

Kenya Seed Industry Study (KSIS) For ASI International

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TABLE OF CONTENTS

Executive Summary	p. 4
Abbreviations	p. 5
Scope of Study	p. 6
Introduction	p. 6
Overview of the Industry	p. 7
Participants and Roles	p. 7
Linkages	p. 10
Products	p. 13
Research, Production and Distribution, Informal Sector	p. 14
Research Activities, Formal Sector	p. 14
Production Activities, Formal Sector	p. 15
Marketing and Awareness Activities, Formal Sector	p. 16
Distribution Activities, Formal Sector	p. 16
Overview of Regulation	p. 18
Variety Release	p. 18
Seed Certification	p. 21
Industry Performance and Potential	p. 22
Current Industry Performance	p. 22
Product Value to Farmers	p. 26
Awareness and Adoption	p. 27
Potential Local and Regional Market Size	p. 28
Potential Industry Development Impact on Individual Farmers	p. 29
Potential Industry Development Impact on the Kenyan Economy	p. 32
Future Trends	p. 35
Industry and System Analysis	p. 36
Key Conclusions	p. 36
Key Contrasts with Other National Seed Industries	p. 38
Staple Food Crop Comparison with Horticultural Crop	p. 40
Industry Development Recommendations	p. 41
Long Term Vision and Goals	p. 41
Overview of Approach for Bringing About Industry Change	p. 41
Key Proposed Initiatives	p. 44
Conclusion	p. 48

List of Tables

- Table 1: Industry Participants and Roles
- Table 2: Categories of Seed Sources
- Table 3: Industry Participants by Category
- Table 4: Main Food Crop Categories

Table 5:	Example of OPV Seedstock Production Calculation
Table 6:	Certified Seed Distribution Channels
Table 7:	Mean Distance (km) to Fertilizer and Hybrid Maize Seed Stockist
Table 8:	Number of Released Crop Varieties from 1950s to date
Table 9:	Comparison of Kenya's Maize Productivity with Other Countries
Table 10:	Seed Crop Hectares Inspected and Approved for Harvest
Table 11:	Percentage of Seed from Different Sources in Kenya
Table 12:	Selected Characteristics of Seed Sector from Secondary Data
Table 13:	Seed Company Portfolio Information
Table 14:	Seed Pack Size Preferences of Farmers
Table 15:	Seed Demand and Supply Situation for Selected Crops in Kenya (2005)
Table 16:	Farmer Segmentation Categories
Table 17:	Example of Impact of Productivity Increase on SHF Family Income
Table 18:	Seed and Fertilizer Usage: Comparative Trials in Burkina Faso (kg/ha yield)
Table 19:	Estimated Economic Impact from Increased Maize Productivity
Table 20:	Comparison of Key Seed Industry Practices in Kenya with Those of Other Countries
Table 21:	Comparison of the Horticultural Crop and Staple Food Crop Seed Sectors in Kenya
Table 22:	Currently Registered Seed Companies in Kenya (Annex 2)

List of Figures

Figure 1:	Estimated Seed Industry Market Share in Kenya, 2010
Figure 2:	Seed Industry Activities Diagram, Informal Sector
Figure 3:	Seed Industry Activities Diagram, Formal Sector
Figure 4:	Cumulative Varieties Released, 1950s to Date
Figure 5:	Varieties Submitted for Release, by Submitting Entity, 2008/09
Figure 6:	Cereal Varieties Released by Sector
Figure 7:	Pulse Varieties Released by Sector
Figure 8:	Estimates of Average Cereal Grain Yields, 1960 - 2010
Figure 9:	Number of Varieties Released Over a 5 Year Period
Figure 10:	Yield Perceptions of Farmers Growing Seed of Improved Varieties, Relative to Their Prior, Unimproved Varieties
Figure 11:	Estimate of Potential Regional Seed Industry Revenue for Staple Food Crops
Figure 12:	Impact on Farmers of Using Hybrid Maize Seed and Fertilizer
Figure 13:	Proportion of Kenyan GDP from Agriculture and Fisheries
Figure 14:	GDP Contribution of Agriculture and Fisheries
Figure 15:	Profile of Kenya's Land
Figure 16:	How Improved Varieties Contribute to Poverty Reduction
Figure 17:	Map of Kenya Showing Study Interview Area

Annexes

Annex 1:	Study Methodology
Annex 2:	Currently Registered Seed Companies in Kenya

Executive Summary

It has long been recognized that Kenya's agricultural productivity, especially productivity for crops other than maize in the highland area, is well below potential productivity. Kenya's maize yield is estimated to be approximately 2t/ha (Tegemeo Institute). This is the same as the 1960 global average, more than half a century ago, and not much more than the US average of 1.5t/ha in the mid 1930s, before hybrids were introduced there. Yields for many other food crops are similarly low, contributing to a continuous cycle of poverty and hunger for millions of Kenya's smallholder farmers and impeding more rapid Kenyan GDP growth.

One important factor – some believe the most important factor – contributing to the low productivity is the seed that farmers are planting. All too frequently the seed planted by Kenyan farmers does not contain the improved germplasm available to farmers in other parts of the world, and frequently quality is wanting as well.

Kenya's farmers are eager for high quality seed of improved varieties that is suited to their agroecologies. Demand is high. The supply response, however, is challenged by myriad factors, ranging from historically low levels of new variety releases for most crops, to undersupply of parental seed material, to low levels of local private sector seed company financing, to the large market share held by the parastatals, Kenya Seed Company and KARI Seed Unit.

Kenya's seed industry, while embodying strengths in many areas, does not embody many of the key working practices and levels of impact seen in mature seed industries in other parts of the world. Key among these are: a large and diverse pool of private sector participants; large degrees of self-regulation among companies; extensive private sector research efforts; rapid innovation and product release into the market; and strong mechanisms for addressing customer complaints.

Existing potential market size based on current cropping patterns is estimated to exceed \$60 million USD at the national level, and perhaps exceed this figure by quite a lot as more smallholders adopt higher value seeds such as vegetable hybrids, and \$490 million USD at the regional level. However, Kenya is not tapping even an estimated 60% of the existing potential at the national level. Furthermore, market growth is sluggish as low productivity does not drive more intensified cropping patterns. Perhaps even more important, subsequent and significant Kenyan GDP growth from agribusiness – growth that would be driven by greater use of improved varieties by smallholder farmers, larger commercial farmers, and industrial producers – is lost each year. This is a significant loss, as there is large regional and global export potential in the agribusiness sector.

There are key initiatives which should be considered to strengthen the performance of the industry. The study outlines eight which can help to bring Kenya's agricultural productivity closer to global averages, make important contributions to the lives of smallholder farmers, and contribute to stronger national and regional economic growth. These initiatives fall under the headings of Policy and Regulation, Awareness and Distribution, and Private Sector Capacity and Performance.

There is good reason for optimism if Kenya decides to act decisively to fully liberalise its seed sector and promote its modern, efficient operation. Many of the needed changes do not require long timeframes to implement, nor do they require large capacity-building initiatives with respect to staffing. A primary determinant of success will be institutional will and public-private collaboration and cooperation.

Abbreviations

a	acre
AATF	African Agricultural Technology Foundation
ADC	Agricultural Development Corporation, Kenya
AFC	Agricultural Finance Corporation, Kenya
AGRA	Alliance for a Green Revolution in Africa
AKC	Anglican Church of Kenya
ASARECA	Association for strengthening Agricultural Research in Eastern & Central Africa
ASCU	Agricultural Sector Coordination Unit
CBO	community based organization
CG	short for CGIAR, Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CNFA	Citizen's Network for Foreign Affairs, an NGO now known simply as CNFA
CRS	Catholic Relief Services
DADCs	District Agricultural Development Committees
DUS	distinctness, uniformity and stability
FAO	Food and Agriculture Organization
FIPS-Africa	Farm Input Promotion System – Africa
GDP	Gross Domestic Product
ICRISAT	International Crop Research Institute for the Semi Arid Tropics
KARI	Kenya Agricultural Research Institute
KASP	Kenya Agrodealer Strengthening Program
KENAPOTA	Kenya National Potato Farmers Association
KENKFAP	Kenya National Federation of Agricultural Producers
KEPHIS	Kenya Plant Health Inspectorate Service
KEPSA	Kenya Private Sector Alliance
KFA	Kenya Farmers Association
kg	kilogram
KNFC	Kenya National Federation of Cooperatives
KSC	Kenya Seed Company
Ha	hectare
ICC	The Inter-ministerial Coordination Committee
m	meter
MNCs	multinational corporations
MoA	Ministry of Agriculture
NAAIAP	National Accelerated Agricultural Input Access Program
NGO	Non-government organization
NPT	National Performance Trials
NPTC	National Performance Trials Committee
NVRC	National Variety Release Committee
OPV	open pollinated variety
PASS	AGRA's Program for African Seed Systems
QDS	quality declared seed
QIPP	(seed that embodies) quality standards, improved genetics, properly positioned, packaged and priced
RSA	Republic of South Africa
SEMI	Seed Enterprise Management Institute
SHF	smallholder farmers
SSA	sub-Saharan Africa
STAK	Seed Trade Association of Kenya
t	metric ton
TWGs	Thematic Working Groups
UoN	University of Nairobi
US	United States
USD	US dollar

Scope of Study

This study focuses on the seed industry in Kenya, and includes seed of the main food crops, with particular emphasis on seed produced in Kenya. The purpose of the study is to:

- 1) Describe the seed industry in Kenya
- 2) Analyze the functionality of the seed industry
- 3) Develop recommendations for improvement

Main food crops include: maize, sorghum, rice, beans, groundnuts, cowpea, pigeon pea, cassava, sweet potato, Irish potato, wheat, and the key vegetable crops (tomatoes, onions, cabbages, etc.)

The industry is defined to include all direct participants (breeders and researchers, producers, processors, packagers, marketers and distributors) as well as all regulatory and enabling bodies (government policy makers, regulators, financiers, suppliers, etc.)

A brief methodology and map of locations of field interviews is included in Annex 1.

One caveat about the methodology is in order: there is little good data available on the commercial seed industry in Kenya, and much of the data that is available is not available over time, making it difficult to determine trends. Furthermore, some of the key data and information that is publicly available does not appear to be accurate. For example, seed companies have confirmed that there are instances where varieties they have released are not listed on the official government website. We are grateful to the Tegemeo Institute for Agricultural Policy and Development at Egerton University for the work they have done to compile and analyze meaningful data about Kenya's seed systems.

Introduction

The seed industry in Kenya is arguably the key cornerstone for the foundation upon which improved agricultural productivity for the country must rest. With seed of improved varieties comes greater incentive to use better management practices, apply fertilizer judiciously, and employ conservation farming practices. Seed of improved varieties also gives farmers the opportunity to move from subsistence farming to commercial farming, even – and perhaps most notably – at the smallholder level.

Quality produced seed of improved varieties drives higher yields. Quite simply, with higher yields from the same, or even less, hectares farmers are better able to feed themselves and begin to use some of their land for commercial purposes or longer term environmental improvements such as reforestation.

Looking ahead, the potential for Kenya to lead a strong regional industry is great. It is estimated that close to 60% of the underutilized agricultural land in the world today is located in Africa. With increasing global population, urbanization, income levels, and demand for meat proteins, the demand for food crops is expected to increase significantly in the coming decades. Eastern Africa is ideally located for export eastwards, where demand is expected to increase at even faster rates than the global average. Improved seed research and breeding, production, distribution, and educated farmer usage will be critical factors in determining if Eastern Africa will benefit economically from strong global demand for food crops.

Additionally, a vibrant, competitive and well-functioning seed industry can become the channel through which new seed research and development can flow to farmers. These new developments will include: newly hybridized varieties for crops such as millet, sorghum, sunflower, and vegetables; drought escaping varieties; new types of seed treatments to protect the inherent yield of the seed; seed developed specifically to meet industrial uses such as those of oil processors; and seed that has been genetically modified, e.g., to tolerate

drought, escape damage from pests, and/or tolerate herbicide application. Without a healthy and innovative seed industry the benefits of these technologies will not accrue to most farmers.

Kenya has great strengths upon which to build, most notably hard-working farmers, a strong cadre of scientists, and established institutions. The challenge for Kenya will be to look ahead in a visionary and proactive way to realise the immense potential that a stronger seed industry promises, both nationally and regionally.

Overview of the Industry

Participants and Roles

The seed industry in Kenya can be split into two sectors: formal and informal. The formal sector is the sector which focuses on breeding, producing and selling seed that is certified by the Kenya Plant Health Inspectorate Service (KEPHIS), the government entity responsible for regulating seed production in Kenya, among its other activities. The informal sector is the sector which produces seed which is used by farmers but is not certified by KEPHIS. Much of this seed is saved and/or exchanged by farmers.

According to a study by the Tegemeo Institute of Agricultural Policy and Development at the Egerton University, approximately four-fifths (78%) of all seed used in Kenya for the top 7 grain and legume crops comes from the informal sector. However, it is important to note that OPV seed from the formal sector can be saved and reused by farmers in the informal sector, although it is highly advisable to replace stocks approximately every three years to ensure continuing purity and freedom from disease.

If saved stock of formerly certified seed of improved varieties that is still of good quality is included in the estimate of seed from the formal sector used in Kenya, the percentage of seed that is truly from the informal sector would be well below 78%, although an exact percentage is not known.

Participants in the seed industry can be grouped as follows:

Table 1: Industry Participants and Roles

Industry Participants	Roles
Breeders and researchers – public, private, and NGO	Develop new varieties by using scientific methods to systematically combine germplasm pools to achieve the desired variety characteristics. Are also responsible for maintaining good, pure breeder seed of varieties over time. Can also be responsible for overseeing production of pre-basic and basic seed, depending upon how responsibilities are assigned.
Foundation seed bulkers – public, private, NGO	Are responsible for taking small quantities of breeder seed and multiplying, or bulking, it to pre-basic and basic levels, which are then used to produce a certified seed crop.
Certified seed producers – corporate, government, contract growers, NGOs	Produce the crop of seed which then becomes certified for distribution in the formal sector, and is known as certified seed. Government and the private sector often contract outgrowers to perform this function.
Processors and packagers – private, government, NGOs	Take raw seed as it is brought in from the field, then dry, clean, sort, test, treat and package it. They also ensure required inspections are done for certification.
Marketers/Awareness Creators – seed companies, extension agents, NGOs	Create awareness and demand for seed of improved varieties via demonstrations, meetings, publications, radio programs, etc.
Distributors – agents and agrodealers, private seed companies, NGOs,	Typically purchase seed, frequently on credit, from seed companies and other producers and then transport and sell seed to the end users. Some distributors give seed away for free.

government entities, multilaterals	
Policy makers and regulators – government and government-contracted entities	Establish formal government policy for the sector, and set up and execute mechanisms for implementing the policy. Their key activities in Kenya include making seed legislation, releasing varieties, certifying seed, licensing seed companies and agents, and enforcing laws that combat fake seed.
Financiers – commercial and donor	Provide both working capital and longer term financing to seed companies to meet seasonal production costs as well as capital investment needs for warehousing, processing machinery, vehicles, irrigation and other farm equipment, etc.
Users – commercial farmers, non-commercial farmers (for their own or shared consumption), industrial purchasers	Plant the end product themselves to obtain a food crop, or purchase it for their own contracted farmers in the case of industrial purchasers.

Source: Agri Experience

However, to fully appreciate the complexity of these categories, it is important to look more closely at the interplay of numerous variables. For example, various categories of seed sources are presented in Table 2 below, delineated by formal vs informal, for profit vs not for profit, commercial vs free. The complexity in Kenya of just this one category becomes clear.

Table 2: Categories of Seed Sources

Category	Examples
1. Formal, For Profit, Primarily Maize	Monsanto, Olerai
2. Formal, Private, For Profit, Varied	Leldet, Dryland Seeds
3. Formal, Parastatal, Varied	KSC, KARI Seed Unit
4. Formal, Not For Profit, Varied	One Acre Fund
5. Formal, Not For Profit, Single Product	CBO cassava multiplication where cuttings are sold
6. Informal, Community-Based, Sold	NGO funded community production for selling
7. Informal, Community-Based, Free	NGO funded community production for sharing
8. Informal, Farmer Saved	Individual farmers saving seed
9. Informal, Market Trader/Consolidator	Artisanal seed dealers at markets, seed fairs
10. Relief Seed Distributor, Free	FAO
11. Government, Sold	KARI Seed Unit
12. Government, Free	Kenyan government free seed program for the poorest farmers

Clearly the industry is driven by multiple channels for farmers to receive seed, with each channel representing differing potential for actually delivering quality, innovation and reliable supply to farmers.

Participants in the informal sector are relatively straightforward to define: famers, exchangers or marketers of non-certified seed, NGOs, and possibly extension workers. Participants in the formal sector are more numerous and play many roles, ultimately incorporating a much larger array of participants than can be described by sources of seed since regulators and enabling actors are also involved.

In Table 3, below, sector participants are mapped by type of institution and area of involvement.

Table 3: Industry Participants by Category

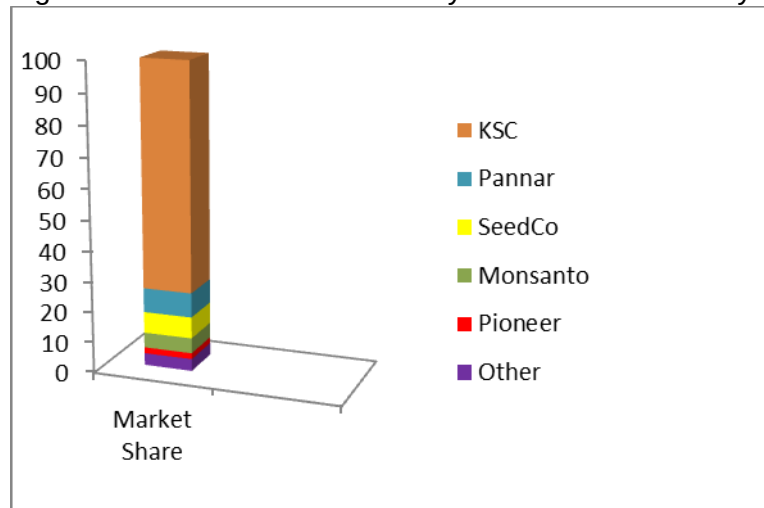
Note: The list of players indicated below is indicative but not exhaustive, particularly with respect to donors in the sector

	Government of Kenya	Private Sector	NGOs and Associations	Donors
Policy	ICC Ministry of Agriculture ASCU TWGs DADCs Egerton Univ. - Tegemeo		STAK AFSTA KENFAP KNFC Plant Breeders Assoc. Agro-Dealer Assoc. Kenya Farmers Assoc. Cereal Growers Assoc.	AGRA
Regulatory	KEPHIS			
Research and Breeding	KARI KSC/Simlaw Public Universities, e.g. Egerton Jomo Kenyatta University of Nairobi	Local Seed Cos. Western Seed Co Multinational Corp., e.g. Monsanto/Seminis Pannar Pioneer SeedCo	CG Centres AATF ASARECA	AGRA
Production, Processing, and/or Packaging	KSC/Simlaw KARI Seed Unit National Irrigation Board	Local Seed Cos. Private Farmers/Contract Growers Multinational Corp., e.g. Monsanto/Seminis Pannar Pioneer SeedCo	CBOs One Acre	AGRA USAID
Marketing, Education, Training, Extension	KARI KSC/Simlaw MoA Univ of Nairobi - SEMIs KENFAP KENAPOTA	Local Seed Cos. Agro-Dealers Agents, Sub-agents, Stockists Multinational Corp. Monsanto/Seminis Pannar Pioneer SeedCo	CBOs One Acre FIPS-Africa CG Centers AATF ACDI-VOCA Religious Organisations	AGRA USAID
Trading and Distribution	KSC/Simlaw KARI NCPB NAAIAP	Local Seed Cos. Agro-Dealers Agents, Sub-agents, Stockists Artisanal Marketers Farmer Groups and Cooperatives Households (informal) Multinational Corp. Monsanto/Seminis Pannar Pioneer SeedCo	Religious Orgs, e.g. CRS CRWRC ACK Committee Islamic Relief CBOs	AGRA BMGF USAID WORLD BANK
Financing	MoF AFC	Local Commercial Banks Social Impact Funds, e.g. AAC ASIF	International NGOs, e.g. Root Capital Plan International Techno Serve Farm Africa	AGRA

Source: Agri Experience compilation; not exhaustive

The seed production sector is dominated by Kenya Seed Company, a government-owned entity, which holds an estimated 70 - 80% market share. Other key participants include several large multinationals and emerging and mid-sized Kenyan companies (e.g., East African Seed, Western Seed, Olerai, Leldet, Freshco, Drylands, etc.) The number of registered seed companies in Kenya is 93, however many of these are either inactive, produce exporters, horticultural seed traders (selling imported seed), or of unknown classification. There are only 4 companies selling both food crop seed and horticultural seed, and an additional 9 or 10 that sell food crop seed of more than one crop, totaling a maximum of 14 companies selling food crop seed. The full list of registered companies is included as Annex 2. The estimated market share for food crop seed is below in Figure 1.

Figure 1: Estimated Seed Industry Market Share in Kenya, 2010



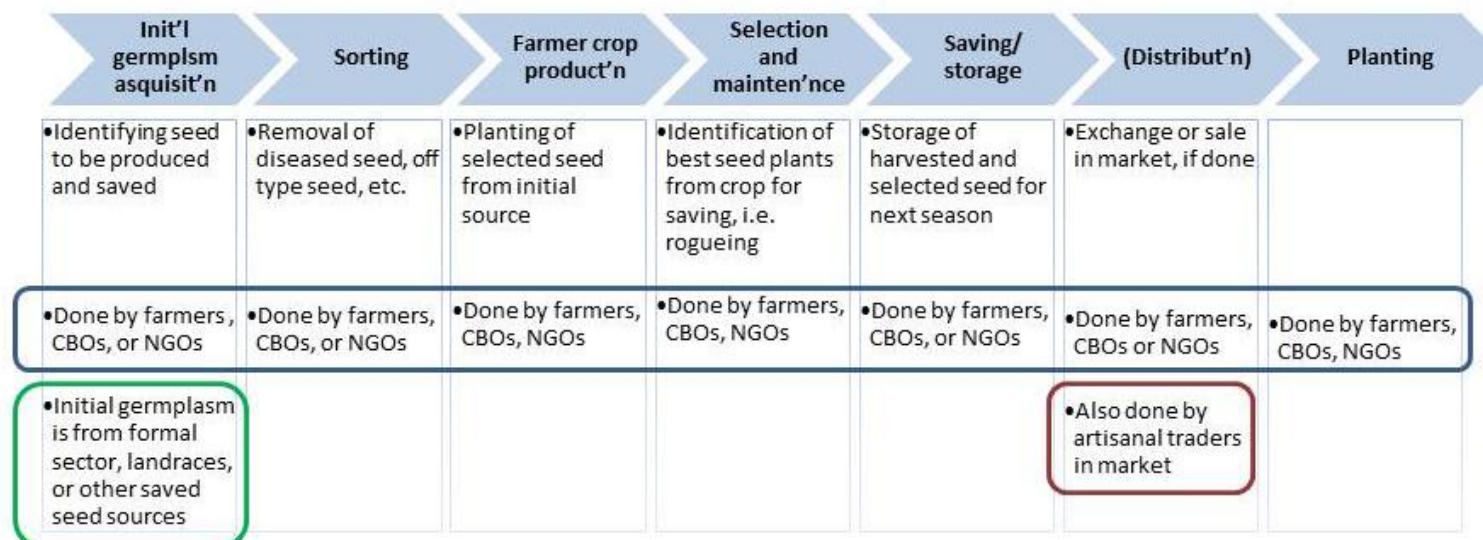
Source: Agri Experience, based on interviews and field work

Linkages

Figures 2 and 3 on the following two pages provide basic illustrations of how the activities and roles in the formal and informal sectors are linked.

Figure 2: Seed Industry Activities Diagram, Informal Sector

Seed Industry Activities and Participants, Informal Sector



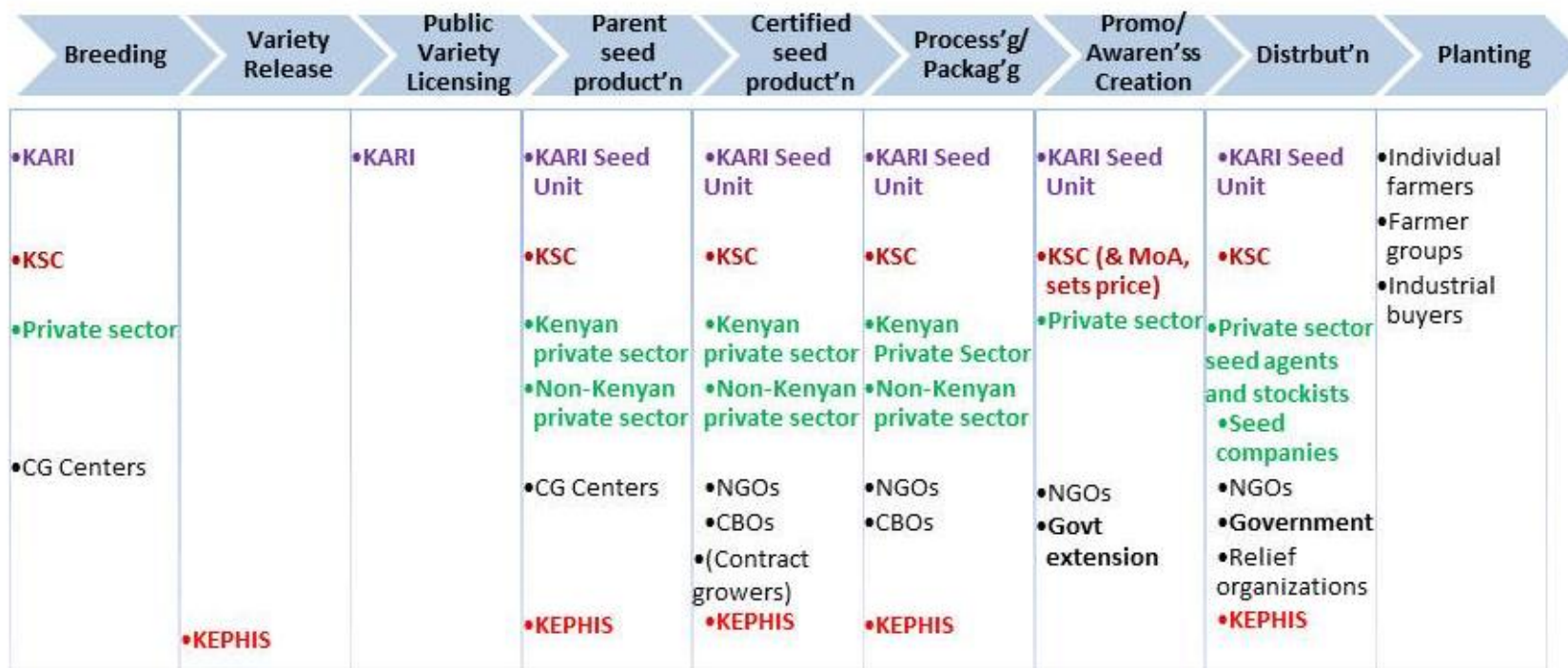
Enabling participants

Initial germplasm providers, donors, trainers, recycled seed advocates, regulatory agencies by permitting informal activities

Source: Agri Experience

Figure 3: Seed Industry Activities Diagram, Formal Sector

Seed Industry Activities and Participants, Formal Sector



Note: government entities are in bold

Enabling participants

Policy makers, private and government input suppliers, financial donors, germplasm donors, commercial and social impact financiers, trade associations, BDS suppliers, infrastructure providers (e.g. for roads, water)

Source: Agri Experience

Products

Table 4 lists the key food crops in Kenya and characterizes the seed. With the exception of vegetable seeds, which do not require certification, the other crops all require certification by KEPHIS. (Note that there are additional crops which require certification, such as oats, which are not included as main crops below.)

Table 4: Main Food Crop Categories

Category	Main Crops	Comments
Grains	Maize, rice, wheat, sorghum, fox tail millet, pearl millet, finger millet	In Kenya, hybrids are available for maize and sorghum, but not other grains. In other parts of the world rice, fox tail millet and pearl millet are also hybridized.
Pulses	Cow pea, pigeon pea, dolichos beans, field beans, soya beans, snap and climbing beans	These are all OPV, even in other parts of the world, with the exception of pigeon pea which has been hybridized
Roots and Tubers	Cassava, Irish potatoes, sweet potatoes	These are vegetatively propagated. The planting material is bulky and quality can deteriorate rapidly after cutting. Cassava and sweet potatoes can be propagated via tissue culture
Horticultural Crops	Bananas, vegetables (onions, peppers, cabbages, etc.)	Hybrid vegetable seed is imported into Kenya. Bananas can be propagated via tissue culture

Each of these categories can be further split into seed for personal consumption and commercial/industrial seed. In some cases industrial users want varieties with specific industrial characteristics such as malting properties and protein levels.

In all cases in Kenya, a variety is valued for its adaptation to local agroecological conditions and farmer preferences. In some cases these preferences are related to traditionally preferred tastes and textures, but in most instances the preferences are tied to deep understanding and wisdom about the type of seed best suited to the agroecology.

Examples of farmer variety preferences tied to agroecological characteristics:

- Flint maize is preferred in areas where storage pests are a problem
- Varieties of specific maturity are valued according to the length of the rainy seasons (i.e., shorter rains require earlier maturities)
- Maize, millet and sorghum varieties with shorter, stronger stalks are valued in areas where lodging is likely
- Disease resistance is valued in areas under heavy disease pressure

As referenced in Table 4 above, seed products are also described by how they are produced. The most typical labels are open pollinated variety (OPV), hybrid, vegetatively propagated, and tissue cultured. OPV seed can be saved and replanted for a number of seasons without significant loss of yield. Hybrid seed, on the other hand, due to the naturally occurring process of heterosis will generally have a higher yield than an OPV counterpart in season 1, but the yield will

fall off if hybrid seed is saved and replanted. The increased yield in year 1, however, justifies the increased seed cost if the seed is of high quality and properly positioned for the user's agroecology.

Seed is fragile and alive. While some vegetable seeds can be kept for ten years if stored properly, other seeds (such as soya) can be difficult to maintain for even one season. Storage conditions are extremely important, with the main enemies of seed quality in storage being heat, moisture, and insects. Seed becomes grain, legume, or simple vegetative mass under poor storage conditions; it is no longer seed.

Research, Production and Distribution Activities, Informal Sector

Seed in the informal sector is essentially saved from a prior harvest. Breeding research is not conducted, and all informal sector seed is non-hybrid. Ideally, the farmer saving the seed selects only healthy true-to-type seed to save and/or sell as an artisanal market trader. A key challenge with this sector is proper storage from season to season. Estimates indicate that anywhere from 30% to 60% of seed of improved varieties saved in the informal sector fail to deliver full yield potential due to poor storage and/or poor selection discipline, implying that significant productivity gains can be achieved by rectifying both of these situations. Seed can be distributed by sharing or via sale by either individual farmers or artisanal traders.

Research Activities, Formal Sector

Seed varieties are created by breeders and the institutions that employ them. Conventional breeding involves crossing and evaluating material from a broad range of sources, continually narrowing the resulting genetic pool until the desired variety characteristics are obtained. The final material is then "selfed" for a sufficient number of generations to ensure stability of the desired characteristics. Breeding varieties with improved genetics can start with indigenous varieties which are then improved to incorporate characteristics such as higher yield, disease resistance or earlier maturity. In recent years breeders have been strongly encouraged (and in many instances required by donors) to incorporate farmer feedback into their breeding activities to avoid having breeders develop varieties that may be personal favorites but will not have broad appeal to farmers.

In Kenya, most breeding is carried out by KARI, although multinational seed companies also have breeding programs as well as several (but not most) local companies. Other participants in breeding are CG centers, universities, and donors.

Breeders are also responsible for producing breeder seed, and usually basic and pre-basic seed as well. (These are the generations of seed one must bulk in order to obtain a sufficient volume of parental stock to produce a certified seed crop. The last generation is frequently referred to as foundation seed.) Breeders are also responsible for maintaining the seed lines, continually monitoring and "cleaning up" the lines so that the initial variety which was bred can always be produced from existing seed stocks – stocks which have not become contaminated or diseased over time. In Kenya, KARI has the main responsibility for breeder and basic seed production, as well as line maintenance, for any varieties which it has developed and released. However, qualifying production entities are permitted to bulk pre-basic and basic seed under KEPHIS supervision.

Most research is focused on farmer yield, in combination with other agronomic traits such as disease resistance, maturity, etc. Increasingly in Africa, some large agribusinesses such as oil

processors and breweries are exploring breeding advances which will benefit their businesses. This is already a focus in many other parts of the world.

Production Activities, Formal Sector

Seed production is a multi-season process. As described above, one must first start with multiple seasons of bulking parental material in order to obtain sufficient volumes to create a crop of certified seed. An example for OPV parental seed production is shown in Table 5. This example illustrates what must be produced over a three year period in order to end up with a certified seed crop of 200t. Hybrid seed production is significantly more complicated since a seed producer must manage multiple parental lines for each variety over a number of years. Clearly good planning and reliable access to isolated, and ideally irrigated, land are critical.

Table 5: Example of OPV Seed Stock Production Calculation

		2010	2011	2012
Certified	Production			200 t
	Area required			47 ha
Basic	Production		1.2 t	
	Area required		0.3 ha	
Breeders	Production	7 kg		
	Area required	16 sq m		

Source: John MacRobert, CIMMYT Seedplan calculator

Because of the time and expertise required to bulk parental material, it becomes difficult for seed production entities to rapidly ramp up production volumes based on government or NGO seed distribution programs with little advance notice. In addition, it becomes difficult for seed companies to rapidly change their product lineups, especially in the absence of assured market acceptance of the new products.

At all production levels, KEPHIS is very involved in regulating quality, and seed cannot be certified, and sold as such, if it does not pass each level of inspection. Seed production must be done with the highest level of agronomic practices to ensure good yield and quality, and in addition must be protected from any kind of contamination. The most common approaches to accomplish this are field isolation, rogueing (removing off type or diseased plants), and clear labeling and separate handling channels in order to avoid mixing varieties. Key inputs for seed production are:

- ✓ High quality foundation seed
- ✓ Isolated land, ideally with irrigation if drought is a risk
- ✓ Fertilizer
- ✓ Technical capacity (especially for hybrid production)
- ✓ Field labor for planting, weeding, harvesting
- ✓ Farm mechanization (extremely helpful for land preparation in particular)
- ✓ Post-harvest storage that is cool, dry and secure
- ✓ Moisture meters and other quality control equipment
- ✓ Money for all of the above

The term seed production generally refers to the field production, and this activity can be done directly by seed companies, individual contract/commercial farmers, community based farmer groups, or government.

However, to manufacture a finished package of seed, the seed must also be **processed, treated** (for many crops, especially maize) and finally **packaged**. These activities must be done with extreme care and generally in a short time period as seed quality is adversely affected by exposure and poor storage conditions. The key inputs required for these activities are:

- ✓ Transportation from the field
- ✓ Drying facilities (possibly mechanized depending upon climate and volume of seed handled)
- ✓ Storage and storage supplies such as pallets, fumigation equipment, probes, etc.
- ✓ Quality control equipment for germination, moisture testing, etc.
- ✓ Processing machinery
- ✓ Seed treatment, if required
- ✓ Packaging
- ✓ Labor
- ✓ Money for all of the above

Marketing and Awareness Activities, Formal Sector

Most marketing and awareness activities in the formal sector are undertaken by private sector seed companies, although NGOs and extension officers also participate. The main activities are demonstration plots, radio campaigns, printed promotional material, and field days. There are several NGOs that have been very active in the sector, such as FIPS-Africa and One Acre Fund, which take a more holistic approach and offer training and at times other services such as credit to farmers. Staff from these NGOs teach farmers how to correctly use seed of improved varieties and other inputs, and also work to ensure the appropriately positioned, high quality, adapted seed from private sector companies is available to their farmers in preferred package sizes -- essentially, QIPP seed.

Agrodealer agents and stockists do some awareness, including demo plots on occasion, but generally they are not highly active in this area. Frequently the person staffing the retail shop is not very familiar with product attributes or benefits, and is not able to engage in marketing or awareness activities.

Distribution Activities, Formal Sector

Seed **distribution** in Kenya typically occurs via a chain of distributors: agents (large wholesalers), sub-agents, stockists (agrodealers), and sub-stockists (kiosk and other small vendors who are not agrodealers but will sell seed in season.)

Seed is also distributed by other entities. These include: seed companies via direct outlet sales; NGOs; Kenya government; relief seed distributors; market traders; and individual farmers. There is no formal data on the volume of seed that flows through the various distribution channels, but a rough estimate based on numerous field visits and general sector knowledge in Kenya is as follows.

Table 6: Certified Seed Distribution Channels

Distribution Channel	% of Total Certified Seed Distributed
Agents/Stockists	80%
Seed Company Outlets	10%
NGOs/projects	5%
Government	5%

Source: Agri Experience estimate based on field knowledge

The key requirements/inputs for the agent/stockist channel are:

- ✓ Transportation (generally seed must be picked up from a depot)
- ✓ Good storage (so seed can maintain quality at the retail location)
- ✓ Education about products
- ✓ Promotional materials
- ✓ Supplier credit

In Kenya, there are an estimated 4,000+ licensed seed resellers. (In 2008/9 KEPHIS issued 3,896 seed sellers' licenses to agents, sub-agents and stockists. Interventions such as AGRA/PASS's Agrodealer Development Program, AgMark implemented via CNFA, may have increased these figures in subsequent years.

Seed industry development has progressed since the formal sector was launched in 1956, the date when Kenya Seed was registered to produce certified pasture seed for the then colonial settlers. Liberalisation of the seed industry was undertaken in 1996. This saw a steady increase in registered seed merchants over the years. In 2005, there were 50 registered seed merchants and since then, the industry has recorded a growth of 43 newly registered seed merchants. (As noted earlier, a list of currently registered seed merchants is included as Annex 2.)

Before liberalization, farmers could only obtain agro inputs through the Kenya Farmers Association shops which were highly concentrated in agriculturally active areas and in major towns. When compared to the situation before liberalization, distribution has greatly improved over the years, as virtually all mid-sized towns, and many smaller ones, have one or more agrodealers. A reduction in the distance that farmers need to travel to obtain inputs is documented in Table 7. Over the 10 year period covered in the study, the average travel distance required for fertilizer purchased was reduced by more than half, while the average travel distance required for hybrid seed purchase was reduced by 40%.

During the course of the field visits for this study, agrodealers were asked about the gender of their customers. Their responses revealed that in their areas 70% of the stockists purchasing seed over the counter from main agrodealers were men. Out of this 70%, over 95% of the men were found to be purchasing on behalf of the women manning the stockist shops in the smaller out of town centres.

80% of the retail (walk-in) farmers purchasing from agro dealers in the main towns were found to be women. In the agro dealer shops, 80% of the seed sellers were women (both mature and young women).

Table 7: Mean Distance (km) to Fertilizer and Hybrid Maize Seed Stockist

Zone	Distance to fertilizer stockist				Distance to hybrid maize seed stockist		
	1997	2000	2004	2007	2000	2004	2007
Coastal Lowlands	30.6	24.3	18.4	11.3	21.8	18.7	9.5
Eastern Lowlands	9.8	5.4	4.2	2.7	6.4	3.7	3.0
Western Lowlands	16.0	11.6	7.5	3.8	9.1	5.4	3.8
Western Transitional	6.3	4.6	2.8	3.6	4.2	2.7	3.7
High Potential Maize Zone	5.0	4.0	3.0	3.6	4.5	3.0	3.7
Western Highlands	3.3	2.2	1.4	2.4	2.6	1.6	2.4
Central Highlands	2.7	1.5	1.4	1.3	1.9	1.5	1.5
Marginal Rain Shadow	26.2	5.8	5.4	2.3	5.2	4.3	2.3
Overall Sample	8.1	5.7	4.1	3.4	5.6	3.9	3.4

Source: Tegemeo Institute of Agricultural Policy and Development, Working Paper #31, 2008

Overview of Regulation

Variety Release

The Seed and Plant Varieties Act, cap 326 of the Laws of Kenya, guides the regulatory process of seed certification and seed production.

The initial step is for a new variety (either bred locally or seeking approval as an import) to be formally released, which means it can then be used to produce seed which can be certified. The breeder of the material to be registered carries out multi-locational trials in various Agro ecological zones in order to ascertain key descriptors of the variety in line with the Distinctness, Uniqueness and Stability Trials (DUS) or alternatively, the breeder can enter the variety directly for National Performance Trials (NPT) which are largely conducted under rainfed conditions, which means that drought can delay the NPT process. Upon satisfactory performance and suitability of a variety, the breeder applies for NPT with KEPHIS. The NPT and DUS trial 2 may last for 3 years. The National Performance Trials Committee evaluates the results and recommends for release those varieties that have outstanding performance in the NPT and the DUS Trials.

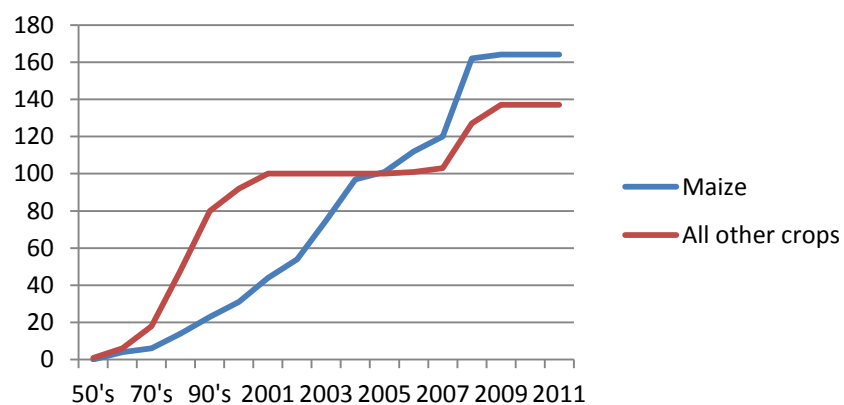
The National Variety Release Committee upon satisfactory data evaluation and the recommendations from the NPT committee then name and release the variety. Upon recommendations of the NVRC, the Minister of Agriculture gazettes the new variety. From the time a breeder registers a variety for certification to the release and registration of the variety, 3 to 4 years may have passed, and possibly more. Table 8 displays the number of variety releases, by crop, from the 1950s through June of 2011. (Note: This data is from the KEPHIS website, but there is reason to believe it does not include all releases. It is the best data available, however. Future effort should be made to update the national variety list if there are, indeed, omissions.)

Table 8: Number of Released Crop Varieties from 1950s to Date

Crop	50's	60's	70's	80's	90's	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Maize	0	4	2	8	9	8	13	10	21	22	4	11	8	42	2	0	0	164
Field Beans				8	8									12				28
Wheat			3	5	6		3						2	2				21
Sorghum			3	3	4	3						1		4				18
Irish Potatoes	1	2	5	4														12
Cassava		3				2								6				11
Cowpea				2	4	3												9
Sweet potatoes	0	0	0	3			4											7
Rice															5			5
Pigeon Pea				2	3													5
Soya Bean															5			5
Snap bean & Climbing bean					3	1												4
Finger Millet				1	1	1												3
Pearl Millet						2	1											3
Dolichos bean			1	1	1													3
Mung Bean					2													2
Fox Tail Millet				1														1
Total / Year	1	9	14	38	41	20	21	10	21	22	4	12	10	66	12	0	0	301

Source data: National Crop Varieties List (Agri Experience note: some industry participants feel this data is inaccurate)

Figure 4: Cumulative Varieties Released, 1950s to date

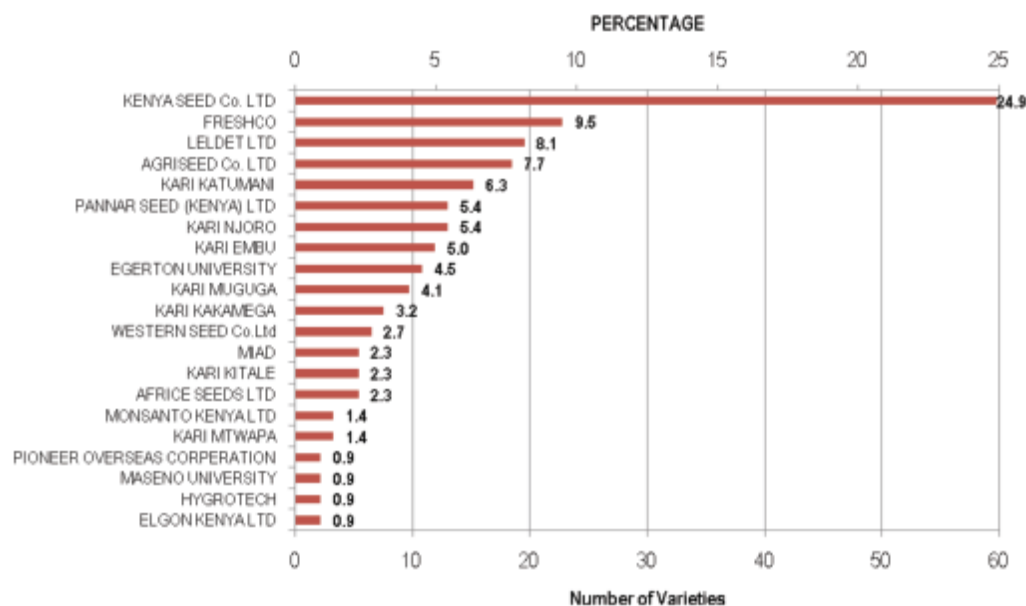


Source: National Crop Varieties List (see note from Table 8)

Varieties proposed for release must be sponsored by a specific seed production entity, which will then have the rights to commercialize the varieties once a license with KARI or another breeding institution has been granted. As seen below, in Figure 5, in 2008 many seed production entities

submitted varieties for release, although Kenya Seed Company was dominant during the year surveyed, with 25% of the total.

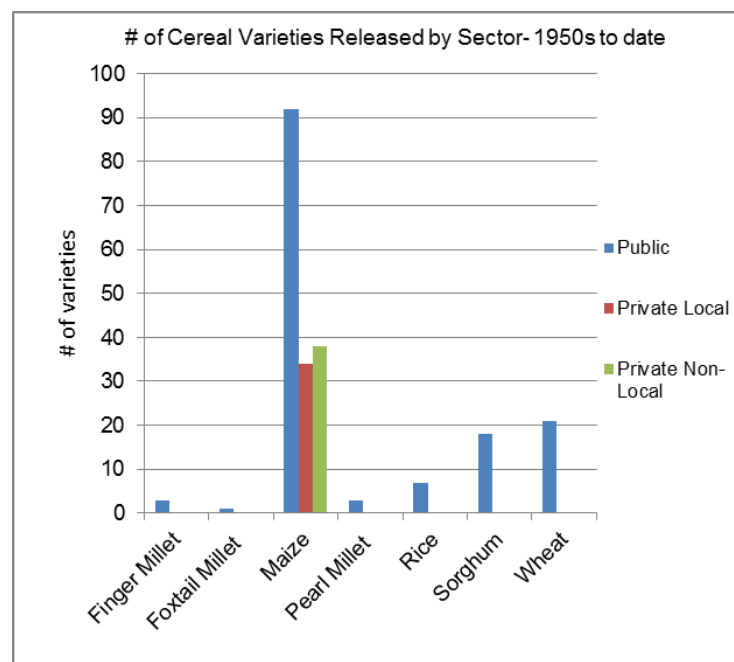
Figure 5: Varieties Submitted for Release, by Submitting Entity, 2008/09



Source: KEPHIS Annual Report

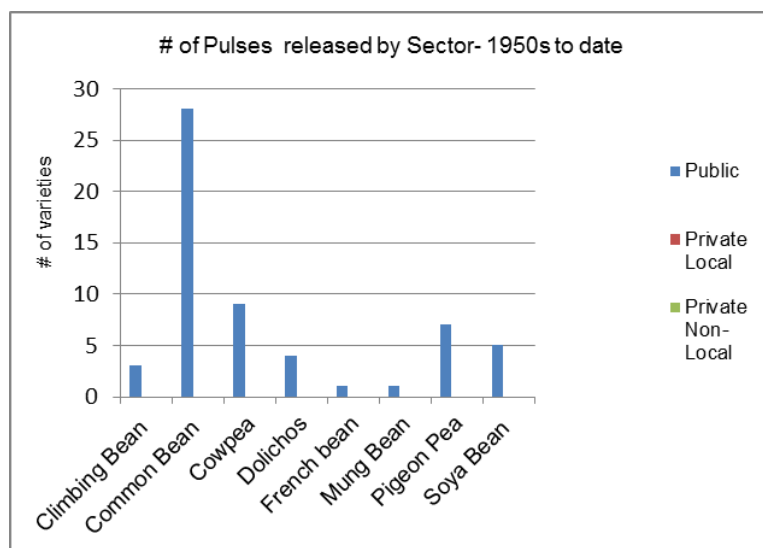
Sadly, as shown below in Figures 6 and 7, the private sector has not been either active and/or successful in releasing varieties with the exception of maize varieties. In addition, overall releases of varieties for crops other than maize has been low.

Figure 6: Cereal Varieties Released by Sector



Source data: National Crop Varieties List (see Agri Experience note from Table 8)

Figure 7: Pulse Varieties Released by Sector



Source data: National Crop Varieties List (see Agri Experience note from Table 8)

Seed Certification

Field inspection

This is the first step in seed certification. Before field inspection commences the seed production entity must:

- Register its fields for inspection, including fields of contract growers
- Provide proof of origin of the parental materials of the varieties registered for inspection. If it's a new variety the information must include the descriptors of the parental materials.
- Observe minimum isolation distances as outlined in the Seed Act.

Timely inspection in the fields is then conducted by KEPHIS to ensure that seed resulting from a crop meant for seed purpose is of the designated variety (trueness to type) and has not been contaminated genetically or physically (varietal purity) beyond certain specific limits. The crop must be healthy and free from diseases, especially seed borne diseases. Crop Inspection is mainly done during flowering, maturity and at harvesting stage. Once the Inspectors give the approval, then the crop can be harvested for processing into seed.

Seed Processing

Seed crops of approved fields are harvested and processed to remove undesirable contaminants such as weed seeds, inert material, immature seeds, broken and diseased seeds. The Seed Merchant/Producer transports the harvested seed to the warehouse/factory after a transport order has been issued by KEPHIS.

Once the seed is in the factory, the Seed Producer may carry out internal tests to ascertain the quality standards of the seed especially moisture content. The Seed Producer applies for a work order from KEPHIS. KEPHIS inspectors inspect the seed lot at the factory, the processing machines and if all is approved, a work order is issued. The Seed Producer can now start

processing the seed. Before applying seed dressing and packing in bags, the KEPHIS Inspectors must come again and inspect the seed lots.

Once the seed is inspected after this step, if approved it is packed in bags according to the market requirements. The KEPHIS Inspectors then sample these packed seed lots and submit to the LANET Seed Testing Laboratories. The Seed Producer must wait for at least 21 days depending on the crop variety to obtain a quality certificate which allows the seed lots to be marketed.

Distribution

Agents through stockists are regulated by KEPHIS. An annual license application is made and issued to the seed agents after the local ministry of agriculture officer has verified the premise and given a nod of good practice and the regional officer has also given the approval. KEPHIS has regionalized these operations which were once centralized at the headquarters in Nairobi.

Industry Performance and Potential

Current Industry Performance

Kenyan agricultural productivity is, overall, stronger than many other countries in SSA. However, it is important to recognize that this is not a challenging benchmark. (See Table 9 below.) RSA may be a more suitable point of comparison. At current maize grain prices, if Kenya is able to close the gap just halfway between the Kenyan average and the RSA average, the value of the additional maize grain production would be more than \$217,000,000 at current prices. (See section on economic impact for a fuller exploration of this theme.)

Table 9: Comparison of Kenya's Maize Productivity with Other Countries

Country	Maize Yield (90 kg bags/acre)
Kenya	9
Uganda	7
Tanzania	4
Rep of S Africa (RSA)	13
Malawi	7
Argentina	31

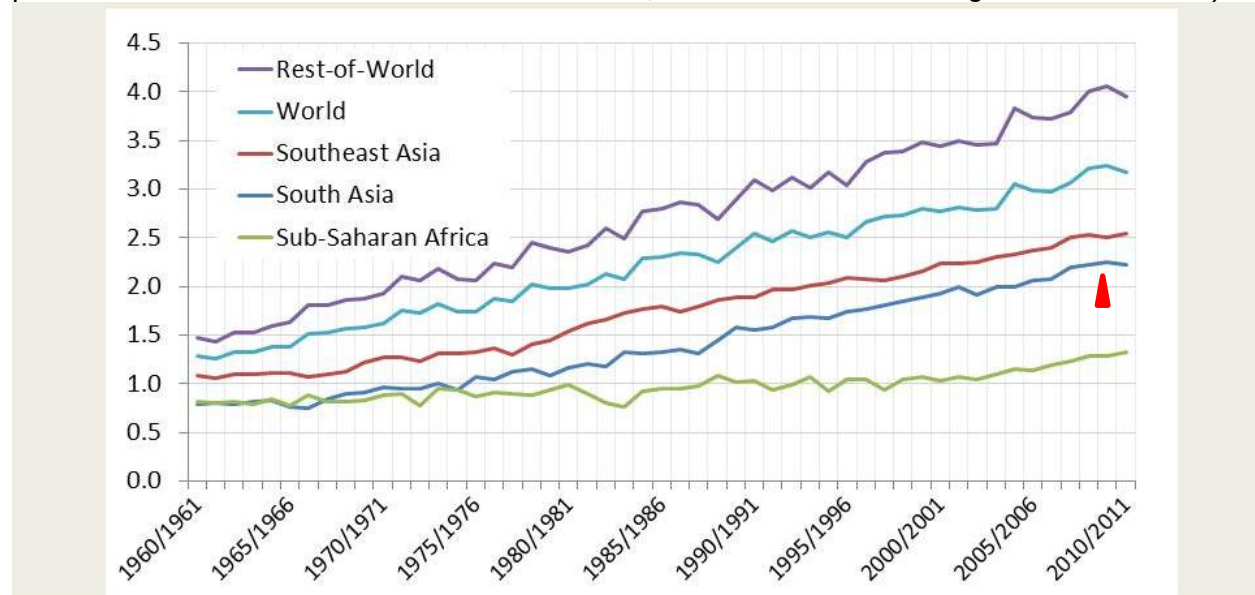
Source: Tegemeo Institute of Agricultural Policy and Development, Working Paper #31, 2008

It is highly likely that a similar, or even more compelling, conclusion can be drawn for other crops such as sorghum, although we have not found specific data to either support or disprove this conclusion for individual crops.

Looking beyond the 5 comparison countries listed above, it is important to recognize that Kenyan productivity has a very long way to go to begin to approach global averages. The chart below shows cereal grain yields based on actual production levels of all major grains, comparing sub-Saharan Africa with other regions of the world. For reference, Kenya's average

maize yield of 2 mt/ha is marked on the chart with a ▲. Maize is Kenya's highest yielding cereal crop, yet its average yield still does not reach overall cereal yields for any non-African area of the world.

Figure 8: Estimates of Average Cereal Grain Yields (mt/ha), 1960 – 2010. (▲ indicates Kenya's position on the Y axis, at 2 mt/ha for maize alone; the overall cereal average would be lower.)



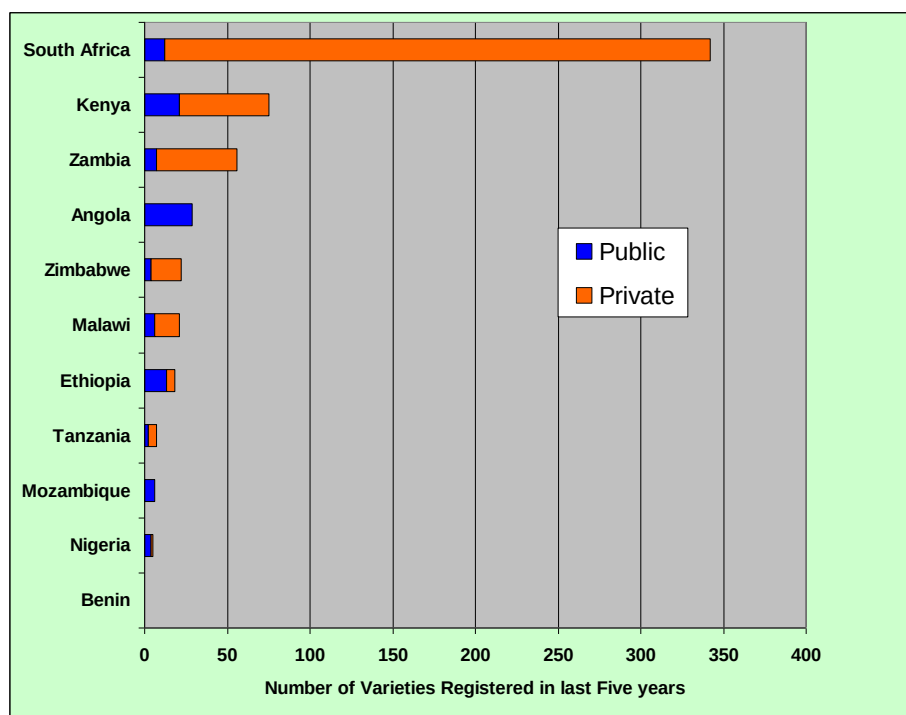
Source: Robert Paarlberg, Calculated from USDA, PS&D data (www.fas.usda.gov/psdonline), downloaded 7 Nov 2010. Results shown are each region's total production per harvested area in barley, corn, millet, mixed grains, oats, rice, rye, sorghum and wheat.

Another measure of industry performance is product innovation. According to the Tegemeo Working Paper 48/201, the average age of maize hybrids grown in Kenya was approximately 18 years in 2010. The most popular variety of maize (KSC's HB614) and wheat (KSC's Kenya Kwale) were released 26 and 25 years ago respectively. Both still command extremely large market shares.

While introductions of new maize hybrids in recent years will bring this average down as the new material is commercialized, these are sobering facts. The good news is that this average age has been declining over the last two decades, and the number of hybrids planted has increased during the same time. This bodes well for the future trend, and is a positive reflection on maize seed liberalization. Similar advanced ages have been reported for the most popular varieties of other crops such as cowpea.

One of the key factors required for product innovation is a regular and robust flow of new variety releases. While Kenya is the leading regional country in the respect, it is far behind the continental leader, South Africa. In addition, a very high percentage of Kenya's releases are public, versus private, releases.

Figure 9: Number of Varieties Released over a 5 year period



Source: John MacRobert, CIMMYT, 2008

We do not have good data on the current volume of certified seed produced in Kenya, but an adequate proxy is the hectares of seed certified by KEPHIS. From June 2006 to June 2010, the volume for the major crops grew from 10,250 to 13,410, an increase of 31%. However, the average production during this five year period was 11,756 (and this average was negatively impacted by the 2009 drought), so the 2006 – 2010 growth is not indicative of overall strong performance given the fact that the formal sector is still a relatively small fraction of the potential market size.

Table 10: Seed Crop Hectares Inspected and Approved for Harvest

Crop	2006	2007	2008	2009	2010
Maize	9,238	10,852	11,494	7,247	9,843
Beans	354	639	974	459	1,222
Soya bean	1	3	5		
Cow pea	217	227	379	842	796
Greengram	179	144	227	226	696
Pigeon pea	1	37	7	108	
Chick pea					
Potatoes	22	21	38	35	37
Rice					3
Sorghum	238	319	332	506	813
TOTAL	10,250	12,242	13,456	9,423	13,410

Source: Compiled from KEPHIS annual reports. Note that data is not reported for many crops.

Additional perspective on current performance can be gained by looking at the industry structure, particularly the sources of seed. Recent data suggests that the seed industry in Kenya had two distinguishing characteristics:

1. The informal sector dominates seed supply at 78% of total volume. Even though 66% of all maize seed and 85% of all rice seed come from the formal sector, informal sector supply of seed of all other crops is so high that the overall average for the informal sector is estimated at 78%. (See Table 11 below.)
2. Within the formal sector, the parastatal Kenya Seed Company has a dominant market position – estimated to be as high as 80%. This type of market leadership is highly unusual. For example, in the US the highest market share ever attained by the leading brand in the seed sector was approximately 45%.

Table 11: Percentage of Seed From Different Sources in Kenya

Crop	Informal System		Formal System				
	Farm-saved seed ²	Community-based schemes	Public companies/ Parastatals	Private local companies	Private foreign companies	Government distribution schemes	Donors/ NGOs
Bananas	80	0	20	0	0	0	0
Beans	80	0	5	0	10	0	5
Cassava	93	2	5	0	0	0	0
Cow-pea	75	8	10	2	0	0	5
Ground-nut	80	3	0	10	0	0	7
Maize	32	2	40	15	5	5	1
Millet	90	3	1	2	0	0	4
Pigeon-pea	80	0	6	4	0	0	10
Rice	15	0	85	0	0	0	0
Sorghum	87	0	4	5	0	2	2
Soy-bean	99	1	0	0	0	0	0
Sweet potato	96	3	1	0	0	0	0
Overall	76	2	15	3	1	1	3

Source: Authors' analysis of Sector interviews; Ministry of Agriculture; KEPHIS; Seed Companies; STAK

Source: Tegemeo Institute Working Paper 31/2008

An important factor for increasing private sector seed production in the formal sector is the availability of both working capital and investment capital for seed companies. Because of the long business cycle and the high infrastructure needs (warehousing, farm machinery, irrigation, processing equipment, vehicles) both long term and seasonal financing needs are high, especially for growing companies. While the sources of financing for KSC are not known, it is clear that most non-MNC seed companies struggle to get adequate and affordable financing. The recent formation of a social investment fund, Pearl Capital's African Seed Investment Fund, has been a positive development, as has Root Capital's entry into the sector with the provision of working capital financing. However, to more rapidly grow industry ability to produce quality seed, additional, knowledgeable financing is needed.

The two charts below profile seed company operations in the region, and clearly indicate many of Kenya's strengths in maize seed variety release and production. It must be kept in mind, however, that any data for Kenya that presents company averages is extremely skewed because of the market dominance of Kenya Seed Company.

Table 12: Selected Characteristics of Seed Sector from Secondary Data

	Kenya	Tanzania	Uganda	Ethiopia
Number of active seed companies ^a	74	31	20	30
% Share of maize seed in national seed sales ^{a,b}	87 (2009)	71 (2009)	75 (2009)	38 (2007-08)
Certified maize seed sales ('000 ton p.a.) ^{a,b}	25-30 (2005-08)	7-7.5 (2005-08)	8.5 (2009)	8.6 (2007-08)
Number of registered maize varieties (year) ^c	164 (2009)	75 (2008)	36 (2010)	42 (2009)
Estimated adoption rates of improved maize varieties (% maize area) ^{d,e}				
- 2007	72	18	35	19
- 1997	71	4	9	8
Establishment national seed trader association (year) ^f	1982	2002	1999	2006

^a Waithaka *et al.*, 2011; ^b MoARD, 2008; ^c National variety lists and other sources; ^d Langyintuo *et al.*, 2010; ^e Hassan *et al.*, 2001; ^f National seed trader associations.

Source: Challenges and Opportunities for Maize Seed Sector Development in Eastern Africa, Erenstein et al, CIMMYT, 2011

Table 13: Seed Company Portfolio Information

	Kenya	Tanzania	Uganda	Ethiopia	Overall
Maize seed portfolio					
- number of current varieties	5.2	5.0	4.3	5.4	4.9
- % hybrid entries	91	17	42	92	58
Average maize seed volume sold in domestic market ('000 ton p.a.)	2.7	0.7	0.8	1.6	1.5
- % hybrids	89	17	26	94	55
- % short duration	28	24	36	3	25
- % drought tolerant	22	36	16	4	22
Retail prices (US\$/kg)					
- Hybrid maize seed	1.91	2.22	1.69	1.27	1.77
- OPV maize seed	1.84	1.08	0.85	0.44	1.05
Maize grain price (US\$/kg)	0.25	0.23	0.20	0.16	0.22
Relative seed price (seed:grain)					
- Hybrid seed	7.8	9.8	8.6	8.0	8.1
- OPV seed	7.5	4.8	4.4	2.7	4.8

Source: Survey data, 2010

Source: Challenges and Opportunities for Maize Seed Sector Development in Eastern Africa, Erenstein et al, CIMMYT, 2011

Product Value to Farmers

A key measure of industry performance is the product value added to farmers. Since there is such a high usage rate of saved seed especially for non-maize and rice seed, one must question the product value delivered to farmers. Seed is misunderstood by many who work with it but who are not seed professionals. At one extreme are those who view most grain and legume matter as seed. At the other extreme are those who understand that true seed can be characterized with the acronym QIPP, as outlined below.

QIPP seed is seed which will increase farmer productivity because it:

- has been produced to **quality standards**;*
- incorporates **improved genetics**;*
- is properly **positioned geographically** so that the farmer will actually realize the productivity gain; and*
- is available at a **packaging and price point** that matches the farmer's risk preferences, especially in the initial stages of using QIPP seed.*

In addition to the above requirements, QIPP seed must also be available reliably at or before planting time each season for a farmer to be willing to move away from saving seed.

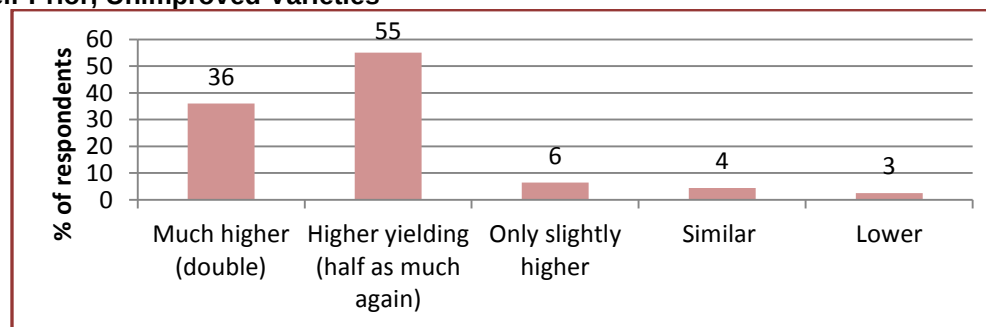
Sadly, the vast majority of seed which is sold in sub-Saharan Africa is not QIPP seed. In Kenya, there are certain crops for which no QIPP seed is available, and certain geographic areas where farmers have few, if any choices of QIPP seed for any crop. In many instances where there is QIPP seed available, it is not available reliably each season. Supply shocks are all too frequent, due to either weather problems, business mismanagement, or diversion of farmers' seed to other purchasers, generally wholesale purchasers such as government, NGOs or relief seed distributors.

Awareness and Adoption

Field interviews uncovered a strong lack of awareness on the part of farmers and agrodealers about new varieties. NGOs such as FIPS-Africa and One Acre Fund are working to address these knowledge gaps and are meeting with success although scaling up the work is difficult and time-consuming.

It is evident across SSA that farmers are eager to try new varieties themselves once they have seen successful demos. For farmers who are then growing the improved varieties, satisfaction rates are extremely high. The data below is from a survey of 1,542 farmers in 6 countries in SSA, including Kenya, in areas where farmers had the opportunity to plant new varieties. As can be seen, 91% of the farmers stated that the new variety was at least 50% better yielding than their prior unimproved variety, with 36% stating that it was at least double the yield.

Figure 10: Yield Perceptions of Farmers Growing Seed of Improved Varieties, Relative to Their Prior, Unimproved Varieties



Source: PASS MTR, 2010, random survey of 1,542 farmers in Tanzania, Kenya, Uganda, Malawi, Ghana, Nigeria and Mali

A related point when looking at farmers trying new varieties is package size. A recent tally of the choices made by over 1,000 Kenyan farmers when selecting the package size to purchase for a new bean variety shows that 99% wanted to buy a package less than 400g, with over 80% wanting only a 75g package. Few companies offer seed in small or micro packs, although there are exceptions such as Leldet Seeds.

Table 14: Seed Pack Size Preferences of Farmers

Gender	Bean package size purchased (grams)			
	75 g	400g	2000g (2kg)	Total
Female	469	89	7	565
Male	349	71	21	441
Total	818	160	28	1,006

Source: FIPS project, Kenya

While some geographic areas have fairly strong adoption and availability of seed of improved varieties, others have little to none, especially for certain crops. An example of this is in Kisii, where farmers say they are still awaiting locally adapted varieties of maize and other crops.

Potential local and regional market size

Efforts to accurately measure industry performance and potential are stymied by the dearth of commercially useful information on an industry-wide basis. However, triangulating some available data – while frequently dated – can help to determine approximations.

The potential size of the food crop seed industry in Kenya for the 7 major crops listed in Table 15 is over 116,000 metric tons. At present day seed prices, this equates to revenue of more than \$100 million USD. However, it is important to note that the volume data below is from 2005. Using these volumes however, and assigning revenue to the formal seed supply based on current prices, the estimated value of the current seed supply is roughly \$41 million USD for these seven crops. (However, STAK estimates that the current revenue level for the entire seed industry in Kenya is \$60 million USD, using current prices and volumes. Note that this exercise is just one example of the lack of commercially useful data in the industry.)

Table 15: Seed Demand and Supply Situation for Selected Crops in Kenya (2005)

Crop	Acreage planted (ha)	Total seed demand (mt)	Formal seed supply (mt)	Proportion of formal: total seed (%)
Beans	1,034,477	62,069	1,030	2%
Cow-pea	72,654	2,034	565	28%
Maize	1,760,618	44,015	27,500	62%
Millet	92,430	739	175	24%
Pigeon-pea	180,240	5,047	19	0%
Rice	15,940	1,275	300	24%
Sorghum	122,368	1,224	433	35%

Source: Authors' analysis of Sector interviews; Ministry of Agriculture; KEPHIS; Seed Companies

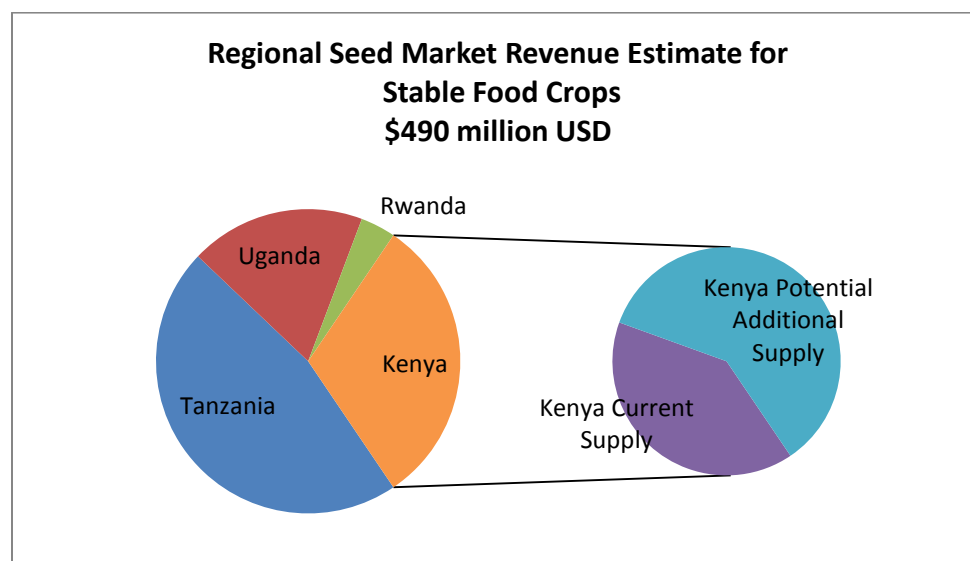
Source: Tegemeo Institute of Agricultural Policy and Development, Working Paper 27/2006

It is important to note that these seed volumes would increase with the higher plant populations that become possible with more advanced breeding and improved agronomic practices. In addition, revenue would increase as higher value seed is developed and adopted by users.

Estimates of total potential seed volumes in the region are also high at more than 60,000 t for Uganda, 150,000 t for Tanzania, and 12,000 t for Rwanda – a total that is expected to exceed

222,000 t, or close to double the size of the Kenyan market (AGRA Policy Group estimate, 2009). It is difficult to estimate the total value of the regional seed market as defined by these four countries, but based on the same revenue/ton experienced in Kenya the value would be approximately \$490 million USD. A graphic representation of the potential regional market is shown in Figure 11.

Figure 11: Estimate of Potential Regional Seed Industry Revenue for Staple Food Crops



Source: Agri Experience estimate based on information from Tegemeo Institute reports, PASS analysis, and current seed price data

Regional opportunities for seed export to neighbors are strong. While seed production in Uganda is at decent volumes overall for maize, volumes of seed production for other crops is very low, and in addition the Ugandan producers are frequently tapped for relief seed purposes in Congo and South Sudan, leaving local farmers with supply volatility. There are significant seed shortages of certain crops, such as beans and groundnuts. As a result, some Kenyan companies are eyeing this market for future expansion, notably Kenya Seed Company and East Africa Seed Company. Rwanda has not yet been able to ramp up local seed production to the required volume and thus continues to import large tonnages of seed each year. Kenyan seed companies are already supplying some of this tonnage to Rwanda. Tanzania also has extremely low supply and penetration of QIPP seed; this market may also be ripe for development, especially if the seed sector there is liberalized.

Finally, it must be noted that a national and regional seed market would grow significantly in value as greater levels of hybridized seed and additional value-added varieties are developed and commercialized.

Potential Industry Development Impact on Individual Farmers

Kenya's farmers fall into various segments, as classified by both farm size and behaviour. A useful way to segment farmers is as follows.

Table 16: Farmer Segmentation Categories

No input subsistence farmers	Farmers who grow food only for consumption and are too poor to use good seed, or fertilizer. These farmers are most likely net purchasers of food.
<i>Subsistence farmers</i>	<i>These farmers are also subsistence farmers, and most likely are also net purchasers of food. They are using some level of improved inputs, but very possibly just one improved input (e.g. seed)</i>
<i>Small scale commercial farmers</i>	<i>These farmers use some of their smallholding to produce a commercial crop in addition to growing food for the family. They have 3 ha or less, and usually buy ag inputs although very possibly just one (e.g. seed)</i>
Mid-sized commercial farmers	Farmers who grow commercial crops on 3 – 50 ha of land. They will vary in sophistication, but do look at farming as a business. Thus they will most likely use high value-added inputs.
Large scale commercial farmers	These businessmen and women are farming more than 50 ha for commercial purposes. They are generally strong users of high value inputs.

Source: Agri Experience

The first three categories together constitute the smallholder farmer segment (SHF), while the italicized categories can be classified as the economically active poor.

Irrespective of the segment into which they fall, Kenya's farmers are hungry for both new varieties of seed and higher quality seed. The impact of higher productivity is significant for them, and will manifest itself economically in two key ways. The first is the impact on a family of not having to spend hard-earned income on food purchases. Studies indicate that the majority of Kenyan poor are net purchasers of cereals despite the fact that the majority of them are also farmers. Experts estimate that the lowest income quartile of the Kenyan population spends 28% of its income on maize (<http://kenya.usaid.gov/programs/economic-growth/490>). The second impact derives from possibly having surplus harvest available for sale, thus increasing family disposable income.

Whether buyers or sellers, the impact can be significant, as illustrated below in Table 17. For a farmer living at the poverty level, this example shows that a 30% increase in annual income can be achieved by switching from saved maize seed to improved maize seed in non-drought years.

Table 17: Example of Impact of Productivity Increase on SHF Family Income

Assumptions:	
Average size of maize hectareage	1 ha
Maize yield with saved seed	6 bags
Maize yield with improved hybrid seed	10 bags
Market value of one 90 kg bag (2011 prices)	3,556 KES
Cost of 25 kg of improved maize seed @ 130 KES/kg	3,250 KES
Impact on Individual Farmer:	
Increased annual disposable income/year, KES	7,418 KES
Increased daily disposable income/day, KES	30 KES
Increased disposable income/year, USD at 80 KES/\$	\$137.17
Increased disposable income/day, USD at 80 KES/\$	\$.38
Note: Increase above daily poverty level of \$1.25 USD	30%
Land freed up for other production, if original yield desired	.4 ha

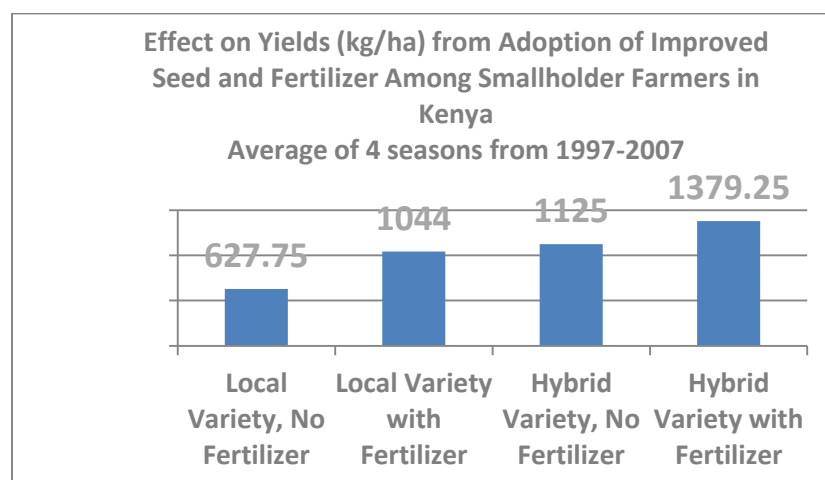
Source: Agri Experience example

A valid question in the case of all crops is “where will this extra two bags, or 20-50% yield increase, come from?” Adoption of improved varieties is one key answer, with an equally

important contributor being the introduction of more modern improved varieties. The most popular maize and wheat varieties (respectively, HB614 grown by 62.6% of farmers, and Kenya Kwale grown by 75.3% of wheat farmers) were both released 25 years ago. It is hard to believe that a large number of farmers may have been planting the same improved variety of maize or wheat for their entire lives. Additionally, use of fertilizer would increase the impact of the example above significantly.

The chart below (Figure 12) presents field data from Kenya, illustrating the very meaningful value to individual farmers of using improved maize seed, particularly in combination with fertilizer. In analyzing the impact of inputs such as seed and fertilizer, it is important to consider the fact that the cost of seed per hectare is well below the cost of fertilizer per hectare, and farmers often choose seed, forgoing the fertilizer due to expense constraints. However, when this occurs farmers are leaving yield potential in the field.

Figure 12: Impact on Farmers of Using Hybrid Maize Seed and Fertilizer



Source: Tegemeo Institute of Agricultural Policy and Development, Working Paper #27/2006; AGRA/PASS averaging

This result has been replicated in studies from other parts of Africa, as evidenced by Table 18 which presents the results of a study done in Burkina Faso. This study also shows the potential for improving productivity in non-maize crops.

Table 18: Seed and Fertilizer Usage: Comparative Trials in Burkina Faso (kg/ha yield)

kg/ha	Local variety, no fertilizer	Improved variety, no fertilizer	% Increase	Local variety, microdosed fertilizer	Improved variety, microdosed fertilizer	% Increase	% Increase vs local variety with no fertilizer
Sorghum (147 trials)	436	675	55%	911	1,879	106%	331%
Maize (315 trials)	900	1,468	63%	2,110	3,293	56%	266%
Cowpea (223 trials)	276	480	74%	667	1,327	99%	381%
Pearl Millet (74 trials)	352	545	55%	809	1,202	49%	241%

Source: AGRA Soil Health study, Jan 2011

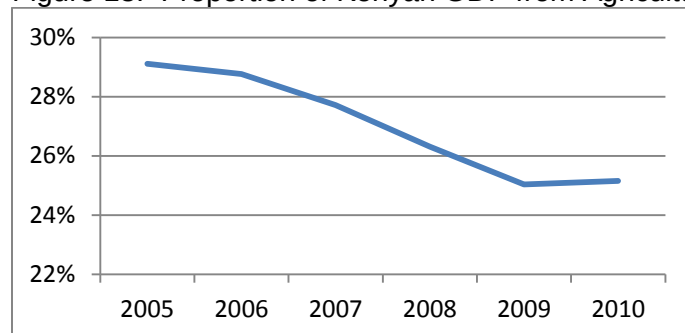
The example of individual farmer impact above in Table 17 can be recalculated with the yields from the Tegemeo Institute research presented in Figure 12. When this is done, the increased

daily disposable income/day rises dramatically to 45 KES, or \$.56 USD (which equates to USD \$205 annually.) There are few other tools available to Kenya's SHF for increasing income so significantly in a single crop season.

Potential Industry Development Impact on the Kenyan Economy

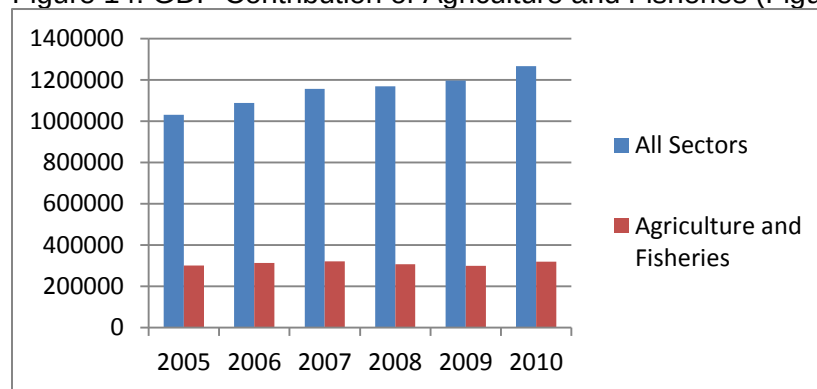
The contribution to Kenya's GDP from agriculture and fisheries is estimated to be in the range of 25 – 26%. This represents approximately \$4 billion USD of a total GDP of approximately \$15.8 USD (at 80 KES/USD). However, this proportion has dropped from its high of 29% in 2005 despite growth in the horticulture export segment, as illustrated in Figures 13 and 14 below.

Figure 13: Proportion of Kenyan GDP from Agriculture and Fisheries



Source: Graph by Agri Experience Data Source: Kenya National Bureau of Statistics – Second Quarter 2011 GDP Release; Table 2 Gross Domestic Product by Activity, pg. 11

Figure 14: GDP Contribution of Agriculture and Fisheries (Figures in Kenya Shilling Millions)



Source: Graph by Agri Experience Data Source: Kenya National Bureau of Statistics – Second Quarter 2011 GDP Release; Table 2 Gross Domestic Product by Activity, pg. 11

Statistics from 2011 indicate an improving situation, though mainly driven by activities in horticulture (farming of cut flowers, fruits and vegetables) and a moderate growth in farming of sugarcane.

The growth and size of agriculture's contribution to GDP is highly dependent upon the seed industry. Examples such as India, where liberalization of their seed sector is believed by many to be one of the key drivers for overall economic growth, are instructive.

The impact on Kenya's economy of developing the seed sector will prove to be additive – a combination of many improvements. In order to assess the full impact, each improvement would need to be assessed and a value attributed to it. Unfortunately there is not sufficient data available to even attempt this analysis, but it is clear that the impact would be extremely large.

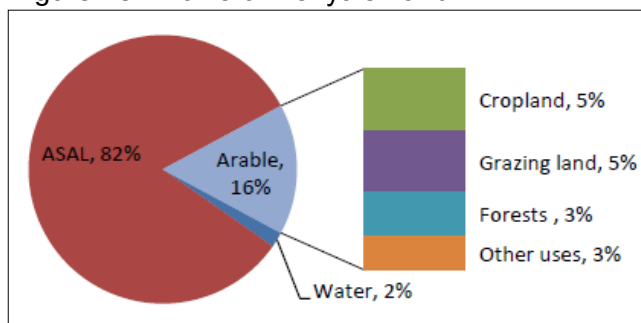
The key additive impacts upon the economy would derive primarily from:

- Increased purchasing power of SHF
- Increased production value from commercial farmers
- Reduced government spending on imported food, with associated storage and transportation costs
- Increased value to local agribusinesses
- Increased opportunities in the regional seed sector
- Increased land available for higher value commercial crops
- Increased purchasing power for other inputs, such as fertilizer and insecticides, which would further improve yield

These benefits would be further supplemented by increased social benefits such as improved payment of school fees, less hunger, etc.

A significant additional factor in developing the seed sector is the realization that crop production on Kenya's arable land must intensify if Kenya is to be food secure, especially in the face of a rising population. In addition, new approaches, including new varieties of seed, must be utilized on arid and semi-arid lands (ASAL). As shown in Figure 15, only 16% of Kenya's land is currently arable, even though an estimated 80% of the population relies on the land for its livelihood.

Figure 15: Profile of Kenya's Land



Source: Agri Experience chart based on data from Kenya's AGRICULTURAL SECTOR DEVELOPMENT STRATEGY 2010–2020, Page 10

While it is not in the scope of this study to estimate the full impact of developing the seed industry on the Kenyan economy, it will be illustrative to take a closer look at an individual area of impact. Table 19, below, continues with the example of the impact on an individual farmer, above, and illustrates the cumulative impact of improving yield for millions of farmers via usage of seed of improved varieties, and newer and better varieties of seed. Since the best data available generally relates to maize production, the example below continues with the focus on maize yield improvement and its possible impact on SHF segment as a whole.

It is important to realize that the SHF impact cannot be assumed to automatically translate to an equivalent GDP impact as a certain percentage of any yield increase will simply free up money normally spend for food security, enabling farmers to spend on other priorities. However, to the extent that the yield increase translates into direct commercial income, GDP will increase accordingly.

Table 19: Estimated Economic Impact from Increased Maize Productivity

	Farmer Impact Based on Example in Table 17	Farmer Impact Based on Tegemeo Data in Figure 12
<i>Assumptions:</i>		
Estimated increase in annual disposable income from use of improved hybrid maize seed, including newer varieties, per ha of maize production (USD) (See prior section.)	\$137.18	\$204.96
Total hectares of maize production in Kenya	1,760,000	1,760,000
Percentage of maize production done by SHF	70%	70%
Percentage of increased yield either sold or which frees up disposable income previously used to purchase additional food (i.e., excluding increased harvest which is simply consumed, above food security levels)	80%	80%
<i>Economic impact on Kenyan SHF from Increased Income and/or Lower Required Expenditures on Food Security</i>	\$135,200,000	\$202,000,000

Source: Agri Experience estimate, basing key assumptions on data from various Tegemeo Institute working papers

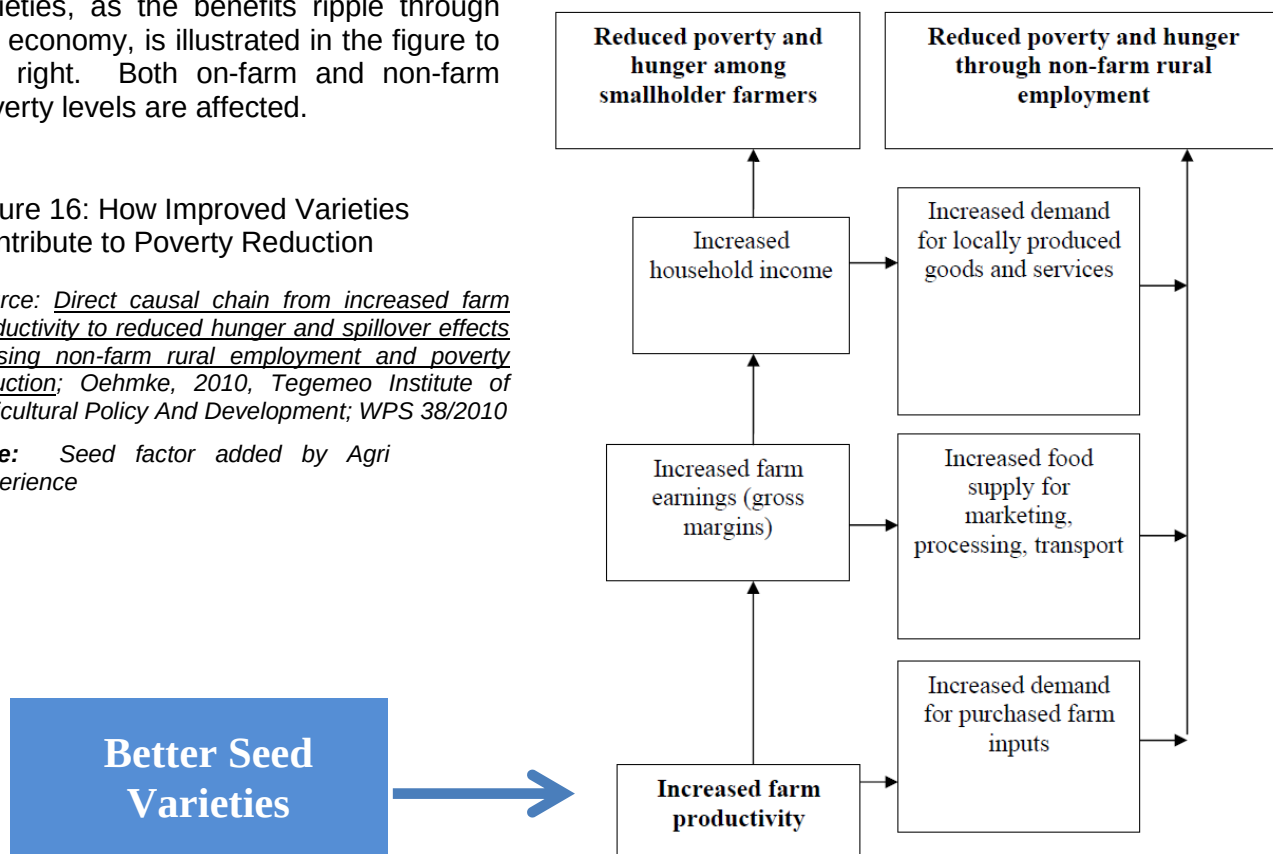
As shown in the example, the increased economic benefit to Kenya's smallholder farmers as a whole – just from increased productivity in one specific crop – is well over \$100 million USD annually and could even range well above the \$202 million estimate based on Tegemeo Institute's extensive field performance data. If similar yield increases could be obtained for other crops, and for agricultural producers other than SHF, total impact based on the Tegemeo example could easily surpass \$1 billion USD annually – and over time, by a significant amount as farmers begin to put land freed up by improved food security into higher value crops. (Source: Agri Experience estimate, taking into account: 1) production by all farmers and not just SHF; 2) two cropping seasons in many locations; 3) intensified planting rates as QIPP seed and fertilizer are employed; and 4) move to higher value added crops as less land is required for household food needs as productivity rises.)

The full value of usage of improved varieties, as the benefits ripple through the economy, is illustrated in the figure to the right. Both on-farm and non-farm poverty levels are affected.

Figure 16: How Improved Varieties Contribute to Poverty Reduction

Source: *Direct causal chain from increased farm productivity to reduced hunger and spillover effects causing non-farm rural employment and poverty reduction*; Oehmke, 2010, Tegemeo Institute of Agricultural Policy And Development; WPS 38/2010

Note: Seed factor added by Agri Experience



Future Trends

There are a number of changes in the marketplace which are already having an impact on the seed industry, although most of these trends are too recent to have been measured or quantified with much rigor. The most important of these changes are:

- Concerns about climate change – Farmers are already moving towards crops such as sorghum which will still yield under drier conditions, in addition to placing higher value on earlier maturing “drought escaping” varieties.
- Information technology – The rapid ascent of mobile phone usage and the accompanying money transfer capabilities have empowered many farmers and their families. Family members who leave the rural area to work are now able to more easily send money home for input and other purchases. Farmers are also more easily able to access market prices for their crops and information about seed availability, in addition to farmers, stockists and agents using mobile money to pay for seed purchases.
- Growth of local seed companies – Largely, but not exclusively, driven by BMGF, Rockefeller Foundation, PASS, and CG center investments in breeding, seed production, financing, and agrodealer development, new seed companies are entering

the market or moving from emerging companies to mid-sized companies. Many of these companies are taking up new varieties that have been released, or are actively seeking to register new varieties.

- Rising costs – On the negative side, increasing fuel and fertilizer costs are having a serious impact on the sector. Of real concern is the high cost of fertilizer for farmers, as well as for seed companies.
- Land pressure – farm size is believed to be decreasing as land continues to be subdivided. It is hoped that new land reform legislation will address this. It is a particularly important issue for seed companies since isolation is required for seed production, particularly for hybrid maize.

Industry and system analysis

Key Conclusions

During the course of field interviews, literature review, data analysis, and ongoing discussions with industry participants, a number of key themes emerged.

Macro Conclusions

1. Increasing the quality, availability, and choice of seed of improved varieties in Kenya represents a **large and increasing economic opportunity**. This impact could reach \$1 billion USD annually in the relatively short term if farmers adopt QIPP seed across a broad spectrum of crops.
2. While there is good seed availability for some crops (particularly maize) in some geographies (especially the high productivity agroecologies, such as the mid-altitude cropping areas), there are **significant unmet needs** both by crop and geography. Many popular varieties have been on the market for a long time with no new, improved replacements.
3. **Aligning breeding activities even more strongly with farmer needs** can have significant upside.

Supply Conclusions

4. There have been **improvements in seed distribution in recent years**, most notably the reduction in the average distance farmers have to travel to get seed. Additionally, there are now **some new brands** in the market, but their presence is still relatively small. However, there are many additional factors that contribute to distribution effectiveness, and there is still great opportunity for improvement in these areas (e.g. seed storage, customer service, product knowledge.)
5. **Over-reliance on rainfed agriculture for seed production** is contributing to erratic seed supply.

6. In addition to improved genetics, farmers **deserve seed that meets quality standards, is properly positioned, and has been appropriately packaged to meet their risk appetites and financial capacity.** Many farmers feel they are not getting this.
7. The lack of a level playing field for the private sector relative to the parastatals, whether real or perceived, is **reducing industry competition and risk-taking.**
8. Low access to large seed multiplication and production sites, dominated by a few large players, drives **pseudo-monopolistic supply behaviour.**
9. **Orphan crop seed is not widely available commercially through the private sector.** While not all private sector companies choose to focus on these crops, those that do **face an uphill battle** with foundation seed availability and side-selling from production. In particular, the bottleneck caused by KARI's difficulties in supplying foundation seed is a very serious issue.
10. The **lack of knowledgeable, low cost financing for seed companies** is holding back private sector growth in the industry.
11. **Inconsistent seed supply patterns are inhibiting farmer uptake of improved varieties.** These are occurring for a variety of reasons, including seed producer cash flow crunches, poor parent seed planning, poor seed storage, side-selling, drought, and lack of access to isolated production sites.
12. **Dealer margins are reputed to be low,** thus discouraging agrodealers from developing and growing seed distribution businesses. *This needs to be investigated further.*
13. **Vegetatively propagated crops are not routinely taken up by commercial producers or distributors** due to the bulk of the planting materials and the low shelf life. However, these materials, when improved, are highly valued by farmers.

Demand Conclusions

14. There is **serious lack of awareness** on the part of farmers of the crop varieties available to them, yet farmers are hungry for new, higher-performing varieties.
15. The vast majority of farmers that do try new varieties that are suited to their agroecology are **very happy with them.**
16. Farmers would like improved varieties that **incorporate more of the characteristics that are present in their indigenous saved varieties.** Frequently they value other characteristics, such as maturity, more than yield.
17. The **research-extension linkages are weak** and characterized by poor communication in many instances. NGOs may be best suited to do this work as private companies are often viewed as being biased.
18. Distribution of relief seed by the government and NGOs in ASAL areas has fostered a **dependence syndrome** over time, leaving farmers with little impetus to adopt or promote new commercial varieties.

Policy and Regulatory Conclusions

19. There are strong arguments to be made for **realigning KEPHIS in line with a more modern, liberalized seed industry**. There are important, positive lessons to be learned from other countries such as RSA, Zambia and India.
20. The **variety release process is onerous and, at times, opaque**. In addition the cost burden to private sector companies of releasing a variety should be examined.
21. Current legislation is in the process of being amended, but this has been a long term process to date. Assuming that the legislation is rewritten in a way that supports strong industry growth, the **key to success will be implementation of the new practices and regulations**. However, implementation of good seed legislation has proved to be elusive in many other African countries that have good policies in place (Ghana, Mali, Uganda).

Key Contrasts with Other National Seed Industries

In the last 50 years, seed sectors in many parts of the developing world have been the target of reform and growth efforts. Some have been more effective than others.

Table 20: Comparison of Key Seed Industry Practices in Kenya with Those of Other Countries

	Practice in Kenya	Alternative approaches taken in other countries
Variety release	Lengthy and expensive variety release process which includes national performance trials, DUS testing, approval by committee. Usually takes at least 4 years. Any variety to be sold in Kenya must go through the formal release process	• No variety release process, per se; varieties must simply be registered (India) • No variety release process. Varieties can be registered under the Plant Variety Protection Act, and/or patented (US) • If variety is released in a neighboring county, it qualifies for release in home country (Harmonization agreement in West Africa, but has not been implemented yet.) <i>Note: The working theory in countries with no variety release process is that farmers know better than government what they wish to plant, so that if they wish to use a variety available to them through the market, they can.</i>
Seed certification	Multiple points of oversight by KEPHIS in formal seed sector process, resulting in final certification documents given	• Seed is not formally certified. Producers must follow Truthful Labeling practices. Farmers have strong complaint channels if practices are not followed. (India) • Some seed is certified, but some seed can be labeled QDS (Quality Declared Seed) which must meet certain standards but need not be certified. QDS seed is used for self-pollinating crops. (Tanzania) • Seed is certified, but the inspection does not need to be done by the government entity. Instead, qualified industry professionals are “licensed” to do the inspections on behalf of the government. Frequently

		these professionals are on site or located nearby, thus ensuring timely inspections. (Zambia) The government has transferred responsibility for seed certification to the national seed trade association, SANSOR (Republic of South Africa)
Licensing	KARI licenses public material in a non-transparent manner, either exclusively or semi-exclusively.	All companies have equal access to material, and can market the same variety under different product and brand names (US and India)
Foundation seed production	Frequently companies are not allowed to bulk basic and pre-basic seed themselves, as all parental seed must have the appropriate label from KEPHIS stating source.	- Companies are allowed to bulk all parental materials, but they must be certified (Uganda, Mozambique, Malawi) - Seed companies purchase parental material from government sources, but can also bulk it themselves (India) - Private sector companies that focus only on parental material production and sale have evolved (US) - Products are not generally exclusive to one company, so several companies band together to share basic and pre-basic seed production work, divvying up the inbred lines for production, and then sharing them with each other (Uganda)
Farmer complaints	As there are usually several layers of distributors between the farmer and the seed company, complaints are hard to channel up the line and farmers do not have much hope of having a complaint addressed	- Seed companies must be licensed in each state where they operate. Farmers can complain about bad practices to the state licensing board. The license can be pulled or suspended if inappropriate business conduct is confirmed. (US) - Farmers have a complaint channel to the government, which will issue a “stop sale” order if there is merit to the complaint (s). This order will remain in effect until the matter is resolved, but the seed company may have lost the entire sales season at that point. These orders are seldom issued as the seed companies proactively maintain quality. (India)
Parastatal status	Two parastatals, Kenya Seed Company and KARI Seed Unit, have an estimated 70-80% market share. There are an estimated 12 other private sector companies for seed for food crops, and most are small in size.	- There were two parastatal seed companies and three private companies in the early 1990s. Today, after liberalization, there are close to 80 seed companies which provide high quality seed of a wide range of crops. (Peru) - After liberalization which began in the 60s and continued with additional reform in the 80s, the vast majority of seed in the formal sector is produced and sold through the private sector. There are an estimated 300+ private seed companies with revenues of >\$1million USD in today's market. (India)

Source: Agri Experience

Staple Food Crop Comparison with Horticultural Crop

A comparison of the horticultural sector with the staple food crop sector clearly shows some marked differences. In general, horticultural crop seed is of shorter maturity, higher ROI, and lower risk than seed in the food crop sector due to the potential for irrigation. In Kenya, most of it is also imported, controlled and produced by private sector companies, and frequently produced as a commercial, versus subsistence, crop, generating foreign exchange when exported. However, horticultural crops usually do not store well enough to meet longer term food needs for a family, nor is the seed generally adapted to variable rainfall conditions. Both sectors are clearly important both commercially and in terms of food security and nutrition.

While many of the underlying characteristics of the food crop sector cannot be markedly changed, increasing yields via the use of QIPP seed in the food crop sector clearly frees up time and labor for economically active poor farmers to allow greater entry by them into the horticultural crop sector, possibly even employing small scale irrigation on a multi-season basis. In addition, the increased health benefits of a more diverse family diet cannot be underestimated.

The comparison below highlights the key differences between the two seed sectors.

Table 21: Comparison of the Horticultural Crop and Staple Food Crop Seed Sectors in Kenya

	HORTICULTURAL CROPS	STAPLE FOOD CROPS
CROP CYCLE	<i>Short, for example 75 days for tomatoes and 45-60 days for collards (kale). There can be many cycles in a year.</i>	<i>For maize, as long as 9 months from planting to cob maturity, but this does not include the drying process. Other crops can be shorter, in the case of beans, or longer as in the case of cassava. Number of cycles per year is dependent upon maturity and rain conditions.</i>
RETURN ON INVESTMENT	<i>Horticultural crops generally give farmers a high ROI when produced for commercial purposes</i>	<i>ROI is generally not as high as for horticultural crops due to seasonal price fluctuations, general dependence upon rainfed conditions, and lack of good storage.</i>
PRICE	<i>The smallest pack size is 10grams for OPV's and costs approximately Kes. 30/=. Imported hybrid seed can be expensive, but is still valued and purchased by farmers if there is a high ROI</i>	<i>Most commonly available pack size for maize is 2kg and costs approximately Kes 400/= Some seed of other crops is available in 1 or .5 kg sizes, but only rarely.</i>
OPV VS HYBRID	<i>OPV's form a bulk of seed business, with the major crops being cabbages, tomatoes, onions, carrots and collards. Hybrid varieties are mostly in the specialty crops such as greenhouse tomatoes, coloured peppers and highland onions</i>	<i>Hybrid maize forms the bulk of the cereal business. The other food crops are all OPV's with the exception of a small amount of sorghum.seed</i>
IMPORTED VS LOCAL	<i>The bulk of the seed, >90%, is imported. Very little local production is done (this is mainly for the collards)</i>	<i>The bulk of the seed is locally grown, with the exception of MNC maize hybrids, which can be imported.</i>
IRRIGATION	<i>Horticulture thrives under irrigation and active farmers, usually around major centres of urbanization, use it widely. SHF frequently use irrigation on small plots.</i>	<i>Local production is mainly (probably over 80%) but not completely rain-fed and is highly concentrated in the North Rift and Western Kenya belt.</i>
REGULATORY OVERSIGHT	<i>The sector is loosely controlled by the government especially the vegetable</i>	<i>The sector is highly controlled by the government especially in seed supply and</i>

	<i>sector. However, Horticultural Crops Development Authority has lately introduced licensing requirements for anyone wishing to engage in trade of vegetables.</i>	<i>seed price through KSC and grain purchase from farmers through the National Cereals and Produce Board. The latter is meant to build the National Grain Reserves and cushion against food insecurity.</i>
PRIVATE VS PUBLIC	<i>Private seed companies control the bulk of the business.</i>	<i>Public seed entities control the bulk of the business</i>
CERTIFICATION	<i>Certification of vegetable varieties is easy. Quality control tests and declarations as per the ISTA regulations are required upon importation.</i>	<i>Certification is complex, especially in the case of hybrid production, and requires numerous visits from regulators during both production and processing.</i>
FOREIGN EXCHANGE INCOME	<i>The sector earns the country a lot of foreign exchange income through exports of vegetables, flowers, fruits and nuts.</i>	<i>The sector earns very little foreign exchange. In fact, exports of grain and seed from Kenya were not allowed at all for food security purposes in 2011.</i>

Source: Agri Experience analysis

Industry Development Recommendations

Long Term Vision and Goals

As one of the key elements underlying the health and growth of the Kenyan economy, the seed industry can become a vital force for growth. To do this it must evolve from its current state – maintaining strengths while simultaneously addressing weakness and targeting areas for growth.

- ✓ It should offer all farmers and industrial buyers multiple choices for seed of improved varieties, produced to high levels of quality, and available on a reliable basis at competitive prices. This must be done for a broad range of staple food and horticultural crops.
- ✓ It should be focused on all segments of farmers, with particular emphasis on economically active poor farmers as this segment is very large and represents the largest opportunity for economic and social impact due to current low levels of access to QIPP seed.
- ✓ It should be sufficiently liberalised to allow for constant product innovation and increasingly efficient production models, but under enough regulatory scrutiny to discourage illegal and fraudulent practices.
- ✓ It should actively look at regional opportunities for expansion, recognizing that the key driver will be added value to farmers and industrial buyers through product innovation. As this occurs, market size may increase considerably.
- ✓ It should recognize that farmer saved seed is a strong and efficient cultural practice. Efforts to improve the seed industry should be done in consonance with, and understanding of the sensitivities surrounding, these long-standing practices.

Overview of Approach for Bringing About Industry Change

A vibrant seed industry is foundational to any crop market system and Kenya is not an exception. Where Kenyan seed industry segments have shown more innovation and/or private sector access, there have been resulting gains to farmers and markets, as in the case of maize and horticulture. Where Kenyan seed industry segments have shown weakness in innovation and/or commercial drivers to educate and sell to consumers (i.e., farmers), those market channels have performed poorly such as for cotton and other non-maize field crops.

Kenya is ideally placed with its financial sector, human capital resources and infrastructure to become a model seed industry for all of eastern Africa. This can have significant economic benefits for Kenya, particularly as regional harmonization continues. However, before the Kenyan seed system can achieve its potential it will require investments in both policy reform to drive innovation and competition as well as improved supply chain management and marketing of quality seeds. Specifically, the industry would need to address the areas of policies, the supply gap, and, support systems for the industry, and specialty market-driven needs. Examples of the types of issues that need to be confronted in each area are offered below.

- The Kenyan **policies** for enabling a competitive industry need to be reviewed with a clear eye towards what is needed to become a model for eastern Africa.
 - The government supports a competitive seed industry, but concurrently supports high levels of parastatal participation via Kenya Seed Company and KARI Seed Unit, fostering uncertainty and potential conflicts of interests. While the industry would benefit from increased clarity on the roles of the parastatals, what is more important is the evolution of a more participatory and inclusive policy analysis and development/reform process.
 - Work needs to be done to foster a working environment with high value placed on evidence, transparency, learning from regional and global experiences, and private sector participation in the policy process. As part of this, the specific processes for registering and leveraging seed technology from outside Kenya need to be reviewed and openly assessed.
 - Policies and practices surrounding exclusive licensing also need to be reviewed and openly assessed. Many countries have made great progress with seed industry growth by pursuing an open licensing practice, yet Kenya pursues primarily semi-exclusive and exclusive licensing. What are the pros and cons?
 - Many varieties that would be highly prized by farmers sit on the shelf while foundation seed for bulking is not provided to meet seed companies' requests. AGRA estimates informally that on average these unavailable varieties would lend at least a 15% gain in productivity or lowering of production cost for farmers.
- There is a lack of private sector investment and incentives to **produce and market (i.e. promote and distribute) higher quality seeds**.
 - In countries like Zambia where liberalization has largely taken place, private firms engage in substantial marketing campaigns that drive knowledge, choice and productive investment by smallholders in quality seed of improved varieties. Kenya does not have similar freedom to operate, particularly in light of the fact that the government sets KSC's price of seed, putting downward pressure on overall market pricing.
 - Gains in productivity could further be enhanced by prioritising the allocation of resources to seed production in the private sector, e.g. by opening up some of Kenya's underutilised irrigation schemes in coordination with the National Irrigation Board.

- Work with various seed companies is needed to assess and support marketing and distribution networks that are more appropriate for rural consumers/farmers. This should include an emphasis on trust building and education-based promotional tactics leveraged through branded retail channels,
- The seed industry is also weakened by the fragile and ***limited interconnectedness of key related market systems*** such as input supply, finance, and ICT market systems.
 - The input industry should be more effectively leveraged to enhance distribution synergies, but the trader-based structure of the input industry creates substantial systemic weaknesses.
 - Financial support for seed companies is improving, but slowly, and interest rates are still high. Support for market-oriented breeding has improved in recent years, but more needs to be done.
 - Kenya offers wide ranging ICT services that can improve the efficiency of certified and quality seed distribution, production supply chains and general extension information, but meaningful applications have yet to be developed and implemented.
 - There is also room for Kenyan universities to play greater roles, but it will be critical for their research and development work to be highly farmer-focused and market driven. At present seed companies say they receive little or no benefit from university research breeding, and often when this work is offered to the private sector it is at prices that are too costly. There is also significant opportunity for universities to play a greater role in product testing, demonstrations, and extension.
- **Market-driven demand** for specialized seed needs to be identified, and product solutions developed to meet these demands.
 - For example, for historic reasons white maize has dominated the personal consumption market in Kenya, yet there is increasing demand for yellow maize for animal feed. Yellow maize contains some key amino acids which are important for animal growth, and thus is valued by the meat and poultry industries. Despite this, yellow maize represents only 10% of the total maize market in Kenya, versus 40-60% of the maize production in more mature markets. Feed millers in Kenya are prepared to pay a premium for yellow maize as this will significantly enhance the quality of the formal feeds they supply dairy and poultry sectors.
 - Another key area of need is with legume crops, particularly for rotation with maize. Large seed producers are interested in planting well-adapted nitrogen fixing legume crops in rotation with their maize seed crops, but are generally unable to find good quality seed to do this.
 - The export market for pigeon pea to India is vast, yet the supply of pigeon pea in Kenya is very low. This crop can do well in Kenya, and has the additional benefit of penetrating hardpan, thus improving soil health and water retention capabilities.

Key Proposed Initiatives

The seed sector in Africa is replete with long lists of every possible improvement that should be undertaken to increase performance. These lists have been made for decades, yet all too frequently changes do not come. This study proposes a finite list of specific initiatives which we believe will catalyze seed industry change in Kenya, thus creating a fertile environment for further evolutionary change that will benefit Kenya's farmers and the overall economy.

Initiatives 1 and 2 address regulatory and policy challenges and opportunities. Initiatives 3, 4, and 5 relate to improvements in distribution and awareness. Initiatives 6, 7, and 8 focus on improvements in private sector performance, including support for industry financing and knowledgeable accounting.

Policy and Regulation

Initiative 1 – Support the establishment of a National Seed Task Force

Background: Agriculture is recognised by Kenya's long term development blue print Vision 2030 as one of the key sectors to deliver the 10 per cent annual economic growth rate envisaged under the economic pillar in the strategy. Growth of the national economy is highly correlated to growth and development in agriculture (ASDS, 2010-2020, GoK), due the fact that agriculture is the mainstay of the economy, contributing 26 per cent of GDP annually even at the currently low productivity levels. Coordination of seed industry development in Kenya can have a very high payoff for the country, both at the farmer level as well as for the national economy, but will require transparent and highly pragmatic dialogue among all stakeholders.

Proposed Initiative: Develop, mentor and underwrite a National Seed Task Force to provide input and implementation assistance on industry development initiatives. In addition to the policy-related items mentioned above in the prior section (Approach for Bringing About Industry Change), key tasks should include:

- Clearly communicate the potential national and regional impact both on SHF and the Kenyan economy
- Explore how this task force should link to the Vision 2030 initiative, as well as how the new constitution may require/support the work of the Task Force.
- Work with stakeholders to determine the ideal future structure of the sector with respect to private sector and parastatal involvement.
- Develop an equitable and more sustainable revenue system that goes back to KARI based on commercialization of varieties bred by KARI.
- Develop better ways to link farmer feedback into breeding efforts
- Explore and address industry complaints about the low levels of foundation seed from KARI Seed Unit for crops other than maize, as both the quality and the quantity of foundation seed available each year constitute the fuel for the entire seed industry engine.
- Explore avenues to utilize the considerable strength of the informal sector to more efficiently ensure the movement of improved genetics throughout saved seed stocks for self-pollinating crops. One possible avenue to explore might be the use of a designation for quality declared, versus certified, seed.

Initiative 2 – Work to liberalize regulatory environment, but support increased sanctions for infractions

Background: The growth of the seed industry in Kenya is hampered by excessive regulatory oversight. This raises costs for seed producers and processors, while also reducing the supply of quality produced seed that reaches farmers on time for planting.

Proposed Initiative: Work with policy makers to understand how liberalization has worked in other countries and develop approach for Kenya. In parallel, work with government to develop and enforce increased sanctions for lack of self-regulation by seed producers and processors.

Awareness and Distribution

Initiative 3 – Promote awareness of the value of QIPP seed with farmers, suppliers and distributors

Background: The term “seed” has been much maligned in the marketplace. Many farmers are understandably unwilling to pay good money for seed because frequently what they have been, or are being, sold as seed is not QIPP seed. (As outlined earlier, QIPP seed is seed that has been produced to quality standards, contains improved genetics, is properly positioned in the agroecology, and is packaged and priced to meet farmers’ risk appetites.) QIPP seed holds significant potential to improve the livelihoods of Kenyan farmers, however all too many do not understand its value. Commercial seed producers frequently contribute to the low value placed on seed from the formal sector by not adhering to the overall goals of QIPP seed.

Proposed Initiatives: 1) Design a program to improve farmers’ perception of the value of seed from the formal sector. Possible actions could include:

- a) Undertake an education campaign in selected pilot areas for both farmers and agrodealers about the nature of QIPP seed and how to recognize it, especially as it relates to improved genetics. Focus on the benefits of refreshing self-pollinating crop seed regularly, e.g. every three years at a minimum.
- b) Establish farmer feedback mechanisms for complaints and verification.
- c) Possibly require seed packagers to include the year of variety release on their labels.

If successful, roll out to other areas.

2) Work with the seed industry to establish and enforce a code of conduct that promotes industry provision of QIPP seed to farmers, in addition to exploring other avenues the industry can take to improve farmers’ perception of value.

Initiative 4 – Increase awareness among SHF of new varieties

Background: Many seed companies do not have the resources (especially the manpower, as this is seasonal work) to effectively create demand for their new varieties among SHF. Kenya has several models of successful NGOs who are doing this work (FIPs-Africa, One Acre Fund)

Proposed Initiative: Explore ways to replicate these success models on a larger scale, and in different geographies, possibly by developing and funding limited term extension projects (i.e., with clear exit plans.) These projects should be focused in areas where there is already sustainable production of new varieties. The key will be to have an exit strategy, so that NGO/extension funding for commercialization is not required long term, and does not discourage companies from assuming responsibility for marketing to farmers.

Initiative 5 – Explore more effective distribution models

Background: The current distribution system is characterized by low dealer margins after transportation costs, lack of dealer aggressiveness with respect to building seed sales volumes, low product education and customer service levels, and multiple layers of middlemen between the seed suppliers and the farmers.

Proposed Initiative: Develop new pilot programs to explore different distribution options, while continuing to seek ways to improve the current system. Pilot programs might include:

1. Support for the development of a large, high quality chain of farmer-oriented seed (and other input) retailers, akin to Farmers World in Malawi.
2. Development of a seed education, service, and distribution center in major cities for workers who wish to buy seed there to carry home for seasonal planting.
3. Support for private sector company pilots, such as dedicated seasonal kiosks, for companies which are committed to producing and distributing orphan crop seed.

To determine how to improve the existing system, further analysis needs to be done to determine exactly where the weaknesses lie and how they can best be addressed. These weaknesses most likely vary by region, and possibly by segment of farmer served. Additionally, the results of recent interventions like KASP should be studied to determine ongoing impact and possible gaps in agrodealer performance that can be addressed.

Private Sector Capacity and Performance

In Kenya the largest market share is held by parastatals, yet a truly vibrant seed industry must include highly competitive and innovative private sector players, at scale. The initiatives below are intended to level the playing field somewhat, although it is recognized that the overall question of the role of the parastatals remains. This issue should be studied and addressed by the proposed National Seed Task Force (Initiative 1).

Initiative 6 – Support private sector provision of QIPP seed for orphan crops

Background: There are key orphan crops for which farmers are still using old varieties, and even for these varieties the supply flow of fresh seed is not good. These crops

include, but are not limited to: cowpea, pigeon pea, field beans, millet, potato, rice and sorghum.

Proposed Initiative: Support commercial scaling up of production of newest/best varieties, through either formal or informal sectors. A key constraint here is foundation seed, and this constraint will need to be addressed.

Initiative 7 – Reduce production risks for seed companies

Background: Seed supply in Kenya is erratic for a number of reasons, with the key ones being major reliance on rainfed agriculture, lack of cold storage for keeping parental material and carryover certified seed, and erratic supply of high quality foundation seed.

Proposed Initiative: Develop support mechanisms to address these challenges for private sector players.

- Priority for use of irrigated land should be given to seed production companies since the product that they produce has an exponential benefit to the economy and the livelihoods of Kenyans. Reliability of seed supply is particularly essential following a drought year.
- The increased use of climate controlled seed storage, which allows seed companies to plan for higher production of parental material under irrigation in a single season and also enables carryover of certified seed stocks for sale in a subsequent season, will lower production risks and production costs.
- Develop a parent seed production and certification process that is supportive of private sector companies more easily bulking their own parental seed. This will allow them to reliably develop and execute long term production plans versus, for many companies, the current “next season” approach. This process must start with the companies being able to reliably purchase high quality breeder seed,

Initiative 8 – Improve ability of existing financial institutions to lend to seed companies

Background: Seed production has a long business cycle and entails a lot of risks. These risks can be considerably reduced by appropriate capital investment in, e.g., storage, irrigation, processing equipment, quality control equipment, and dryers. The long business cycle means that working capital is required in fairly large levels, generally to pay contract growers of fund on-farm production.

Proposed Initiative: Sponsor an initiative to increase and improve commercial bank financing for seed companies in Kenya, working to develop both more enlightened lenders and borrowers. If necessary, seek funding for subsidized lending rates, as current seed business margins do not support high levels of interest rates. An additional specific effort should be made to identify and support accounting firms interested in developing a specialization in the seed industry, from both an audit and management capacity building perspective. This will strengthen the individual companies’ management teams and help to satisfy lender concerns about the reliability of financial statements.

Conclusion

Kenya has a unique opportunity to drive significant economic growth, increase social well-being, and pursue more environmentally sustainable land use practices through modernization of its seed industry. The paths taken in other countries can serve as fertile ground for ideas and lessons about implementation. While there are many strengths upon which to build, the industry at present embraces many practices which are not consistent with a mature, well-functioning industry. The net result of many of these practices is the low rate of product innovation, a sluggish supply response to seed demand, and high costs for seed production, processing, and distribution entities.

With global demand for food rising and agriculture currently playing a strong role in the Kenyan economy, improving the seed industry offers great hope for increased economic activity domestically, regionally, and beyond the region. However, one hallmark of proposals for seed industry change in Kenya is that there have been many, and for a long time. If Kenya wishes to take advantage of this opportunity, it will be important to move with vision and a sense of urgency from discussion to action.

ANNEX 1 Study Methodology

The study is based on data compilation and analysis, literature review, on-going discussions with industry participants, and field interviews.

The study team was comprised of three individuals, with over 35 years of combined years of experience in seed systems. Two of the team members were Kenyan; the non-Kenyan member has been involved with Kenyan seed system work since 2007.

Field interviews were undertaken to explore issues, confirm or disprove hypotheses, and develop a greater understanding of the issues on the ground. In rural areas, these interviews focused on agrodealers, seed companies, farmers, and provincial agricultural staff. A formal questionnaire and interview techniques were used to gather data. The areas covered are indicated in the table and map below.

LOWLANDS- LAKE BASIN	KISUMU
HIGHLANDS-	KISII REGION
TRANSITIONAL ZONES	KIRINYAGA-MWEA
DRYLANDS- EASTERN	MACHAKOS-
DRYLANDS- EASTERN	EMBU- MBEERE
RIFT VALLEY- PLAINS	KAJIADO-NAROK
RIFT VALLEY- HIGHLANDS	WEST POKOT
RIFT VALLEY-CENTRAL	NAKURU

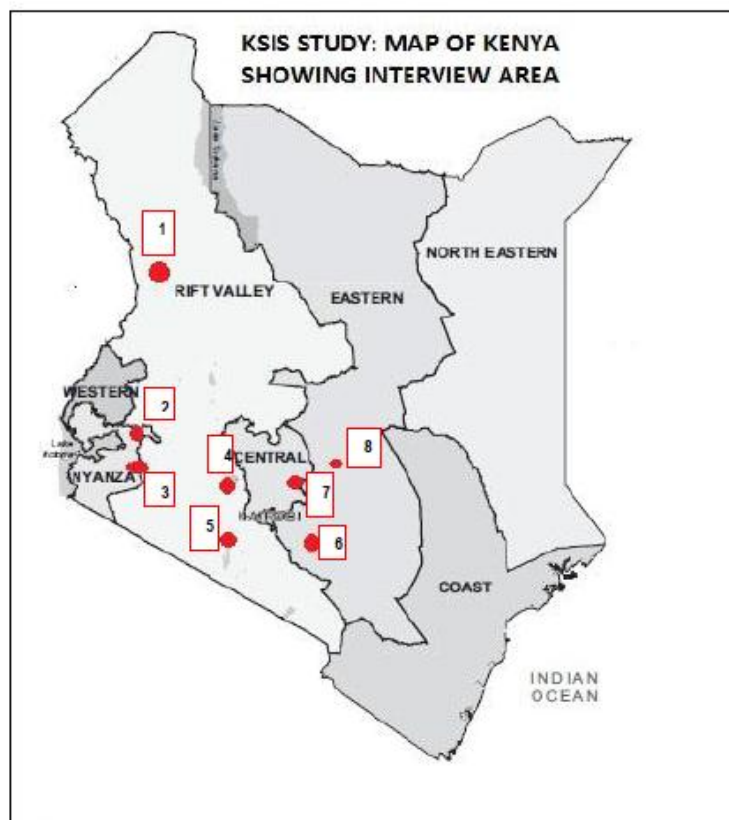


Figure 17: Map of Kenya Showing Interview Area

KEY

1. West Pokot
2. Kisumu
3. Kisii
4. Nakuru
5. Kajiado-Rongai
6. Machakos
7. Kirinyaga-Makutano
8. Embu

ANNEX 2 Table 22: Currently Registered Seed Companies in Kenya

Seed Company		
East African Seed Co	Food and Horticultural Crops	
Farmchem Ltd (Pioneer)	Food and Horticultural Crops	
Monsanto Kenya Ltd	Food and Horticultural Crops	
Royal Seed Ltd	Food and Horticultural Crops	4 Total
ADC Seed Potato Project	Food Crop	
Agri-Seed Co	Food Crop	
Dryland Seeds Ltd	Food Crop	
Freshco International	Food Crop	
KARI Seed Unit	Food Crop	
Kenya Seed Company	Food Crop	
Leldet Ltd	Food Crop	
Olerai Ltd	Food Crop	
Pannar Seed Co. Ltd	Food Crop	
Western Seed & Grain Co	Food Crop	
Lesiolo Grain Handlers Ltd	Food Crop ?	11 Total
Agrichem and Tools Ltd	Horticultural	
Amapop Seeds Ltd	Horticultural	
Amiran K Ltd	Horticultural	
Continental Seeds Company	Horticultural	
Elgon Kenya Ltd	Horticultural	
GNASS K Ltd	Horticultural	
Hygrotech EA Ltd	Horticultural	
Kenya Highland Seed Co.	Horticultural	
Safari Seeds Ltd	Horticultural	
Savanna Seeds Ltd	Horticultural	
Simlaw Seeds	Horticultural	
Syngenta East Africa Ltd	Horticultural	
Syova Seed LTd (branch of EA Seed)	Horticultural	
Veterinary & Agronomic EA Ltd	Horticultural	14 Total
Alibhai Shariff & Sons Ltd	Inactive	

Bayer East Africa Ltd	Inactive	
Goldsmith Seeds K Ltd	Inactive	
Hortitec K Ltd	Inactive	
Lagrotech	Inactive	5 Total
Africallalily K Ltd	Other	
Agro Irrigation and Pump Services	Other	
Alliance One Tobacco K Ltd	Other	
British American Tobacco K Ltd	Other	
Carzan Flowers Ltd	Other	
Charles Gerald Ltd	Other	
Color Vision Roses Ltd	Other	
Dominion Farm Ltd	Other	
Equip Agencies Ltd	Other	
First Choice Seeds Enterprises	Other	
Green Africa Foundation	Other	
Green Forest Social Investment Ltd	Other	
Greenlife AgroScience EA Ltd	Other	
Hamer K Ltd	Other	
KEFRI Seed Centre	Other	
Kenfap Services Ltd	Other	
Kenya Malting Ltd	Other	
Kitui Ginneries Ltd	Other	
Lake Basin Development Authority	Other	
Midlands Ltd	Other	
Milwar Enterprises	Other	
Mount Elgon Orchards Ltd	Other	
Murphy Chemicals Ltd	Other	
Mwea Cotton Ginnery Ltd	Other	
Mwea Rice Growers Multipurpose Society	Other	
Oil Crop Development Ltd	Other	
Orion East Africa Ltd	Other	
Rehabilitation of Arid Environments	Other	
Rifcot Ltd	Other	
Stokman Rozen K Ltd	Other	
Suera Flowers Ltd	Other	

Tree Biotechnology Project	Other	
Migotiyo Plantations	Other??	
Wakala Africa Ltd	Other??	34 Total
AAA Growers Ltd	Produce exporter	
AgriFresh Kenya Ltd	Produce exporter	
Benvar Estate Ltd	Produce exporter	
Chemisian Farm Ltd	Produce exporter	
East African Growers Ltd	Produce exporter	
Everest Enterprises	Produce exporter	
Frigoken Ltd	Produce exporter	
Greenland Agroproducers Ltd	Produce exporter	
Homegrown K Ltd	Produce exporter	
Kisima Farm	Produce exporter	
Sunripe(1976) Ltd	Produce exporter	
Vegpro K Ltd	Produce exporter	
Wilham K Ltd	Produce exporter	13 Total
Crop Africa Ltd	Seed Outgrower	
Lambwe Seed Growers (LASGA)	Seed Outgrower	
Pollen Ltd	Seed Outgrower	
Redshank Ltd	Seed Outgrower, flowers and vegetables	4 Total
GeneticTechnologies International LTd	Tissue culture	1 Total
Adaptive Seed Co Ltd	Unknown	
Agrifarm EA Ltd	Unknown	
Egerton University Seed Unit	Unknown	
Mavuno Seeds	Unknown	
MIAD	Unknown	
Sacred Seed Company Ltd	Unknown	
Uniseed	Unknown	7 Total
TOTAL		93