Bank, Zambia exports more seed - chiefly maize seed - than any other African country. In 2011, for example, Zambia exported enough maize seed to plant 880,000 Ha.

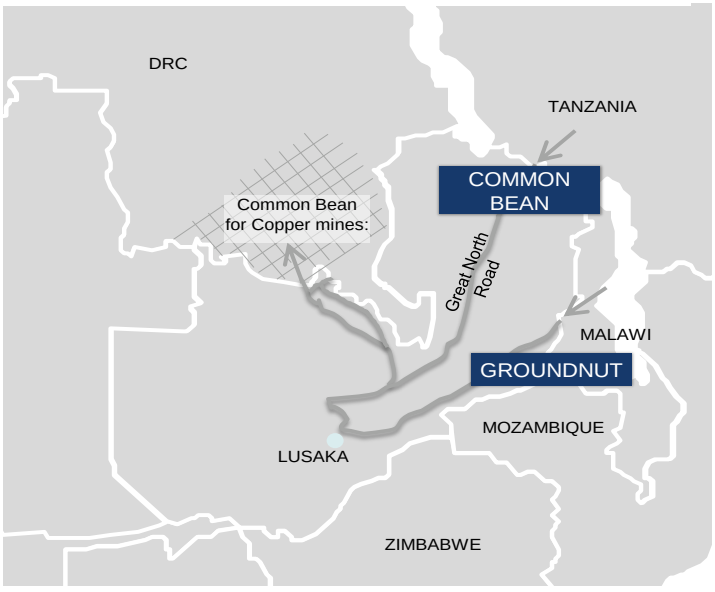
The singular focus on maize was not always the case. In the 1960s, Zambia was a key exporter of groundnut, exporting an estimated 8,000 MT to the U.K. through the Eastern Provincial Marketing Cooperative. However, exports ceased in the 1970s due to high aflatoxin incidence and the importing countries' insistence on more consistent shape and size of groundnut. These inconsistencies were a result of varieties being bred without regard for market preferences. To

date, varieties have still not been bred to address market requirements for certain characteristics.

Aside from formal trade, there is also evidence of a significant volume of informal, unregulated cross-border trade by farmers and traders between Zambia and surrounding countries. Zambia is bordered by eight countries, affording many opportunities for grain and seed to move in both directions according to supply and demand. This informal market is driven somewhat by commodity price differences across markets but more so by persistent food-deficit regions in the DRC, particularly in Katanga province. According to a 2011 Agribusiness Commercial Legal & Institutional Reform Diagnostic for USAID, many of the DRC's food staple imports come from Zambia.

Informal trade for this study's crops, groundnut and common bean, is less visible and highly variable, depending on short-term shortages. According to a source at Zambia's SCCI, approximately 1,000-1,500 MT of groundnut is imported annually from Malawi and possibly Mozambique through Chipata, and a portion of that is classified as QDS for planting in Zambia.

Figure 20: **Informal trade flows.**



Source: Field research team interviews (2016).

Field interviews suggest that common bean intended for commercial purposes is informally purchased from Tanzania, through traders who then clean and sell small quantities for seed in Zambia. The exact volumes of common bean imported from Tanzania are unclear, but experts suggest they are quite small, less than 1,000 MT annually. Common bean from Zambia also moves along the Great North Road to feed copper miners in the DRC's Copperbelt area, as depicted in Figure 20. Exact volumes are unclear but likely no more than 2,000-5,000 MT.

1.4 KEY ACTORS IN THE SEED SYSTEM

PUBLIC SECTOR OVERVIEW

Ministry of Agriculture and Livestock (MAL)

MAL's mission is to facilitate and support the development of a sustainable, diversified, and competitive agricultural sector that assures food and nutrition security, contributes to job creation, and maximizes the sector's contribution to GDP.

Zambia Agriculture Research Institute (ZARI)

ZARI is the largest agricultural research entity in the country, with activities carried out in all three agroclimatic regions. It has ten research stations, with Mount Makulu Central Research Station (south of Lusaka) functioning as the headquarters. The institute's overall objectives are to develop and adapt crop, soil, and plant protection technologies and to provide high-quality, appropriate, and cost-effective services to farmers. ZARI's facility at Mount Makulu is one of Zambia's only two fully equipped agricultural laboratories capable of detailed soil analysis and other agricultural testing.

Seed Control and Certification Institute (SCCI)

SCCI, a department under MAL, is Zambia's seed certification authority and the center for seed services in the country. The institute enforces Zambia's Plant Variety and Seeds Act, which provides for regulation and control through variety testing and release; production and marketing of seed; import and export of seed; seed quality control; and coordination of the seed industry. SCCI also enforces the Plant Breeder's Rights Act, which ensures that breeders collect royalties appropriately from the use of their varieties.

The SCCI has three technical sections:

1. **Variety testing, registration, and protection:** Tests varieties for a minimum of two years in six locations (two for each agroclimatic zone) at a cost of $125 per variety per year for Distinctness, Uniformity, and Stability (DUS) and Value for Cultivation and Use (VCU) tests. 90% of newly registered varieties come from the private sector. Zambia does not perform on-farm trials, but instead relies on breeders to provide on-farm data.
2. **Seed inspection and seed system development:** Registers seed growers, seed sellers, and conducts field inspections.
3. **Seed testing:** Highly decentralized, with one national and seven regional labs as well as four private-sector labs, audited annually; 150 licensed inspectors from the private sector and NGOs who receive two-week training and are monitored through random visits and bi-weekly reports.

For variety testing and release, both DUS and VCU tests are required by the SCCI. The variety release process is overseen by a committee consisting of members of SCCI, the Zambia Seed Trade Association, Zambia National Farmers Union, Department of Agriculture, ZARI, and the University of Zambia. Public sector research institutes (ZARI, University of Zambia, Cotton Development Trust, Golden Valley Agricultural Research Trust and private agribusinesses (SeedCo, Pannar, Zamseed, Monsanto, Pioneer, Premier, Kamano, Syngenta MRI, etc.) are involved in applying for variety releases.

Phytosanitary measures are overseen by the Plant Quarantine and Phytosanitary Services department within ZARI. Inspectors at the border clear imported seed, with ZARI issuing a phytosanitary certificate for all exports.

PROGRAMS AND NGOS

SHARE Africa

SHARE Africa's objective is to reduce poverty by sharing knowledge, experience, and materials in the spirit of the New Testament. Its outgrower program, which started in 2011, for peanut butter production, provided free seeds to outgrowers, collected commercial seed produced by those farmers, and the bought excess grain they produced to sell on tender. SHARE Africa is forecasting production of 27 MT of commercial groundnut seed in 2016.

PROFIT+

PROFIT+ is one of the key mechanisms working in program areas related to USAID Zambia's Feed the Future initiative. Focusing on maize, soybean, sunflower, groundnut, tomato, and onion in the Eastern Province corridor, PROFIT+ aims to improve smallholder farmer productivity, expand markets and trade, and increase private sector investment. Its main program components include identifying and disseminating improved productivity technologies, developing value-chain finance schemes, developing export strategies for value chains, and improving the capacity and governance of cooperatives to improve market linkages for high-value processing. PROFIT+ is targeting 200,000 smallholder farmers in four districts in eastern Zambia with an entry point in cooperatives, producer associations, and community groups (FtF Impact Evaluation of Groundnut Value Chain in Zambia).

Right to Seed (Self Help Africa)

Self Help Africa is an international development agency working to eradicate hunger and poverty in Africa. The organization works with smallholder farmers, helping rural communities to produce more food, access markets, and earn a living from enterprise development. Self Help Africa has been working for nearly 30 years in Ethiopia, Kenya, Malawi, Uganda, Zambia, Burkina Faso, Togo, and Ghana. Self Help loans basic seed sourced from ZARI to farmer groups and cooperatives to produce QDS groundnut and common bean seed which is then sold to farmers, and the loan is paid back to Self Help. In the 2014/2015 season 17,000 Kg of groundnut and 30,600 Kg of common bean QDS was produced under Self Help Africa's program in Zambia.

Community Markets for Conservation (COMACO)

COMACO is a novel, emerging company in Zambia that is pioneering an innovative way for making markets and conservation work together. It was established in 2003 by the Wildlife Conservation Society as a commodity trading and processing company working directly with smallholder farmers. To date, COMACO has built seven trading centers and has registered 36,000 farmers as members. It produces IT'S WILD! a special brand of organic, value-added processed products.

The COMACO business model starts with the offer to pay its farmer members a premium for their produce of up to 20% above standard market rates if they comply with a "conservation

pledge" listing practices the farmer is asked to follow. This premium, paid when conservation compliance is verified, adds substantially to household income, incentivizing sustainable production and commitment to wildlife and ecosystem conservation.

If communities demonstrate continued efforts to manage land and resources responsibly, such as the development and enforcement of a Community Conservation Plan and Community Conservation Areas, COMACO rewards farmers with additional market opportunities and incentives. These include investments in infrastructure or having access to new markets, such as developing projects to establish carbon reduction incentives to reward forest preservation and wildlife protection through anti-poaching incentives.

COMACO is the lead implementing partner of Better Life Alliance (BLA) which is a public-private partnership between USAID, OAM International, Wildlife Conservation Society, General Mills, and the Royal Norwegian Embassy. BLA's goal is to increase sustainable, market-led growth resulting in improved food and income security for 40,000 households. BLA provides inputs, farmer training, value-added processing, and access to national and international markets. By the end of the BLA project, it is expected that COMACO will be self-financing from sales and a stand-alone company independent from the Wildlife Conservation Society (Feed the Future Baseline report: Impact evaluation of gender and groundnut value chains in Zambia).

Alliance for a Green Revolution in Africa (AGRA)

AGRA works across 18 countries focused on distinct problems related to seed production, soil health, and agriculture markets. AGRA has worked with partners in the public and private sector, and the alliance has reached out to 17 million family farmers and thousands of local African-owned agriculture businesses.

In 2014, AGRA's activities in Zambia included research capacity building, research and development, input production and distribution; awareness creation on agriculture transformation; adoption; and production, postharvest and marketing. To date AGRA has worked directly with four seed companies in Zambia, deploying grants to support seed production and marketing activities.

PRIVATE SECTOR OVERVIEW

Private seed companies

The private sector consists of Zambian seed companies focusing on a mix of maize, vegetables, legumes, and cereals and international companies mainly focused on hybrid maize. Table 6 highlights the private seed companies active in Zambia.

Zambian private seed producers typically lack of working capital and struggle with outdated facilities in need of repair. International seed companies, on the other hand, have invested in seed production and processing infrastructure in Zambia which not only serve Zambia markets but also are utilized as a production base for neighboring countries in which they operate.

Zambia has a history of original genetic research and certified seed production. Extensive seed research was once carried out by the public sector (ZARI and its predecessors) and the seed produced was marketed through the now privatized parastatal company, Zamseed. The company later began development of its own new varieties of hybrid maize and other crops.

This made Zambia a leader in African seed technology. Zamseed continues today as a private company and is one of just five companies in Zambia (along with Zambia's MRI Seed now owned by Syngenta) that is capable of developing new types of germplasm. The other three are Pannar Seed in South Africa, SeedCo from Zimbabwe, and Monsanto.

Another private company active in the country is Syngenta/MRI, which is exporting maize hybrid seed to Zimbabwe, Malawi, and Mozambique and also has registration trials in Tanzania and Kenya. Kamano Seeds is a notable private company active in small grain cereals, OPV maize, and legume seeds in Zambia. It is dependent on the government's Farmer Input Support Program and sells about 4,000 MT through this program. In addition, Kamano exports to Angola and Malawi.

Table 6: **Key private seed companies.**

Company	Country of origin	Crop focus	Maize seed estimated market share	Key activities and challenges in Zambia
Zamseed	Zambia	Maize, legumes, vegetables	9%	• First seed company in the country established in the early 1980s; privatized from being a parastatal in the early 1990s to a private company • Has production capabilities; short on working capital, and facilities are outdated and need repair
Kamano	Zambia	Small grain cereals, legumes, maize	1%	• Has a processing plant and does tool processing for other small companies; short on working capital
DuPont/Dow Pioneer-Pannar	U.S.	Maize	15%	• Using as production base for other DuPont companies • Potential interest in soybean
Monsanto-Dekalb	U.S.	Maize	1%	• Using as production base for other Monsanto Africa companies
Syngenta/ MRI- China	China	Maize	27%	• Using as major breeding site for maize and production export to other Syngenta companies
Seed Co	Zimbabwe	Maize, other crops	38%	• State of the art production and processing facilities for export to other Seed Co companies.

Source: Research team analysis (2016).

Cooperatives and farmer groups

The MAL estimated in its investment plan that there are as many as 3.5 million members of agricultural cooperatives—known as Primary Cooperative Societies—that help members access subsidized inputs and mobilize crop marketing through depots and collection points. However, the ministry also recognizes that these cooperatives have not functioned effectively because of the dominance of a small number of elite groups, low level of commitment among members-at-

large, suboptimal pricing for services and products, and a general lack of business understanding among members. According to USAID, farmer groups and farmer aggregation are common in Zambia but not well-structured. There is limited coordination and information exchange among the multiple community-based contract growers and seed producers. Furthermore, these groups have insufficient access to foundation seed, uncoordinated marketing efforts, and a low level of technical backstopping.

Agro-dealers

Agro-dealers in Zambia fall into two main groups: *Boma* agro-dealers located in commercial centers along highways and *Rural* agro-dealers that are often small enterprises with limited business capacity and access to capital. Both groups tend to focus their activities on maize and vegetable seed, fertilizer, and crop protection (Fawley-King et al., 2010). Interviews suggest an interest from agro-dealers to more actively participate in groundnut and common bean seed sales, but the lack of supply and inconsistent quality has led them to only opportunistically sell seed when it is available. As a result, smallholder farmers have limited access to improved varieties of seed other than maize and mainly obtain their seed through informal means of saving seed and trading with neighboring farmers.

NATIONAL SEED SYSTEM STRATEGY

Table 7 depicts the broad focus areas within NAIP, which includes two seed-specific activities focused on the adoption of improved varieties and seed delivery systems. Historically, almost 60% of Zambia's agriculture expenditures have been channeled into these two activities, which are:

1. **Farmer Input Support Program (FISP)** provides incentives for adoption of improved varieties. Historically, this program distributed fertilizer for maize production through district-level government authorities to members of farmer cooperatives. However, the program had a dismal track record of delivering inputs on time, according to the World Bank. A restructuring of FISP that began in 2015 is intended to focus on reaching more smallholder farmers and a diverse set of crops beyond maize with the aim to support 300,000 smallholder farmers under an e-voucher system that is value-based, rather than input-based. This change is meant to give farmers flexibility in their choice of inputs, including for crops other than maize as well as livestock and fisheries.
2. **Good Agricultural Practices (GAP)** training introduces farmers in agronomic best practices, including usage of improved planting material in cereals, legumes, oil seeds, tubers, and horticulture. This training addresses the challenges of low levels of improved input adoption, poor response to fertilizer due to soil acidity, and low adoption rates of conservation agriculture. To address low adoption of improved seed and limited funding for agricultural research, there are plans to train 10,000 smallholder farmers in seed multiplication of various crops in an effort to increase the adoption of improved seed.

Additionally, NAIP outlines alternative financing programs to enhance service delivery systems, to ensure adequate funding of research and extension, as well as seed-specific activities focused on enhancing seed extension, seed testing, variety testing, registration, and protection.

Table 7: **Government focus areas in NAIP.**

	NAIP	FOCUS AREAS
INTERRELATED PROGRAMS	**Sustainable natural resources management**	• Land-use planning, administration, and management • Ensure efficient water use and irrigation • Forestry management • Energy efficiency promotion • Capture fisheries management
	Agricultural production and productivity improvement	• Livestock • **Crops: "To increase sustainable crop production, productivity, and value addition for a diversified range of competitive crops apart from maize"** • Aquaculture
	Market access and services development	• Institutional market arrangements and performance • Increasing access to rural and market infrastructure • Increasing access to rural finance • Promote value chain integration
	Food and nutrition security and disaster risk management	• Food security • Nutrition security • Disaster risk management and mitigation
SUPPORT SERVICES	**Knowledge support systems**	• **Research** • **Seed** • **Extension**
	Institutional development	• Policy dialogue • Planning, M&E • Financial management and procurement • Human resources management

Source: NAIP (2014).

CHAPTER 2: CURRENT SITUATION – PRIORITY CROPS FOR EGS STUDY

2.1 SELECTING CROPS TO BE STUDIED

The selected crops for in-depth EGS system analysis were identified during a consultative process with BFS, USAID Zambia, and key seed system stakeholders in Zambia. Prior to kicking off field research activities, the field research team facilitated a crop selection meeting in Zambia with 15 stakeholders from the public, private, NGO, and donor sectors. In advance of the meeting, the field research team developed a matrix of key indicators crossed with ratings definitions as the basis for discussions (see table 8 depicts). These indicators created a framework to select crops that would have the largest impact on smallholder farmers and specifically women. The field research team first identified the top ten crops by area and rated them based on current production and their ten-year historical compound annual growth rate to illuminate the potential growth prospects for the crop. The team then performed desk research to categorize the importance of the crop with respect to food security based on how many households grow the top crops and the percent of production used for household consumption. Next, the team assessed the importance of the crop to females based on participation in production as well as the importance of the crop to smallholder farmers based on percentage of smallholder farmers growing the crop. During the crop selection meeting, stakeholders agreed that groundnut and common bean should be selected for study due to their smallholder farmer and food security importance.

To ensure that the EGS study encompassed both the formal and informal seed systems as well as the broader crop value chain, the field research team targeted a comprehensive set of stakeholders to be interviewed. Over thirty stakeholders were interviewed representing public, private, NGOs, and donor actors. Public sector interviews included breeders from ZARI and certification and inspection personnel from SCCI. Private sector interviews included local and regional seed companies, commodity traders, associations, and agro-dealers. Seed producers including outgrowers and farmers representing farmer groups and cooperatives were interviewed who play a critical role in seed production and distribution in the formal and informal seed sectors. The field team also conducted interviews with several development groups and NGOs working specifically with seed growers, extension services, commodity traders, private seed companies, and smallholder farmers.

Table 8: **Crop selection framework.**

KEY INDICATORS	RATINGS DEFINITIONS				
	●	◕	◑	◔	○
AREA	Largest crop area	Second and third largest crop area	Fourth and fifth largest crop area	Sixth and seventh largest crop area	Eighth, ninth and tenth, etc. largest crop area
PRODUCTION	Largest production volume	Second and third largest production volume	Fourth and fifth largest production volume	Sixth and seventh largest production volume	Eighth, ninth and tenth, etc. largest production volume
PRODUCTION GROWTH	>20% 10-year CAGR	10%-20% 10-year CAGR	5%-9.9% 10-year CAGR	0%-4.9% 10-year CAGR	<0% 10-year CAGR
FOOD SECURITY FOCUS	High		Medium		Low
GOVERNMENT STRATEGIC PRIORITY	Priority seed system and crop		Priority crop		No priority
KEY STAKEHOLDER PRIORITY	Priority seed system and crop		Priority crop		No priority
GENDER ROLES	Primarily grown by females		Grown by females and males		Primarily grown by males
SMALLHOLDER FARMER IMPORTANCE	High		Medium		Low

CAGR=Compound Annual Growth Rate

Source: Research team analysis (2016).

2.2 SELECTED CROPS

As a result of this process (details of which are highlighted in Table 9), two crops were selected for the analysis: groundnut and common bean. Following is a summary of the key reasons why each crop was selected for this EGS systems study.

Groundnut

Groundnut represents Zambia's largest legume crop by area and is a key crop for smallholder farmers, particularly women. However, groundnut has generally been neglected by the private sector seed industry, and as a result, there is limited availability or usage of improved seeds and yields have remained low. In order to capitalize on an opportunity to increase exports and high-value processing of groundnut, there is also a critical need to address the aflatoxin issue.

Common bean

As a key food security and nutrition crop in Zambia, common bean is important to smallholder farmers, especially women. While soybean was considered a potential priority crop as well, common bean was selected as a higher priority due to the fact that it has been neglected by the private sector and in need of support to improve yields. In contrast, soybean already has private sector interest and is of less importance to smallholder farmers and household consumption.

Subsequent chapters in this study will focus on the two selected crops.

Table 9: **Priority crop selection results in Zambia.**

KEY INDICATORS / TOP CROPS BY AREA	AREA	PRODUCTION	PRODUCTION GROWTH	FOOD SECURITY FOCUS	GOVERNMENT STRATEGIC PRIORITY	KEY STAKE-HOLDER PRIORITY	GENDER ROLES	SAMLLHOLDER FARMER IMPORTANCE	Comments[3]
MAIZE	●	●	◕	●	●	◔	○	◕	Lead crop for germplasm and seed system investment
CASSAVA	◕	◕	○	◑	○	◕	◑	◑	Lower priority focus for government-led investment
GROUNDNUT	◕	◕	◕	◕	◑	●	●	●	Significant improvements needed in yield and aflatoxin control; lack of EGS supply
COTTON	◑	◔	○	○	○	○	○	◔	No food security role, export-oriented crop
SOYBEAN	◑	◑	◕	◑	◑	◑	◔	○	Significant private sector investment; of three key legume crops, lowest government priority
COMMON BEAN	◔	○	◑	●	◕	●	●	◕	Critical for food security and SHFs; value add opportunities economically and nutritionally
SUNFLOWER	◔	○	◕	◔	◔	◔	○	○	Minor crop, limited breeding
MILLET	○	○	◔	◔	○	○	○	○	Minor crop, limited breeding
SWEET POTATO	○	◔	◑	◔	○	○	○	○	Minor crop, limited breeding
WHEAT	○	◑	◑	◔	◔	○	○	○	Minor crop, limited breeding

Low ○ ◔ ◑ ◕ ● High

Source: Research team analysis based on consultation with key stakeholders (2016).

CHAPTER 3: CURRENT SITUATION – EGS SYSTEMS

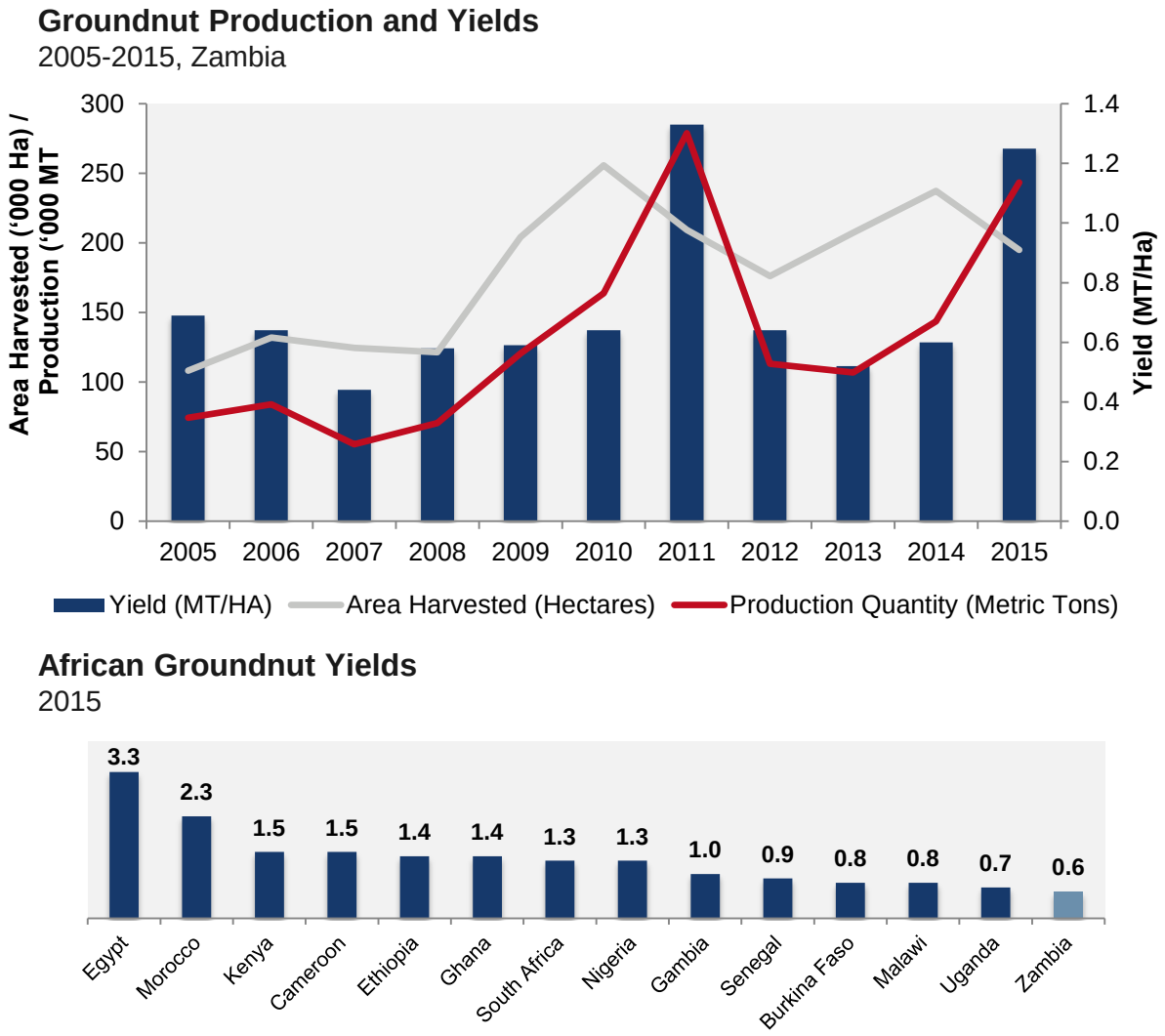
3.1 GROUNDNUT

SUPPLY

As a uniquely versatile source of protein, groundnut is the most important legume in Zambia; it is consumed as a snack, as peanut butter, as a powder mixed with a variety of vegetables or crops to make traditional dishes, and as an excellent source of cooking oil. Its versatility extends beyond consumption, as it helps improve soil fertility by fixing nitrogen, and its straws are commonly used as animal feed. As a cash crop, groundnut gives relatively high returns for limited land area.

In the 1960s, Zambia was a key supplier of confectionery groundnut on the world market, as its Chalimbana variety was favored by consumers. However, Zambia's parastatal marketing company was dismantled when it became a costly burden on producers, and its seed breeding program collapsed. At the same time, South Africa's marketing efforts increased, and tastes began turning toward the smaller confectionery nuts produced there. Compounding this shift away from Zambia were concerns about aflatoxin due to low-quality inputs and poor agronomic practices. This situation continued to the present moment, as groundnuts in Zambia are produced almost entirely by smallholder famers with limited access to quality inputs and insufficient safeguards against aflatoxin. Figure 21 illustrates that Zambia's groundnut sector suffers due to lack of improved seed and minimal input usage, with yields currently well below regional averages. Production and yields have been relatively flat for the last ten years, however government data suggests there were production spikes in 2011 and 2015. While this could be due to favorable weather conditions, it is not exactly clear what drove these production increases.

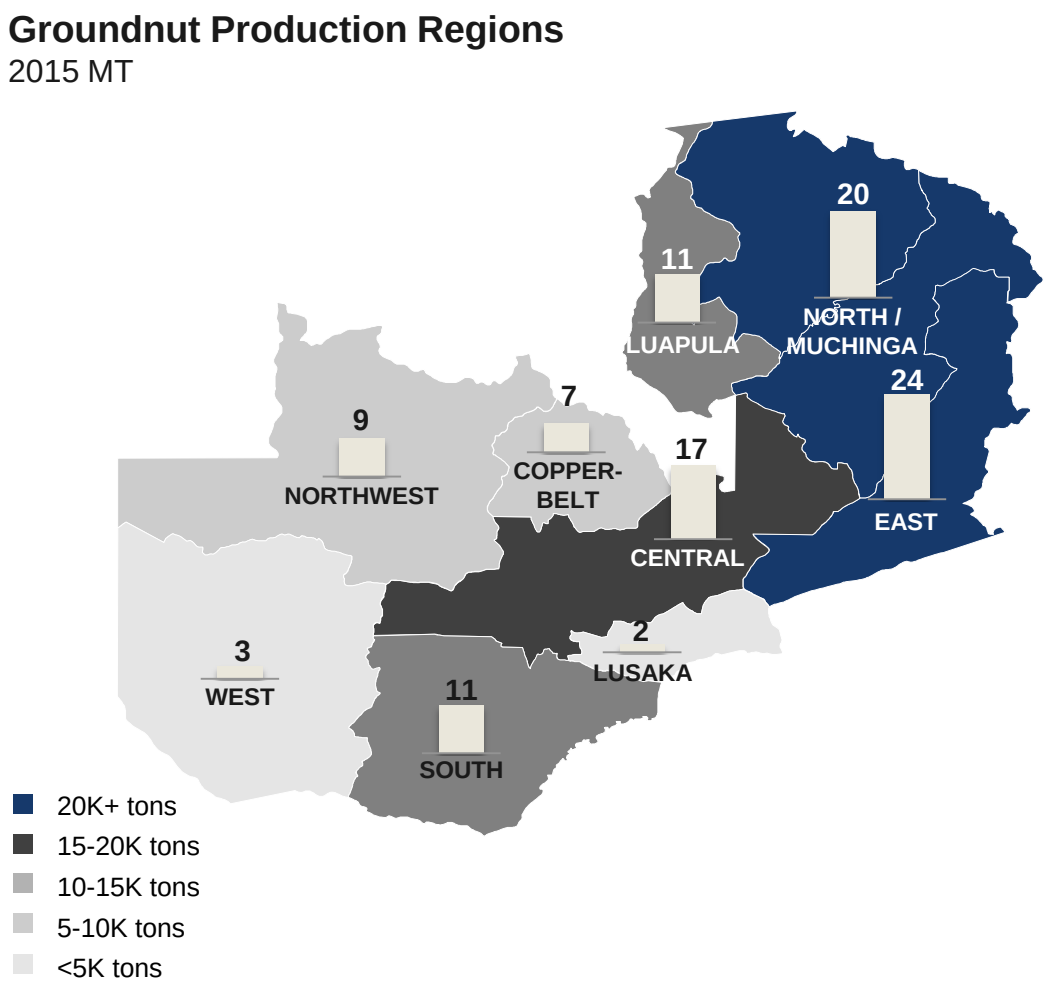
Figure 21: **Groundnut area, production, and yield.**



Source: Zambia Country Stat (2016), FAO Stat (2016).

Groundnut is mainly grown in Zambia's Northern and Eastern provinces due to the relatively higher levels of rainfall and coarse-textured and sandy loam soils, as illustrated in Figure 22. Although these provinces represent key groundnut production zones, their yields are not higher than national averages due to lack of improved input usage by the smallholder farmers dominating the region. The Eastern province is one of the poorest in the country, with poverty incidence of 79% and child malnutrition levels of 56% (versus the 45% national average).

Figure 22: **Groundnut production by province, 2015.**



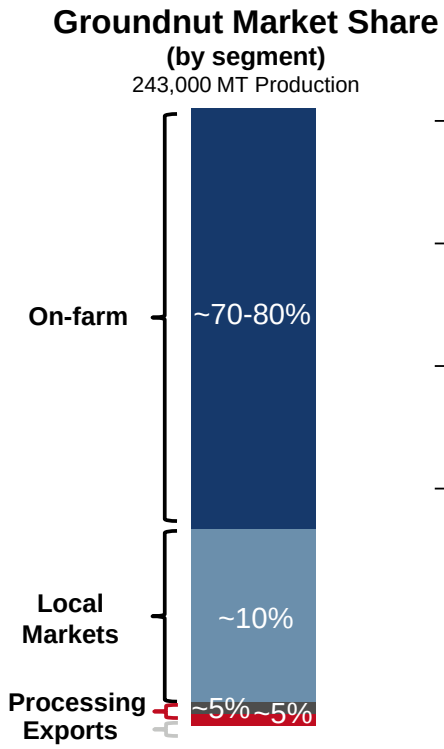
Source: Zambia Country Stat (2016).

DEMAND

The majority of groundnut is consumed on-farm as an important nutritional component of the traditional Zambian diet, as can be observed in Figure 23's illustration of groundnut demand segments. If farmers have excess production from harvests after providing for their household consumption needs, they sell to small traders and associations who then sell to local markets and restaurants. Processors, which represent a modest portion of demand, prefer high oleic acid to linoleic acid ratio and oil content for peanut butter production. They typically use outgrower models that provide inputs to growers and then buy production back at a set price through agreements (not necessarily a formal contract).

Processors for both domestic and export markets are extremely sensitive to aflatoxin concerns with groundnut sourcing. The potential for reinvigorated exports is strong, but only if standards can be established to ensure reliable aflatoxin control systems. Small volume informal exports continue, primarily to the DRC.

Figure 23: **Comparison of groundnut demand segments.**



	Segment Description	Segment Needs
On-farm consumption	• Estimated to be at least 80% for on-farm consumption and farmer-saved seed	• Confectionery, not too oily • Less labor needs for harvesting (digging requirements) • Disease and drought tolerance • Yield
Local markets	• Local shop owners who buy groundnut to be sold to farmers who do not save seed, as well as households that do not grow groundnut	• Confectionery, not too oily
Processors	• Key processors include COMACO, EPFC, and RABS (processor from Malawi) • Processors have outgrower model that provide inputs to growers	• While no specific preferences is communicated to growers, high O/L ratio and oil content preferred for peanut butter production • Low levels of aflatoxin
Exports	• Formal groundnut exports to South Africa stopped ten years ago due to aflatoxin levels • Small informal exports continue as traders buy groundnut and then transport to copper belt for miners in DRC (1/2 of exports) • Balance of exports go to Tanzania	• Durable shells that don't crack in transport • Low levels of aflatoxin • Confectionery, not too oily

Source: Mofya-Mukuka et al, Ross et al, and expert analysis.

IMPROVED VARIETIES

There are 17 disseminated groundnut improved varieties in Zambia. The two main varieties - Chalimbana and MGV 4 - are highly diverse in terms of yield potential, maturity day, % oil, and oleic acid to linoleic acid ratio. A list of the varieties available in Zambia, along with some information about each is presented in Table 10. MCV 5, which ZARI released in 2008, has the potential to be adopted by more growers, but the research teams' interviews revealed that farmers are not aware of its benefits. While interviews and secondary research confirmed that Chalimbana and MGV 4 are the most popular groundnut varieties grown in Zambia, more specific market share data does not exist.

Five varieties were released in 2015 and it is unlikely they have been adopted by a significant number of farmers to date. Farmers tend to continue using varieties they have had the most experience with, rather than adopting improved varieties that might better address their needs. MGV 4, for example, is the best recognized and is commonly saved by farmers through recycling of seed. It is, however, not a good variety for cooking due to high oil content. To date, breeding efforts have focused on yield, quality, and disease resistance with no real efforts to breed varieties with processing qualities (e.g., high oil content).

Table 10: **Key groundnut varieties.**

Variety name	Botanical group	Maturity day	Yield *MT/Ha*	Color	Year of release	Other characteristics
Chalimbana	Virginia	140-160	0.8-1.5	Tan	1964	45-48% oil, O/L ratio* 1.6, confectionery
Makulu	Virginia	130-145	2.0-2.5	Red	1963	48-50% oil, O/L ratio <1.0, oil
Natal Common	Spanish	90-100	0.5-1.5	Tan	1954	45-48% oil, no seed dormancy
MGS-2	Virginia	140-150	1.5-2.5	Tan	1988	45-48% oil, confectionery
MGV 4	Virginia	120-140	1.5-2.5	Red	1991	48-50% oil, O/L ratio 2.1, confectionery, oil
Chipego	Spanish	110-120	1.0-1.5	Tan	1995	48% oil, no seed dormancy, confectionery
Champion	Virginia	150-160	2.5-3.0	Pink	1998	48-50% oil, confectionery, oil
Comet	Spanish	90-100	1.0-2.0	Tan	1984	45-48% oil, no seed dormancy
Luena	Spanish	90-100	1.0-2.0	Tan	1998	48% oil, O/L ratio 1.1, confectionery, no seed dormancy
Chishango	Virginia	120-130	2.0-2.5	Tan	2003	47% oil, O/L ratio 1.5, confectionery
Katete	Spanish	90-100	1.0-1.5	Tan	2005	
MGV 5	Virginia	120-130	2.5-3.0	Tan	2008	48% oil, O/L ratio 1.5, confectionery
MGV 6	Virginia	Medium	High		2015	Rust tolerant
MGV 7	Virginia	Medium	High	Red	2015	Rosette resistant, large seed size
Wazitatu	Valencia		High	Red	2015	3-4 seeded, early leaf spot tolerant, small seed size
Lupande	Spanish	Early			2015	Medium seed size, high kernel, haulm weight
Wamusanga	Spanish	Very early	High	Tan	2015	

MOST POPULAR VARIETIES

**O/L ratio= Oleic to Linoleic ratio*

Source: Field research team interviews (2016).

As depicted in Figure 24, farmers perceive seed as a high-cost input relative to their low level of farm income. The higher costs for certified seed production are driven by both inspection costs as well as higher levels of input usage (fertilizer and pesticides) to maximize yield. Despite being aware of improved varieties, farmers feel they can't afford improved seed and don't see the value generated from investing in improved varieties. As a result, most of the area is planted with farmer-saved seed.

An issue that further exacerbates farmers' concern about high costs of certified improved varieties is that seed is often sold in packages that are too large (2.0 kg and above) (Tripp, 2006). Smallholder farmers prefer small packs (0.5 kg-1.0 kg which are not commonly available.

The recycling of seed by farmers is a key reason for the low groundnut yields in Zambia. While robust data is limited, a Program Officer for the NGO Program Against Malnutrition, which works with more than 100 farmer groups, estimates that yield reduction can reach up to 50% by the third year that farmers save seed, which is significant considering that farmers on average save seed for at least five years. Each year the seed is recycled, genetic purity, performance, and germination decreases, which reduces yield. It is critical that the research and extension services focus on demonstrating this to farmers through village-level field trials.

Figure 24: **Formal versus informal variable cost basis – groundnut.**[1]

Formal vs. Informal Market on Variable Cost Basis Example: Groundnut ***MGV5***

Formal Market Cost/Ha **Certified Seed Production Costs**		**Informal Market Cost/Ha** **Informal Seed Production Costs**		**Informal Market Cost/Ha** **Saved Seed Production Costs**	
Seed Cost (Basic)	$300	Purchase Open Market	$150	Recycled Seed	$0
Fertilizer	$250	Fertilizer	$190	Fertilizer	$130
Pesticide	$88	Pesticide	$48	Pesticide	$25
Planting & harvesting	$664	Planting & harvesting	$510	Planting & harvesting	$210
Labor general	$400	Labor general	$308	Labor general	$208
Transportation	$20	Transportation	$20	Transportation	$0
Inspection/lab/ germination fees	$45	Inspection/lab/ germination fee	$10	No Inspection	$0
Other variables	$500	Other variables	$415	Other variables	$175
Total Variable Cost	**$2,267**		**$1,651**		**$748**
Estimated Yield Kg/Ha	*1,500*		*1,350*		*1,270*
Estimated Cost USD/Kg	**$1.51**		**$1.22**		**$0.58**

Perceived Cost Difference = ~3x

Source: Research team analysis (2016).

3.2 COMMON BEAN

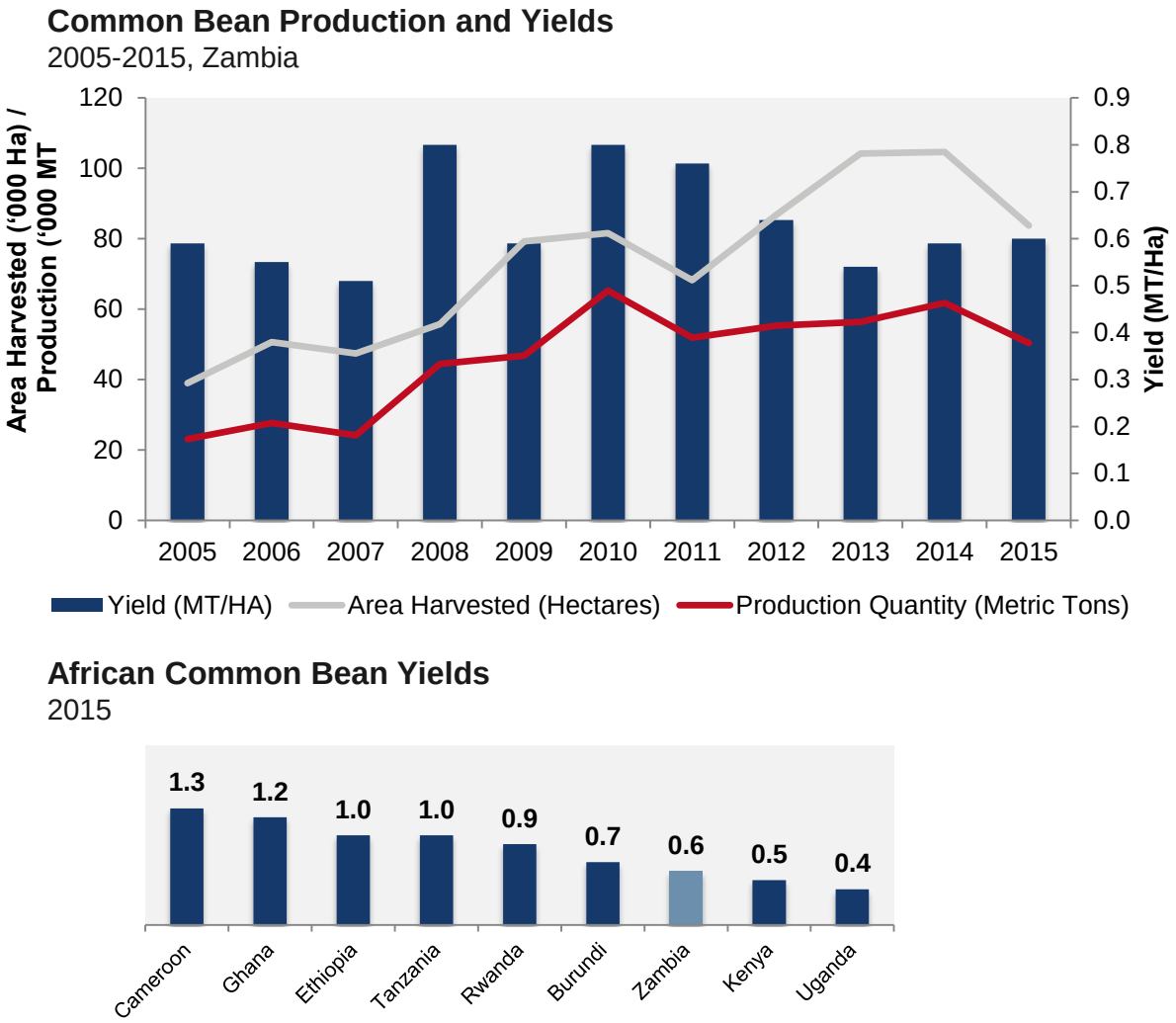
SUPPLY

Common bean (*Phaseolus vulgaris)* is Zambia's third-most important legume crop in terms of area and production but is considered the second-most important food security crop behind maize, as it is consumed by the majority of the population in many forms including the pod, the green seed, and the mature dried bean. It is especially critical for smallholder farmers in the north. Biofortified common bean varieties have not been a focus for the HarvestPlus program in Zambia, despite the fact that there have been efforts to introduce biofortified maize in Zambia to mixed results due to a lack of market demand and poor yield performance. Almost all common bean production focuses on bush bean, with improved varieties having a yield potential of 1-2 MT/Ha.

[1] Labor costs are estimated to be higher in the formal production system because labor is assumed to be hired while in the informal sector, it is assumed less labor would be hired and fewer operations conducted (e.g., one plowing rather than two). For the farmer saved seed calculation, no labor costs were assumed because in interviews with farmers, they consistently mentioned that they do not count their own labor as a cost. While there is clearly a cost to time, the purpose of this calculation was to show how the farmer perceives the cost of seed.

As seen in Figure 25, production has remained relatively flat in Zambia, as potential yield gains have been inhibited by limited adoption of improved varieties, soil infertility, abiotic stress, and lack of best-in-class agronomic practices. As a result, common bean yields in Zambia are well below most of its neighboring countries.

Figure 25: Common bean area, production, and yield.

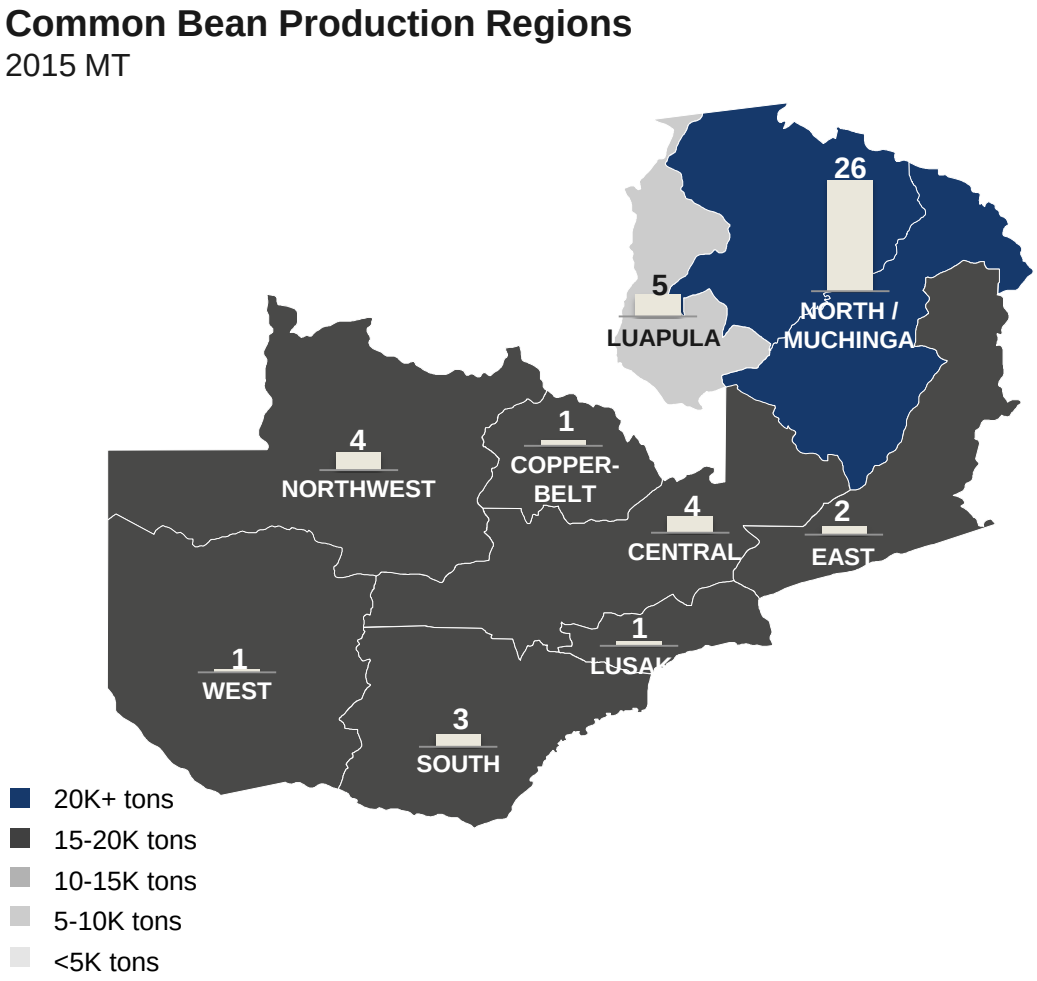


Source: Zambia Country Stat (viewed in 2016), FAO STAT (viewed in 2016).

Figure 26 shows the geographic distribution of common bean production within Zambia, where the Northern and Muchinga provinces account for more than 60% of production, mainly by smallholder farmers. While only 16% of smallholder farmers grow common bean nationally, Northern and Muchinga smallholder farmer share is 54% and 36%, respectively. Nonetheless, yields in these provinces are not on par with national averages, due to the issues outlined earlier. In the north of Zambia, where there is a long rainy season, farmers sometimes plant three crops in a season, although two is more common. The first is intercropped with maize, groundnuts, or cassava; the second is planted between January and March on free draining

soils; and the third is planted in the dry season where it can either draw on residual moisture or be irrigated.

Figure 26: **Common bean production by province, 2015.**

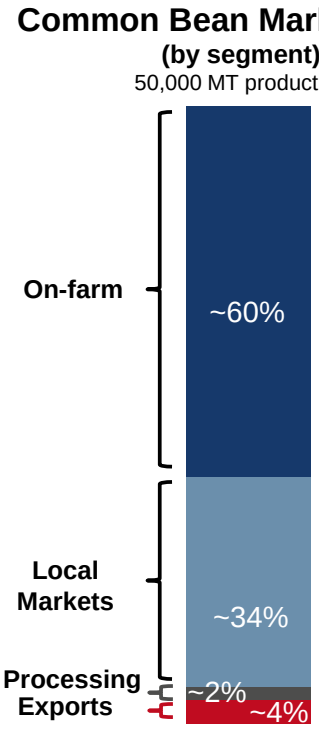


Source: Zambia Country Stat (2016).

DEMAND

Common bean is an important staple food crop in Zambia and is primarily grown for on-farm consumption and also as a source of revenue through sale in local markets. According to various estimates, on-farm consumption accounts for around 60% of demand, with around 35% going to local markets and a very small proportion for commercial processing or export, as depicted in Figure 27.

Figure 27: **Comparison of common bean demand segments.**



	Segment Description	Segment Needs
On-farm consumption	• Majority of common bean used for on-farm consumption, which also includes farm-saved seed	• Yield, disease resistance, drought tolerance, reliability • Fast cooking, speckled and purple, large grain, dwarf /semi-dwarf
Local markets	• Common bean sold in local markets usually dried (~90%) with the remaining being fresh pods • Farmers typically sell directly, bypassing intermediaries	• Grading system rarely used • Sorted common bean generally higher priced than mixed • Type, color, and size are not specified
Processors	• Very small formal processing industry; there is a canning processor in Zambia	• Varieties ideal for baked common bean, relishes, and WFP
Exports	• While Zambia a net importer, a small volume of common bean are exported to DRC to feed copper miners as well as Tanzania, Angola, Botswana, and South Africa • Key importers include Tanzania and Malawi	• Color and taste preferences based on traders serving specific export market countries

Source: Birachi et al (2012), Chemonics (2009), and expert analysis (2016).

There is a very small formal processing industry which prefers varieties that are ideal for baked common bean and relishes. Less than 2% of production is processed, and processing is unlikely to play a significant role in the future unless a canning industry is developed, as in Kenya.

Zambia is a net exporter of common bean, with small volumes of informal imports primarily from Tanzania and informal exports to feed copper miners in the DRC. Color and taste preferences for the export market vary by destinations and generally do not command significant price premiums.

ADOPTION OF IMPROVED VARIETIES

ZARI's common bean breeding program has focused on yield, cooking time, quality, disease tolerance, and drought and flood tolerance. Some of the most prominent improved varieties include Kabulangeti (which was released in 2007 and sourced from Tanzania), Mbala mixture (consisting of white and yellow beans), Lusaka (a yellow bean that also has a local varietal version), Solwezi (which is red and mottled), and Lundazi (a red bean), as shown in Table 11. Specific varietal market share data was not available.

Despite the availability of these newer, improved varieties, they have not been widely adopted by farmers, who prefer to grow varieties they are familiar with. Hundreds of common bean varieties, most landrace, are grown in Zambia. While newer varieties offer disease resistance and yield potential of 2.5 MT/Ha, most farmers continue to plant varieties that are susceptible to disease and have yields in the range of 0.3-0.5 MT/Ha. Nonetheless, smallholder farmers prefer

them for their taste and color, as well as the lower cost of sourcing local varieties from neighboring farmers rather than paying for certified seed. A recent study on the adoption of improved common bean varieties in over 400 households in the Northern and Muchinga provinces concluded that while more than 70% of households surveyed were aware of at least one improved variety, only 42% had ever grown an improved variety. Of those that never grew an improved variety, 73% said that lack of availability was the reason. A lack of cash to buy the seed was the second most-cited reason (International Center for Tropical Agriculture, ZARI, Michigan State University, 2014).

Table 11: **Key common bean varieties.**

Variety Name	Year of Release	Title Holder / Agent
Mexican 142	Not available	Zambia Seed Co.
Boroti	1970	Zambia Seed Co.
Misamfu Stringless	1973	Zambia Seed Co.
Misamfu Speckled Sugar	1979	Zambia Seed Co.
Contender	1984	Zambia Seed Co.
Carioca	1984	Zambia Seed Co.
Bat 331	1984	Zambia Seed Co.
NEP 2	1984	Zambia Seed Co.
Top Crop	1984	Zambia Seed Co.
Glamis	1984	Zambia Seed Co.
Chambeshi (A 197)	1998	Zambia Seed Co.
Lyambai	1999	Zambia Seed Co.
Lukupa	1999	Zambia Seed Co.
Kalungu	2004	ZARI
Bounty	2004	SeedCo International (Z)
PAN 148	2006	Pannar Seeds (Z)
Kabulangeti	2007	ZARI
Kapisha	2007	ZARI
Kabale	2007	ZARI
Cardinal	2007	Progeny Seeds
Speckled Ice	2007	Progeny Seeds
PAN 116	2008	Pannar Seeds (Z)
PAN 128	2008	Pannar Seeds (Z)
PAN 185	2009	Pannar Seeds (Z)
Luangeni	2009	ZARI
PAN 123	2010	Pannar Seeds (Z)
Kalambo	2011	ZARI
Sadzu (Climber)	2011	ZARI
Mbereshi	2012	ZARI
Lungwebungu	2014	ZARI
Lunga	2014	ZARI
Kware	2015	Klein Karoo Seed

MOST POPULAR VARIETIES

Source: SCCI (2013).

As previously mentioned with groundnut, adoption of improved common bean varieties through the formal system is constrained by the high perceived cost relative to saving seed (Figure 28). While this is more pronounced in groundnut, with three times the cost differential between certified seed and farmer-saved seed, common bean is also quite high with estimations reaching two times the cost of saved seed.

Figure 28: **Formal versus informal variable cost basis – common bean.[2]**

Formal vs. Informal Market on Variable Cost Basis Example: Common bean ***Kabulangeti***

Formal Market Cost/Ha Certified Seed Production Costs		**Informal Market Cost/Ha Informal Seed Production Costs**		**Informal Market Cost/Ha Saved Seed Production Costs**	
Basic Seed Cost	$160	Purchase Open Market	$87	Recycled Seed	$0
Fertilizer	$204	Fertilizer	$150	Fertilizer	$130
Pesticide	$48	Pesticide	$48	Pesticide	$24
Planting & harvesting	$210	Planting & harvesting	$190	Planting & harvesting	$150
Labor general	$95	Labor general	$65	Labor general	$30
Transportation	$55	Same	$55	On-farm	$0
Inspection/germinations	$45	No inspection/germinations	$10	No inspection/germinations	$0
Other variables	$74	Other variables	$55	Other variables	$37
Total Variable Cost	**$891**		**$660**		**$371**
Estimated Yield 1,500 Kg/Ha		**Estimate Yield 1,350 Kg/Ha**		**Estimate Yield 1,275 Kg/Ha**	
Estimated Cost USD/Kg	**$.60**	**Estimate Cost/Kg**	**$.48**	**Estimate Cost/Kg**	**$.34**

Perceived Cost Difference = ~2x

Source: Research team analysis (2016).

3.3 GROUNDNUT AND COMMON BEAN SEED SYSTEMS

STRUCTURE OF EGS VALUE CHAIN

The groundnut and common bean EGS seed systems are quite similar in terms of steps of the formal and informal systems, key actors, supply bottlenecks, and demand constraints. It is estimated that 4% of the groundnut planted area is supported by the formal seed system, while estimates are closer to 3% for common bean.

Within the groundnut and common bean informal markets, experts estimate 10% of the total planted area is under a QDS system, with the balance being a combination of farmer-saved seed, farmer to farmer exchanges, and trader to farmer transactions. Interviews with key stakeholders across the seed value chain, including cooperatives, farmer groups, agro-dealers, traders, and processors, suggest that demand far exceeds supply, and that lack of EGS supply is the critical issue leading farmers to informal markets.

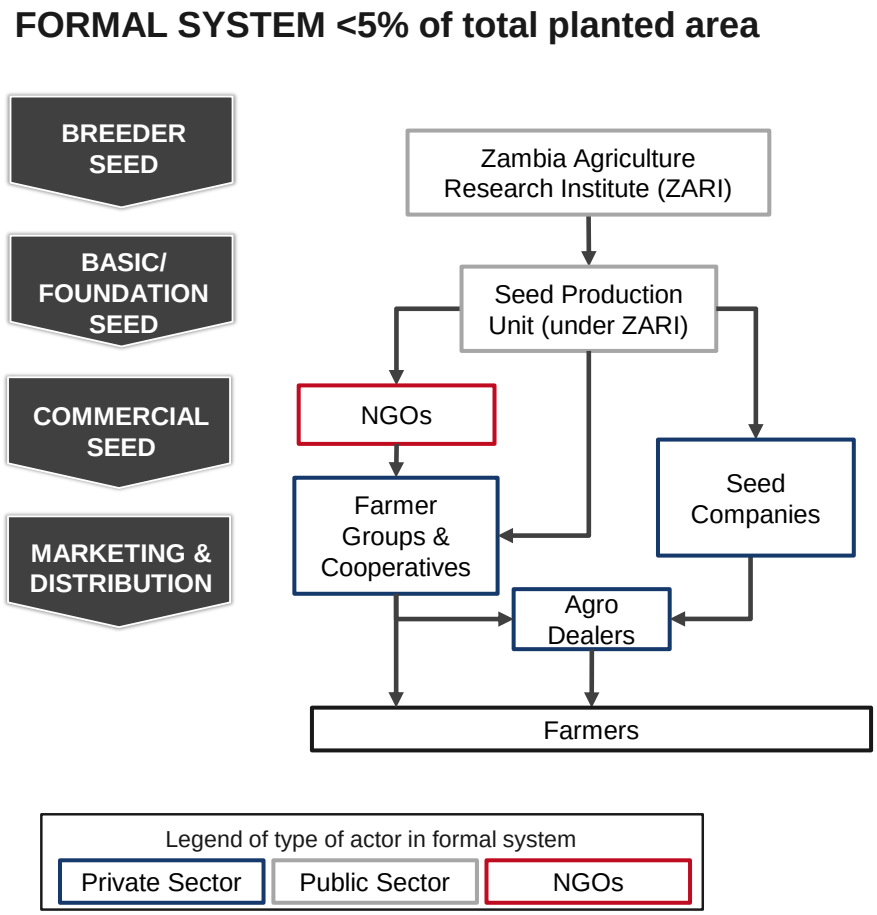
[2] Labor costs are estimated to be higher in the formal production system because labor is assumed to be hired while in the informal sector, it is assumed less labor would be hired and fewer operations conducted (e.g., one plowing rather than two). For the farmer saved seed calculation, no labor costs were assumed because in interviews with farmers, they consistently mentioned that they do not count their own labor as a cost. While there is clearly a cost to time, the purpose of this calculation was to show how the farmer perceives the cost of seed.

FORMAL SYSTEM

ZARI produces breeder seed, while the Seed Production Unit (under ZARI) produces basic seed, as shown in Figure 29. Certified seed production is led by the private sector: farmer groups, cooperatives, and local seed companies, with some participation from NGOs, while agro-dealers, farmer groups, and cooperatives generally market and deliver the seed to farmers.

SCCI is in charge of certification which includes field inspections and seed sampling. Seed fields are inspected at four stages per season: before or just after planting, at vegetative stage, at flowering stage, and at crop maturity. Seed crops that don't meet standards either fail or are downgraded to lower classes, whereas crops that meet required standards are authorized for harvesting as seed for further certification processes including seed sampling, laboratory seed testing, and post-harvest control. In order to facilitate inspections of all seed crops, SCCI also trains and licenses private seed inspectors who work for seed companies, NGOs, and the crop extension service of the Ministry of Agriculture. Samples of seed produced during each growing season are selected at random and assessed for purity at one of eight seed-testing laboratories. Interviews suggest this is highly resource intensive and an expensive process that while useful for higher value crops like hybrid maize, is not cost effective for groundnut quality assurance.

Figure 29: **Structure of the groundnut and common bean formal seed system.**



Source: Expert analysis (2016).

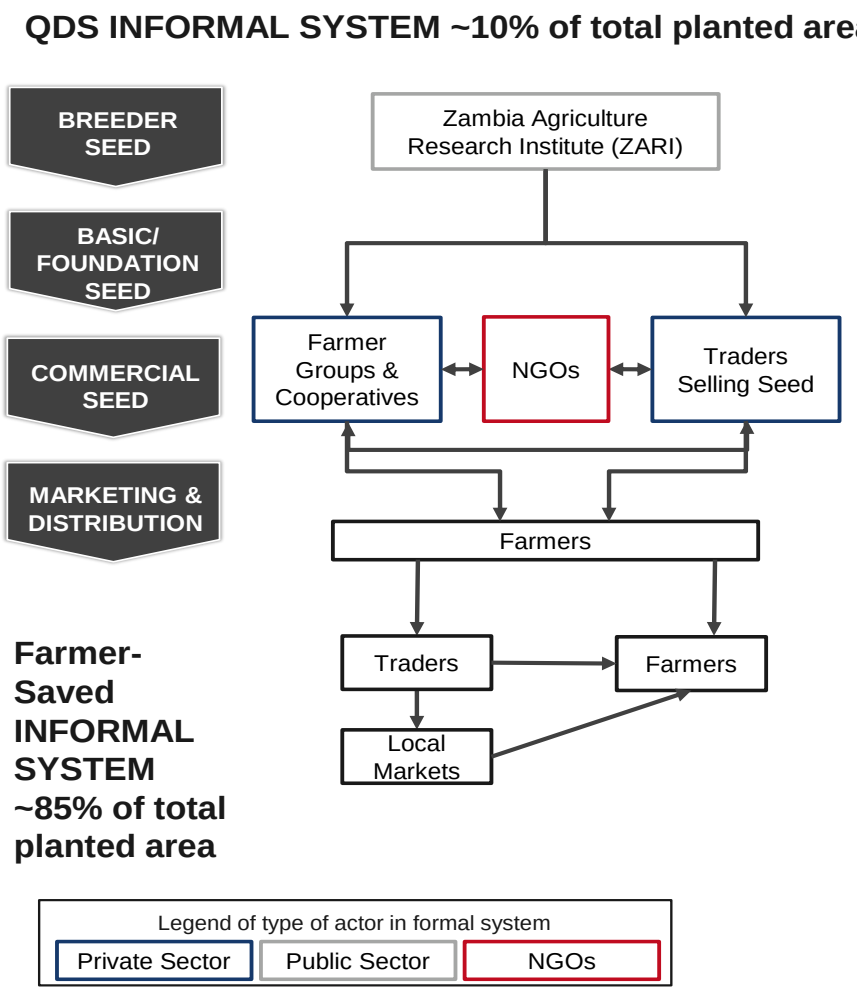
INFORMAL SYSTEM

Because Zambia's formal system cannot meet existing demand for EGS and certified seed, the informal market plays an important role. With respect to groundnut, only 10% of the total planted area is with QDS in the informal market while ~86% is planted with farmer-saved seed. Common bean QDS acreage is also ~10% with 87% of total area farmer-saved.

As Figure 30 shows, in the QDS informal system, ZARI produces breeder seed which is then sold directly to farmer groups, cooperatives, and traders who multiply commercial seed. 10% of the acreage of commercial seed is inspected, mostly by licensed inspectors. Commercial seed is then given a germination test by SCCI before it is cleaned and packaged and sold directly to farmers via local markets or exchanges. Interviews suggest that the QDS system is at times not enforced and that QDS is often sold with limited inspections conducted.

The majority of the informal system (86-87% of total planted area) involves farmers saving and replanting seed, or exchanging informally with neighboring farmers. Due to the lack of storage, cleaning facilities, and financing, seed sales are done on an ad-hoc basis, rather than planned in advance. Sometimes, farmers sell seed to other farmers for the price of grain, without a price premium for seed. Farmers also clean and sell their crop production (as seed) informally and opportunistically to small-scale traders, based on spot demand. Traders either sell the seed to local farmers or markets where differentiation between grain and seed is often unclear. Obviously, this seed provides no quality assurance, and there are significant issues with germination and performance.

Figure 30: **Structure of groundnut and common bean informal seed system.**



Source: Expert analysis (2016).

KEY EGS SYSTEM BOTTLENECKS AND CONSTRAINTS

There are numerous EGS supply bottlenecks, as well as demand constraints, identified in the groundnut and common bean seed system value chain. These include:

Supply bottlenecks

- **Under-capacity of breeder seed:** There is insufficient infrastructure, including lack of irrigation needed to reduce growing risk, insufficient land, lack of mechanization, absence of cold storage for germplasm (which forces ZARI to grow seed each season to maintain seed germinations, a significant strain on resources that increases risks from droughts), absence of drying facilities, and lack of testing capabilities.
- **Lack of private sector involvement in basic and commercial seed production:** Low profitability levels of groundnut and common bean EGS, mainly driven by low seed production yields, have challenged local seed companies to invest in production. Additionally, local seed companies have limited technical know-how to produce high-quality basic and commercial seed; a lack of resources for processing and capacity

building; limited ability to invest in seed production and marketing capabilities to address smallholder farmer needs (such as selling seed in small packs).

- **Resource-intensive certification system:** The certification system is based on hybrid maize, a higher value crop that can support a higher cost system due to margins generated, but is not fit for groundnut and common bean seed producers who cannot afford to pay certification costs for these lower margin crops.
- **Absence of an EGS demand system:** There is no formal centralized process in which demand for commercial seed is captured and informs how much basic and breeder seed needs to be produced in a set time horizon. Instead, ZARI produces small amounts of breeder seed and supplies it to commercial seed producers on an ad hoc basis. Without a formal process for forecasting demand, EGS and commercial producers are unable to budget and plan seed production to supply the market which prevents them from reaching economies of scale which would in turn lower production costs.
- **Under-capacity of QDS system:** SCCI does not have the resources to enforce and implement a QDS system beyond the minimum requirements. Interviews suggest SCCI currently inspects only the minimum legal requirement of 10% of all QDS production fields. Furthermore, SCCI only has two inspectors covering the entire Eastern province and while private sector seed inspectors can be "deputized", this has only occurred with cotton and maize to date (USAID Seed System Security Assessment, Eastern Zambia, 2013). At current resourcing levels SCCI would likely have difficulty to meet growing demand or requests for more inspections.

Demand constraints

- **Smallholders lack of awareness of improved varieties' benefits:** ZARI outreach programs are under-resourced to conduct sufficient demonstration trials to show farmers the value of buying improved varieties, as they are limited by seed, numbers of plots, and staff. Furthermore, there is a significant undersupply of extension officers which in 2011 was estimated to be an extension officer to farmer ratio of 1:9000 which is far below the recommended level of 1:4000 (NAIP 2014). Moreover, a 2010 World Bank report estimated that extension officers spend 75-80% of their time dealing with FISP logistical issues rather than their core function of providing extension advice to farmers (NAIP 2014).
- **Lack of crop grades and standards:** The lack of crop grades and standards lowers the price premiums farmers can realize for higher quality groundnut and common bean production. For example, in the maize market, there are crop grades such as #2 and #3 yellow corn which have specific quality and moisture parameters that command a price differential. #2 yellow corn would be positioned for export markets while #3 yellow corn would be designated for local feed and processing purposes with a lower price point. Such a system does not exist in groundnut and common bean in Zambia and as a result, farmers are not incentivized to invest in improved seed as they are not rewarded for higher quality production.
- **Limited awareness of the business case to invest:** Smallholder farmers are not aware of the potential return on investment of using quality seed and good agronomic practices. Good agronomic practices not only have the potential to increase yield and quality, but in groundnut specifically, there is the opportunity to lower aflatoxin levels which could stimulate higher priced demand from traders. While this is a key constraint

for both groundnut and common bean, the challenge to demonstrate value is more pronounced in common bean because the performance of improved varieties versus saved seed is less evident than in groundnut.

- **Lack of credit access for seed producers and smallholder farmers:** Seed producers as well as smallholder farmers don't have the cash needed to invest in seed production and best agronomic practices. Access to credit from commercial banks is focused on large commercial farms and Zambia's MFI sector is one of the smallest in the region. As a result, farmers are constrained to purchase improved seed and, therefore, local seed producers are constrained to expand seed production.
- **Lack of varietal improvement:** Demand from farmers for improved varieties has waned because the ZARI groundnut breeding program has only released seven improved varieties since 2000 and the most popular variety continues to be Chalimbana, released in 1964. There are many reasons for the deceleration in varietal improvement, notable factors including:
    - Lack of resources to explore the depth of the germplasm (such as marker-assisted breeding[3]), constrains the speed and effectiveness with which the ZARI breeding program can make varietal improvements.
    - Lack of communication between breeders and farmers, which makes it difficult for breeders to set the right breeding targets to address farmer needs.
    - Absence of incentive mechanisms such as breeder royalty payments, which discourages breeder to focus on varietal improvements.
    - Misaligned incentives for breeders who are currently rewarded by the number of releases rather than market impact and penetration, which would better support breeding for farmers' needs.

3.4 RECENT DEVELOPMENTS

There have been recent developments regarding quality assurance regulations in Zambia. There are currently differences in minimum standards between the Southern Africa Development Community (SADC) and COMESA Harmonized Regional Regulatory Systems and Zambia's Plant Variety and Seeds Act with respect to variety release and certification that affect importing and exporting seed. SCCI is in the process of aligning the Act to become fully compliant with the SADC and COMESA regional seed regulatory systems. Additionally, the USAID supported SADC Harmonized Seed Regulations Project was kicked off in December 2015 with the aim at operationalizing the SADC Seed Harmonization regulations to improve seed trade across member states.

[3] Marker assisted breeding is a process whereby a marker (morphological, biochemical or one based on DNA/RNA variation) is used for indirect selection of a genetic determinant or determinants of a trait of interest (e.g. productivity, disease resistance, abiotic stress tolerance, and quality). Advantages of marker assisted breeding include greater efficiency of target trait selection which may enable certain traits to be fast-tracked, since specific genotypes can be easily identified and selected. Moreover, background markers may also be used to accelerate the recovery of recurrent parents during marker-assisted backcrossing.

3.5 PROMISING MODELS

COMACO

As previously mentioned, COMACO has pioneered outgrower schemes for groundnut in Zambia. The model works as follows:

1. COMACO organizes low-income, food-insecure farmers into producer groups.
2. Groups are trained to utilize best agronomic practices to optimize yield and mitigate soil and tree loss.
3. COMACO provides inputs, including improved varieties to smallholder farmers.
4. Farmers may sell their surplus production at favorable prices if they are members of a COMACO producer group.
5. COMACO monitors compliance of required farming methods.
6. An end of season “conservation dividend” is paid to producers who are in compliance with guidelines on conservation based production practices and who sold their production to COMACO.

To date, COMACO works with 63 cooperatives comprising 2,000 to 3,000 farmers growing groundnut on 10,000 Ha. While the model has been successful, there are several constraints to further growth, such as:

1. The lack of basic and commercial high-quality seed.
2. Limited knowledge of groundnut seed quality by agro-dealers.
3. Seed financed by COMACO to farmers is at times sold by farmers rather than used for planting.
4. Working capital constraints at COMACO.
5. Limited farmer awareness of the value of improved varieties, and no organized process to demonstrate new varieties effectively.

COMACO has attempted to address supply bottlenecks and demand constraints in cooperation with several seed-related ventures, but these have not led to lasting solutions. COMACO is now working directly with ZARI to source breeder seed because of the lack of basic seed availability, which creates higher costs for COMACO as they have to multiply two steps of basic and commercial seed.

LOCAL SEED SYSTEM PROJECTS

Numerous donor-related local seed system projects across Zambia in the past decades have made a considerable contribution to the diffusion of improved varieties (Table 12). While these projects vary in terms of geographic and crop focus, the general designs have been similar, with a focus on village-level production. The implementing agency typically trains local producers in seed production and provides inputs such as improved seed either free of charge or on credit. They then buy seed from the local producer and supply that seed either free of charge or on credit to target farmers.

Notably, only two of the 12 projects in Table 12 included common bean while almost all of the others included groundnut, suggesting that, given the importance of common bean for smallholder farmers, there is a strong argument for a greater focus on seed systems for common bean.

Table 12: **Local seed system projects.**

	DONOR	PROVINCE	CROPS	DESCRIPTION
Southern Province Household Food Security Program	IFAD	Southern	Cowpea, sorghum, sunflower, sesame, **groundnut**, bambaranut, sweet potato	Seed growers trained in each district, project buys seed from them, and distributes to village seed communities
Luapula Livelihood and Food Security Program	FINNIDA	Luapula	**Common bean**, sorghum, millet, rice, **groundnut**, cassava, sweet potato	Farmers loaned seed for multiplication, and encouraged to sell seed
Multiplication and Distribution of Seed/Planting Materials Project	SIDA	Northern, Northwestern, Southern, Western	Sorghum, millet, **groundnut**, cowpea	156 farmers trained in seed production, expected to become seed producers
Smallholder Farm Systems Seed Diversification Project	UNDP	Eastern, Lusaka, Central, Northern, Copperbelt, Luapula	Sorghum, millet, **groundnut**, maize, cowpea, **common bean**, rice, soybean, sunflower, cassava, sweet potato	164 farmers trained in seed production, expected to sell to other farmers or to merchants
Drought Rehabilitation Project	SIDA	Southern, Lusaka, Eastern, Western, Northwestern	Sorghum, cowpea, **groundnut**, millet, cassava, sweet potato	Farmers trained as seed entrepreneurs, project also helps seed move between areas
Livingstone Food Security Program (CARE)	USAID	Southern (3 districts)	Maize, sorghum, **groundnut**, bambaranut, millet, green gram, sunflower	Farmers being trained as seed entrepreneurs
Bulima Seed Growers Association	EU	Copperbelt (Mpongwe District)	**Groundnut**	Group has sold seed to various donor projects, also attempts its own marketing
Int. Union for Conservation of Nature Seed Multiplication Program	World Bank	Western (Lukulu District)	Cowpea, sorghum, maize, rice	Farmers are loaned seed to multiply, repay loan to project, which distributes to other farmers
Small-Scale Seed Production Project	GTZ	Southern	Maize, sorghum, millet, cowpea, **groundnut**	As above
Chipata Diocese Development Project	Miserio	Eastern (several districts)	**Groundnut**, maize, sunflower	As above
Farming Systems Research Team	GRZ	Western (Kaoma District)	Cowpea, **groundnut**, sorghum, maize, millet, cassava	Farmers multiply seed and are expected to sell to others
Rural Community Development and Motivation Project	Lutheran World Fed.	Eastern (several districts)	Several crops	Seed is loaned to farmers and farmer groups for multiplication

Source: Zulu and Miti sourced from Strategies for Seed System Development in Sub-Saharan Africa (2006).

Previous analysis of strategies for seed system development in Sub-Saharan Africa (Tripp, 2006) identified a number of common problems across these village-level projects, including:

1. Lack of basic seed and supply information for village producers to maintain activities.
2. Lack of training of seed producers to sustain seed multiplication post-project.
3. Lack of seed conditioning, storage, and sustainable finance for seed producers to store and sell seed after harvest.
4. Over-emphasis on quality control which is unsustainable without post-project funding.
5. Lack of attention to marketing as farmers only focus on selling to their neighbors.

6. Limited linkages beyond the target area. Due to the localized character of the projects, the seed systems developed were self-contained and difficult to scale.

CHAPTER 4: ECONOMIC ANALYSIS

4.1 POTENTIAL EGS DEMAND

INTRODUCTION

The amount of EGS required for a given crop is a key variable in determining the optimal crop archetype. To aid in identifying these crop archetypes, the research team developed an EGS demand model for the two crops included in this study.

As official early generation supply and demand figures were difficult to obtain, the team conducted interviews with key stakeholders to obtain information on current usage of EGS and to identify demand constraints. Because much of the data obtained in interviews was informal, (i.e. the reported usage and determinants of usage were based on the interviewee's experience and view of the system rather than formal records), the field researchers attempted to triangulate data through interviews with several individuals about a given crop and in the links of the value chain.

The information and data obtained during field interviews was used to formulate assumptions that informed models of the potential demand for EGS. Given the absence of formal data, the team modelled cases and sensitivities to estimate the magnitude of potential demand and the impact of the key variables within the model on demand. The three cases developed include:

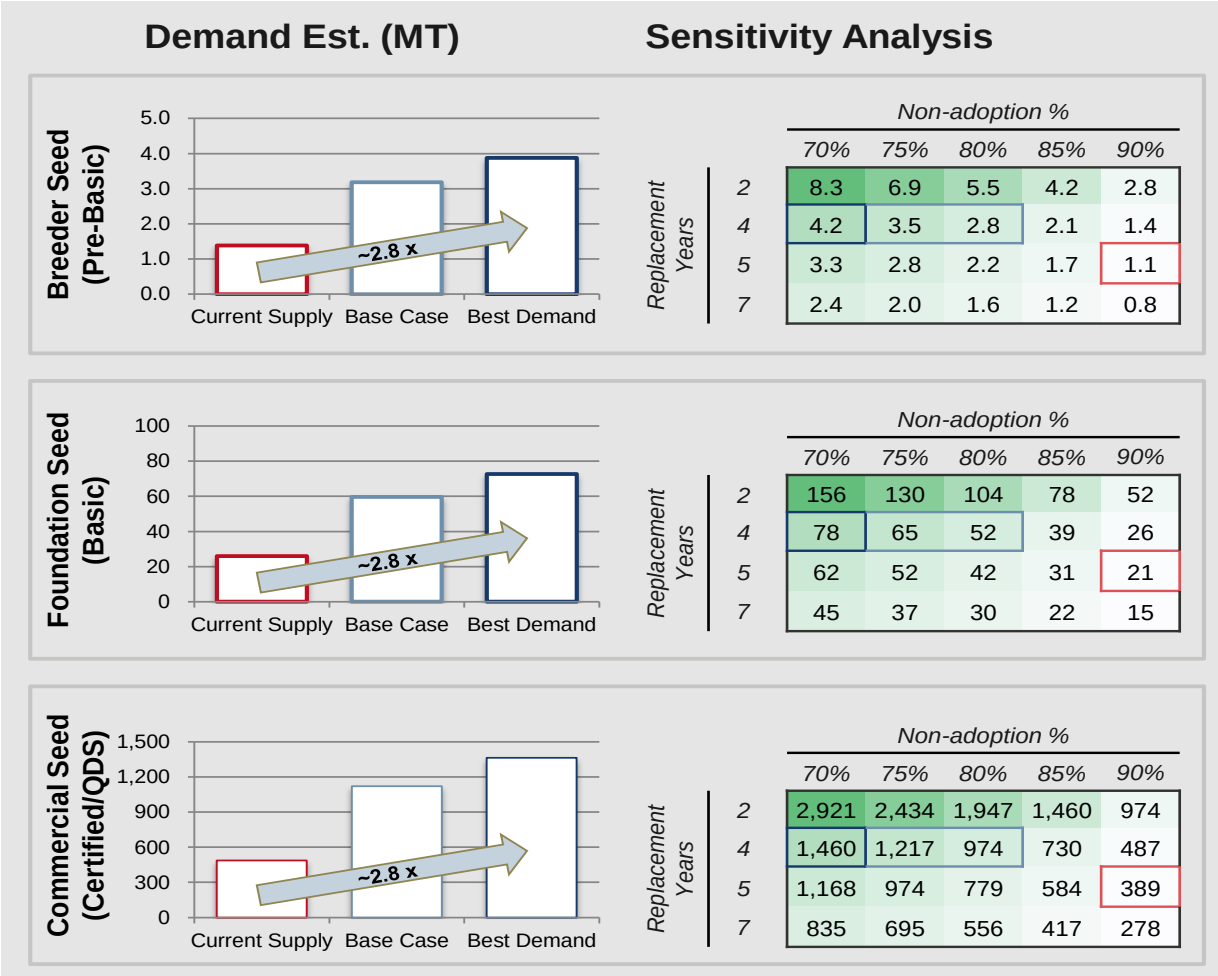
- **Current EGS supply:** Current level of supply in market.
- **Potential EGS demand - base case:** All EGS specific recommendations are implemented, with other market impediments assumed to remain in place.
- **Potential EGS demand - best case:** All EGS specific recommendations are implemented, with other value chain and policy constraints addressed (e.g., downstream value chain improvements, non-EGS policy changes, agronomic best practices, packaging, credit).

The potential EGS demand cases are based on a five to seven-year timeline for implementation of the recommendations. It is critical to note that these models are not seed production plans or detailed bottom-up evaluations of demand, but rather a high-level analysis to inform the selection of crop archetypes.

GROUNDNUT

As previously mentioned, interviews with key stakeholders across the seed value chain mentioned that demand of EGS far exceeds supply. However, due to the fact that there is no centralized demand system in place to collect demand data for EGS, demand was calculated based on estimates of replacement rates and non-adopter rates. Assumptions of non-adopters decreasing from 90% to 70% and replacement years decreasing from 5 to 4 years led to a best case demand that is almost three times of current supply.

Figure 31: **Groundnut - potential early generation seed demand.**

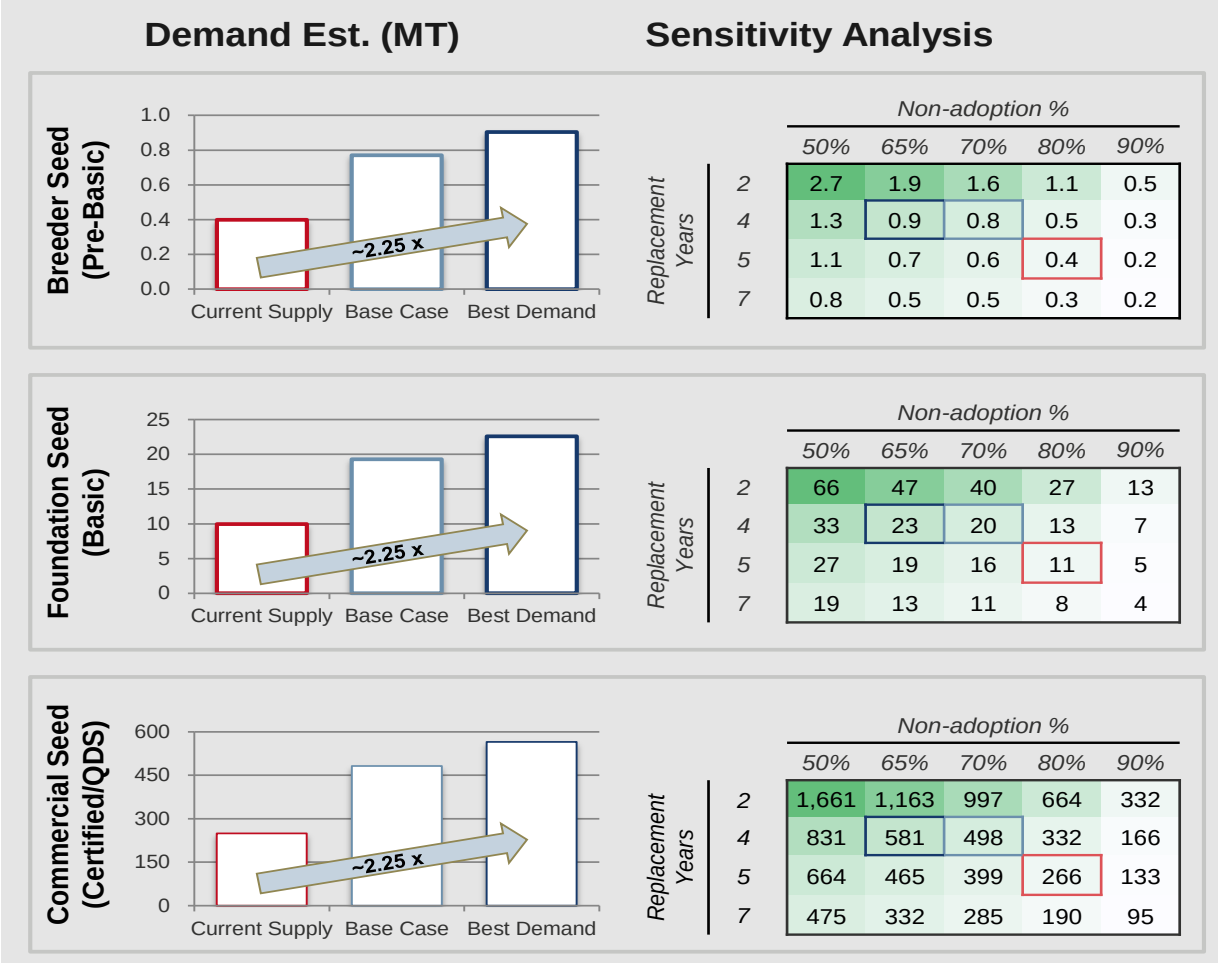


Source: Field research team interviews (2016).

COMMON BEAN

Common bean dynamics are quite similar to groundnut, but it is more difficult to demonstrate the value of adopting improved varieties at the farmer level. Thus, best-case demand, as shown in Figure 32, is estimated to be about twice that of current supply (versus best-case demand three times that of current supply for groundnut).

Figure 32: **Common bean - potential early generation seed demand.**



Source: Field research team interviews (2016).

4.2 PRODUCTION COST OF EGS

INTRODUCTION

The cost of EGS production will have a major impact on the optimal archetype for each crop, on the ability to scale EGS supply, and on the sustainability of the system. Understanding the cost is critical to developing a realistic and achievable plan for increasing supply. For this study, cost models were built using very limited data available from official sources and obtaining best estimates of production cost through interviews with seed producers, farmers, and ZARI personnel engaged in seed production.

Due to the lack of official cost information and the diversity of players in the Zambian seed sector, the cost models developed for this study were primarily focused on variable costs of production. It is critical to note that this analysis is not a full costing of production costs, as factors such as start-up costs, infrastructure, depreciation of fixed assets, cost of unapproved varieties, testing, and other early-stage investments were not included.

Tables 13 and 14 provide high level estimates of production cost levels for groundnut and common bean. It is understood in the industry that breeder seed production is not a profit center, and the actual cost of producing breeder seed is trivial compared to the cost of research and development activities for a variety. If the Zambian government or other stakeholders wish to make research and development programs for new varieties financially self-sustainable, as related to the end product of breeder seed, that is an issue to be addressed separately from this study.

GROUNDNUT AND COMMON BEAN EGS PRODUCTION COSTS

Basic and commercial seed production is costlier for groundnut than for common bean because of higher planting rates and higher production costs such as labor for digging and harvesting. A key opportunity to lower costs and improve profitability is through increasing yields, which would lower costs on a $/Kg basis.

***Table 13*: Groundnut - EGS cost of production.**

	Pre-Basic/ Breeder Seed	Assumptions	Basic Seed	Assumptions	Commercial/ Quality Seed	Assumptions
Demand MT	1.4		26		487	
Variable Cost $ per Ha	$2,415	*Harvesting labor costs are ~25% and land preparation costs are ~15% of total variable costs*	$2,820	*Digging/threshing/ winnowing costs are ~15% and land preparation costs are ~15% of total variable costs*	$2,267	*Planting/harvesting costs are ~30% of total variable costs*
Fixed Cost $ per Ha	$4,621	***Breeder salaries ~$3,270***	$1,079	***Breeder salaries ~$550***	$501	***No breeder salary allocation; labor in variable costs***
Total Costs	$7,036		$3,899		$2,768	
Margin	*$704*	*10% base assumption*	*$390*	*10% base assumption*	*$277*	*10% base assumption*
Cost + Margin $ per Ha	$7,740		$4,289		$3,044	
Cost + Margin $ per Kg	$5.16	***1,500 Kg/Ha yield***	$2.86	***1,500 Kg/Ha yield***	$2.03	***1,500 Kg/Ha yield***

Source: Field research team interviews (2016).

***Table 14*: Common bean - EGS cost of production.**

	Pre-Basic/ Breeder Seed	Assumptions	Basic Seed	Assumptions	Commercial/ Quality Seed	Assumptions
Demand MT	0.4		10		249	
Variable Cost $ per Ha	$1,310	*Seed cost and fertilizer applications are both approximately 17% of total variable costs*	$1,178	*Breeder seed represents approximately 15% of total variable costs*	$814	*Planting/harvesting and fertilizer costs are each ~25% of total variable costs*
Fixed Cost $ per Ha	$8,972	***Breeder salaries ~$7,600***	$959	***Breeder salaries ~$425***	$493	***No breeder salary allocation; labor in variable costs***
Total Costs	$10,282		$2,137		$1,384	
Margin	*$1,028*	*10% base assumption*	*$214*	*10% base assumption*	*$138*	*10% base assumption*
Cost + Margin $ per Ha	$11,310		$2,351		$1,522	
Cost + Margin $ per Kg	$7.54	***1,500 Kg/Ha yield***	$1.57	***1,500 Kg/Ha yield***	$1.01	***1,500 Kg/Ha yield***

Source: Field research team interviews (2016).

4.3 EGS MATCHED WITH REVENUE/COST

In matching revenues and costs of EGS for the two selected crops, it becomes apparent that currently, neither groundnut nor common bean is commercially attractive, as demonstrated in Table 15. That being said, both crops currently have a positive contribution at the basic and commercial level, which presents opportunities for increased private sector involvement.

While breeder seed is not profitable in either crop targeted in this study, this is not uncommon across other crops and countries. Study analysis suggests groundnut is slightly more profitable than common bean at the basic seed level, and common bean is slightly more profitable at a commercial seed level. However, the differences are small, and due to the significant variance in assumptions made, these estimates suggest that both crops currently have similar profitability.

Furthermore, current pricing levels are below the value that would be created by planting improved varieties. Thus, there is an opportunity to improve profitability not only through higher seed production yields but also through increased pricing once value is demonstrated at the farm level.

Table 15: **EGS matched with revenue/cost.**

Crop	BREEDER SEED						
	Price / Kg	Cost + Margin / Kg	Seed Rate (Kg/Ha)	Demand (MT)	Total Revenue (Ha)	Total Cost (Ha)	Contribution (Ha)
Groundnut	$3.75	$5.16	80	1.4	$300	$413	($113)
Common Bean	$3.00	$7.54	60	0.4	$180	$452	($272)

Crop	BASIC SEED						
	Price / Kg	Cost + Margin / Kg	Seed Rate (Kg/Ha)	Demand (MT)	Total Revenue (Ha)	Total Cost (Ha)	Contribution (Ha)
Groundnut	$3.75	$2.86	80	26.0	$300	$229	$71
Common Bean	$2.67	$1.57	60	10.0	$160	$94	$66

Crop	COMMERCIAL SEED						
	Price / Kg	Cost + Margin / Kg	Seed Rate (Kg/Ha)	Demand (MT)	Total Revenue (Ha)	Total Cost (Ha)	Contribution (Ha)
Groundnut	$2.73	$2.03	80	487.0	$218	$162	$56
Common Bean	$2.27	$1.01	60	249.2	$136	$61	$75

Source: Field research team interviews (2016).

Table 16: **Summary of groundnut assessment.**

Groundnut	Assess-ment	Comments
MARGINAL ECONOMIC VALUE OF IMPROVED VARIETIES		
Differential performance of improved varieties	**Med.**	Potential yield benefits of improved varieties 2x greater than national averages, but on-farm results yet to demonstrate potential in a compelling way.
Frequency of seed replacement	**Low**	Farmers plant saved seed for five+ years to reduce cost of production.
Differentiating characteristics	**Med.**	While there are clear differentiating characteristics for groundnut, such as oil content, there are no standards and grades in place to capture value.
Fragility of seed	**Med./High**	Groundnut seed highly fragile which limits transportability and need for storage.
Cost of quality seed production	**High**	Production costs high due to low multiplication rates and low yields, even relative to other legumes grown in Zambia, like common bean.
Overall Value of Improved Varieties	**Med.**	**Marginal economic value of improved varieties moderate, but potential to improve value in long term if grades and standards put in place to drive price premiums.**
MARKET DEMAND FOR QUALITY SEED OF IMPROVED VARIETIES		
Total demand for seed	**Med.**	Real demand for seed is high as most widely grown legume crop in Zambia, but value of improved varieties needs to increase to drive demand.
Requirement for quality assurance	**Med.**	While requirement for quality assurance not as high as in hybrid maize, aflatoxin challenges require a robust quality assurance system.
Farmer demand for specific varieties	**Med.**	Chalimbana and MGV 4 identified as most popular varieties grown by farmers, but reasons for growing based more on experience rather than on adopting improved varieties that can better address their needs.
Market demand for specific varieties	**Med.**	Downstream demand for aflatoxin free production.
Overall Demand for Quality Seed	**Med.**	**While largest legume crop in acreage terms in Zambia, until value of improved varieties is demonstrated and markets are created, demand will be below potential.**

Source: Research team analysis (2016).

Table 17: **Summary of common bean assessment.**

Common Bean	Assess-ment	Comments
MARGINAL ECONOMIC VALUE OF IMPROVED VARIETIES		
Differential performance of improved varieties	**Med.**	Potential yield benefits 2x of improved varieties greater than national averages but on-farm results have yet to demonstrate potential in a compelling way.
Frequency of seed replacement	**Low**	Farmers plant saved seed for 5+ years to reduce cost of production.
Differentiating characteristics	**Low**	While characteristics in color, taste, and cooking quality exist, opportunity to capture value via price premiums is non-existent in current market environment.
Fragility of seed	**Low**	Seed durability a non-issue as seed is not stored for a significant time, and seed is used locally.
Cost of quality seed production	**High**	Production costs high due to low multiplication rates and low yields.
Overall Value of Improved Varieties	**Low/Med.**	**Marginal economic value of improved varieties low to medium as cost of production high and pricing opportunities minimal.**
MARKET DEMAND FOR QUALITY SEED OF IMPROVED VARIETIES		
Total demand for seed	**Med.**	Third most widely grown legume crop in Zambia, but value of improved variety yields needs to be validated and demonstrated.
Requirement for quality assurance	**Med.**	Attributes relatively easy to maintain (low genetic drift and hardy seed), therefore certified seed does not provide the same value in common bean as in other crops.
Farmer demand for specific varieties	**Low**	Farmers plant variety mixes rather than specific varieties; the value of any single variety is difficult for a farmer to see in this situation and makes widespread adoption of any one variety a challenge.
Market demand for specific varieties	**Low**	No existing downstream demand from large-scale industrial processors and no variety-specific export demand to stimulate adoption of specific varieties.
Overall Demand for Quality Seed	**Low/Med.**	**Common bean is planted widely but will not increase until value of improved varieties is demonstrated and/or cash markets are created.**

Source: Research team analysis (2016).

CHAPTER 5: EGS OPERATIONAL STRATEGIES

5.1 OPTIMAL MARKET ARCHETYPE

Groundnut and common bean have been classified into specific market archetypes based on the respective marginal economic value of the quality of their improved varieties and the level of demand for crops grown with quality seed of improved varieties. Table 18 summarizes this study's assessment across a range of factors.

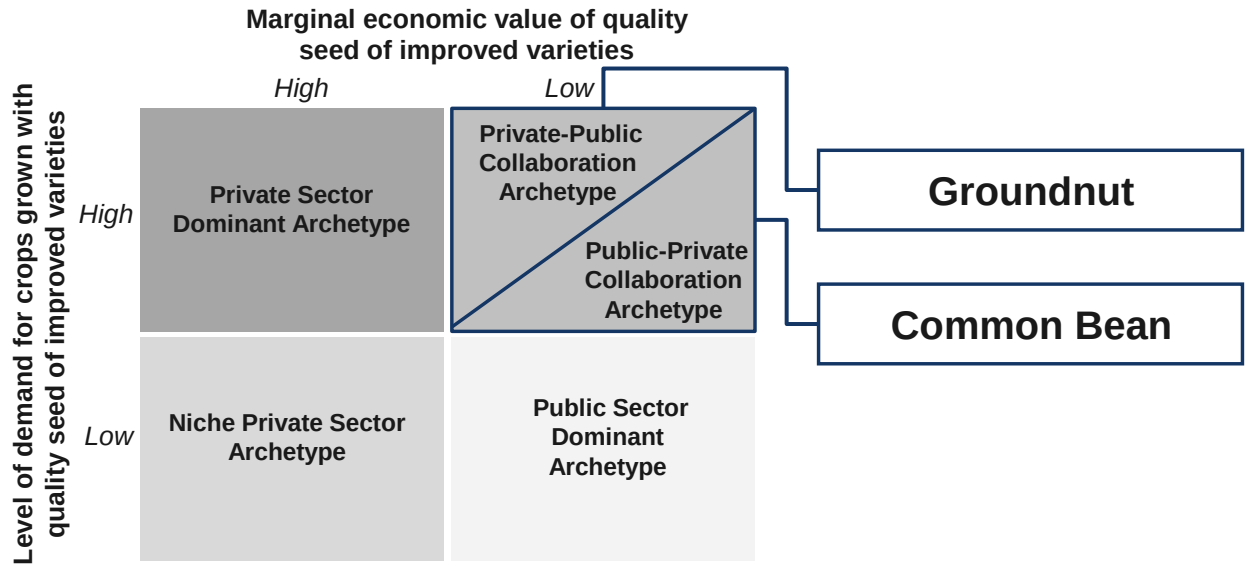
Table 18: **Summary of crop assessments.**

Assessment Summary	Groundnut	Common Bean
MARGINAL ECONOMIC VALUE OF IMPROVED VARIETIES		
Differential performance of improved varieties	**Med.**	**Med.**
Frequency of seed replacement	**Low**	**Low**
Differentiating characteristics	**Med.**	**Low**
Fragility of seed	**Med./High**	**Low**
Cost of quality seed production	**High**	**High**
Overall Value of Improved Varieties	**Med.**	**Low/Med.**
MARKET DEMAND FOR QUALITY SEED OF IMPROVED VARIETIES		
Total demand for seed	**Med.**	**Med.**
Requirement for quality assurance	**Med./High**	**Med.**
Farmer demand for specific varieties	**Med.**	**Low**
Market demand for specific varieties	**Med.**	**Low**
Overall Demand for Quality Seed	**Med.**	**Low/Med.**

Source: Research team analysis (2016).

As Figure 33 illustrates, both crops can be classified within the collaborative archetype, although groundnut presents the opportunity to attract stronger private sector participation in a Public-Private Partnership to EGS systems.

Figure 33: **Optimal archetype classification.**



Source: Research team analysis (2016).

Groundnut: Public-Private partnership archetype

- *Economic* Value: Currently marginal value of improved varieties is limited by low seed production yields which increases costs and absence of a market that supports premium pricing.
- *Demand*: Current high demand has the potential to grow with the introduction of new varieties that meet farmer, market, and export needs, as well as opportunities for processing varieties to drive an emerging sector.

Common bean: Public-private collaboration archetype

- *Economic Value:* Marginal economic value of improved varieties low to medium as cost of production high and opportunities to increase prices are minimal.
- *Demand*: While a key food security crop in Zambia, until the value of improved varieties is demonstrated and/or cash markets are created, demand will be below potential.

5.2 KEY CHALLENGES

In order to reach the identified optimal market archetypes for each crop, there are a series of both crop-specific and cross-crop challenges, which are outlined in Table 19.

Table 19: **Summary of key challenges.**

	Ideal State	Current State		
	Key Factors	**Obstacles to Overcome**	**Groundnut**	**Common Bean**
Regulation & Quality Assurance	Established IP protection and royalty enforcement	No royalty enforcement mechanisms in place	✓	✓
	Robust grading system and standards in place	Absence of crop grades and standards lowers the price premiums farmers can realize, discouraging farmers from investing in improved seed	✓	✓
	Functioning Quality Declared system	Quality Declared system only reaches minimum requirement of 10% of QDS production fields and rarely enforced	✓	✓
Technical & Mgmt. Capabilities	Properly trained and staffed personnel for quality testing labs and field inspection	Inadequate qualified lab personnel; lack of skilled personnel for field inspection and sampling	✓	✓
	Properly trained and staffed extension system	Understaffed and limited ability to support seed producers	✓	✓
	Seed producers with business and technical skills	Seed producers lack training and ongoing support	✓	✓
Demand Creation & Market Linkages	Improved varieties meeting grower needs	Significant drop-off in varietal improvement and number of releases, inadequate breeding infrastructure and germplasm depth	✓	✓
	Robust demonstration trial platform driving grower adoption	Demonstration trials constrained by seed availability, trained personnel, and number of plots	✓	✓
	Sufficient number of point of sales in close proximity to farmers	Limited participation of agro-dealers in seed sales other than hybrid maize	✓	✓
	Seed quantities that serve target market needs	Smallholder farmers have limited access to small packs of seeds	✓	✓
	Clear visibility of demand	No market demand system in place for EGS producers to forecast demand accurately	✓	✓
Incentives & Access to Capital	Clear subsidy strategy to ensure sustainable improved seed adoption	FISP limited in reach to smallholder farmers and crops other than maize (even though technically FISP should include crops beyond maize)	✓	✓
	Financing to support seed producer and grower investment	Limited access to loans from commercial lenders constraints seed company investment and lack of microfinance constrains farmer investment in improved varieties	✓	✓
	Breeder incentives aligned with market needs	Breeders currently incentivized by number of variety releases rather than market impact	✓	✓

Source: Research team analysis (2016).

5.3 PUBLIC-PRIVATE PARTNERSHIP MECHANISMS AND SOLUTIONS

DEFINITION AND BACKGROUND

A PPP is commonly defined as a government service or private business venture that is funded and operated through a partnership between the public sector or government entity, private sector companies, NGOs and other stakeholders. Accordingly, the public sector or government actor may provide support in a number of ways, including through fiscal policy or the contribution of infrastructure or expert capabilities. Typically, a PPP involves the transfer of some risk from the public sector to the private sector, with the balance of risk often determined by the allocation of potential value in the partnership. Within the PPP, private sector actors should not be viewed as comparable to a contractor or vendor, but instead as equal partners with the public sector, aligned at every stage of the PPP.

PPPs have increased in prevalence in recent decades, especially in the developing world. This has corresponded with the increase of private sector resources dedicated to developing countries. The Congressional Research Service notes that government development assistance agencies such as USAID and the State Department are working with private sector entities in unprecedented ways to determine when and if such partnerships can lead to improved development results. As explained in the Obama Administration's 2010 Quadrennial Diplomacy and Development Review, "private sector partners can add value to our missions through their resources, their capacity to establish presence in places we cannot, through the technologies, networks, and contacts they can tap, and through their specialized expertise or knowledge." Modern PPPs, characterized by joint planning, joint contributions, and shared risk, are viewed by many development experts as an opportunity to leverage resources, mobilize industry expertise and networks, and bring fresh ideas to development projects. Partnering with the private sector is also widely believed to increase the likelihood that programs will continue after government aid has ended. From the private sector perspective, partnering with a government agency can bring development expertise and resources, access to government officials, credibility, and scale.

Several benefits and disadvantages exist for PPPs (IISD, 2011):

Potential Benefits

- Increased efficiency, expertise, and innovation from the private sector may contribute to better infrastructure and greater cost and time savings.
- Project risks are shared among the partners.
- Access to private sector finance allows increased investment.
- PPPs provide the private sector with access to reduced risk, secure, long-term investment opportunities that are in some sense sanctioned by government.

Potential Disadvantages

- Accountability and transparency issues may be distorted under PPPs as private sector financed components may fail to appear in public accounts and reports. Similarly, evaluation is made more difficult as private sector data on profits, costs, or lessons learned may be considered commercially confidential.

- The inclusion of exclusivity agreements within PPP contracts can have the effect of awarding monopoly markets to private partners.
- It is necessary for both the public and private sectors to possess PPP-specific capacity for an agreement to be implemented successfully.

There are many examples of successful PPPs within many sectors. An example from the Congressional Research Service of the Malawi Dairy Association Development Alliance summarized in Table 24 below. The objective was to build the capacity of small dairy farmers, local milk processing plants, and farmer-owned milk bulking programs in order to improve production and profitability. The partners collaborated on improving the entire dairy value chain and included loan program that enabled farmers to purchase new heifers, improve feed and cattle health, loan guarantee programs for local milk processing facilities, and improved milk bulking practices. The PPP provided rural dairy farmers, feed producers, and small and medium-size dairy processing facilities with the resources and tools required for a successful dairy industry.

Table 20: **Partners, contributions, and motivations for Malawi dairy PPP.**

Partner	Contribution	Motivation
Land O'Lakes	Technical expertise, significant experience in Malawi, introduction of new cattle breeds	National visibility, social responsibility
Local milk producers/dairies	Investments in new practices and technology, capital for farmer loan programs	Higher, more predictable income
General Mills	Financing	National visibility, social responsibility
Monsanto	Soybean seeds and technical assistance. The mature beans are used for cattle feed	National visibility, social responsibility
USAID	Technical advice, financing, partner and alliance coordination	Economic growth
Government of Malawi	Extension agents that worked in the value chain, assistance with animal importation, assistance with processing paperwork quickly	Economic growth

Source: Congressional Research Service (2013).

RATIONALE

The most significant challenges confronting EGS systems in Zambia are the cost of current systems and the growing unwillingness of major donors to fund EGS systems in Africa. The structural and demand issues identified in this study that impact quantity, quality, and use of early generation and certified seed can be addressed and resolved, but only if adequate financial and human resources are brought into play.

It would be a daunting task for the GRZ to undertake all of the changes necessary to build a fully capable and effective EGS system, even in the absence of funding constraints. In the absence of donor funding for EGS systems, the government should be willing to consider

alternatives that will incentivize private sector participation and reduce the need for government support of the seed sector.

Furthermore, the GRZ's priority on maize production and hybrid maize seed production has shifted both public and private sector focus away from food security crops such as groundnut and common bean. This has disproportionately affected smallholder farmers in Northern and Eastern provinces where groundnut and common bean are key crops.

The similarities in groundnut and common bean present an ideal opportunity to develop an EGS public-private partnership (EGS-PPP) that encompasses both crops. The EGS-PPP would be formed from public and private actors, NGOs, and associations operating under existing legal frameworks and utilizing assets, facilities, and resources. The EGS-PPP would:

- Exploit the similarities in two legume crops grown in the same North and East regions of Zambia.
- Create the scale necessary to generate private sector investment interest in smallholder farmer food security crops often overlooked in a maize-dominated country.
- Provide opportunities to develop a fit-for-purpose QDS system designed specifically for lower margin crops such as groundnut and common bean (rather than maize), that is cost-effective and efficient.
- Anchor the EGS-PPP on the larger groundnut crop which has more significant downstream opportunities for the private sector for processing and exports.

The EGS-PPP would be responsible for the production of basic seed. The breeding organization would continue to have responsibility for breeder seed production, and QDS would be produced in the private sector. Although the EGS-PPP would not have responsibility for the production of breeder seed, there would need to be a close working relationship with the breeders. The breeder is the ultimate authority on the phenotype of the varieties in production and would play a critical role in ensuring basic seed meets the variety specifications. When questions arise in basic production fields, the breeder must be available to walk fields with the EGS-PPP personnel and identify key quality issues such as "off types."

An important difference between the current system of certified seed production and the approach taken with an EGS-PPP is that basic seed would only be sold to qualified seed producers who have demonstrated expertise and capabilities in producing quality seed of a defined standard. The EGS-PPP would work with private growers (farmers, cooperatives, and local seed companies) to certify their standing as Quality Seed Producers.

An effective EGS-PPP would significantly reduce or even eliminate government responsibility for production of EGS for certain crops and stimulate the development of a robust private seed sector. This would allow the government to redirect resources away from EGS production and provide additional support for research and extension activities to ensure a steady supply of improved varieties and enable farmers to realize more of the potential inherent in improved varieties.

MECHANISMS AND SOLUTIONS

An EGS-PPP would have three primary objectives:

- Produce enough EGS to meet current and future demand.

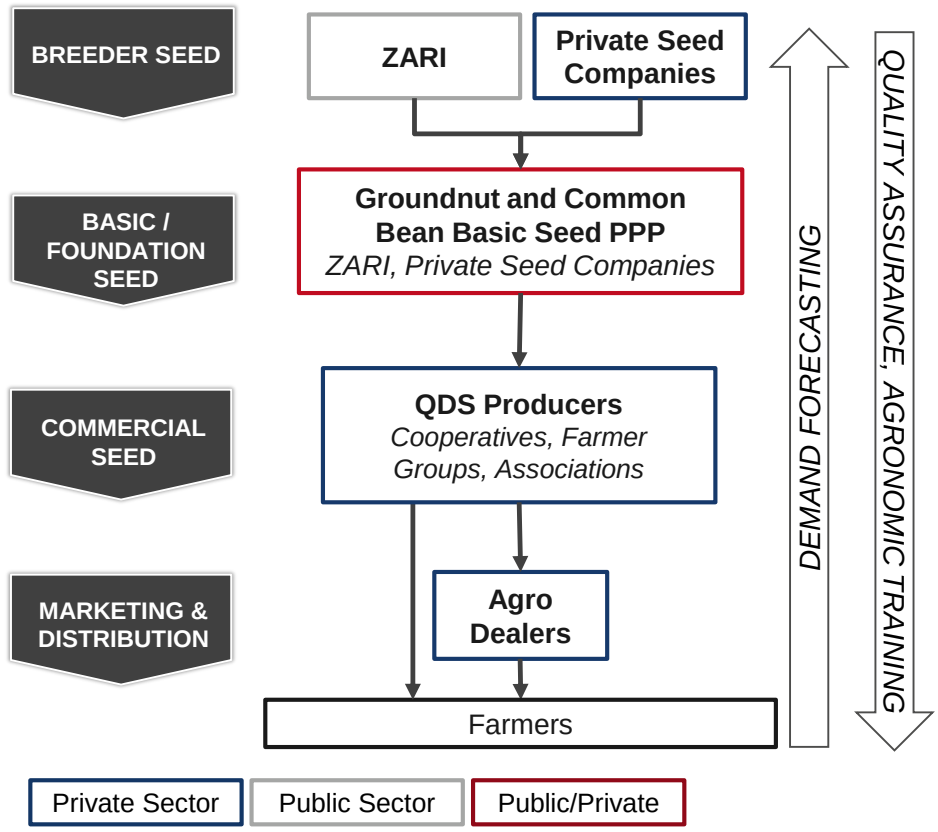
- Produce seed at the lowest possible cost while continuing to meet quality standards.
- Stimulate demand for improved varieties and quality seed at the farm level.

Produce enough EGS to meet current and future demand: The EGS-PPP would utilize resources such as land, personnel, technical know-how, and seed production infrastructure such as processing and packaging facilities from the both the public and private sectors.

More specifically ZARI would be the main supplier of germplasm and collaborate with private seed companies that have groundnut and common bean breeding programs to produce breeder seed. The EGS-PPP would be responsible for production of basic seed, targeting key locations in the Eastern and Northern provinces. These locations would be determined by their proximity to concentrations of smallholder farmers as well locations that present ideal growing situations for optimal seed production yields. Public actors such as the ZARI Seed Production Unit and private actors such as local and international seed companies, NGOs, cooperatives, and farmer groups could be part of the EGS-PPP at the basic seed production level. QDS would be the designated class of commercial groundnut and common bean seed sold to farmers. It would be critical for QDS growers to be located in close proximity to target smallholder farmers to lower transport costs. Producers of QDS would most likely be cooperatives, farmer groups, and NGOs such as COMACO and SHARE Africa.

Specific roles for each level of seed production are outlined in Figure 34.

Figure 34: **Groundnut and Common Bean EGS-PPP Seed Production Activities.**



Source: Research team analysis (2016).

Produce seed at the lowest possible cost while continuing to meet quality standards: The low profitability of producing and marketing groundnut and common bean has been a key constraint to increasing private sector participation in EGS. Critical factors contributing to low profitability have been high certification costs and a lack of an EGS and commercial seed demand forecasting system which prevents seed producers from reaching economies of scale which would in turn lower production costs. Furthermore, seed production yields are low (especially common bean) which lowers profitability. Improved agronomic practices are important to increasing yield, especially in common bean.

In order to address these constraints, the EGS-PPP would implement a central demand forecasting system that would originate at the commercial seed producer level, collecting the demand needs of those producers. That demand would then feed up the seed supply chain to inform basic seed and breeder seed demand. The EGS-PPP at the basic seed level would be ideal to manage this system as it is the key link between commercial seed and breeder seed. It would be essential that this forecasting system capture current and future demand in order that seed producers would be able to develop long term seed production plans. A transparent and easily accessible production plan would enable seed producers to optimize infrastructure and allocate resources to production which would in turn lower production costs.

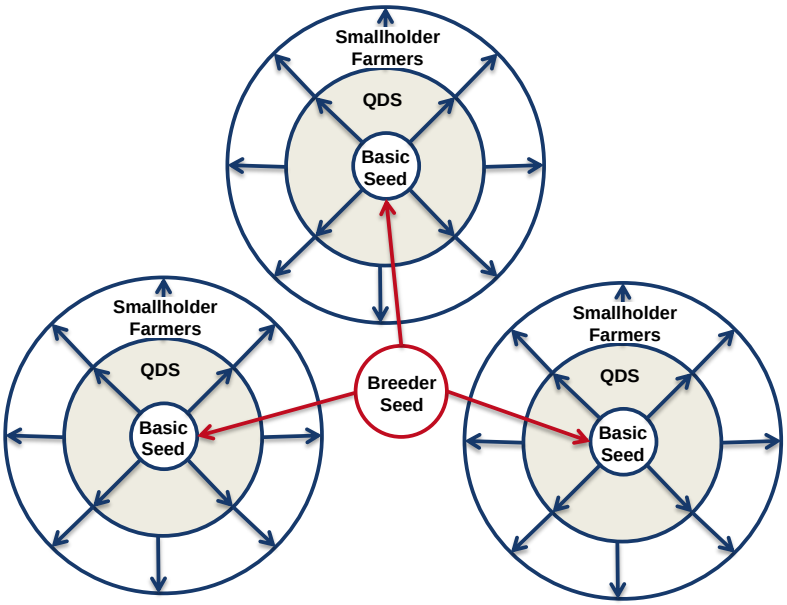
Additionally, the EGS-PPP would adopt QDS as the preferred class of commercial seed. As previously mentioned, certification costs, while reasonable for higher value crops like hybrid maize, are not economically sustainable for lower margin crops like groundnut and common bean. QDS production presents a practical solution that balances the need for consistent quality at the most cost effective level. In order to ramp up the capacity of QDS, it will be critical to coordinate both public SCCI and private seed company labs and personnel to ensure testing and inspection infrastructure can satisfy future demand.

Another key component of lowering production costs would be the implementation of a localized seed production model. Due to high transport costs and seed fragility (specifically for groundnut), it will be useful to decentralize basic and QDS production (see Figure 35). By locating production as close to markets as possible, transportation costs could be minimized which may translate into lower production costs.

Finally, the EGS-PPP would prioritize agronomic training of seed producers. Low seed production yields have been a key driver of high production costs which in turn reduces profitability. By implementing best agronomic practices in groundnut and common bean seed production, yields and profitability would likely increase.

Figure 35: **Localized Seed Production Model.**

For illustrative purposes



Source: Research team analysis (2016).

Stimulate demand for improved varieties and quality seed at the farm level: While current demand for EGS exceeds supply, there remains a need to prove at the farm level the benefits of using improved versus local varieties and buying QDS rather than saving seed that is not quality assured. In order to stimulate demand, the EGS-PPP would focus on increasing the number and dispersion of farm level demonstration trials. ZARI extension in collaboration with ZARI researchers, NGOs, and local seed companies would be the key actors implementing these trials, demonstrating at a farm level the benefits of improved quality varieties.

Additionally, the EGS-PPP would utilize seed small packs, providing the optimal volume of seed demanded by smallholder farmers for planting. Current seed pack sizes of up to 5 kg are often too big for smallholder farmers which discourages them from investing. Developing small packs in quantities of 0.1-0.5 kg that serve smallholder farmer needs would be a critical component to increasing demand.

Table 25 below highlights a broader but not exhaustive list of potential stakeholders for the EGS-PPP including their contributions and motivations.

Table 21: Groundnut and Common Bean EGS-PPP Potential Stakeholder List.

	Actors	Contribution	Motivation
Public	MAL	Administrative facilitation and expedition, financial support, concept validation	Economic growth
	ZARI	Improved varieties, land for seed production, extension services	Freed up resources, demand forecasting, increased revenue
	SCCI	Quality assurance services	Social responsibility
Private	Local Seed Companies, Farmer Groups, Coops, Agro-Dealers	Land and personnel for seed multiplication, seed distribution networks	Business and technical training, access to improved varieties, increased revenue
	Agro-processors, commodity traders and associations	Market information for processed products, consistent demand for higher priced products, export market linkages	Access to consistent supply and quality for trading, processing, and exports
	Banks, MFIs, and Chilimbas	Credit for agribusiness investment and working capital, short term credit for smallholder farmer input purchases	Economic growth
NGOs	COMACO, SHARE Africa, MUSIKA, Self Help Africa	Implementation expertise, partner and alliance coordination, technical advice	Program benefits aligned with NGO objectives

Source: Research team analysis (2016).

OPERATING PRINCIPLES

The EGS-PPP for basic seed should be established under a legal structure that allows actors within the PPP to generate and retain operating profits. The only way to ensure the EGS-PPP can meet its goals in the long term is to enable it to charge market rates for seed and use retained profits for continuing improvements to operations.

The ZARI breeding programs would receive royalties on sales of EGS and potentially on the sales of QDS varieties originating in their program. The basic concepts of the royalty program could be built into the formation documents, leaving specific royalty rates and terms determined on a case-by-case basis. Private sector partners would expect to benefit financially from the operations of the EGS-PPP. This could come in the form of royalties on sales of proprietary varieties or assured supply of raw product for processing partners.

The EGS-PPP should develop, or tap into, an effective system to forecast product demand. A major limitation of the current system is the absence of real-time information on the specific varieties and quantities needed to meet market demands. The EGS-PPP will be well placed to collect and utilize demand information.

ESTABLISHING A GROUNDNUT AND COMMON BEAN EGS-PPP

In order to establish a successful EGS-PPP, it would be important to develop an approach that addresses all of the complexities associated with partnering with a broad set of stakeholders. The Urban Land Institute outlined ten principles might help guide the development of a PPP for

a groundnut and common bean EGS-PPPs (Urban Land Institute, 2005). These principles will have different action items depending upon the crops, but provide a framework for the public and private sector actors involved in the PPP.

1. **Prepare properly for a PPP**: Public actors lead by MAL, ZARI, and SCCI, and NGOs such as COMACO and SHARE Africa as well as private sector seed companies (local and regional), agro-dealers, farmer group and cooperative representatives, and key agro-processors will need to convene multiple meetings and interactions to jointly assess priorities and capabilities, determine potential roadblocks (legislative, resource based, etc.), develop timelines and expectations, establish feasibility, get to know the other partners, and establish the right team.
2. **Create a Shared Vision**: Within the PPP, the founding organizers will need to cast a wide net giving all stakeholders and potential partners an opportunity to provide input on the vision, determine the best ways to sustain the vision through a detailed implementation strategy, potential partners, and a time frame for achieving the vision.
3. **Understand Your Partners and Key Actors:** At the outset it will be important to get the MAL's and ZARI's buy-into the PPP purpose. The EGS-PPP concept will provide value for groundnut and common bean, and the similarities of both crops present an ideal opportunity to develop an EGS-PPP that encompasses both crops. These similarities include key actors in EGS-PPP as the majority of public, private, and NGO actors are active in both groundnut and common bean.
4. **Be Clear on the Risks and Rewards for All Parties**: Each party identified and included in earlier principles will need to be fully involved so as to have the full understanding of the risks and rewards for their specific involvement, whether they are public sector or private sector actors.
5. **Establish a Clear and Rational Decision-Making Process**: Within the EGS-PPP, the partners will need to create a road map, define roles and responsibilities, and create appropriate checks and balances to ensure actions are taken in a timely manner and every actor is accountable to the other partners.
6. **Make Sure All Parties Do Their Homework**: Prior to entering into any partnership agreements, ensure that all actors have completed their due diligence to their own level of satisfaction, ensure that information is shared openly and freely, adopt scenario planning, and pursue creative public/private financing plans, if necessary.
7. **Secure Consistent and Coordinated Leadership**: Focus on qualities such as integrity, discernment, and awareness of the human spirit, courage, compassionate sense of humor, intellectual energy and curiosity.
8. **Communicate Early and Often**: Emphasize both internal and external communication with internal communication ensuring that roles and responsibilities are clear and complexity managed and external communication ensuring the PPP is transparent to all stakeholders. This type of communication will be a critical to the success of the undertaking, especially aligning interests and consistent information sharing across a diverse set of organizations.
9. **Negotiate a Fair Deal Structure**: General principles to reach a fair deal should include a detailed division of responsibilities among the stakeholders, outcomes, and objective performance measures. Each stakeholder should perform its own due diligence before committing to the EGS-PPP charter and plans.

10. **Build Trust as a Core Value**: Building trust from the beginning of the EGS-PPP that endures throughout the course of the partnership should be a priority for all stakeholders. As noted by the Urban Land Institute, “to endure, partnerships require a foundation of trust in each partner’s commitment to the project and its objectives” (Urban Land Institute, 2005).

5.4 RECOMMENDATIONS

The priorities for groundnut and common bean are highly aligned. The focus is to expand and enhance EGS production capabilities to meet current and future demand through public-private collaboration that ensures profitable EGS production and a robust yet cost effective quality assured system that increases farmer demand to purchase improved, high quality seed. In order to achieve these objectives, here following are specific recommendations:

Increase marginal economic value of groundnut and common bean

There is an opportunity to reposition groundnut and common bean as higher value crops in Zambia. In order to increase the marginal economic value of groundnut and common bean, it is critical to establish a quality assurance system that is cost-effective and efficient. It is recommended that the existing QDS system in Zambia be scaled up and positioned as the official system for groundnut and common bean. Furthermore, in order to lower production costs and improve profitability, seed production yield improvement should be enhanced by improved agronomic practices, which would lower costs on a $/Kg basis.

Additionally, commercial market grades and standards should be established. With a grading system in place, farmers would have the opportunity to be rewarded for higher quality production by obtaining pricing premiums for groundnut and common bean production that has specific quality parameters. A key component of operationalizing a system of grades and standards is to stimulate downstream demand for higher value varieties. This would be achieved through a strengthening of ties between breeders, farmers, and processors to ensure that breeders are setting breeding targets to develop improved varieties (especially groundnuts) that meet both farmers’ and processors’ needs. It is also recommended that extension services should redouble their efforts in aflatoxin management through farmer training in agronomic best practices and access to storage to stimulate demand from processors and exporters.

Stimulate farmer adoption of improved varieties and quality seed

To increase farmer adoption of improved varieties and quality seed, it is recommended that on-farm demonstration trials are increased and extended in key groundnut and common bean growing regions. It is critical that these trials are designed to compare the performance of farmer-saved seed versus quality seed as well as improved varieties versus local varieties. Successful execution of these trials will require a sufficient numbers of plots, seed, and staff to reach smallholder farmers. This will allow for direct engagement with the farmers and also help to prove the value proposition of the seed being sold by the PPP. Additionally, ZARI extension (in collaboration with ZARI researchers, NGOs, and private seed companies) should be expanded to train and provide ongoing support in the use of best agronomic practices, as well as calculating the costs and benefits of investment in inputs such as improved seed. Once the investment case for investing in improved varieties is demonstrated and understood by farmers, the GRZ should work with banks, MFIs, and Chilimbas with the aim of establishing purpose-built

agricultural lending products to smallholder farmers. As previously mentioned, the EGS-PPP should ensure that small packs of seed are sold, tailored to the volume needs of smallholder farmers, which would further increase farmer demand.

A longer term recommendation would be to accelerate varietal improvements in groundnut and common bean. While there have been recent releases of improved groundnut and common bean varieties, it appears that there has been a drop-off in varietal improvement. It is recommended that both the groundnut and common bean breeding programs be reviewed and the depth of their germplasm analyzed. Additionally, it is recommended that both breeding programs be properly resourced, including irrigation, sufficient land for breeding, mechanization, cold storage for germplasm, and drying capabilities. These necessary elements of an efficient breeding system are mostly absent or incomplete. The result is constrained breeding outcomes and high operating costs. It is also recommended that breeder incentives are reformed to align with market impact rather than number of releases. Such a system has been successfully implemented for the Drought Tolerant Maize program in Africa in which breeders and breeding programs are recognized for commercial achievements such as area penetration of a specific variety rather than number of varieties released.

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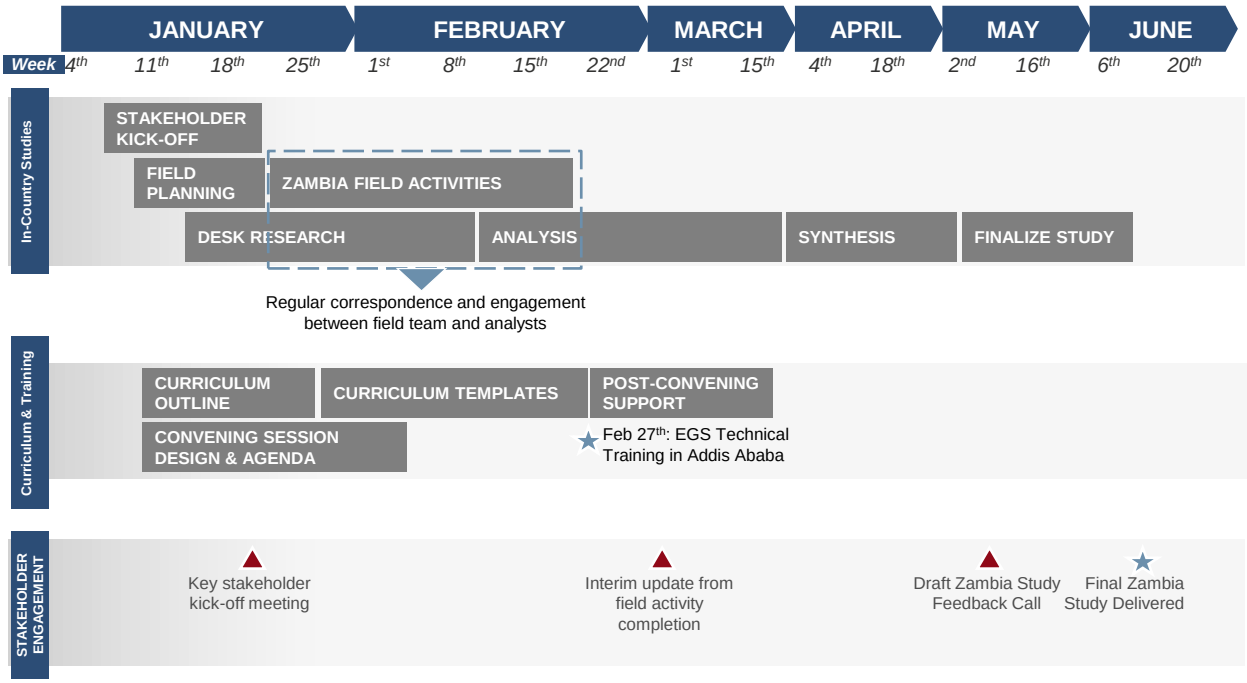
Data Sources

World Bank World Development Indicators, extracted February 2016

Zambia Country Stat, extracted February 2016

ANNEX A: PROJECT TIMELINE



ANNEX B: FIELD RESEARCH TEAM

Zambia Field Research Team	Zambia Stakeholders	Project Management Team
Dave Westphal (Lead) **Watson Mwale** (CCN) **Catherine Mungoma** (CCN)	**Harry Ngoma, Anna Tommes** (USAID Zambia) ZARI, Ministry of Agriculture, selected seed companies, NGOs active in seed supply, value chain actors such as processors, farmers, farmer groups, traders	**Africa Lead/DAI**: David Tardif-Douglin, Chuck Johnson **USAID**: David Atwood, Mark Huisenga **Context**: Mark Nelson, Rob Lowenthal, and Dan Creagh

ANNEX C: STAKEHOLDER INTERVIEW LIST

Interview	Role
Public	ZARI Eastern Province Research Station
Public	ZARI Common Bean Breeder
Public – Quality Assurance	SCCI
Private – Seed Company	ZAMSEED
Private – Seed Company	Kamano
Private – Seed Company	SeedCo
Private – Seed Company	Stewards Globe Limited
Private – Seed Producer	NWK Agri-Services Zambia
Private – Seed Producer	ZASAKA
Private – Agro Dealer	MSP Farmers Shop
Private – Agro Dealer	Sheni Agriculture
Private – Commodities Exchange	ZAMACE
Private – Commodity Trader	Link Commodities, Sole Proprietor
Farmer Groups/Cooperatives	Groundnut Farmer, Eastern province
Farmer Groups/Cooperatives	Farmer Cooperative Representative, Eastern Province
Public	Cotton Board of Zambia
Public – Private	Cotton Development Trust
Association	Zambia Seed Trade Association
Association	Zambia Cotton Ginners Association
Association	Cotton Association of Zambia
NGO	COMACO
NGO	Share Africa
NGO	MUSIKA
NGO	Self Help Africa