academicresearchJournals

Vol. 6(9), pp. 558-569, December 2018
DOI: 10.14662/ARJASR2018.091

ISSN: 2360-7874
http://www.academicresearchjournals.org/ARJASR/Index.htm

Academic Research Journal of Agricultural Science and Research

Full Length Research

Collective action for seeds technology transfer and commercialization: a systematic review of seed producer farmer groups' seeds technology promotion and supply experiences in Ethiopia

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Accepted 16 November 2018

This systematic review document explored the seed sector in Ethiopia by looking into its type, actors, performance and prospects relating to seed producer farmers' collective action initiatives. There are three seed systems in Ethiopia viz. formal, intermediate and informal seed system. Rural development agencies and experts promote farmer collective action for numerous benefits in agrarian countries. In recent years, seed producer farmer groups flourishing across the country, putting efforts in new variety adaptation, evaluation, demonstration, multiplication, promotion and supply filling formal seed supply deficits. In Ethiopia, crop productivity still remains very low relative to its potential yields, the low productivity could be attributed to limited access to and adoption of seeds of improved varieties among other factors- in major crops the area covered with improved varieties is estimated to be still 10%. Given the limited access and adoption of seed technology, fruitful farmer collective action initiatives observed in the seed sector. These collective action initiatives shortening the time span to get newly released varieties as the platform makes contact with certified seed suppliers and farmers multiply the seed with close support of experts that enhance access and farmer-to-farmer seed exchanges. So far, a number of seed producer farmers groups have been established under diverse commodities. And their efforts have been recognized by governmental, NGOs, research organizations and private actors. Seed producer farmer groups are largest seed suppliers and strengthening their initiative will be important to improve access and use of technology thereby production, productivity and address food insecurity and poverty leading to economic growth and development at large.

Keywords: collective action, seed multiplication, seed dissemination, seed business, Ethiopia

Cite this article as: Bezabeh, A (2018). Collective action for seeds technology transfer and commercialization: a systematic review of seed producer farmer groups' seeds technology promotion and supply experiences in Ethiopia. Acad. Res. J. Agri. Sci. Res. 6(9): 558-569

INTRODUCTION

Agriculture is the base of Ethiopian economy as engine of pro-poor growth through agricultural intensification, diversification and commercialization of smallholder and to eradicate rural poverty (Spielman et al., 2008).

Recently, Ethiopia managed remarkable economic performance of 10.2% growth in 2014/15, a double digit growth trend where agriculture has remarkable contribution, a 38.8% to the GDP in 2014/15. Also, GDP per capita reached to USD 691 while poverty is estimated to have declined to 22% from 38.7% a decade ago (World Bank, 2014).

In this regard, source of agricultural growth associated with increasing productivity, for example productivity of cereals has increased by 45% while the production level per hectare (yield) is growing by 22% (CSA, 2014/15). Adoption of improved seeds and modest changes in farmer cultivation practices, can yield remarkable abundance for small-scale farmers and as per capita land holding size diminishes the future source of agricultural growth inevitably rely use technologies. Growth in production and productivity enable addressing the country's food security and poverty reduction challenges (Spielman et al., 2008).

Empirical evidences, however, reaffirm that development, adoption and application of modern agricultural inputs (chemical fertilizer, improved seeds, pesticides and irrigation) remains low in Ethiopia. The sector is characterized by low input-output rain-fed smallholder farmers. Chemical fertilizer use for example is low. Only 30–40%of Ethiopian smallholders use fertilizer (Rashid et al., 2013). The physical application rates of fertilizer are also well-below those recommended by the extension programs; on average only 37-40 kilogram per hectare in 2013 compared with an average of 102.0 kg fertilizer use per hectare across Asia in 1995 (Hazell, 2009) and about 9 kg nutrients per hectare in Sub-Saharan countries (Belay, 2003). Raising crops production and productivity among others determined by use of improved varieties and applying other associated recommended inputs.

Accordingly, information on how farmers obtain, manage and share seed is crucial for designing appropriate mechanisms to deliver new crop varieties. However, local seed producer farmer groups are poorly understood and few empirical studies cover how their collective action characterized in seed production and exchange. In Ethiopia, in recent times the seed sector can be characterized by remarkable dynamism. Seed sector receives the focuses of public sector research organizations, extension services; farmers' organizations, market actors, such as private breeders, seed companies, stockists, and trade associations; civil society actors such as non-governmental, farmer and community based organizations; and farmers themselves (Dawit et al., 2008). More account of the seed sector performance to be presented as subtopic in the forthcoming pages.

Seed access, availability and use in Ethiopia

Literatures ascertain that access to improved varieties constrained by various factors. These constraints are contestable property rights relating to the improvement of cultivated varieties (cultivars); absent institutions in the market for improved cultivars; and information asymmetries in the exchange of seed between buyers and sellers Hassan et al. (2001), as cited by David DJ et al. (2011)

The first constraint emerges from the public goods nature of research embodied in improved cultivars and the inherent market failure that accompanies cultivar improvement. Consider a scenario where a farmer saves and replants seed of an improved cultivar across seasons and, in doing so, avoids paying the private innovator who improved the cultivar for his or her investment in research and development (R&D). In this scenario, the social returns from enhanced yields or increased output exceed the returns to the private innovator. This suggests that the public sector must play a continuous role in cultivar improvement, by investing in agricultural R&D.

The second constraint is associated with mechanisms designed to increase the private innovator's capacity to recoup his or her investment in R&D and overcome the market failure described above. Biological mechanisms such as hybridization (common in maize and increasingly in rice, millet, and sorghum) imply that farmers must purchase seed each season to reap the yield benefits of hybrids the vigor conferred by heterosis. Institutional mechanisms such as intellectual property rights (plant variety protection certificates, patents, and trade secrecy laws) similarly allow the innovator to recoup investment costs through litigation when a farmer plants improved cultivars without paying some fee to the innovator for use of the seed. The inability to leverage the biological properties of hybrids, enforce IPRs, or prevent farmers from saving seed can discourage private investment in cultivar improvements that have potentially significant social impacts, thus signaling another difficulty in correcting this market failure.

A third constraint emerges where the characteristics of improved seeds are known only by the innovator, implying that farmers are unable to make accurate ex ante assessments of quality, giving unscrupulous sellers an advantage over their customers. Remedies to this include strong regulation of the seed certification process or truth in labeling laws. Importantly, the absence of such regulations—or worse yet, the wholesale deregulation of the seed sector as part of a wider market liberalization program—can inhibit smallholder adoption of improved cultivars Hassan et al. (2001), as cited by David DJ et al.(2011)

In short, seed is a tricky good to manage due to inherent market failures that are difficult to overcome. We examine these issues in the context of Ethiopia's seed system and market, focusing on the (a) adoption of improved seed, (b) the demand and supply for improved seed, and (c) the seed industry structure.

Still the formal seed supply estimated covering 10-20% of the seed demand while the rest (80-90 percent) is covered by the informal sources (FAO and ICRISAT, 2015). The gap filled by farmer-to-farmer exchanges or saved seed or smallholder farmers that have been engaged in seed production and supply (Fekadu, 2010). Obviously, the use of improved seed, fertilizer, agrochemicals, irrigation, and mechanization etc has greater variability across the country (Akalu and Ermias, 2015). Several studies ascertain that access, availability and use of seeds of improved varieties are often one of the top priorities of producers. Improving seed quality is one of the least costly ways to increase yields and protect against plant diseases.

An important indicator of the performance of the seed sector is the seed replacement rate, defined as the share of seed planted that is official or certified seed as opposed to saved seed or grain purchased from other farmers. As shown in Table 1, less than 6%of wheat area in Ethiopia is planted with first-generation improved seed, defined as seed obtained from the Ministry of Agriculture, a cooperative, a seed company, or another source of varietal pure seed (Nicholas et al. 2015). Therefore, on average, wheat farmers purchase improved seed roughly every 17 years. It should be noted that wheat is a self-pollinated crop and retains its yield and other characteristics over several generations of saved seed. Although the seed replacement rate for wheat has increased somewhat in the past decade, it remains low by international standards. In the United States, the seed replacement rate for wheat is 37%, meaning that farmers purchase seed roughly every three years. In India, the rate is 20%, so farmers purchase seed every five years.

In contrast, about 40%of maize area in Ethiopia is planted with (first-generation) improved seed. Since maize is cross-pollinated, it quickly loses its yield and other attributes of the original after a few years of recycling, so there is a stronger incentive for farmers to purchase improved seed.

According to Nicholas et al. (2015), in focus group discussions, farmers reveal at least three factors that constrain the purchase of improved seed. First, the availability of wheat seed is limited. The Ethiopian Seed Enterprise and regional seed companies do not produce as much as is demanded by farmers, so the Bureaus of Agriculture and cooperatives must ration the limited supplies. Second, seed quality is variable, so farmers are reluctant to purchase a product that may not perform as expected. Finally, farmers are cash-constrained and are sometimes unable to purchase inputs even if they would be profitable.

A second performance indicator for the seed sector is the varietal replacement rate, the rate at which new varieties are introduced. Because pests and diseases evolve over time, each variety becomes more vulnerable to their attacks over time. Without a certain minimal level of “maintenance” breeding and new varieties, the yield of existing varieties decline. In the case of wheat, yellow rust and stem rust have become serious problems. One of the most popular wheat varieties, Kubsa, was “lost” (became susceptible) to rust in 2010, leading to an intensive search for varieties that remain resistant. A variety called Digalu replaced it, but this became susceptible to “Digalu rust” in 2013. Wheat varieties are being obtained from CIMMYT and ICARDA, as well as being imported from Kenya and Nepal. They undergo local testing for yield and resistance under Ethiopian conditions before being registered and released in the country. A variety called Kingbird from Kenya is now being tested and may be released this year. In the meantime, Kubsa continues to be used, but it requires spraying to control the rust.

Governmental, nongovernmental, farmers' organizations, private agencies make efforts to solve the seed sector challenges. Accordingly, these systematic review aims describes status of evolving collective action initiatives of farmers in seeds multiplication and dissemination and analyze factors that determine seed producer farmer groups grow into formal seed business entities.

THEORY OF COLLECTIVE ACTION

Literatures on collective action in theory and practice had emerged from dissatisfaction and failures of many of the rural development programs of the 1960s and 1970s (McCarthy, 2004). The development paradigms of this period assumed that communities would intentionally engage in collective activities, with little time and inquiry given to understand under what condition will this happen or on how these actions might be sustained (McCarthy, 2004). Beginning with the work of Olson (1965) a body of theory soon developed attempting to explain the enabling conditions for successful collective action outcomes.

Some of the greatest gains empirically and theoretically on the subject of collective action have been found in the field of natural resource management (NRM). Of particular importance have been the works of Ostrom (1990). Agrawal (2002) synthesized these works in an effort to identify a common list of enabling conditions for successful collective action outcomes. These conditions include (1) small group size; (2) clearly defined boundaries; (3) shared norms; (4) past successful experiences; (5) appropriate leadership; (6) interdependence among group members; (7) heterogeneity of endowments, homogeneity of identities and interests; and (8) low levels of poverty.

Various literatures relate theory of collective action to that of social capital. Uphoff et al., (1990) highlight how structural forms of social capital (that is, roles, rules, procedures, social networks) facilitate mutually beneficial

Table 1. Area cultivated under different management practices by crop in 2003/04 and 2013/14

Crops	Improved seed applied			Pesticide applied			Irrigated		
	2003/04	2013/14	Annual growth (%)	2003/04	2013/14	Annual growth (%)	2003/04	2013/14	Annual growth (%)
Cereals	4.9	10.1	7.5%	12.4	26.1	7.7%	0.9	0.7	-2.5%
Teff	0.6	3.1	17.8%	19.8	39.5	7.2%	0.4	0.4	0.0%
Barley	0.4	0.6	4.1%	8.4	23.0	10.6%	0.6	0.4	-4.0%
Wheat	**4.1**	**5.6**	**3.2%**	**30.4**	**47.2**	**4.5%**	**0.3**	**0.4**	**2.9%**
Maize	20.1	40.0	7.1%	1.4	5.7	15.1%	2.4	1.4h	-5.2%
Sorghum	0.5	0.2	-8.8%	1.2	9.2	22.6%	0.9	1.0	1.1%

Source: Computation the CSA-AgSS of 2003/04-2013/14 cited in Nicolas et al. (2015)

collective action and how cognitive forms of social capital (that is, norms, values, attitudes, and trust) are conducive for mutually beneficial collective action. The authors show how these forms of social capital brought about successful collective action measures in management of irrigation schemes. Other study by Ostrom (2005), has similarly shown how human and social capital formation often represented in community-based groups have been pivotal in solving many of the communities' development problems, particularly in the areas of natural resource management.

While there is substantial evidence behind the importance of social capital to maintain and improve natural capital, far fewer studies examine how social capital is utilized for the purposes of collective action to improve the marketing performance of groups. This is particularly apparent when examining the extent that group characteristics may influence or determine certain marketing outcomes. The studies that do emerge are often looking at higher tier organizations, such as cooperatives or agribusiness enterprises. For example, Ostrom (2005) shows how interpersonal trust and wealth heterogeneity among cooperative members were enabling conditions for the success of the cooperative, especially during the first stages of cooperative formation. Poteete and Ostrom (2004) show how social capital, as expressed through business firm relationships, contributed positively to firm productivity and performance. With little attention in the literature given to the effects of social capital and other group characteristics/assets on the marketing performance of lower tier organizations such as producer groups, more importantly there is little or no literature on emerging collective action towards seed production, exchange and pathways towards local seed business development.

Similarly, Agrawal (2002) list out the enabling conditions for successful collective action outcomes in natural resource management. These conditions include: (i) small group size; (ii) clearly defined boundaries; (iii) shared norms; (iv) past successful experiences; (v) appropriate leadership; (vi) interdependence among group members; (vii) heterogeneity of endowments, homogeneity of identities and interests; and (viii) low levels of poverty. The review of collective action theory parallels the social capital literature. Uphoff et al. (1990) highlight how structural forms of social capital (roles, rules, procedures and social networks) facilitate mutually beneficial collective action and how cognitive forms of social capital (norms, values, attitudes and trust) are conducive for mutually beneficial collective action. However, available studies that do emerge often examine higher level organizations, such as cooperatives or agribusiness enterprises. That implies that there is limited knowledge on status and performance of collective action of producer groups like seed producers, marketing groups of different sizes, which remain for investigation in the future.

Conceptualization of collective action

It is important to define the domain of the concept of collective action, so that when researchers from various disciplines interact they have a common understanding. Sandler (1992) defines collective action as an action taken by a group (either directly or on its behalf through an organization) in pursuit of members perceived shared interests. This is not the best and only definition. What most definitions have in common is that collective action requires the involvement of a group of people, it requires a shared interest within the group and it involves some kind of common action which works in pursuit of that shared interest. Although not often mentioned, this action should be voluntary, to distinguish collective action from

hired labor. Examples of collective actions include collective decision-making, setting rules of conduct of a group and designing management rules, implementing decisions, and monitoring adherence to rules. Members can contribute in various ways to achieve the shared goal: money, labor or in kind contributions (food, wood).

The action can take place directly by members of a group, or on their behalf by a representative or even employee (Sanlder, 1992). The coordination can take place through a formal organization, through an informal organization, or, in some cases, through spontaneous action. Collective action is easiest to identify when there is a clearly defined group that takes part. Moreover, clearly defined boundaries is the first of Ostrom's (2005) design principles for long-enduring, self-organized irrigation systems which have also been applied to many other cases of natural resource management. This indicates that boundedness of the group, which allows people to know who else is (or should be), contributing, fosters collective action. At the same time, in many instances of collective action it is not clear how the group is defined nor are the boundaries necessarily fixed or rigid. Some people may participate one time, others another, with none of them knowing exactly who is involved, but all identifying with the collective action. For example, neighborhood clean-up activities may be done periodically without clearly defining who is in the neighborhood. Thus, there is a gray area between organized and bounded collective action and action within more amorphous social networks.

Formal or informal organizations may be helpful in coordinating collective action, but it is important to distinguish between organizations and collective action. Many organizations exist on paper only, and do not lead to action; conversely, collective action may occur spontaneously. Moreover collective action can manifest itself and can be understood as an event (a onetime occurrence), as an institution (rule of the game applied over and over again), or as a process. While many previous studies analyze the institution of collective action, others (Sultana and Thompson, 2003) focus on the process of collective action. The event, e.g. collective response to a flood versus institution (collective maintenance of an irrigation system) presents by itself a very interesting question: when does an occurrence become institutionalized and what are the implications? Institutionalization depends on the object of collective action; any kind of collective action for routine maintenance will likely become institutionalize because it is a recurrent need in a community or group of users, while collective action for seed exchanges is likely not to be institutionalized where the need to exchange seed occurs only sporadically (Markelova and Mwangi, 2010).Types of collective action

In the literature, collective action has been described as taking various forms including the development of institutions, resource mobilization, coordination activities and information sharing (Poteete and Ostrom 2004). The purpose of collective action affects the level at which we have to analyze the phenomenon: which institutional level (operational, collective choice or constitutional level if we use Oakerson's (1992) institutional framework) and which social unit (individual, group, community, intra-community etc). Similarly indicators of collective action might differ depending on the specific objective of collective action. If we investigate collective action for the maintenance of an irrigation system or collective action for the constitution of a federation of watershed groups, indicators of collective action will again differ, or in any case not overlap entirely. Poteete and Ostrom's paper (2004) discusses how indicators had to be redefined when moving from the study of irrigation systems to forestry, and the tension of maintaining a common core set of measures even among forestry sites around the world.

It is also critical to identify the level at which collective action takes place. Many studies focus on community-level collective action, but not all forms of collective action take place at this level. Many microfinance programs use groups of ten to twenty members. McCarthy (2004) study demonstrates the importance of cooperation among groups within the community, e.g. for water point management. Sultana and Thompson (2003) study the process of fostering collective action in multi stakeholder processes, and national federations of forest and water user groups in Nepal provide examples of larger-scale collective action. The appropriate units of analysis will therefore vary, depending on the research or policy question (Pretty and Ward, 2001).

CHARACTERISTICS OF THE ETHIOPIAN SEED SECTOR

In Ethiopia there are both public and private organizations in formal seed supply sector, including the Institute of Biodiversity Conservation (IBC), the Ethiopian Institute of Agricultural Research (EIAR), the Regional Agricultural Research Institutes (RARIs), Universities, 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 MoARD, Regional Bureaus of Agriculture and Rural Development (RBoARD), Ethiopian Grain Trade Agency (EGTA), Farmers' Cooperative unions (FCUs) and NGOs.

Formal seed production is mainly in the hand of the ESE, which is one of the public enterprises involved in the production, seed quality control, distribution and marketing of both foundation and commercial seeds (Zewdie et al., 2009). The ESE has four seed farms and use contractual seed production agreement with farmers from where produce and supply seed in the market. It

mainly produces under contract arrangement with farmers and commercial seed growers. Limited private companies like Pioneer Hi-Bred Seeds and some commercial seed growers are also involved in the production of limited quantity of seeds with about 8% of the total certified seed supply annually.

Variety development has long been the sole responsibility of the EIAR. Since research decentralization, the RARIs start to hand over Variety development activities in their region. Moreover, Agricultural Universities and Colleges are contributing to variety research and development.

The EIAR and RARIs produce breeder seed and parental lines; the EIAR and the ESE are responsible for pre-basic and basic seed supply. The variety release activities and mechanism is still controlled at a federal level (ibid, 2009). Though formal seed supply sector aims to supply adequate amounts, high quality, at the right time, place, and with reasonable prices its supply is estimated to be about 10-20% while the rest (80-90%) is covered by the informal sources (Zewdie et al., 2009).

Collective action and role of seed producers' farmer groups

Ethiopian agriculture requires over 700,000 tons of seed each year to grow cereals (such as teff, maize, wheat, sorghum, barley, and finger millet) and pulses (such as faba beans, field peas, haricot beans, and chick peas) (Thijssen et al., 2008).

Seed supply by the formal sectors does not suffice the demand. As a result, recently various initiatives are emerging to fill seed demand and supply gaps. The initiatives include involvement of nongovernmental in local seed development, seed producers' farmers groups, and private seed companies among others.

In this regard, Integrated Seed Sector Development (ISSD) is a concept that acknowledges and appreciates the unique challenges faced by a sector characterized by diversity and complexity, which it advocates should be addressed in a pluralistic approach to development (Louwaars and de Boef, 2012). Such an approach should strengthen individual seed systems, while actively seeking opportunities for integrating the activities of, and complementarities between, these multiple systems in the sector. Foremost, this approach guides the identification and characterization of multiple systems in the seed sector, which include, in Ethiopia: the farmer seed system, where farmers produce, save and exchange seed among themselves (Louwaars and de Boef, 2012); local seed business system, in which farmer groups produce a seed with a local market orientation; and a range of formal systems for certified seed production and dissemination involving public, private, regional, national and international producers and companies (Tesfaye et al., 2012). All of these systems exist to satisfy the diverse demands of the market and its specific segments.

Local Seed Business (LSB) development is one component of the ISSD Ethiopia Program, focusing on organizing and supporting groups of farmers (often legally registered as seed producer cooperatives) to produce and market quality seed that has great local demand. Local Seed Businesses target the segment of the seed market that is neither attractive for private companies (MacRobert, 2008), nor cost effective for public enterprises; hence, the niche remains untapped. These farmer organizations strive to deliver quality seed of a diverse range of local (e.g. wheat, potato, barley, sorghum, field pea) and improved varieties of important local and traditional food and cash crops that are adapted to the local agro-ecologies and affordable for smallholder farmers (Alemu et al., 2013).

Herein lays two key assumptions and/or conditions for LSBs to be successful in their business: seed demand is regular for sustainable production; and production is cost effective at attractive prices to the consumer.

Emergence of seed [wheat] producers' farmers groups common phenomena in most wheat producing areas. Seed producers' collective action facilitated by actors that include but restricted to LSB development Dutch supported programme of ISSD, CYMMIT, most of EIAR/RARIs, Oromia Seed Enterprise, SNNPR'S Seed Enterprise, Tigray Seed Enterprise, Amhara Seed Enterprise, ICARDA, NUME, SARDSC, higher learning institutes from Ministry of Agriculture and Nature Resources, Regional bureau of agriculture to local administrative bodies.

Similarly, in recent years, the seed sector development geared to smallholder farmers with substantial investment. For instance, from 2007 to 2012, the World Bank funded 87 seed sector projects, worth $ US 513 million, with a strong focus on the vulnerable (Rajalahti, 2013) and, in the same period, the Alliance for a Green Revolution in Africa's Program for Africa's Seed Systems (AGRA/PASS) dispensed 112 grants totaling $35,244,164 and geared to improving smallholder livelihoods.

The broad rationale for focusing on seed sector interventions is that seed is a vehicle for delivering a range of advances, all of which can benefit smallholders. Seed can be the conduit for moving new varieties, giving farmers access to more productive, yield-enhancing traits. New seed is linked to strategies for raising nutrition, as with biofortified varieties selected for elevated micro-nutrient levels (Bouis and Welch, 2010). Further, in response to climate variation, stress-tolerant varieties or clusters of diverse varieties are promoted as good practice to enhance system resilience: multiple options can allow farmers to shift crop or variety portfolios in response to changing conditions (McGuire and

Sperling, 2013). Hence, seed is a vehicle linked to promoting productivity, nutrition and resilience: one entry point can potentially move forward multiple goals.

Non-governmental organizations (NGOs) and donors have signaled the need to support more locally-driven initiatives and particularly those that organize around what are called informal, farmer-based, local or traditional seed sector operations (GTZ, 2000). Activities here tend to be decentralized and might revolve around local entrepreneurship, seed banking, community-based seed production, or seed villages. While proponents of formal or informal seed sector development seem divided and even polarized in their respective zones of influence, farmers, in practice, often engage in actions to smooth the divides. For instance, on the demand side, farmers have long drawn from both formal and informal systems, accessing seed for different crops from distinct channels, e.g., maize from agro-dealers and groundnuts from local markets (Sperling, 2008). On the supply side, an increasing number of farmers are involved in participatory variety selection, sit on variety release committees, or access improved varieties through local trader networks (Sperling et al., 2014). More recently, initiatives to recognize and explicitly plan for an 'integrated seed sector' have started to be sketched (Sperling et al., 2014), but pivotal points for catalyzing formal and informal integration tend to be ad hoc rather than managed, and are localized, rather than achieved at scale (Sperling et al., 2014). The Bill and Melinda Gates Foundation (BMGF), in particular, is aiming to become a champion in this area labeled "Integrated Seed Sector Development.

In Ethiopia, seed producers' farmer groups are different in terms of their commodity preferences, naming, status, prospects, success, etc. The emergence of such groups give testimonial on paradigm shift that farmers are not mere technology recipient but also contribute in technology selection, adaptation, diversifications, multiplication and exchange like the seed producers groups do (Melaku, 1997).

In recent years, the seed producers' farmer groups tend to transform into Local Seed Businesses (LSBs) entity. For instance, a Dutch supported project working in collaboration with higher learning institutes, bureau of agriculture, research organization striving to accelerate the transition from farmer, community or cooperative-based seed production towards a formal commercial approach to seed production (Fitiwy and Abay, 2010). The initiative is piloting and promoting farmer-led LSBs in four regions in Ethiopia, it also seeks to support them in becoming autonomous in their operations within the Ethiopian seed system. During their initial set-up stage, LSBs may operate within a community/local setting where commercialization takes place at kebele or district levels. At these levels, the seed quality may be of an informal status or it may be quality-declared. However, as the status of the LSBs increases they may gradually commercialize seed beyond district levels and enter the formal system, producing certified or other forms of quality-declared seed. In essence, the project aims to strengthen both farmers' organizationally independent role and the commercial orientation of local seed production within the local seed systems.

In terms of the performance, 24 LSB sites were established in late 2009, and 12 more new sites were identified and supported by the project by mid-2010 (Dawit, 2011). Most of the LSB sites established in each region had previous experience in seed production and marketing, but had not been organized as independent business entities.

Prior to LSB establishment many farmers' seed production groups or cooperatives are approached by the Bureau of Agriculture and Rural Development (BoARD) or seed enterprises or unions to produce seed on a contractual arrangement, see Table 2 for farmers groups and Ethiopian Seed Enterprise (ESE) partnership for seed production in 2009/210.

Although partnership between farmers and ESE or bureau of agriculture taken as a path to enter seed business in the future, such arrangements are not stable overtime and therefore may often be seen by farmers as simply an alternative livelihood activity. The major goal of the LSB project, therefore, is to formally organize these farmers groups and cooperatives into legal business units, referred to as Seed Producer Cooperatives (SPCs). Classified as SPCs, the legally-established businesses are able to be supported on technical seed production, cooperative management and business development. For most of the SPCs established in 2009, business plans were prepared with the participation of each cooperative and with the approval of the General Assembly. As they currently function, many SPCs market their seed to one main organization, such as a regional seed enterprise, whilst in other cases the cooperatives sell directly to farmers.

One major challenge to the success of SPCs is their attitude of dependency on public services in areas of business that do not need support. In order for SPCs to become self-sustaining, long-term business plans need to be both understood and implemented. In principle, business experts at the woreda level are supposed to support the establishment and functioning of the cooperatives. In practice, however, the business orientation capacity of experts at woreda level is very poor. In response to this lack of capacity, experts point cooperatives towards the public service, thereby deepening SPC dependency. For example, although there is sufficient seed demand in cooperative areas, SPCs face difficulties in finding customers in cases where they must market seed themselves, which is due in part to their imbalanced dependency on support and in part to a lack of training in taking on new business roles. Thus, a

Table 2. The importance of farmers based seed multiplication from the overall ESE 2009/210 production

Crop type	Share of seed produced under FBSM of the total certified seed produced by ESE					Total actual certified seed production			No of varieties under production	
	Plan		Actual							
	Area (ha)	Production (Qt)	Area (ha)	Total Produced (Qt)	Total Collected (Qt)	Total area (ha)	Total Produced (Qt)	Total Collected (Qt)	FBSM	Total
Hybrid Maize	0.03	0.02	0.01	0.02	0.02	7,270.22	76,578.51	76,568.51	2	8
Composite Maize	0.08	0.13	0.09	0.39	0.36	347.47	2,658.30	2511.30	1	3
Bread Wheat	0.54	0.51	0.42	0.47	0.21	19,009.25	457,657.67	308,068.29	10	13
Food barley	1.00	1.00	1.00	1.00	1.00	268.68	5,461.00	220.67	4	4
Malt Barley	0.45	0.45	0.42	0.63	0.13	1,192.25	20,655.57	8,773.17	2	2
Barley both	0.62	0.62	0.52	0.71	0.15	1,460.93	26,116.57	8,993.84	6	6
Teff	0.90	0.90	0.95	0.96	0.87	3,293.22	37,223.20	12,457.77	5	5
Sorghum	0.44	0.30	0.44	0.00	0.00	136.45	1201.01	1,201.01	1	3
Finger Millet	0.00	0.00	0.00	0.00	0.00	42.38	703.20	703.20	0	2
Haricot Beans	0.61	0.55	0.19	0.43	0.09	430.19	1,848.87	1,156.82	2	3
Faba Bean	0.39	0.36	0.13	0.27	0.00	707.49	4,515.68	3,293.21	3	4
Field Pea	0.91	0.94	0.52	0.88	0.18	78.93	570.96	83.50	2	2
Lentil	1.00	1.00	1.00	1.00	1.00	70.50	987.00	540.00	1	1
Chickpea	0.93	0.94	0.92	0.93	0.75	554.48	8,016.22	2,143.53	5	5
Linseed	0.00	0.00	0.00	0.00	0.00	63.70	244.40	244.40	0	2
Total	-	-	0.39	0.47	0.19	34,926.14	644,438.16	426,959.22	44	63

Source: ESE cited in Dawit (2011).

two-fold capacity building initiative is needed: (i) intervention for business experts at the woreda level is vital if cooperatives are to operate as legitimate businesses; and (ii) capacity building for farmers involved in SPC businesses should be designed in such a way that they are enabled to assume the responsibility of their own seed marketing.

The International Center for Agricultural Research in the Dry Areas (ICARDA) Seed Unit is establishing pilot Village-Based Seed Enterprises (VBSEs) to complement the public sector and to provide farmers in unfavorable environments and remote areas with improved seed of low-value crops (Zewdie et al., 2009). The same authors state that VBSEs may work with two types of product: (i) local improved varieties that have been developed, tested, and selected by either conventional plant breeding or with the participation of farmers and (ii) locally adapted and preferred landraces linking genetic resource conservation and use.

Moreover the following potential advantages of VBSEs have been indicated. These are:

- Participation—they mobilize and involve the target group, small farmers in unfavorable environments and/or remote areas,
- Decentralization—they multiply seed of adapted varieties that have been selected based on farmers' preferences in target areas,
- Market driven—they link actual seed demand from farmers with local production,
- Cost effective—they lower transport, marketing and distribution costs, thus reducing seed prices,
- Relevant quality—they can adopt seed quality standards appropriate to farmer requirements,
- Appropriate technology—they can use low-cost cleaning and treatment equipment to improve seed quality at the farm level,
- Sustainability—they provide a mechanism for farmers to be self-supporting in seed production and marketing, and
- Evolution—they can eventually evolve into small, privately owned seed companies.

In recent years the capacity of seed producer farmer groups work has increased considerably, which is generally attributed to the diversity of interests of the actors involved in the Ethiopian Seed System and their determination to see the range of farmer-based seed multiplication activities expanded. The main drivers of actor interests can be categorized as follows: (i) genetic resource conservation and seed security; (ii) improved access and adoption of new crop varieties; (iii) increased seed production and profitability; and (iv) promotion of local commercial seed enterprises (Table 3 & Figure 1) (Dawit, 2011).

Challenges of seed producers' farmers groups

Although the contributions of seed producers' farmers groups are modestly increasing, the initiative also faces

Table 3. Seed producers' farmers groups, drivers, actors and interests

Drivers	Actors	Interests
Genetic resource conservation and seed security	- Institute of Biodiversity and Conservation (IBC) - Relief Society of Tigray (REST) - Catholic Relief Services (CRS) - Ethio-Organic Seed Action (EOSA)	- To ensure the conservation of Ethiopian landraces alongside the utilisation of improved varieties - To ensure seed security in case of disaster
Improved access and adoption of new crop varieties	- Ethiopian Institute of Agricultural Research (EIAR) - Regional Agricultural Research Institutes (RARIs) - Agricultural Higher Learning Institutes (AHLIs)	- To improve access to released crop varieties - To enhance the adoption of the released varieties - To enhance Ethiopian landrace improvement in an effort to repatriate farmer varieties - To demonstration research impact
Increased seed production and profitability	- Ethiopian Seed Enterprise (ESE) - Amhara Seed Enterprise (ASE) - Oromiya Seed Enterprise (OSE) - South Seed Enterprise (SSE)	- To overcome land shortage - To increase volume of certified seed produced to reach more farmers - To maximise profit
Promotion of local seed enterprises	- Royal Netherlands Embassy	- To promote the transition of farmers' group seed production schemes into commercial businesses at micro level

Source: (Dawit, 2011).

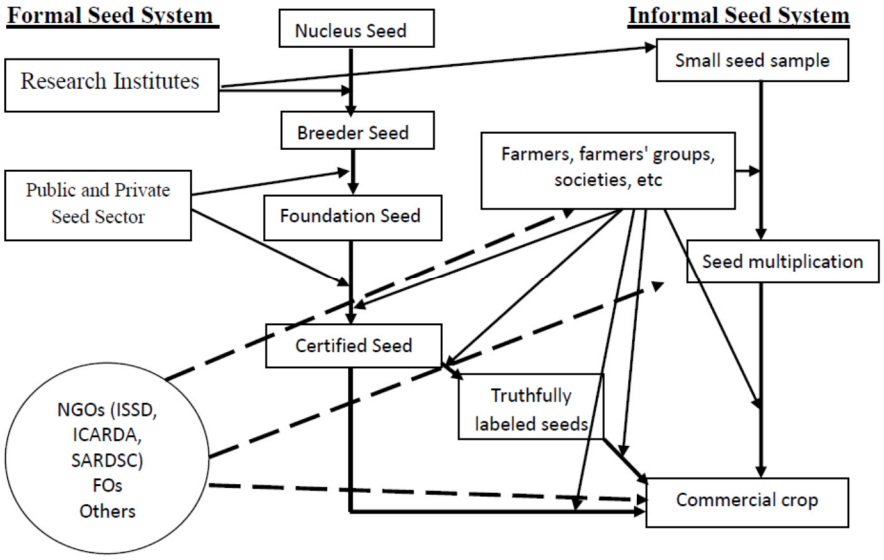

Figure 1. Linkages among seed producers' farmers groups and other seed actors
Source: adapted from (FAO and ICRISAT, 2015)

several challenges: (i) the organization of farmers; (ii) the requirement of intensive supervision; (iii) the reduced amount of seed supply due to quality rejection; and (iv) low quality seed recovery rates (the proportion of seed actually collected from farmers).

For instance in the 2009/10 production period, the proportion of quality seed that was approved from the total production is meeting with relative success, where on average 94%of the produced seed from cereals and about 80%from pulses was approved, the actual seed recovery rate is very low for most of the crops (Dawit, 2011, Zewdie, et al, 2009). This has serious implications for the current and future success. In the 2009/10 production season, the ESE has recorded an average recovery rate of 47%for cereals and 21 percent for pulses. The major reason for the low recovery rates is linked with the limited price incentives that ESE contracts provide to participating farmers as compared to the prices offered to them in the black markets.

The low seed recovery rate has different implications for the actors functioning within the Public Seed Enterprise seed producer farmer groups' model. The ESE

is negatively impacted, as low seed recovery rates reduce the amount of seed that can be marketed by the enterprise, decreasing the business's own profits. On the other hand, for farmers participating in the seed producers' scheme retaining seed increases its local availability for their own use or for sale to local farmers. As such, low seed recovery for ESE means increased access to seed for farmers.

The seed producer's farmer groups scheme is also an important means of seed production for the South Seed Enterprise (SSE), which became operational in late 2009 (Shimelis and Hussein,2013). SSE produces seed through two main approaches: (i) contract farming with commercial farms located in the region, focusing on hybrid maize; and (ii) through FBSM for OPV crops (wheat, teff and barley from cereals and haricot beans, chickpeas and faba beans from pulses), its sole producer of OPV varieties.

The overall challenges facing public seed enterprise based seed producers' farmer groups are as follows (Dawit, 2011; Zewdie et al., 2009,): (i) the dependence of farmers on rainfall patterns causing variability of production; (ii) the difficulty of having clustered farmers with similar soil characteristics; (iii) the dispersed nature of sites that create difficulty in supervision and quality control; (iv) the unwillingness of farmers to sell seed to the public seed enterprises once the seed is produced; (v) the limited ability of farmers to sell the seed to the enterprises as per the set schedule, which then considerably effects the enterprise logistics for seed purchase, seed pack assembly and use of seed cleaning facilities; (vi) the high demand for skilled labour for seed purchase, seed pack assembly and transport; (vii) the limited financial capacity of the enterprises to undertake timely planned purchases from farmers; and (vii) the limited facilities of the regional seed enterprises, especially seed cleaning facilities and storage warehouses, thereby increasing their overall cost of production.

CONCLUSIONS

For years farmers have been custodians of germplasms, bartered, exchanged and sold the seed of local crop varieties to relatives, neighbors, and other members of their communities. This practice continues to the present day, but it now also includes trade in the seed of modern varieties. Such farmers play vital role in popularization of newly introduced varieties, multiply, transfer upto its commercialization. In this regard, there are numerous active innovative farmer groups engaged in seeds adaption, demonstration and dissemination across the country called by different names including seed producers' farmer groups, community based seed producers, farmers' research groups, seed outgrowers, seed contract producers, farmers participatory varietal selection groups etc. The naming directed by seed producers' farmer groups and partnering organization like seed enterprises, NGOs, research organizations, private seed companies.

Emergence of seed producers' farmer groups is a need based collective action to solve challenges related to access and availability seeds of improved varieties. The scheme is consistent with policies of privatization, decentralization, and the development of small rural businesses that encourage long-term sustainability. As locally devised strategy, it may include individuals, as well as groups of farmers, and farmer organizations, and based on local circumstances, can design market-oriented seed delivery mechanisms that are self-reliant and sustainable.

Linkages with agricultural research institutes and agricultural universities need to be strengthened to grow as seed business enterprises. The formal seed sector can also provide capacity building and quality assurance services, extension services (e.g., technical guidance and supervision), and financial services that can provide credit and thus access to working capital and equipment. Seed producers' groups enhance promotion, adoption and diffusion of new varieties and associated technologies that maintain sustainable demand and supply balance. Thus, food security and poverty challenges solved through better production and productivity. Equally, seed producers encounter partnering organization like seed enterprises, NGOs, research organizations, farmers organizations, private companies each devise different incentive mechanism that promote certain groups while others not. And there are competing claims and potential gaps in coordination of the collective action. Thus, collaborators need proper coordination to mobilize and realize seed multiplication, exchange in a win-win and sustainable manner.

List of Acronyms

CSA Central Statistical Agency of Ethiopia
R&D Research and Development
IPRs Intellectual Property Rights
ICRISAT International Crops Research Institute for the Semi-Arid Tropics
ICARDA International Centre for Agricultural Research in the Dry Areas

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