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Seed Production and Dissemination Systems Analyses: The Case of Ethiopia

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Abstract
Seed is among the most key input for improving crop production and productivity. Increasing the quality of seeds can increase the yield potential of the crop by significant folds. Hence, access to and uses of seeds are critical factors for the ability of smallholder farmers to increase agricultural production and productivity, ensuring food security and improving livelihoods. The Ethiopia seed system has undergone a tremendous change during the past three decades. But, still the sector is unable to guarantee farmers' access to seed of improved varieties, in the right quantity, of the right quality, and in a timely manner, mainly because of the highly centralized seed distribution system and virtual absence of seed marketing conducted by the seed producing enterprises and companies. Beside these, the sector suffers from weak linkage and integration among the stakeholders; there is a substantial gap exists between the production and availability of commercial seed and farmers' demand. This paper presents the current seed system deriving the country by analyzing the overall policy context, as well as the main interests driving seed policy formulation and implementation and the roles and interaction of the different public and private actors. It describes the stakeholders and structure of the seed system and examines its performance in contributing to seed availability and access. It also briefly indicates the major constraints in the sector regarding with the production and dissemination of improved seed and suggests the possible solution to tackle these constraints.
Keywords: Improved seed; Seed system, Ethiopia, Food security, Seed distribution

1. Introduction

Ethiopia is predominantly an agrarian country with the vast majority of its population directly or indirectly being involved in the production of crop and livestock. Hence, agriculture plays a vital role in Ethiopian economy. Agriculture in Ethiopia contributes about 45% of the GDP, 85% of the total exports and more than 85% of employment (Alemu, 2012). But, still the sector is not yet adequately commercialized to bring about rapid change in production in line with increasing population pressure. The problem is not that Ethiopia is poorly endowed with agricultural resource; instead the problem is that new technologies have not been permitted to make any inroads into Ethiopian agriculture (Astatkie *et al*., 2012).

Agriculture in Ethiopia is caught in a low input-low output trap, due in part to low levels of investment, low technology application, and low capacity. The solution needs to involve a structural change, for which major capacity development is needed, including a quantum change in human capacity, input supply, technology adoption, and provision of infrastructure. Specially, in order to increase the production and productivity of agricultural output, the use of modern agricultural technologies are vital, out of which fertilizer and high yielding variety of crops are the most important technologies to increase the level of crop production (Atilaw, 2010).

Seed is among the most key input for improving crop production and productivity (Beyene, 2010; Mugonozza, 2001). Increasing the quality of seeds can increase the yield potential of the crop by significant folds and thus, is one of the most economical and efficient inputs to agricultural development (Atilaw, 2010). Ever since seed was considered an important vehicle to extend intensified production techniques in developing countries, the supply system has received considerable attention.

Generation and transfer of improved technologies are critical prerequisites for agricultural development particularly for an agrarian based economy such as of Ethiopian. Despite the release of several technologies, particularly of improved crop varieties, there has been limited use of improved seeds by the majority of farmers, yet for some important crops the area covered with improved varieties is estimated to be less than 5% (Thijssen *et al*., 2008). The unavailability of quality seeds at the right place and time coupled with poor promotion system, is one of the key factors accounting for limited use of improved seeds, which further contributing for low agricultural productivity (Atilaw, 2010).

A sustainable seed system will ensure that high quality seeds of a wide range of varieties and crops are produced and fully available in time and affordable to farmers and other stakeholders. However, in Ethiopia like in many developing countries farmers have not yet been able to fully benefit from the advantages of using quality seed

due to a combination of factors, including inefficient seed production, distribution and quality assurance systems, as well as bottlenecks caused by a lack of good seed policy on key issues such as access to credit for inputs. This review paper is aimed to give an overview about the status of the Ethiopia seed industry and to assess seed production and dissemination strategy of the country.

2. Status of the Ethiopian Seed Industry

Seed system in Ethiopia represents the entire complex organizational, institutional and individual operations associated with the development, multiplication, processing, storage, distribution, and marketing of seed in the country. Farmers, particularly smallholder ones, are involved in multiple kinds of seed systems, which can guarantee them in obtaining the quantity and quality of seeds they need and to market their produce (Atilaw, 2010).

Seed systems in Ethiopia can be divided into two broad types: the formal system and the informal system (Alemu, 2010; Atilaw, 2010). Both systems are operating simultaneously in the country and difficult to demarcate between the two. There is however, a fact that the formal system is the original source of improved seeds in the informal system. There is also a system that interact the two systems referred to as integrated seed system. Other forms of seed systems operating in both systems also exist such as Community - Based Seed System (CBSS). Though not well developed, few commercial seed systems are also operating in the country (Atilaw, 2010).

2.1. Formal seed system

The formal seed system is called formal because it is mainly government supported system and several public institutions are also involved on it. It also includes private producers, cooperative unions and private seed companies. The producers and companies are legally licensed to produce seed of food and cash crops. There are also some licensed seed traders that import and market vegetable seed of exotic varieties (Gemeda *et al*., 2001; Tesfaye *et al*., 2012).

The major actors of the formal system are: National Agricultural Research Systems (NARS), Ministry of Agriculture (MoA), Ethiopian Seed Enterprise (ESE) and private seed companies specializing on specific crops like Pioneer. Recently, regional seed enterprises (RSE) were also established as public seed enterprises (such as Oromiya Seed Enterprise (OSE), Amhara Seed Enterprise (ASE), and Southern Nations nationalities and Peoples Region Seed Enterprise (SRSE) and entered into the formal system. All actors have inter-dependent roles in the system and inefficiency of one actor will automatically affect negatively the performances of the rest of the actors. NARS (EIAR & RARIs) is responsible for variety development and supply of initial seed, and ESE and RSEs are playing key roles in mass production of improved seeds. MoA is also involved in variety release, multiplication, certification, and distribution of seeds in the country. Private seed growers and other farmer institutions such as unions and cooperatives are also playing key roles in multiplication and distribution of different classes of seeds. Legal institutions such as variety release procedures, intellectual property rights, certification programs, seed standards, contract laws, and law enforcement are also an important component of the formal seed system of any country. They help determine the quantity, quality, and cost of seeds passing through the seed system (Atilaw, 2010).

The Ethiopian government has enabling policy framework for agricultural research and technology generation and is fully supporting the research system by allocating appropriate resources. Therefore, the country's agricultural research system (NARS) has developed and released more than 664 varieties of 50 different crop types. ESE has only been able to produce 111 different seeds of just 26 different crop varieties in 2009 cropping season. Seed multiplication by ESE focused mainly on two cereal crops (wheat and maize) and annual supply of certified seed by the enterprise doesn't exceed 20,000 tons (Marja *et al*., 2008 as sited in Atilaw (2010)). Wheat and hybrid maize constitute about 85% of the total output of the enterprise.

Table 1: Area cultivated (ha) by major crops over the last five years (2005/06-2009/10) Cropping season.

	Cropping season				
Crop	2005/06	2006/07	2007/08	2008/09	2009/10
Cereals	8,072,561	8,463,080	8,730,001	8,770,118	9,233,025
Pulses	1,292,063	1,378,939	1,517,662	1,585,236	1,489,308
Oil crops	796,397	740,847	707,059	855,147	780,916
Vegetables	117,578	95,194	119,091	162,125	138,393
Root crops	168,836	188,917	184,329	145,742	212,208
Other annuals	77,554	97,677	84,977	69,103	63,418
Permanent	767,582	823,121	1,039,313	906,518	53,086
Total	11,292,571	11,787,775	12,382,432	12,493,989	11,970,354

Source: CSA, 2006-2010

It is reported that over the last five years (2005-2010), on average more than 12 million hectare of land are cultivated by the major food crops (Table 1). These are: cereals, legumes, oilseeds, root crops and horticultural crops. In 2009/10 cropping season the total area covered by improved seeds was about 361,231 hectares. In the same season, the largest volume of improved seeds used was that of maize and wheat, which amounted to about 5,720 and 4,690 tons, which has covered the largest area under improved seeds cultivation estimated to be about 210,000 and 38,000 hectares, respectively (Table 2).

Table 2: Area covered (ha) by improved seeds (formal) during 2005/06 to 2009/10 cropping season.

	Cropping season				
Crop	2005/06	2006/07	2007/08	2008/09	2009/10
Cereals	429,536	335,369	412,629	430,937	322,819
Pulses	5,224	5,025	6,309	14,918	12,912
Oil crops	1,833	4,056	2,273	2,328	9,139
Vegetables	779	559	501	1,899	2,788
Root crops	813	2,114	2,251	799	3,721
Other annuals	70	102	-	-	-
Permanent	9,681	11,742	5,828	13,120	9,852
Total	447,936	358,967	429,791	464,001	361,231

Source: CSA, 2006-2010

2.2. Informal seed system

Informal seed systems include farmer-saved and exchanged seed of important food crops, comprising both local and improved varieties that have been accessed through the formal distribution system (Tesfaye *et al*., 2012). The seed production-distribution chain in the informal seed system is short and simple, without any regulation. There are five key features distinguish the informal from the formal system. These are, the informal system is traditional, semi-structured, operate at the individual community level, uses a wide range of exchange mechanisms, and usually deal with small quantities of seeds often demanded by farmers (Gemeda *et al*., 2001; Atilaw, 2010).

In the context of some countries like Ethiopia, the informal system is extremely important for seed security. The bulk of seed supply is provided through the informal system, implying its importance in national seed security. About 60-70% of seed used by Ethiopian smallholder farmers is saved on-farm and exchanged among farmers, and the remaining 20-30% is borrowed or purchased locally. The informal seed system (either self-saved seed or farmer-to-farmer seed exchange) accounts for 90% of the seed used by smallholder farmers while the share of improved seed is less than 10% (Thijssen *et al*., 2008).

The majority of Ethiopian farmers show a tendency of depending on the informal system due to the following key reasons, primarily, it is relatively cheaper and readily available in the farmer's villages just at the time of seed is needed. Secondly, it allows use of seeds after testing on primary adopter farmers and lastly, it is more reliable and its sustainability is more guaranteed than the formal system (Atilaw, 2010). In 2009/10 cropping season, out of 10,979,645 hectares (84.75%) were covered by local seeds. Moreover, about 71.3% of the total cultivated area is covered by major cereals: tef, maize, barley, wheat and sorghum, followed by legumes (11.5%) and oil seeds (6%) (Table 3).

Table 3: Area covered (ha) by local (informal) seeds over the last five years (2005/06- 2009/10) cropping season

	Cropping season				
Crop	2005/06	2006/07	2007/08	2008/09	2009/10
Cereals	7,636,935	8,127,710	8,309,899	8,333,097	7,660,560
Pulses	1,283,564	1,373,914	1,509,394	1,568,457	1,358,379
Oil crops	790,471	736,791	702,518	851,626	706,361
Vegetables	116,298	94,636	118,026	159,626	122,832
Root crops	167,189	186,804	180,624	143,761	183,254
Other annuals	77,000	97,575	83,041	68,048	56,431
Permanent	750,353	810,364	1,023,591	885,427	48,927
Total	10,821,810	11,427,794	11,927,093	12,010,042	10,136,744

Source: CSA, 2006-2010

2.3. Integrated seed system

The line between the formal and informal seed sectors can become somewhat blurred, as seeds of improved varieties can be saved by farmers and eventually considered as "local variety" or "local seed" after some years of usage. In addition, in Ethiopia there have been attempts made by the government and NGOs to promote quality seed production and distribution through market channels for landrace varieties, although until now the volume they represent is quite small (Lipper *et al*.,2005; Atilaw, 2010). Thus, the formal and local seed systems are not always as distinct or separated as the two labels may imply something to integrate and synergize both systems (Figure 1).

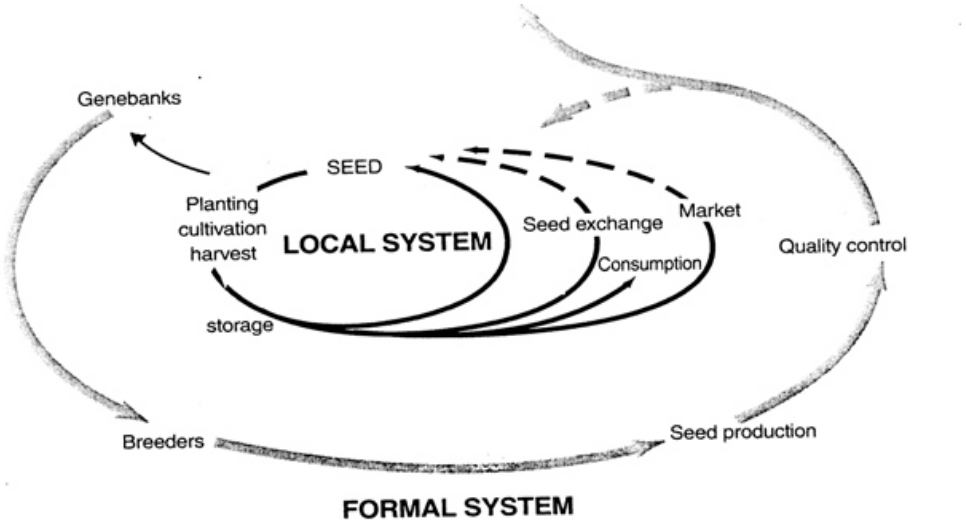

Figure 1: The local system of farmers' seed supply and formal seed system: two parallel functioning systems with relatively little interaction (Almekinders and Louwaars, 1999)

Current Ethiopian seed policy thinkers are pushing to modernize and strengthen the formal seed system, encouraging the uptake of new seed varieties. Seed policy is also influenced by donors who are interested in strengthening the national seed system through programs providing technical support and investment. These include the Program for Africa's Seed System (PASS) of the Alliance for a Green evolution in Africa (AGRA) and the Agricultural Growth Program (AGP). At the regional level, Ethiopia has joined neighboring countries in efforts to foster seed policy harmonization and problem-solving through the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). This association represents the National Agricultural Research Systems, together with the Common Market for Eastern and Southern Africa (COMESA), which promotes regional trade and investment (Alemu, 2012).

3. Ethiopian Seed Policy and Regulatory Frameworks

The Ethiopian seed policy was first formulated in 1992, and serves as the basis for different laws and regulations. This seed policy focused on plant genetic resource conservation, crop variety development, testing and release, seed production and supply, seed import and export, and reserve seed stocking. Various activities have been undertaken to enforce the implementation of the policy (Tesfaye *et al*., 2012). The main objectives set by the policy are to: Ensure the plant genetic resources collection, conservation, evaluation and use by the national research and development programs; Enhance and streamline variety development, evaluation, release,

registration and maintenance; Develop an effective system for producing and supplying high quality seeds of important crops to satisfy the national seed requirements; Encourage the participation of farmers in germplasm conservation as well as in seed production and supply systems; Create a functional and efficient organizational setup to facilitate collaborative linkage and coordination in the seed industry; Regulate seed quality standards, import and export, seed trade, quarantine and other seed-related issues (Bishaw *et al*., 2008).

The regulatory organ in the Ethiopian seed system is the Ministry of Agriculture and Rural Development. In 2004, Proclamation No. 380/2004 gave MoARD the authority to supervise. This shows the commitment and interest of the government to strengthening the seed system in the country all government organs dealing with seed regulation, seed production and seed distribution. Several proclamations were issued to legally enforce and implement various activities underlined in the national seed industry policy. They included the Plant Protection Decree (No.56/1971), the Plant Quarantine Regulation (No.4/1992), the Plant Breeders' Rights Proclamation (No. 481/2006), the access to Genetic Resources and Community Knowledge and Community Rights Proclamation (No.482/2006), and the National Seed Proclamation No. 206/2000. Moreover, major stakeholders were also reconstituted into new legal entities through various proclamations and regulations including the EIAR (Proclamation No. 79/1997), the Institute of Biodiversity Conservation (IBC, Proclamation No. 120/1998) and the ESE (Regulation No. 154/1993). The national seed policy and regulatory frameworks were realigned with rural development polices and strategies issued by the government in 2001.However, due to the limited capacities within regulatory bodies, despite the existence of a seed policy, seed law and seed standards, their implementation is still mostly at the infant stage. In most cases they are remain on the paper. Although some of the proclamations are being revised ahead of their implementation, stakeholder awareness about these laws and regulations is still very limited (Tesfaye *et al*., 2012).

4. Seed System Structure

The seed industry in Ethiopia involves range of both public and private sector (Figure 1). The national research system-headed by the Ethiopian institute of agriculture research (EIAR) and comprised of a range of federal research centers, regional research centers, and agricultural universities and faculties is charged with developing improved varieties and materials needed to produce and multiply certified seed for onward sale to farmers. Regulatory function, such as, varietal release reviews and seed certification are performed by various department of the MoARD (Spielman *et al*., 2009).

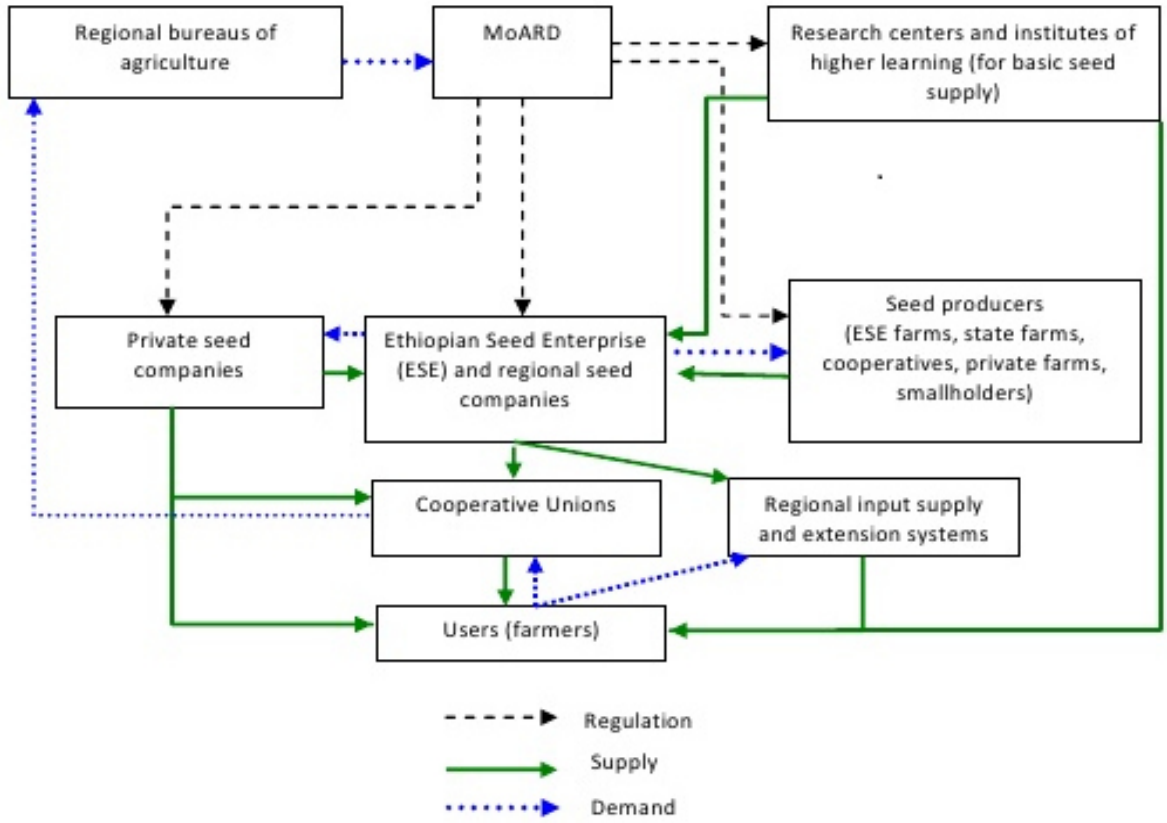

Figure 2: A schematics of the Ethiopian seed system (Spielman *et al*., 2009)

Improved seed production and multiplication is carried out by the ESE, which relies on its own farm and to a limited extent, private sub contractor, state farms and cooperatives- to bulk up seed that is supplied to the regional extension and input supply system, more recently, state owned regional seed enterprise have also emerged in Oromia , SNNP and Amahra. Improved seed is supplied to Ethiopia small holders primarily through regional, state run extension and input supply systems that operate with a degree of guidance from the federal MoA and MoARD. This regional system is made up of regional bureaus of agriculture and rural development (BoARDS), their woreda offices, and extension agents (developing agents) working in the kebele (peasant association level. These organizations collaborate closely with farmers' cooperatives and regional credit and saving institution in both supply inputs and disbursing credit (Spielman *et al*., 2009).

5. Stakeholders in Ethiopian Seed system and Their Roles

In Ethiopia, the formal seed sector comprises both public and private organizations, including the Institute of Biodiversity Conservation (IBC), the Ethiopian Institute for Agricultural Research (EIAR), Regional Agricultural Research Institutes (RARIs: research organizations operating within the regional states), Universities, the Ethiopian Seed Enterprise (ESE), Pioneer Hybrid Seed Ethiopia (PHSE), several small-to-medium scale private seed farms and the farmers. Other relevant stakeholders are the Ministry of Agriculture and Rural Development (MoARD), the Bureaus of Agriculture and Rural Development (BoARDs: the regional state extension bodies), farmers' cooperative unions (FCUs) and NGOs (Bishaw *et al*., 2008). Table 4 shows the key stakeholders in the formal seed system.

Table 2: The formal seed system and its stakeholders

Seed system components	Involved stakeholders	Regulatory stakeholders	Regulatory measures
Plant breeding	EIAR, RARIs and Universities	MoARD	Targets in terms of crop, improvement targets
Variety release	National Variety Release Committee	MoARD	Distinctiveness, uniformity and stability, uniqueness, value for cultivation
Breeder seed Production	EIAR, RARIs and Universities	Variety Maintaining Research Centre Seed	Seed quality control
Pre-basic seed Production	EIAR, RARIs, universities and ESE		Seed quality control
Basic seed Production	ESE and private seed companies	MoARD	Seed quality Assurance
Certified seed production	ESE, private seed farms, farmer based seed production	MoARD	Seed quality Assurance
Farmer based seed Production	ESE, BoARD, NGOs and farmers	BoARDs	Seed quality control
Seed distribution and sales	ESE, OSE, ASE, Co-operatives, BoARDs	BoARDs	Price, quantity to respective Buyers
Use of seed for grain Production	Farmers	Ethiopian Grain Trade Agency	Grain quality

Source: Bishaw *et al*., (2008)

5.1. The public sector

Activities in the public sector include research, variety development and evaluation, variety release and verification, early generation seed multiplication, certified seed production and processing, regulation, marketing, dissemination and also demand assessments for formal dissemination. The Federal Ministry of Agriculture and Regional Bureaus of Agriculture coordinate the public seed sector with an impact on both the research institutions and public seed enterprises, for which both federal and regional entities exist. In this institutional landscape, a complex of organizations and institutions operate, each responsible for parts of the above-mentioned components of the public seed value chain (Tesfaye *et al*., 2012).

Variety development has long been the sole responsibility of the EIAR. Since research decentralization, RARIs have increasingly been commissioned to develop varieties suitable for their regions. Moreover, agricultural universities and colleges are contributing to variety research and development. The variety release mechanism is still controlled at a federal level. The EIAR and the RARIs produce breeder seed and parental lines; the EIAR and the ESE are responsible for pre-basic and basic seed supply (Bishaw *et al*., 2008). The ESE is the major seed

producer in the formal seed system, and owns four seed farms where it produces largely pre-basic and basic seeds of different crop varieties (Table 5).

Table 3: Ethiopian Seed Enterprise's seed production farms

Seed farm	Location	Area (ha)	Altitude (m)	Average Rainfall (mm)	Main crops
Gonde Eteya BSF	Arsi	400	2150	800	Highland
Shallo BSF	W. Arsi	1018	1700	842	Low - medium land
Kunzila BSF	W. Gojam	509	1800	NA	Low - medium land
Ardayta Seed F	Arsi	3116	2500	812	Highland

These farms, however, could not produce all the required early generation seed, due to limitations in crop adaptation. Therefore, the EIAR fills the gap in the supply through its regional branches, which better represent the various agro-ecologies. The shortage of pre-basic and basic seed has continued to pose problems in the seed industry. The role of private seed companies is still limited to the production of hybrid maize seed, while the ESE is the main public sector seed producer and supplier of other crops and varieties. BoARDs and some NGOs help small farmers with informal seed production and supply (Bishaw *et al*., 2008).

MoARD is an umbrella organization which coordinates and leads the various activities of the seed industry. The main tasks of MoARD's various departments include the national seed policy, variety registration and release, seed import/export, seed certification, quarantine and extension. Previously, the responsibility for official seed quality control and certification was given to the now defunct National Seed Industry Agency (NSIA). To date, it is handled by the Agricultural Inputs Quality Control Department of MoARD, which is now being restructured. BoARDs in regional states and FCUs play a vital role in seed distribution while credit is offered by various financial institutions through FCUs. The FCU's share in seed supply to small farmers is now growing very rapidly (Bishaw *et al*., 2008). Figure 3 indicated the major actors in public sector of the Ethiopian seed system.

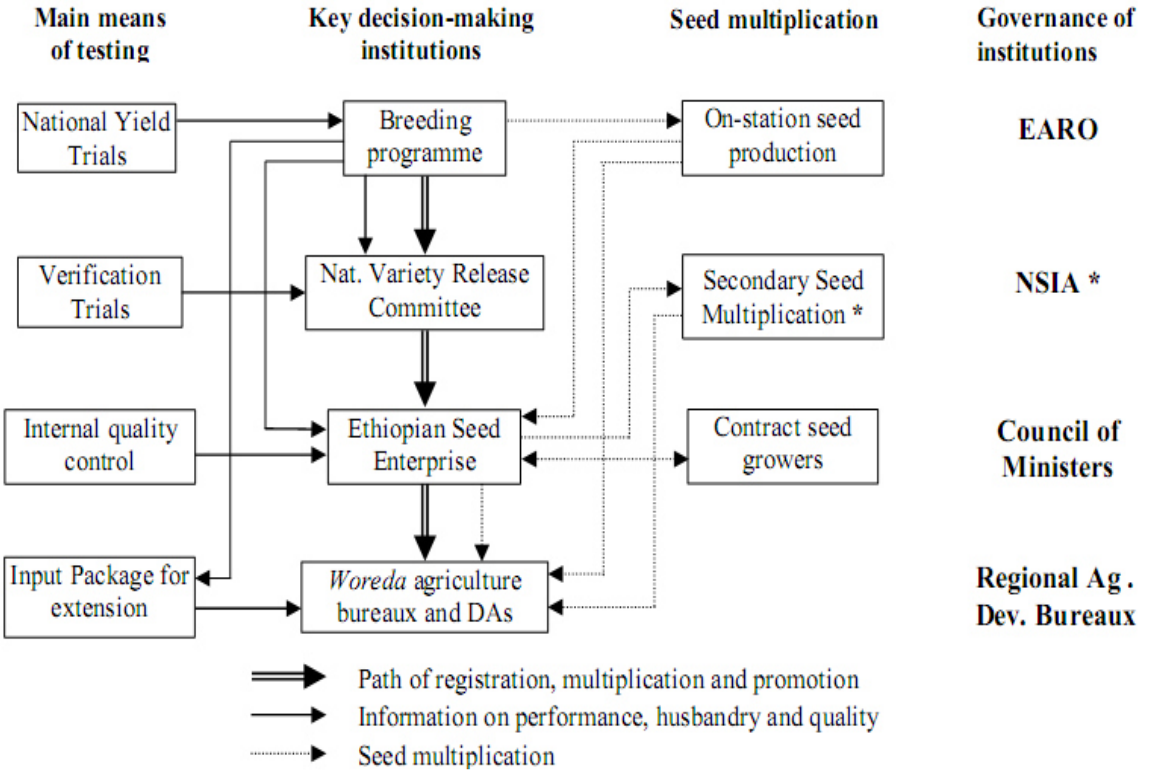

Figure 3: Different actor in the seed system of Ethiopia and their relations (McGuire, 2005)

5.2. The Private Sector

Private seed companies (both domestic and international) are primarily concerned with the production, processing and marketing of hybrid maize seed. An increasing number of international seed companies are now entering the Ethiopian seed sector, introducing commercial varieties of potato, vegetables and hybrid maize. Most domestic companies are small or medium in size, and are locally oriented, but the production and marketing programmes of international companies target the areas of high productivity, such as Amhara, Oromia

and the Southern Nations, Nationalities and People's Region (SNNPR). Partnerships with public organizations, such as research institutes, Bureaus of Agriculture and some cooperatives, plays a significant role in variety demonstration, scaling-out farmer-based quality seed production and out-grower schemes. The scale of use of quality seed of improved varieties has increased over the last ten years (Tesfaye *et al*., 2012).

5.3. The NGO sector

NGOs programmes mainly focus on intermediary systems with a community-based and local seed business approach. These NGOs support the establishment of primary cooperatives and unions for achieving local seed security, and consequently attaining food security. Other NGOs offer support for establishing community seed banks, and provide emergency or relief seed. NGOs have been responsible for organizing farmers' groups and seed producer cooperatives by liaising with the cooperative promotion offices of the government. Other NGOs and international development programmes aim to improve the capacities of farmers' groups for producing and marketing seed, by organizing training and donating post-harvest technologies, such as seed cleaning machines. In some instances, NGOs have indefinitely secured the market for cooperatives and community-based producers, purchasing seed in bulk at fixed prices and then disseminating seed from its area of production to where it is needed by individual farmers for planting. The link to micro-financing institutes and/or commercial credit providers has not yet been well established, and access to finance remains a gap in the production of quality seed, and availability of quality seed for purchase by farmers (Tesfaye *et al*., 2012).

6. Linkage among Stakeholders in the Seed Systems

Linkages are interactions between organizations which allow the exchange or transfer of information, resources or power, the mechanisms of which can be structural or functional (ICRA, 2010). Linkages and linkage mechanisms can be strong or sometimes poor or not working. The reasons for poor linkages are weak management capacity, inappropriate organizational structure, unfavorable reward systems, time and money constraints, inappropriate planning, little or no monitoring and evaluation of the process of interaction and different organizational cultures, expectations and operating procedures (Gera *et al*., 2010). Therefore, inter-organizational linkages should be assessed to maintain better aspects and negotiate improvements in existing linkages, linkage mechanisms and develop new relationships. Decisive factor that can influence the effectiveness of linkages include intensity and formality of contacts, ways of contacts stakeholders awareness of other stakeholders function, relevance of services, urgency, timeliness, accessibility, quality of communication, control over the relationship, and mandate of representatives (Gera *et al*., 2010).

The Ethiopia seed system suffers from weak linkage and integration among the stakeholders and especially poor marketing system, seed multiplication schemes may fail to give the intended service to the farmers (Alemu 2012). Farmers either cannot afford improved inputs or lack the knowledge to use them. Weak systems connect agricultural outputs to processors and numerous barriers exist that prevent quality products from reaching end users, such as insufficient packaging and storing, inability of Ethiopian products to meet international market standards, and restrictive trade regulations. Ethiopia faces challenges of limited capacity at all levels of government and in the private and financial sectors, which restricts the development of the institutions that support market development and linkages (Gera *et al*., 2010).

To improve crop management, seed producers may also require close and regular field supervision by technical support staff for an initial period. Supporting seed production efforts by farmers requires technical and business-related expertise and Collaborative linkages need to be fostered among farmers, researchers, agro-enterprise specialists, NGOs, and the formal seed industry. Seed policy reforms need implementing more client-oriented research systems, this gives a chance to farmer seed producers to involved in participatory varietal selection with plant breeders or offer feedback on newly released varieties.

6.1. Seed production system

In Ethiopia, the seed demand is increasing rapidly due to the agricultural development. Thus, securing the supply of quality seed and planting material of the most important food crops is the most effective way to sustain food security (Atilaw, 2010). Currently, government and private seed enterprises are involving and combining their efforts to produce and supply seed to the growers. The public seed production is dominated by Ethiopian Seed Enterprise (ESE) and since 2008 regional seed enterprises (RSEs) have come into the picture, at present there are two RSEs, Oromiya Seed Enterprise (OSE) and Amhara Seed Enterprise (ASE). There are about 30 licensed private seed companies mainly involved in the production of hybrid maize seed (Alemu, 2010).

The role of cooperatives in seed multiplication is increasing from time to time. They are already engaged in seed production, cleaning and trading of Quality Declared Seeds (QDS) of OPV varieties with technical support from

woreda BoARD. However, the supply of basic seed of adapted improved crop varieties is in shortage for such program. The ESE produces certified seed through contract arrangement on state and private commercial farms, on farmers' fields along with the production on own farms. Similar approach is followed by the newly established regional seed enterprises (Alemu, 2010).

It is expected that the emergence of regional seed enterprises will promote the production of seed for crops that are not so far produced through the formal system. An additional alternative in increasing the seed production capacity, the public seed enterprises are promoting farmers-based seed production and marketing schemes and considerable achievements have been made. For instance, the Amhara Seed Enterprise (ASE) has promoted Farmers' Based Seed Multiplication Scheme (FBSMS) immediately after its establishment in early 2009 with a focus on potential areas for seed multiplication and clustering approach. The focus on potential areas helps in reducing the cost of production and also helps to get quality seed. The clustering helps to ease the management and supervision of the seed production process. In general, it is estimated that about 70 percent of the supply of certified seed in the region was from FBSMS in 2009 production season. The arrangement of the FBSMS is that the basic seed is supplied by Seed Enterprises i.e. by ESE and/or regional seed enterprise and required training is given to participating farmers along with area selection and clustering. Then, the seed enterprises purchase the seed by adding premium prices (market price plus 15 percent). The major challenges in the FBSMS are the limited capacity of the seed enterprise both ESE and regional SE to purchase timely from farmers, limited capacity of facilities like harvesting and threshing, cleaning and grading facilities, and storage. Wheat, malt barley, teff and rice are the main cereals where FBSM is promoted (Alemu, 2010).

6.2. Seed certification and quality assurance

Seed certification is one of the important mechanisms in order to provide farmers with good quality seeds (Nishikawa, 2010). Since, farmers have difficulty assessing the physical or genetic qualities of seeds before they are planted and grown, certification of seed quality is essential to provide consumers with quality assurance and a means of redress if expectations are not met (Alemu, 2010). Successful seed program is one which is able to supply a sufficient quantity of high quality seed at the required time, at a reasonable cost and at a place where it is needed. The seed standards in Ethiopia have been prepared under the direction of the agricultural product standards committee and published by the Quality and Standards Authority of Ethiopia. Currently, the Authority revised its seed standards and prepared field and seed standards for 174 crops versus the 74 crops standards that were officially issued for implementation (Atilaw, 2010).

Ethiopian Seed Standards includes the minimum limits of germination, varietal purity, physical purity and other quality attributes of Certified, Quality Declared and Emergency Seed, or of any other standard the Minster may establish under article 15 of the new draft law. In this system, the producer declares that the seed meets the established Quality Declared Seed standards based on internal quality controls, which the regulatory authority later controls through spot checks. It relies on the technical facilities and competence of seed producers to control quality; as such, it is initially intended to apply to large producers (Atilaw, 2010).

Previously, the responsibility for official seed quality control and certification was given to National Seed Industry Agency (NSIA) and later transferred to the Animal and Plant Health Directorate of MoARD. To date, the implementation of seed inspection and certification restructured and decentralized to Bureaus of Agriculture and Rural Development (BoARDs) in regional states. However, these laboratories and services are limited in terms of technical, human, financial and operational capacity. Consequently, they are unable to provide the required services to certify seed in different parts of the country. Furthermore, since seed quality control has been embedded within the Bureaus of Agriculture, they are also responsible for organizing production and dissemination (Tesfaye *et al*., 2012).

Table 4: Seed processing, storage and laboratory facilities in Ethiopia

Institute/ location	Seed processing (tons)		Seed testing laboratory (sample tested/year)	Storage (tone)
	Per hour	Seed processed/year		
ESE				
Addis Ababa	-	-	5,000	-
Asela	3.0	24,192	2,5000	5,000
Koffele	3.0	24,192	2,5000	3,700
Awassa	5.0	40,320	2,5000	4,300
Nekempte	2.5	20,160	2,5000	5,000
Mobiles (4)	7	12,960	-	-
Asssassa	-	-	-	4,000
Dodola	-	-	-	4,000
Kombolcha	-	-	-	2,000
Robe	-	-	-	4,000
Bahrdar	2.0	16,128	2,5000	4,000
Gonder	-	-	-	1,500
Sub-total	-	137,952	17,500	39,600
Pioneer				
Addis Ababa		6,000		2,000
Total		143,952		41,000

Source: Bishaw *et al*., (2008)

The ESE operates a central seed testing laboratory at headquarters and five mini laboratories attached to seed processing plants and storage facilities located in different regions (Table 6). ESE has kept its internal seed quality assurance activities even after the introduction of formal seed certification under the MoARD. The Regional Seed Enterprises and private seed growers are using seed laboratories of their respective Region, neighboring regions or ESE laboratories for quality assurance and cleaning and labeling their seeds. The quality of seed could be tested by sending sample seed to Official Government Seed Testing Laboratory. The seed law may allow official testing of seed every year. The seed quality could be also done in own - laboratory through proper sampling of seed and following the procedures set by the standard authority It was observed that some Ethiopian seed standards are excessively high, which has resulted in the rejection and destruction of good quality seed (Atilaw, 2010).

6.3. Seed distribution and marketing system

Seed dissemination involves the mechanisms through which seed and information about it are moving from one to the other actor. Insights from focus group discussions indicate that informal social networks serve as a means to share information. Understanding the preference of seed producers is useful to establish a sustainable seed supply system and influence the perception of seed producers and users favorably (Beyene, 2010).

Seed marketing is a vital link between the seed producers and the farmers that ultimately use the seeds. Although significant public resources are invested in the public plant breeding and multiplication, the products are not reaching farmers. Open pollinated variety seed that is available is often stockpiled in farmer unions and cooperatives, and ineffective distribution mechanisms hinder the reach of existing seed (Alemu, 2010).

Distribution of seed currently happens only through existing institutions, such as cooperatives and farmer unions, and is a constraint to the meaningful development of the private seed sector. Based on the demand planning process, MoARD instructs ESE on the type and quantity of seed to be delivered to cooperative unions, who in turn provide the seed to the primary cooperatives and farmers under them. This centralized system leaves cooperatives and farmers with relatively little flexibility in determining the type of seed they get, when they get seeds or choice of suppliers. Due to central government seed allocation and "wholesale" seed prices set by GOE, cooperatives often are burdened by seeds they cannot sell, are unable to act as independent businesses serving the needs and interests of their farmer members, and cannot take advantage of high demand for certain seeds in the formal market that do not fit with centralized seed planning. Although cooperatives are supposed to approve the original seed demand figures provided by the BOARD, this is a long way from the independent assessment of farmer members' seed demand that characterizes most cooperatives elsewhere in the world (Alemu, 2010).

The current inability of companies to market seeds outside of government channels is a major stumbling block to the development of the private seed sector in Ethiopia. For example, the majority of Pioneer's production is

marketed through ESE and/or BoARD channels, although it also has a small network of seed dealers that sell Pioneer seed independently. As long as private producers do not have the opportunity to market their own products through dealers then the advantages from a competitive private sector will not be realized, since selling to a single customer (the government) does not allow for a dynamic private seed sector (Alemu, 2010).

6.4. Plant variety protection

Ethiopia has been an active sympathizer of farmers' rights ever since the mid‐1980s when the concept of farmers' rights began to emerge. Since then, it has played a significant role in all the negotiation processes related to farmers' rights and access to genetic resources. Important progress has been made in developing policy frameworks to address the rights of communities, farmers and breeders at national level. However, the pace toward implementing farmers' fights has not been as significant as the role that Ethiopia has played at the regional and global levels. Ethiopian Intellectual Property Office (EIPO) was established by Proclamation No 320 of 2003 to study, analyze and recommend intellectual property policies and laws. The Plant Breeders' Rights Proclamation (Proclamation No. 481/2006) was developed to encourage plant breeders by offering economic rewards as incentive for their contributions in the agricultural sector, realizing that the utilization of new plant varieties developed through research play a significant role in improving agricultural production and productivity (Atilaw, 2010).

7. Major Constraints in Ethiopia Seed System

In assessing the performance and structure of the Ethiopian seed industry, we can figure out some constraints, which can be grouped in to policy/regulatory and technical constraints. Regarding the policy and regulatory aspect, it should have to be revisited again and should be amended. The other constraints are due to poor linkages between the stake holders. Alemu *et al.,* (2010) sort outs the major constraints in the public sectors due to poor linkage system in the sector.

7.1. Policy and regulatory constraints

The national seed policy and relevant laws and regulations have not been revisited and amended to keep up with new developments in the industry. A number of articles need to be amended, particularly with regard to seed quality standards, which are very high for some crops. The Seed Law No. 206/2000 demands conformity with these standards for any commercial seed. It proved impossible to achieve such standards at the current stage of development in the seed sector. This concern was noted by the responsible agency but no practical action is taken yet. Another major constraint is the inefficiency of the executing agencies. There are serious problems in implementation, although the seed sector has now better legal frameworks. Repeated restructuring of the executing agencies left the responsibilities shared among various departments of the MoARD, which is now being reorganized. This weakened the enforcement and serious fraudulent practices were reported by some suppliers. It is important that the quality assurance is strengthened so as to enforce the seed laws and prevent malpractices which have very serious repercussions for the agricultural sector (Bishaw *et al*., 2008).

7.2. Inconsistent demand planning and target setting

The government's methods for estimating seed demand from farmers and subsequent seed production targets are inconsistent and inaccurate, leading to both over and under-estimation of demand. The allocation process is also slow, contributing to delivery delays. Thus, there is a need for more reliable information about farmer seed-demand to calibrate projections, including a better database of local and regional needs. Inclusion of data from and consultation with private sector sources on the demand-side calibration could also be beneficial in setting prospective targets. Furthermore, planning is currently favorable to high potential areas, yet the low-potential areas are also a source of demand for improved seed. Given the lack of strong market incentives in low-potential regions, there is a case for GOE to play a stronger role in these areas.

7.3. Productivity gaps and financial constraints in contract grower schemes

ESE and RSEs experience productivity gaps and financial constraints in their contract grower schemes, resulting in reduced quantity and quality of seed production. Retrieval rate from contract growers is often very low, with some growers returning less than 50 percent of the expected seed result.

7.4. Lack of coordination between production, processing and delivery

The current processing, cleaning, testing and storage facilities are not aligned to major seed producing areas. Key resources remain concentrated in specific areas, increasing logistics costs and slowing delivery to remote areas. Five additional state-run seed producing entities have been established, but no additional processing capacity. Furthermore, current capacity is unknown; making it difficult for ESE/RSEs to take advantage of available processing, cleaning, and testing and storage resources or to understand what excess capacity could potentially

be made available for private producers.

7.5. Low participation of private sector in seed industry

For a sustainable national seed industry development, it is necessary that private seed sector participation flourishes. For one reason or another, the private seed sector is still undeveloped in the country. Special attention and support should be offered by the government particularly in making the working environment more encouraging to the private sector. Other farmer organizations involving in seed sector such as unions and cooperatives are also playing key roles in multiplication and distribution of different classes of seeds and other farm inputs.

8. Suggested solutions

The constraints facing the seed sector require policy, regulatory, managerial and technical intervention if progress is to be achieved in seed industry development in Ethiopia. Thus, core interventions and enabling actions can holistically strengthen the Ethiopian seed system to improve farmers' productivity and livelihoods through an increasingly open and competitive seed production system that provides an affordable and diversified choice of seeds from both the public and the private sector. The current developments and initiatives in the national seed system have revealed the following key issues that need special attention: Given that the public sector is and will continue to be the dominant player in Ethiopia's seed sector. It is important to improve the operational effectiveness of public seed enterprises through improved assessments of farmer demand and revised seed production strategies for each crop type. As effective seed demand assessment mechanisms and genuine involvement of farmers/users during planning phase is crucially important. As seed is an expensive product, every seeds produced must be channeled into the seed system. Thus, appropriate systems which can strictly control seed outlets should be in place; demand-driven seed multiplication strategy and supply with value addition in the seed chain should be looked into. Enable private sector seed companies to reach their potential**:** promoting private sector involvement through enabling differentiated pricing and flexibility of distribution models outside of the government. Thus, provide opportunities for consolidation of investments on capacity building, basic facilities, infrastructure and training activities on variety maintenance and initial seed production at national and regional levels. Collaborative institutional linkages need to be fostered among all actors and stockholders to strengthen the seed system of the country.

9. Conclusion

Increasing the production and productivity of the crop sub sector is one of the measures taken in Ethiopia to assure food security of more than 80 million people and escape from long-lived poverty persisted in the country. This improvement can only be realized if modern technologies are utilized from which seed take the first priority due to its nature. However, in order as seed to be a key factor in agricultural productivity, it must be channeled into a system. In Ethiopia, the formal and informal seed system were operating for several decades and playing the lions share in supplying seeds for the entire crop production. Smallholder farmers are involved in either of the systems that can guarantee them with the quantity and quality of seeds they need. The Ethiopian Seed Enterprise, was remained the sole seed producer for years in the formal system. Seed production by the enterprise is focusing mainly on, wheat, and maize; seeds of other crops are entirely supplied by the informal system and the research systems. In countries like Ethiopia where the formal seed supply is inefficient, the informal system is extremely important for seed security of the nation. The majority of Ethiopian smallholder farmers are largely dependent on this system mainly through farm-saved seed exchange. Thus, National seed policies should recognize the role of smallholder seed producers and the informal seed sector as a whole. In this respect, legislations and practices that hinder the development of the sector should be reviewed with the aim of removing the hindrances and replacing them with enabling policies and strategies. In addition to this, for a sustainable national seed industry development, it is necessary that private seed sector participation flourishes. Thus, government should collaboratively work with the non-governmental organization and private sector. Currently, Ethiopian seed system has been confronted with several challenges. The sector is still unable to meet farmers need in terms of varietal choice and timing of seed supply. One of the key factors which restrict the utilization of improved varieties is due to weak coordination and linkages among actors in the system for seed development, production, multiplication and distribution. Thus, coordination and linkages among all actors and stockholders is need strengthening to foster rapid, orderly and effective growth.

References

Almekinders, C. and Louwaars, N. (1999). Farmers seed production. Inter-mediate Technology Publications Ltd, London, UK. 291 pp.

Alemu, D. (2010). Seed system potential in Ethiopia: Constraints and opportunities for enhancing the seed sector. International Food Policy Research Institute.

Alemu, D., Rashid, S. and Tripp. R. (2010). Seed system potential in Ethiopia: Constraints and opportunities for enhancing the system. Washington DC: IFPRI.

Alemu, D. (2012). The Political Economy of Ethiopian Cereal Seed Systems: State Control, Market Liberalization and Decentralization. Future Agricultures Consortium. Policy Brief 048.

Astatkie, M., Legesse, B. and Zerfu, E. (2012). Analysis of economic impacts of triticale (*Triticosecale Wittmack*) adoption: The case of Farta wereda, Ethiopia. *Journal of Scientific Research and Reviews* 1(2): 20 – 25.

Atilaw, A. (2010). A baseline survey on the Ethiopian seed sector. The African seed trade association. October, 2010. Addis Ababa, Ethiopia.

Beyene, F. (2010). The role of NGO in informal seed production and dissemination: The case of eastern Ethiopia. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 111(2): 79-88.

Bishaw, Z., Sahlu Y. and Belay S. (2008). The status of the Ethiopian seed industry. In: Thijssen, M.H., Z. Bishaw, A. Beshir and W.S. de Boef, (Eds.). Farmers, seeds and varieties: supporting informal seed supply in Ethiopia. Wageningen, Wageningen International. 348 p.

Central Statistical Authority of Ethiopia. 2005-2010. Annual Agricultural Sample Survey Report. Addis Ababa, Ethiopia.

Gemeda, A., Aboma, G., Verkuijl, H. and Mwangi, W. (2001). Farmers' Maize Seed Systems in Western Oromia, Ethiopia. Mexico, D.F.: International Maize and Wheat Improvement Center (CIMMYT) and Ethiopian Agricultural Research Organization (EARO).

Gera, D., Fisseha, M., Getnet, Z., Kindie, T. and Melkamu A. (2010). Multi-stakeholder linkages in rural innovation processes in amhara region, Ethiopia. Amhara national Regional State, BoARD. Working Document Series 137.

ICRA (International Center for development oriented Research in Agriculture), (2010). ICRA Anglophone Programme Learning Materials. ICRA, Wageningen, the Nerherlands.

Lipper, L., Romina, C. and Winters, C.P. (2005). Seed system, households‟ welfare, and an economic methodology applied in Ethiopia, ESA technical paper. Agricultural and Development Economics Division, the Food and Agricultural Organization of United Nation.32p.

McGuire, S., 2005. Re thinking seed system analysis and reform for sorghum in Ethiopia, Thesis, Wagenigen University, Netherland.293p

Mugonozza ,S, G.T, 2001. Seed system in Africa, International center for agriculture research in the dry Areas. ICARDA.

Nishikawa, Y., 2010. Good Quality Seeds and Linking Formal Seed System with Farmers' Own Perspectives and Initiatives: A Japanese Experience. Pp 1-7. *In*: Alemu, D., Kiyoshi, S., Kirub, A. and Assefa. K., (ed.). Ensuring Seed Quality in Ethiopian Seed System, Status and challenges. Empowering Farmers' Innovation. Series No. 3.

Spielman, D.J., Kelemework, D. and Alemu, D. (2009). Policies to promote smallholders intensification in Ethiopia: the search for appropriate public and private roles. Paper presented at seventh international conference on Ethiopian economy, Addis Ababa, June 25-27.

Tesfaye, Y, Ayana, A. and Gareth, B. (2012). Ethiopia Seed Sector Assessment. ISSD Briefing Note – September 2012**.** Wageningen University and Research centre, Wageningen, the Netherlands.

Thijssen, M.H., Bishaw, Z., Beshir A. and de Boef, W.S. (2008). Farmers, seeds and varieties: supporting informal seed supply in Ethiopia. Wageningen, Wageningen International. 348 p.

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