WORKING STRATEGY DOCUMENT

Seed System Development Strategy

VISION, SYSTEMIC CHALLENGES, AND PRIORITIZED INTERVENTIONS

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List of acronyms

AGP	Agricultural Growth Program
ASE	Amhara Regional Seed Enterprise
ATA	Agricultural Transformation Agency
BH	Bako Hybrid
BMGF	Bill and Melinda Gates Foundation
BoA	Regional Bureau of Agriculture
CSA	Central Statistical Agency
DA	Development Agent
EIAR	Ethiopian Institute for Agricultural Research
EPA	Environmental Protection Agency
ESA	Ethiopian Standards Agency
ESE	Ethiopian Seed Enterprise
ESGPA	Ethiopian Seed Growers and Processors Association
ETB	Ethiopian Birr
FTC	Farmer Training Center
GOE	Government of Ethiopia
GTP	Growth and Transformation Plan
HLI	Higher Learning Institute
IBC	Institute for Biodiversity Conservation
IV	Improved variety
MoA	Ministry of Agriculture
MLE	Monitoring, Learning and Evaluation
NARS	National Agricultural Research System
NGO	Non-Governmental Organization
NSIA	National Seed Industry Agency
NVRC	National Variety Release Committee
OPV	Open pollinated variety
OSE	Oromia Regional Seed Enterprise
PSE	Public seed enterprise
QC	Quality control
QDS	Quality declared seed
QPM	Quality Protein Maize
RARI	Regional Agricultural Research Institute
RSE	Regional seed enterprise
SNNP	Southern Nations, Nationalities and Peoples Region
SPV	Self-pollinated variety
SSE	South Regional Seed Enterprise

Acknowledgments

It is with the support and contribution of many partners that this vision and strategy document was developed for the Ethiopian seed system. ATA would like to express its sincere appreciation for the data, insights and guidance of its partner organizations from public, private and NGOs sectors, at Federal, Regional

and International levels. ATA looks forward to continued collaboration towards the transformation of the seed system and the agricultural sector as a whole.

Federal

Ministry of Agriculture, Directorate of Input Marketing Ministry of Agriculture, Directorate of Animal and Plant Health Regulatory Services (APHRS)
Ethiopian Institute for Agricultural Research (EIAR)
Ethiopian Seed Enterprise (ESE)
National Seed Planning Committee
Federal Cooperative Agency (FCA)

Regional

Amhara Regional Bureau of Agriculture
Amhara Regional Agricultural Research Institute (ARARI)
Amhara Regional Seed Enterprise (ASE)
Oromia Regional Bureau of Agriculture
Oromia Agricultural Research Institute (OARI)
Oromia Regional Seed Enterprise (OSE)
Somali Regional Bureau of Agriculture
SNNP Regional Bureau of Agriculture
Southern Agricultural Research Institute (SARI)
South Seed Enterprise (SSE)
Tigray Regional Bureau of Agriculture

Private Sector

Ethiopian Seed Growers and Processors Association
Pioneer Hi-Bred Ethiopia
Alemayehu Makonnen/Seed Co.
Anno Agro-Industry
Avallo Seed Company
Hadia Seed Company

International

Alliance for Green Revolution in Africa (AGRA)
International Wheat and Maize Improvement Center (CIMMYT)
International Food Policy Research Institute (IFPRI)
International Center for Agricultural Research Dry Areas (ICARDA)
International Potato Center (CIP)
Seed Trade Association of Kenya (STAK)
The Bill and Melinda Gates Foundation (BMGF)
The Royal Netherlands Embassy
The United States Agency for International Development (USAID)

Executive Summary

For smallholder farmers, investing in varieties of improved seeds and modern inputs is a critical step towards increasing yields, and as a result, improving livelihoods. As demonstrated in many research papers and relevant country case studies, increasing the utilization of seeds of improved varieties, when accompanied with other agricultural inputs and appropriate agronomic practices, can dramatically increase Ethiopia's annual crop production. Recent studies suggest that adopting improved varieties in an additional quarter of the current crop area could increase production of maize by ***over 60%*** and self-pollinated crops by ***over 30%*** in these areas. This would result in a total production increase of more than 7 million tons per year.[1]

In addition, several Asian and Latin American countries have realized strong increases in crop productivity, output, and food security in the last few decades, specifically due to the dramatic adoption of high-yielding crop varieties (e.g., semi-dwarf rice varieties), along with improved agronomic and management practices as well as strategic policies and investments. For example, India witnessed a tremendous boost in the production of crops from 1951-1999 (food grains increased from **50.8 million tons to 202.5 million tons**, cotton from **3 to 12.8 million tons** and sugarcane from **5.2 to 290.7 million tons**), driven by all of the aforementioned factors.[2]

For the seed system to effectively act as a catalyst of agricultural transformation, seeds of improved varieties have to be made available to a broad base of women, men, and youth farmers on a continual basis, at the right quantity, quality, time, and price. Most farmers in Ethiopia have very limited access to high quality, improved seed in convenient outlets, and many released varieties of different crops with superior traits have not still been widely disseminated. Some of the specific challenges associated with seed include the limited capacity and lack of role clarity of the different actors, the focus of the system on very few crops and varieties, mismatch between supply and demand resulting in shortage and excess inventory, and quality issues due to inappropriate production, storage, and transport practices.

An additional area of complexity is the fact that formal seed production (defined as seed provided to farmers through an institutionalized network of public and private institutions) still has a limited footprint in Ethiopia, covering under 6% of the total land area. Like many developing nations, the Ethiopian seed system is highly dominated by the informal sector (defined as farmers producing and exchanging their own seeds), along with an emerging intermediate sector consisting of community based seed producers.[3] Due to the relative immaturity of the formal sector and its associated improved seed and technologies, the majority of smallholder farmers will likely be reached through the informal and the intermediate sectors in the near-term. Hence, the linkages and evolutionary patterns between these sectors have to be well understood and strengthened.

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[1] Dercon S. et al., 2009
[2] Govindan A. and Russel C., 2003
[3] **Note:** See Section 4.2 "Defining the intermediate sector", for clarifications on specific groups that are included in the intermediate sector (starting on page 70). For clarification, larger farmer entrepreneurs are classified in the Formal Sector as they have to register in order to produce and distribute seed.

The vision and mission for Ethiopia's Seed System is laid out below in **Exhibit 1**:

OVERALL FIVE-YEAR **VISION for Ethiopia's Seed System**
An innovative market-led multi-sector seed system that effectively contributes to improvement of farmers' livelihood

OVERALL FIVE-YEAR **MISSION for Ethiopia's Seed System**
A well-functioning seed system that enables all farmers, women, men, and youth, to access seed of improved varieties at the right quality, quantity, time, and price, from a range of producers and distribution channels in order to increase production and productivity

There are several underpinning factors that are critical to enabling this vision:

- **The effective development, release, and registration of high-quality varieties.** The goal here is to effectively develop and release varieties that meet farmers' needs, be it yield, disease resistance, or other variables related to the value chain. Strong, well-resourced, self-sustainable research institutions are essential for developing and maintaining varieties, as are independent regulatory structures to register and release these varieties.
- **Clearly delineated roles of public and private producers in the formal sector.** Each type of producer should operate in a domain in which it has a relative advantage while meeting the need of farmers. The private sector has had a strong track record in opportunities such as hybrid maize seed and other types of high-value crops such as horticulture, largely driven by the relatively higher margin of these crops vs. self-pollinating varieties (SPVs). Given this, the mission of the public entities should be to fill gaps that private companies will be less likely to fill, namely SPVs such as wheat and tef, and geographies that the private sector cannot reach.
- **A vibrant market environment that enables both public and private producers to produce, market, and distribute seed effectively through multiple channels**. Ideally, seed producers should have both accountability for and the incentives to produce high-quality, high-performing seed. Through Direct Seed Marketing (DSM), Ethiopia can have a system by which seed producers directly market their seed to farmers through multiple channels, which will foster healthy competition after receiving the necessary certifications, and lead to greater choice and value for farmers.
- **Structures that ensure quality at all stages of the seed system.** As the seed system grows in terms of quantity as well as the range of producers participating, quality control will become increasingly paramount. To enable this, regulatory mechanisms ranging from field inspections to laboratory tests are essential. As the sector evolves, the goal is that producers and distributors will naturally be incentivized to maximize quality as they will directly bear the associated risks and rewards through increased farmer demand for high quality seed.
- **Robust intermediate sector that decentralizes seed production and distribution while maintaining effectiveness.** Community-based seed production and distribution enables easier access to seed and builds local economies. The goal is to effectively support community-based producers so that they can be transformed into independent, self-sustaining seed enterprises that address local needs. In particular,

the goal of community-based seed production is to satisfy needs and demands in self-pollinating crops and geographies; while the formal public sector should focus here, there are still significant gaps that can be satisfied by community-based seed production. It is critical to ensure that quality and other critical parameters - timeliness and choice - are still satisfied in this system.

- **Maximizing the potential of the informal sector (farmer-based seed production).** The informal sector currently forms the vast majority of the seed system, and this is expected to continue in the future. There are two essential techniques to building this sector—the first is strengthening awareness of and building best practices in seed management, and the second is promoting innovative local seed marketing networks. Despite the expected growth in the intermediate sector in the near future, experience from other countries suggests the majority of seed production will still be driven by the informal sector.

Stepping back from these key areas, additional systemic bottlenecks will have to be addressed through strategic interventions across the formal, intermediate, and informal sectors. Over 30 systemic bottlenecks across the different areas of the seeds system have been identified, which will be addressed by a respective set of interventions.

To be effective, interventions need to be prioritized and sequenced, and implementation must be coordinated among governmental, private sector, and non-governmental implementation partners. Each intervention requires activities owned by different stakeholders in the seed sector and must be translated into specific, actionable deliverables owned by specific stakeholders. The final success of this strategy depends on appropriate ownership, coordination, and accountability by relevant partners at all levels.

Recognizing this fact, the GOE has identified the seed system as a priority area of focus. Given the significant current and future role the agricultural sector plays, a vibrant seed system that provides quality seed to meet farmers' demands is an essential enabler to continued economic and social development in Ethiopia. So far, continued efforts by concerned stakeholders have made considerable progress in developing the country's seed system. Such efforts could, however, be further enhanced and coordinated to significantly contribute to the overall transformation of the agricultural sector.

Furthermore, gains in agricultural productivity cannot be achieved through the seed system alone, no matter how dynamic and efficient it may be. Farmers need to use seeds as an element within a well-adapted set of agricultural inputs and information, in a responsive and service-driven extension system, and ultimately have the opportunity to market their outputs in markets that will provide positive returns on their investments.

Chapter 1. Introduction

1.1 Purpose and scope of this unified strategy document

This document seeks to outline Ethiopia's national strategy to transform the seed system in a comprehensive manner. It is intended to guide domestic and international partners in targeting their investments and efforts towards addressing systemic bottlenecks with the objective of bringing about holistic transformation, rather than piece-meal activities within the seed system. This is a living document and will be refined and updated as the system and its needs evolve in the coming years.

This document was created to align stakeholders across the seed system on a unified strategy that will improve the production, distribution and adoption of high quality seed. To achieve this task, the ATA is working directly with national and local stakeholders to:

- Identify the primary **bottlenecks** to smallholders' success in each step of the value chain;
- Design a set of comprehensive, actionable **interventions** addressing these issues**;**
- Propose a series of key **activities** and recommended owners to successfully carry out the strategy.

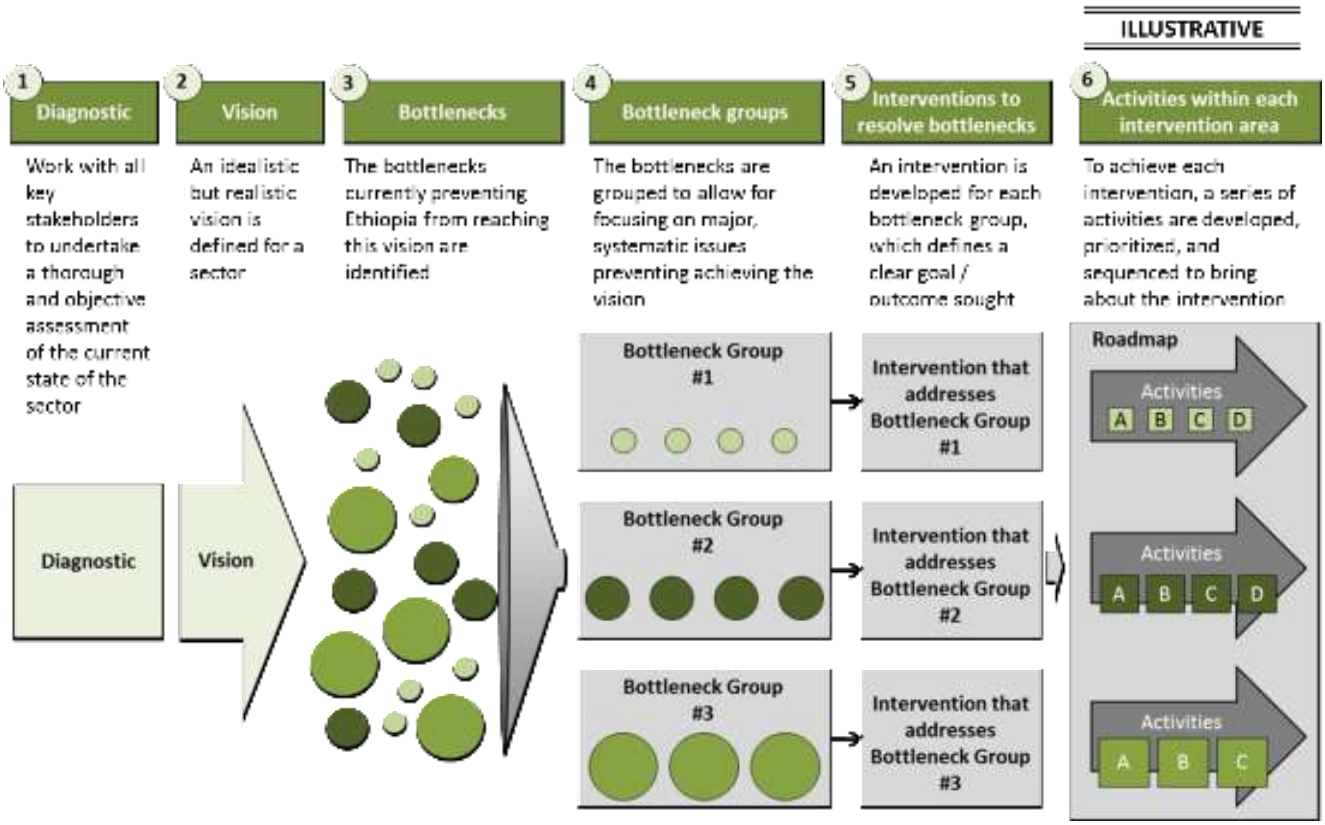
This document does not include implementation timetables, budgets, or resourcing assessment for the proposed interventions, which will be designed by the implementing stakeholders. As such, it is intended to serve as the blueprint for the seed sector, enabling stakeholders to coordinate their activities to be harmonious and comprehensive.

1.2 Strategy development approach

The bottlenecks in the seed system are diverse and complex across the value chain and at all levels of governance. As such, this national seed sector strategy was developed in a strategic, systematic, and stakeholder-consultative process, with input from an inclusive set of stakeholders, per ***Exhibit 1*** on the next page.

Exhibit 2

From vision to roadmap: how the ATA approaches problem-solving



First, the ATA and MoA worked with a variety of stakeholders at multiple levels to develop a **vision** for the seed sector in Ethiopia.

Next, qualitative and quantitative analysis was conducted to understand the issues and constraints that formed **bottlenecks** to the achievement of the identified vision—the most critical of which are detailed in this document. Next, strategic interventions were designed to address these bottlenecks. Distinctions were made between bottlenecks affecting different parts of the value chain in order to frame solutions on discrete key issue areas that, though interrelated, engage distinct sets of stakeholders who can work independently to drive results in parallel. All bottlenecks have been identified through:

- *Review and synthesis* of existing diagnostic and strategy materials on the sector
- *Systematic interviews* with experts and stakeholders, including the Ministry of Agriculture, research organizations, academia, and other development partners
- *Original research*, including quantitative analysis on production, price, and sales trends, interviews and field visits with farmers and other rural groups, and case studies.[4]

[4] This document is indebted to the Central Statistics Agency, the UN FAO, as well as numerous development and implementation partners who have collected systematic production, sales, climate, resource, livelihood, and outcomes data. A full list of data sources consulted and interviews conducted can be found in Appendix B.

Next, interventions were designed to address these groups of bottlenecks. Collaborating closely with the relevant stakeholders, the ATA and MoA developed a set of targeted **interventions** to address and overcome the constraints posed by bottlenecks in the seeds system, guided by the following:

- *Historical experience* in Ethiopia of successful and unsuccessful projects in the sector;
- *International best practices* that can be tailored to the Ethiopian context
- *Consultations with experts*, using problem-solving sessions to form workable hypotheses with the many stakeholders named in this document (see *Appendix B. Key informants*).

This set of systemic bottlenecks and strategic interventions, developed on sound analytical foundations in close partnership with stakeholders, form the basis of the National Strategy for the Seed System. This document goes further to suggest activities that should be owned by stakeholders in the sector, proposing a prioritization scheme for the first five years.

A series of workshops was organized to translate the interventions into tangible workplans and actions. From October 18-19, 2011, a national workshop was organized in Adama with the objective of translating the Formal Sector strategic interventions into work plans and actions. At this workshop, stakeholders endorsed the vision, interventions and implementation framework for the Formal Seed Sector. In addition, another national workshop was conducted on October 1, 2012 in Addis Ababa to refine the draft vision, systemic bottlenecks and interventions for the informal and intermediate sectors of Ethiopia's seed system. At the end, a final national event brought together all relevant stakeholders of the three sectors for final review and endorsement of the unified national seed sector strategy.

The following sources have been used while developing and identifying the vision, bottlenecks and interventions outlined in this document:

1. **Extensive review of the relevant literature on international seed systems** - the Ethiopian seed sector has been the subject of substantial investigation. The ATA team has conducted an exhaustive review of a number of reports and analysis of international cases which revealed enabling factors and successful interventions from other countries
2. **In-depth key informant interviews and discussions with stakeholders in the Ethiopian seed system**- discussion with various stakeholders from the MoA, BoA, National Agricultural Research System (NARS), Institute of Biodiversity Conservation (IBC), Higher Learning Institutes (HLIs), Public Seed Enterprises (PSEs), private seed companies, development partners, cooperatives, farmers and many others brought context to and surfaced constraints listed in the literature review. These interviews have also helped the team validate findings and recommendations
3. **Case studies of the Ethiopian seed system**- These include interviews and analyzing inputs from workshops with key stakeholders from the NARS and public/private seed enterprises, and analysis of secondary data on the Ethiopian seed system
4. **International case studies on the seed sector of other countries**- this involved expert interviews and detailed analysis of available secondary data to draw lessons from experiences of selected countries such as Kenya, Malawi, Tanzania, India, US and others

To realize the ambitious vision contained in this document by 2018, stakeholders across all sectors and levels of government must be engaged. Below are some of the key stakeholders who have been deeply involved in

the process of crafting this sector strategy, and who will become owners of specific interventions contained within it. The successful execution of this strategy will depend on their commitment, alignment, and continued engagement over the next five years.

1.3 Major stakeholders of the seed system

Research Institutions

The National Agricultural Research System (NARS) plays a foundational role in the seed system by developing the improved varieties and best management practices that are multiplied and delivered to farmers Increase production and productivity levels of crops. The NARS is comprised of EIAR, Regional Agricultural Research Institutes (RARIs) and higher learning institutions (HLIs).

Extension Services

Research institutions depend on extension services to popularize new technologies. In Ethiopia, this is done entirely by the public system driven by the Extension Directorate of the MoA and Extension structures of Regional BoAs. The Research, Extension and Farmer Linkage Advisory Council (REFLAC) lead the linkage between research and extension. This Council consists of a broad group of stakeholders beyond research, extension and farmers; it includes IBC, NGOs, agribusinesses, ECX, the Ministry of Trade and Industry, MFIs and several others.

Public Seed Enterprises (PSEs)

Within the formal system, public seed enterprises (PSEs) have the largest share in the production and marketing of certified seed: this includes the Ethiopian Seed Enterprise (ESE) and Regional Seed Enterprises (RSEs) in Amhara, Oromia, SNNPR and most recently, Somali. In general, PSEs exercise the double mandate of implementing the government's aim of producing sufficient quantities of improved varieties for key crops to facilitate adoption by smallholder farmers and becoming self-sustaining businesses. Therefore, PSEs produce seeds of varieties that are needed by farmers – even if they are not the most profitable. For example, on average, about 60% of ESE's seed production has been wheat varieties: wheat is less profitable for seed producers because of its high seeding rate, low multiplication rate and farmer's ability to recycle seed without significant yield loss. In addition, PSEs also have limited profit margins since affordable and equitable distribution of seed is the primary priority determined by their respective board of governors.[5]

More importantly, other government bodies are heavily involved in managing the PSEs, even though they have autonomous budget. Even though the MoA governs ESE, it operates under its own budget. Similar to ESE, RSEs are governed by respective BoAs. In addition to their own budget, they also receive operational support including deployment of Bureau staff to serve as internal quality control staff for RSEs.

Private Sector

[5] Interview with ESE and ASE

Privately owned seed companies are significant contributors to national seed output and are second only to PSEs. Foreign seed companies such as Pioneer and SeedCo import varieties developed by their own privately funded research, which broadens Ethiopian farmers' access to technology. They rely on internationally recognized seed brands and internal quality control facilities. Domestic seed companies have a smaller market share but they have shown tremendous growth in the past decade: growing from less than 5 in number to nearly 35 currently, operating at varying scales.

Farmer Organizations

Farmer organizations are also major producers of seed. Because of their fundamental mandate of serving farmers' interest, they are well positioned to produce and distribute seeds that will maximize the benefit to farmers. While only a few farmer organizations produce certified seeds, many produce seed at a baseline level of quality and serve as distribution outlets for public and private seed producers.

Regulatory Institutions

The Ministry of Agriculture (MoA) is the federal government body that drives the development of laws, standards and procedures related to the seed system. It works closely with Regions and other federal government agencies – such as Ethiopian Standards Agency – in this capacity. The MoA is also responsible for international trade and exchange of germplasm and seeds, as well as the entry of international organizations involved in seed production and supply.

At the Regional level, Bureaus of Agriculture (BoAs) enforce these laws and standards. BoAs have Regional seed quality control labs, which undertake inspection, sample collection and testing.

Institute of Biodiversity Conservation (IBC)

IBC is federal government institute with the mandates to ensure the (1) conservation of biodiversity, (2) sustainable utilization of resources, and (3) access to and sharing of benefits of biological resources. In the case of crops, IBC maintains a gene bank for the preservation of indigenous varieties. IBC is a close ally of the research system in the identification, collection, characterization, and maintenance of improved varieties by acting as a source of new genetic material for breeding programs. It is also a key partner in the identification and management of risks related to biodiversity reduction that are associated with widespread adoption of improved varieties.

Smallholder Farmers

Smallholder farmers are the ultimate consumers of seed, and therefore a participatory approach is critical in all stages and sectors of the seed system, be it determining which varieties are selected, having multiple outlets and producers to choose from, and multiple other areas.

1.4 The seed system and its components

The seed system refers to the full set of activities and stakeholders involved in effectively developing, producing, and distributing seed to smallholder farmers.

Currently, the seed system in Ethiopia can be classified into two broad sectors – **the formal and the informal sectors.** The Ethiopian formal sector is made up of institutional operations associated with the development of improved varieties, multiplication, processing, storage and distribution to farmers. Specifically, this includes research institutions, public seed enterprises, large private corporations, and small private seed enterprises. On the other hand, in the informal sector, farmers select their crops and local landraces/varieties, produce their own seeds, and/or locally exchange and purchase seeds. Although the formal seed sector started about six decades ago, it still remains limited to a few major crop varieties developed by agricultural researchers. As a result, the informal sector remains the major supplier of seed of improved and local varieties for many crops grown by small-scale farmers.

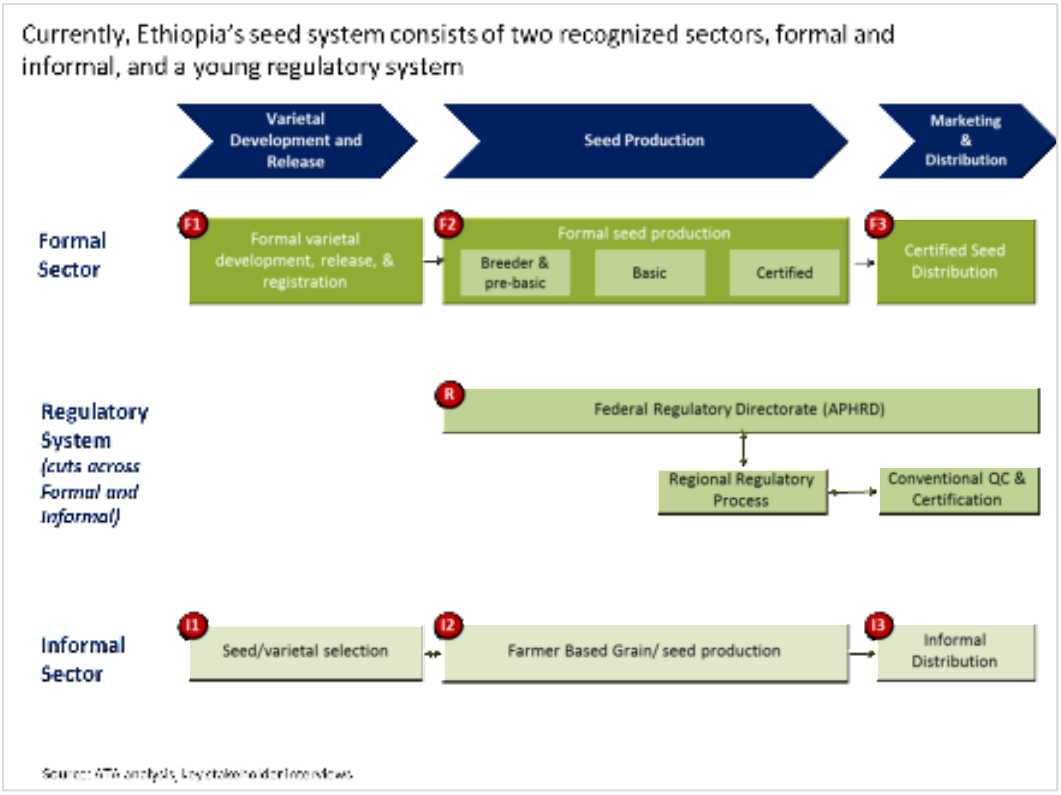
While the formal and informal seed sectors are well recognized, this strategy document also identified an emerging third sector within the Ethiopian seed system – the **intermediate sector,** which has distinct yet overlapping features with the already recognized sectors. As noted earlier, the major actors in this newly defined sector are community based seed production systems in which groups engage in collective seed-related activities. For example, this would include community based seed producers who produce and distribute seed that may not be certified nor fully regulated under existing regulations by the regional bureaus of agriculture, but are producing higher quality seed than produced by the informal sector. These stakeholders offer a unique opportunity for meeting the needs of Ethiopia's farmers and therefore should not be categorized merely as part of the informal sector.

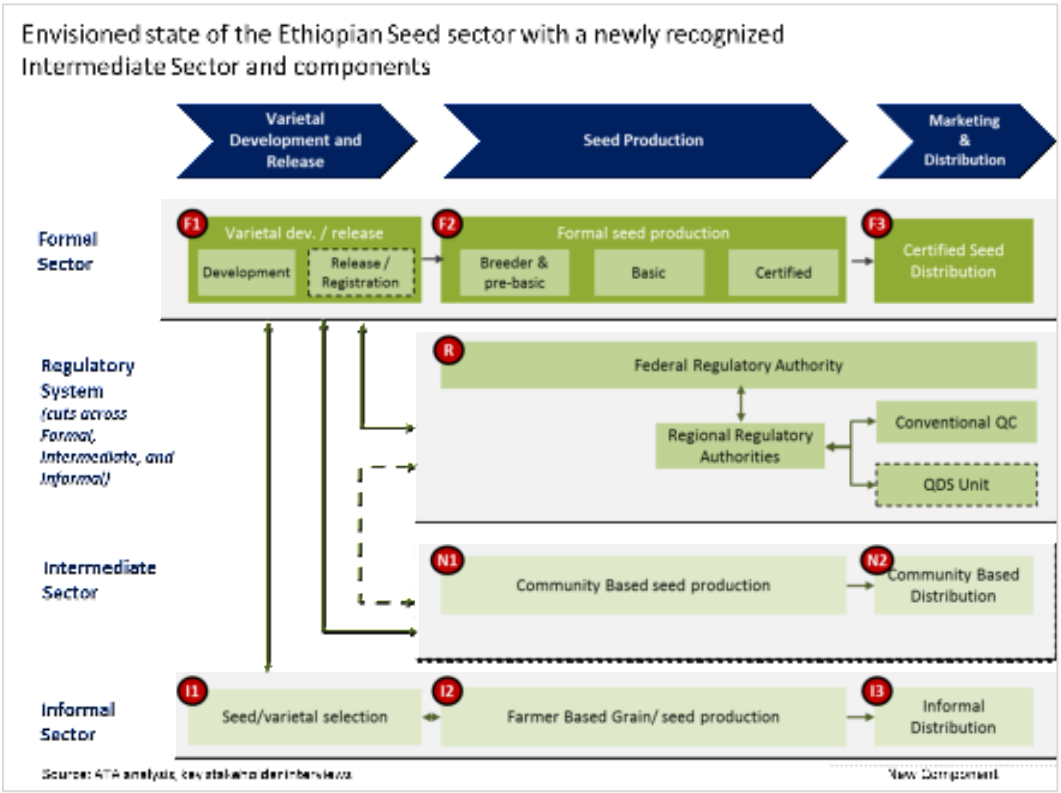
The major rationale for the recognition of the intermediate sector includes the following:

- To focus activities that identify and effectively address systemic challenges that hamper the growth of market oriented yet limitedly regulated community-based seed enterprises
- To strengthen a more decentralized seed production and dissemination system that complements the currently centralized formal seed system.

The diagrams and tables below ***(Exhibits 3 and 4)*** depict both the current and envisioned seed system, and how all the different components link together.

Exhibits 3 and 4



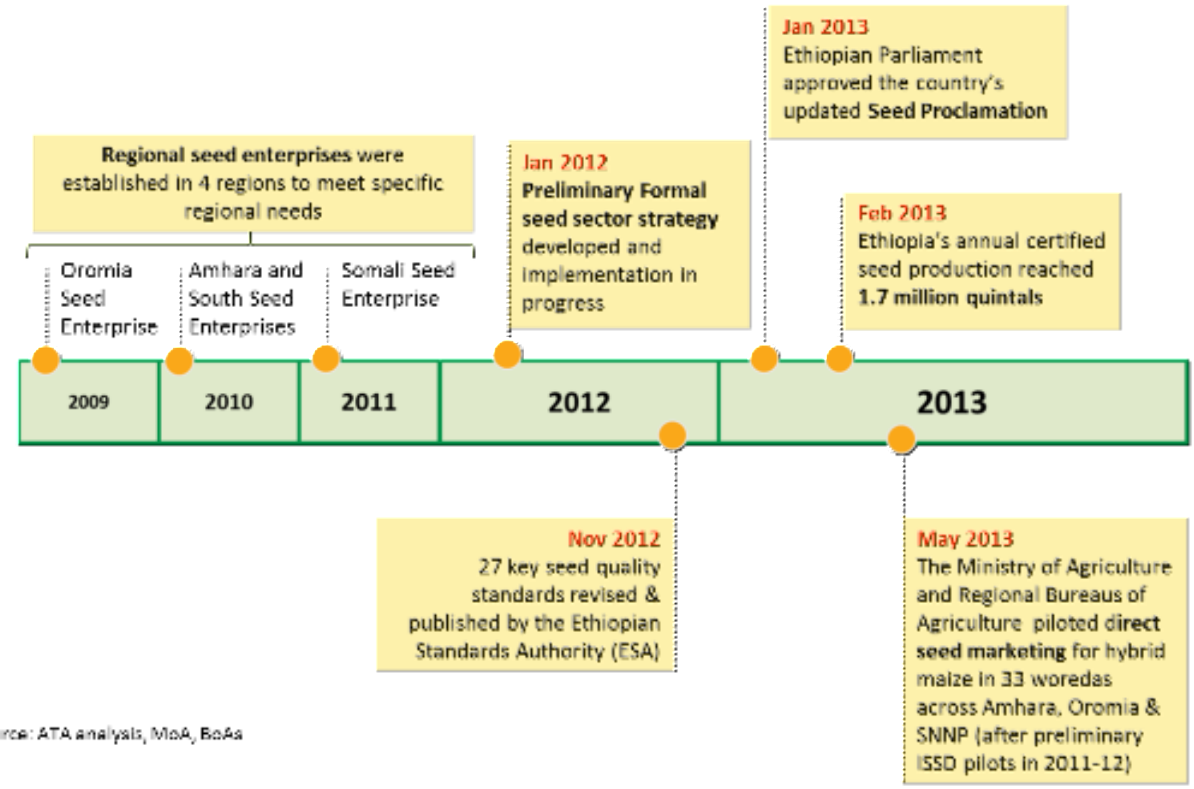


1.5 Recent Developments in the Ethiopian Seed System

In the last 5-10 years, the Ethiopian seed system has seen a surge in production volumes of certified seed. Over the last decade, certified seed production has increased over five-fold[6]. However, this growth has come at the expense of quality, which has significantly deteriorated while the production volumes have increased. This is a result of a number of developments across all the steps of the value chain. Major achievements in the Ethiopian seed system are as outlined below.

Exhibit 5

There have been a number of achievements in Ethiopia's seed sector over the last 5 years, including the establishment of 4 Regional seed enterprises in 4 regions, as well as a new seed proclamation



Source: ATA analysis, MoA, BoAs

Seed Law and the Regulatory System:

- **New Proclamation and New Regulations**: a new seed proclamation endorsed by the House of Representatives after a thorough evaluation by partners. Specifically, the new proclamation emphasizes guidelines around variety release and registration, internal quality control, and clearly defines the relationship between the federal MoA and regional BoAs. Based on the new proclamation, a draft seed regulation is being and will be developed.

[6] Data from public seed enterprises and the MoA's National Seed Coordination Unit

- **Standards:** Old seed quality standards were revised in collaboration with the Ethiopian Standard Authority and 27 of them endorsed and distributed to users.
- **Apex and Regional body setup:** Regulatory bodies at both the Regional and the Federal levels are being restructured to be more independent and autonomous. Technical committees were established in three of the largest seed producing areas (Amhara, Oromia and SNNP) to conduct a detailed needs assessment and to propose recommendations on organizational structure, mandate, etc.

Early Generation Seed Production:

- As early generation seed supply was one of the major challenges of the Ethiopian formal seed sector, ATA, in collaboration with development partners, supported the NARS to build capacity for quality breeder seed production. The capacity building support was aimed at rehabilitation of the existing small irrigation structures and machinery needs at five research centers of EIAR. As a result of this support, the research centers could engage in off-season multiplication of early generation seed to alleviate the current supply shortfall in pre-basic and basic seed.

Certified Seed Production:

- **Decentralization of production**: Since 2009, four new RSEs have been established in Amhara, Oromia, SNNP and Somali to address location-specific needs. These RSEs, though young, are steadily increasing their share of the national certified seed output and the overall amount of certified seed produced in the country. These RSEs work with community-based and private out-growers to multiply certified seed.
- **Increased involvement of private sector**: An increasing number of small scale and larger private seed companies have emerged fairly steadily. Currently, nearly 35 private sector companies are producing certified seed. These companies mostly focus on hybrid maize and account for about a third of hybrid maize seed supply in the past three years.[7] These include both local seed companies as well as international seed companies like Pioneer and SeedCo.

Certified Seed Distribution:

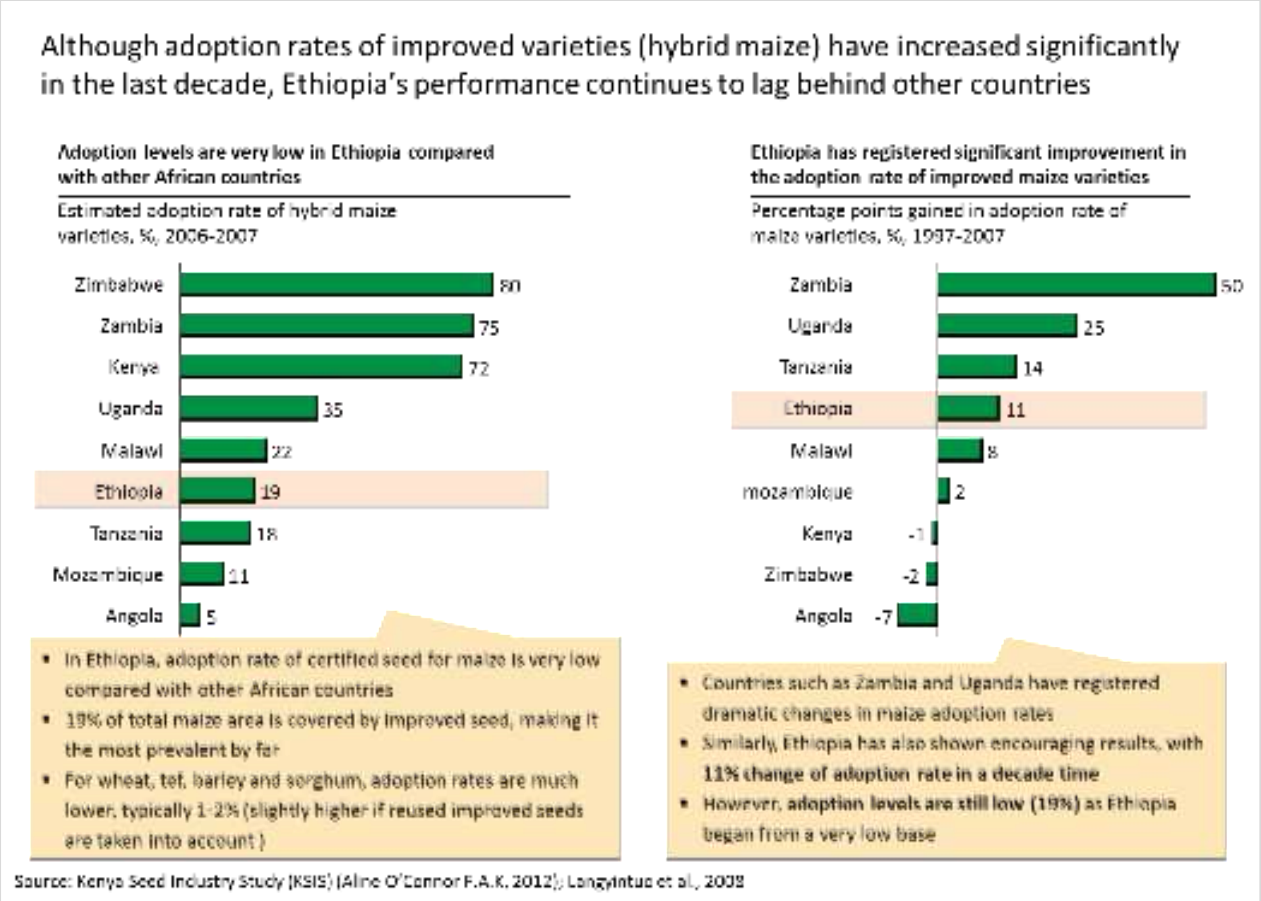
- **Direct seed marketing**: Seed distribution has also seen some exciting progress with the introduction of Direct Seed Marketing (DSM) in 33 woredas in across Amhara, Oromia, and SNNP to promote access and timely availability of increased amounts of certified seed to farmers. DSM is an alternative seed marketing model in which producers take an active role in the distribution of seed through multiple channels including the current retailers, the primary cooperatives, producer outlets, and independent seed stores.

The use of improved varieties in Ethiopia is very low by sub-Saharan Africa standards as demonstrated by the exhibit on the next page. In the 2006-07 season, adoption of certified seed for hybrid maize was only

[7] Steering Committee, 2011.

19% of the total area, and this was the crop with the widest adoption. For other crop types such as wheat, tef, barley and sorghum, adoption rates were even lower

Exhibit 6



Availability to improved varieties has the potential to significantly improve smallholder productivity. However, in order to be truly effective, the production of certified seeds needs to match farmers' demand for specific varieties.

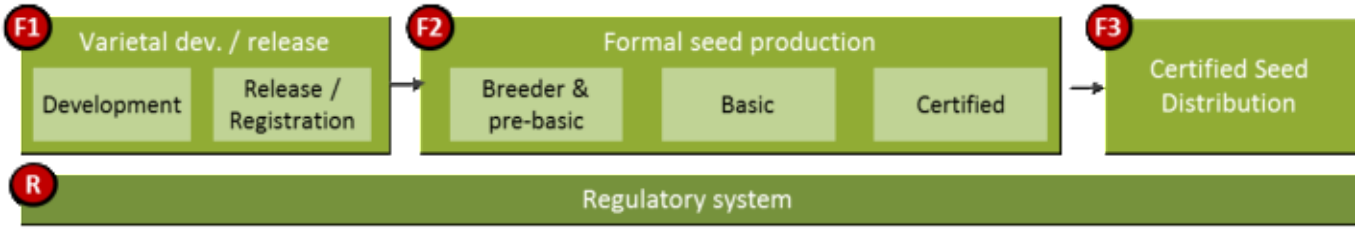
Ethiopia's seed system has experienced tremendous growth in the past five years. Farmers are more willing to invest in and adopt certified seeds. This is a result of large-scale popularization and awareness campaigns conducted through the collaboration of MoA, EIAR, BoAs and international partners such as Sasakawa Global, CIMMYT, and others. In response, more seed producers have emerged and increased seed supply significantly. Going forward, however, it will be necessary to strengthen the effectiveness and sustainability of existing stakeholders and create enabling environments for the entry of others, ultimately so that more farmers use the most appropriate certified seeds and have access to more choices.

Chapter 2: Formal seed sector

2.1 Key components, overall framework, and objective for the formal sector

As discussed, the formal sector refers to the established institutions involved in the seed value chain - from development through distribution - namely research institutions, public seed enterprises, registered private producers, and registered seed cooperatives. The formal sector is composed of three major elements, namely 1) varietal development and release, 2) seed production, and 3) seed marketing and distribution. Within each of these elements is a set of components.

Exhibit 7



F1. Varietal Development, Release, and Registration

The first step in the formal seed sector is the development of new varieties that have superior characteristics compared to existing varieties. These characteristics are measured primarily in terms of yield but other variables including resistance to pests/diseases, resource use efficiency, climate resilience (drought and heat tolerance, shorter maturation time), and other factors related to the grain value chain (nutrition content for consumers, biomass for animal feed, fiber content for cotton, etc.). Once an improved variety is developed, it can be adapted to be used by broader agro-ecologies. For example, improved varieties may be imported from comparable countries, verified under Ethiopian agro-ecologies, and released for local use. A similar process can be used for varieties developed in Ethiopia. An improved variety also needs to be maintained to make sure that it remains genetically consistent - or true-to-type. For publicly released varieties in Ethiopia, NARS and a few international private companies carry out this component in the value chain.

F2. Formal Seed Production

Effective production and scaling of improved seed varieties is a multi-step process. After the improved variety has been developed and released, there are four stages of multiplication that need to occur: from initial seed to breeder seed, breeder seed to pre-basic seed, pre-basic seed to basic seed, and then basic seed to the certified seed, which will flow into distribution channels that will be distributed. In certain cases, a crop variety goes straight from breeder to basic seed. As each stage occurs over a growing season, this process totals 3 to 4 years, although multiplication can also be done in the off-season.

The multiplication of basic seed to certified seed must be done according to quality standards into certified seed, which will be planted by the farmer for grain production. This stage includes processing, such as cleaning, chemical treatment and packaging and testing for purity, germination and seed health. The entire production cycle is as well subject to quality control and certification using Ethiopian seed and field quality standards.

F3. Certified Seed Distribution

Certified seed distribution represents the delivery of certified seed to farmers. In Ethiopia, most certified seed is distributed through cooperative unions. In very limited cases, retailers (e.g., seed stores and private outlets) also sell and distribute seed.

R. Seed law and the Regulatory System

The regulatory system supports and oversees the above components. It consists of laws, regulations and enforcement institutions that serve four purposes:

i. Ensure enabling environment for various stakeholders in the seed value chain to develop varieties
ii. Enable an effective way for research centers and foreign companies to effectively register new varieties, (through the Distinctness, Uniformity, and Stability test (DUS) and Value for Cultivation and Use test (VCU)
iii. Ensure high quality seeds are produced through inspection, sample testing, grow-out test of varieties and other QC methods.
iv. Safeguarding both seed suppliers and users against fraud and malpractice.

Given all this, the objective of the formal sector is;

> A dynamic, efficient and well regulated formal sector that provides farmers with sufficient, affordable, timely and high quality certified seeds of improved varieties for key crops through multiple production and distribution channels while maintaining the genetic biodiversity of the country.

Component F1: Varietal development, release, and registration

The goal for varietal development is a system that develops and maintains the varieties that meet smallholder farmers' needs, providing early generation seeds to all licensed public and private sector seed companies that meet clear regulatory standards. To enable this, three bottlenecks and their respective interventions have been identified.

Bottlenecks and interventions for Varietal Development in the Formal Sector

	Bottlenecks		Interventions	Owners
F1.1	Lack of resources in public research system to effectively develop improved varieties and produce breeder seed	F1.1a	Strengthen breeding capacity of National Agricultural Research Institutions	EIAR/NARC
		F1.1b	Strengthen the financial viability of the public research system	EIAR/NARC
F1.2	Lack of clear communication, role clarity, and accountability among various research institutions and units	F1.2	Establish a clear link between federal and regional research institutes to ensure coordination and avoid duplication of efforts	EIAR/NARC

F1.3	Limited commercialization and adoption of improved varieties by seed producers and farmers	F1.3a	Develop contractual agreements and effective pricing / marketing mechanisms between research and extension and seed producers	EIAR/NARC
		F1.3b	Ensure variety development incorporates traits beyond simply yield	
		F1.3c	Research institutions and producers should work to actively popularize new improved varieties to drive adoption	
F1.4	Lack of capacity of maintainer institutions results in risk of poor quality	F1.4	Ensure high capacity for maintainers of each improved variety through designated maintenance breeders and sufficient nucleus seed	EIAR/NARC

In addition, an independent variety release and registration system is critical to ensuring the availability of new varieties, their production, and subsequent adoption by farmers. This system should be independent from variety development, and cater to both institutions that develop varieties locally as well as those that import from abroad. There are three critical bottlenecks that currently prevent this, to which a set of interventions have been proposed.

Bottlenecks and interventions for Varietal Release and Registration in the Formal Sector				
	Bottlenecks		**Interventions**	**Owners**
F1.5	Current varietal release system is not independent from varietal development	F1.5a	Establish an autonomous regulatory entity at the federal level that will also be responsible for conducting varietal evaluation, release, registration, and PVP (Plant Variety Protection)	MoA Regulatory Directorate
		F1.5b	Develop new and amend existing variety release and registration guidelines detailing steps and processes of varietal evaluation, release and registration	MoA Regulatory Directorate
F1.6	Current varietal release and registration process has severe capacity constraints	F1.6	Build capacity of the variety evaluation, release, and registry authority	MoA Regulatory Directorate
F1.7	Post-release duties and rights of the variety owners are not enforced due to capacity constraints	F1.7	Complete revision of Plant Breeders' Rights Proclamation and draft regulations for immediate implementation	MoA Regulatory Directorate

Background and History of Varietal Development

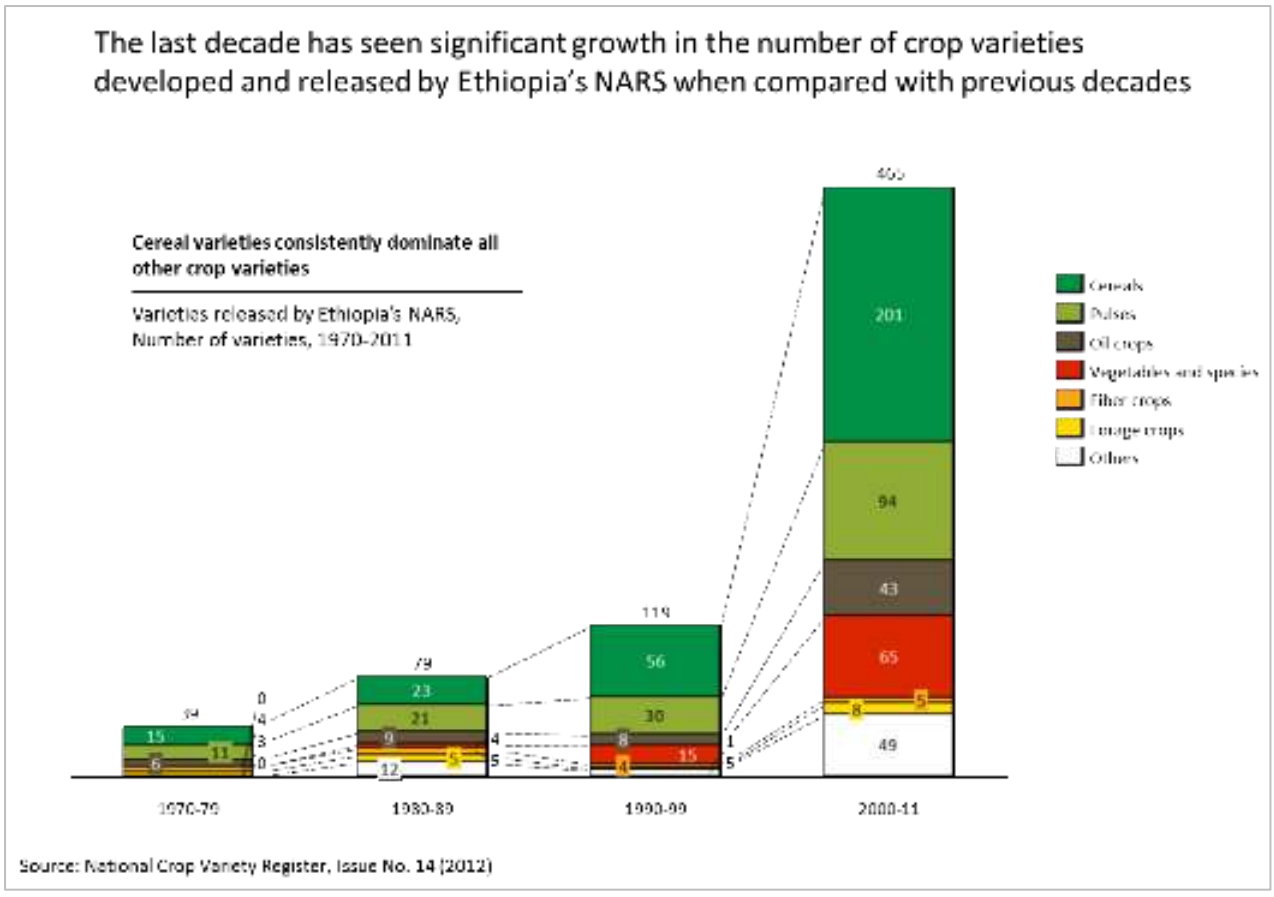
The first step in the seed value chain is the development of improved varieties by the research system. The major components of variety development include acquisition of germplasm, breeding, and multi-location varietal trials. Research centers may use local or newly introduced source materials as an input for further manipulation and enhancement. The next step involves the breeding and testing of candidate germplasms or adaptation of existing materials from sources like CGIAR to new or broader agro-ecologies by conducting multiple trials. The final step is to carryout verification trials at multiple locations to assess the adaptability and agronomic performance of candidate varieties.

In Ethiopia, the history of varietal development dates back to the 1950s. However, a more systematic varietal development activity, which involved multi-location trials, was started after the establishment of the

Institute of Agricultural Research (IAR) in 1966[8] (renamed EIAR in 19XX). After few decades, the varietal development process was progressively decentralized as different regional research centers were established.

Currently, the majority of improved varieties are developed by the public agricultural research system, which consists of the federal research institute (EIAR), the Regional Agricultural Research Institutes (RARIs) and higher learning institutions (HLIs). The NARS also works closely with international research centers - mainly the Consultative Group on International Agricultural Research (CGIAR) and the International Maize And Wheat Improvement Center (CIMMYT)- to access germplasm, build capacity and address broader systemic challenges. In addition, a handful of international seed companies such as Pioneer and Seed Co. have begun to import, adapt, and register varieties from other countries, but these varieties still are evaluated by experts that represent public research institutions.

Exhibit 8



The ideal state of a varietal development system has been outlined below (prior to delving into the specific bottlenecks).

1. **Structure and focus**:

[8] Hailu (1991); Tesfaye and Jemal (1982)

a. A well-resourced and staffed public research system at both the national and regional levels.
b. Focus on developing new varieties and adapting existing varieties to broader agro-ecologies.
c. Maintaining high quality inbred lines and producing sufficient and high quality breeder seed.
d. Progressively leaving pre-basic and basic seed production to public/private seed producers.

2. **Approach to varietal development**:
   a. Researchers should be strongly linked with farmers, extension agents and farmer organizations.
   b. Ensure the varieties developed meet farmers' needs through participatory varietal selection or other approaches.
   c. Follow-up with farmers that have adopted, promoting best practices and sending farmers' feedback to researchers.
   d. Ensure supply of breeder seed and nucleus seed is stored at IBC at the time of release and
   e. Perform varietal maintenance using appropriate techniques to recommended levels.
3. **Coordination and governance:**
   a. Ensure coordination between Regional and Federal research institutes as well as with other stakeholders through an independent governing authority that works across all stakeholders in the seed system (including the Ministry and Regional Bureaus, as well as seed enterprises).

Bottleneck F1.1: Lack of resources in public research system to effectively develop improved varieties and produce breeder seed.

CASE STUDY 1: India's approach to ensuring role clarity and coordination among research institutions
Indian Council of Agricultural Research (ICAR).[18]

Background

- ICAR was established in 1929 as an autonomous society under the Ministry of Ag, Department of Ag Research and Education
- It is the apex body for coordinating, guiding and managing research and education in agriculture in the entire country.
- Members are Indian Ag Research Institute, 45 research institutes, 47 universities, 30 National Research Centers, 6 National Bureaus), 25 Project Directorates and 80 All India Coordinated Research Projects
- ICAR is led by a Secretary-level civil servant in the Ministry of Agriculture, with superior rank to regional directors

Breeder Seed

Production of breeder seed is a mandate of ICAR and is undertaken with the help of member institutions, sponsored breeders recognized by selected State Seed Corporations (similar to RSEs in Ethiopia) and NGOs.

Foundation Seed

Production of foundation seed is a mandate of the National Seed Corporation (similar to ESE), State Farms Corporation, State Seeds Corporation, and State Departments of Agriculture and private seed producers.

Technology Adoption

- ICAR oversees all matters related to IP and technology transfer/ commercialization.
- Individual institutes can enter into licensing contracts and commercial agreements with other parties according to ICAR guidelines.
- ICAR facilitates and supports partnerships.

Lessons for Ethiopia

- There is a need to address the coordination and resource allocation at the national level and the current role of EIAR.
- A membership-based body such as ICAR that can facilitate coordination, resource allocation as well as broader activities such as advocacy, addressing research policy issues and managing the interaction between research and other parts of the agricultural sector such as processors, regulators and farmer, can meet this need.

The public research system faces several capacity constraints - both in terms of human resources, as well as the necessary facilities, i.e., adequate laboratory infrastructure and equipment. Public research institutions are not only responsible for developing, adapting and maintaining improved varieties; but also producing

breeder and pre-basic seed. Their involvement in multiplication of earlier generation seed requires them to have seed units with lab equipment, farm management machinery and staff. Moreover, the low retention rate of experienced scientists has been a persistent problem for national breeding programs. This calls for revitalization of the NARS capacity.[i] The recent establishment of National Agricultural Research Council (NARC)addresses this, but this should be a continued area of focus.

Intervention F1.1a: Strengthen breeding capacity of National Agricultural Research Institutions

Plant-breeding research has to be assisted with recent technical advances such as biotechnology to efficiently tackle the daunting challenge of increasing agricultural productivity. So far, the potential of agricultural biotechnology has not been tapped significantly in the country. This technology could complement the conventional breeding programs and be used to not only develop new crop varieties that are tolerant to diseases, pests and biotic stresses, but also improve crop productivity and nutritional quality of food and feed.

Although the controversy around GMO technologies has dominated the issue of biotechnology, it is important to note that there are many approaches within the biotechnology areas (such as molecular marker assisted breeding) that do not deal in any way with genetic engineering.

To this effect, EIAR has recently developed an agricultural biotechnology strategy and is currently putting considerable effort to establish a focal institute at Holetta Research Center (HRC). High priority areas identified include: application of *in vitro* propagation and diagnostics (tissue culture) and Marker Assisted Selection (MAS) for selection of superior traits. Additionally, doubled haploid techniques were introduced in the Bako research center. To fully realize such benefits, the capacity of NARS must be developed both in terms of human resources and the necessary facilities. Regarding human resources, a substantial gap is the lack of a clear development plan for breeders, which results in high staff turn-over and gaps in knowledge & skill transfer.

Finally, research should proactively demand new germplasm for promising varieties from international institutions such as CIMMYT.

Intervention F1.1b: Strengthen the financial viability of the public research system

Effective contractual relationships between the research institutes and seed producers will strengthen the financial viability of the public research system. Experiences of model countries such as India, US, Kenya and others show that public breeding programs are able to generate a significant share of revenue through either variety licenses or royalty payments. The experience of India and its lessons for Ethiopia are presented in detail in the case study above. Public research institutes (NARS and HLIs) could use these additional financial resources to strengthen their technical and infrastructural capabilities as well as expand existing/new research efforts. However, utmost care should be taken to ensure that public research agenda doesn't shift to commercially attractive crops, while abandoning the crops that are less viable financially, but critically needed by the majority of smallholder farmers. Among the practical challenges that these other countries faced at the initial stage of executing such arrangements include overcoming a lack of awareness and seed producers defaulting on the payment that were promised to research institutions.

For further discussion on this issue, please refer to the **ATA Research and Extension Strategy.**

Bottleneck F1.2: Lack of clear communication, role clarity, and accountability among various research institutions and units

Coordination and governance is a critical area of improvement for EIAR and the respective RARIs. This is especially relevant to varietal release, as there is a risk of efforts being duplicated, and no consistent mandate across the different crops. For example, wheat varietal development is conducted at a national level, while barley and potato varietal development is coordinated at a regional level. This creates risks to a unified approach to varietal development across different crops and geographies.

Additionally, there needs to be clear role clarity and distinction between the units that develop new varieties and manage breeder seed multiplication, and the unit that focuses on quality control at the breeder stage, including fingerprinting and Grow-Out testing. Currently, distinction these units is not very clear. In addition, research centers often lack adequate human and infrastructural capacity to effectively conduct these functions.

Intervention F1.2: Establish a clear link between federal and regional research institutes to ensure coordination and avoid duplication of efforts

Given this, role clarity among the different levels of research is required, especially with respect to varietal development. The recent establishment of NARC begins to address this issue of coordination. Specific components required to ensure variety development occurs effectively include:

- Clear designation of which centers are responsible for which activities, ideally by type of crop and applicability to agro-ecologies
- Set of guidelines supported by a legal binding structure to enforce the responsibilities of regional and national research centers

Broadly speaking, a variety that is developed to be applicable to a broad range of agro-ecologies across Ethiopia should be developed by EIAR, while a variety that is applicable to specific regions should be driven by the RARIs. Of course, there have been certain exceptions, such a regionally-developed variety that has been discovered to have relevance to another region; thereby involving a sharing of germplasm between two RARIs (e.g., Amhara and Oromia).

Bottleneck F1.3: Limited commercialization and adoption of improved varieties by seed producers and farmers

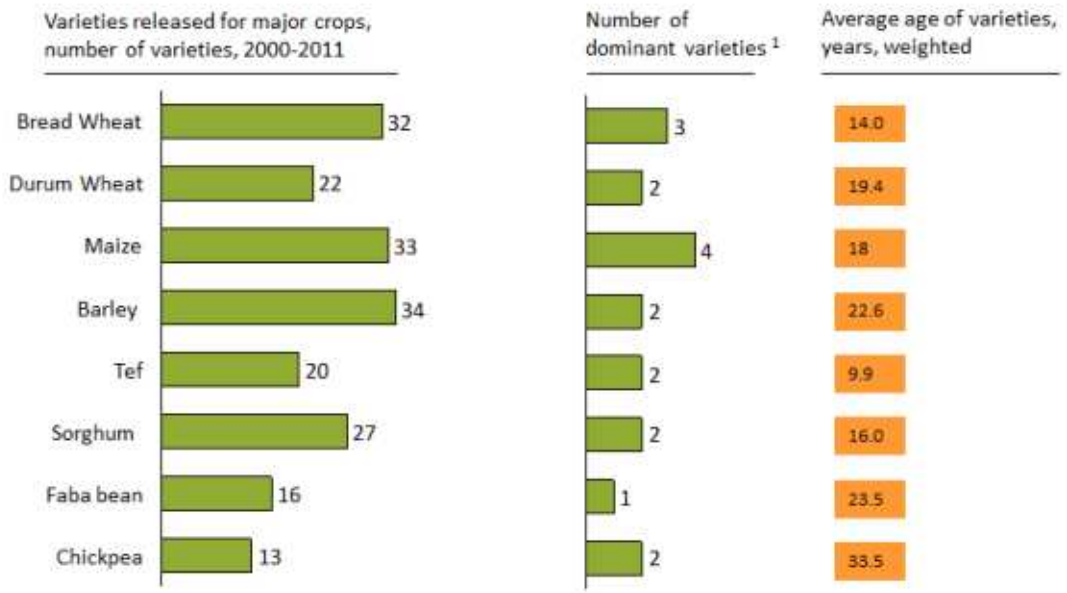
Ethiopia's NARS has a vast amount of expertise thanks to its nearly 60 years of experience. Based on this experience and the GOE's commitment to agricultural growth, the NARS continues to develop, adapt and release improved varieties that can enable farmers to raise their yields. In the past 10 years, it has released almost 50 varieties for wheat and around 20 each for maize, tef and barley.

In spite of this, very few of these varieties are adopted and commercialized by seed enterprises. For example, 95% of hybrid maize seed production from public varieties is accounted for by two hybrids released about twenty years ago: BH-660 and BH-540. The exhibit below shows the number of varieties

accounting for 80% or more of the formal sector seed production, as well as the weighted average age of the varieties since their release.

Exhibit 9

Despite the development and release of large number of varieties by Ethiopia's NARS, most of these varieties have not yet been commercialized, with very few old varieties dominating overall seed and crop production



Source: Crop Variety Register, *Issue No. 14, MoA-APHRD Directorate (2012)*; Farmers, seeds and varieties: supporting informal seed supply in Ethiopia (Thijssen M.H. et al., 2008); ATA analysis

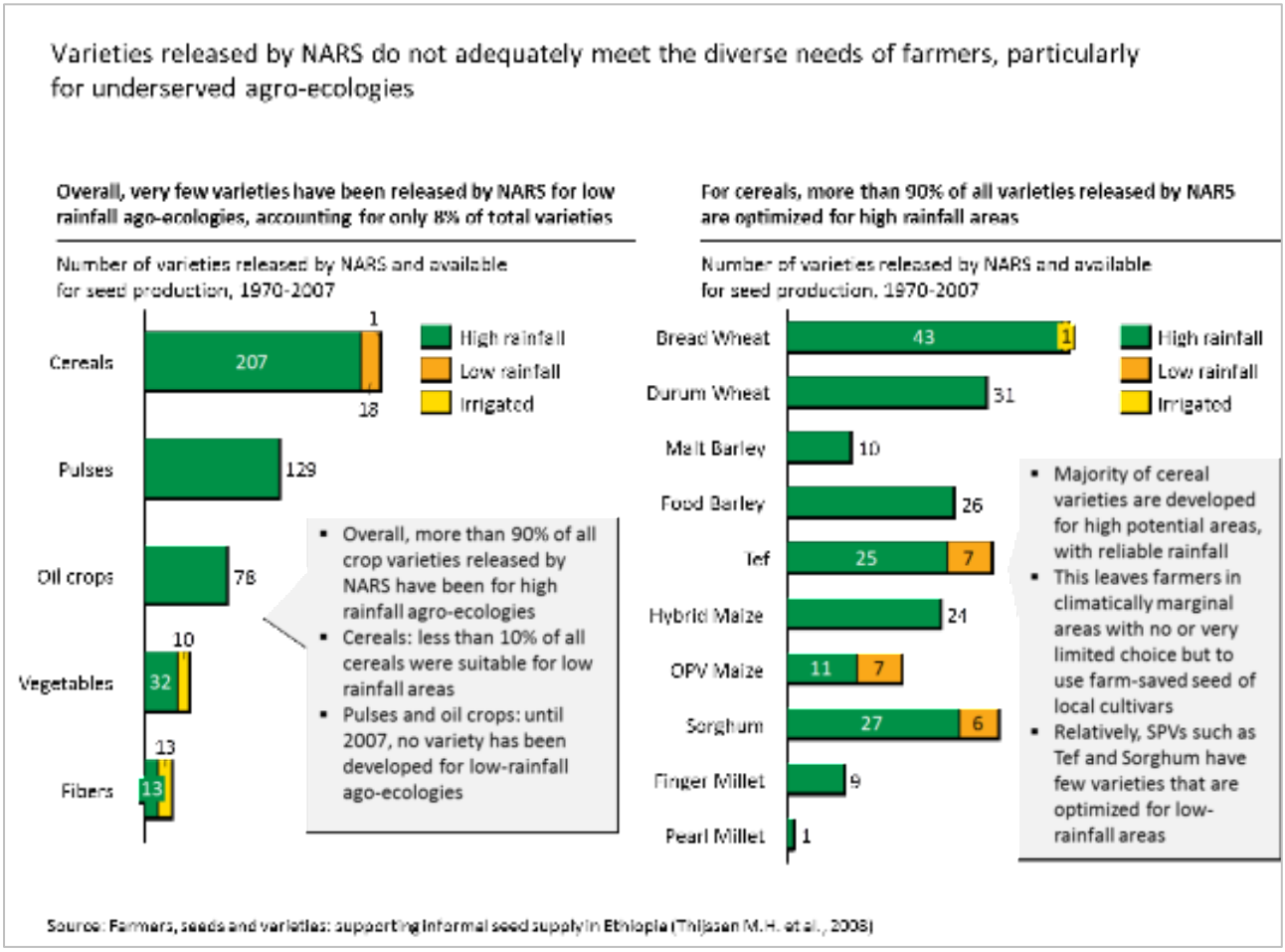
[1] *Dominant varieties- is defined as those varieties accounting greater than 80% of certified seed sales for each crop*

There are several root causes for the lack of farmers' adoption of newly released varieties:

1) **In addition to extension, research institutions and producers should become actively involved in popularization.** Although the research system develops new varieties, adoption is generally left to extension services, and the linkage between extension and research has traditionally been weak. Additionally, seed producers lack incentives to actively promote a variety that other producers can sell as they generally do not develop their own varieties (with the exception of ESE, Pioneer and other international seed companies). As a result, a significant share of the promotion activity falls to the public extension system, which in many cases is overburdened with many different responsibilities. Furthermore, the link between the extension system at the local level and researchers developing new varieties has historically been underdeveloped.
2) **Improved varieties are often not applicable to all agro-ecologies, especially low-rainfall areas, and also focus on specific crops.** The majority of improved varieties are developed for high-potential areas, with reliable rainfall and hence, farmers in more geographically or climatically marginal areas often have no choice but to use saved seeds of traditional varieties. Of all the varieties currently released, only 11% of cereal varieties are adapted to low-rainfall areas (as of 2008). Additionally,

improved varieties tend to focus on a small subset of crops, i.e., hybrid maize at the exclusion of cereal and pulse SPVs.

Exhibit 10



3) **Improved varieties are not fully aligned with the characteristics seed producers and farmers value.** In some cases, new improved varieties are not fully aligned with the factors that most strongly influence the decisions of seed producers and users. For example, the maize hybrid BHQP-542 was developed for its high protein content. However, it is a single-cross and yields lower than its lower-protein counter-part BH-540. Due to these drawbacks, seed producers have been reluctant to multiply the seed. As a result, there has been an increased focus on promoting varieties that have more competitive yields in recent years. Moving forward, demand-driven variety development and release that includes the perspectives of researchers, seed producers, distributors, farmers, and grain processors, will continue to be absolutely critical. For further information on Participatory Plant Breeding, please refer to **Bottleneck and Intervention I1.1** on page 100-101.

Intervention F1.3a: Develop contractual agreements and effective pricing / marketing mechanisms between research and extension and seed producers

In order to ensure commercialization and adoption, there needs to be a clear and strong interaction model between research, extension and seed producers at the outset of the variety development process. This includes effectively identifying the target farmers and agro-ecologies that will benefit from the new variety

and creating attractive business models for seed producers. As needed, this interaction model can also encourage seed producers and farmers to experiment with the new variety through incentives, such as through free samples. This area will need to be addressed in greater detail through a strategic re-design of the relationship between the national research and extension system and seed producers.

Additionally, defining the respective roles of seed producers is also critical. Namely, ***Case Study 1*** indicates the importance of role clarity between national and regional seed producers; this is further discussed in Intervention F2.4a (delineating and enforcing roles among seed producers).

Once the seed is certified, it is critical to have a sound and effective pricing/marketing mechanism that incentivizes seed producers to actively engage in the promotion of new varieties. The need for such a mechanism is discussed in detail in subsequent chapters.

When these contractual agreements are facilitated, it is equally critical to ensure that decision-making occurs both at the research center and apex level to ensure alignment as the research centers are ultimately responsible for varietal development.

Intervention F1.3b: Ensure variety development incorporates traits beyond simply yield

As discussed above, yield is often given priority as a consideration in variety development, but it will be essential to consider other factors. This specifically includes high protein content, as in the case of high quality protein (HQP) maize, as well as other factors such as oil content, resistance to pests/diseases, and resource use efficiency. This will require a participatory approach in which researchers will have the chance to educate themselves about the other needs of farmers beyond yield.

CASE STUDY 2: Contractual arrangements between public research institutions and seed companies in India

Reform

- In the early 1990s, the Indian Council of Agricultural Research (ICAR) led the establishment of contractual relationships between public research organizations and public and private seed companies.
- This allows public research institutions to collect royalties from any licensee of patented crop varieties.
- The terms and conditions of such agreements have been clearly designed and published as ICAR's guidelines for intellectual property management and technology transfer/ commercialization.

Content of Contracts

- Such arrangements are made through MoUs or MoAs between public research organizations and seed producers.
- MoUs are complemented with detailed license agreements.
- The agreements are legally binding under India's contract law and they outline the obligations of each party.
- The licensor (research) is obliged to supply breeder seeds/parental lines or basic seeds.
- The licensee is obliged to make two types of payments:
  - Upfront payment at the time of signing the contract
  - Royalty fees: annual payments defined as percentage of seed sales by the licensee
- In addition to providing revenue for research institution, this approach enhances farmers' access to the latest improved varieties and hybrids.

Challenges

- Federal and state funding for research programs has declined although it has not been established whether the decline is in response to the added revenues from royalties.
- Contracts may put medium- and small-sized seed companies at a disadvantage since they tend to be less capable of making upfront payments.

Lessons for Ethiopia

- Royalty payments can generate a significant contribution to the budget of public breeding programs.
- Contractual arrangements increase the interaction between research institutions and the seed industry. This may help research become more demand-driven.
- However, a possible risk is that contract-based research might bias public research towards commercially viable crops and neglect other priority crops.
- For an infant seed industry such as in Ethiopia, any royalty scheme should ensure funds collected are distributed across the entire research system.

Intervention F1.3c: Research institutions and producers should work to actively popularize new improved varieties to drive adoption

A stronger link between research, extension, and producers will be critical to ensuring on-the-ground popularization of new varieties. This could potentially entail joint demonstrations between research, extension, and producers to ensure that farmers are rapidly and effectively educated about these improved varieties. In the long-run, effective contractual agreements **(see Intervention 1.2a)** will better encourage these actors to collaborate in extension, and also ultimately make research more demand-driven.

One recent example of collaborative popularization was when EIAR worked with RBoAs to identify specific zones for multiplication for certain self-pollinating varieties (barley, wheat, chickpea). Zonal and woreda level stakeholders identified farmers to demonstrate these varieties on 0.25 hectare plotes; and this was supplemented with trainings.

Bottleneck F1.4: Lack of capacity of maintainer institutions results in risk of poor quality

Maintenance breeding is critical so that the variety remains true-to-type, especially as it goes through multiple generations of multiplication over the years. The research center that releases a variety is also responsible for maintaining the variety because it knows the characteristics of the variety best. However, currently, these institutions lack sufficient capacity – financial, equipment and human – to help in undertaking maintenance breeding.

International best practice indicates that older varieties should be pulled back from the seed system as newer and higher performing varieties are released. However, in Ethiopia, farmers continue to demand and use older varieties. One implication of this is that research institutions are expected to maintain an increasingly high number of varieties, constraining them further.

While there is limited data about the capacity level of variety maintainers, conversations with key stakeholders indicate that many designated maintainers are unable to adequately carry out their maintenance responsibilities due to technical and infrastructural capacity constraints[9].

Intervention F1.4: Ensure high capacity for maintainers of each improved variety have sufficiently high capacity to meet their obligations through designated maintenance breeders and sufficient nucleus seed

Upon approval and registration of a new improved variety, the maintaining institution should be provided the necessary resources and guidelines. However, some important varieties are currently not maintained, although their maintaining institutes were registered in the national varietal register.[ii] The first step is to designate maintenance breeders for each improved crop variety and ensure sufficient technical and physical resources. Another activity is to ensure that there is sufficient reserve of nucleus seed for each of the released varieties. The Institute of Biodiversity Conservation (IBC) and the research system should strengthen their relations and design checking mechanism for the presence of pure quality nucleus seed for each released variety. The link needs additional staffing, training and technologies/facilities for maintenance breeding and testing of genetic consistency.

[9] Resource gap assessment of five major agricultural research centers (2012): a joint study developed by ATA-EIAR

In addition, certain measures can be taken to further enhance the abilities of maintainer institutions. For example, tracking of data on specific varieties is crucial, and to this end, a central database (ideally supported by ICT methods) that enables open access of varietal descriptors by relevant stakeholders. Additionally, there needs to be a clear varietal retirement plan, i.e., a guideline that indicates when a variety should no longer be produced, ideally based on performance data vs. newer varieties.

Background and History of Varietal Release and Registration

Most countries have variety release procedures to evaluate and regulate varieties for which seed can be produced and traded. The goal of variety release is to ensure new varieties that enter the market are both superior and differentiated at least in terms of one characteristic - not just in terms of yield but a range of factors including resistance to pests/diseases, resource use efficiency and others. In addition, a strong variety release program can prevent the use of varieties that might have a negative impact on domestic agriculture, such as those susceptible to major diseases that could create the risk of significant production loss and thus increase the risk of food insecurity.

Variety release procedures usually encompass performance testing through multi-locational trials as well as administrative registration procedures. They can be either mandatory or voluntary, depending on the country. To fulfill the role properly, the variety release system must be operated efficiently and fairly. While unduly long procedures for release of new varieties can delay farmers' access to the benefits of advances in plant breeding, inadequate testing in fewer locations could also limit farmers' access to a diversity of varieties that are adapted to various agro-ecologies and to a range of end uses.[10]

There are two major tests in variety release and registration: Distinctness, Uniformity and Stability test (DUS) and Value for Cultivation and Use test (VCU).

DUS is an acronym to refer to the test criteria used for registration of newly released varieties.

- Distinctness: New varieties should be clearly distinguishable from any other existing varieties, at least by one characteristic.
- Uniformity: Individual plants of new variety should be sufficiently uniform at the same propagation stages.
- Stability: Characteristics of new variety should be stable through repeated propagation. DUS results are meant for registration purposes.

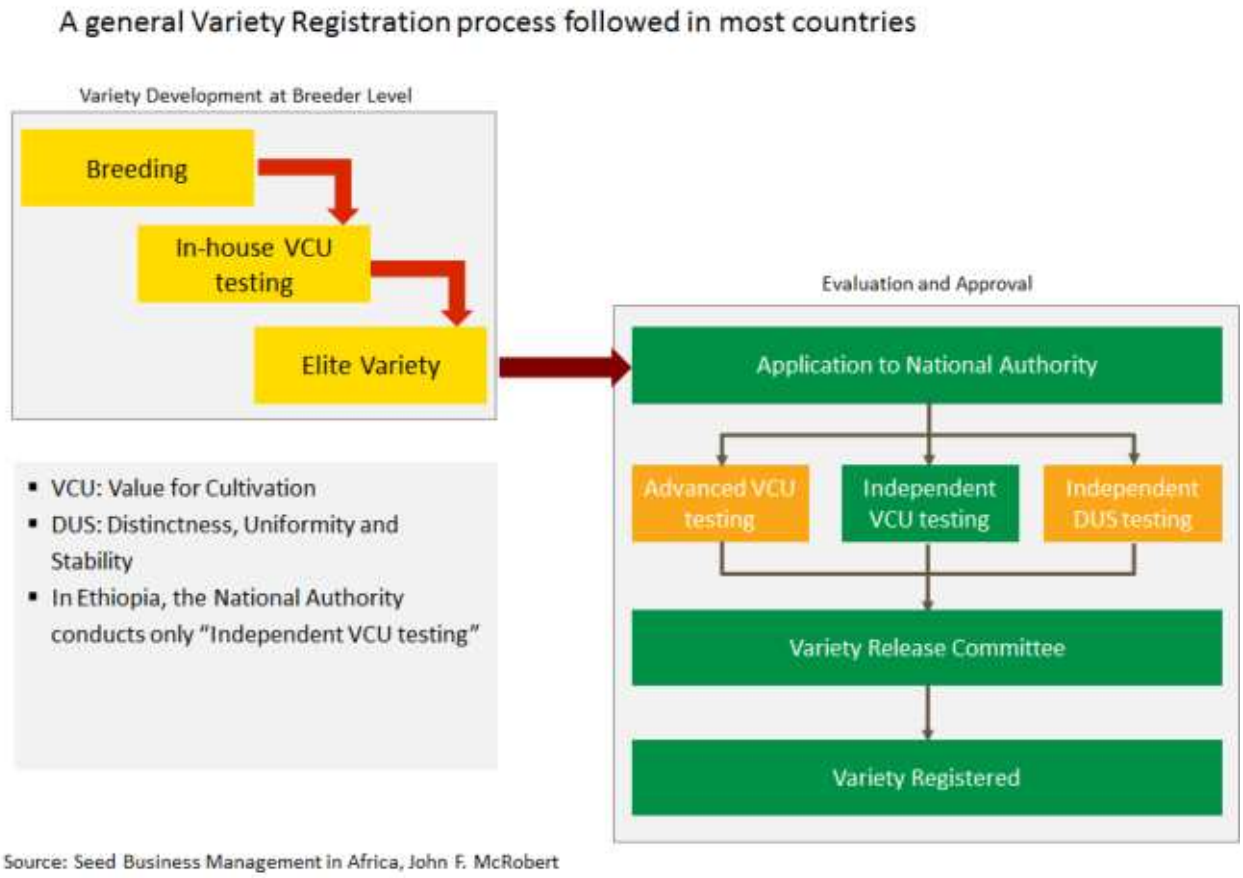
The VCU refers to two aspects of variety performance:

- Characteristics focused on the cultivation of the variety (such as yield, resistance to diseases, agronomic performance) and
- Characteristics focused on the subsequent use of the variety (example for wheat milling and baking quality, for cotton lint quality). VCU test results are used for the release of the variety.

[10] FAO.2011. Strengthening Seed Systems: Gap Analysis Of The Seed Sector.Report.Pp.23

One of the main problems with using only VCU for variety registration, as in the case of Ethiopia, is that it is a subjective value judgment of a variety's usefulness for cultivation and use, albeit based on objective data.

Exhibit 11



Source: Seed Business Management in Africa, John F. McRobert

In Ethiopia, crop variety release activities were initially introduced and managed by the National Crop Improvement Conference (NCIC) that involved multiple stakeholders, which used to recommend different crop technologies. In 1982, the activity was taken over by the National Variety Release Committee (NVRC). Later on, the NVRC further expanded its scope of activities to evaluation of verification plots, release and registration of newly developed crop varieties.

The establishment of the National Seed Industry Agency (NSIA) in 1993 marked the beginning of organized seed production and certification system in Ethiopia. The Agency took over the responsibility of variety release and registration while most of the other activities like technical evaluation of candidate varieties and verification trials remained under the management of ad-hoc committees. Nevertheless, until the enforcement of the first Ethiopian Seed Law (206/2000) there was no legal footing for the various activities of the NVRC. In 2004, when the responsibilities and duties of the Agency were officially transferred to the MoA, the variety release was taken over by the Crop Production Department. Currently, the Variety Release, Protection, and Seed Quality Directorate (VRPSQD) of the Ministry of Agriculture (MoA) coordinates various activities related to Variety Release. In addition to the current Proclamation that repeals the older Ethiopian Seed Law (206/2000) also acknowledges plant breeders' rights through the PVP law (Proc. 481/2006).

Variety release and registration guidelines for field crops and horticultural crops have been in use since 1994 and 1998 respectively. In these guidelines, the composition of the National Variety Release Committee (NVRC), conditions for release, supporting documents for application, evaluation procedures, amendments, and various forms are included. Currently, a standing National Variety Release Committee and various technical committees drawn from different institutions undertake variety release and evaluation. The system has serious limitations to plan and coordinate the activities due to various overlapping assignments of the committee members.

The importance of having a crop variety registry has been recognized for a long time, but only received due attention in 1997 when the first crop variety register was produced. Crop varieties released through NVRC have been automatically registered by the secretariat of the committee (coordinating office) without any additional tests or decision. The registry contains all varieties (obsolete ones along with those in production). Limited variety descriptors and other relevant agronomic data available were included as part of the registry. The documents have been released regularly every year. However, the information in the registers is not sufficient and lacks standardized DUS data, which is vital to protect breeder's rights and to provide complete information to safeguard stakeholders. This is mainly a result of improper DUS and VCU testing.

Bottleneck F1.5: Current varietal release system is not fully independent from varietal development

Though the MoA-VRPSQC is mandated to oversee and coordinate the evaluation of candidate varieties for release and registration, evaluation activities are conducted on the Public NARS research fields. According to key informant discussions with private company representatives and APHRD experts,[11] private companies had limited confidence in the collected data and results of evaluation submitted by researchers of the public system. This is specifically because the publicly developed varieties by NARS are in direct competition with

[11] Interviews conducted with private company representatives and APHRD experts, 2012

the private candidate varieties and this creates a conflict of interest in the evaluation process. Moreover, researchers from public agricultural research institutes are often form the technical committee that is responsible for evaluating the performance of candidate varieties submitted for release to APHRD.

Intervention F1.5a: Establish an autonomous regulatory entity at the federal level that will also be responsible for conducting varietal evaluation, release, registration and PVP (Plant Variety Protection)

Though it is difficult to establish an autonomous institution only for these activities in the Ethiopian context, it is possible to have a relatively well-focused independent structure to administer the variety evaluation, release and registry system. The likely option would be to include variety release and registry as part of the regulatory structure that is proposed under the regulatory section of this document. This will help to separate the variety release and registry from the varietal development actors and to ensure autonomy and trust in a new release system, equipped with qualified experts and required infrastructure to protect and maintain variety genetic quality and patent rights.

In India, the Central Seeds Committee constituted a Central Sub-Committee on Crop Standards Notification and Release of Varieties for Agricultural Crops and Horticultural Crops to discharge the functions of release/notification, provisional notification and de-notification of cultivars at Central level; state seed sub-committees (SSSC) discharge similar functions for release at State level.[12]

Intervention F1.5b: Develop new and amend existing variety release and registration guidelines detailing steps and processes of varietal evaluation, release and registration

Varietal release is an official authorization that allows seeds of varieties to be commercialized and made available for farmers. Procedures associated with varietal evaluation, release and registration need to ensure that varieties released meet farmers' specific needs, while still enabling the research system (both private and public) to operate at relative ease. One intervention in this regard is to revise the composition of the existing National Varietal Release Committee (NVRC) so that it adequately represents relevant stakeholders of the seed industry. The other is to revise the existing varietal release guideline so that it creates a conducive and streamlined environment for both public and private researchers. One area of revision in this regard is the costs and timelines associated with variety registration as they are prohibitively high when compared with other model countries, creating a disincentive for potential entrants. Additionally, revising the guideline is important to incorporate international protocols and align to recent development in evaluation procedures and technologies. Finally, amending the guidelines can provide proper incentives and accountability mechanisms to ensure NVRC members conduct timely evaluation and reporting.

Bottleneck F1.6: Current varietal release and registration process has severe capacity constraints

Variety release and registration comprises of multiple activities including accepting request of release of candidate variety, conducting multi-location verification and adaptation trials, organizing and coordinating

[12] http://seednet.gov.in/material/IndianSeedSector

multi-stakeholder evaluation committees, evaluating the report of the evaluation committee, and organizing variety release standing committee meetings to endorse results for qualified candidate varieties.

However, VRPSQCD lacks the required number of qualified staff, resulting in public NARS directly or indirectly conducting data collection, analysis, and report development. Furthermore, as the financial system of the department is under the MoA finance pool, there are many efficiency constraints that hinder the timely evaluation of candidate varieties. Namely, funding for activities will take longer to release, resulting in delays from conducting timely evaluation, making the trustworthiness of data collected questionable. Besides, the committee members will not be equipped to conduct the evaluation process without proper financing or there is no any substitution mechanism in their absences that enable to carry out timely evaluation.

Poor technical, financial and human resource capacity, coupled with the deficiency in the variety evaluation and release guidelines, has been negatively affecting the DUS and VCU testing procedures essential for variety evaluation. DUS tests have not been conducted for varieties released in Ethiopia and most of the VCU tests were not done on time or as per prescribed technical guideline.

Poor verification plots that do not meet guidelines and standards result in technical evaluations that may not be very rigorous and result in releasing sub-optimal varieties. Newly released varieties may not be better than existing older varieties and may not meet the right need of smallholder farmers. This is one of the key reasons why many newly released varieties are not commercialized. The major reason for the release of sub-optimal varieties includes:

a. Evaluators and data sets: Evaluators do not conduct rigorous evaluation of candidate varieties against data sets and sometimes rely on the success in verification only.
b. Lack of standardized DUS testing: Candidate varieties have not been tested for their DUS. The lack of the DUS data resulted in a knowledge gap when identifying and differentiating varieties of the same crop species. This ended up contributing to unreliable field inspection results that led to rejection of many seed fields. Moreover, lack of DUS based variety protection resulted in lower motivation of breeders to effectively work on release of new varieties, hampering investment in the seed sector. Furthermore, the lack of easy access to DUS information, results in duplication of efforts in variety development that led to poor resource utilization between Federal and regional governments.

The release system also lacks evaluation of parents and inbred lines in the cases of hybrids. Under the current system, only F1 hybrids are eligible for evaluation, which denies the inclusion of parents in the verification. This poses serious problems in subsequent activities of seed multiplication and seed quality control. Both seed companies and seed quality control experts did not have the opportunity to determine the morphological and agronomic behaviors of the parents of the released hybrids**.**

Intervention F1.6: Build capacity of the variety evaluation, release and registry authority

The new institution for variety evaluation, release and registry will require strategic investments to build its technical, infrastructural and financial capacity. Specifically:

- **Human resource development:** Conducting VCU and DUS testing procedures requires qualified experts who specialize in variety release and registration. These experts should be adequately

trained to acquire necessary technical expertise to discharge their duties effectively, and compensated at a level that encourages retention and attracts qualified experts.
.

- **Create finance and logistic unit within the Directorate:** The authority should be equipped with the required number of vehicles and equipment to effectively conduct evaluation activities frequently and on time. Financial independence, e.g., control of spending decisions, is also critical to enable independent decision-making and ensure the timely release of funds.

- **Construct federally managed VCU and DUS testing stations:** to separate the variety development and release activities, the Directorate for variety release and registration in MOA should have its own VCU and DUS testing stations managed by its experts and delegated evaluation committees. To ensure such stations, representative locations will be identified and selected across agro ecologies. Involvement from all relevant parties, i.e., regional states, developmental partners, and the MoA will be critical to selecting and supporting the DUS sites with the appropriate equipment and human resources.

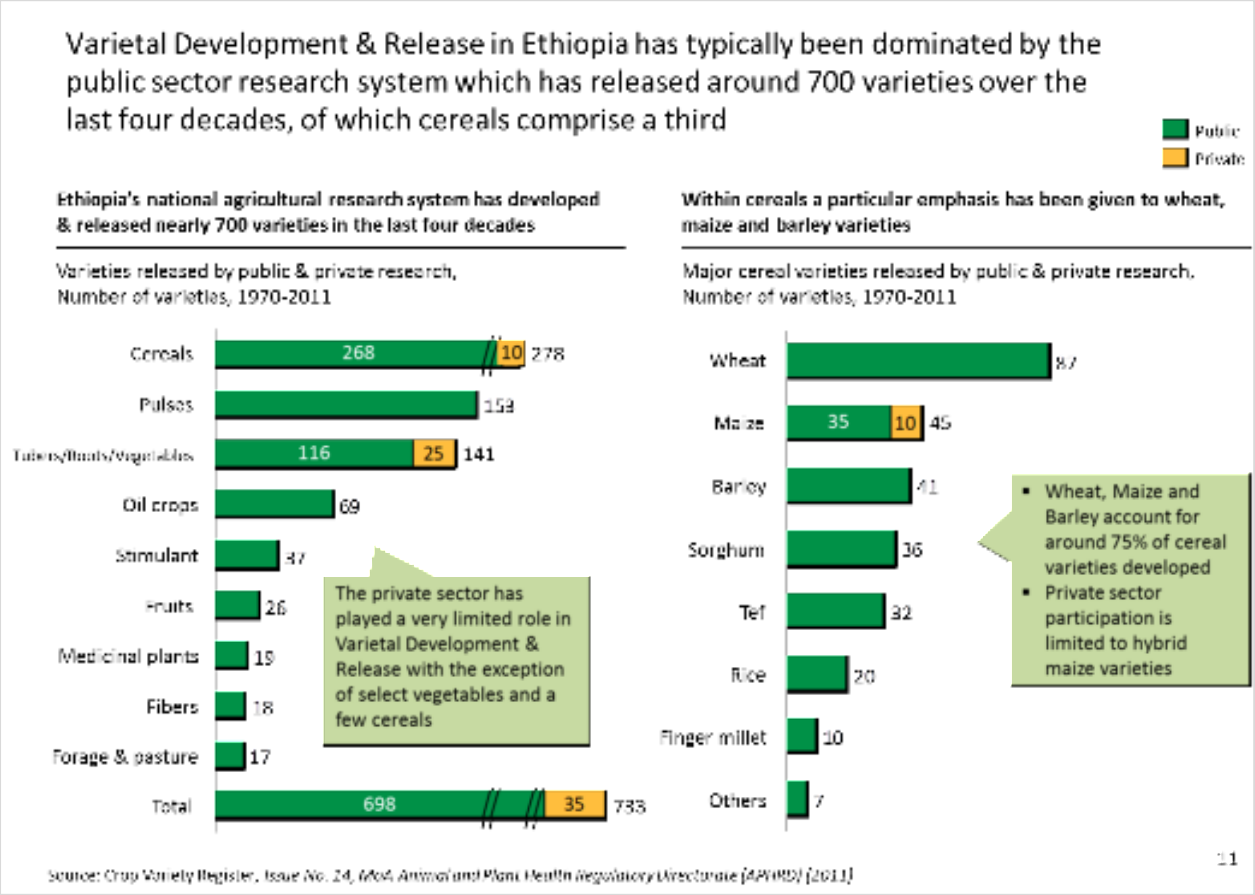
Bottleneck F1.7: Post-release duties and rights of the variety owners are not enforced due to capacity constraints

Despite the existence of Variety Protection Law since 2006, provisions of this law have not been implemented yet. The proclamation has been amended, as some of the articles are outdated, and therefore failed to address current needs of the seed industry, particularly the commercialization of horticultural and floricultural crops.

Though there are a number of issues that would arise regarding implementation and enforcement of this new Proclamation, this is the right time to apply plant breeders' rights in Ethiopia at least for the horticultural and floricultural sectors. Additionally, Ethiopia is in the final process of joining Common Market for Eastern and Southern Africa (COMESA) and the World Trade Organization (WTO) where the country should abide by the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement. The TRIPS agreement demands member countries to have some sort of Plant Variety Protection (PVP) in place. Besides being a WTO requirement, implementation of PVP will stimulate the private sector and international companies to introduce superior varieties into the system. Per the exhibit below, the development and release of varieties has been largely driven by the public sector.

The Variety Release Guideline and the Variety Protection Law (Proc. 481/2006) require the owners of new varieties to preserve nucleus seed at IBC. Unfortunately, only very few breeders met their obligation due to poor enforcement of breeder's rights and duties.

Exhibit 12



Intervention F1.7: Complete revision of Plant Breeders' Rights Proclamation and draft regulations for immediate implementation

As mentioned earlier, the old Proclamation on plant breeders' rights is currently under revision. The revision process would consider most local and international developments. Among others, COMESA and WTO requirements will be part of the new proclamation. To support the implementation of the revised proclamation, regulations have to be drafted and endorsed.

Component F2: Seed production in the formal sector

Formal seed production should ideally consistent of a set of diverse, qualified seed producers that produce adequate quantities of early generation and certified seed; and cater to the needs of farmers through timely delivery of sufficient volumes of high-quality seed that meets national standards. To this end, a set of six bottlenecks and respective interventions have been identified.

Bottlenecks and interventions for Seed Production in the Formal Sector				
	Bottlenecks		**Interventions**	**Owners**
F2.1	Seed producers lack capacity for internal quality control	F2.1a	Provide guidelines/standards to enforce internal quality control for all seed producers	MoA/RBoA Regulatory

		F2.1b	Enable seed producers to build capacity for internal quality control	RBoA/ESE/RSEs/ Private sector
F2.2	Seed production volume does not satisfy farmers' demand	F2.2	Strengthen national seed demand estimation and local market assessment	MoA/RBoAs/ESE/ RSEs/Private sector
		Intervention F2.6 is also relevant to this bottleneck		
F2.3	Limited availability of early generation seed	F2.3	Increase capacity of breeding institutions to produce higher quantities (linked to Intervention 1.1a)	EIAR/RARIs
F2.4	Lack of market environment reduces incentives to maximize quality and quantity	F2.4a	Delineate and enforce roles and responsibilities among seed producers	MoA/RBoAs
		F2.4b	Support private sector producers to meet needs for commercially attractive crops	MoA/RBoA
F2.5	Inefficient out-grower management by seed producers	F2.5	Develop effective out-grower management by seed producers	ESE/RSEs/Private Sector
F2.6a	Delayed seed processing and delivery by seed producers	F2.6a	Support seed producers with sufficient financing and land so that they can scale effectively to satisfy unmet demand	ESE/RSEs/Private Sector
F2.6b	Seed producers lack effective commercial (customer-facing) operations	F2.6b	Support seed producers to improve business planning, marketing, and operations management	ESE/RSEs/Private Sector

Background of Seed Production in Ethiopia

In Ethiopia, seed production is dominated by the public sector with a small yet growing role of the private sector. The private sector primarily focuses on hybrid crop varieties – and includes multinational companies (e.g., Pioneer, SeedCo), as well as smaller local companies. From the public companies, the Ethiopian Seed Enterprise (ESE) plays a dominant role, but the relatively young Regional Seed Enterprises (RSEs) are currently showing strong growth in terms of production volumes.

With the establishment of RSEs, certified seed production has increased over five-fold over the last 10 years, as per the exhibit below;[13] the volume of seed is even higher considering the recent growth of the private sector. In spite of this strong growth in seed production, there are quite a few challenges that need to be addressed so that this growth can be consistent, comprehensive and sustainable.

Specifically, the RSEs depend on out-growers for most of their seed production, and have faced challenges in terms of seed collection. ESE's estimates show that in the 2010/11 season, 65% of the seed produced on

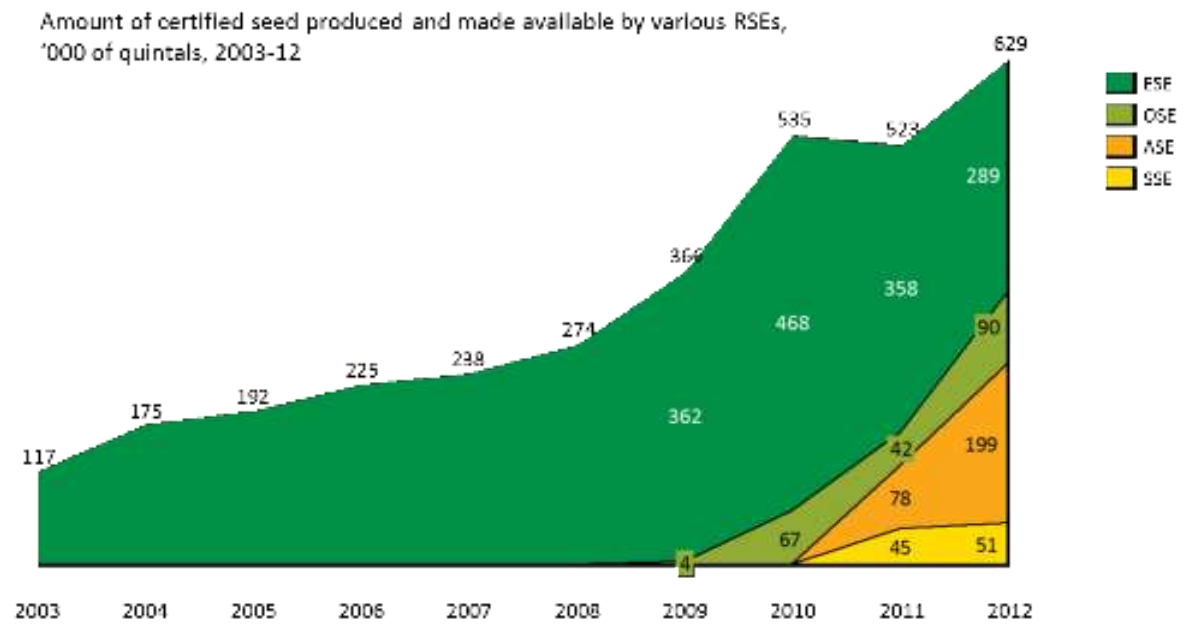
[13] Data from public seed enterprises and national seed coordination unit of the MoA

smallholders' plot was uncollected.[14] In addition, the quantity improvements have not been matched by improvements in quality.

Moving forward, for seed producers to adopt varieties that have been developed and released by the research system, sufficient quantities of high quality pre-basic and basic seeds, consistent with the growing demand for certified seed, need to be produced by an efficient and diverse (public and private) set of producers.

Exhibit 13

Public seed enterprises have been performing at varying levels, with ESE supplying the majority of national certified seed output, and RSEs showing strong growth in production volumes



Source: ESE, OSE, ASE, SSE, National Seed Coordination Unit MoA
[1]Others include local producer coops, local private producers, multi-national companies and farmer-based seed multiplication schemes organized by BoAs of each region

Bottlenecks and Interventions Focused on Quality Control (F2.1)

In addition to external quality control, internal quality control systems are necessary for all seed producers. The essential role of the internal quality control system is emphasized by the Ethiopian Seed Proclamation 782/2013, which states that all commercial seed producers need to establish internal quality control (IQC) systems. However, the combination of the limited capacity of regulatory functions and the absence of IQC

[14] Dalberg (2011)

results in uncertain and usually low quality seed reaching farmers. Internal quality control systems consist of two aspects:

- The first is to ensure quality is maintained in the production phase, including acquisition of high quality source material. Producers need sufficient human resources to ensure the right skillsets and facilities for the staff to carry out their functions are available.
- The second is an internal quality lab that can adequately test and evaluate the seed, similar to the role of external regulators. Seed producers need to understand regulatory requirements and have capacity to build their internal quality control to meet those regulatory requirements.

In India, both public and private seed enterprises continuously strengthen their internal quality control and assurance and have now developed strong departments/units within their organizations to ensure the provision of high quality seed. For instance, Vibha seed, one of the biggest private seed companies in India, has developed stringent internal quality assurance system at two levels. One is at the field inspection level where seed analysts monitor fields through all steps of seed production to prevent failures. The second level is post-harvest quality assurance where laboratory tests are conducted for physical purity, moisture content, germination, vigor and seed health. The genetic purity test is conducted either by a Grow Out-Test (GOT) or in laboratory using molecular markers.[15]

Moreover, to support such activities and build the capacity of seed producers in internal quality assurance, the Government of India has established a National Seed Research and Training Center (NSRTC) under the Ministry of Agriculture. This center is mandated to set up and run a National Seed Quality Control laboratory as well as to provide trainings on seed quality issues.[16]

Bottleneck F2.1: Seed producers lack capacity for internal quality control

On the capacity side, the rapid growth in seed production in recent years, led by the RSEs and their networks of out-growers, has not been accompanied by a commensurate investment on internal quality control systems. For hybrid maize in particular, the ATA's recent assessment during 2011 of the production facilities across 8 research centers and 10 seed producers suggests that neither lab facilities nor the number of trained and experienced staff is adequate to ensure the quality of seed at all stages of the value chain. [17]

In addition, many seed enterprises are found to lack infrastructural capacity in terms of farm machineries and implements, seed processing and storage facilities (cold rooms), seed testing labs and vehicles for transportation. Capacity gaps also include skilled staff such as plant breeders, seed technologists, pathologists, entomologists, and others.[18]

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[15] Santhy V. et al., 2008; Vibha Seeds, 2011
[16] Pingal P., 2001
[17] ATA Assessment of Production Capacity, 2011
[18] Benti T., 2011

Other than the Ethiopian Seed Enterprise and a few private seed producers, seed producers are almost entirely reliant on inadequately available rented processing equipment, which introduces additional risks to quality. Significant capacity gaps were identified at all stages of the seed value chain in this regard:

- **Basic seed:** producers of hybrid maize (in some instances) were found not to be enforcing sufficient isolation or de-tasseling of maize female parental lines on their out-grower farms. In addition, maintenance breeding for SPVs is not adequately conducted, for example, timely removal of off-types from production fields. Moreover, although there has been little basic seed storage from year to year, as production volumes increase, the lack of appropriate storage facilities will also likely become another critical issue.
- **Certified seed:** The problems in certified seed production are highly observed in cases where majority of production is through out-growers. The lack of internal quality control capacity of seed enterprises and poor knowledge level of out-growers is the primary reason for poor quality across the seed value chain. These factors can be attributed to the irregularities in the issuance of competence certificate. Some producers obtained the certificate without having enough trained manpower and adequate facilities. Additionally, there is often inadequate subsequent follow-up from the regulatory bodies, and challenges related to the renewal of certificates.

Intervention F2.1a: Provide guidelines/standards to enforce internal quality control for all seed producers

Establishment of clear and comprehensive assurance/control standards and enforcement guidelines for internal quality control is critical. This will require updating the existing seed laboratory testing and company level field inspection procedures based on internationally accepted standards. Additionally, revising the number and qualifications of quality control staff, enforcing internal quality labs for seed enterprises, and managing storage and transport facilities require special emphasis.

The federal seed regulatory authority should oversee this process, but regional authorities should drive the operations of this process through field inspection, certification and capacity building for compliance. This will ensure production of high quality seed.

Intervention F2.1b: Enable seed producers to build capacity for internal quality control

Beyond strong regulations, internal quality control (IQC) is also critical. This need is especially strong for the regional seed enterprises as well as smaller local private players. To effectively implement this, capacity-building programs should be developed and implemented.

Seed enterprises should be the primary drivers of these capacity-building activities. As most of these activities are long-term interventions, priority areas should be identified and implementation should be done in phases. Capacity-building should also focus on human resource development and equipping internal seed laboratories with modern equipment and technologies that make both in-lab and field quality control more effective and efficient. Based on the implementation roadmap developed by each enterprise, regulatory bodies are expected to oversee compliance of the specified standards and guidelines. Financial support and training could be requested from development partners as needed.

That said, the government should work to enable the rapid development of this infrastructure, for example, activities that the government can get involved include facilitating credit services to enable producers to invest in long-term IQC laboratories, develop best practices / guidelines, and facilitate credit services.

Another way to effectively develop quality control facilities in a sustainable manner given resource constraints is this idea of sharing infrastructure, such as IQC laboratories, testing equipment, and more; for example, the Ethiopian Seed Growers and Processors Association (ESGPA) can invest in a shared service that each producer commits a certain amount of investment to. In any case, internal quality control will occur over time, and therefore, external quality control through an effective regulatory system is equally critical **(see Interventions R.2a-R.2c)**

Bottlenecks and Interventions Focused on Quantity (F2.2 to F2.3)

Bottleneck F2.2: Seed production volume does not match farmers' demand

Currently, there is a significant challenge in effectively forecasting and fulfilling farmers' demand, both in terms of variety and volume. This is driven by a few factors:

- **Forecasting methodology:** The MoA employs a bottom up demand-assessment, with input from woredas, development agents (DAs), and individual farmers about their seed needs. However, the process currently does not consider shifts in demand due to changes in rainfall pattern, farmer preferences, and the overall market. The precise methodology involves a rough estimate of the types and quantities of seed farmers want to purchase the following year in each region. This target is loosely apportioned to the various producers (i.e., ESE and the RSEs). At the end of the cycle, the government through the Input Marketing Directorate allocates supply proportionally through the cooperatives based on the original demand or also overall crop area coverage for each region / woreda to ensure equity. However, shifts in demand due to changes in rainfall pattern and market situation are not considered.
- **Link with distributors:** Cooperatives and unions are the primary mode of distribution in many cases. Today, the demand assessment system does not have a direct link with the distributors (cooperatives and unions). Seed producers have a very limited role in marketing and distribution – they do not know their customers and they do not have tangible, market intelligence data to plan next year's production.
- **Supply bottlenecks:** Even in cases where demand is correctly forecasted, there are often supply bottlenecks driven by climate uncertainty during seed production (e.g., droughts), lack of adequate infrastructure, land, and financing from the producer standpoint, and poor out-grower recovery.
- **Allocation of cost and risks across actors in the system:** At present, regional bureaus of agriculture assume the costs of seed marketing, promotion, and popularization through services provided by their extension systems. These regional bureaus also assume other costs and associated risks, including: the costs of seed overstocks, carryovers, and storage losses, the costs of non-payment of credit taken by cooperatives and cooperative unions for the purchase of bulk seed, and reputational damage owing to farmer dissatisfaction with insufficient seed supply, poor quality seed, or late seed delivery.

Intervention F2.2: Strengthen national seed demand estimation and local market assessment

Several actions can be taken to strengthen the way in which demand for seed is estimated and assessed. In the short- and medium-term, there could be activities to transition demand assessment to seed producers and distributors, as they will now have incentives to produce the correct amount of seed (see Intervention F3.1 – Direct Seed Marketing). Specifically, seed producers will directly bear the costs of carryover as well as the opportunity costs of not forecasting sufficient demand.

- **National demand estimation:** The government should lead a collaborative process with players across the seed value chain, including research institutes, seed producers, and cooperatives, to forecast demand on the basis of current market conditions.
- **Make this data available through a national platform:** The government could make data on seed demand and supply publically available through a national data center or facility.
- **Adjust for supply shocks through emergency reserve strategy:** Beyond estimating national demand, the government should ensure preparedness for emergency situations – such as natural disasters that destroy young crops – by leading the design and execution of emergency reserve strategy.

Overall, this will require significant changes in current approaches. Specifically, local seed companies enter contracts with regional governments, and there contracts have pre-determined seed production targets, distribution quotas, and prices. By removing these distortionary strategies, seed producers and seed consumers can more effectively negotiate over the terms of exchange and assume responsibility for production and consumption. [19]

In the longer-term, the government could take a limited role in demand assessment, allocation, and pricing, as producers will bear more of this responsibility due to Direct Seed Marketing implementation (see Intervention F3.1). Additionally, real-time market information should be clearly accessible and shared in order for producers to effectively redistribute carryover seed to areas with shortages; and the government should support the facilitation and flow of this information. To reinforce this, extension should effectively work to check and confirm farmer demand on the ground.

In addition to better demand assessment, producers require effective resources to scale up operations, and this point is discussed in **Intervention F2.6 on page 49 of the strategy.**

Bottleneck F2.3: Limited availability of early generation seed

Scarce quantities of earlier generation seed ultimately results in limited quantities of certified seed down the line, as per the exhibit below. For RSEs to ramp up their production, there needs to be a significant increase in the production of pre-basic and basic seed for all crops, if not by the RSE itself, then by ESE or another public provider. If sufficient volumes of early generation seed were available, then RSEs would be able to produce even more certified seed and come closer to reaching their production targets with their current assets and develop the capacity to meet expected increases in future demand.

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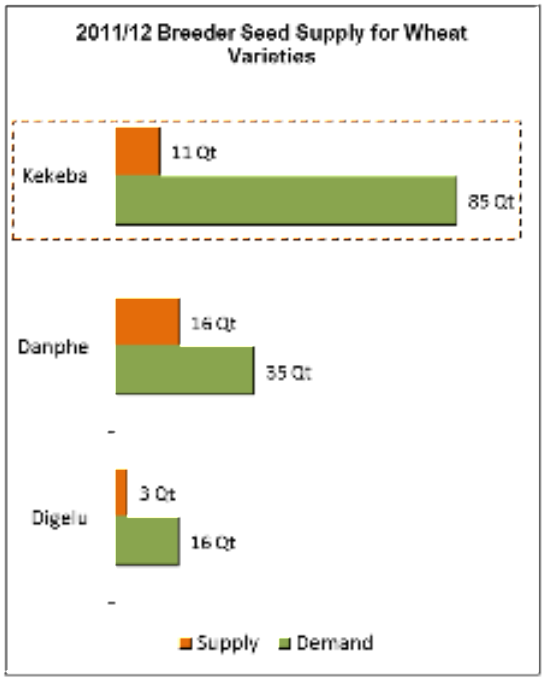
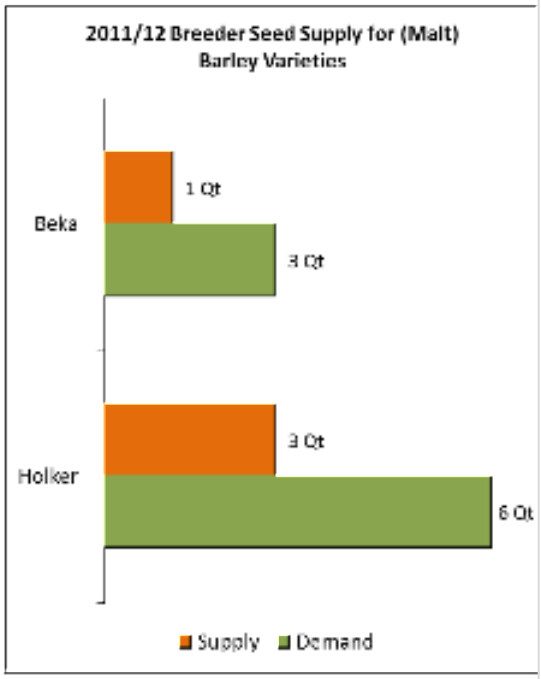
[19] Transforming Demand Assessment and Supply Responses in Ethiopia's Seed System and Market, Spielman and Mekonnen, 2012

To date, RSEs have done the multiplication of the limited quantities of pre-basic and basic seed that they produce on their own farm due to the need for more care and vigilance in their production. This has been possible to some extent with hybrid maize seed, but for crops such as wheat, the multiplication needs to be done on farmers' fields in the highland areas as out-growers. In these scenarios, it is especially critical to follow due process to avoid the risk of contamination.[20]

Exhibit 14

There is a significant shortage of available breeder seed for popular cereal varieties which results in a cascading effect on amount of certified seed produced





Source: EIAR-National Seed Coordinating Unit

Intervention F2.3: Increase capacity of breeding institutions to produce higher quantities **(linked to Intervention 1.1a)**

Another critical component of building the research system (see Intervention 1.1a) is ensuring that they can effectively meet the required quantities of early generation seed. Certain specific actions need to be taken to increase the amount of breeder seed upon the release of a new variety, as this directly impacts how much and how quickly that variety can be multiplied and scaled.

One area of focus is identifying additional irrigation sites for researchers to conduct seed multiplication and working on a contract basis with seed producer cooperatives (SPCs) is a possible option, especially for self-

[20] ibid.

pollinating varieties. More broadly, research institutions can set up arrangements with producers for additional plots and land, be it through leasing, renting, or other means. In order to mitigate the risk of outgrower farmers running off with pre-released seed, a robust system to identify target farmers will be required. To ensure the appropriate level of accountability from the seed producer standpoint, clear contractual arrangements will be required. This has also been effective with hybrid maize; as such, research institutions and producers should work together to ensure sufficient volume of early generation seed across all crop types. Ultimately, the amount of seed produced at each stage of the process needs to tie back to a clear understanding of demand on the ground for specific varieties.

In order to make further breeder seed multiplication affordable, financing will also be required for research institutions - for example, advance payments can be distributed by producers to research institutions.

Overarching Bottlenecks and Interventions (F2.4 to F2.6)

Bottleneck F2.4: Lack of market environment reduces incentives to maximize quality and quantity

Beyond tangible measures to improving quality and quantity (as discussed above), a competitive market will further enable realization of both these factors. Today, there are multiple challenges facing the private sector entities in competing fairly with the public seed enterprises. This is in stark contrast to benchmark countries with more mature seed systems such as Kenya and India (per the exhibit below). Regional Bureaus of Agriculture and local seed producers currently work together on a contract basis in which producers secure early generation seed while committing to produce seed at a specific quantity and price.. This creates multiple disincentives for the growth of the private seed production sector, which remains weak and fragmented.

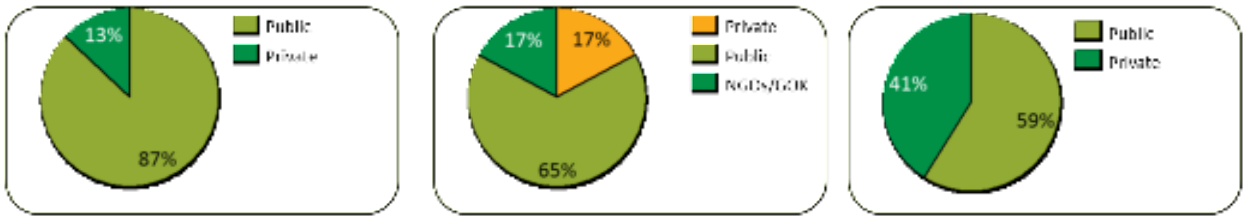
In order to build a robust private sector capable of increasing its production, supplementing the current volume contribution of the public system and meeting farmer demand, several constraints must be understood and addressed: (i) the shortage of basic seed for private seed growers, (ii) government intervention in all commercial aspects of the value chain, (iii) poor business and regulatory support, and (iv) insufficient support and start-up funding for young seed companies.

Exhibit 15

Certified seed production in Ethiopia is dominated by the public sector, in contrast with other benchmark countries like Kenya and India

Ethiopia	Kenya	India

▪ Certified seed production is dominated by the public sector, with an estimated supply share of >85%
▪ Within the public sector, ESE remains the major supplier and since 2010, RSEs are also playing an increasing role in certified seed supply.
▪ Private sector activity is generally limited to hybrid maize
  ○ There are a few private companies exclusively engaged in hybrid maize
  ○ In 2011, private companies supplied ~35% of hybrid maize
▪ Involvement of foreign companies is very low, with only 2 MSC currently active in the country
	▪ Compared to Ethiopia, the private sector plays a greater role in seed production and distribution
	▪ By 2011, the number of total seed producers reached 74 (compared to 30 in Ethiopia)
	▪ The crop focus of the private sector is highly limited to hybrid maize and groundnuts
	▪ In 2011, the private sector had a 20% supply share for improved maize
	▪ For non-hybrids, the public sector dominates the seed market (>80%)
	▪ The private sector is composed of both local producers and a growing number of MSCs
		▪ Private sector plays a significant role in seed production
		▪ In 2010, more than 400 seed companies were operating in the country
		▪ However, their prime focus has been on high value-low volume seeds (maize, sunflower and cotton) and vegetable seeds
		▪ Market for low value-high volume seeds of cereals, oilseeds is still dominated by public sector
		▪ Annual certified seed output reached a 2.5 million tons in 2008/09



Source: Kenya Seed Industry Study (KSIS) (Aline O'Connor F.A.K, 2012); Seed Division of DAC (India); National Seed Coordination Unit, Ethiopia (2012)

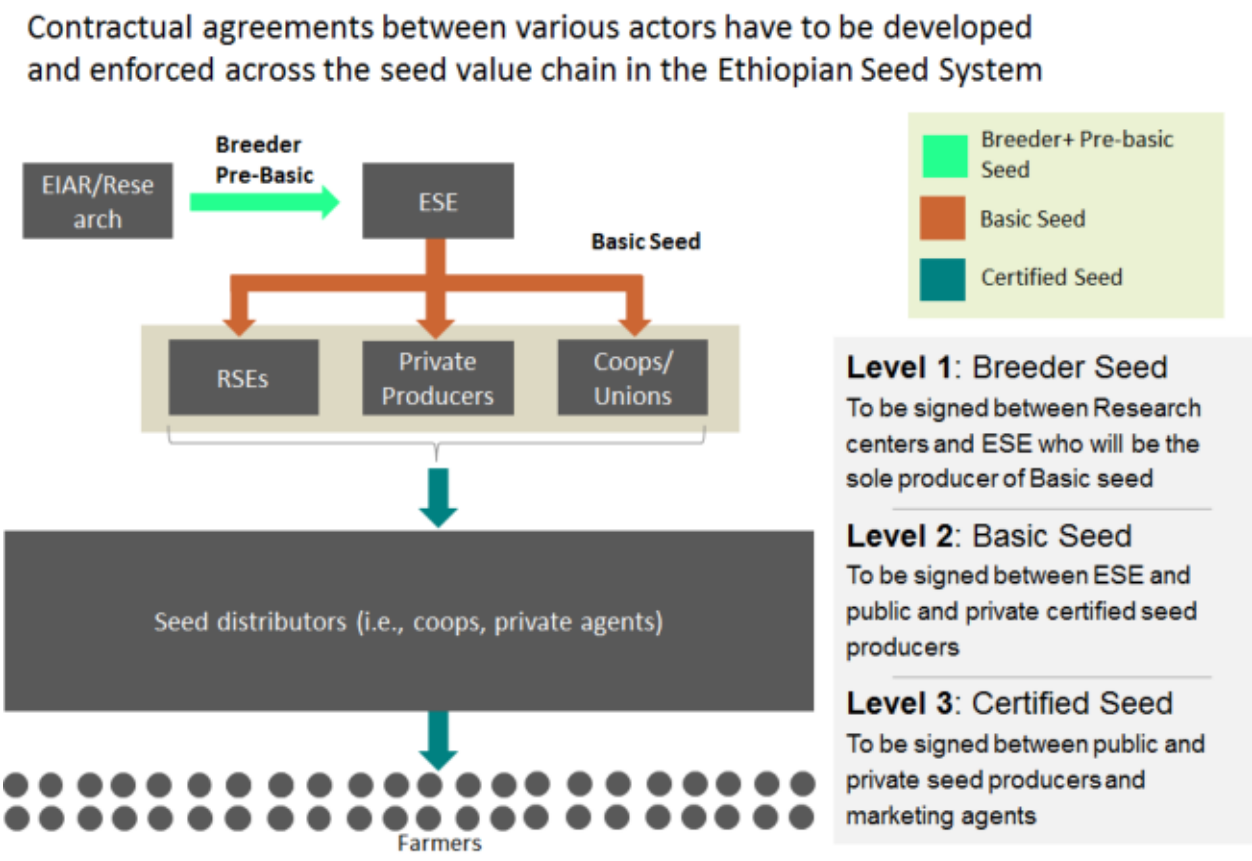
Intervention F2.4a: Delineate and enforce roles and responsibilities among seed producers

There is currently a working hypothesis for role sharing that has gained strong traction among public and private enterprises as they aim to fill various gaps and avoid overlap of responsibilities. In this scenario, regional seed enterprises and private companies operating in specific regions would supply certified seed to farmers in areas where they have competitive advantages.

On the other hand, the Ethiopian Seed Enterprise (ESE) would focus its efforts on the production of pre-basic and basic seeds of public varieties in addition to its responsibility to supply certified seed to fill gaps in supply. Given its experience as the oldest seed producer in the country as well as the highest relative technical and physical capacity, ESE is well positioned to produce earlier categories of seed that have higher quality standards and are needed by all other producers. Any locally registered seed producer will have access to basic seed of public varieties. Seed producers registered to operate in more than one region would also continue supplying certified seed wherever they operate.

Finally, in addition to their tasks of varietal development, research institutes would concentrate on the production of high quality breeder seed. Under exceptional circumstances, the activities of research institutes could extend to the production of pre-basic seed. The exhibit on the next page provides an overview of this delineation.

Exhibit 16



Intervention F2.4b: Support private sector producers to meet needs for commercially attractive (low-volume and high margin) crops

The private sector is a smaller but a rapidly expanding source of certified seeds in Ethiopia. The role of private companies requires an enabling environment for continued growth and expansion as well as regulation. This includes supportive policies, equitable access to inputs – including land, source material, and finance – and provision for differentiated branding and pricing of seeds.

As has been occurring over the past five years, this expansion should be encouraged from both the local and the international private sector. The local private sector has been steadily growing in number and capacity. Despite the many challenges they face, local seed companies have been able to deliver good quality seed to farmers. The enabling environment that will be created by supportive policies is expected to increase the entry of new local seed businesses and enhance the capacity of existing ones.

The value of international seed companies in meeting Ethiopian farmers' needs is best demonstrated in Pioneer Hi-Breed's experience in Ethiopia. It has one of the most respected seed brands in the country with a track record of very high proportion of sales to production volume, even at times of large excess inventory by other producers. In addition, Pioneer brings in newer and high performing improved varieties for Ethiopian farmers every few years, a big achievement considering that the average improved variety for maize has been in use for more than 20 years.

Based on this positive experience, regulatory institutions should facilitate the systematic entry of other international seed companies to the Ethiopian seed industry, as they have done in recent years. Such expansion should of course be done carefully to protect Ethiopia's farmers against predatory and monopolistic practices and ensure that these companies have demonstrated business ethics and high quality products that are relevant for Ethiopia. The MoA also needs to ensure that the entry of these international seed companies does not have the undue effect of crowding out the young domestic private sector seed companies, but rather act to complement their efforts. One way to enable this is to have international seed companies such as Pioneer focus more on high-value, low-volume varieties such as hybrid maize, including through local producers such as the case of SeedCo with Alemaheyu Farms..

Enabling additional international companies to enter the Ethiopian market requires clear and transparent regulations to obtain a business license, import varieties for verification, secure land, and access inputs. Given the importance of the seed sector, reducing the time and steps involved to enter the market is critical and would be an incentive for international seed investors. Furthermore, specific attention should be made to attract international seed companies with relevant varieties in commercially viable hybrids and those that leverage biotechnological tools that are compatible with Ethiopia's Biosafety Legislation.

Policies should also be aligned and integrated among institutions and departments whose mandates touch on seed business: these include MoA, IBC, EPA, Ethiopian Investment Agency and others. There also needs to be clearly defined roles among Federal and Regional Authorities in the implementation of these policies.

Support for domestic private sector seed companies is essential to establishing a foundation for a competitive seed industry in Ethiopia. Despite several systemic challenges, Ethiopian farmers are currently benefiting from a number of domestic private sector seed producers. These companies have shown tremendous promise and have contributed greatly to quality seed supply over the past five years. These seed companies are run by experienced professionals who are committed to not only financial success, but also bringing positive impact to the lives of smallholder farmers.

Bottleneck F2.5: Inefficient out-grower management by seed producers

RSEs – especially Amhara Seed Enterprise and Oromia Seed Enterprise – rely heavily on smallholder out-growers for seed production. This approach has enabled them to produce large amounts of seed soon after their establishment; ASE produced more than 789,000 quintals of seed in its first year of operation.[21] This would not have been possible if they waited until they could produce seed independently from their own leased land.

However, there are two challenges that RSEs face in depending heavily on smallholder out-growers: risks to quality and low retrieval rates of seed.

- **Quality threats.** Working with smallholder out-growers requires effective management of quality. Firstly, out-growers need intensive training on the technical requirements of seed production to ensure

[21] Data from ASE, 2011

high quality. This is exceedingly important for hybrid maize where simple mistakes can render the entire seed from the plot – and those around it – unusable. This requires strong quality control capabilities from the RSE standpoint. However, RSEs face severe capacity constraints given their young age, particularly in the area of quality control; they are often forced to depend on DAs for quality assessments that are not sufficiently qualified or incentivized.

- **Low retrieval rates of seed.** Another critical challenge that most PSEs, especially RSEs, have faced is the low retrieval rates of seed from out-growers. The main constraint is cash-flow management and the timely availability of capital to ensure seed buy-back. PSEs have been unable to pay farmers at the time of purchase, as agreed to in the signed contracts. This is due to challenges in acquiring BoA-facilitated loans from banks and credit unions as well as logistical deficiencies. Difficulties in obtaining these loans mean RSEs are unable to pay out-growers for seeds on time, which increases risk in terms of seed collection as farmers might sell their seed as grain or to the seed may enter the informal seed sector. In addition, the price offered by RSEs to farmers to buy back the seed (which is determined by an assessment of the market price with a 15 percent mark-up) was also deemed to be too low and farmers instead preferred to hold on to the seed and sell it as grain or seed in the informal market later in the year.[22]

As PSEs expand their production volume, the enterprises require larger loans from commercial banks to purchase the seed produced by out-growers, resulting in larger interest payments.

Intervention F2.5: Develop effective out-grower management by seed producers

Seed producers can take several approaches to effectively manage out-growers. Firstly, out-growers need to fully understand the importance of seed crop management to carry out all the procedures. However, the bigger issue is effectively incentivizing farmers to properly manage the seed crop and sell it back to the seed producer per the contract. PSEs have reported major challenges in procuring seed from out-growers, especially as grain prices fluctuate and farmers may be offered higher prices from traders and black-market actors.

Domestic and international experience shows that this can be addressed through various approaches:

- **Clustering out-growers.** ASE groups smallholder out-growers into clusters that can be managed as bigger seed farmers. A cluster may consist of up to 200 farmers. The enterprise then deals with the representative of the cluster rather than hundreds of farmers, thus reducing its management costs. Being part of a cluster also increases an out-grower's accountability: because his/her management of his/her plot affects the success of other parts of the cluster, the out-grower will face pressure to be thorough in complying with the guidelines of the contract.
- **Comprehensive tracking systems and databases.** In addition to clusters, multinational seed companies in India make use of comprehensive tracking systems to reward reliable out-growers and discontinue working with unreliable ones. If one seed producer blacklists an out-grower, it will be difficult for the

[22] Dalberg, ASE Strategy Refresh, 2011

out-grower to work with any other seed producer. Seed producers in Ethiopia can build database of their out-growers and their success rate in collaboration with inspection services. In addition, seed producers will need to collaborate so that they can share best practices and information that will enable them to incentivize out-growers to become better partners in seed production.

- **Formal certification and registration system.** Related to the above, a basic certification system for out-growers based on specific criteria (e.g., level of education, historical recovery rates, dispersion of plots) should be facilitated by seed producers to ensure that out-growers meet a certain bar to ensure effective recovery of seed at the appropriate quality level.
- **Sufficient incentives for out-growers.** Seed producers (especially public seed enterprises) need to revisit their incentive structure, and offer competitive premiums to out-growers such that recovery is maximized. This will of course require additional financing for producers **(see Intervention F2.6a on page 49-50).**

Bottleneck F2.6a: Delayed seed processing and delivery by seed producers

PSEs have a limited time window in which they can sell their seed, as it must be done in time for seed sowing (April-May for Maize, and May-July for wheat and tef). This makes it especially critical to prevent any delays, which are driven by two primary factors:

- **Credit constraints for PSEs.** PSEs face cash shortages when purchasing from out-grower farmers at harvest time, which requires them to secure loans. The delays associated with securing loans have a cascading effect on seed acquisition from farmers, and ultimately selling seed in time for sowing season.
- **Lack of adequate processing facilities.** Furthermore, lack of adequate processing facilities creates additional delays. For example, in 2010-11 it was estimated that it took two to three months for all RSEs to process all maize seed, whereas with their own machine it would have only taken them only one month. In addition, RSEs lack adequate capacity in terms of their own trucks and rely on using other government trucks or private fleets to transport collected raw seed to the storage and processing centers. This also further delays the distribution process.[23]

Bottleneck F2.6b: Seed producers lack effective commercial (customer-facing) operations

To date, seed producers (PSEs and private) have not undertaken any significant marketing or promotional activities to sell their seed and differentiate their brands, and the enterprises have only one person responsible for promotional activities.

This is largely driven by a lack of incentives for seed producers to invest in marketing. Specifically, seed quantities and prices are set beforehand by the regional BoAs, limiting the potential upside associated with more effective marketing.

Intervention F2.6a: Support seed producers with sufficient financing and land so that they can scale effectively to satisfy unmet demand

[23] Dalberg, ASE Strategy Refresh, 2011

Beyond access to earlier generation seed and a robust market structure, seed producers ultimately need the tangible resources to grow their operations. Even with improved pricing for quality and an ability to sell freely, producers currently require additional financing to make key capital investments, be it in land / plots for seed multiplication, cleaning / processing equipment, transportation, or agent/channel development.

The government should play a role in linking producers to financial institutions that can effectively provide this financing, as well as development organizations that are willing to make one-time investments in building the seed production capacity of Ethiopia.

In addition, it is important to consider the differences between hybrid maize and self-pollinating varieties when thinking about how to effectively grow the volume of seed production. Given the reduced need to introduce new seed on annual basis and lower profitability, SPVs are primarily produced by producers unions and cooperatives; interventions pertaining to this are discussed in **Chapter 4 on the Intermediate Seed Sector, starting on page 72.**

Intervention F2.6b: Support seed producers to improve business planning, marketing, and operations management

One of the key areas in which PSEs and private seed producers should be strengthened is in business planning. In this regard, they need to develop strategic plans that will enable them to meet their mandates of filling underserved areas and effectively competing with each other. This will enable them to make an effective use of public sector support for seeds that are less commercially viable, particularly OPVs and SPVs that can be recycled and important orphaned crops such as sorghum whose seeds have low prices due to low grain prices but are used by many smallholder farmers. Effective operations are critical not only for small private players and the newly established RSEs, but also large private players and the ESE. Regional governments have demonstrated their commitment to increasing seed supply by making large start-up and on-going investments in RSEs. However, RSEs should begin to recuperate their investments, and ultimately become self-sustainable and independent. This will be critical as they are still expected to play a strong role in the seed sector alongside private companies.

More critically, Direct Seed Marketing will enable a competitive market environment in which producers can directly market and brand their seed, without quantity and price restrictions. This will encourage producers to become more commercially-oriented as effective marketing can now drive financial benefits. **(See Intervention F3.1)**

Component F3: Marketing and distribution in the formal sector

The goal of marketing and distribution is to set up a system that creates the market environment and incentives for seed producers to deliver seed effectively through multiple channels. There are numerous factors to keep in mind when developing a robust marketing and distribution system for certified seed: timeliness, quantity, quality, choice / competition, price, and channel reach.

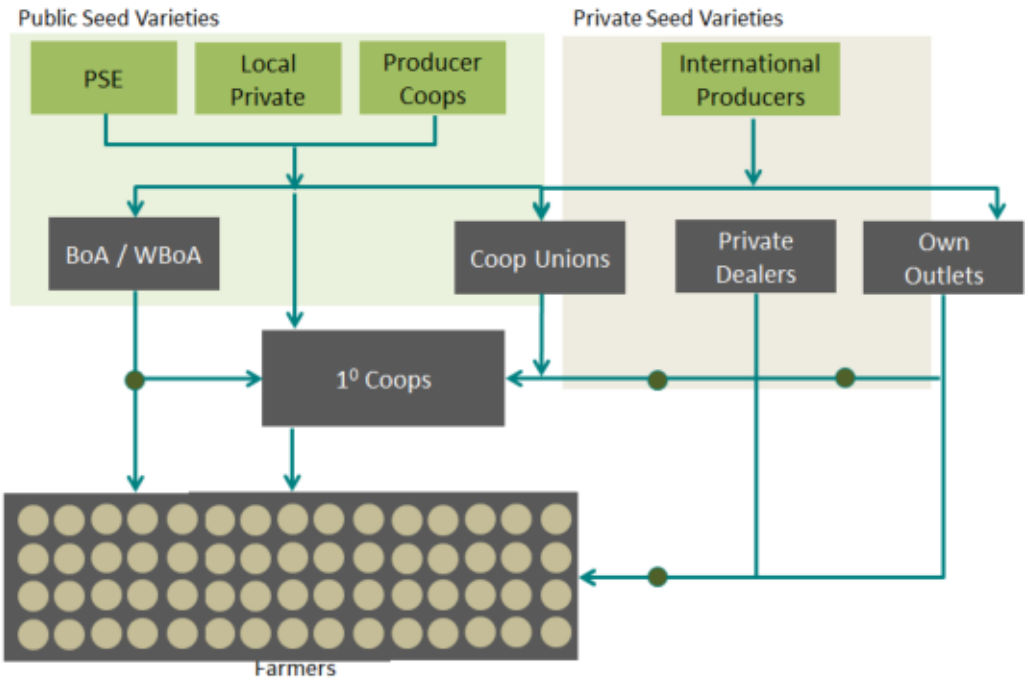
In other words, the channels should also provide timely access to *high quality* seeds of *improved varieties* at *sufficient quantities* and at a *price governed by market forces* subject to close monitoring by the government to ensure there is no collusion or monopoly pricing and done according to quality standards set in the

country pertinent to seed. To this end, a set of six bottlenecks and respective interventions have been proposed with respect to formal sector marketing and distribution.

Bottlenecks and interventions for Seed Marketing and Distribution in the Formal Sector				
	Bottlenecks		**Interventions**	**Owners**
F3.1	Producers lack effective channels to market and distribute their seed	F3.1	Support seed producers to market directly to farmers (Direct Seed Marketing)	MoA/RBoAs
F3.2	Variable quality of seed available at distribution channels due to limited quality control by regulatory bodies	F3.2	Strengthen regulatory structures to improve quality control at distribution	RBoAs Regulatory
F3.3	Marketing agents currently lack the means and incentives to distribute seed effectively	F3.3	Equip marketing agents to distribute seed more efficiently as a viable business	FCA/RBoAs
F3.4	Marketing agents lack incentives to effectively measure demand	F3.4	Enable marketing agents to more actively assess seed demand through direct involvement and incentives	MoA/RBoAs
F3.5	Fixed pricing for public varieties dis-incentivizes producers and distributors to invest in quality and marketing	F3.5	Implement open pricing mechanism for seed producers of public varieties	MoA/RBoAs
F3.6	Farmers lack input credit to adopt modern varieties	F3.6	Provide financial services products for farmers to increase input affordability	MoA/RBoAs
F3.7	Producers and distributors lack appropriate access to finance, transport and storage facilities	F3.7	Establish more robust transportation, logistics, and storage systems for seed, and better financing for agents	ESE/RSEs/ Private sector

Exhibit 17

Certified seed marketing and distribution models can vary, with four types of distribution channels to farmers, that function at varying levels of intensity



Source: ATA Analysis; *The political economy of Ethiopian cereal seed systems (Dawit A., 2010)*
FBSMS of BoAs- Farmer Based Seed Multiplication Schemes organized and implemented by BoAs of regions e.g. Oromia, Tigray, etc

For context, there are four seed distribution channels as shown above:

- **The BoA and WBoA:** This is most common in SNNPR and Tigray, where DAs and woreda officials act as the intermediaries to transport BoA allocated seed (quantities, varieties) to their constituent farmers from the BoA specified seed producers.
- **Coop unions and primary cooperatives:** Unions and primary cooperatives are the primary channel where the bulk of the seed (of all public crop varieties) flows through to end-farmers. The producers of public seed varieties include PSEs, private seed multipliers, and coop unions that are involved in certified seed production.
- **Private dealers and owned outlets:** Foreign variety producers like Pioneer can use multiple channels and market their seed through private, independent dealers and/or own outlets.

Bottleneck F3.1: Producers lack effective channels to market and distribute their seed

Seed of most cereals is primarily channeled through the regional BoA and distributed by cooperatives, which leaves farmers with limited alternatives to access quality seeds at a competitive price.

In recent years, the horticulture and vegetable sector has made substantial achievements in exploring alternative models and seed distribution for these crops currently occurs through multiple channels. In the last few years, increasing number of local and international companies distribute vegetable and horticultural

seeds and fertilizers using multiple channels such as through direct marketing, private dealers, cooperatives, NGOs, etc.

However, most cereal and pulse seed producers of public seed varieties cannot market seed directly to farmers. The local BoA controls the allocation and distribution. Therefore, producers of public varieties are unable to receive feedback or understand farmers' preferences or build a marketing model into their businesses. However, interviews with seeds producers reveal that multiple private and public companies are interested in marketing their seeds directly and developing their brands.[24] In fact, a few have experimented with direct sales and have gotten encouraging results.

Intervention F3.1: Support seed producers to market directly to farmers (Direct Seed Marketing)

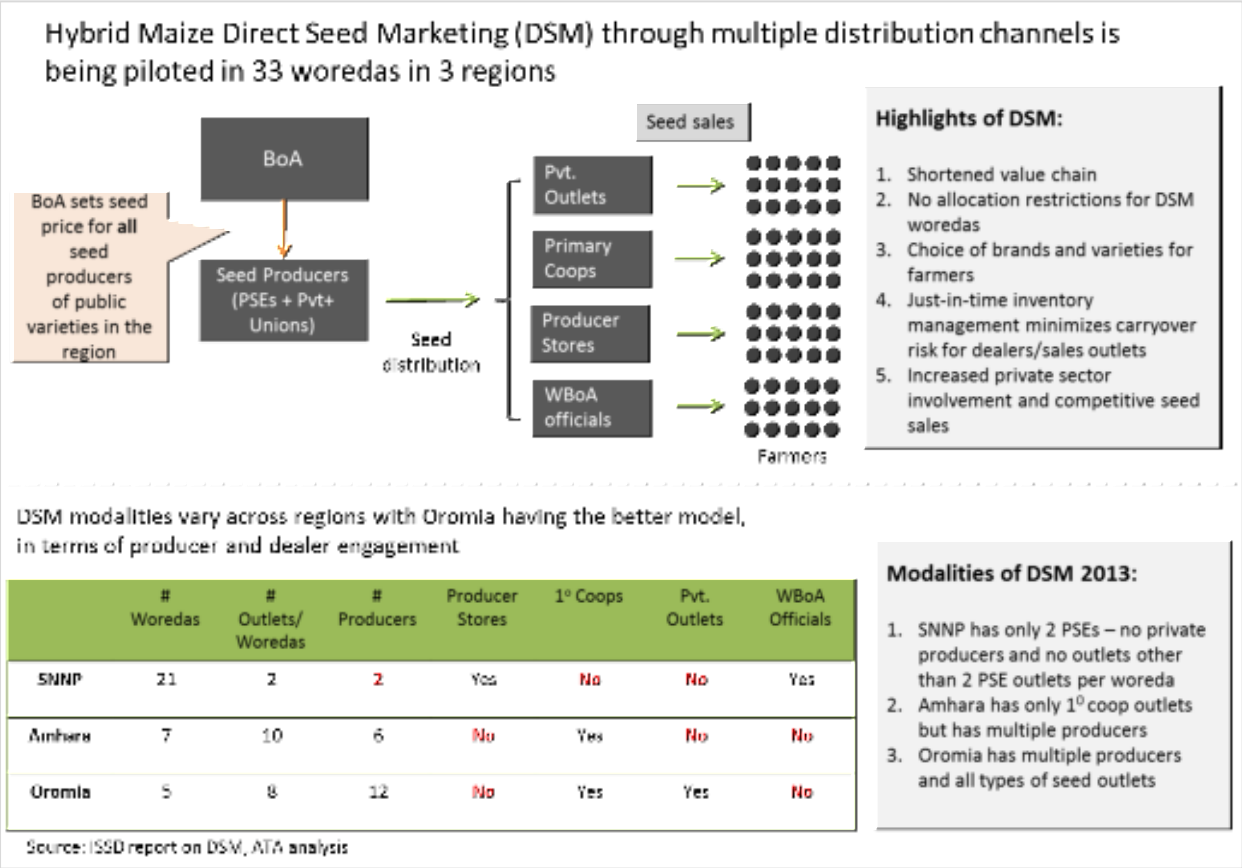
Given their scale and resources, capable and certified seed producers should be able to market their seeds directly to farmers once they fulfill the established standards for seed distribution. Early on, the experience of the three companies that have marketed seeds directly to farmers, namely Pioneer Hi-Bred, Anno Agro Industry and Avallo, demonstrated that sales coulfdad be increased substantially if the seed producer sold its seed directly to farmers or operated through alternative private distribution channels at the market level rather than totally relying on the BoA and cooperatives. Anno Agro-Industry, a private seed company in Oromia has also reported that its strong brand and farmers' expressed interest will enable it to market directly.

In 2013, an expanded Direct Seed Marketing (DSM) approach for hybrid maize was piloted in 33 selected woredas in three regions (Oromia, Amhara and SNNP). Fifteen seed producer enterprises (4 Public, 2 unions and 9 private) marketed their seeds in the selected woredas. About 10 varieties of hybrid-maize seed were distributed through cooperatives, seed producer outlets and private stores in the woredas. The distributors were operating on a commission basis paid by the seed producers.

[24] Based on interviews conducted with Alamayehu, Anno Seed Company, Gadissa Seed Company, and Amhara Seed Enterprise (ASE)

Direct seed marketing experience of 2013:

Exhibit 18



	# Woredas	# Outlets/ Woredas	# Producers	Producer Stores	1⁰ Coops	Pvt. Outlets	WBoA Officials
SNNP	21	2	2	Yes	No	No	Yes
Amhara	7	10	6	No	Yes	No	No
Oromia	5	8	12	No	Yes	Yes	No

Based on preliminary feedback from a joint MoA-ATA study, this direct seed marketing pilot had many advantages including:

a. Timeliness.
b. Enhanced accountability of producers.
c. Better choice of varieties and brands.
d. Less burden for DA's and woreda officials.
e. Reduced cost of seed distribution for the government.
f. Increased demand for certified seed.
g. Quantity distributed - e.g., in Oromia over 90 percent of seed supplied was distributed to farmers in DSM woredas.

Challenges of DSM 2013:

Despite the many obvious benefits of DSM, there have been a few challenges that have been observed in the 2013 planting season. These challenges are primarily around the execution of the DSM model as opposed to fundamental issues with the approach. These challenges are highlighted below need to be better addressed and mitigated in future iterations of this approach:

a. Limited number of seed selling outlets at kebele level.

b. Lack of adequate storage facilities at selling points.
c. Participation of DAs/WBoA experts as marketing representatives in some regions (SNNP and Oromia) adding more burden.
d. Fixed pricing discourages seed producers from investing on quality beyond minimum standards and multiplying additional quantities of seed.
e. Limited channel beyond cooperatives or DA/WBoA experts in SNNP and Amhara.
f. Limited technical and infrastructural capacity of producers and marketing agents.

As of April 2014, the MoA and ATA are working with implementing partners to scale DSM to over 65 woredas. Retailing is occurring through both cooperative agents and private agents, but all channels are required to meet the same standards in order to retail. As DSM scales further, a set of wholesalers will be critical to ensuring sufficient geographic reach for producers.

Bottleneck F3.2: Variable quality of seed available at distribution channels due to limited quality control by regulatory bodies

Currently, seed regulatory institutions primarily focus on quality control activities during production and processing. The level of quality control during marketing and distribution of seed is relatively low due to capacity limitations of regulatory authorities. This increases the risk of quality deterioration during transportation, storage and marketing by seed sellers as it may not pass through regulatory checks.

Intervention F3.2: Strengthen regulatory structures to improve quality control at distribution

Similar to quality control for producers, quality control at distribution needs to be addressed through a combination of policy enforcement and capacity building.

On the policy enforcement side, the regulatory system will need to ensure that all distributors fulfill the minimum standards for maintaining quality of seed, particularly storage. This should be required for all seed distributors to obtain certificate of competence of distribution as well as for maintaining the certificate. Regulatory institutions will need to have the necessary capacity to spot-check and inspect seed distributors regularly and make sure that they comply. On the side of capacity, seed distributors need to be aware of policy requirements for quality control and have the resources to build quality control infrastructure. This could be achieved through training programs as well as support for accessing storage and transport facilities through credits.

In the longer-term, producers should play a critical role in ensuring that distributors effectively manage the quality of their seed as Direct Seed Marketing will incentivize them to do so, as they directly carry the downside risk associated with seed waste. Specifically, farmers are allowed to open bags of seed and return them if they are dissatisfied with the quality.

Bottleneck F3.3: Marketing agents (primarily cooperatives) currently lack the means and incentives to distribute seed effectively

In Ethiopia, certified seeds are currently marketed primarily through cooperatives under the guidance of MoA and Regional BoAs. However, there are a subset of woredas that are practicing Direct Seed Marketing, in which private agents also market seed. While seed distribution through cooperatives has quite a few

advantages, there are several risks and challenges due to the current structure and operation capacity of cooperatives. As illustrated in Exhibit 17 and 18, there are a significant number of agricultural and multi-purpose cooperatives throughout the country, primarily in the four big regions. Unfortunately, most experts agree that many of these cooperatives lack the capacity to operate as well-functioning business entities and do not serve their members and other farmers particularly effectively.

Additionally, the new agents that have been identified under DSM also face similar bottlenecks around capacity and storage issues, as well as operating as business entities.

Intervention F3.3: Equip marketing agents to distribute seed more efficiently as a viable business

These issues that agents currently face will be addressed through Direct Seed Marketing, which focuses extensively on strengthening cooperative and private agents to become more effective distribution channels.

Agent certification and training is a crucial component of DSM. A technical committee at the regional level should ensure that all seed marketing agents meet a minimum set of standards, such as effectively separating chemicals and seeds, allowing for proper ventilation, improving cleanliness standards, etc. DSM implementing partners should work to provide trainings around various topics, including warehouse and inventory management, internal quality control, financial management, and market analysis. Customer service and education is also a crucial component of these trainings - it is critical that agents understand and cater to farmer needs, and provide recommendation for the use of certified seeds. Additionally, incentives in DSM can reinforce these agents to improve their operations; for example, they will compete for commissions provided by seed producers, which will incentivize both timely, effective delivery as well as quality. This will address the issues that cooperatives currently face regarding receiving low margins for distribution of seed and other inputs. **Bottleneck F3.4:** Marketing agents lack incentives to effectively measure demand

The conventional seed distribution model does not create a need for cooperatives (which are the only marketing agent in this model) to effectively measure demand. This is a result of the fact that specific quantities and prices are decided on by the RBoAs as a result of the contractual agreements they have with producers. Additionally, the RBoAs pre-assign seed producers to the specific agents, limiting the agents' ability to procure seed on a competitive basis. Finally, the margins that cooperatives are allowed to charge for seed and fertilizer are fixed and low compared to other countries. Given that agents neither have control over the quantity of seed they sell nor the commission associated with it, they do not invest in accurately measuring demand.

Rather, they rely on the respective BoAs to provide demand estimation. However, demand estimations are based on surveys conducted in the preceding year, which tend to change according to weather patterns. A farmer may change his/her mind for reasons related to grain prices and weather. This results in excess inventories, which translates into storage costs for the cooperatives and financial costs on the invested capital for the inventories.

Intervention F3.4: Enable marketing agents (cooperatives and private) to more actively assess seed demand through direct involvement and incentives

This challenge can be addressed in two ways:

Directly involving agents in the demand assessment process in the near-term (as discussed in Intervention F2.2): It is critical to involve downstream players in the demand estimation process. This includes a mechanism through which cooperatives can go beyond the BoA's estimation process and supply local knowledge of markets, including potential shifts in rainfall pattern and farmer preferences. As cooperatives are usually the closest stakeholder to the smallholder farmer, involving them in demand assessment is absolutely critical.

Establish incentives for agents to accurately assess demand in the long-term through Direct Seed Marketing (as discussed in Intervention F3.1): Direct Seed Marketing will provide agents more incentives to accurately measure demand. Ultimately, agents will enter contractual agreements with producers to carry their seed, and also be able to negotiate commission payments from producers on the amount of seed they sell. This will significantly increase the need and incentives for agents to accurately measure the demand for the farmers that they serve.

Bottleneck F3.5: Fixed price setting process for public varieties dis-incentivizes producers and distributors to invest in quality and marketing

MoA and BoAs at the Federal and Regional levels technically set prices of seed for public varieties with initial input coming from seed producers (both public and private). However, since the last two years, private companies have played a very limited or no role in the price setting process. This is due to a structure in which public seed enterprises in consultation with BoAs agree on uniform prices with no or limited role of private sector players.

Consequently, all seed producers, with the exception of international seed companies such as Pioneer, are forced to sell their seed at prices that do not account for varying quality levels (brand) and of productivity of the variety and production cost differences. Moreover, seed producers vary in their location and hence have varying production and distribution cost structures (such as transport, processing and storage costs). A price setting process that does not enable for flexibility based on real-time demand affects the volume, quality and timeliness of seed produced and distributed.

Specifically, in the current system, investing in quality comes at a cost. If seed producers are unable to recoup this investment through pricing that reflects quality, they are less likely to invest in quality beyond the minimum standard set by the regulatory system. As a result, the right amount and quality of seed are not always made available to end users at a competitive price. Furthermore, there is little, if any, differentiation of price between different varieties of a given crop.

The key exception to note is private companies who produce their own private varieties, such as Pioneer and SeedCo. These producers are allowed to freely price these varieties independently of the BoA and PSEs.

Current seed pricing mechanism at the Regional level

Steps followed:

i. Marketing departments of the PSEs conduct market assessments annually from February-April every year to decide on prices for buying seed from their out-growers.
ii. Total cost of production is then analyzed taking into account production overhead and administrative expenses
iii. Management boards of the respective seed enterprises then establish profit margins. The boards are typically comprised of representatives from input directorate of MoA/BoAs, Research (EIAR/RARIs) and the PSEs themselves.
iv. Private companies producing public varieties have limited or no role in the price setting process. These companies submit cost of production data to BoAs (input units) of the respective regions that they are operating in. The input units of the BoAs unilaterally determine selling prices.

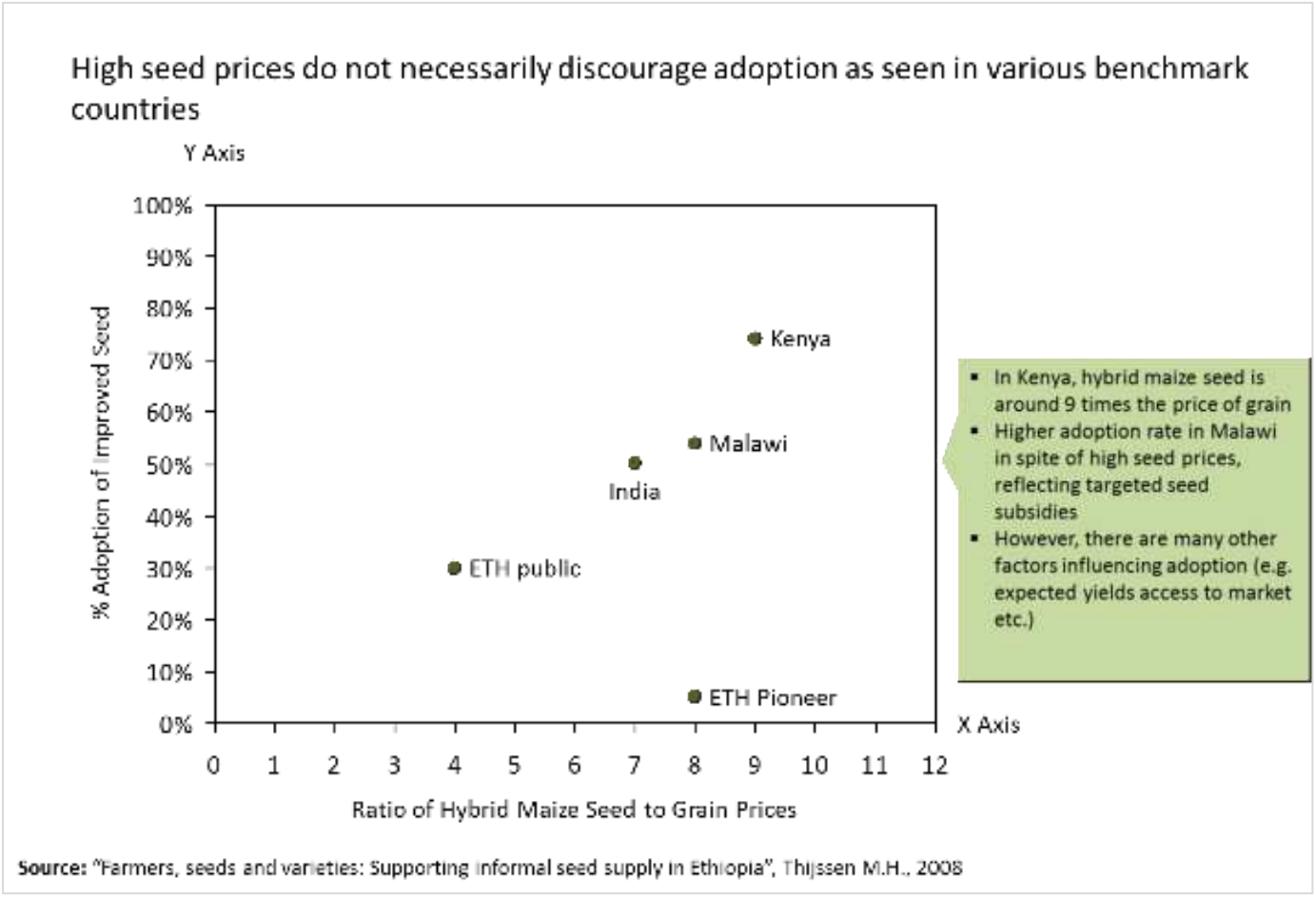
Intervention F3.5: Implement open pricing mechanism for seed producers of public varieties

Pricing is one of the most important elements to improve the quality and quantity of improved seeds in the agricultural sector. Producers should be compensated for the higher operating costs associated with investments in quality, transportation to more distant locations, and other factors. As such, it is critical to establish pricing based on what the market can bear, and producers should be allowed to set their own prices. As per *Exhibit 19*, higher seed prices do not necessarily discourage adoption, based on data from other benchmark countries and experience in Ethiopia with Pioneer and SeedCo. If structured properly, an effective pricing system would enable farmers to access the most appropriate seeds according to their expected returns, while creating strong incentives for producers and distributors to increase production and quality.

Potential outcomes and benefits of open pricing:

- Farmers will benefit from adequate quantities of good quality seed as producers of good quality seed are encouraged to invest in the same.
- More choices to farmers as multiple seed suppliers will get to compete on price, quality and quantity.
- Seed companies are encouraged to compete for market share by trying to build good reputations among farmers for good quality seed.

Exhibit 19



As seen in the exhibit above, data from other countries indicates that there is significant room for upward price movement based on the ratio of hybrid maize to grain prices. As a result, increases in quality and corresponding increases in price will likely not have a negative impact on farmer adoption, provided there is timely availability as well as effective education and training. Compared with other developing countries, certified seed prices are relatively low in Ethiopia. Comparing seed and grain prices, the ratio of maize seed to grain prices was approximately 4X in Ethiopia, compared with 8X or more in Kenya and India. Despite the higher price, hybrid adoption rates in those countries are several time those of Ethiopia.

This holds true in Ethiopia as well, as demonstrated in the case of Pioneer seed. Pioneer is priced at least 2X more than other public varieties, yet farmers prefer Pioneer varieties to other local hybrids. While pricing should incentivize producers and distributors, it should also be free from monopolistic behavior, i.e., collusion. Compared to many other developing countries, there are only a small number of seed producers in Ethiopia. The fact that there is limited or almost no supply of certified seeds for some critical crops such as tef and barley increases the propensity for monopoly behavior.

It will thus be the critical for the regulatory institutions to identify cases of monopoly pricing and take action. By strengthening their linkages with farmers and farmer organizations, regulatory institutions can build recourse mechanisms to curtail monopoly pricing, poor quality seed, and any other illegal behavior by producers and distributors.

Bottleneck F3.6: Farmers lack credit to adopt the inputs associated with modern varieties Farmers need access to financial services, savings, credit or other financial instruments, to purchase inputs related to seed, such as fertilizer, pesticide, herbicide, etc. Currently, many farmers do not have the cash at the time of seed delivery to purchase inputs, although they usually gain the cash after harvest. Credit is one important tool to support farmers in the affordability of improved seeds and inputs. However, credit products, including credit guarantees, need to be well designed in order to meet farmers' needs while not creating a burden on the government, particularly at regional levels.

Intervention F3.6: Provide financial services programs for farmers to increase input affordability

Although producers will take responsibility for popularization and promotion as a result of Direct Seed Marketing, effective adoption of seed is driven by multiple factors, including affordability, to which credit will be crucial. Farmers' ability to afford seed and related inputs may be enhanced through the introduction of support schemes like savings, credit, and possibly, well-designed insurance systems and voucher schemes. Specific programs include the following:

- **Savings mobilization:** This is the most risk-free and effective means of supporting farmers to purchase seed and other inputs. Successful financial strategies in this area include savings groups and the introduction of electronic platforms that make savings more affordable.
- **Credit schemes:** Credit availability is one important tool to address the timing factor that hinders adoption. Even if farmers are able to recover his/her investments in inputs by increasing productivity, they may not have the cash to purchase the inputs early in the season. Some partial or total credit guarantees schemes provided to farmers are conditional on meeting certain standards (e.g. Ethiopia's current 50% credit guarantee for inputs to the very poor) have proven extremely successful in Ethiopia and in other countries. As a recent project implemented by the International Development Enterprise (IDE) and MFIs in Oromia and SNNP illustrates, well-designed and executed credit guarantee schemes have realized repayment rates of over 98%, even in food insecure woredas.[25] In Kenya, the credit guarantee scheme implemented by Equity Bank has registered an average of 95% repayment rate. These types of products have the ability to provide farmers without savings a viable means of purchasing the inputs related to seed, such as fertilizer, while limiting the burden on the government to subsidize or cover any losses.

  Moving forward, credit schemes may be initiated in high potential areas – such as AGP woredas – where credit repayment rates will be high compared to other parts of the country. On a smaller scale, established seed producers and distributors can provide credit to successful farmers that are loyal customers as part of their branding and customer retention strategy, especially given that they will be directly marketing to farmers.

Weather risk and voucher programs: Finally, there could also be a consideration of well-designed weather risk and voucher programs, which were ineffective and wasteful in the past, but are showing promising results in other parts of Africa through a completely redesigned format.

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[25] International Development Enterprise

Bottleneck F3.7: Producers and distributors lack appropriate access to finance, transport and storage facilities

Seed quality can be compromised during and after production. Once seed is produced, processed and packaged, it needs to be transported and stored in the appropriate facilities. In order to avoid physical mixing or contamination, transport vehicles should be sufficiently clean from damaging materials such as chemicals and pests.

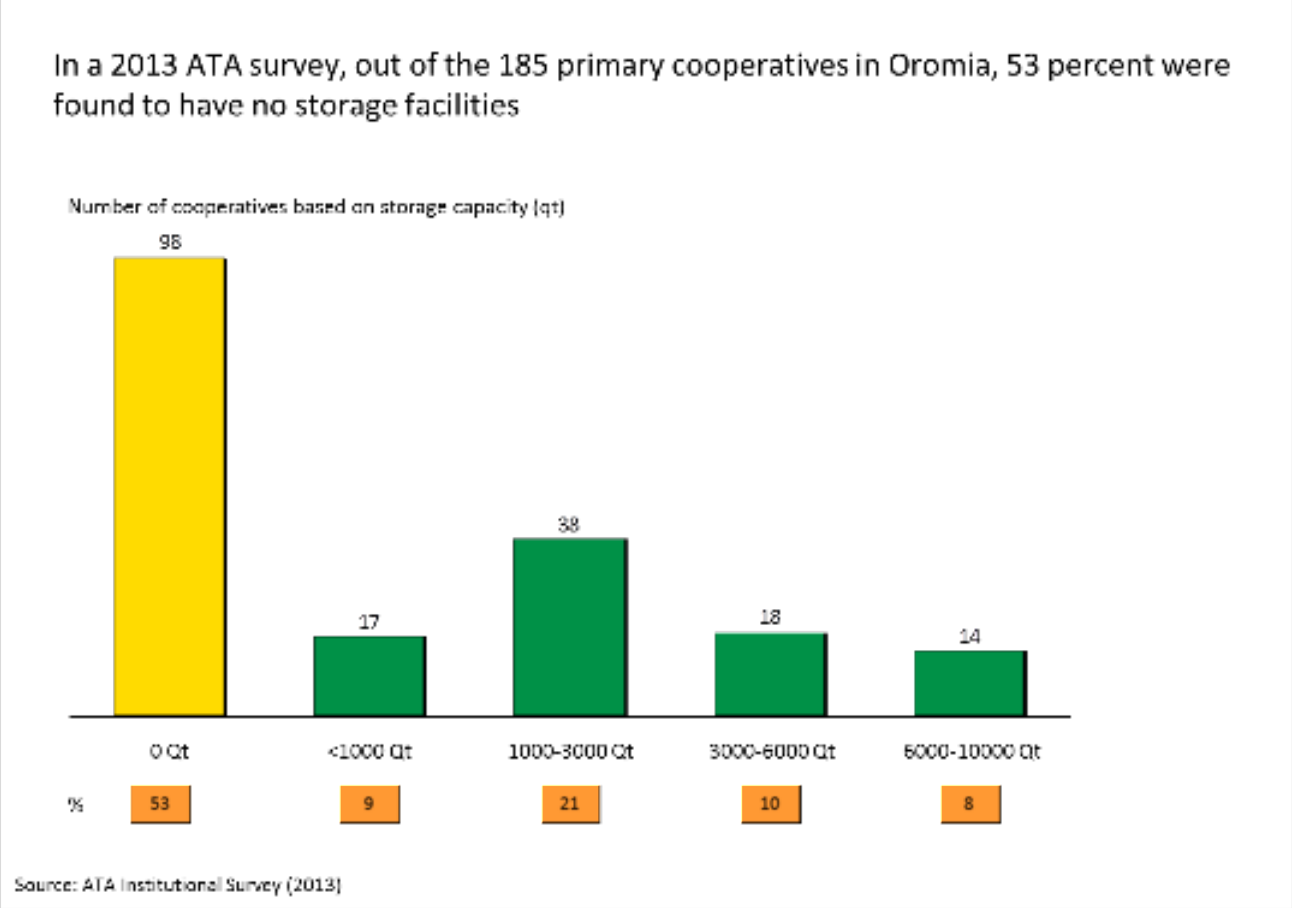
There is very limited seed storage capacity in Ethiopia. With the exception of experienced seed producers such as ESE and Pioneer, most seed producers rent storage that was built for grain, or worse, for chemicals, which can cause contamination and damage to the germination process due to sub-optimal moisture content of the air in the room.

These gaps are especially true of cooperatives, which lack both storage facilities and management skills. The storage facilities in most cooperatives are multi-purpose. They serve as storage for various agricultural inputs and outputs, which results in fast deterioration of seed quality. Furthermore, cooperatives lack knowledge on best practices of seed storage management, which contributes to product losses. Per the exhibit below, stakeholders have pointed out that except for large, well-established cooperative unions, very few cooperative unions and primary cooperatives have transport and storage facilities that are appropriate for seed.

Additionally, the certified channels / retailers (e.g., primary cooperatives, private agents) in the Direct Seed Marketing approach will be required to have appropriate storage facilities and trained / inspected to ensure they follow best storage practices.

One critical point to consider when assessing the lack of investments made by marketing agents is a lack of access to sources of financing; this is a cross-cutting constraint at all points in the seed value chain - for research institutions, producers, agents, and farmers.

Exhibit 20



Intervention F3.7: Establish more robust transportation, logistics, and storage systems for seed, and better financing for agents

To avoid the possibility of seed being adulterated, or mixed with grain, during the time of transportation, there needs to be effective tracking. Furthermore, seed must be stored in proper facilities that have been designed and built particularly to address the risks associated with seed storage. The stores need to provide sufficient space such that seed bags are not piled up in too many layers; this results in the seed grains in lower layers getting physically damaged and reducing their likelihood of germination. The storage facilities should also be built to minimize infestation by pests such as rats and weevils while providing adequate ventilation and product specific storage spaces. Moreover, cooperative personnel must be equipped with the required seed warehouse management skills.

In terms of developing these facilities, both public and private actors should work to provide resources to agents. More importantly, improved access to finance is also important for agents such that they can make these upfront investments; this can be done through a variety of instruments (similar to farmers), including credit guarantees and revolving funds.

Chapter 3: Regulatory system

The regulatory system is a cross-cutting component of the seed system. Strong regulation is a critical means to ensure that that seeds meet the minimum standard through all stages of the process, from variety development and registration, to seed production, seed marketing, and distribution.

The core activities in regulation include quality inspection of seed production fields, as well as laboratory testing of seed samples from multiple sources: processed seed of newly harvested fields, carryover seed, and seed from retail shops. The mechanism of response is through reports of accepted or rejected seed fields and lots.

Currently, the national seed regulatory system consists of quality standards and seed-related legal frameworks at the federal level, with the majority of implementation at regional level. The Federal system is expected to ensure consistency across regions and facilitates through application of standards by Regional Authorities, which are well positioned to support and partner with local stakeholders. This Federal-Regional role sharing is compatible with Ethiopia's broader federal structure in which the federal body focuses on coordination, export-import issues, certifying federally registered companies, and laboratory accreditation.

Other countries that have comparable government structures and development needs have similar role-sharing arrangements between the federal and regional levels. India's National Seed Board, previously Central Seed Certification Board (CSCB), is a federal level body that is mandated to coordinate, oversee and assist State Seed Certification Agencies (SSCAs). The SSCAs then conduct spot checks and certification to ensure that quality seed reaches farmers. ***Case Study 3*** briefly summarizes India's seed regulatory system and highlights lessons for Ethiopia.[26]

[26] Santhy V. et al., 2008; Ravinder R.C. et al., 2007; Govindan A. et al., 2003

In Germany, the same principle applies through the "Working Group of the German Seed Certification Agencies," which is responsible for coordinating and ensuring uniform technical application of regulations within the seed certification procedure. The Working Group has also established guidelines for field inspection, sampling, packaging and labeling, accreditation of seed testing laboratories, and field inspection. At present, in Germany, there are 15 Seed Certification Agencies which work closely within the framework set by the federal Working Group. Germany's National Seed Act provides the legal provision for this Federal authority.[27]

3.1 Objective, bottlenecks, and interventions

An autonomous and impartial regulatory system that sets, revises, and enforces seed quality standards across the system to protect all stakeholders, especially farmers

Bottlenecks and interventions around regulatory structures keep in mind two critical areas:

- Regulatory structures need to be *autonomous* (finance, managerial and technical) from the seed industry so that they can enforce standards impartially among all producers and distributors for the benefit of farmers.

- Regulatory structures need to have sufficient capacity - vehicle, equipment, staff capability, room space, and other factors, so that they can enforce standards thoroughly across the industry.

In addition, the regulatory system also needs to make farmers aware of their rights to good quality seed and actions they can take to protect themselves against fraud and adulteration. Finally, the system should be robust enough to share and adopt technologies and harmonize standards and protocols with other countries.

CASE STUDY 3: India's seed regulatory system[11]

Reforms

- The Seed Act of 1966 provided for the establishment of Seed Certification Agencies (SCAs) in each state of the country to function according to the following principles:
  - Autonomous entities adopting standards and procedures that are uniform throughout the country
  - Not to be involved in the production and marketing of seeds
  - Operate on no-profit no-loss basis
  - Maintain adequate staff trained in seed certification
- This Seed Act also provided the impetus for setting up both Central and State Seed Laboratories to carryout seed analysis
- Seed Control Order of 1983 and National Seed bill of 2004 are other prominent legal provisions which:
  - Enabled the setting up of the National Seed Board (NSB), previously the Central Seed Certification Board (CSCB) which is mandated to advise the government on all matters relating to seed and coordinates/oversees the functioning of all State Certification Agencies
  - NSB is mandated to centrally prescribe minimum standards for parameters including germination, genetic/physical purity and seed health
  - All seeds for sale and distribution in the market would have to be registered with the NSB

Outcomes

- Currently, 22 states in India have their own seed certification agencies, enabling Indian farmers access to best quality seed
- Seed analysts of different SCAs analyze samples according to procedures laid out in the Seed Testing Manual published by the Indian Council of Agricultural Research (ICAR)
- SCAs are entrusted to outline the procedures for submission of applications for growing, harvesting, processing and storage of seed intended for certification

Lessons for Ethiopia

- A national regulatory entity autonomously responsible for designing standards and legal frameworks, overseeing foreign investments and coordinating regional seed certification agencies, would best serve Ethiopia's context i.e., Federal-Regional role sharing through coordination and implementation respectively.

[27] Working group of the German Seed Certification Agencies, 2011; Certification of seed potatoes in Germany, 2011

Interventions around variety release and registration, as well as downstream quality control, are largely dependent on a strong regulatory structure. The specific bottlenecks and interventions are listed below.

Bottlenecks and interventions for the Regulatory System				
	Bottlenecks		**Interventions**	**Owners**
R.1	Regulatory institutions lack autonomy and role clarity	R.1	Restructure existing federal and regional regulatory entities	MoA/RBoAs Regulatory
R.2	Regulatory institutions lack capacity	R.2a	Strengthen the capacity of existing seed labs, regional, and federal regulatory bodies	MoA/RBoAs Regulatory
		R.2b	Enhance Field Inspection Capacity	MoA/RBoAs Regulatory
		R.2c	Ensure financial viability / sustainability of regulatory institutions	MoA/RBoAs Regulatory

As indicated, the primary bottlenecks are around autonomy and degree of capacity.

Bottleneck R.1: Regulatory institutions lack autonomy and role clarity

Seed regulators need a certain level of autonomy and role clarity in order to enforce standards consistently and impartially among all stakeholders in the industry. This is especially needed where there are institutional linkages between research institutions, producers, and distributors.

Autonomy: Currently, the federal MoA and Regional BoAs oversee regulation of the seed system and other inputs. BoAs manage the Regional quality control labs which employ inspectors and lab technicians. This creates a conflict of interest due to potential biases toward public regional seed enterprises. Ideally, inspectors and lab technicians should make objective decisions on seed quality, rejecting all seed that does not meet minimum standards regardless of producer. Inspectors and technicians need to be able to document and submit their findings to the regulatory institution without the influence of seed volume interests of high level officials within BoA or fear of retaliation by the concerned seed producer or distributor. In cases where there is disagreement, their findings will need to be challenged through the appropriate appeal process following legal procedures.

Role clarity and coordination: The new seed proclamation that is made official on January 2013 gave the regions a new mandate to administer its articles in their respective regions. While Regional Bureaus lack an actionable coordination mechanism, the federal directorate is expected to take this responsibility.

Intervention R.1: Restructure existing federal and regional regulatory entities

Regulatory agencies in any country are mostly independently organized, but report to their respective ministries. The reason for this is while regulatory bodies need to operate at a certain autonomy level; they are enforcing regulations that have considerable consequence and need to operate within the political system of the ministry.

To meet the requirements of the revised seed law, restructuring both federal and regional regulatory bodies is essential to become consistent with the new proclamation. As such, the MoA and Regional Bureaus will need to enhance or set up the appropriate institutions that are defined in the law and provide them with the necessary organizational structures. They also need to be separated from seed quantity- and quality-oriented interests of public and private producers, have clearly defined roles, and be staffed with well qualified personnel. These factors are critical in successful organizations such as KEPHIS (see **Case Study 4**).

The two areas that are critical are 1) clear guidelines that define the regulatory scope and 2) an organizational structure with self-management power in terms of human resource, finance and decision making.

Per the Seed Law, the federal regulatory bodies are expected to be responsible for the following:

- Development of the legal framework
- Support of technical capacity building
- Oversight of regions for consistency in implementing national seed proclamations and regulations
- Variety release and Plant Variety Protection
- Accreditation of seed laboratories
- Issue certificate of competence for multiregional enterprise
- Oversight of the import and export of seeds and business

CASE STUDY 4: Kenya undertakes parallel reforms of increasing regulatory capacity while de-regulating seed market

Kenya Plant Health Inspectorate Service (KEPHIS)

Autonomous regulator

- In 1997, KEPHIS was established as a national seed regulatory agency under the Ministry of Agriculture, and is governed by a board of directors.
- Its mandate includes variety release, licensing and seed quality certification some of which were formerly done by the Kenya Agricultural Research Institute (KARI).
- To achieve its mandate, KEPHIS provides 5 major services:
  1. Plant Variety Protection
  2. Seed Certification
  3. Phyto-sanitary Services including Biosafety
  4. Agro and Agri-Input Formulation Analysis
  5. Farmer Advisory Services
- In addition to establishing KEPHIS, Kenya increased the number of seed quality control labs.
- KEPHIS charges fees for its services.
- KEPHIS is now authorized to outsource activities like certification and testing to qualified individuals on its behalf, enabling it to accelerate processes like variety testing, which has been cut from 3 years to 2 years; it is therefore to expand its level of services.

Result: Increasingly Competitive Industry

- Number of registered seed companies increased from 13 in 1998 to 75 in 2008 (although Kenya Seed Corporation, still holds large market share)
- Number of new maize cultivars released increased from 2 public and 1 private between 1984 and 1993 to 11 public and 60 private between 1994 and 2003
- Private companies are increasingly becoming involved in research (producing and owning their varieties) and extension/popularization of these varieties.

Lessons for Ethiopia

- The expansion of industry – a result of growth of existing producers and entry of new ones – requires building of a strong regulatory system. Regulatory institutions will facilitate the delivery of high quality seeds by supporting research, producers, as well as farmers. They can enforce various legislations that have jurisdiction over seed including PVP, bio-safety, quality standards, etc.

The regional bodies are meant to implement, test, and enforce regulations around quality:

- Implementation of national legal frameworks
- Technical, financial, managerial and infrastructure capacity building within the region
- Field inspection, seed quality testing, decision on rejections of seed fields and seed lots
- Enforcement of regulations

There are certain areas where the Federal regulatory body needs to closely coordinate with regions – namely seed certification training, dissemination of legal frameworks, and conducting visits to confirm that the regions' activities are aligned with legal frameworks, and ensuring that regional seed laboratories fulfill requirements.

Bottleneck R.2: Regulatory institutions lack capacity

Regulatory capacity is currently insufficient at all levels. Regions have limited number of staff and vehicles, a situation exacerbated by the continued expansion of seed production.

A. Field Inspection capacity gaps

Since 2000, the demands on field quality control in Ethiopia have greatly increased due to three main factors:

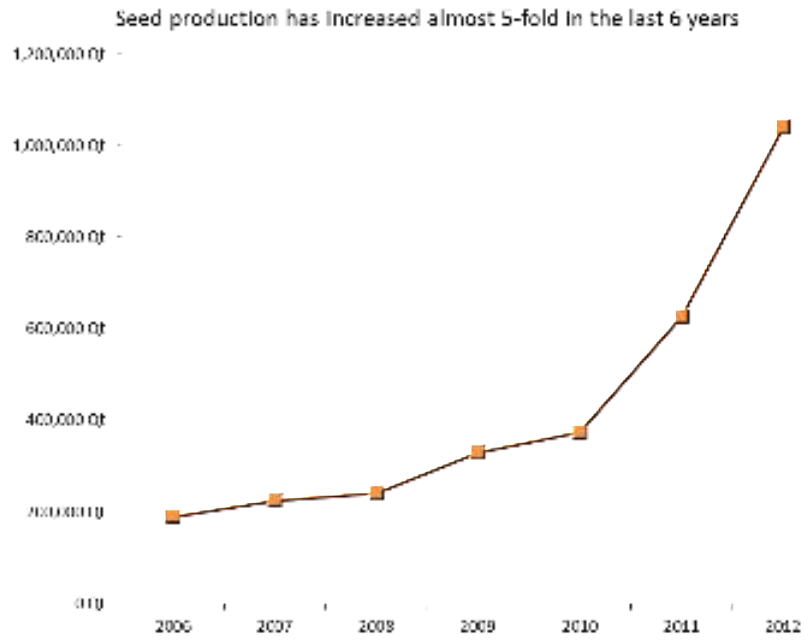
i. Fivefold increase in seed production in terms of area as well as volume
ii. Increase of seed producing companies/enterprises from 2 to over 30
iii. Greater fragmentation of production sites

Prior to 12 years ago, production sites were clustered, making it easier for field inspectors to inspect large areas in limited time. Over the past 12 years, there has been a push to include more smallholder farmers in seed multiplication, resulting in smaller and more dispersed seed production plots. Field inspectors currently spend much more time visiting these smaller sites than they did before.

In spite of the above changes in the seed sector, the field inspection capacity of the seed labs has remained constant. In particular, there is a shortage of vehicles for field visits, rendering most labs unable to visit more outlying seed producers or out-growers. More than 90% of the seed labs are still working with one vehicle granted by the World Bank 12 years ago. This limits inspection of all seed produced in the sector and thus large amounts of seeds are sent to market without passing national seed standards. While vehicle procurement will remain critical, interventions that address broader issues, e.g., clustering out-growers will be equally essential to ensuring seed labs are equipped to inspect seed. Per ***Exhibit 21*** below, the dramatic increase in seed production is accompanied by fragmentation of seed-plot sizes. Support from ATA significantly increased capacity of the seed labs in 2012 (per ***Exhibit 22***), demonstrating the impact of effectively supporting these seed labs.

Exhibit 21

Since the establishment of the regional seed labs, seed production has increased drastically while the seed-plot sizes have become very fragmented



Increased seed testing and field inspection demand on Seed QC Centres

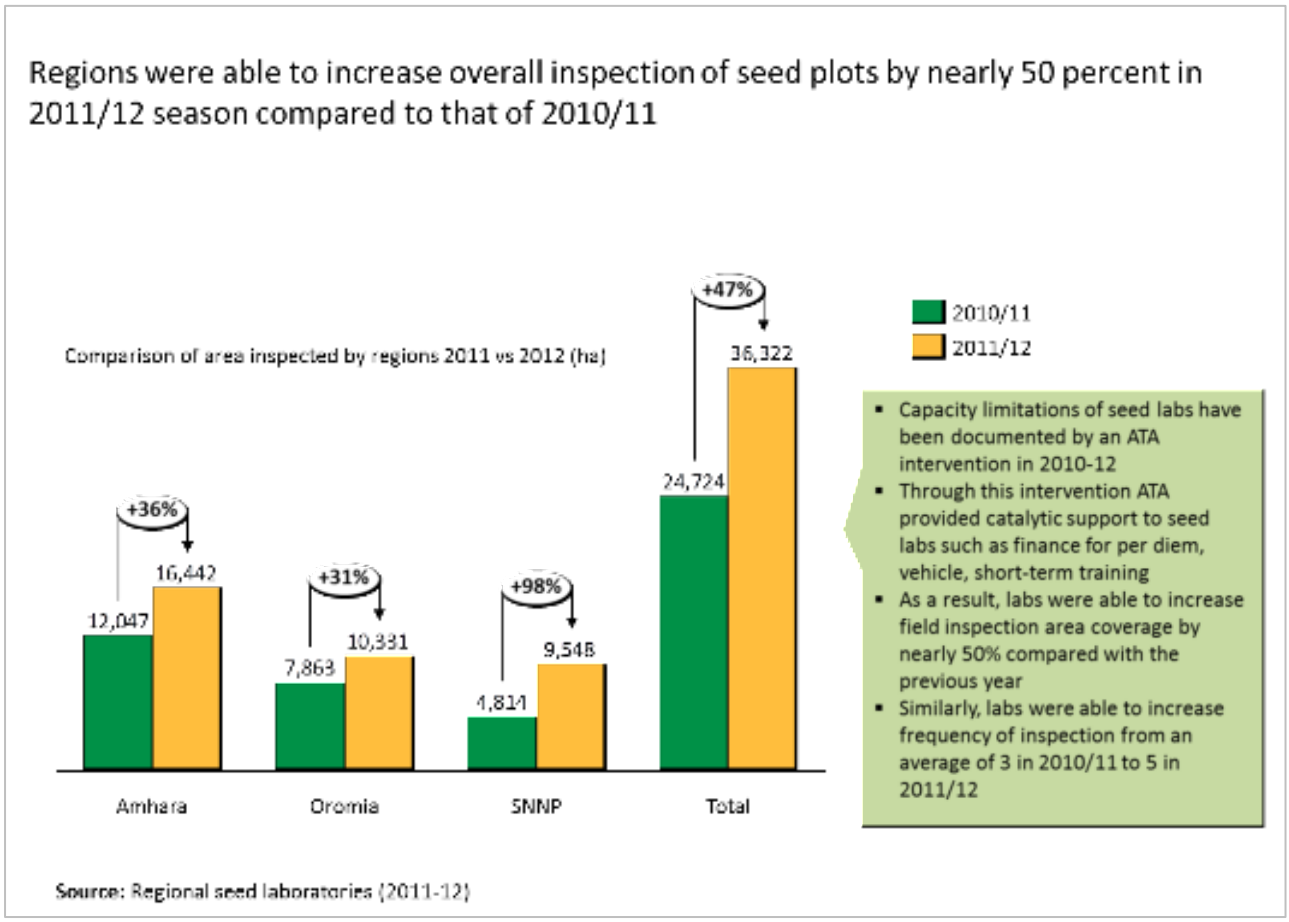
Seed production becomes more fragmented

>500% Increase in National Production

PSE & Private Seed Enterprise increase from 2 to +30

Source: "Farmers, seeds and varieties: Supporting informal seed supply in Ethiopia", Thijssen M.H., 2008

Exhibit 22



B. Seed sample testing capacity

In-laboratory seed quality testing has to be primarily conducted between February and May; given this narrow time window, sufficient resources to conduct seed quality testing are critical. Current challenges include insufficient room space, lack of equipment, and spaces that currently combine office and lab-related activities. As a result of these inadequate resources, testing all the required number of samples across the various factors has not been possible. For example, the seed health test is an important indicator of seed quality, but it is not used in a consistent fashion due to limited testing equipment, room space and trained personnel.

Though seed labs were established and equipped by the World Bank 10-15 years ago, they still require additional resources to replace out-dated equipment and to serve increasing production volumes. Increasing seed testing efficiency enables the on-time reporting and quality control that ensures delivery of seed to farmers on time.

C. Human Resource Gaps

Most seed labs are staffed with technical experts who are under skilled due to high staff turnover, which is due in part to low compensation. A lack of expertise results in a lack of trust and credibility when the results of the seed labs act as gatekeeper for rejection or approval.

Theoretically, the Ministry of Agriculture and BoAs support regional quality control labs through periodic training. However, interviews with BoAs indicate that the training programs could be improved to be more comprehensive. For example, current training does not reflect the most up-to-date information on newly released varieties and their morphological descriptors, testing equipment maintenance, differentiating noxious seeds and seed borne disease; therefore, inspectors are not fully aware of the expected morphological characteristics of new varieties, weeds and diseases, leading to poor inspection results.

In addition, MoA-Animal and Plant Health Regulatory Department (APHRD), which provides some of the training support for BoAs, is severely constrained by staff size. In 2011, the department was working with less than 4 experts, who are expected to work on regulatory issues across the agriculture sector in the country, not just the seed system. Moreover, the BoAs, which are expected to oversee the overall implementation process in their respective regions, are not equipped with the required human capital in terms of professional skills and experience.

Intervention R.2a: Strengthen the capacity of existing seed labs, regional, and federal regulatory bodies

A needs assessment study led by ATA recommended that the existing labs should be expanded, in line with their strategic seed production locations, as opposed to building new labs in less strategic locations. Strengthening the capacity of existing seed labs will focus on the following key areas:

- **Improving coordination of seed producers with seed labs**

  As the period for timely field inspection and seed testing is short, there is a need for high level coordination between seed labs and seed producers. The producers should notify the seed labs of their production plans well in advance along with expected seed inspection and testing times. This will prevent the delay in quality certification and hence the delay in seed delivery. Additionally, producers and growers should register their seed production plan ahead of time to regional regulatory agencies. Regional and federal seed regulatory bodies should also advise seed producers about their plans in executing their quality control activities.

- **National accreditation of Regional seed labs**

  Accreditation of regional seed labs is the responsibility of the federal government. Regions should work closely with the Ministry of Agriculture to ensure that labs are performing up to seed lab national standards. Accreditation of regional labs will help ensure the quality of tests conducted at the labs is consistent and trusted by all actors across the seed value chain.

- **Develop Expertise of Technical Staff**

  In order to develop the expertise of technical staff at the Seed labs, technical staff should be given trainings. Two distinct training programs are recommended by the ATA to focus on short and long term technical development. Beyond increasing the skill level of technical staff, the trainings will give incentive for staff to stay in seed labs longer. Retaining staff also has the benefit of developing institutional knowledge.

- Short-term training could focus on increasing the capacity of seed laboratories in terms of basic inspection and seed lab testing procedures, with international exposure visits as well. The long-term component of the recommended training is to advance technical staff in their academic studies. It is necessary to strengthen domestic post-graduate studies in seed technology to meet the demands of high-level seed QC officers. Ideally, this will involve tailored trainings in consultation with higher-education institutions to address specific areas of specialization.

- **Reduce staffing turnover through higher wages and/or benefits for technical staff**

  High turnover has been a critical issue for seed labs. ATA's needs assessment determined a key contributor to staff retention would be an increase of the wages and benefits of the technical staff. Beyond higher compensation, other ways to improve retention are effective training, an organizational structure with opportunities for promotion, and other benefits such as housing and family support.

- **Increase technical to support staffing ratio with specific focus on field inspectors**

  Regions should assess the current workload of the Seed labs and reconfigure staffing to address the high demand workload areas. Currently, certain regions have a high administrative-to-technical staff ratio, which demonstrates a poor use of resources considering the purpose of the Seed labs. As much as possible, seed labs should rely on regional administrative support and save budgets allocated to the Seed labs for technical staff. Most notably, expectations for outputs of field inspectors are unrealistic considering their workload. Regions should increase technical staffing, specifically for field inspection.

  One way to manage resources is to employ a generalist approach, hiring technical staff that both inspect and test seed. During times of high inspection demand lab staff will participate in field inspection. Immediately upon completion of inspection, when seed samples are tested, inspection staff will participate in seed testing. Legally, a field inspector cannot take responsibility for testing seeds he/she collected; but to address this, seed lab heads can arrange possible reshuffling.

- **Expand lab infrastructure**

  Regions should invest in expanding facilities to enable more area for seed testing. Storage, office space and testing labs should be in distinct rooms as to allow timely and quality testing.

- **Increase access to equipment**

  Quality lab equipment will enable labs to test samples more quickly and precisely.

Intervention R.2b: Enhance Field Inspection Capacity

In addition to the general recommendations above, there are two recommendations specific to increasing the seed labs ability to conduct field inspections: access to vehicles and clustering production fields.

Vehicle Access. As discussed, vehicles are a critical component of effective field testing because they enable the very fundamental component of certification: visiting fields before harvest. The timing of this event is sensitive and requires multiple vehicles to be available continuously for a limited, but critical, time.

Therefore, the ATA recommends that the region and other developmental partners invest in additional vehicles for Seed labs.

Production Field Clustering. In addition to increased vehicle access, clustering production sites will allow for the efficient use of resources and the ability to inspect more fields. Clustered production makes field inspection more time efficient with less travel time between fields. At the woreda and regional levels, governments should both focus on attracting farmers with sufficient area for high levels of seed production, as well as helping smallholder farmers consolidate their plots so that they can be inspected as if it were one plot. Furthermore, the governments should support farmers to rent or lease neighbouring lands to further increase production. The regions can follow different options to attract these larger farmers and encourage them to invest in seed production.

Role of Inspection in Seed Production and Distribution. As discussed in **Intervention 3.2** (refer to page 55), regional regulatory bodies should not only be responsible for managing seed quality at production, but also at distribution, especially as Direct Seed Marketing (DSM) scales up. In terms of certification, the regulatory system will need to ensure that all distributors fulfill the minimum standards for maintaining quality of seed, particularly storage. Prior to seed sales and distribution each year, a team of regulatory experts should evaluate marketing agents nominated by seed producers based on a range of factors including level of education, experience selling seed, experience selling other products, storage practices (e.g., separation of seed and fertilizer, proper ventilation), and other factors. The best agents should receive a certificate of competence of distribution, but a subset of agents can work under mentoring and closer oversight of the regional regulatory bodies.

Additionally, regulatory institutions will need to have the necessary capacity to spot-check and inspect seed distributors regularly and make sure that they comply to the standards listed previously. On the side of capacity, seed distributors need to be aware of policy requirements for quality control and have the resources to build quality control infrastructure. This could be achieved through training programs as well as support for accessing storage and transport facilities through credits. Over time, producers will have a natural incentive to take responsibility for these activities, and it is critical for producers to manage quality both upstream (at out-grower level) and downstream (at distributor level).

Intervention R2.c: Ensure financial viability / sustainability of regulatory institutions

In order to reduce the cost burden on the federal and regional governments, it is critical to establish structures that enable sustainability of inspection. One option to enable this is to set up inspection and certification fees such that seed companies are obligated to pay for the certification service provided by the regulatory bodies. The details of the inspection fees could potentially be articulated within the seed regulation or through directives.

Chapter 4: Intermediate seed sector

4.1 Importance of Intermediate Sector

In the last two decades, there have been multiple efforts to improve farmers' access to seed of preferred varieties, at the right quantity and quality, in a sustainable manner.

In this vein, a substantial effort has been the introduction of *community-based seed production systems* in which farmers' groups organized at local levels produce seed of mostly modern, and to some extent, local varieties. These community-based producer groups are organized and supported by a combination of development partners, regional bureaus of agriculture, seed enterprises, etc. These groups can include cooperative seed producers' unions that are not formally licensed or registered in the production of certified seed as part of the formal sector.

The **Intermediate Sector** is intended to formally recognize such community-based groups as a separate entity from the informal and formal sectors. Although are several groups that could fall into a middle category outside of formal and informal, ***Section 4.2*** discusses what specific groups are part of the intermediate sector, what groups are not part of the intermediate sector, and the rationale for this categorization.

The specific rationale for delineating an intermediate sector includes the following factors:

- **Encouraging a decentralized production and distribution system to bridge the formal and informal seed sectors, especially to fill gaps in less profitable crops such as most self-pollinating varieties (SPVs) that PSEs cannot reach.** In the formal sector, various factors affect the scale and complexity of seed production, storage, and distribution, presenting a major challenge in the effective delivery of seed to farmers, particularly in marginal and underserved geographies/crops. As a result, the formal sector tends to focus on a few commercial crops (hybrid maize and wheat) while neglecting less profitable crops (most SPV cereals, pulses, oil and root crops) that are critical for food security of smallholder farmers. It is the intermediate sector that can fill this gap through localized production.
- **Reducing the burden on constrained regulatory and quality control authorities.**[28] As opposed to the conventional seed certification process, the Quality Declared Seed (QDS) regulatory scheme employs a less stringent process, which reduces the burden on seed regulatory authorities. Under the QDS system, community-based producers are allowed to multiply and market seed without undergoing the full inspection and quality testing procedures. In this scheme, producers declare the quality of their seed, while following the limited minimal quality control established by the regulatory authorities. That said, satisfying the QDS standard still requires a robust internal quality assurance scheme.
- **Improving linkages and interactions between the formal and informal sector.** Community-based seed producers are a potential pathway through which farmers in the informal sector can group together and create self-sustainable seed production organizations that have the potential to grow into private companies in the formal sector.

[28] Regional seed regulatory system report: current status and recommendations (2013)

- **Improving access to and adoption of newly released modern crop varieties and superior local varieties.** Sizeable community-based seed producers are a supplementary route to introduce the best varieties of seed (in addition to the formal sector), given their scale and reputation in their local communities.

When implemented effectively, community-based seed production schemes have several tangible advantages, including:

i. Better suited to provide farmers with a broad range of seed products that are less profitable for large-scale seed enterprises, specifically in the case of self-pollinating varieties
ii. Potentially reduce the costs of seed production and transportation
iii. Improve adoption of new crop varieties by potentially serving as demonstration sites
iv. Increase timeliness of seed delivery through alternative channels and models
v. Provide more direct support for farmers to generate more income.

Despite the large potential advantages, such schemes usually suffer from systemic challenges, including:

i. Low quality seed due to lack of access to formal quality control structures
ii. Poor seed recovery from participating farmers
iii. Overdependence on technical and infrastructural support from public institutions and development partners
iv. Limited financial self-sustainability

Given the above background, it is important to recognize community-based seed production and distribution programs as a separate sector has distinct components, yet overlapping and connecting features with the already recognized formal and informal sectors.

4.2 Defining the intermediate sector: key players involved

Definition of the newly recognized intermediate sector

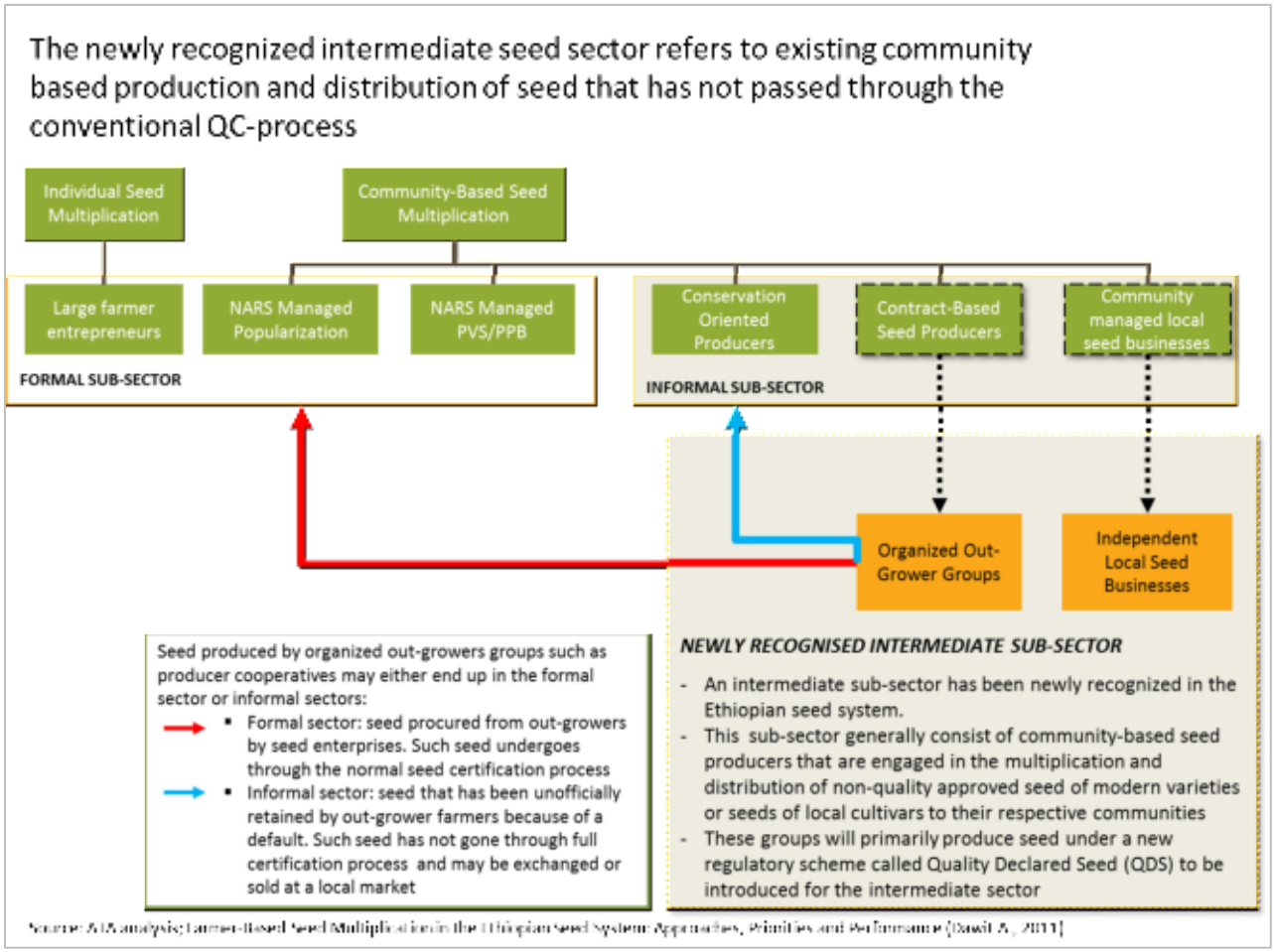
The intermediate sector is specifically defined as business-oriented community-based groups (producer cooperatives or unions) that are engaged in the multiplication and distribution of noncertified seed of either modern or local varieties:

- The multiplication and distribution is generally within that local community and nearby areas (as opposed to farmer entrepreneurs that may scale beyond the local community).

- These groups are not formally registered, but have the option of applying for a newly introduced seed regulatory scheme, Quality Declared Seed (QDS). As part of the seed proclamation, QDS is a less stringent quality standard and is meant to complement the existing convention of the formal quality control system to

There are specific boundaries drawn around the intermediate sector. While there are different types of community-based, mid-scale seed production activities with varying objectives and actors - the two areas that comprise an **intermediate sector** are the organized out-grower groups and independent seed businesses that are not formally licensed or regulated to produce certified seed.

Exhibit 23



A description of the each of the groups is below, with rationale around why the last two groups comprise the intermediate sector.

Large Farmer Entrepreneurs: A group with strong potential to distribute improved seed is the growing set of farmer entrepreneurs. However, these farmer entrepreneurs need to formally brand their seed in order to scale and grow beyond their communities. As a result, these farmer entrepreneurs directly enter the Formal Sector from the Informal Sector since the proclamation requires them to formally register as a seed enterprise. This is different from community-based production systems that can grow in membership and scale without registration.

NARS Managed Popularization: The research-based CBSM model focuses on the introduction of new crop varieties into the local seed system by NARS through direct involvement of extension experts, development agents, and farmers. One key popularization approach is the demonstration of technologies on farmers' fields in which farmers and development agents are actively involved before launching official popularization

through the extension system. The other popularization approach is the pre-scaling-up initiative[29] launched by different agricultural research institutes. This initiative was designed to improve the dissemination of agricultural technologies to locations that have limited access to available technologies through the combined effort of research and extension.

NARS Managed Participatory Variety Selection (PVS) and Participatory Plant Breeding (PPB): This approach was designed and initiated in response to poor adoption of modern varieties that are developed in research stations of different research institutes[30]. Two approaches have been employed by Ethiopia's NARS as part of its research activities: Participatory Variety Selection (PVS) and Participatory Plant Breeding (PPB)[31]. Although not identical, these two approaches represent similar models with minor differences in the timing of farmer involvement. PVS is limited to the testing of finished crop varieties, while PPB concerns the entire breeding process.[32] The main target goal of the PVS and PPB approaches is to improve adoption of new varieties through:

i. better interaction between researchers and farmers in identifying desirable traits
ii. the strengthening of farmers' knowledge in varietal selection and maintenance techniques
iii. better access to different germplasm pools for farmers' own experimentation and selection of local varieties

Some of the challenges to implementing PVS and PPB potentially include high costs compared to conventional breeding, slow pace in institutionalizing PVS/PPB into NARS crop improvement programs, and limited expertise of researchers in PVS and PPB.

Both NARS Managed Popularization and PVS/PPB involve formal contracts with research institutions and are intended to inform variety selection and registration for established public and private seed producers, as opposed to local communities. As such, they should be considered part of the formal sector.

Conservation-Oriented Producers: Actors in this category promote the conservation of crop genetic resources by working towards seed security of local varieties (landraces). One of the most common strategies to achieve this is the setting up of local conservation institutes such as Community-based Seed Banks (CSBs). CSB's help mobilize local farming communities towards conservation and utilization of crop genetic resources at the grass root level. This particular type of CBSM is mainly located in areas that are prone to frequent drought, such as parts of Tigray and the central rift valley of Oromia.[33] On the other hand, some CSBs have also been setup in biodiversity hotspots that are known to possess high crop genetic diversity. In addition in the areas where crop landrace seeds are aggressively replaced by improved seeds, farmers may neglect use of landrace seeds due to their inherent low yielding characters in all agro-ecologies. Monocropping practices may also give rise to the loss of landrace biodiversity.

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[29] Pre-scaling up program was implemented since 2008 to disseminate of agricultural technologies such as new crop varieties before full-scale expansion
[30] Belay et al. (2008) and Witcombe (2005)
[31] PPB- Participatory Plant Breeding; PVS- Participatory Varietal Selection
[32] Witcombe J. (2005) and Almekinders et al. (2007)
[33] Alemu D. (2011)

However, these operations are generally at too small a scale and are not well-resourced enough to serve as a pivotal actor in filling critical gaps in self-pollinating varieties (SPVs). Some of the major challenges include lack of adequate technical and infrastructural capacity of CSBs, lack of financial sustainability due to dependence on NGO support, and weak support from and integration with existing government structures (e.g. extension and research system)[34]. As such, they are considered as part of the Informal Sector as opposed to the Intermediate Sector.

The primary groups that form the Intermediate Sector are contract-based seed producers that have potential to become organized out-grower groups, and community-managed local seed businesses that have the potential to become independent local seed businesses:

Organized out-grower groups: There are a range of groups that produce and market seed for large-scale seed companies through contracts. While many of them will continue to produce under contract, a subset of these groups can become independent producers in their communities.

The out-grower mode of production was started by the Ethiopian Seed Enterprise (ESE) in the 1980s with the aim of multiplying seed for crops that are technically and economically difficult to produce under mechanized conditions (mainly tef and wheat). Following this, the former National Seed Industry Agency (NSIA) designed and launched a national-wide program called Farmer-Based Seed Production and Marketing Scheme (FBSPMS) in 1997. This program was implemented in close collaboration with Regional Bureaus of Agriculture (BoAs) with five-year financial assistance provided by the World Bank.

In this scheme, PSEs, in collaboration with the regional BoAs, enter into contractual arrangements with farmers organized into producers' cooperatives or other farmer groups with clustered plots. PSE's usually organize farmers' plots into different clusters in order to simplify and streamline logistical operations such as technical supervision and support, seed collection and processing, etc. This is especially true for Self Pollinating Varieties (SPVs), as indicated by ***Exhibit 24*** on the next page.

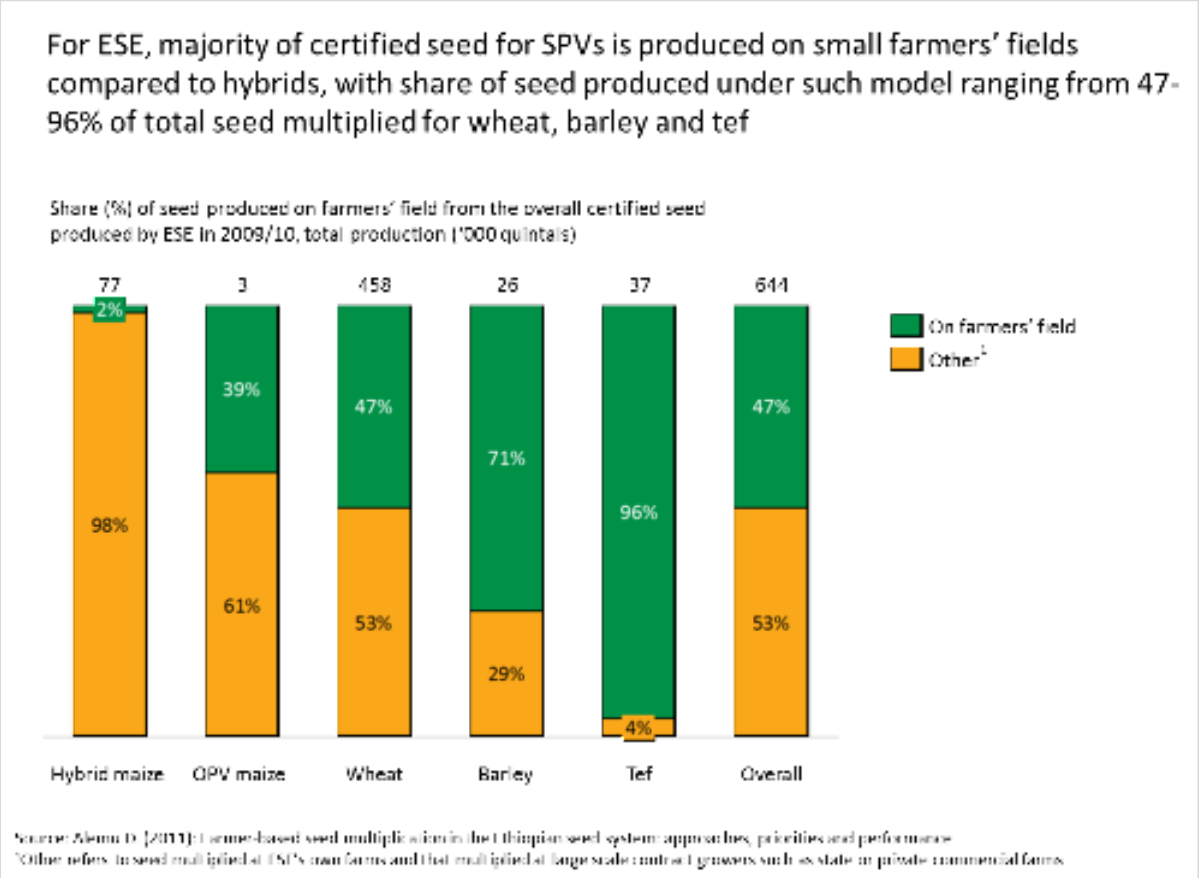
There are a couple of reasons why these contract-based producers can evolve into community-based producers:

- **Many contract-based producers already distribute to the informal sector (despite their contracts):** In a sense, out-growers already link the formal and informal sectors, since seed produced by such groups (cooperatives or unions) can enter both the formal and informal sectors. As discussed in Bottleneck and Intervention F2.5, out-growers often sell their seed into the informal sector due to factors such as lack of timely payment and favorable pricing offered by RSEs. In these cases, the withheld seed does not go through the normal certification processes, and is either exchanged among farmers or sold as seed or grain in local markets.

[34] Engels J.M.M. et al (2008: Role of community seed banks in the conservation and use of crop genetic resources in Ethiopia

- **These producers already have some of the existing infrastructure to produce at meaningful scale for their communities:** As contract-based growers, these farmers have already invested in producing seed at some degree of scale. That said, there is still substantial work to improve the operational efficiency and financial sustainability of these out-growers in order to make them effective Community Based Seed Producers (CBSPs).

Exhibit 24



As a result, effectively equipping out-growers to become independent producers in their communities will localize seed production, and also create a system that directly incentivizes them by linking them directly to their customers. Once established, these organized out-grower groups can operate similarly to independent local seed businesses, producing seed through the Quality Declared scheme (QDS); this is discussed more detail in the community-based seed producer section below.

Community-managed local seed businesses: Beyond contract-based out-growers, there are community-managed local seed businesses that have potential to become independent local seed businesses that could be engaged in the production of Quality Declared Seed (QDS). These businesses are generally producer cooperatives. Currently, these producers are not formally registered and regulated, but produce seed for their local community. While some of these businesses eventually transition into Formal Sector entities, the goal of the Intermediate Sector is to provide a route by which these independent businesses can register for QDS and supply seed to their local communities.

Seed production and marketing operations are primarily performed by the producer groups themselves with minimal support by BoAs and development partners. Most of these producers focus on selected SPVs (OPV maize, wheat, barley, soybean, lentil, etc.) and to a limited extent, hybrid maize multiplication by a few experienced producers.

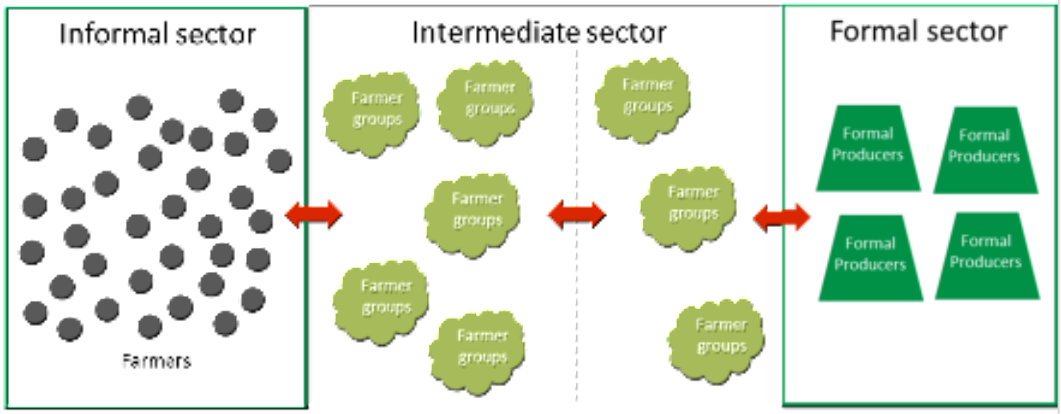
Within producer cooperatives, there are a range of maturity levels. At their initial stage of development, many producer groups may only produce non-quality approved seed for their own community (at district/ kebele level), hence informal seed. At this stage, the quality of seed would have an informal status, i.e. not quality approved by the responsible regulatory body. However, as their capacity develops or advances, they may market seed beyond their community. In this case, the Quality Declared Seed (QDS) system, a new regulatory scheme to be introduced for the intermediate sector, will provide a more streamlined method of quality control for these groups.

In the longer-term, some of these producers may also grow and transition into formal sector entities by producing certified seed. In fact, a few producers' cooperatives have already demonstrated this transition: for example, Edget, Meki Batu and Becho Wollisso Unions. However, not all producers who want to produce certified seed actually become formal producers due to various challenges. Currently, many of these unsuccessful producers end up returning to the informal sector. The goal is for Quality Declared Scheme (QDS) to cover these earlier stage businesses that have not transitioned to formal entities. ***Exhibit 25*** depicts the different routes of inter-sectoral transitions that are expected to exist among the three seed sectors, i.e., informal, intermediate and formal.

Per ***Exhibit 26***, the major operational Community-Based Seed Producers (CBSPs) face are: (i) lack of adequate technical and infrastructural capacity, (ii) weak support by and linkage with formal sector institutions, (iii) technical and logistical difficulty of clustering farmers' plots, and (iv)lack of a sustainable business model as most depend on external NGO support.

Exhibit 25

There is a continuous movement of actors between the three sub-sectors as the seed industry evolves and matures



	Informal sector	Intermediate sector		Formal sector
Primary Actors	Individual farmers saving or exchanging seed among themselves	Organized farmers groups to intentionally produce and market seed	Organized farmers groups	Seed enterprises
Organization	No organization. Seed is often a byproduct of grain production	These groups are not officially registered as producers	Officially registered producer groups	Officially registered private or public seed companies
Regulation	No Regulation	No Regulation	New scheme called Quality Declared Seed production	Conventional quality control procedure for certified seed
Varieties	Mainly local varieties	Local or modern varieties	Local or modern varieties	Only modern varieties produced and marketed

Exhibit 26

While there has been notable improvement in the performance of different farmer-based seed multiplication schemes, there is still substantial room for improvement in areas of quality, quantity, technical knowledge and finance

	Qualitative assessement of different farmer-based seed multiplication schemes				
	Conservation oriented producers	NARS managed PVS/PPB	NARS managed popularization	Contract-Based Seed Producers	Community managed local seed businesses
Quality	◔	◕	◕	◑	◔
Quantity	◔	◔	◔	◕	◑
Finance	◡	◕	◕	◔	◡
Technical knowledge	◔	◑	◑	◕	◔
OVERALL ASSESSEMENT	Very low-limited	Very low	Limited	Moderate-Limited	Moderate-Limited

●	◕	◑	◔	◡
Very Strong	Strong	Moderate	Limited	Very low

Source: ATA analysis, stakeholder interviews

4.3 Key components and overall framework of the intermediate sector

The seed value chain of the intermediate sector is comprised of three key components: community-based seed multiplication, community-based marketing and distribution and the cross cutting seed regulatory system. A schematic view of these value-chain components is presented below.

Exhibit 27

Link to Varietal Development, Registration, and Release

The intermediate sector does not have a separate mechanism for varietal development - generally, CBSPs multiply both modern and local varieties. However, to more effectively link CBSPs to varietal development, it will be critical to improve their access to early generation seed through better linkages with research centers **(Bottleneck and Intervention N1.2)**.

N1. Community-Based Seed Production

This is the first component of the seed value-chain in the intermediate sector. This includes different types of organized producer groups involved mostly in the multiplication of modern crop varieties. To a limited extent, some CBSPs are also engaged in the multiplication of seed for local varieties. As mentioned earlier, most of these producer groups are mainly organized and supported by development partners in collaboration with some public institutions (BoAs). Typically, seed is multiplied on farmers' fields that are often small and fragmented plots.

In the Ethiopia's context, two types of CBSP groups have been recognized to operate in the intermediate sector: (i) out-grower CBSPs that are contracted by formal sector seed enterprises and companies for supplying seed on contractual basis (ii) CBSPs that operate as independent local seed enterprises.

N2. Community-Based Seed Distribution

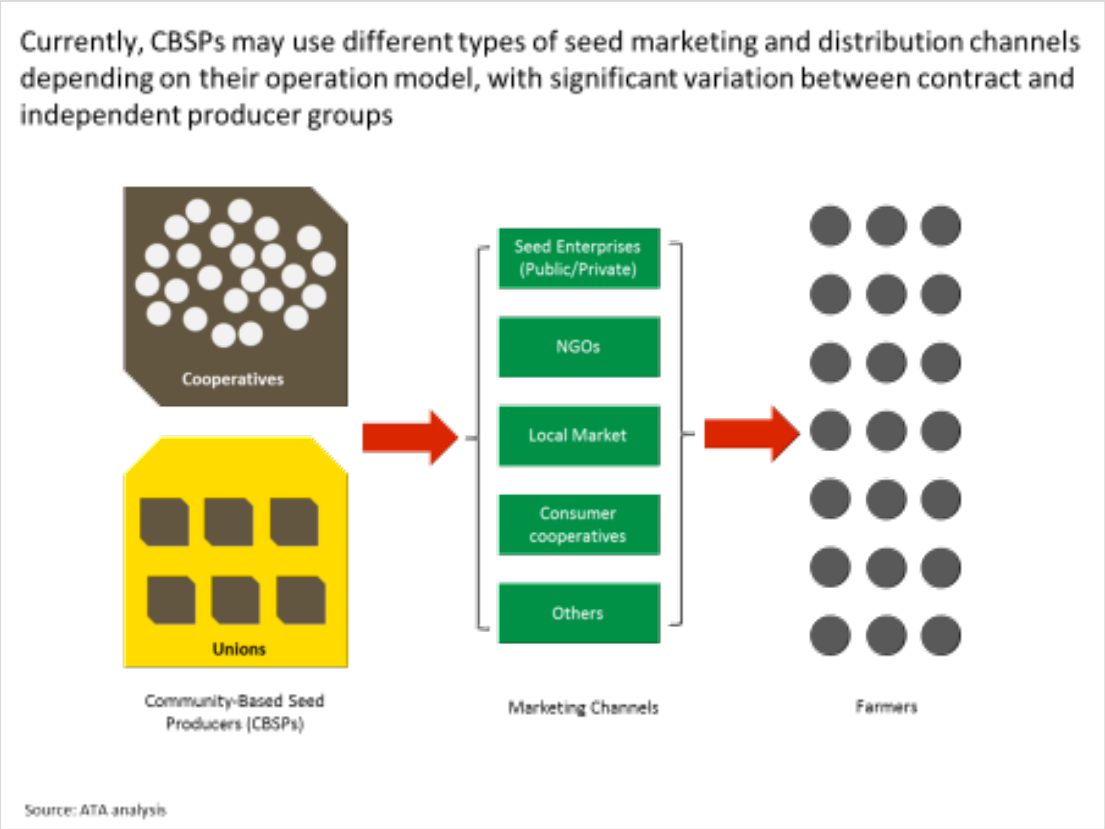
The next step in the intermediate sector value chain is marketing and distribution of seed to end-users. The two CBSP groups treat marketing and distribution of seed differently.

In case of out-grower seed production, seed marketing is the sole responsibility of seed companies/ enterprises which "buy back" the seed produced by CBSPs. Under such arrangements, participating farmers are allowed to officially retain some portion to meet their needs from the total seed output. However, many out-grower farmers are known to default on their contract by refusing to sell back seed to seed enterprises. Such unofficially retained seed can be sold as either seed or grain in local markets.

On the other hand, CBSPs that are operating as independent seed businesses are partly involved in marketing of seed. The level of involvement depends on the maturity and capacity of the CBSPs. In most cases, seed produced by these groups is either taken up by regional BoAs or development partners that usually support their very creation. However, a few of these CBSPs directly market their seed to customers.

Exhibit 28 below shows the different channels of seed marketing for the two groups of CBSPs.

Exhibit 28



R. Role of the Seed Regulatory System in the Intermediate Sector

Effective quality control in the intermediate sector requires a new approach to regulation. The existing regulatory institutions do not have sufficient capacity to conduct full quality certification across the range of community-based seed producers (CBSPs), both organized out-grower groups and independent local seed businesses. As a result, seed labs must focus resources on either conducting partial inspections of farmers' fields or only conducting inspections of plots that have been suspected of being low quality.
Given the increasing role of CBSP in Ethiopia's seed system, the less stringent quality control system is expected to be introduced, namely the Quality Declared Seed (QDS) regulatory system. In the QDS system, seed producers have the option to market without undergoing full inspection and quality testing procedures of the current regulatory system that leads to certified seed. Instead, the regulatory system will develop a limited but critical set of regulations that ensure that quality seed is being produced, although not certified. For example, designating seed as QDS may only require licensing of the producer and inspection of a small portion of the total seed produced (commonly 10%). It is envisioned that CBSPs will be the primary beneficiaries of the QDS system.

Given all this, the objective for the intermediate sector is the following:

> A well-functioning community-based seed production and distribution system operated by farmers' groups that gradually develops into independent, self-sustaining seed enterprises to sufficiently meet the local-specific needs of respective farming communities and contribute to increased income to the producers.

Exhibit 29

Despite a decent increase in the capacity of CBSPs, there is considerable capacity gap in terms of human resource and facilities critical for undertaking multiplication, storage, processing and marketing of seed

	Source of finance	Facilities	Technical knowledge	Quality	Quantity	OVERALL ASSESSEMENT
Multiplication of certified seed	◔	◔	◔	◔	◑	Limited-Moderate
Storage	○	◔	○	◔	○	Very low Limited
Processing	○	◔	○	○	○	Very low
Marketing & Distribution	◔	○	○	◔	◔	Limited
OVERALL ASSESSEMENT	Very low-limited	Limited	Very low	Limited	Very low-Moderate	

●	◕	◑	◔	○
Very Strong	Strong	Moderate	Limited	Very low

Source: ATA analysis

Component N1: Seed production in the intermediate sector

The goal for seed production in the intermediate sector is to create small to medium scale local seed enterprises that can fulfill unmet needs in seed production, namely in less profitable crops such as Self-Pollinating Varieties (SPVs). As such, a set of four bottlenecks and respective interventions has been outlined below.

Summary of Bottlenecks and Interventions

Bottlenecks and interventions for Seed Production in the Intermediate Sector				
	Bottlenecks		**Interventions**	**Owners**
N1.1	Many community-based producers are not operationally or financially sustainable	N1.1	Improve operational efficiency and sustainability of existing CBSPs so that they are able to gradually transition into independent business entities	FCA/RBoAs
N1.2	Lack of adequate access to early generation seed (basic or C1)	N1.2	Improve linkage between CBSPs and research centers which maintain early generation seed	EIAR/RARIs
N1.3a	CBSPs lack capacity to produce sufficient volume of seed to satisfy demand gaps	N1.3	Develop contractual agreements and build operational capabilities of CBSPs to improve quantity of seed	RBoAs/FCA
N1.3b	CBSPs have low seed recovery rates from their member farmers due to poor business planning			
N1.4	Quality of seed produced and supplied by CBSPs often fails to meet minimum quality standards (based on the formal certification process)	N1.4	Promote Quality Declared Seed Regulatory System (QDS) to ensure baseline seed quality	MoA/RBoA Regulatory

Bottleneck N1.1: Many community-based producers are not operationally or financially sustainable

The major reasons that contribute to the unsustainable business models of community-based seed producers include:

- **Community-based producers lack adequate access to financial resources to cover production costs**

  One of the major expenses for farmers involved in seed production is the procurement of core agricultural inputs such as fertilizer, source seed, pesticides, etc. Farmers usually lack adequate cash particularly at the time inputs need to be produced since cash becomes available only after harvest season. Credit is, therefore, an important tool for supporting farmers to afford inputs. However, smallholder farmers often have limited access to financial services. In addition, for CBSPs that operate

independently from large-scale seed enterprises, seed cleaning and storage activities also require significant cash[35].

The other major expense for CBSPs is the financing required to buy-back seed from out-grower farmers. The purchase of seed from out-grower farmers usually occurs a few months prior to seed sales and requires significant funds on-hand to pay contract farmers. As a result, CBSPs require a robust and extended cash flow. Unfortunately, conventional financial institutions such as MFIs, commercial banks, etc., are less familiar with the needs of these local seed business and also consider such investments as high-risk[36,37].

- **Community-based producers are overly dependent on NGO support and are not self-sustainable**

  Most community-based seed producers have been organized and supported by development partners through technical and infrastructural support such as cleaning machines, construction of storage facilities, etc. Public institutions such as BoAs, research institutes, and HLEs (Higher Learning Institutes) usually participate in the provision of basic seed and other inputs, training of farmers and cooperative personnel on different issues, provision of credit, seed marketing, and other activities. Support from both NGOs and public institutions are critical to strengthening the capacity of community-based seed businesses; however, support provided thus far has not yet enabled most of these producers to become self-sustaining and long-lasting entities[38].

Intervention N1.1: Improve operational efficiency and sustainability of existing CBSPs so that they are able to gradually transition into independent business entities

Developing effective CBSPs will require access to financial resources as well as technical and infrastructural capabilities.

Improving access to financial resources: the following are some of the potential solutions for improving CSBP's' access to financial resources:

- **Launching a revolving CBSP fund:** Commercial banks and other financial institutions have few incentives to lend to CBSPs due to excessive risk. Moreover, there is no financial institution that is dedicated to offering exclusive financial services to CBSPs so far. This calls for the development of a revolving fund that will be dedicated to CBSPs.
- **Providing credit guarantees to lending institutions:** In Ethiopia, most CBSPs lack the financial capacity to fulfill lending requirements. Providing credit guarantees is one option to catalyze adequate financing to CBSPs in the near term. Credit guarantees can be deployed to provide incentives for financial institutions to increase the volume of lending to SPCs. Some of such institutions include rural lenders such as MFIs, rural SACCOs, CBE, etc.

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[35] Wamura-Sako small-scale farmers seed producers'
[36] Understanding seed systems used by small farmers in Africa: Focus on markets
[37] Sentimela P.S. et al (2004): Successful community-based seed production strategies
[38] Alemu D. (2011

Building operational capabilities: the following are some potential solutions for improving CBSPs' capabilities in order to enable them to operate as standalone businesses

- **Strengthening knowledge of CBSPs** in areas such as seed business management, entrepreneurship, cooperative leadership, and business planning
- **Avoiding over-dependence of CBSPs** on development partners by designing more targeted assistance programs in which CBSPs graduate from NGO support
- **Promoting the establishment** of new community-based local seed businesses in high and low potential areas for seed
- **Establishing technical and infrastructural capabilities** including processing machines, appropriate channels / storefronts, etc.

Bottleneck N1.2: Lack of adequate access to early generation seed (basic or C1)

For producer cooperatives that have transitioned into formal sector producers, early generation seed is usually allocated by their respective BoAs. The producers' cooperatives then purchase the seed (basic or C1) from the public institution assigned by the BoA, which includes research centers and PSEs[39]. However, for producer cooperatives that are in their early stage of development (seed out-growers), source seed is sold by PSEs within CBSM programs. Alternatively, development partners also procure source seed from research centers and provide it to some producer cooperatives that are in early establishment phase[40].

However, in most instances, supply of early generation seed falls short of the effective demand. The issue of early generation seed shortage can be understood by studying the case of Edget Seed Multipliers and Marketing Cooperative Union. Although Edget was a pioneer CBSP in the SNNP region, it has only been able to secure less than 50% of its total basic seed requirement. The supply shortfall for basic seed has even worsened in 2011, with the union unable to meet more than 95 percent of its basic seed needs. Based on other primary interviews, this shortage is common for most other producers in this sector as well.

Some of the root causes for the unavailability of sufficient quantities of source seed include the following:

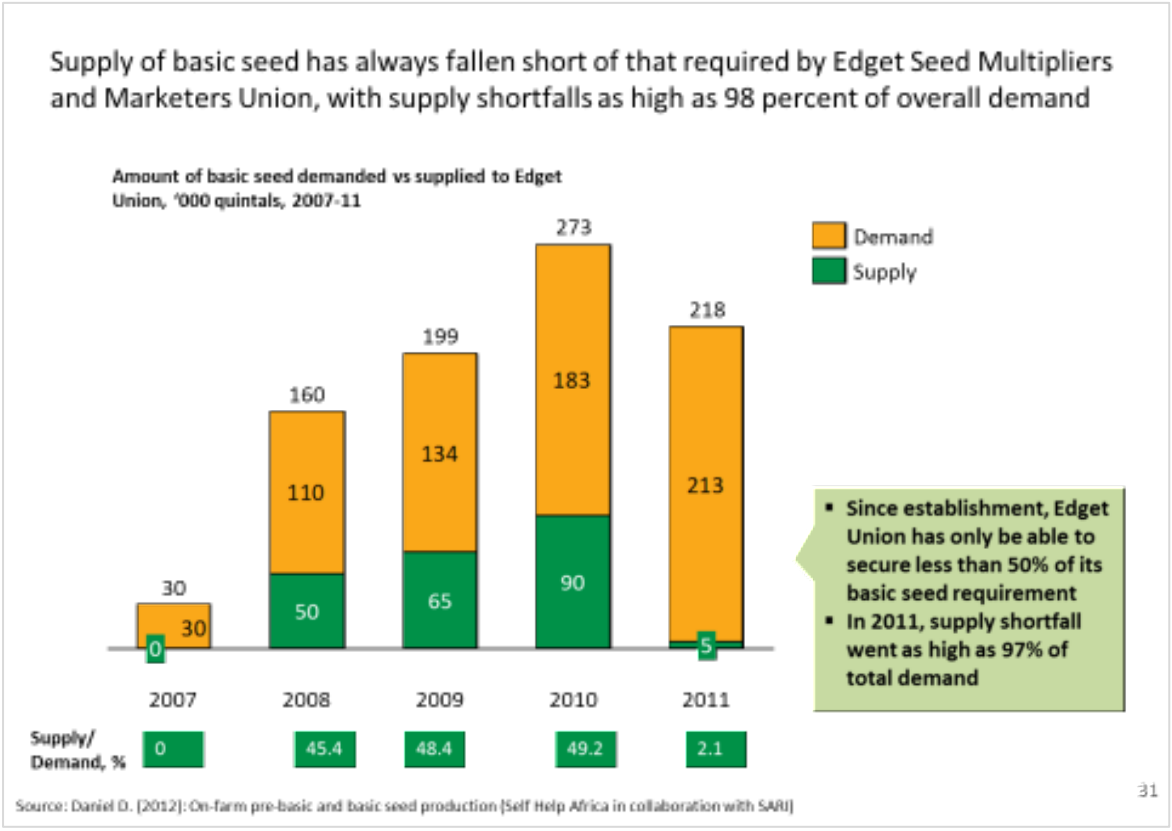
- **Producer cooperatives are not adequately linked with PSEs and research for accessing source seed:** allocation and distribution of source seed has been solely managed by BoAs, which does not allow a direct link between source seed producers (research and PSEs) and producer cooperatives. Currently, there are no contractual arrangements in place between source seed suppliers and producer cooperatives that can help guarantee the supply of the right amount, quality and brand of source seed at the right time.
- **Overall shortage of source seed produced by research institutions and PSEs:** the amount of source seed produced by research and PSEs falls far short of the demand. The demand for source seed has increased tremendously, in part due to the increasing need of community-based seed producers that are emerging in various parts of the country. Normally, source seed is allocated through a quota system in which MoA-

[39] Local Seed Business Newsletter (2011): Issue 7
[40] Alemu D. (2008): Farmer-based seed multiplication in the Ethiopian seed system- approaches, priorities and performance

BoAs determine the quantities based on set priorities while addressing the issue of equity. Specifically, priority is given to public and private seed enterprises over CBSPs, leaving them with limited options to access source seed. The problem of seed shortage for CBSPs is especially acute for seeds of hybrid varieties compared with non-hybrids[41]. The case of the Edget Seed Multipliers and Marketers Union (in the exhibit on the next page) demonstrates this.

[41] Alemu D. (2011): Farmer-based seed multiplication in the Ethiopian seed system- approaches, priorities and performance

Exhibit 30



Intervention N1.2: Improve linkage between CBSPs and research centers which maintain early generation seed

There are two major routes by which CBSPs can improve their links with research centers.

- **Contractual arrangements between CBSPs and research/PSEs for better access of source seed.** As discussed in **Intervention 2.4a,** contractual agreements are essential to delineating and enforcing roles and responsibilities between the research institutions, ESE, and RSEs. This should be extended to effectively incorporate the intermediate sector - ideally, CBSPs should be included as part of the Level 2 contractual agreements (which, as discussed, would be between the ESE and the full range of public / private seed producers).
- **Promote production of source seed by selected CBSPs or other private producers in partnership with research centers or public seed enterprises (on contract basis with research centers/PSEs).** CBSPs with extensive experience in seed production have potential to get involved in the production of source seed, particularly for self-pollinating varieties. The production of source seed on farmers' field, however, requires close monitoring and support from research institutions to ensure quality.

  The latter approach has been demonstrated in the SNNP region in which basic seed of selected wheat varieties was produced by an experienced CBSP, Edget Seed Multipliers and Marketers Union (see *CASE STUDY 5)*. In this initiative, Edget Union partnered with the Southern Agricultural Research institute

(SARI) and an international development partner (Self Help Africa). As a result, a total of 84.3 tons of good quality basic seed was produced on farmers' field[42]. The quality of the seed produced met threshold quality standards for purity, germination and moisture[43].

Similar initiatives could be designed for the production of source seed by CBSPs that have extensive knowledge and experience in certified seed production. This may be particularly feasible for self-pollinating crop varieties as it is technically easier to manage compared with that of hybrid varieties. Successful implementation of such initiatives would, however, needs strong partnership and collaboration between CBSPs and public institutions.

Bottleneck N1.3a: CBSPs lack capacity to produce sufficient volume of seed to satisfy demand gaps

The following are some of the major root causes for low seed production volumes:

- **Poor monitoring and supervision of seed production plots:**
  Individual plots are small and often located far from each other making proper follow-up and recovery of seed highly difficult. Moreover, farmers usually plant diverse crops and varieties in the fragmented plots, which in turn make clustering of adjacent plots difficult.

  Seed production conducted on smallholder farmers' fields usually requires continuous monitoring. Poor road infrastructure in most locations is a hindrance for close supervision and frequent communication.

- **Inadequate follow-up and support by government structures at various levels (BoA, woreda and kebele)**

  So far, cooperative-based seed multiplication and distribution has been organized and supported by a variety of both governmental and non-governmental organizations. This resulted in various challenges such as lack of proper recognition in the overall seed system, and difficulty to effectively coordinate operations among key stakeholders that are engaged in the implementation of this activities.

  In most of the initiatives, technical committees were established at the woreda level to provide support and monitor field operations. Such committees are typically composed of woreda level technical experts and Development Agents (DAs). However, these committees do not have the time and resources to or other quality challenges. Namely, the technical experts and DAs usually shoulder a variety of other responsibilities. As a result, it has proved difficult to effectively provide adequate technical support and close supervision. In addition, these experts and /DAs usually lack adequate seed-specific expertise such as seed production, quality assurance, seed business management, seed marketing, etc. to provide adequate technical support.

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[42] Daniel D. (2012): On-farm pre-basic and basic seed production by Edget Seed Multipliers and Marketing Cooperative Union- Self Help Africa in collaboration with SARI
[43] Wolkite Seed Laboratory (2012)

- **Poor agronomic practices:** lack of adequate knowledge in proper agronomic practices reduces potential yield

- **Infrastructural capacity:** producers usually lack adequate access to modern seed processing and storage facilities that are affordable and meet the specific needs of seed producer cooperatives

- **Lack of access to supporting inputs:** This includes lack of access to credit and unavailability of other inputs beyond seeds such as fertilizer, etc.

Bottleneck N1.3b: Community-based seed producers have low seed recovery rates from their member farmers due to poor business planning

The amount of seed collected, processed and sold by producer cooperatives is usually low due to high default rates by out-grower farmers participating in CBSM. Assessment studies conducted by ATA revealed that most of the well-established producers' unions had low to medium seed recovery rates (<60%)[44]. On the other hand, seed produced under CBSM programs organized by formal sector public seed enterprises suffer from an even lower seed recovery levels when compared to those run independently by seed producer cooperatives. For instance, in the 2009/10 production season, ESE was only able to recover 47 and 21 percent of all cereal and pulses seed produced under its CBSM program respectively. In the next production season (2010/11), ESE's seed retrieval rates further deteriorated to as low as 35 percent of total seed produced at smallholder farms. Some of the major reasons for low seed recovery rates are as below:

- **Unattractive premiums:** Prices offered by formal sector enterprises or producer cooperatives are often unattractive to contract growers. As a result, out-grower farmers are often not willing to sell back the seed multiplied under contractual arrangements. Instead, farmers sell the seed in local markets for relatively higher prices or exchange

CASE STUDY 5: A seed producer' union in Butajira, SNNP

Edget Farmers' Seed Multiplication and Marketing Cooperative Union is located in Butajira zone of the SNNP region. It is one of the pioneer cooperatives in Ethiopia in the production of improved seed at community level.

Formation: Initially 7 primary cooperatives (PCs) were organized by the BoA and Self Help Africa (SHA) to produce wheat seed. Later on the number of cooperatives grew to 12. Realizing their limited capacity in seed processing, packaging, storage and marketing, the 12 PCs combined their efforts and formed a union

Current status: Over the last five years, the number of member PCs grown from 4 to 15. The overall production of seed has also increased 3 fold to reach 1,100 tons within the same period

Outputs: the union has been able to improve the supply of seed while improving the livelihood and profitability of its members. A survey has shown that average income of seed producer cooperative members increased by 83-151% in Gurage and Siltie zones.

Lessons learnt: strong support and collaboration between public and NGOs is key for success of such schemes. Union in collaboration with research experimented on an innovative project to produce basic seed of wheat on farmers' fields. This model shown encouraging results

Challenges: securing adequate quantities of source seed has been a challenge for the union. The union has overly depended on external support with limited prospect for independence

Source: Daniel D. (2012): On-farm pre-basic and basic seed production

[44] ATA survey of three seed producer cooperative unions in Oromia and SNNP regions (The unions covered in this survey are Meki Batu, Becho Wolliso and Edget Unions)

part of the seed with neighbors and relatives. Part of the reason for unattractive prices is attributed to untimely market surveys that are then used to determine purchasing prices by buyers (seed enterprises or coops). Premium prices are usually fixed at times when grain prices are at their lowest, resulting in unattractive seed prices for out-growers who prefer to receive higher prices later in the season.

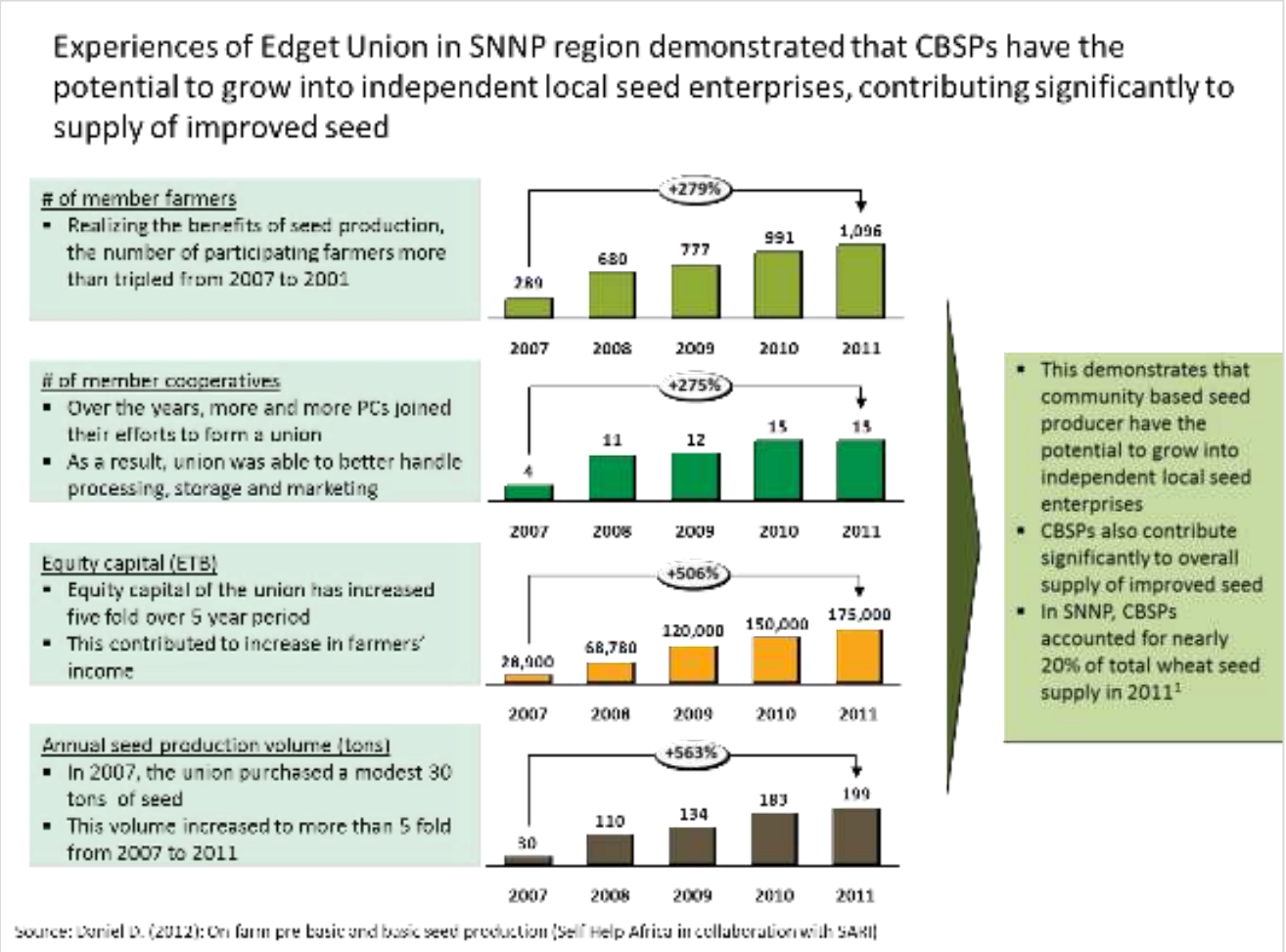
- **Lack of adequate technical skillsets and infrastructural capacities to effectively plan, monitor, and manage contractual arrangements:** Agreements that are entered into with individual out-grower farmers are often technically difficult to enforce as cooperatives deal with large number of farmers. Moreover, farmers do not consider such agreements legally binding and disputes arising from defaults are difficult to manage through arbitration.

Intervention N1.3: Develop contractual agreements and build operational capabilities of CBSPs to improve quantity of seed

- **Improve the knowledge of out-growers, cooperative personnel, DAs, etc. on contract planning, management and enforcement.** This could be achieved by providing targeted and continuous training on the above mentioned issues. The short to medium-term trainings could be provided by experts at different organizations such as seed enterprises, cooperative promotion agencies, etc.
- **Strengthen the logistical and storage capability of CBSPs** so that they are able to effectively collect, transport and store seed from out-grower farmers
- **Promote proper clustering of plots** and the use of relatively larger individual plots in farmer-based seed multiplication schemes
- **Develop guidelines or manuals on appropriate agronomic practices** that tailored to community-based seed multiplication
- **Ensure proper pricing mechanisms for out-growers** that CBSPs source from in order to maximize retrieval rates

The experiences of Edget Union (per the exhibit on the next page) demonstrate the potential of CBSPs to grow into independent local seed enterprises that effectively supply improved seed.

Exhibit 31



Bottleneck N1.4: Quality of seed produced and supplied by CBSPs often fails to meet minimum quality standards (based on formal sector certification standards)

- **Producers usually lack adequate technical knowledge in proper seed production and quality assurance techniques**

  Several reports indicate that CBSPs have very limited technical knowledge in proper seed production techniques[45,46,47,48]. For instance, out-grower farmers had limited knowledge in maintaining proper cropping history of their seed fields. As a result, the risk of mechanical mixing was found to be higher on farmers' plots. Additionally, rouging of off-type plants is often not conducted properly as farmers have preconceived ideas that such activities might result in crop failures.

[45] Sahlu Y. et al (2008): The farmer-based seed production and marketing scheme- lessons learnt
[46] MacRobert J.F. (2008): Supporting the development of small to medium scale seed enterprises in Sub-Saharan Africa
[47] Ere Union seed producers and marketing cooperatives, Gimbichu district, Oromia region
[48] Wamole farmers' cooperative for maize seed production in Boricha woreda, SNNP region

Another challenge has been farmers' tendency to apply high seeding rates to compensate for poor land preparation. Studies indicate that overplanting of seed has the potential to negatively affect the quality and quantity of seed[49,50]. On the other hand, some farmers tend to plant seed deep in the soil which resulted in low plant densities. In such instances, farmers tend to use their own seed to fill open spaces which results in poor genetic quality. Most importantly, one of the most common challenges of ensuring high quality seed in CBSM is the difficulty to maintain adequate isolation distances[iii] due to high fragmentation of plots and multiple cropping systems.

These and other factors contribute to the reduction of potential seed yield and increased risk of poor quality seed. For instance, during the 2007/08 production season, field inspection showed that more than 8 percent of total seed produced by ESE's CBSM program was rejected, compared to a less than 1 percent rejection rate on ESE's own farms[51].

- **Technical difficulty to implement conventional quality control by the regulatory bodies**
  Regulatory institutions face huge technical and logistical constraints to conduct regular quality control activities on farmers' plots that are fragmented in nature and usually located far from infrastructure. In many instances, it has proven difficult to conduct field inspections on numerous fragmented seed fields in a sustainable manner. Such regulatory activities tend to be resource intensive and are not economically feasible given the multiple rounds of field inspections and lab tests that need to be conducted based on the conventional certification scheme.

- **Existing quality standards are too stringent for community-based seed producers** that have limited technical and infrastructural capacity to adequately meet conventional quality standards

Intervention N1.4: Promote Quality Declared Seed Regulatory System (QDS) to ensure baseline seed quality

FAO designed and introduced the Quality Declared Seed (QDS) Regulatory System to improve quality of seed by using resources already available within seed producers. The QDS system was intended to serve as an alternative quality assurance mechanism to the conventional system. It is primarily intended for specific crops, geographies and farming systems where implementing a full-fledged quality control system is difficult or results in limited impact. QDS is a relatively open scheme, which allows it to meet the needs of farmers in a flexible way without compromising basic standards of seed quality. This scheme is not designed to compete with the existing conventional quality control system, but rather complement it and ensure farmers have greater access to quality seed.

The primary responsibility of seed quality under the QDS scheme lies with the seed producer, with minimal quality control by the official regulatory body. Generally, the QDS scheme is implemented based on three key principles:

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[49] Bogale T. et al (2013): Crop management research for tef
[50] Ethiopia's National Tef strategy
[51] Dalberg (2012); ESE annual report (2008)

- **First, a list of varieties eligible to be produced as QDS need to be established.** Typically, QDS schemes include three types of crop varieties: (i) varieties developed through conventional breeding methods, (ii) local varieties that have evolved over a period of time under particular agro-ecological conditions of a defined area, and (iii) varieties developed through alternative plant breeding approaches such as Participatory Plant Breeding. For seeds of local varieties and varieties developed through PPB, the minimum QDS standards may vary from those developed through conventional plant breeding approaches. However, there should be clear labeling of quality declared vs. quality certified seed to avoid confusion in the marketplace.
- Second, seed producers are required to be registered at an appropriate regulatory authority to produce QDS seed
- Finally, the authority checks at least 10 percent of the seed offered for sale under the designation of QDS.

As QDS is deployed across Ethiopia, the following intervention activities should be implemented properly:

1. Develop a national standard for QDS, detailing a set of standard procedures that need to be followed during the implementation of QDS
2. Popularize concepts of QDS to increase awareness among regulatory personnel and CBSPs

Component N2: Marketing and distribution in the intermediate sector

Historically, seed marketing and distribution has been considered as the weakest segment of most community-based seed production and distribution programs[52,53]. Specifically, community based seed producers (CBSPs) have not had clear routes to market and distribute seed, outside of contracts to formal sector producers.

In order to create an independent intermediate sector, it is critical to establish a seed marketing system that links CBSPs with both formal and informal channels. This is the primary goal for the intervention around marketing and distribution in the intermediate sector. Linkage to the channel structure established by Direct Seed Marketing (DSM) will be absolutely critical for the long-term.

Summary of bottlenecks and interventions

Bottlenecks and interventions for Seed Marketing and Distribution in the Intermediate Sector				
	Bottlenecks		**Interventions**	**Owners**
N2.1	Lack of adequate and sustainable market for CBSPs	N2.1	Support CBSPs to progressively market their seed using multiple marketing strategies and distribution channels	FCA/RBoAs
N2.2	CBSPs are currently engaged in limited crop and varietal portfolio (# and type of crops and varieties)	N2.2	Effectively link CBSPs with research and conservation institutes through contractual agreements for accessing source seed of diverse crop varieties	FCA/RBoAs

[52] Alemu D. (2011): Farmer-based seed multiplication in the Ethiopian seed system- approaches, priorities and performance

[53] Sahlu Y. et al (2008): The farmer-based seed production and marketing scheme- lessons learnt

Bottleneck N2.1: Lack of adequate and sustainable market for CBSPs

One the major challenges for CBSPs is the lack of adequate and sustainable markets. Historically, the amount of quality seed sold by producer cooperatives has been very low. A large factor of this is the lack of connection to established input marketing and distribution channels such as coops, private dealers, etc.

Historically, BoAs or public/private seed enterprises have approached most community-based producer groups to produce and supply seed on contractual basis. However, such contracts are not generated on a regular basis and are therefore treated less strictly. In addition, the direct role of CBSPs is actually limited in terms of marketing; they depend largely on the BoAs or NGOs who organize and support such CBSPs as the demand sinks for the seed, impacting their ability to identify markets and become self-sustaining.

In recent years, however, different development partners that promote community-based seed businesses are supporting them to become independent in their business operations. However, most of these CBSPs are at their early stages, and hence, lack adequate technical knowledge in seed business management activities such as market analysis, customer service, branding, demand creation, etc.[54].

Intervention N2.1: Support CBSPs to progressively market their seed by linking them to multiple marketing strategies and distribution channels

As explained in the bottleneck section, most CBSPs do not directly market their seed to consumers as they depend on BoAs and seed enterprises for marketing. As more and more CBSPs become self-sustaining independent business entities, they should be expected to find customers and market seed by themselves. One approach to guarantee adequate demand for seed produced by CBSPs is to link them through the distribution channels that are getting established in Direct Seed Marketing, as well as other channels in the informal sector. This can be achieved through contractual arrangements between CBSPs and seed distributors such as input marketing cooperatives, private dealers, etc.

Bottleneck N2.2: CBSPs are currently engaged in limited crop and varietal portfolio (number and type of crops and varieties)

According to data on nearly three hundred primary cooperatives, nearly 70% of community-based seed production stems from a single variety of tef (quncho), and four varieties of wheat (kakaba, digalu, danda'a, and qubsa).[55] This clearly indicates that the crop and varietal portfolio of CBSPs is quite limited.

This is a critical gap as CBSPs require a diverse portfolio that can adapt for a range of agro-ecologies and environments, and that accommodate both modern and local varieties.

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[54] Alemu D. (2011)
[55] CBSP Sector-wide Data, Alemu D. and Abebe A. (2014)

Intervention N2.2: Effectively link CBSPs with research institutes through contractual agreements for accessing source seed of diverse crop varieties

One key solution to improve the portfolio of CBSPs is a stronger linkage to the public research centers that produce improved seed varieties (see **Intervention N1.2** on page 89). However, there is also an opportunity to provide a stronger linkage to local seed varieties by setting up contracts and/or partnerships with Community Seed Banks (CSBs) and institutions such as the Institute of Biodiversity Conservation (IBC).

Chapter 5: Informal seed sector

5.1 Introduction and background

Typically, the informal seed system can be defined as unregulated seed operations that are largely characterized by localized efforts of seed selection, multiplication, use, and exchange between farmers and/or farming communities without any oversight or standards. Specifically, this is neither seed that is neither certified nor Quality Declared. It involves the use of seed or planting material that is either saved from previous harvests to be sown in the subsequent cropping season or exchanged between farmers or farming communities through diverse channels or outlets. Most seed exchanges and transactions take place between neighbors and relatives based on barter, social obligations, etc.

The informal sector is the dominant source of planting material in most developing countries as the formal seed sector usually satisfies a very small segment of the potential seed demand (typically less than 20%) for most food crops[56]. This figure is especially low for self-pollinating and vegetatively propagated crops. Informal seed systems are also referred to as farmer-managed seed systems[57], traditional seed systems[58] and local seed systems[59].

Similar to most developing countries, the informal sector is the dominant sector among the three sectors that exist in Ethiopia's seed system. Despite the recent growth of the formal sector in producing and distributing modern seed varieties, the informal seed sector still serves as the prime supplier of seed of both modern and local (i.e., landraces) varieties for a vast range of crops grown by smallholder farmers in Ethiopia. The distinction between the three sectors is explained in Chapter 1 of this document; the informal seed sector has not been adequately studied compared to the other two sectors.

Per the exhibit on the next page, seed sourced from the informal sector covers more than 90% of Ethiopia's total cultivated area[60]. When this is disaggregated by crop type, cereals account for about 80% of the total cultivated area followed by pulses and oilseeds with 13% and 7% of area coverage respectively. The dominance of the informal sector is consistent when examining Ethiopia's top cereal crops; this is with the exception of maize and wheat which are relatively better served by the formal sector.

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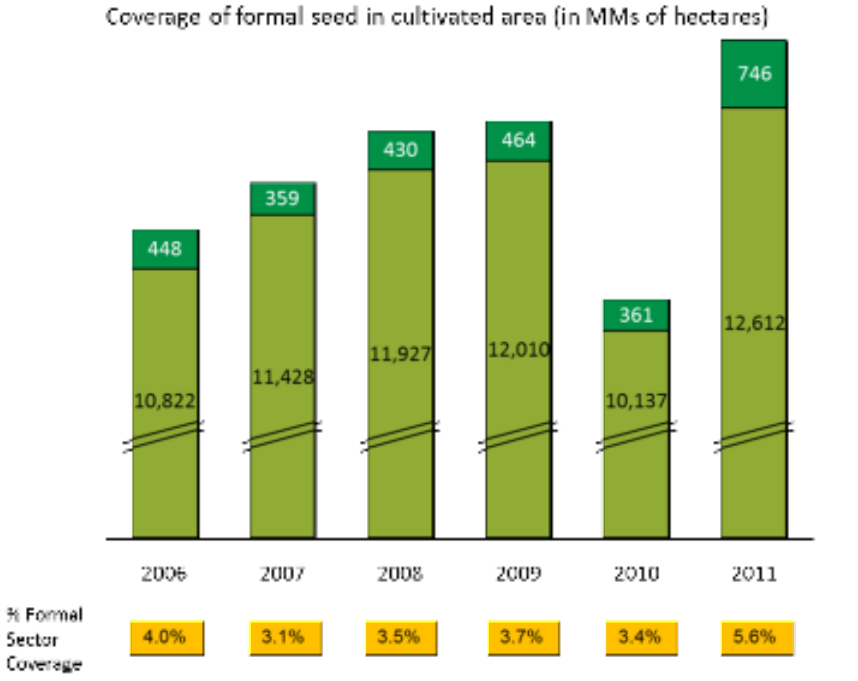
[56] Johannes M.M. Engels (2008)
[57] Bal and Douglas (1992)
[58] Cromwell, Friss-Hansen and Turner (1992)
[59] Almekinders, Louwaars and de Bruijn (1994)
[60] CSA Annual Agricultural Sample Survey (2011)

Exhibit 32

The majority of Ethiopia's cultivated area has been covered by informal seed, even as Ethiopia's cultivated area has increased



In the informal sector, the availability of sufficient seed may not be consistent or of guaranteed quality due to several limitations. This is particularly true after a poor harvest season or during natural or manmade disaster conditions when it is difficult for smallholder farmers to set aside seed from their harvest, which results in seed shortages. Additionally, the concept of seed quality varies significantly between modern varieties and local varieties. In the case of modern varieties, the issue of quality includes both genetic and physical attributes of the seed. In the case of local varieties, seed quality mostly refers to physical attributes of the seed, with limited focus on varietal identity as local cultivars are diverse in nature, which is one of their major benefits.

Despite the limitations of the informal sector, it is the only source of seed supply for farmers with no other alternative. It is, therefore, critical to analyze the features of the informal sector to develop a comprehensive strategy for the overall seed system.

5.2 Scope of the informal sector strategy

This section of the seed sector strategy will primarily focus on specific farmer groups, crops and agro-ecologies that are under-served by the formal and intermediate sectors due to several reasons already discussed. More specifically:

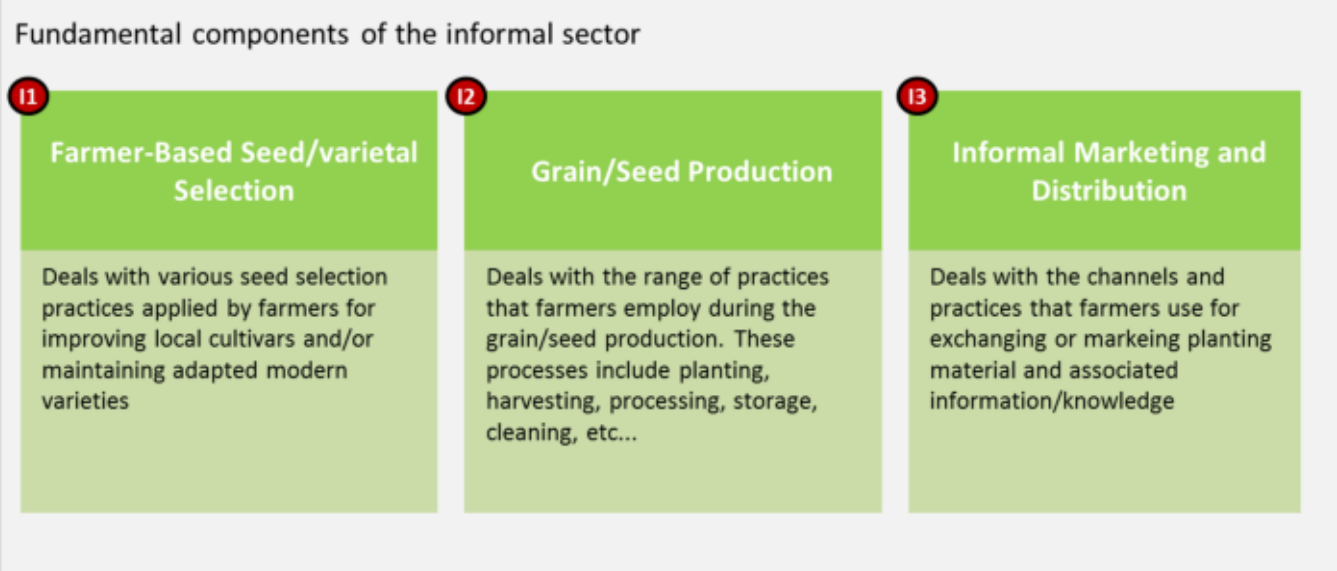
- **The formal sector tends to heavily concentrate on a few crops and geographies that are commercially viable, namely hybrid maize and wheat.** However, most of the less focused on crops (most self-pollinating crops such as cereals, pulses and oil crops) and agro-ecologies (areas of low-to-medium agriculture potential and distant geographies) play a critical role in meeting the food security needs of the vast majority of smallholder subsistence farmers.

5.3 Key components of the informal sector

Farmers' seed systems or the informal sector can also be viewed as managing the flow of genetic material and information, including most of the above processes, although the flow does not typically follow a sequence that is, as clearly defined in the formal seed systems[61]. Despite this, the chain of processes is ultimately similar to the formal seed system. In the formal case, there are a limited number of actors involved in actually performing or regulating each process[62]. These processes normally include seeking germplasm, varietal development, evaluation and release, certification, distribution, extension, varietal maintenance, adoption and use.

In the Ethiopian context, the informal seed sector involves three fundamental process-oriented components (as per the exhibit below). These are (1) seed/varietal selection and maintenance, (2) grain/seed production and (3) informal distribution. Usually, these components do not follow a particular sequence as clearly defined in the formal sector. Moreover, there are also overlaps and interactions between these components.

Exhibit 33



[61] McGuire S. 2000
[62] Tripp, 1997

The three major components of the informal sector are described briefly as follows:

I1. Seed/varietal selection and maintenance

This component refers to a range of practices that farmers employ in selecting and maintaining their planting material. While many assume that varietal selection can only be performed by research institutions, farmers also practice such activities for improving and maintaining local or adapted improved crop varieties, using visual characteristics such as plant height, grain size and panicle shapes.

In fact, farmers have been the principal managers of agro-biodiversity of crop varieties and seeds. Historically, farmer selection is at three levels: crops (usually a diversity of species), varieties (a diversity of genetic variation within species) and seeds (diversity within a local variety) for planting and replanting. Unlike the institutions of the formal sector, farmers primarily select for genetic diversity instead of homogeneity. By maintaining diversity, farmers are able to minimize risks, stabilize yield and income, and meet their local needs. These local needs extend beyond just yield, but also include other factors such as grain quality for local food/beverages, storability, disease resistance, and suitability for intercropping and crop residue value are taken into consideration.

To this end, farmers' traditional selection practices, coupled with more formal selection, help maintain the genetic diversity of crops.

I2. Grain/seed production

This component of the informal sector refers to the range of practices that farmers employ throughout all steps of seed/grain production. These processes include pre- and post-harvest operations such as field selection and preparation, planting, harvesting, processing, storage, etc.

Typically, there is no specialized seed production in the informal sector and seed is often derived from normal grain production. Therefore, seed production could be considered as an integral part of grain production in the informal sector. Most farmers in the informal sector usually select good quality "grain" and save a portion as "seed" for subsequent planting season. Farmers, however, usually give special care for "seed" during the different steps of crop production such as planting, harvesting, cleaning, treating and storage.

An ''informal'' seed grower could be defined as a farmer who is not a member of an organized seed production program and produces "seed" for personal use or for exchanging with neighbors or relatives. "Seed" production is an essential component to primary farming operations. Seed operations are usually

low-budget, with minimal or no special equipment used for growing, harvesting, cleaning, treating or storing seed. Informal seed growers are not subject to the seed law[63].

I3. Informal marketing and distribution

This component refers to various processes and practices that farmers employ for exchanging planting material and associated information. Exchange practices usually vary between different crops and communities. As noted earlier, the majority of Ethiopian farmers rely mainly on informal networks for exchanging seed. Such networks are the major route by which seed reaches poor farmers in rural communities. In addition, it is through these networks that farmers have been able to maintain crop diversity and transfer associated knowledge from one generation to the next about development and preservation of appropriate local varieties.

Given all this, the following objective for the informal sector has been highlighted:

> A well-developed informal seed system that is well linked with the formal and intermediate sectors to ensure availability of and access to adequate amounts of high-quality seeds that meet specific needs of farmers in diverse agro-ecological zones of Ethiopia while maintaining local genetic diversity.

Component I1: Farmer-based seed/varietal selection and maintenance

Successful farmer-based seed and varietal selection requires adequate knowledge as well as clear coordination with research institutes, ensuring the back-and-forth exchange of varieties (modern and local alike). The three bottlenecks and interventions below are focused on these areas:

Bottlenecks and interventions for Farmer-based seed / varietal selection and maintenance				
	Bottlenecks		**Interventions**	**Owners**
I1.1	Farmers may lack adequate knowledge in best seed selection techniques that help maintain genetic uniformity of modern varieties and enhance the performance of existing local varieties	I1.1a	Improve dissemination of best practices in seed / varietal selection and maintenance for the informal sector	RBoAs/ Extension
		I1.1b	Improve linkage between farmers and NARS crop improvement programs through Participatory Plant Breeding and Participatory Varietal Selection schemes	EIAR/RBoAs
I1.2	Germplasm of local crop genetic resources collected by conservation institutes have not been adequately characterized	I1.2	Strengthen pre-breeding component of Ethiopia's biodiversity conservation institute and promote increased use of indigenous germplasm in breed improvement programs of the NARS	IBC

[63] Gregg B.R. and van Gastel A.J.G., 2000

I1.3	High risk of genetic erosion of local varieties with the increased adoption of varieties developed through the formal sector	I1.3	Support the conservation of local genetic diversity by strengthening the capacity of community-based conservation institutes to reduce risk of genetic erosion	IBC

Bottleneck I1.1: Farmers may lack adequate knowledge in best seed selection techniques that help maintain genetic uniformity of modern varieties and enhance the performance of existing local varieties

Farmers have been using different seed and varietal selection methods, usually as part of their grain production process, for many generations. In doing so, farmers consider a diverse set of criteria and selection intensity that vary tremendously between farmers and among communities. Farmers perform different selection methods at varying stages of "seed" production. The following are some examples of farmers' selection practices:

- **Selection from stored grain:** farmers may select healthy looking and "true-to-type" seeds from their stored grain. In farmers case, this refers to seed that resembles those of the mother crop and seed that do not show obvious disease symptoms
- **Selection after harvest, but before threshing and storage:** this is when farmers look at the set of grain at harvest and then select what serves as "seed" for the next season. This practice is particularly common in maize and sorghum, where the best-looking ears and heads are kept separately for seed

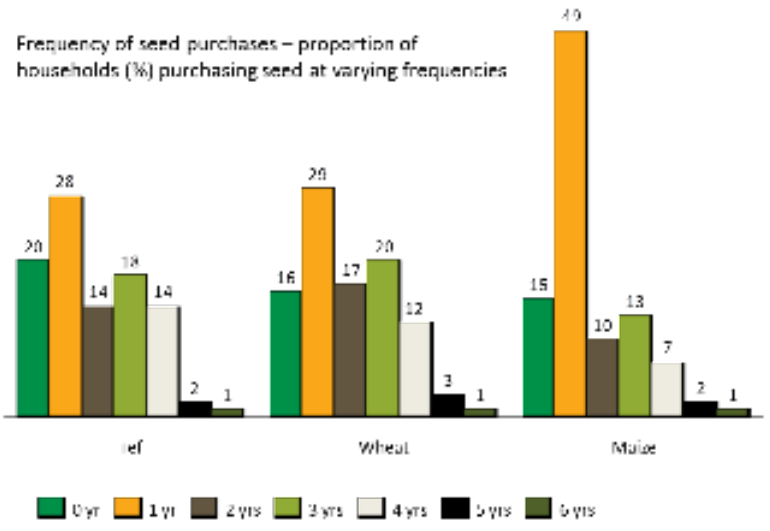
Given these factors, the two major challenges are:

- **Lack of knowledge on proper recycling**

Several studies have indicated that seed replacement rates are very low in Ethiopia as farmers recycle formal seed beyond the recommended levels. This is mainly attributed to lack of adequate knowledge in proper seed recycling rates. Other reasons include limited access to fresh seed from the formal sector and inability to afford seed. To realize the full potential of modern varieties, farmers are expected to use recommended levels of seed recycling rates. However, if seed is not properly refreshed by farmers, it is highly likely that the quality deteriorates due to physical mixing and damage during production and harvesting by traditional methods. The exhibit on the next page provides a breakdown of purchasing rates for different crops, demonstrating the high recycling rates prevalent among farmers.

Exhibit 34

Seed replacement rates are usually low in Ethiopia as farmers are accustomed to recycling seed of modern varieties beyond recommended levels



- Farmers purchase seed of improved varieties do so relatively infrequently
- Particularly for hybrid maize, it is expected that farmers purchase seed more frequently given the recommended seed replacement rate is one year
- The chart shows that out of all farmers who purchased improved maize seed, only 50% do so annually
- For non-hybrids like tef and wheat, seed replacement rates are even lower

Source: Spielman D. and Mekonnen D. (2012): Transforming demand assessment and supply responses in Ethiopia's seed system and market

- **Lack of knowledge on broader agronomic issues, including quality improvement and maintenance**

The current extension system does not adequately address seed-specific agronomic issues that are key to improving both quality and quantity of planting material used by smallholder farmers. Some of these important agronomic issues that have not been given adequate attention include seed quality improvement and maintenance, proper seed use, pest management, etc. In addition, development agents (DAs) and woreda-level experts have limited knowledge in appropriate seed selection and maintenance practices[64].

Several studies have shown that the genetic and physical quality of seed for local varieties could be improved by harnessing a combination of best traditional and modern selection techniques. However, farmers usually lack adequate knowledge on improved seed selection and quality maintenance techniques that can enhance the quality of seed[65].

[64] Almekinders C. and Louwaars N.P. (2008): Supporting farmers in maintaining and selecting seeds of local varieties
[65] Asfaw A. (2008): Participatory varietal evaluation and breeding of the common bean in the Southern region of Ethiopia

Intervention I1.1a: Improve dissemination of best practices in seed / varietal selection and maintenance for the informal sector

Ethiopia's current extension system should design and introduce seed specific packages that are targeted to effectively increase farmers' awareness on seed production, selection, seed quality and pest management. To this end, the following interventions could be implemented:

- **Revise existing crop-specific extension packages to incorporate tools and practices that will address seed-specific needs.** Extension directorates of regional BoAs and the MoA can develop such packages that will in turn be implemented by DAs.
- **Develop various manuals on proper seed/varietal selection, recycling, and quality maintenance techniques.** These manuals will need to be tailored to specific types of crops, seeds and geographies. For instance, selection objectives vary greatly between modern and local crop varieties. Such manuals can then be used by DAs to train farmers.
- **Use demonstration plots at Farmer Training Centers (FTCs) and ATVETs** to demonstrate seed selection and quality maintenance tools

Intervention I1.1b: Improve linkage between farmers and NARS crop improvement programs through Participatory Plant Breeding and Participatory Varietal Selection schemes

Several studies have documented the need and effectiveness around combining efforts of farmers and researchers in developing high-yielding crop varieties specifically adapted to the diverse agro-ecologies [66,67,68].

Research centers in Ethiopia are increasingly recognizing the importance of working with farmers in the varietal development, verification and dissemination process. In this regard, among the most frequently used approaches are Participatory Varietal Selection (PVS) and Participatory Plant Breeding (PPB).

To effectively realize the benefits of participatory crop improvement programs, the following interventions are proposed:

- **Promote the participation of farmers in multiple stages of variety developmen**t and testing of experimental varieties in farmers' fields (target environment)
- **Identify and support local seed/variety selectors** that are well recognized by their respective communities
- **Institutionalize PPB and PVS in Ethiopia's National Agricultural Research System** to ensure participation of farmers and other clients at multiple stages of crop breeding
    - Develop national guidelines for designing and implementing PPB and PVS
    - Strengthen knowledge-base of breeders in various models of PPB and PVS

[66] Walter de Boef and Juliana Bernardi
[67] Wakjira A. et al (2008): Participatory varietal evaluation and breeding of the common bean in the Southern region of Ethiopia
[68] Participatory Varietal selection of barley in the highlands of Tigray in northern Ethiopia

- **Encourage the increased use of local crop germplasm** in the crop improvement programs of NARS

Bottleneck I1.2: Germplasm of local crop genetic resources collected by conservation institutes have not been adequately characterized

Characterization of crop germplasm is essential for effective utilization of crop genetic resources from conservation institutions. Characterization of crop germplasm is primarily conducted by conservation institutes to select candidate materials that will be used by different crop improvement programs of the NARS. So far, preliminary evaluation of basic morphological and agronomic characteristics has been undertaken for close to 70 percent of all accessions[69] collected by the Institute of Biodiversity Conservation[70]. However, detailed evaluations of characteristics such as nutritional composition, tolerance to drought, and soil salinity and diseases have only been done on very few crop accessions[71].

Intervention I1.2: Strengthen pre-breeding component of Ethiopia's Biodiversity Conservation Institute and promote increased use of indigenous germplasm in breeding improvement programs of the NARS

One of the key responsibilities of IBC is to make germplasm available for further breeding activities of the NARS. In the last few decades, the IBC has been able to supply local germplasm to both local and international research institutions[72]. Germplasm supplied to such institutes has helped generate improved crop varieties with valuable traits such as increased yield, as well as resistance to biological and environmental stresses.

However, to fully benefit from the diverse crop genetic resource of the country, the following intervention activities are proposed:

- **Improve linkage between conservation institutions and research centers of the NARS** so that breeding programs can increasingly use local germplasm to develop improved varieties
- **Strengthen research component (i.e., resources, tools, etc.) of Ethiopia's conservation institutes** so that it is able to adequately conduct pre-selection of local germplasm
- **Develop / improve variety release guidelines** so as to allow for the release of varieties that are developed based on farmer's criteria and preferences (including PVS/PPB)

Bottleneck I1.3: High risk of genetic erosion of local varieties with the increased adoption of varieties developed through the formal sector

As the coverage of the formal sector increases, an increasing number of local varieties are being replaced with modern varieties. This poses potential risk of genetic erosion if proper conservation measures are not

[69] Germplasm accession is a collection of genetic resources for a given organism. For plants, the germplasm may be stored as a seed
[70] IBC (2007): Country report on the state of plant genetic resources for food and agriculture
[71] Balcha and Tanto T. (2008): Genetic diversity and informal seed systems in Ethiopia
[72] IBC (2007): Country report on the state of plant genetic resources for food and agriculture

put in place. Loss of genetic diversity or "genetic erosion" refers to the loss of individual genes and/or varieties that result in the narrowing of crop genetic base.

For instance, a study conducted in Eastern Shewa revealed an estimated loss of wheat local diversity ranging between 75-100 percent of total landraces that are grown in the studied districts[73]. Among a variety of reasons, the gradual replacement of local varieties has a potential to deprive breeders from access to important traits, which can serve as an input for their breeding program particularly with the increased impact of climate change. Farmers prefer to keep genetically diverse plant populations as they are less susceptible to biological and/or climatic irregularities. Thus, attention needs to be given to the fact that farmers select and plant diverse assemblage of crops (usually a diversity of species), varieties (a diversity of genetic variation within species), and seeds (diversity within a variety) to reduce the risk of failure and increase the food security. In the course of selection, these local varieties have developed distinctive traits to adapt to marginal production environments.

In Ethiopia, a number of community-based seed banks have been established as part of the in-situ conservation approach. The IBC in collaboration with the Global Environmental Facility (GEF) program of the UN supported the establishment of 12 CSBs in selected districts of Amhara, Oromia, SNNP and Tigray, from 1994-2002.

These CSBs are owned and managed by local farmers to exchange seeds of local varieties. Often, farmers are organized as Crop Conservation Associations (CCAs). The seed exchange among farmers and CSBs is based on protocols and rules that are determined by the respective CCAs. Farmers become members by depositing seeds of local varieties in the form of shares and are subsequently allowed to borrow seed on pre-agreed interest rate. As a result, farmers are made to return more seed than they initially borrowed, thereby enabling the CSB maintain its seed stock.

Currently, however, only 2 of the 12 CSBs are currently operational while the rest were disbanded due to various challenges. The following include some of the major challenges CSBs and other related farmer associations face:

- **Untimely and poor seed return rates:** farmers who borrow from their respective CSBs usually fail to return back the seed in a timely manner. In some instances, participating farmers may not return the seed they borrowed at all. As a result, the seed stock in CSBs dwindles over time, which in turn affects its sustainability.

- **Insufficient demand for seeds of local varieties:** with the ever-increasing supply of modern varieties, the demand for seeds of local varieties is decreasing. Administration of seed banks that usually cover a number of widely spread communities has proven to be challenging and complicated

[73] Tsegaye B. and Berg T. (2007): Genetic erosion of Ethiopian tetraploid wheat landraces in Eastern Shewa, Central Ethiopia

- **Limited capacity:** most CSBs lack adequate technical and infrastructural capacity to undertake their activities[74]. Farmers' knowledge is often very limited in proper seed management practices such as seed cleaning, and storage. Additionally, there are no uniform standards of seed management. For instance, a heterogeneous appearance of local seeds was acceptable to some but not to others[75].

- **Unsustainable operating model as CSBs depended on NGO support:** most of these CSBs were supported by and were overly dependent on NGOs from the onset of their establishment. When this project-based support was no longer available, most of the CSBs faced huge difficulties sustaining their existence. Moreover, these CSBs are poorly linked or integrated with existing structures of the government such as extension, FTCs, etc.

Intervention I1.3: Support the conservation of local genetic diversity by strengthening the capacity of community-based conservation institutes to reduce risk of genetic erosion

To effectively conserve the genetic diversity of crop varieties, the capacity of local conservation institutes that are engaged in on-farm conservation and use of crop genetic resources will need to be strengthened. Moreover, local conservation activities should also be adequately linked with that managed by conventional conservation institutes (IBC, EIAR, ILRI, etc.). This could be achieved by implementing the following activities:

Evaluate and re-design the operating model of community-based conservation institutes to ensure their sustainability and efficiency

Conservation of local crop varieties and seed security has been promoted through Community Seed Banks (CSBs) that have been implemented in different parts of the country since 1994. CSBs are primarily aimed at increasing local seed security and contribute to conservation of local crop diversity through continued use.

As noted in the bottlenecks section, most of these CSBs are project-based and are overly dependent on NGO support. Implementing the following interventions could enhance the sustainability of these institutions:

- **Develop a business case where CBSs are able to effectively market their surplus seed,** hence cover their operational costs (e.g. establish and support seed open markets, provision of revolving fund to CSBs, establishment of community biodiversity management funds, etc.)
- **Design a system where CSBs will benefit from Ethiopia's access and benefit sharing agreements** with potential companies that intend to use local genetic diversity for commercial purposes[76]
- **Assist CSBs in drafting guidelines or bylaws that govern their day-to-day operations:** CSBs are expected to prepare rules and regulations that lay our procedures and mechanisms for conducting seed collection, quality control, and distribution with clear descriptions of roles and responsibilities of each CSB member. To this end, CSB personnel should be provided with technical training group management as well as the basics of CSB management.

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[74] Role of community gene/seed banks in the conservation and use of crop genetic resources in Ethiopia
[75] Berg T and Abay F. (2008): Community seed banks: experiences from Tigray in Ethiopia
[76] Engels J.M.M. et al (2008): Roles of community gene/ seed banks in the conservation and use of crop genetic resources in Ethiopia

Strengthen the technical and infrastructural capacity of community-based conservation institutes

Farmers involved in CSBs will, therefore, need to have adequate knowledge on proper seed management techniques. CSBs personnel should be trained on best seed management practices, which include maintenance of biodiversity register, seed cleaning, storage, etc.

Additionally, CSBs should also have access to associated farm infrastructure that is simple and affordable including storage facilities and seed cleaners.

Integrate the community-based conservation activities with existing structures of BoAs such as the extension system

Enhance linkage between formal and informal crop conservation institutions

- **Improve CSB's access to ex situ collections of local germplasm found stored at IBC:** Farmers have great difficulty in accessing the local cultivars from ex situ collections of the IBC. The gene bank (s) is located a long distance away from farmer villages. In addition, they are only able to respond to a restricted number of requests at a given time with small volumes of seeds or planting material. Therefore, farmers or CSBs who want to restock seed of local varieties that have been lost or degenerated find it difficult to use ex situ collections[77].
- **Improve and support documentation and exchange of local conservation practices** in order to keep farmers and CSBs abreast of latest practices

Establish new community-based conservation institutes such as CSBs in selected strategic locations that are crop biodiversity hot-spots. The goal is to expand beyond the twelve existing CSBs, with a focus on locations in each crop with a high number of local cultivars.

[77] Mabille, 2003

Component I2: Grain/seed production in the Informal Sector

Farmer-based seed production requires access to best practices that balance both modern and traditional methods, as well as a seed emergency program to provide appropriate buffer in challenging times. The three bottlenecks and interventions below focus on these areas:

Bottlenecks and interventions for Farmer-based grain/seed production				
	Bottlenecks		**Interventions**	**Owners**
I2.1	Farmers are currently unable to produce sufficient yield and quantity seeds for preferred varieties	I2.1	Promote application of appropriate agronomic practices that enhance yield and quantity	RBoAs Extension
I2.2	Seed emergency programs are poorly designed and executed, which is especially a problem for the informal sector	I2.2	Set up an efficient National Seed Emergency System that effectively responds to natural/manmade disaster conditions by contributing to seed security	MoA/RBoAs
I2.3	High risk of poor quality seed due to poor cleaning and storage practices	I2.3	Strengthen farmers' awareness in proper seed management methods and improve access to affordable implements	RBoAs Extension

Bottleneck I2.1: Farmers are currently unable to produce sufficient yield and quantity of seeds for preferred varieties

Various factors affect the availability of seed in the informal sector including agro-climatic conditions, crop productivity level, availability of seed reserve, etc. Seed shortages are not uncommon in several circumstances. For instance, low productivity of most crops in Ethiopia affects seed supply as farmers will have less seed to save. In addition, during drought periods or civil unrest, most farmers are unable to set aside sufficient seed from their harvest. The major causes include:

- **Lack of adequate knowledge of best on-farm agronomic practices** significantly reduces grain yield and hence seed yield

- **Climatic and environmental challenges:** Successive seasons of drought or flood usually requires repeated re-planting of farmers' saved-seed. This results in depleting farmers' seed stock leaving farmers with inadequate planting material for smallholder farmers. As a result, seed availability becomes inadequate not only for the individual farmer who rely on farm-saved seed, but also for their social networks. In such circumstances, farmers may have to rely on poor-quality planting materials, such as food grain obtained in local market whose varietal characteristics and physical quality is unknown[78].
- Lack of adequate local seed reserve entities such as community seed banks (already covered in previous component).

[78] David, Mukandala and Mafure (2002); Louwaars (2007) and McGuire (2008)

Intervention I2.1: Promote application of appropriate agronomic practices that enhance yield and quantity

Improved crop production and soil management practices have the potential to increase the productivity of crops. Generally, farmers have insufficient awareness in improved agronomic practices such as seed bed management, planting, pest and weed management, cropping system, etc.

- **Seed bed management:** conventional tillage and land preparation increases production cost and contributes to soil fertility loss. As a result, this has a significant negative effect on potential crop yield. Several studies indicated that adoption of improved tillage (minimum or no tillage) have been low in various agro-ecologies of Ethiopia[79].

- **Sowing and harvesting:** the timing and technique of sowing seed has significant effect on crop yield. For instance, field experiments on tef showed that when sowing dates were delayed by one and two weeks' time, the biomass and grain yields were reduced by 35% and 60-80%, respectively[80]. Furthermore, planting depth and planting technique (row vs. broadcast) have been proven to significantly affect grain yield, hence seed yield.

- **Pest and weed management:** frequency and timing of weeding are known to affect crop yield significantly. A study conducted on tef indicated weeds can reduce tef biomass by up to 30% during the first weeks after crop emergence. On the other hand, a study conducted in Northeastern Ethiopia combination of reduced tillage and herbicide application demonstrated a very high tef grain yield of 16.59 qt/ha[81].

- **Cropping system:** in most crop growing area of the country, continuous monoculture is the most dominant crop production system. Other cropping systems such as crop rotation, intercropping and double cropping are not practiced to the necessary levels

Bottleneck I2.2: Seed emergency programs are poorly designed and executed, which is especially a problem for the informal sector.

Ethiopia has suffered from recurrent drought for at least the past 30 years, prompting a succession of emergency responses. With the exception of few years, there has been disaster response every year since 1983-84. The primary objective of emergency seed programs is the provision of seeds and associated farm tools to households or farming communities that have been affected by natural or man-made disaster such as drought, flood, conflict, pest infestation, etc. Such programs have played a big role in helping farmers recover from disaster conditions, and consequently reduce dependency on food aid. In Ethiopia, seed aid has been one of the most important activities of many relief organizations (both public and NGOs)[82].

Melese (2007); SG2000 (2004)
Abdul Shukor et al. (2009)
02-04)
[82] Bramel, et al. (2004)

Although seed aid programs contributed immensely towards achieving seed security in disaster conditions, several challenges have been known to limit effectiveness and efficiency. The following include some of the major challenges of Ethiopia's seed emergency system:

- **Lack of national emergency seed needs assessments:** Currently, needs assessment for seed aid is extrapolated indirectly from food security assessments. Several assessments in different parts of the country have shown that food and seed security are not identical, but rather complementary. The trigger used to signal a "need for seed aid" is often a "harvest failure"; however, not all production shortfalls necessarily translate to a seed shortfall. As a result, emergency seed needs are usually skewed as calculations that are extrapolated from "food gaps".

  At present, there are three seed assistance contexts: emergency seed aid for acute situations, special assistance programs for chronically stressed areas, and seed aid as part of development programs[83]. There appears to be no clear emergency seed aid/assistance strategy that can address the various seed assistance contexts of the country during and after the occurrence of natural disasters.

- **Lack of national seed security/assistance guideline:** Seed aid in Ethiopia is supply-driven rather than demand or problem-driven. This is mainly attributed to lack of guidelines that clearly outline steps in the design, assessment, and implementation of emergency seed programs or interventions in response to natural and/or human-induced disasters in the different agro-ecological zones of the country.

- **Poor coordination among seed aid programs:** Various NGOs and programs do not have a clear mechanism by which to coordinate allocation efforts in emergency situations.

- **Lack of effective and flexible seed quality control system for emergency seeds:** during emergency situations, seed that is planned for distribution need to pass through proper quality/quarantine checks. Multiple experiences in the past have indicated that introduction of emergency seed that has not passed adequate quarantine measures has, in multiple instances, lead to introduction of devastating insect pests, plant diseases and noxious weeds[84].

Overall, challenges associated with emergency seed distribution will especially be a problem for the informal sector, as the formal and intermediate sectors will begin to benefit from a more market-based environment that enables them to react more quickly to shifts in demand.

Intervention I2.2: Set up an efficient National Seed Emergency System that effectively responds to natural/manmade disaster conditions by contributing to seed security

In the informal seed system, a seed-secure farmer may not necessarily be one who produces all seed needs. According to FAO guidelines, for farmers to be seed secure three major conditions must be met: a) seed has to be available, b) farmers need to be able to access it, and c) the quality has to meet producer or consumer preferences. These three elements of seed security are briefly described in *Exhibit 32* below.

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[83] FAO-MoA (2009)
[84] FAO-MoA (2009): Emergency seed aid guidelines for Ethiopia (Not officially endorsed by MoA)

Exhibit 35

The three key elements of seed security and their brief description

Elements of seed security	*Brief description*
Availability	▪ Sufficient quantities of seed can be obtained: ▪ Within reasonable proximity (Spatial availability) and ▪ In time for critical sowing periods (temporal availability)
Access	▪ Farmers have adequate cash or other resources (for example, financial credit or friends and relatives willing to help out) to buy appropriate seed or barter for it
Quality	▪ Seed is of acceptable quality

Source: Modified from Remington et al. (2002)

The level of seed insecurity can also be determined by duration, such as *acute or chronic seed insecurity. Acute seed insecurity* is brought on by distinct disaster conditions of short duration that often affect much of a given farming population. For instance, it may be triggered by failure to plant, loss of a harvest, or high pest infestation of seed in storage. On the other hand, *chronic seed insecurity* exists independently of a disaster or acute stress, although acute insecurity might exacerbate chronic insecurity. Such insecurity is often found among farmers that are marginalized in one of the three ways: economically by poverty, lack of land or labor; ecologically as in areas of repeated drought or degraded land; and politically insecure areas. Usually, chronically seed insecure populations may experience continual shortages of seed to plant, encounter difficulties in acquiring off-farm seed for lack of cash, and routinely have nothing available but low quality seed of less preferred varieties[85].

Therefore, to effectively respond to specific seed security constraints, seed emergency programs need to be designed and targeted properly. To this end, assessment of the three key dimensions of seed security (availability, access, and quality) can help relief workers better understand and prepare for emergency situations. However, there have been few explicit assessments of seed insecurity in Ethiopia during or even after an emergency.

[85] Catherine L. (2006): Seed vouchers in emergency programming- lessons from Ethiopia and Mozambique

The following are some of the most important long-term intervention activities proposed to improve the current emergency seed system of the country:

1. **Develop a national strategy for seed reserve and emergency assistance:** setting aside certain portion of seed produced annually by the three sectors, particularly focusing on drought tolerant varieties
2. **Set up an independent institution for assistance activities,** including assessing, planning and implementing seed assistance activities throughout the country
3. **Develop a special seed quality control system for emergency seed conditions**
4. **Set aside an independent fund (revolving fund)** that is specifically dedicated for emergency seed aid
5. **Improve effectiveness and sustainability of existing seed emergency programs** aimed at improving seed security, mostly organized by NGOs

Bottleneck I2.3: High risk of poor quality seed due to poor seed cleaning and storage practices

Generally, harvesting and post-harvesting operations have strong effects both on seed quality and quantity. Common operations include drying, threshing, cleaning, treatment, etc. Sub-optimal levels of temperature, moisture, etc. may have negative effects on the quality of seed during these processes.

Harvesting should be well timed to allow quick drying of the seed, thereby reducing losses due to shattering or field infestation by storage insects (e.g., weevils in maize, bruchids in faba bean, etc.). However, farmers usually delay harvesting, primarily due to unavailability of sufficient labor during peak harvest season. In a similar manner, timely threshing is critical so as to avoid physical damage of the seed. Late threshing may crack the seed, as it will be over-dried while early threshing may contribute to pre-mature germination and subsequent loss of vigor.

There are many traditional processes and techniques used for processing, drying, cleaning and processing and storage including seed fumigation, sieving, handpicking and chemical treatments. These methods are often time and labor intensive and are of sub-optimal quality and inputs are hard to access.

Losses during storage could be large and are often exacerbated by climatic conditions. For instance, late rains usually affect seed viability for the following planting season. A study by McGuire (2007) showed that 40% of interviewed farmers in Chiro, Eastern Hararghe Zone, reported poor germination at times of late rains[86].

On the other hand, lack of adequate skillsets in operating/maintaining modern storage facilities and its associated cost may prohibit farmers from using such facilities.

[86] McGuire S.J. (2007)

Intervention I2.3: Strengthen farmers' awareness in proper seed management methods and improve access to affordable implements

Seed Cleaning

a. *Increase awareness of farmers in best seed processing techniques*

For most crops, seed processing is not very different from cleaning of grain. Although traditional grain processing practices are also suited for seed cleaning, some modifications can be made to improve both quantity and quality of seed:

Harvesting: provision of locally-adapted training to farmers on optimal harvesting time could improve germination. Depending on the area and crop type, this may involve early harvesting before the rest of the crop, or late harvesting after rains have finished. Other methods include introduction of rapid drying techniques and pre-planting germination tests for evaluating germination levels.

Physical purity: simple modifications of traditional processing techniques have demonstrated improvements in the quantity and quality of farm-saved seed. For example, modification of the traditional threshing technique has improved seed yield by avoiding mechanical damage from pounding of beans[87].

Varietal purity: for self-pollinated crops, simple guidelines detailing methods of preventing mixing of seed from different varieties at various stages, i.e., during harvest, on drying floors and storage, are critical. Training of farmers in how to rogue off-types and diseased plants and weeds is essential. In addition, encouraging in-field selection of seed during the growing season, rather than after harvest, enables farmers to select desired characteristics.

b. *Improve farmers' access to affordable on-farm seed/grain cleaning implements that meet local needs*

There has been little research in understanding farmers' knowledge in "seed" processing techniques in Ethiopia. The limited work that has been carried out has found different communities and individuals with a great deal of skills in using locally developed techniques that have been fine-tuned to a considerable degree over time.

Proven seed/grain cleaning technologies have the potential to reduce post-harvest losses and improved grain/seed quality. Most notably, the mechanical thresher has been proven to provide significant benefits to farmers based on productivity gains, quality improvement, and reduced labor costs. Mechanical threshers should be promoted through knowledge dissemination practices and increased financial access to machinery for farmers and small enterprises.

In particular, two key activities will help in accomplishing this. First, comprehensive training sessions and manuals should be designed and conducted to disseminate knowledge of post-harvest technology benefits and use (e.g., field days, woreda-level training events). Training sessions and related materials that will be used to raise awareness and market post-harvest technologies to farmers must include an explanation of how post-harvest technology can be profitable for farmers. Additionally, developing and

[87] CIAT (1992)

providing affordable, locally-adapted implements will increase the capacity of farmers to appropriately store and clean seed.

Seed storage

Improve awareness of farmers in effective seed storage techniques

Strengthening the technical knowledge of farmers in improved on-farm seed storage practices has a potential to enhance the quality and health of seed. Storage structures and management practices can be improved through the following activities:

- **Encourage smallholder farmers to construct small-scale storage at farm gate level**. Improved storage structures, such as Pit Storage Bag (PSB) and brick and metal silos should be evaluated and disseminated to smallholder farmers for short-term storage at the farm-gate level.
- **Promote knowledge-based storage management practices.** Smallholder farmers and cooperatives require training to understand and apply best post-harvest management practices, including temperature and humidity measurement and management, recommended shelf span, fumigation practices, and product isolation, among others. Improved seed storage practices could be disseminated to farmers through multiple channels. Firstly, the traditional extension system should be leveraged, and detailed, rigorous training should be provided to development agents, cooperative management and other relevant woreda and FTC administration and staff. Secondly, specific events should be designed and conducted solely to provide information to farmers (e.g., farmer field days), demonstrating the positive results of using post-harvest technology. Finally, indirect transmission of information is possible through the development of materials like production manuals, television and radio programs, and other publications that can reach a high volume of farmers[88].

Component I3: Marketing and distribution in the informal sector

Farmer-based seed production requires access to best practices that balance both modern and traditional methods, as well as a seed emergency program to provide appropriate buffer in challenging times. The three bottlenecks and interventions below focus on these areas:

Bottlenecks and interventions for Farmer-based grain/seed marketing and distribution				
	Bottlenecks		**Interventions**	**Owners**
I3.1	Limited local seed diffusion and dissemination networks / access points for exchanging / marketing seeds of local cultivars or recycled improved varieties and associated knowledge	I3.1	Strengthen and promote innovative local seed marketing networks for efficient seed diffusion	IBC/WBoAs

Bottleneck I3.1: Limited local seed diffusion and dissemination networks/access points for exchanging/marketing seeds of local cultivars or recycled improved varieties and associated knowledge

[88] National Tef Strategy Document

Local markets play an important role in the exchange and circulation of crop genetic resources. They provide a pathway for the dissemination of both improved varieties and the exchange of local varieties among neighboring areas.

Due to the isolated nature of the informal sector, however, seed exchanging/marketing networks are usually limited to particular community structures. Exchange of planting material or of new varieties occurs through social relationships within a particular cultural group, family or local institutions. Social, economic and cultural conditions tend to shape introduction and exchange of planting materials in farming communities. For instance, wealth plays an important role in seed exchange as farmers who purposefully seek and screen new types tend to be wealthier. In the contrary, poor farmers usually have less access to desired seed types, and as a result, less seed or varietal security. However, the efficiency of local seed markets in the provision of seed greatly depends on a lot of factors such as type of crop, community, etc. and is yet to be understood.

Availability of seed is constrained even more during times of environmental and social disasters or disruptions as self-saved seed stocks are lost and farmers might not be able to access seed locally[89].

Intervention I3.1: Strengthen and promote innovative local seed marketing networks for efficient seed diffusion

The following platforms could be used to strengthen local seed exchange/marketing networks:

a. **Community Seed Fairs:** Organize community seed fairs to promote exchange of seed between farmers and communities

Small farming communities have been able to maintain diverse sets of crop varieties and associated knowledge of seed/varietal management for many years. However, exchange of planting materials and associated management information is usually limited to specific community structures. As a result, even farmers living in nearby communities may not be well informed or have access to the existing crop/varietal diversity. Organizing community seed fairs offers a potential solution to improve the level of seed exchange between different farming communities. In community seed fairs, farmers play an active role in exchanging or marketing their own seeds and also their local management practices such as seed storage, processing and use. The two major benefits of community seed fairs are improved availability of seed for preferred local varieties, hence seed security, and maintenance of crop genetic diversity under farmers' natural conditions.

Key activities proposed:

- Develop guidelines for organizing community seed fairs in different parts of the country. Existing guideline developed by FAO could be further refined to reflect Ethiopia's context
- Educate researchers, extension personnel, local district administrators, etc. so that they are able to properly organize and support community seed fairs
- Enhance awareness of farmers (village leaders, women, etc.) on the benefits of community seed fairs

[89] IFPRI (2009): Local markets, local varieties- rising food prices and small farmers' access to seed

- Recognize and incentivize farmers participating based on their performance in seed fairs. Some of such incentives include; provision of certificates to participating farmers, presenting awards to best performing seed displays

b. Community Seed Banks: Set up new and strengthen existing Community seed banks (CSBs) or conservation associations across the country

Community seed banks play an important role in providing seed security and conservation of local crop diversity. This is particularly critical for agro-ecologies that have low potential (poor soil fertility, low and variable rainfall, etc.).

CSBs are farmer-led organizations that are engaged in the collection seed of local germplasm together with the associated knowledge of cultivation. Seeds are regenerated and distributed to farmers upon request. Since they are locally managed, CSBs provide easy access to planting materials. To effectively establish more CSBs, a key tactic could be incentivizing model farmers in various communities.

Short- and Long-Term Modalities for Different Value Chain Components in the Seed System, by Crop Category				
Crop category	Varietal dev't & breeder seed production	Seed production		Marketing & Distribution
		Pre-basic & basic seed production	Certified seed production	
Hybrids	▪ Short-term: varietal development will continue to be dominated by public research with active collaboration with CG centers for germplasm access and capacity building ▪ Long-term: the role of private sector in varietal development will increase significantly*	▪ Short-term: public research to withdraw, while public and private seed producers take responsibility ▪ Long-term: combination of public & private seed enterprises have a key role in producing pre-basic & basic	▪ Short-term: combination of public and private, with reducing involvement of public ▪ Long-term: Highly driven by private sector	▪ Short-term: quota-based distribution through coopes, and growing use of direct agents (both cooperative & private) ▪ Long-term: marketing agents responsible for all inputs
SPVs cereals (non-industrial applications)	▪ Short-term: remains to be dominated by public research ▪ Long-term: public research will continue to dominate varietal development with increased role by private sector for crops with industrial and nutritional values**	▪ Short-term: public seed producers to dominate pre-basic & basic ▪ Long-term: combination of public & private seed enterprises produce pre-basic & basic	▪ Short-term: primarily driven by public producers, with increasing scale of CBSPs ▪ Long-term: driven by combination of public producers and CBSPs, with some private involvement	▪ Short-term: quota-based distribution through coopes, emerging use of direct agents (cooperative & private) ▪ Long-term: marketing agents responsible for all inputs, and few CBSPs

Oil crops	▪ Short-term: remains to be dominated by public research ▪ Long-term: public research will continue to dominate varietal development with increased role by private sector for crops with industrial and nutritional values	▪ Short-term: given lack of quantity , research to multiply pre-basic seed; public seed enterprises to multiply basic seed ▪ Long-term: public seed enterprises to dominate, with increasing private and agribusiness involvement	▪ Short-term: primarily driven by public seed producers ▪ Long-term: combination of CBSPs. public, with increasing private and agribusiness involvement	▪ Short-term: quota-based distribution through coopes, limited involvement of agribusinesses ▪ Long-term: marketing agents responsible for all inputs
Pulses	▪ Short-term: remains to be dominated by public research ▪ Long-term: public research will continue to dominate varietal development with increased role by private sector for crops with industrial and nutritional values	▪ Short-term: given lack of quantity , research to multiply pre-basic seed; public seed enterprises to multiply basic seed ▪ Long-term: public seed enterprises to dominate, with increasing private and agribusiness involvement	▪ Short-term: primarily driven by public seed producers ▪ Long-term: combination of CBSPs. public, with increasing private and agribusiness involvement	▪ Short-term: quota-based distribution through coopes, limited involvement of agribusinesses ▪ Long-term: marketing agents responsible for all inputs
Fruits	▪ Short-term: stronger role of the public research in varietal development with some level of participation by private sector ▪ Long-term: both public and private playing stronger role***	▪ Short-term: depending on function, either public enterprises, community-based seed producers, or agribusinesses ▪ Long-term: strong dominance of agribusinesses & CBSPs	▪ Short-term: CBSPs and agribusiness are both heavily involved ▪ Long-term: CBSPs and agribusiness continue to be heavily involved	▪ Short-term: CBSPs and agribusiness, through private agents ▪ Long-term: CBSPs and agribusiness, through private agents
Vegetables	▪ Short-term: OPVs will continue to dominated by the public research while	▪ Short-term: currently dominated by private sector	▪ Short-term: currently dominated by private sector	▪ Short-term: currently dominated by private agents

	hybrids will be dominated by the private research ▪ Long-term: the same trend	▪ Long-term: continue to be dominated by private sector	▪ Long-term: continue to be dominated by private sector	▪ Long-term: continue to be dominated by private agents
Root crops	▪ Short-term: primarily driven by public, with some private involvement ▪ Long-term: primarily driven by private	▪ Short-term: primarily driven by public research, with some private involvement ▪ Long-term: primarily driven by private, with limited public involvement	▪ Short-term: primarily driven by CBSP & private involvement ▪ Long-term: primarily driven by private and CBSP	▪ Short-term: currently dominated by CBSP with some private agent involvement ▪ Long-term: continue to be dominated by CBSP with some private agent involvement
Industrial crops	▪ Short-term: will continue to be dominated by public research with limited role of private ▪ Long-term: dominant engagement of the private sector with limited role of public research. Privates are expected to introduce genetically modified germplasm (e.g. BT cotton, etc)	▪ Short-term: public producers, with some private involvement ▪ Long-term: dominated by private and agribusiness	▪ Short-term: public producers, with some private involvement ▪ Long-term: dominated by private and agribusiness	▪ Short-term: dominated by public sector (through coops) and agribusinesses ▪ Long-term: dominated by agribusinesses, sometimes through private agents
Forage	▪ Short-term: will continue to be public dominated ▪ Long-term: possible increase of private research role and continued dominance by public sector	▪ Short-term: will be dominated by public producers ▪ Long-term: largely private sector and agribusiness driven	▪ Short-term: will be dominated by public & CBSP producers ▪ Long-term: largely private sector and agribusiness driven	▪ Short-term: driven by public producers (through coops) & CBSPs ▪ Long-term: driven by CBSPs, through agents

Additional Context on Crop-Specific Modalities

Additional considerations and rationale for the value chain model for different types of crops is laid out below, based on a review of existing literature on the topic for more mature seed systems:

For Hybrid Seeds

This is the category that should move most strongly toward privatization, both in terms of research and production. Looking across all African seed systems, hybrids out-perform OPVs by 18-20% across all yield ranges,[90] and are more difficult for farmers to save due to segregation.[91] This should result in a pricing that reflects the relatively higher value and outcomes related to hybrids, as well as a compelling source of recurring annual revenue due to the need to purchase hybrids year-after-year. The business case for the private sector to produce hybrid seeds has strong logic.

For Self-Pollinating Cereal Varieties (Without High Industrial Value)

Self-pollinating wheat, tef, and barley are recyclable and also command a lower price in the market, reducing the incentive of private companies to participate in the varietal development and production of this seed. Given the lower value of the intellectual property associated with SPV cereals, privates will not be as involved, creating a need for public research institutions to continue activity in this area. That said, a systematic approach to production and distribution is necessary - as discussed earlier in this document, farmers recycle wheat and tef seed well beyond recommended levels. Community-based seed producers enable an anchor and limit the touchpoints through which improved varieties of wheat and tef can be introduced, while still maintaining a decentralized enough system to provide farmers easy access to seed. Additionally, these groups are already heavily involved in this process - for example Farmers' Marketing Cooperatives and Local Seed Businesses (types of CBSPs) in Tigray, the Oromia Rift Valley, and SNNP produce first and second generation certified seed of wheat and tef for cereals and haricot beans, lentils, and chickpeas for pulses (and oil crops).[92]

Limiting improved SPV cereal seed to only public seed enterprises (PSEs) will reduce farmers' access to these seeds, resulting in lower adoption. That said, PSEs should continue to focus on SPV cereals as this is a critical gap not met by the private sector, and CBSP production will likely not be sufficient enough to satisfy the demands for these crops across Ethiopia.

For Self-Pollinating Oil Crops, Pulses, and Cereals with Strong Industrial Value

Considerations are similar as to Self-Pollinating Cereal varieties, with the exception of a more promising demand sink for these crops, resulting in much stronger agri-business involvement. Food producers have begun to get involved in this sector, and strive to integrate their entire supply chain from variety development through to sales of the final food product. As such, it is important to consider the involvement of private agri-business in industrial and nutritional contexts. Additionally, the market for industrial cereal crops such as malt barley and durum wheat will have similar dynamics; in fact, specific malt producers have indicated a desire for land to multiply their own proprietary varieties.

For Fruits, Vegetables, and Root Crops

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[90] John MacRobert, CIMMYT, "Supporting and stimulating farmer access to improved maize germplasm through public-private partnerships in the seed value chain", 2013
[91] CSA-India, "Open Source Seed Systems", 2010
[92] Dawit Alemu, "Farmer-Based Seed Multiplication in the Ethiopian Seed System," December 2011

Irrigative crops command a higher price in the market, and as a result, this increases the value of seeds produced. High-value crops, such as vegetables, can have far more expensive seeds, especially for improved varieties with dramatically higher yields. For example, improved onion seeds can run well over 3,000 ETB/ha, in contrast to wheat seed prices of 1,800ETB/ha.[93] This points to a greater involvement of the private sector in these crop categories, which is already true for vegetables. The MoA should work with regional irrigation offices to make a compelling investment case for producers to produce these types of seeds; that said, given the lower level of private presence in this area, ESE and the RSEs should continue to stay involved in these categories. An additional area of importance for these types of crops is community-based seed producers - producers' cooperatives with access to irrigation are heavily involved in production of seed of horticultural crops such as potato and onion.

For Industrial Crops

Industrial crops again have strong revenue potential, resulting in high potential for private and agribusiness activity. In addition, the recent proclamation has allowed for GM technology to be used in these crops, and adoption of genetically modified cotton was anticipated as of January 2014.[94] As such, the long-term vision is for all activity from research through to distribution to be driven by the private sector.

For Forage Seeds

Forage seed is an especially underserved area in Ethiopian agriculture, and is very important to developing a robust livestock sector in Ethiopia. Fodder seed production has risks due to being an intermediate product in the livestock value chain, as opposed to a final good.[95] As such, the current strategy is to work with smaller local players, such as Eden Field Agri-Seed Enterprise and Nissir Agro Industry Cooperative Enterprise, and continue to have public and development players focus on research and varietal development.[96] Despite the fact different varieties for various agro-ecologies are released from public research in collaboration with CGIAR, forage seed production is not yet an attractive area for privates. However, as the market for forage seed scales, private players will get involved more heavily.

[93] Calculations based on average onion seed price of 800 ETB/kg and seed rate of 3.5 kg/ha, and bread wheat seed price of 10.5 ETB/kg and seed rate of 175 kg/ha. Seed rates taken from national crop registry database, averaged across improved varieties, and prices taken from ATA Household Irrigation team's survey of woreda-level horticultural input prices in AGP woredas.
[94] Thomson Reuters Foundation, "Ethiopia Plans GM Crop Boost for Cotton Industry", January 2014
[95] ILRI/IFPRI, "Forage seed supply in Ethiopia", May 2011
[96] ILRI/FeedSeed Planning Meeting, February 2014

Chapter 7: Modalities for Different Crop Categories

7.1 An integrated and comprehensive seed sector development approach

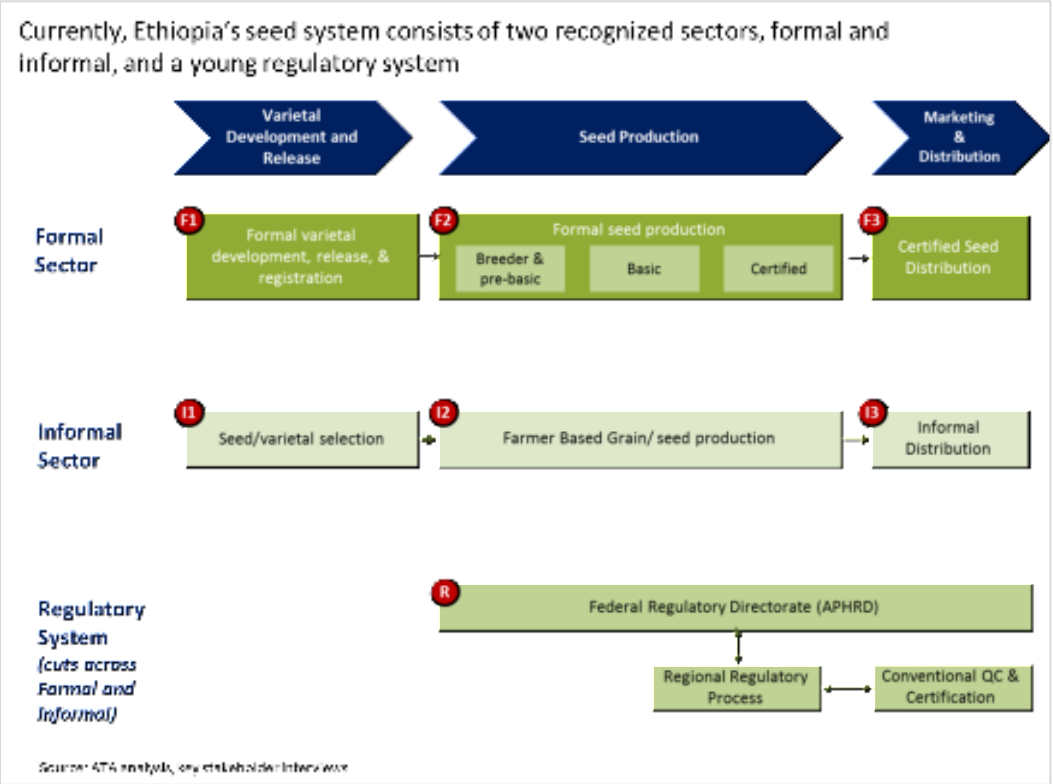
Historically, Ethiopia's seed system has been known to be comprised of two distinct sectors, namely the formal and informal. As discussed, an intermediate sector consisting of community-based seed producers should also be recognized to meet an emerging gap and support the mandate of the seed sector in general. Each of the three sectors has distinct yet overlapping features that complement each other. The three sectors are envisioned to interact in specific ways to maximize the performance of the overall seed system.

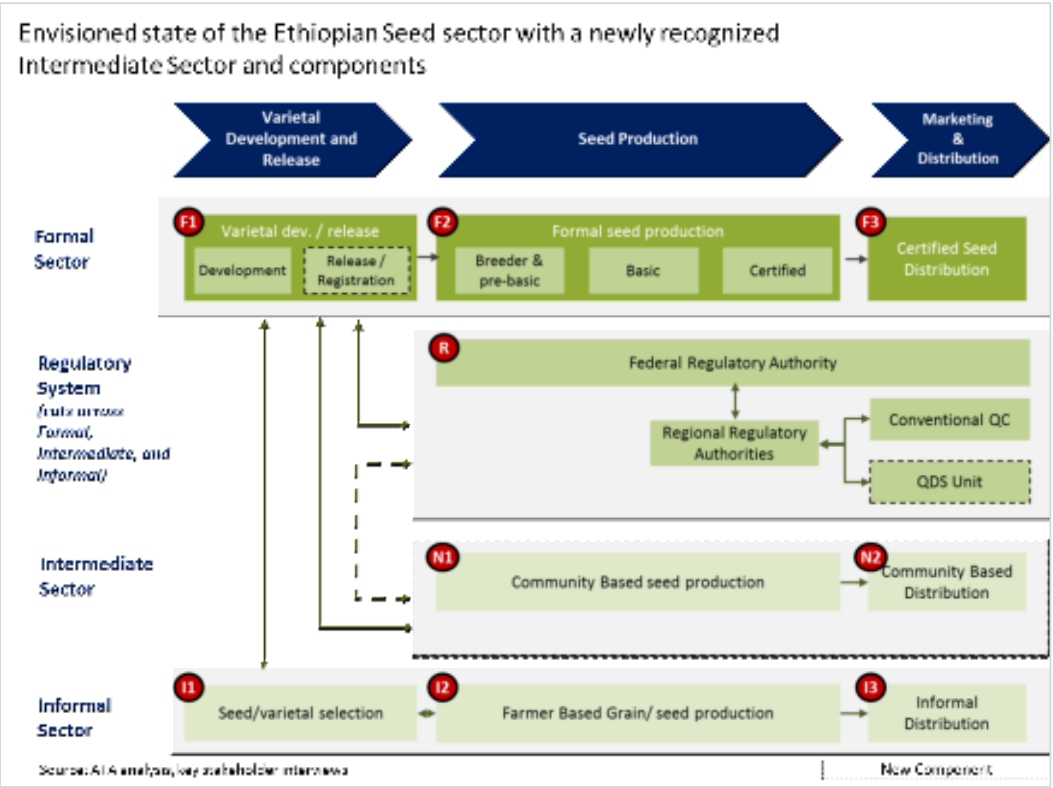
To this end, an integrated seed system development model has been developed where effectiveness of the three sectors is enhanced by promoting proper interaction at various levels. This model recognizes the pluralistic nature of the seed system and promotes complementarity between value-chain components of each sector. To realize this, a two-pronged approach is proposed:

A. **Linkage strengthening:** this refers to strengthening of linkages and interactions that already exist between value-chain components of each seed sector
B. **Linkage creation:** create new linkages and interactions between new and existing value-chain components of each seed sector

The following two schematic presentations depict the existing and envisioned state of Ethiopia's seed system. In the new system, new components and linkages are proposed across the value-chain of the three sectors. On the other hand, existing components and linkages will be strengthened so that the overall seed system functions in a streamlined manner.

Exhibits 36 and 37





7.2 Linkages and interactions between the three seed sectors

	Linkages	Relevant Sectors	Owner
A	Establish contractual agreements between CBSPs and formal enterprises to exchange seed at various levels	Formal and intermediate	ESE/RSE/Private sector/ Mbps
B	Establish linkage between CBSPs and formal distribution outlets (e.g., cooperatives, agents)	Formal and intermediate	CBSPs/FCA/Private sector
C	Popularize Quality Declared Seed (QDS) to increase awareness of CBSPs and strengthen capacity of seed regulatory authorities	Formal and intermediate	MoA Regulatory/CBSPs
D	Ensure farmers get involved in the varietal development and release process to account for their needs	Formal and informal	EIAR/RARI
E	Enable farmers to continue to maintain local genetic diversity	Formal and informal	IBC
F	Leverage informal networks for both the formal and intermediate sector to distribute seed	All sectors	FCA/RBoAs
G	Enable the exchange of knowledge across all three sectors	All sectors	FCA/RBoAs

Linkage A: Establish contractual agreements between CBSPs and formal enterprises to exchange seed at various levels

This will enable two major developments. Firstly, this will provide CBSPs adequate access to source seed (basic or C1) from formal institutions without having to heavily rely on research for source seed. Additionally, CBSPs can sell to formal producers to ensure a sufficient market for CBSPs beyond their local communities, in turn enabling them to operate as self-sustaining businesses.

Linkage B: Establish linkage between CBSPs and formal distribution outlets (e.g., cooperatives, agents)

As channels and outlets grow through direct seed marketing, they can provide a route for not just formal seed producers to distribute seed, but also smaller CBSPs. This can be done through formal linkages and contracts. On the other hand, informal mechanisms such as seed fairs and regular forums could enhance marketing of seed among CBSPs themselves.

Linkage C: Popularize Quality Declared Seed (QDS) to increase awareness of CBSPs and strengthen capacity of seed regulatory authorities

Once the independent regulatory authorities establish a process for QDS, it will be critical to find ways to educate CBSPs. QDS can enable both intermediate players to effectively scale without the heavy costs associated with going through the full quality control and certification. However, for QDS to work, regulatory staff must be properly trained in the appropriate techniques and procedures of QDS.

Linkage D: Ensure farmers get involved in the varietal development and release process to account for their needs

As discussed, a major bottleneck to adoption of formal seed is that the varieties may not meet farmers' diverse needs. As a result, the process needs to be participatory – effective participatory plant breeding (PPB), and participatory varietal selection (PVS) will enable this. To realize this, there needs to be support both to the research centers and the farmers / community groups. The research centers will require the financial and operational capacity, as well as the technical knowledge, to deploy these processes. Ultimately, research centers will adequately use local crop germplasm in their crop improvement programs.

In order for this to be effective, contractual agreements between research institutions and seed enterprises to ensure adequate breeder and pre-basic seed of the right varieties will be critical **(Intervention F2.4a).**

Linkage E: Enable farmers to continue to maintain local genetic diversity

On the other hand, it is equally critical to make sure research institutions are linked to community groups such as CSBs and other conservation organizations that are engaged in maintaining crop genetic diversity. This way, high-quality varieties can easily reach the informal sector. Additionally, CSBs can receive incentives to maintain genetic diversity, e.g., improving output market for farmer-produced seed, and potentially also commercialize genetic diversity by making sure that farmers benefit from access for benefit sharing agreements that are signed between international companies.

Linkage F: Leverage informal networks for both the formal and intermediate sector to effectively distribute seed

As the informal sector forms the majority of the seed system, it is critical for the other sectors to work through the informal distribution networks that already exist. This will effectively improve the dissemination of improved seed. Ways to effectively do this include organization of local community seed fairs, farmer / producer associations to promote knowledge and planting, and more broadly, the multi-channel Direct Seed Marketing model.

Linkage G: Enable the exchange of knowledge across all three sectors

Best practices across all stages and sectors of the seed system, be it quality control, effective inventory management and storage, planting techniques, should be effectively disseminated. Direct Seed Marketing provides an opportunity to streamline the flow of knowledge and ensure that it is exchanged in a relatively structured fashion. Linking DSM to FTC / demonstration plots and providing training pamphlets on planting techniques can improve this further.

7.3 Implications for Gender

Women constitute half of the rural farming community in Ethiopia, contributing 48% of labor over all agriculture, and 70% of household food production.[97] A number of studies indicate that investments in women's access to agricultural inputs and agronomic practices can bring up to a 30% increase in production.[98] As such, interventions need to clearly involve men and women, support women's institutions and target at least 30% female-headed households in all extension services.[99] Furthermore, the role of women in specific interventions that are expected to have the greatest impact has been underlined below - the overarching points to keep in mind for each intervention is how to ensure the seed industry responds to the needs of both men and women farmers, as well as ways improve the role of women in all stages of the seed system through a positive working environment and empowerment.

Gender in Intervention F3.1: Support producers to market directly to farmers (Direct Seed Marketing)

- The Direct Seed Marketing pilots should aim to ensure that women get sufficient opportunities while recruiting seed sellers and effectively track progress against this goal. According to IFPRI's evaluation, 17.4% of seed sellers participating in DSM were women, with the highest female participation in SNNP (28%). Moving forward, DSM should aim to have 25-30% female seed sellers by 2015.
- Additionally, DSM pilots should aim to target woredas with a higher portion of female households. The initiative was successful in this regard last year, with 5.4% female-headed households in DSM woredas vs. 4.4% female-headed households in non-DSM woredas. The difference was strongest in Oromia (6.3% female-headed households in DSM vs. 1.8% female-headed households in non-DSM).[100]

Gender in Intervention F3.5: Provide financial services programs for farmers to increase input affordability

- According to the 2012 ATA baseline survey, only 5.4% of female-headed households received credit for agricultural purposes, compared to 13.2% of male-headed households. The goal will be to increase the female-headed households receiving agricultural credit to 30%, and married women receiving agricultural credit to 20% by 2015. Another way to further involve women in credit disbursement is to have both heads of households co-sign on loans.

Gender in Intervention R2.a: Strengthen the capacity of existing seed labs, regional, and federal regulatory bodies

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[97] Ministry of Agriculture, Environmental Protection and Development Report (1992), A Case study On Women's Access to Agricultural Extension Services

[98] Creating Gender-Responsive Agricultural Development Programs- an orientation document February 2012, Bill and Melinda Gates foundation

[99] Ethiopia's 5-year Growth and Transformation Plan, 2011-2015.

[100] IFPRI, Tables from Farmer and Seller Surveys, October 2013

- As new bodies are established and strengthened, it is critical to encourage the role of women professionals in the workplace. The MoA and EIAR have assigned focal departments to focus on gender equality, and as such, opportunities to incorporate female professionals in technical activities such as field inspection and laboratory testing are very important when thinking about how to capacitate regulatory bodies.

Gender in Intervention N1.1: Improve operational efficiency and sustainability of existing CBSPs so that they are able to gradually transition into independent business entities

- Focusing and building the capacity of female-led community based seed producers is absolutely critical. For instance, data from one of the emerging coop seed enterprise (Edget Union) indicated that membership of female is only 12%.[101] As more interventions are developed for the intermediate sector, tracking female membership and involvement will effectively allow CBSPs to serve as another route for women's empowerment.
- The lack of financial services for inputs has an impact on the financial sustainability for CBSPs to cover production costs, including seed cleaning and storage. As discussed, male headed households are more likely to receive credit for agricultural purposes than female headed households, so there should be mechanisms to ensure financial support for female-led CBSPs.

Gender in Intervention N1.3b: Develop contractual agreements and build operational capabilities of CBSPs to improve quantity of seed

- In general, contract-related activities such as serving as an out-grower for a seed company or community-based seed producers should entail an inclusive-decision making process. Specifically, the enterprises involved need to ensure that household decisions are joint - according to FAO, relationships can be adversely affected in situations where payments are given to men for work largely carried out by the female members of the household. [102]

Gender in Intervention I1.1b: Improve linkage between farmers and NARS crop improvement programs through Participatory Plant Breeding (PPB) and Participatory Varietal Selection (PVS) schemes

- When engaging farmers in participatory research, NARS should reach out to both male and female members of a household in order to get the broadest set of insights possible. A key area is while judging the attractiveness of a newly developed variety before it is presented to the National Variety Release Committee (NVRC). Women will be more likely to provide feedback on its characteristics beyond yield potential – including key health-related issues and effectiveness in preparation.

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[101] On Farm Pre-Basic and Basic Seed Production, June 2012, Self-Help Africa
[102] Contract Farming: Partnerships for growth, 2001, FAO

Chapter 8. Implementation Plan

8.1 Interventions in Progress

	Priority interventions already begun	Component	Owner
F1.1a	Strengthen breeding capacity of National Agricultural Research Institutions	Formal varietal development	EIAR/NARC
F1.3a	Develop contractual agreements and effective pricing / marketing mechanisms between research and extension and seed producers	Formal varietal development	EIAR/NARC
F1.5a	Establish an autonomous regulatory entity at the federal level that will also be responsible for conducting varietal evaluation, release, registration, and PVP (Plant Variety Protection)	Formal varietal release & registration	MoA Regulatory Directorate
F1.5b	Develop new and amend existing variety release and registration guidelines detailing steps and processes of varietal evaluation, release and registration	Formal varietal release & registration	MoA Regulatory Directorate
F1.6	Build capacity of the variety evaluation, release, and registry authority	Formal varietal release & registration	MoA Regulatory Directorate
F1.7	Complete revision of Plant Breeders' Rights Proclamation and draft regulations for immediate implementation	Formal varietal release & registration	MoA Regulatory Directorate
F2.4a	Define and enforce roles and responsibilities among seed producers	Formal seed production	MoA/RBoAs
F2.4b	Support private sector producers to meet needs for commercially attractive crops	Formal seed production	MoA/RBoAs
F3.1	Support seed producers to market directly to farmers (Direct Seed Marketing)	Formal seed marketing and distribution	MoA/RBoAs
F3.2	Strengthen regulatory structures to improve quality control at distribution	Formal seed marketing and distribution	RBoAs Regulatory
F3.3	Equip marketing agents to distribute seed more efficiently as a viable business	Formal seed marketing and distribution	FCA/ RBoAs
F3.4	Enable marketing agents to more actively assess seed demand through direct involvement and incentives		MoA/RBoA
F3.5	Implement open pricing mechanism for seed producers of public varieties	Formal seed marketing and distribution	MoA/RBoAs
R.1	Restructure existing federal and regional regulatory entities	Regulatory system	MoA/RBoAs Regulatory
R.2a	Strengthen the capacity of existing seed labs, regional, and federal regulatory bodies	Regulatory system	MoA/RBoAs Regulatory
R.2b	Enhance Field Inspection Capacity	Regulatory system	MoA/RBoAs Regulatory
R.2c	Ensure financial viability / sustainability of regulatory institutions	Regulatory system	MoA/RBoAs Regulatory

8.2 Priority Interventions

	Priority interventions already begun	Component	Owner

F1.2	Establish a clear link between federal and regional research institutes to ensure coordination and avoid duplication of efforts	Formal varietal development	EIAR/NARC
F1.3b	Ensure variety development incorporates traits beyond simply yield	Formal varietal development	EIAR/NARC
F1.3c	Research institutions and producers should work to actively popularize new improved varieties to drive adoption	Formal varietal development	EIAR/NARC
F2.5	Develop effective out-grower management by seed producers	Formal seed production	ESE/RSEs/Private sector
F2.6a	Support seed producers with sufficient financing and land so that they can scale effectively to satisfy unmet demand	Formal seed production	ESE/RSEs/Private sector
F2.6b	Support seed producers to improve business planning, marketing, and operations management	Formal seed production	ESE/RSEs/Private sector
F3.6	Provide financial services products for farmers to increase input affordability	Formal seed marketing and distribution	MoA/RBoAs
F3.7	Establish more robust transportation, logistics, and storage systems for seed, and better financing for agents	Formal seed marketing and distribution	ESE/RSEs/Private sector
N1.1	Improve operational efficiency and sustainability of existing CBSPs so that they are able to gradually transition into independent business entities	Intermediate seed production	FCA/RBoAs
N1.2	Improve linkage between CBSPs and research centers which maintain early generation seed	Intermediate seed production	EIAR/RARIs
N1.3	Develop contractual agreements and build operational capabilities of CBSPs to improve quantity of seed	Intermediate seed production	FCA/RBoAs
N1.4	Promote Quality Declared Seed Regulatory System (QDS) to ensure baseline seed quality	Intermediate seed production	MoA/RBoA Regulatory
N2.1	Support CBSPs to progressively market their seed using multiple marketing strategies and distribution channels	Intermediate seed marketing and distribution	FCA/RBoAs
I1.1b	Improve linkage between farmers and NARS crop improvement programs through Participatory Plant Breeding and Participatory Varietal Selection schemes	Farmer-based seed / varietal selection and maintenance	EIAR/RBoAs
I1.2	Strengthen pre-breeding component of Ethiopia's biodiversity conservation institute and promote increased use of indigenous germplasm in breed improvement programs of the NARS	Farmer-based seed / varietal selection and maintenance	IBC

8.3 Secondary Interventions

	Priority interventions already begun	Component	Owner
F1.1b	Strengthen the financial viability of the public research system	Formal varietal development	EIAR/NARC
F1.4	Ensure high capacity for maintainers of each improved variety through designated maintenance breeders and sufficient nucleus seed	Formal varietal development	EIAR/NARC

F2.1a	Provide guidelines/standards to enforce internal quality control for all seed producers	Formal seed production	MoA Input Regulatory Directorate
F2.1b	Enable seed producers to build capacity for internal quality control	Formal seed production	RBoA/ESE/RSEs Private sector
F2.2	Strengthen national seed demand estimation and local market assessment	Formal seed production	MoA/RBoAs/ESE/ RSEs/Private sector
F2.3	Increase capacity of breeding institutions to produce higher quantities (linked to Intervention 1.1a)	Formal seed production	EIAR/RARIs
N2.2	Effectively link CBSPs with research and conservation institutes through contractual agreements for accessing source seed of drivers crop varieties	Intermediate seed production	FCA/RBoAs
I1.1a	Improve dissemination of best practices in seed / varietal selection and maintenance for the informal sector	Farmer-based seed / varietal selection and maintenance	RBoAs/Extension
I1.2	Strengthen pre-breeding component of Ethiopia's biodiversity conservation institute and promote increased use of indigenous germplasm in breed improvement programs of the NARS	Farmer-based seed / varietal selection and maintenance	IBC
I1.3	Support the conservation of local genetic diversity by strengthening the capacity of community-based conservation institutes to reduce risk of genetic erosion	Farmer-based seed / varietal selection and maintenance	IBC
I2.1	Promote application of appropriate agronomic practices that enhance yield and quantity	Farmer-based grain / seed production	RBoAs Extension
I2.2	Set up an efficient National Seed Emergency System that effectively responds to natural/manmade disaster conditions by contributing to seed security	Farmer-based grain / seed production	MoA/RBoAs
I2.3	Strengthen farmers' awareness in proper seed management methods and improve access to affordable implements	Farmer-based grain / seed production	RBoAs Extension
I3.1	Strengthen and promote innovative local seed marketing networks for efficient seed diffusion	Farmer-based grain / seed marketing and distribution	IBC/WBoAs

Chapter 9. Conclusion

Experiences in countries such as India, Kenya, as well as within Ethiopia, indicate that access to improved seed can play a substantial role in increasing the productivity, and as a result, income of smallholder farmers.

However, realizing this will require a range of interventions across the different components of the value chain - variety development, variety release, production, and distribution - as well as the different sectors - formal, intermediate, and informal - of the seed system. As discussed, critical points of focus include the breeding and release of high-quality varieties, establishing a competitive market environment across seed production and distribution, a robust community based seed-production system to satisfy SPV demand, and improving best practices in seed management for the informal sector. These areas must be underpinned by a strong regulatory system that effectively incentivizes relevant stakeholders of the seed industry while ensuring the supply of high-quality seed.

Aligning stakeholders to effectively develop and coordinate priority interventions is essential - this will be done through a series of workshops, and ultimately, a national council to manage the transformation of the seed system through the implementation of the proposed strategic interventions. In addition, systematic, regular and objective monitoring and evaluation (M and E) of progress with the overall Strategy and its different components is critical to success.

The success of this strategy will be assessed against the immediate output of timely delivery of high-quality seed at the right quantities, and then, the longer-term outcomes of yield and income. This strategy is ultimately predicated on producing a single outcome: a well-functioning seed system that enables farmers to access seed of improved varieties at the right quality, quantity, time, and competitive price, from a range of producers and distribution channels. The achievement of this outcome will be measured closely through a series of indicators that will be measured at baseline levels in 2014 and monitored preiodicially to track progress toward this outcome based on parameters set by multiple stakeholders.

Appendix A: Summary of Bottlenecks and Interventions

	Bottlenecks		Interventions	Owners
Varietal Development in the Formal Sector				
F1.1	Lack of resources in public research system to effectively develop improved varieties and produce breeder seed	F1.1a	Strengthen breeding capacity of National Agricultural Research Institutions	EIAR/NARC
		F1.1b	Strengthen the financial viability of the public research system	EIAR/NARC
F1.2	Lack of clear communication, role clarity, and accountability among various research institutions and units	F1.2	Establish a clear link between federal and regional research institutes to ensure coordination and avoid duplication of efforts	EIAR/NARC
F1.3	Limited commercialization and adoption of improved varieties by seed producers and farmers	F1.3a	Develop contractual agreements and effective pricing / marketing mechanisms between research and extension and seed producers	EIAR/NARC
		F1.3b	Ensure variety development incorporates traits beyond simply yield	EIAR/NARC
		F1.3c	Research institutions and producers should work to actively popularize new improved varieties to drive adoption	EIAR/NARC
F1.4	Lack of capacity of maintainer institutions results in risk of poor quality	F1.4	Ensure high capacity for maintainers of each improved variety through designated maintenance breeders and sufficient nucleus seed	EIAR/NARC
Varietal Release & Registration in the Formal Sector				
F1.5	Current varietal release system is not independent from varietal development	F1.5a	Establish an autonomous regulatory entity at the federal level that will also be responsible for conducting varietal evaluation, release, registration, and PVP (Plant Variety Protection)	MoA Regulatory Directorate
		F1.5b	Develop new and amend existing variety release and registration guidelines detailing steps and processes of varietal evaluation, release and registration	MoA Regulatory Directorate
F1.6	Current varietal release and registration process has severe capacity constraints	F1.6	Build capacity of the variety evaluation, release, and registry authority	MoA Regulatory Directorate
F1.7	Post-release duties and rights of the variety owners are not enforced due to capacity constraints	F1.7	Complete revision of Plant Breeders' Rights Proclamation and draft regulations for immediate implementation	MoA Regulatory Directorate
Seed Production in the Formal Sector				
F2.1	Seed producers lack capacity for internal quality control	F2.1a	Provide guidelines/standards to enforce internal quality control for all seed producers	MoA Regulatory
		F2.1b	Enable seed producers to build capacity for internal quality control	RBoA/ESE/RSEs/ Private sector
F2.2	Seed production volume does not match farmers' demand due to absence of sound seed demand and distribution mechanism	F2.2	Strengthen national seed demand estimation and local market assessment	MoA/RBoAs/ESE/ RSEs/Private sector
		Intervention F2.6 is also relevant to this bottleneck		

F2.3	Limited availability of early generation seed	F2.3	Increase capacity of breeding institutions to produce higher quantities (linked to Intervention 1.1a)	EIAR/RARIs
F2.4	Lack of market environment reduces incentives to maximize quality and quantity	F2.4a	Delineate and enforce roles and responsibilities among seed producers	MoA/RBoAs
		F2.4b	Support private sector producers to meet needs for commercially attractive crops	MoA/RBoA
F2.5	Inefficient out-grower management by seed producers	F2.5	Develop effective out-grower management by seed producers	ESE/RSEs/Private sector
F2.6a	Delayed seed processing and delivery by seed producers	F2.6a	Support seed producers with sufficient financing and land so that they can scale effectively to satisfy unmet demand	ESE/RSEs/Private sector
F2.6b	Seed producers lack effective commercial (customer-facing) operations	F2.6b	Support seed producers to improve business planning, marketing, and operations management	ESE/RSEs/Private sector
Seed Marketing and Distribution in the Formal Sector				
F3.1	Producers lack effective channels to market and distribute their seed	F3.1	Support seed producers to market directly to farmers (Direct Seed Marketing)	MoA/RBoAs
F3.2	Variable quality of seed available at distribution channels due to limited quality control by regulatory bodies	F3.2	Strengthen regulatory structures to improve quality control at distribution	RBoAs Regulatory
F3.3	Marketing agents currently lack the means and incentives to distribute seed effectively	F3.3	Equip marketing agents to distribute seed more efficiently as a viable business	FCA/RBoAs
F3.4	Marketing agents lack incentives to effectively measure demand	F3.4	Enable marketing agents to more actively assess seed demand through direct involvement and incentives	MoA/RBoAs
F3.5	Fixed pricing for public varieties dis-incentivizes producers and distributors to invest in quality and marketing	F3.5	Implement open pricing mechanism for seed producers of public varieties	MoA/RBoAs
F3.6	Farmers lack input credit to adopt modern varieties of crops with high seeding rate	F3.6	Provide financial services products for farmers to increase input affordability	ESE/RSEs/ Private sector
F3.7	Producers and distributors lack appropriate access to finance, transport, and storage facilities	F3.7	Establish more robust transportation, logistics, and storage systems for seed and better financing for agents	ESE/RSEs/Private sector
The Regulatory System				
R.1	Regulatory institutions lack autonomy and role clarity	R.1	Restructure existing federal and regional regulatory entities	MoA/RBoAs Regulatory
R.2	Regulatory institutions lack capacity	R.2a	Strengthen the capacity of existing seed labs, regional, and federal regulatory bodies	MoA/RBoAs Regulatory
		R.2b	Enhance Field Inspection Capacity	MoA/RBoAs Regulatory
		R.2c	Ensure financial viability / sustainability of regulatory institutions	MoA/RBoAs

				Regulatory
Seed Production in the Intermediate Sector				
N1.1	Many community-based producers are not operationally or financially sustainable	N1.1	Improve operational efficiency and sustainability of existing CBSPs so that they are able to gradually transition into independent business entities	FCA/RBoAs
N1.2	Lack of adequate access to early generation seed (basic or C1)	N1.2	Improve linkage between CBSPs and research centers which maintain early generation seed	EIAR/RARIs
N1.3a	CBSPs lack capacity to produce sufficient volume of seed to satisfy demand gaps	N1.3	Develop contractual agreements and build operational capabilities of CBSPs to improve quantity of seed	RBoAs/FCA
N1.3b	CBSPs have low seed recovery rates from their member farmers due to poor business planning			
N1.4	Quality of seed produced and supplied by CBSPs often fails to meet minimum quality standards (based on the formal certification process)	N1.4	Promote Quality Declared Seed Regulatory System (QDS) to ensure baseline seed quality	MoA/RBoA Regulatory
Seed Marketing and Distribution in the Intermediate Sector				
N2.1	Lack of adequate and sustainable market for CBSPs	N2.1	Support CBSPs to progressively market their seed using multiple marketing strategies and distribution channels	FCA/RBoAs
N2.2	CBSPs are currently engaged in limited crop and varietal portfolio (# and type of crops and varieties)	N2.2	Effectively link CBSPs with research and conservation institutes through contractual agreements for accessing source seed of diverse crop varieties	FCA/RBoAs
Farmer-based seed / varietal selection and maintenance in the Informal Sector				
I1.1	Farmers may lack adequate knowledge in best seed selection techniques that help maintain genetic uniformity of modern varieties and enhance the performance of existing local varieties	I1.1a	Improve dissemination of best practices in seed / varietal selection and maintenance for the informal sector	RBoAs/ Extension
		I1.1b	Improve linkage between farmers and NARS crop improvement programs through Participatory Plant Breeding and Participatory Varietal Selection schemes	EIAR/RBoAs
I1.2	Germplasm of local crop genetic resources collected by conservation institutes have not been adequately characterized	I1.2	Strengthen pre-breeding component of Ethiopia's biodiversity conservation institute and promote increased use of indigenous germplasm in breed improvement programs of the NARS	IBC
I1.3	High risk of genetic erosion of local varieties with the increased adoption of varieties developed through the formal sector	I1.3	Support the conservation of local genetic diversity by strengthening the capacity of community-based conservation institutes to reduce risk of genetic erosion	IBC
Farmer-based grain/seed production in the informal sector				
I2.1	Farmers are currently unable to produce sufficient yield and quantity seeds for preferred varieties	I2.1	Promote application of appropriate agronomic practices that enhance yield and quantity	RBoAs Extension
I2.2	Seed emergency programs are poorly designed	I2.2	Set up an efficient National Seed Emergency System that effectively	MoA/RBoAs

	and executed, which is especially a problem for the informal sector		responds to natural/manmade disaster conditions by contributing to seed security	
I2.3	High risk of poor quality seed due to poor cleaning and storage practices	I2.3	Strengthen farmers' awareness in proper seed management methods and improve access to affordable implements	RBoAs Extension
Farmer-based grain/seed marketing and distribution in the informal sector				
I3.1	Limited local seed diffusion and dissemination networks / access points for exchanging / marketing seeds of local cultivars or recycled improved varieties and associated knowledge	I3.1	Strengthen and promote innovative local seed marketing networks for efficient seed diffusion	IBC/WBoAs

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[i] Dilip G., 2011; ICAR, 2011, Revathi R., 2005

[ii] Crop Variety Register (Issue No. 13), 2010

[iii] Isolation distance refers to the separation required from the periphery around a farmer's plot to avoid pollen contamination from other sources during seed multiplication