

The role of NGO in informal seed production and dissemination: The case of eastern Ethiopia

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Abstract

Seed is the basic input to crop production. Farmer-based seed production as an alternative agricultural technology transfer is increasingly given especial attention in developing countries where food insecurity is critical. This paper aims to assess the seed production and dissemination strategy among smallholder farmers in eastern Ethiopia that has been introduced by Hararghe Catholic Secretariat (a Non-Governmental Organization). A survey of 160 households in four administrative districts and focus group discussions were used to collect data. While narratives helped understand the process, logistic regression was used to identify determinants of land allocation to seed production. Results indicate the crucial role of informal networks and social capital as facilitators of access to production inputs, information and knowledge. The informal seed supply system initiated by the NGO has a huge potential to benefit smallholder farmers by improving their access to higher-yielding varieties of various crops, thereby contributing to an increase in their wellbeing. However, the traditional practice of seed exchange, influenced by social relations, will remain uneconomical to seed producers. Thus, the paper suggests that this potential can be further exploited if some pre-conditions such as establishment of seed banks, investment in human capital, removal of the underlying constraints and creation of reliable seed markets are given emphasis.

Keywords: seed systems, informal exchanges, seed dissemination, Ethiopia

1 Introduction

Food security and poverty reduction are increasingly given policy priority in developing countries. Improved agricultural technologies play a prominent role to achieve this (von Braun *et al.*, 2005; Dorward *et al.*, 2003a). Production and distribution of improved seed and the creation of institutions that facilitate it are some of the critical components (Lipton, 2005; Dorward *et al.*, 2003b). In Ethiopia, there have been only two seed producing enterprises: one is the Ethiopian Seed Enterprise (ESE), established in 1979 and the other was the multinational private company (Pioneer Hi-bred Ethiopia established in 1990). Before 1979, the Ethiopian Seed Industry was very much ad hoc, and seed multiplication and distribution were carried out by a number of small uncoordinated agencies such as Agricultural Research

Centres, Colleges and Universities of Agriculture, different project related agencies such as Rural Development Unit. Until 1990, ESE was solely responsible for the sale of seed, distribution of inputs such as seed, fertilizers and insecticides (Gemedo *et al.*, 2001).

Meanwhile, the informal seed system has existed in parallel among Ethiopian farmers where they used their own indigenous knowledge to select seed. There existed in-kind exchanges in which social norms and informal networks served as a means to have access to quality seed. A number of case studies underline the importance of supporting farmers' practices in seed processing and storage and the formation of community seed banks since informal seed systems are considered instrumental in the conservation of agro-biodiversity (Thijssen *et al.*, 2008). Moreover, other studies on seed systems in eastern Ethiopia indicate that the informal seed sector is the primary source of seed supply (McGuire, 2005; Storck *et al.*, 1991; Mulatu, 2000). Along this, the initiative of the Hararghe Catholic Secretariat was to explore and improve the informal seed system in eastern Ethiopia.

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At a wider scale, improved seed distribution to farmers has been regulated by the MoARD and the actual distribution is still being undertaken by the Ethiopian Seed Enterprise and private seed companies. Cooperative unions and cooperatives are also involved in this activity. The National Agricultural Research System has contributed to the development of different appropriate crop varieties that are suitable to farmers' needs and do fit into various ecological constraints (mainly drought) but the ultimate availability of these varieties remains limited due to a weak production, distribution, and marketing system (Alemu *et al.*, 2008)¹. Almost half a decade ago, the overall utilization of the improved seed was 2% of the national improved seed requirement. Meanwhile, performance of seed production and distribution through the formal sector has been sufficient to fulfil only 5% of the country's annual seed requirement (ESE, 2001). The seed produced by the formal seed system is far below the demand for improved seed.

To fill this gap, smallholder farmers have been engaged in seed production since recently, which is recognized as an informal system. This has been in line with the growing concern for the informal seed sector to respond to an increasing demand for the improved seed. As a result, Ethiopia has started informal farmer-based seed production and multiplication scheme (FSPMS) in order to meet the ever increasing demand for quality seeds (Gemedu *et al.*, 2001). The farmer-based seed production and multiplication scheme has been operational in seven high crop producing potential regions of Ethiopia since 1997. These regions and the National Seed Industry Agency (NSIA) are providing training and technical assistance and inputs, including seed of new varieties to farmers participating in the scheme.

During the early 2000s, the scheme enabled smallholder farmers to produce 24,500 tons of improved seed of basic food crops like cereals and pulses. Three to four hundred thousand farmers were assumed to have benefited from improved seed produced through the scheme (Gemedu *et al.*, 2001). The number of farmers who participated in the program reached 25,937. Hararghe Catholic Secretariat (HCS) has been engaged in such a scheme in eastern Ethiopia since 1999/2000 cropping season². Informal seed sector, such as farmer-based seed production and multiplication scheme, is perceived to be an easier way for small-scale seed programs to de-

velop. The programs can be very effective to promote the production and availability of quality seed.

Even if seed is a basic input in crop production, poor farmers cannot get adequate access to it for several reasons, one of which is structural and infrastructural problem. It is, thus, becoming timely to enable farmers to produce and use their own seed so that other farmers would largely rely on locally available seed, which could enhance farm-level productivity. AU-HCS food security project has targeted this end. In order to increase the impact of such programs, it is essential to identify major production constraints of farmers³, study the farming systems of the area and analyse the socio-economic conditions of farmers. The main objectives of the project were: 1) to improve farmers' knowledge on seed and seed production through providing training and organizing on-farm supervision at critical times, 2) to facilitate the establishment and development of local groups around seed production, management and distribution in order to build the capacity of farmers to create a sustainable seed supply system, and 3) to encourage farmers to get involved in commercial seed production to improve their livelihoods.

The intention of this paper is to assess the extent to which these objectives have been achieved and evaluate the characteristics of seed transaction and its link with food security and the overall entrepreneurship development among participant farmers. Thus, examining the characteristics and knowledge of farmers involved in seed production and their entrepreneurship ability and identifying factors that affect farmers' preference in seed marketing and how the seed dissemination and information exchange on seed system operates are very crucial to understand processes that facilitate seed and food security.

2 Framework for analysis

A classic economics literature considers a 'firm' as a production function or production possibilities set. A firm is also viewed as a 'black box' that translates inputs into outputs. Using three important components (technology, input prices and market demand), firms maximize profits subject to certain constraint, where a firm is modeled as a single actor, facing a series of straightforward decisions on output level and where production is planned in terms of economies of scale (Spulber, 1989). However, such conceptualization undermines the interdependent nature of firms and how the action of one firm influences that of the other at a lower scale and the transactions between firms to exchange knowledge and information about a new technology at a larger scale. The

¹The authors provide a detailed institutional structure for the formal seed supply system in Ethiopia (p.307)

²Although NGOs are discouraged from taking part in the seed system, the 1997 Ethiopian seed legislation allows their involvement in the seed sector, considering it as part of an informal system (Gemedu *et al.*, 2001, p. 8). For example, CARE and World Vision are engaged in seed production, distribution and marketing using community-level projects (Alemu *et al.*, 2008).

³Drought and out-migration had negative effect on the smooth running of project activities.

practice of searching for information and the exchange relations between any two producers can be explained by the concept of social capital. In that sense, one can draw upon social capital to improve private or collective well-being (Coleman, 1990; Cleaver, 2005), i.e. social ties are important assets often used as a means to build other forms of capital that may essentially contribute to household food security (Schmid, 2000; Bebbington, 1999).

In the context of this study, social capital has a critical role in enabling a community to maintain crop-diversity and in improving access to seed since those households having contact with external organizations also could have access to information on seed. Interventions aiming at improving seed supply systems should not only focus on how to increase seed supply through the inclusion of the informal sector into seed programs, but also emphasize the role of social capital and its instrumentality in facilitating seed and information exchange (Winters *et al.*, 2006). These authors indicate ... that “social relations are an important part of the seed system and thus seed sourcing decision” (p.14). Such sources of seed supply are critical for a larger proportion of farmers where social networks both within and among communities play an important role in the seed supply system and in securing livelihoods (McGuire, 2005; Almekinders *et al.*, 1994; Badstue, 2004). The link between livelihood insecurity and social protection is exhaustively discussed in the literature, taking into consideration the role of informal social protection in managing risk, supporting vulnerable groups and promoting adoption of economic activities, which might lead to a higher return (Devereux, 2001). A more effective use of existing social networks in areas where the use of information communication technology is undeveloped will largely contribute to improved access to new agricultural technologies (Bandiera & Rasul, 2006; Bebbington, 1999; Winters *et al.*, 2006).

Thus, a household’s capacity to produce improved seed is determined by the established social capital, which is expressed by the exchange relations made around seed production as reciprocal arrangements can be made, the asset endowments of a household (land, labour, ability to purchase seed and other assets invested) in seed production and the different forms of support supplied by the external actors⁴ (Figure 1).

This will determine the quantity of seed produced at a community level that can increase the overall supply. The seed produced and information about it is diffused through the informal relations within a society. Analysing such relationships and transactions between rural households with the logic of markets can be extended to accommodate the role of informal networks in seed dissemination. The importance of informal net-

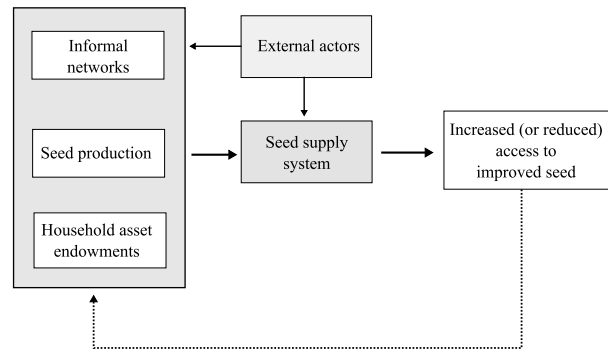


Fig. 1: Model of a household seed production and supply system

works in creating access to livelihood resources, such as seed, either through markets or other forms of exchange will increase households’ capacity and capability to generate assets that would in turn encourage investment in seed production (Bebbington, 1999).

Such conceptualization has gained momentum pursuant to the development and extensive use of the sustainable livelihoods framework as an analytical tool (Scoones, 1998) and the key role of social capital in asset creation and poverty reduction (Cleaver, 2005; Grootaert & Narayan, 2004). Aspects of asset creation and poverty reduction increase the centrality of access to reliable markets and institutions that mediate the relations between markets and the poor. Intervening agencies that target pro-poor market development, such as commercial seed production, need to understand the underlying role dynamics at household level and the embedded institutions that prohibit or enhance entry into markets (Dorward *et al.*, 2003b).

3 Methodology

This study has been carried out in two highland (Meta and Chiro) and two lowland (Mieso and Dire Dawa) districts, where farmers are engaged in seed production of the four major crops (maize, bean, sorghum and wheat). Results of the study are based on the data collected through focus group discussions and household surveys conducted in the four case-study districts where the HCS intervention took place. The initial stage of data collection involved preliminary assessment of target groups through observing their farms. A more descriptive information on general characteristics of farmers involved in the project, which includes agricultural productivity and socio-economic conditions of farmers, the inputs of the development agents and the role that local animators have played in encouraging and assisting farmers were captured using focus group discussions. Participants of the focus group discussion were those volunteer farmers

⁴External actors could be NGOs, the private and public sector, which may provide credit, advice and training.

who participated in the project and who were thought to be knowledgeable about the project intervention. A checklist consisting of guiding questions was used to facilitate the discussion. Important topics covered include motivations for participation in the project, how farmers were selected and the criteria used and the reasons for discontinuity in participation by some farmers. The intention was to have an overview on how the project operated rather than an in-depth case study.

A subsequent step in the data collection was the household survey carried out among those households selected randomly from the list of participant farmers. A standardized questionnaire was used with the purpose of getting an in-depth insight on the socio-economic, institutional and environmental conditions that could inhibit or facilitate farmers' participation in the seed project and desirable adjustments to be introduced in order to sustain positive impacts of the project. The study covered 160 households sampled from four districts (40 households per district). A household head was contacted for the interviews. The survey covered important points such as knowledge of seed production and management, seed marketing (quantity sold or exchanged), seed dissemination (preferences for community level seed dissemination and surplus seed use), information exchange and intervention approach and the impact of involvement in the seed security project on farmers' well-being.

While collecting data, some challenges were faced. First, some of the selected farmers for the interview, in almost all districts, have received training on the use of improved farm implements though the project did not give the implements, especially the plough. Such farmers have shown a concern on why they should be trained if the implement were not there. It was challenging to collect data in a relaxed mood. Secondly, some farmers did not receive seeds continuously in all years of the project since new participants were joining the project each year. And thirdly, the recurrence of droughts has damaged crops and livestock, which has negatively affected farmers' motivation to provide information. Responses obtained through discussions with key informants (farmers and animators) were narrated and described in a way the qualitative information complements the results from the survey. Data collected through standardized questionnaire were processed and coded using SPSS software for further analysis. After computing the descriptive statistics, a binary logistic regression (Greene, 2003) was used to identify determinants of land allocation to improved seed production where the dependent variable was has binary outcome ($Y = 1$, if a household allocates most of its land to seed production, 0 otherwise).

4 Results

4.1 Seed production and management

a) Seed Production: Field-based evidence shows that knowledge of seed production has gradually increased since the inception of the project in 1999. Reference can be made to the situation of farmers in the Weiber Kebele⁵ of the Meta District where local animators observed a great difference in yield obtained between using local and improved seed. In the year 2000, 200 kg of haricot bean was distributed to participant farmers. However, there was no need to distribute wheat since the seed produced in the previous year was sufficient to cover the local seed demand. Farmers exchanged seed among themselves informally and their knowledge in maintaining seed quality and reserving seed for next cropping season after selling and exchanging some was observed.

More and more farmers came into the project by observing others' benefit. For example, in 2001, the number of beneficiaries in Meta District has increased from 140 to 205 households. During this year, the plan of HCS was to supply wheat and haricot bean since maize was eliminated from the system due to impurity of seed caused by cross-pollinated nature of the crop and partly attributed to the lack of cooperation between participant and non-participant farmers. Lately, local animators advised those producing impure seed not to use such seed type on farms adjacent to plots allocated to improved seed production. Assessment of farmers' participation shows that irrespective of the actual benefits obtained from being part of the project, 62 (38.8 %) of the sample households has continued to participate in the project, whereas 5 (3.1 %) rejoined the project after discontinuing in the second year.

In the case of Meta (Walensu Kebele), 110 farmers started with haricot bean in 2000, but there was low production due to shortage of rainfall. In 2001, other farmers purchased seed from these farmers. Wheat seed was purchased from HCS but many farmers could not get bean locally and presented their request to HCS, showing that the demand for bean seed was high. For the year 2002, the intention was to distribute bean seed, which was preferred due to its taste, greater market demand and good yield potential. The major challenge in this kebele was slow credit repayment since farmers often repay credit faster for oxen⁶ than for seed. This attributes to the experience in the provision of an emergence relief, which was given for free. Another problem was low level of awareness of the local animators on objectives of the seed production and multiplication program. It was unclear for them how the sustainable seed supply system needs to be established to ensure self-reliance

⁵Kebele is the lowest administrative unit in Ethiopia

⁶Supply of farm implements and oxen is also part of the project intervention package.

through enhancing local exchange of seed and initiating localized seed banks.

In 2000, 115 farmers in Chelenko Lola Kebele took maize, wheat and haricot bean, spade, sickle and digging hoe; returned all the seed on their own; sold some to HCS with 20% increment over the local price and exchanged some with other farmers. In 2001, 110 of the 115 farmers failed to grow maize due to poor seed quality, indicating that most of the farmers were unsuccessful in producing maize seed. Having understood the importance of seed production, over 40% the sample households allocated most of their land to seed production, 28.8% allocated half of their land and surprisingly 3.8% has allocated their entire plot to seed production.

Land allocated to seed production has increased over the years. There are a number of factors that determine farmers' land allocation decisions to improved seed production. Table 1 presents the descriptive statistics of the variables influencing land allocation decisions while Table 2 provides the binary logistic regression results.

b) Food insecurity and limited technical capacity: An important constraint mentioned during the discussion with the animators was the problem of food insecurity among smallholder farmers that undermines the potential to save seed either for sale or exchange. The survey indicates that whenever there is extra seed, left over after sowing, close to 34% of the households tend to consume as food rather than selling. Although discussion with key informants reveals that poor knowledge of seed storage compels consumption of extra seed (fear of insect attacks if they try to keep it), systematic analysis of the survey data indicates that those who tend to consume are the ones who are relatively food insecure. Nearly 17% of the sample households prefer to exchange seed with neighbours that will secure farmers' access to seed; it also helps other farmers to obtain seed on time, which is crucial under rain-fed farming.

The second source of challenges in seed production and management identified during the focus group discussion were limited resources and technical capacity. Much of the seed used for sowing in the studied districts are landraces and farmers' saved seed. There are resource poor smallholder farmers operating relatively on smallholding, with most of the labour being supplied by the household. Limited knowledge of quality seed, late delivery and distribution, high production cost, lack of adequate field machinery, tools and equipment, low purchasing power, insufficient credit system, and unfavourable climatic conditions are among the pressing challenges that undermine their efficiency. Discussion with the project staff reveals that the HCS's strategy to transform seed producing smallholders into entrepreneurs has also provided training and production facilities to enhance capacity even if this had its own limitation. In order to maintain seed quality, majority of farmers (60%) practice seed sorting and threshing and

storing separately. Others store specific seed type permanently in a particular granary to avoid adulteration.

4.2 Seed marketing and dissemination

a) Seed marketing: This was also the aim of the project towards which experts have been committed to improve farmers' knowledge in seed marketing. This objective was not attained where the survey result indicates that there is no adequate market available for seed production and a few farmers tried to sell their seed. For instance, of the sample households, 84.4% did not find buyers at all. This was attributed to poorly organized seed market, lack of awareness of potential buyers, HCS's interference in buying seed at better prices as well as inadequate surpluses of seed produced. Among categories of buyers assessed during the survey, traders give attractive prices for seed producers as compared to others other than HCS. Selling of seed takes place largely during the wet/rainy season unlike most other cereals, indicating that farmers realized the value of seed and the need to commercialise seed production. In terms of seed marketing options, selling is preferred to a simple exchange of seed as the latter is not economical while compared to selling⁷. This proves the importance of establishing well-functioning local market that benefits seed producers.

But in terms of convenience, exchange is easier than selling although farmers prefer selling only due to price incentive. The economic loss that occurs due to exchange practice, attributed to rural social ties⁸, can only be avoided if the marketing system is well developed and local seed companies and seed producers are effectively linked. The actual losses incurring due to missing markets become clear from the respondents' assessment of price differences between improved seed and land races. The survey shows that by exchanging 20 kilos of improved sorghum seed to that of land races, an improved seed producer incurs a loss of 30 ETB (Ethiopian Birr).⁹

It reveals that the price difference for beans was highest while it was lowest for maize. The actual market price of beans was high as compared to others. In other words, seed producers can gain 200 ETB additional income by producing 100 kg of improved bean seed over the local land races. This indicates the potential economic gains provided that the seed market is well organized. Nevertheless, this result cannot give reliable indication on the profitability of producing seeds be it maize or beans. The purpose here is to denote that com-

⁷In addition, local people may bargain to exchange equal quantity of improved seed to landraces.

⁸Greater degree of commercialized seed production can be risky for poor farmers who may not afford and can only rely on exchange using informal social relations.

⁹US \$ = 9.96 ETB

Table 1: Descriptive statistics for variables expected to determine land allocation to seed production (N = 160)

Variables	Min.	Max.	Mean	Std. Dev.
Education level (in years of schooling)	0	12	2.459	2.199
Engaged in non-farm activities (no=0, yes=1)	0	1	0.125	0.331
Land holding (ha)	0.25	1.25	0.578	1.478
Sharing farm implements (no=0, yes=1)	0	1	0.687	0.464
sold improved seed (no=0, yes=1)	0	1	0.156	0.364
Need cooperative for seed marketing (no=0, yes=1)	0	1	0.496	0.501
Exchange Preferred over selling (no=0, yes=1)	0	1	0.427	0.496
DAs as source of market price (no=0, yes=1)	0	1	0.318	0.467
Informed about seed bank (no=0, yes=1)	0	1	0.337	0.474

Table 2: Determinants of land allocation decision to seed production (N = 160)

Explanatory Variables	B	S.E.	Sig.	Exp(B)
Education level	0.107	0.061*	0.083	1.112
Engaged in non-farm activities [†]	-1.145	0.624*	0.066	0.318
Land holding (ha)	-0.049	0.118	0.678	0.952
Share farm implements [†]	-0.356	0.424	0.401	0.700
Sold improved seed [†]	-0.424	0.518	0.413	0.654
Need cooperative for seed marketing [†]	-0.380	0.353	0.282	0.684
Exchange Preferred over selling [†]	0.248	0.361	0.493	1.281
DAs as source of market price [†]	0.329	0.375	0.381	1.389
Informed about seed bank [†]	1.136	0.388*	0.003	3.115
Constant	-0.549	0.538	0.307	0.577
-2 Log likelihood	195.8	-	-	-

Note: Variables denoted with [†] are dummy.

mercialisation of seed production can support household food security through providing additional income while losses are likely due to missing markets.

b) Seed Dissemination: 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 favourably. In this study, selling seed back to HCS, selling at the market, establishing local seed bank, exchange with other farmers and giving them a loan were the key mechanisms in seed dissemination. The survey shows that 78.1% of the sample respondents reported selling to HCS as the most preferred way in seed dissemination followed by exchange with others.

However, there was variability observed across the districts studied where more farmers in Dire Dawa

(60%) and Chiro (65%) sold seed while greater proportion in Meta (55%) tended to exchange. The local animators and project staff believe that selling to other farmers will only be attractive if HCS withdraws the 20% price premium and the local seed market operates effectively. While comparing seeds of different crops, the mean quantity exchanged is higher for sorghum followed by maize seed where the exchange practice is suitable more for these crops than others. This was in reverse to the price difference per kilogram sold, which is lower for sorghum and maize. The survey also reveals that the number of farmers with which a typical seed producer exchanges beans' seed is lowest in project years 2 and 3, whereas that of maize and sorghum have shown an increment. As a result, seed dissemination through exchange has become faster for sorghum and slower for bean.

4.3 Assessing the project intervention approach

Realizing a sustainable seed supply system is influenced largely by the approach used in the project in-

tervention. The approach HCS followed in initiating and scaling up of the informal seed production and dissemination had some limitations. Insights during the discussions and the survey result have indicated some drawbacks. First, even if women are often engaged in marketing activities and frequently visit markets in the study area, the survey shows that housewives were not important sources of information on seed market. Household heads tended to rely on outsiders as sources of information on seed prices. This might have occurred mainly due to low level of women's awareness about seed production, management and marketing. The project seemed not to be holistic in considering a household as a unit in the production and utilization process.

Second, the provision of seeds and other inputs experienced a supply push approach, i.e. they were distributed simply because they were available during the planting season. While some farmers got more than required, others obtained very small quantity of seed at planting time and still others experienced a delay. This signals that there was a problem of planning to meet the requirements of target group, which was common in Dire Dawa and Mieso. A discussion with the HCS project staff reveals that drought and shortage of fund (to purchase seed from producing target farmers) constrained seed supply to the new target farmers. Moreover, most farmers were trained in how to use farm implements but did not receive them, resulting in the deterioration of trust on the part of the farmers.

Third, the initial intention of the project was to find a 'trickle-down' approach working on the basis of an 'invisible hand' principle, where some farmers who joined the project benefit from it and the rests will be attracted so that the impact of intervention will scale-up. But the reality was quite different; some farmers who first joined the project have withdrawn, while others came in intermittently and were partly involved.

There were mixed views reflected when it comes to target selection. Some farmers indicate that project targets were selected on willingness basis, with the support of community representatives and considering the socio-economic conditions of different households. The target selection considered those who were believed to be capable of creating assets that support their livelihoods as well as others suffering from inability to make a bare subsistence. Since the project's intention was to contribute to food security effort, targeted farmers were those who were poor and constrained to make a living from the asset they held. Other groups of farmers indicated that the target selection procedure was found to be biased in favour of choosing resourceful farmers – a practice which was in contrast with the project intention.

Again the efforts made in training farmers to utilize technologies properly and gain the necessary skills in working with improved packages were very low. Although farmers were not trained well and majority did

not take training, they were able to repay the credit on inputs. Of the total sample households, 57.5% were able to repay the credit and 41.9% failed to repay due to partial crop failure, total crop failure in Mieso and Chiro and death of oxen caused by severe drought conditions. Prices are lower during harvest and farmers suggest for credit repayment to be at the time of harvest. This does not seem to be a rational choice if farmers have to maximize profit from commercial seed production. But they pointed out that one can benefit from reduced total interest on the loan and minimized risk of eating improved seed if repayment takes place upon harvest even though prices are higher in wet season. The survey shows that most farmers (62.5%) were satisfied with the quantity of seed provided at a time and the varieties the project distributed in its seed production and dissemination scheme.

5 Discussion

The case study indicates that in a situation when seed industry is underdeveloped, an NGO can play a great role in enhancing improved seed production capacity of smallholder farmers that can in turn contribute to attaining food security. Farmer-to-farmer exchange of information, as one of the strategies of the project, is found to be instrumental in increasing farmers' understanding of the business potential of seed production. Quality seed production is the most essential component in increasing yield thereby income for farm households (Almekinders *et al.*, 1994; Lipton, 2005). The seed production capacity and benefits are measured through assessing the extent to which a particular farmer engages himself in the activity and the ability of this farmer in identifying constraints in seed production, trying to suppress those constraints through own efforts or external support. To test this, a logistic regression model was estimated (Table 2) and shows that education level of a household head (in years of schooling) and awareness about the importance of seed bank encourages a household to allocate more land to seed production. Investment in education, which is high on the government agenda in connection with the attainment of millennium development goal, would largely contribute to increasing awareness over the need to transform agricultural production.

However, engagement in non-farm activities does not have a favourable influence as expected. Although those activities might contribute to household income, there will be less labour available to manage the plots allocated to improved seed production. Contrary to the expected, size of land holding does not have the expected sign though not significant. The reason is that while comparing the targeted districts, 50 percent of the sample households stayed in the project for the entire project period in Dire Dawa and Meta, whereas this number was very low (22.5%) for Chiro probably due to variability in rainfall and shortage of land.

The results reveal diversity among farmers across different locations in terms of seed management. And such divergence was associated with the poor post-harvest seed management but not necessarily connected to the genetic potential. Contrast to farmers in Weiber, those in Chelenko Lola Kebele did not store seed for the next cropping season as it does not germinate or will easily be attacked by a weevil. As a result, they sell or consume the remaining after sowing their field; they do not preserve seed in case there is crop failure. Some farmers consume the seed if they fail to sow on time due to late rain, which has a negative effect on the sustainable seed supply system.

An important requirement to involve farmers in the informal seed system is to understand their evaluation criteria. Farmers usually evaluate the quality of a given crop variety according to their own criteria. Although yield has generally been seen as an important criterion, smallholder farmers tend to prefer yield stability to maximum yield in line with their policy of risk reduction¹⁰. Apart from selection criteria, like resistance to pests and diseases, which are generally important, other specific criteria may be included, such as growth period, colour, taste, etc... To ensure that important criteria are not overlooked, farmers' judgments need to be incorporated into the implementation of the project. Thus, it is important that before attempting to execute such a comprehensive project, farmers' need, their production constraints and the type of farming system should be studied in depth, which was not emphasized in this project. An indication of this problem was the failure of maize seed production in Chiro District where improved maize seed was sown adjacent to local maize plot. This implies that the project could have increased its role in filling the gap in demand for improved seed if it had primarily focused on improving farmers' capacity to overcome these constraints.

The result also reveals that seed marketing was another constraint for those smallholders who were able to produce for market. Marketing in this case involves certain level of transactions in producing quality seeds, looking for appropriate markets and developing linkages with various customers in order to secure prices, one of which could be making contractual arrangements with traders and primary crop producers. Understanding the system in which various forms of transactions take place helps in creating appropriate governance structure in the informal seed supply system. The existing literature suggest that enhancing farmers' capability and skill to produce quality product and creating associations, such as sales cooperatives, in search for better prices collectively are effective ways to benefit from seed production (Thijssen *et al.*, 2008).

¹⁰Since variability is an important determinant of vulnerability, households tend to choose lower but less variable yields over yield maximization – which could retard growth in the agricultural sector (Devereux, 2001, p.512).

As this case study reveals, however, a number of factors affect farmers' transaction in seed marketing. While cultural norms defining relationships affect seed exchange rate¹¹, and unavailability of market¹² have a negative influence, the prevailing price level difference between landraces and improved seed encourages farmers to be involved in informal seed production. Although exchange is found to be uneconomical, it overcomes the problem of seed scarcity that could arise from an increase in seed prices over the years where prices for improved seed have increased. Such a price hike could play a prohibitive role for access to improved seed as long as government fails to subsidize it (Tadesse, 2008).

Another constraint ahead that can affect seed dissemination is related to the situation where HCS terminates the project and may no longer buy seed from farmers. There is a need to establish a mechanism through which seed can be disseminated on sustainable basis, one of which is development of rural seed banks having its own governance structure, rules and regulations. Although HCS has had such an intention to ensure sustainability, most seed producers still did not understand what a seed bank means and how it can operate as well as what its roles could be. This implies the need to spend much time in creating such an institution where the seed bank facilitates seed exchange (Ramprasad, 2007). The result has provided cases where unused seeds after sowing are consumed other than being stored for future use for different reasons.

6 Conclusion

The existing theoretical literature on social capital underlines that where exchange relations favour cooperation, the capacity to create assets increases. Results have shown great divergence among respondents in this line. Even though the presence of social capital on the basis of kinship facilitates seed dissemination, the problem of missing markets undermines the possibility for small-scale seed producers to sustain seed production. This is because exchanging seeds with relatives plays a rather exploitative role, creating disincentives. Though the logistic regression result shows that awareness of the possibility to establish seed bank has a positive influence on land allocated to seed production, the majority of the farmers (66.3 %) do not have any idea about how it will operate. Despite this asymmetry in awareness, almost

¹¹81.9 % of the sample farmers indicate that the exchange rate remains equal when seed exchange occurs between relatives, indicating how social capital facilitates seed supply though it hinders smallholder farmers' entrepreneurship development.

¹²A national level study shows "although the market for improved seed is less-developed, the use of improved seeds grew rapidly with a compounded growth rate of 47 % per annum after the reform (1992-2001)" (Tadesse, 2008, p.6-7), implying that the informal seed supply system plays a crucial role.

all of the sample households were willing to contribute seed to a seed bank if any.

The findings imply that food security projects aiming at creation of sustainable seed supply system should pay attention to: 1) training farmers not only in seed production but also in management, marketing and the importance of forming groups or associations that work together to attain sustainability, 2) providing seed on time to farmers in remote areas, encourage them to contact animators or development agents for advice and assistance, and 3) advice for farmers on how they can benefit out of seed production by improving access to price information and through promoting collective action to form cooperative seed banks. Forming cooperative seed banks is in line with the government policy, aiming at transforming subsistence agriculture. This form of organizing seed producers could also discourage the consumption of unused seed as a food.

However, the presence of small fragmented farms in eastern Ethiopia undermines the possibility to create a sustainable seed supply system through the engagement of smallholder farmers in seed production. In the case of maize seed production, for example, only those farmers with large land size or neighbouring households who could cooperate to adjust their farming systems have a potential for improved seed production. Some institutional arrangements in land allocation to improved seed production can be introduced. Scaling up this requires an intervention to assist farmers in realigning their production system to overcome impurity.

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