Introduction to the Special Issue

Seed supply in local markets:
supporting sustainable use of crop genetic
resources

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ABSTRACT. This introductory paper summarizes the policy context, methodological
approach, and key results from the set of papers contained in this special edition derived
from a FAO-led project on seed sourcing in local markets and its farm-level impacts. The
introduction provides the conceptual framework used in the papers for considering the
relationship between sourcing seed from market and rural household decision-making
as well as the effects this has on two key farm outcomes: on-farm diversity and house-
hold welfare. Approaches for data collection and study site selection are described, with

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a focus on how methodological issues were addressed in the different studies. Lastly, the paper summarizes the results of the individual papers and draws broad conclusions and policy implications for promoting the sustainable utilization of crop genetic resources through increasing market access and in a manner that supports agricultural production.

1. Introduction

Seed is the basis for increasing the productivity, resilience and returns to agricultural production systems, all essential elements to achieving food security and poverty reduction in developing countries (FAO, 2010a). To fulfil this role, seed must be both accessible and appropriate – that is, it should be of good quality and free from disease and should include the genetic properties suitable for satisfying the producer’s needs. In addition, it is essential that farmers have the means and information to be able to identify and obtain it.

Aside from the direct private benefits obtained from crop yields and returns, farmers’ selection and planting of seed may generate positive or negative environmental externalities. The former includes the in situ conservation of agricultural biodiversity (Brush, 1995; FAO, 1998; Lipper and Cooper, 2009); the latter involves the loss of crop genetic diversity that generates significant costs in the form of lost option values for future varietal development, as well as increased genetic vulnerability to pest and diseases (Gepts, 2006; Lipper and Cooper, 2009; FAO, 2010a). As a consequence, policies that affect farmers’ choice of seed and variety to plant – including policies that directly or indirectly affect seed supply and their diversity, quality, availability and accessibility – have important implications for both development and environmental outcomes. However, very little research has been conducted on how relevant characteristics of seed supply sources affect farmers’ seed sourcing decisions, and the implications this choice has on potential trade-offs between welfare and environmental outcomes at the farm level. That is the gap which the set of papers presented in this special issue intends to address.

At present, most seed in developing countries is obtained from the informal sector, which covers all non-certified seed. The varieties or cultivars found in this sector range from landraces developed through farmers’ selection over centuries, to recycled improved varieties derived from saved and replanted seed. In contrast to the uniformity and varietal purity found in the formal sector, seed in the informal sector often consists of blended and mixed varieties generated through cross-pollination and adaptation (Bellon, 2006). A common form of seed in the informal sector of developing countries, where seed and product are often interchangeable, is the crop product, e.g., grain or tuber. In short, the informal seed sector comprises both improved as well as traditional genetic material but without the varietal distinction and the related standards and certificates providing information on the seed that are essential components of the formal seed sector.

Certified seed is defined as seed of a prescribed standard of quality produced under controlled multiplication schemes either from basic seed or previous generation certified seed (FAO, 2010b).
Another major distinction between the formal and informal seed sectors is related to the supply channels through which seed may be obtained. Aside from own-farm saved seed, which in most developing countries represents the dominant seed source, informal seed supply tends to be governed by social networks and relationships. In traditional settings, reputation and social norms generally provide the guarantee of seed quality (Almekinders et al., 1994). However, these sorts of traditional exchange systems are often challenged by major social, economic and agro-ecological changes such as conflicts, rapid population growth and economic development and may, thus, not be adequate or sufficient to meet seed demand. Moreover, depending on households’ access to social capital, some farmers might be excluded from this seed source whereas others might have privileged access (Bellon and Taylor, 1993; Badstue, 2004; Cavatassi et al., 2012).

In recent years, awareness has been raised as to the importance of local agricultural markets as a source of seed. Local markets, which comprise mainly the informal seed sector but also, in some cases, formal sector seed outlets, have been found to be an important source in the wake of major shocks such as crop failure or conflicts (Sperling and Cooper, 2004), as well as in the wake of receding public sector seed programmes under structural adjustment programmes implemented in most developing countries in the 1990s (FAO, 2010a). Assessing the role and efficiency of local agricultural markets as a source of seed is, hence, essential to obtaining a complete picture of the options farmers have for accessing seed in developing countries.

One of the most pressing current debates in development is how markets can be governed to facilitate economic growth and development. A major concern is to improve the efficiency of markets by reducing transaction costs and providing a supportive institutional environment (Jayne et al., 2002; World Bank, 2002). The role of transaction costs in smallholder farmers’ decisions to participate in input and product markets has also received considerable attention (Sadoulet and de Janvry, 1995; Key et al., 2000; Bellemare and Barrett, 2006). Yet many argue that non-market mechanisms may be needed, at least initially, to overcome the risks facing market participants in poor rural areas, particularly in the case of staple food crops (Dorward et al., 2005). While there is no consensus on how best to govern agricultural markets in developing countries, most agree that markets are not functioning well in many contexts and interventions are needed to improve their performance (Dorward et al., 2005).

Governing seed markets is particularly difficult owing to the inherent lack of transparency in identifying seed quality and genetic content. Often it is not possible to distinguish the variety or seed quality by visual inspection alone, thus putting ‘would-be’ purchasers at a disadvantage in the absence of any other mechanism for providing this information. Research has indicated that this type of information asymmetry is a major factor in determining farmers’ seed sourcing decisions. It has also been shown to be a source of inefficiency in seed exchanges between farmers and end-users (Barkley and Porter, 1996; Lambert and Wilson, 2003). Lack of quality control and poor or unsuited genetic materials are problems that
plague the informal seed sector and pose a major barrier to improving crop productivity and ultimately farm household welfare (FAO, 2010b). A common solution to overcoming this problem is the development of a formal seed system, in which information is provided through rigorous varietal standards and seed certification procedures. However, for low-value and semi-subsistence production systems, the returns farmers can obtain on formal sector seed are questionable. This is particularly true when considering annual seed renewal for crops whose seed farmers can easily save and recycle over several cropping seasons with limited dilution of genetic purity and seed quality (Heisey and Brennan, 1991). Since farmers do often recycle the seeds of such crops, effective demand for formal sector seed is limited, which in turn reduces the potential returns from and incentives to invest in formal sector seed enterprises and reduced supplies (FAO, 2010b). Thus, for many crops and production systems, improving exchanges within the informal seed sector is the key means of improving farmers’ access to seeds.

One of the main issues we seek to address in the set of papers summarized and presented in this special issue is that of the factors affecting farmers’ decisions to source seeds in local markets, which play an increasingly important role in the informal seed sector. The research focuses on assessing how seed access affects farmers’ decisions to source seeds from markets, and then traces the impact the sourcing choice has on household welfare and crop diversity maintained on-farm. The literature leads us to suspect that the choice of seed source can lead to trade-offs between environment and development outcomes at the farm level, particularly when seed is sourced from markets. However, no systematic set of studies of the effect of seed sourcing from local markets has been conducted.

The studies presented in this special issue were conducted to address this key gap in the literature. The papers are the result of a Food and Agriculture Organization of the United Nations (FAO)-led project implemented with the Consultative Group on International Agricultural Research (CGIAR) and national research institution partners in five countries, Bolivia, Mali, India, Ethiopia and Kenya, and for some selected major crops. These crops are respectively: potato for Bolivia, minor millet for Mali and India, sorghum and wheat for Ethiopia, and pigeonpea for Kenya. The project involved the development of a common conceptual framework and methodology (Lipper et al., 2009). The major thrust of the research effort is analysing the characteristics and performance of seed supply sources, focussing particularly on the informal seed sector and local agricultural markets and using this information to assess the farmers’ choice of seed source. A key innovation was the development of market performance indicators related to the role and function of markets in promoting the sustainable utilization of crop genetic resources, which is a major policy objective under the International Treaty on Plant Genetic Resources for Food and Agriculture which came into force in 2009 (ITPGRFA, 2009). Lipper et al. (2010) provides a summary of the research findings related to the market performance indicators.

In the remainder of this introductory paper we first present the conceptual framework utilized to conduct the studies in section 2, followed by
data collected and how methodological issues were addressed in section 3. Section 4 summarizes the results of the paper, distinguishing determinants of seed market participation from impacts on on-farm diversity and welfare measures. Finally, section 5 concludes the paper, drawing some important policy implications.

2. Conceptual framework
The set of studies presented in this special issue use a common conceptual framework (Lipper et al., 2009, 2010), developed through the implementation of technical workshops and interactions between project participants. The framework utilizes concepts drawn from institutional economics and builds upon work on market governance for agricultural development and poverty reduction.

The working hypothesis is that key characteristics of seed supply systems affect the ability and willingness of farmers to access and obtain seed from that source, as well as their choice of seed. In addition to supply factors, farmers’ access to and use of seed is also driven by demand factors, and the interaction of supply and demand factors determines the farm-level utilization of crop genetic resources. In turn, the on-farm utilization of crop genetic resources through planting and cultivating certain crops and varieties influences household welfare as well as on-farm diversity, as laid out in figure 1.

Three main dimensions of market performance are considered: (1) the availability of diverse genetic resources in local markets, (2) the seed-related information available about these resources, and (3) the costs of obtaining the seed, including transactions cost as well as purchase price. The characteristics of markets along these three dimensions are hypothesized to be dominant determinants of farmers’ ability and willingness to obtain seed from local agricultural markets (Lipper et al., 2010).

![Figure 1. Conceptual framework](https://www.cambridge.org/core/terms). Downloaded from https://www.cambridge.org/core. IP address: 54.191.40.80, on 12 Sep 2017 at 18:21:42, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/S1355770X12000393
One of the major areas of focus in this set of studies is the exchange of seed under a voluntary transaction between buyers and sellers in local agricultural markets which may involve seed from either the formal or informal sector. The focus is on retail or ‘micro-retail’ transactions, where the farmer is the purchaser of the seed (Fafchamps and Vargas, 2005; Lipper et al., 2009). Since there is often a range of market outlets varying in size and scope within a given locality, we use the concept of a ‘marketshed’ to give the sense of a system or network of market flows within a given area. The links between these markets within the marketshed have an impact on the characteristics of any one of them. For example, in Kenya ‘market hoppers’ are vendors who move from primary to secondary markets to sell produce and seed, which impacts on the level of genetic diversity found therein (Audi et al., 2010). In contrast, few links were found between dominant and secondary markets in Mali (see Smale et al., 2012).

The demand factors that determine the choice of crop and variety farmers choose to plant are shaped by the households’ consumption and risk preferences, as well as production conditions (Smale, 2006). These in turn are driven by the endowments of natural, financial, human and social capital of the household. Households seek to generate income and consumption benefits through the choice of crops and varieties they choose to plant, constrained by their agro-ecological conditions. Risk also plays a major role in determining the set of crops and varieties maintained, with diversification providing insurance against failures, as well as pest and disease attacks. The factors determining the households’ demand for crop genetic resources in the form of seed also influence their preference and choice of seed source, given the range of sources available. Among these, a significant role is played by social capital, both in channelling information as well as in shaping households’ capacity to identify potential sourcing options and to access seed therein (Cavatassi et al., 2012).

Having established the analytical relationship between seed supply and demand and its influence on the farm utilization of crop genetic resources, the next question to answer is related to the effects on the two key outcomes of interest: household welfare and on-farm diversity. Ultimately, we are interested in assessing the sustainability of the utilization of crop genetic resources which requires attention to the private values farmers obtain, as well as the positive and negative environmental externalities generated through selection of crops and varieties grown (Lipper and Cooper, 2009; FAO, 2010).

Household welfare is broadly defined and measured along several dimensions and sources of utility that include both income and consumption measures which, in the contexts studied, translate into various measures of productivity, food security, resilience and nutrition. Households are assumed to be able to gain utility from crop production via

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2 It is not just a zone with some markets located in it, but rather it is a trading network with links between market outlets. Usually there is one dominant market located in larger population centres, together with several smaller secondary markets in more remote locations.
consumption of their own produce, or alternatively through sales of crop production to obtain income for consumption of other goods or to satisfy other needs. Crops and varieties cultivated may differ in productivity and marketability, as well as in their storability and consumption traits (i.e., taste, cultural and culinary values, cooking characteristics, etc.). At the same time, the crops and varieties farmers cultivate generate a pattern of on-farm diversity which can generate a positive externality in the form of option values. The on-farm diversity is also measured along several dimensions, capturing the distribution, evenness and rarity of the genetic diversity maintained. The specific variables and indexes used to measure welfare and on-farm diversity are explained in detail in the next section.

3. Data and methodological issues
Establishing the relationship between seed access, diversity and farmer welfare is not a trivial undertaking due to complications in defining and measuring each variable as well as in establishing causal links between the variables. Unless data are specifically collected for the purpose of establishing this link, data limitations will affect the way variables are defined and the possible methodological approaches. These issues are briefly noted here, as is the manner in which they are addressed in the papers in this special issue.

The first consideration in identifying these critical relationships relates to the choice of case study site for data collection, a choice that requires keeping in mind the aforementioned definition of ‘marketshed’. Choosing a study site that meets the research objective is not a negligible task, as it requires a set of different seed sources as well as different means of accessing seeds including markets, but also an area in which there is a degree of varietal diversity. A remote area may have significant agricultural biodiversity, but there may be limited access to seed via markets or outside intervention. At the other extreme, there may be areas where market activity or seed interventions overwhelmingly predominate exchanges, limiting diversity as well as supply options.

The choice of study site required considering this trade-off and in most cases reflected two main factors: (i) there was variation in market access in that some farmers regularly obtained seed via markets while others did not, and (ii) farmers had access to seed through some outside intervention managed by governmental or non-governmental organizations. In the case of Bolivia, the study site was chosen solely on the first factor in an area where potato seed markets had developed, but some potato diversity remained due to the presence of multiple potato cropping systems. For Mali, two dryland areas were chosen with different levels of market access, but also where an intervention had been administered that sought to improve millet access and diversity. The Kenya and India sites were similarly chosen and reflected both variation in market access as well as the presence of outside interventions that could influence diversity and farmer welfare. In the case of Ethiopia, the second factor played a greater role in site selection, with the focus being on a site where an outside
seed intervention was assumed to be influencing farmers’ decisions. The selection of case study sites allowed for an analysis of similar types of situations across a range of different crops and locations.

Of course, the choice of study sites and marketshed and the emphasis placed on that choice influence the definition of seed access and how the analysis has been conducted. Given that the hypothesis to be tested is the influence seed access has on on-farm diversity and household welfare, this definition is critical. In some cases, seed and product (i.e., grain or tubers) are largely indistinguishable. Consequently, defining market access is determined by access to either market. This definition is used in both Mali and India. In other cases, seed markets do exist and can be analyzed. For example, in the Bolivia case study the emphasis is not only on purchasing seed for potato production but the transaction costs associated with this purchase. In the case of Kenya, input (seed) and output (grain) markets could be distinguished and both are analyzed. Defining access to seed via interventions is more straightforward as it depends on whether the farmer participated in the intervention. In the cases presented in this special issue, where seed interventions are part of the analysis, this definition is straightforward.

Defining diversity is relatively simple, as standard definitions, taken from biological literature (Baumgartner, 2002), exist and all of the papers use one or more of these diversity measures. These can be measures of crop diversity – referred to as inter-specific diversity – or measures of varietal diversity within a given crop – referred to as infra-specific diversity. Only the Ethiopia paper, where both sorghum and wheat diversity are present in the study sites, focuses on both types of diversity, with the remaining papers analyzing infra-specific diversity.

Actually measuring diversity requires data on the number of different types of crops or varieties cultivated (richness), the amounts or area share of each type (evenness), and the dominance of each type (rarity). Diversity data were collected in three ways: (1) farmer interviews based on using variety names (all studies), (2) agro-morphological grow-outs of sampled varieties to confirm varietal identity (Mali, Kenya, Ethiopia, India), and (3) molecular studies of sampled varieties (Kenya, India, Mali). Molecular and agro-morphological data were used to verify data on named varieties obtained from farmers, providing the basis for developing indices of diversity. These data can be combined in many ways to provide alternative diversity indices with the idea that, as species richness and/or evenness increase, so does diversity, whereas the opposite holds true for dominance. The most straightforward measure of diversity is a count of the named varieties, which focuses solely on richness. A range of diversity indexes – including the Shannon–Weaver, Simpson and Margeleff – have been developed to measure richness and evenness in different ways, each positively correlated with diversity (Smale, 2006; Lipper et al., 2009). In contrast, the Berger index of diversity focuses on the inverse dominance of crops or varieties in a given area (Smale, 2006; Lipper et al., 2009). For the papers presented in this special feature, all papers use multiple indicators to measure on-farm diversity. In the case of Bolivia and Mali, diversity has also been measured at the market level and is analyzed.
Lastly, measuring farmer welfare presents greater challenges than the diversity measure. Firstly, the notion of welfare is fairly broad and can often be context specific. When market functioning is limited and households are largely subsistence and heavily reliant on crops, agricultural outputs may be sufficient to measure welfare. Where markets function well, this may not be adequate. Secondly, seed access is only one factor influencing farmer welfare and it may be difficult, or require large data sets, to trace the link between access and an ultimate welfare measure. Finally, the welfare measure is dependent on the available data, and some common measures, such as consumption expenditures per capita, require long questionnaires that are often not possible to collect given other information required in a survey. In the end, the most common welfare measures used in this set of studies are food security and dietary diversity indices. These are indices mainly developed by the Food and Agriculture Organization (FAO) that have been shown to be good proxies of farmer welfare and easier to collect than expenditures. These measures are used in Mali, Kenya and India. Additional production measures are also used in some of the studies including Bolivia (yields), Ethiopia (yields and crop failure) and India (yields and net revenue). Because of the drought conditions in Ethiopia at the time of that study, other measures of food security and resilience are also used.

Once these measures are established, the greatest challenge for these studies is in establishing causal relationships between seed access and the measures of on-farm diversity and welfare. Access, whether through markets or a seed intervention, is generally not a random process, but is rather a choice taken under a variety of constraints in turn influenced by a range of factors. As such, in establishing relationships between the key variables, it becomes difficult to separate the impact of access to seed from the characteristics of those who have access, hence creating a standard endogeneity problem. Solving this problem requires having a carefully designed data collection strategy as well as appropriate econometric methods to use the data. Each of the papers solves the issue using approaches appropriate for their context. In three cases – Bolivia, Mali and Ethiopia – instrumental variable approaches are used to deal with endogeneity. In the case of Kenya and India, propensity score matching is used to create an unbiased estimate of the impact of access. The Bolivia paper also uses a selection model to control for seed market access. The details of these approaches are left for the individual papers, but each represents different ways to address the issue.

4. Results
Each of the papers in this special issue highlights different aspects of the seed sourcing decision, including an assessment of the seed supply source, as well as the impacts of the seed sourcing on two key farm level outcomes: on-farm diversity and household welfare.

4.1. Determinants of seed sourcing
Generally, the results indicate that the characteristics of local markets influence farmers’ decision to source seed via these markets. As
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aforementioned, market characteristics are assessed along the dimensions of diversity, information and costs.

Results indicated that the level and type of varietal diversity available in the markets is a strong predictor of farmer participation in markets in the case of Bolivia and Mali. In Bolivia, in particular, higher levels of diversity available in markets reduce the negative effects of distance by almost half. In other words, distance becomes ‘less negative’, indicating that biodiversity in the market compensates farmers for travelling longer distances. Similarly, in Mali, a higher average number of dissimilar varieties is positively associated with sourcing seed via local markets. Finally, in Kenya, households located in areas where an ICRISAT intervention increased varietal diversity available in local markets were significantly more likely to source seed via these markets.

Evidence on the importance of the availability of information about the quality and genetic characteristics of the seed on farmers’ decision to source seed via markets is more nuanced, partly due to the difficulty in defining variables that reflect this factor. The problem of information asymmetries in seed market transactions depends on the physiology of the crop; for potatoes (Bolivia) and pigeon pea (Kenya), visual inspection can reveal varietal differences to a large extent, whereas for sorghum (Mali and Ethiopia) and minor millets (India), it is more difficult to detect such differences. Thus ‘would-be’ purchasers are more reliant on alternative information sources, depending on the level of trust that can be placed on these sources. In the case of Mali, participation in local markets for seed was significantly higher where the majority of vendors were farmers selling their own grain and hence conveying high levels of varietal identification.

Another source of information is represented by information flow via networks and social capital, as demonstrated by the strong role social capital is found to play in seed sourcing decisions across several of the studies. Households with better access to social capital were more likely to source seed in markets in both Bolivia and Mali, whereas in Ethiopia social capital played a major role in seed sourcing and selection, with a significant difference between those linked to networks within versus outside the community.

Last but not least, the costs associated with accessing seed in various markets also make a difference in the participation decision. Transactions costs, particularly those involved with transportation to distant markets, play a key role in the decision to source seed via markets in virtually all of the studies. However, as the Bolivia study illustrates, the effects of such costs can be offset by other advantages distant markets offer, such as higher levels of diversity. The Bolivia study also indicated a strong and negative relationship between seed price and farmers’ likelihood of sourcing seed in the market. However, in other studies, the effects of seed prices on participation are less clear, partly due to the difficulty in distinguishing seed from product prices, and partly due to fairly limited variation in prices between markets. Not surprisingly, in Mali price seemed to have no effect on the decision to purchase seed, given the very little price variation found.

Turning to the issue of household characteristics and their effect on seed sourcing decisions, the set of studies provides some interesting additions to
the literature on market participation. The Kenya study indicates that the determinants of input and output market participation are not the same, with the exception of farm size which had positive and significant effect on participation in both types of markets. In contrast, input market participation was more site specific. Measures of income and wealth were significant determinants of input market participation, but neither was significant in explaining output market participation. More generally, the results on the relationship between household wealth and market participation indicate considerable variability across the specific crop type, production and marketing system and location. In India, factors determining output market participation were quite different between the Plains and Hills locations. The former represents a more commercialized system where larger farms were found to be significantly more likely to sell to the market. In contrast, farm size was not significant in the comparable estimation for the Hills, and in a reduced estimation it was actually negative and significant. On the other hand, higher household levels of education were an important predictor of participation in the Hills area.

In Mali, participation in the market for seed was associated with higher levels of income in the more remote location, but with lower levels of assets in the more commercialized area.

4.2. Effects of market participation on on-farm diversity
With regard to the findings related to the relationship between seed source and on-farm diversity, the results are rather varied across the studies presented; however, a generally negative relationship between participating in markets for seed and on-farm diversity is found. On the other hand, the relationship between output market participation and on-farm diversity is often found to be positive.

In Kenya and Mali, seed market participation was associated with less on-farm diversity both in richness and evenness of varieties planted — e.g., households that participate in markets are more likely to specialize in the varieties they plant. In Bolivia, households that participate in seed markets have higher levels of on-farm diversity when they are credit constrained, which is not the case for non-participants, suggesting that market participants with access to credit will specialize in their choice of variety. In contrast, a higher level of social capital amongst market participants was positively associated with on-farm diversity, whereas this factor was not important in explaining on-farm diversity among non-participants. The Ethiopia study goes into greater depth in examining the role of social capital on diversity, distinguishing between bonding and linking types of social capital. Findings show that linking social capital enhances inter-crop diversity, whereas the number of associations the household is affiliated with, a measure of bonding social capital, is a negative and strongly significant predictor of inter-crop diversity. However, the effects of social capital on infra-specific diversity are less evident, with only bonding social capital found to be positively and significantly associated with a more even distribution of on-farm infra-specific diversity. A negative relationship between market participation and on-farm diversity was also found for the Hills site.
in India. However, in both Kenya and the Plains area of India, participation in output markets was positively associated with on-farm diversity.

4.3. Effects on household welfare
The results across the papers suggest that the effects of seed market participation on welfare are negligible or difficult to detect, whereas output market participation is generally positively and significantly associated with higher yields, but not necessarily higher levels of household food security.

Both the India Plains case and the Ethiopian study found higher yields associated with output market participation. However, in the India case, this yield benefit does not translate into an immediate effect on household food security or dietary diversity, as market participation was found to have no significant effect on these outcome indicators. The Bolivia case has an interesting twist to the results, contrasting the factors explaining productivity between participants and non-participants in the seed markets. The authors show that on-farm diversity has a positive effect on yields for those that participate in the market, but a negative one for those that do not participate. The Mali study indicates that those who participate in the market to acquire grain for food or seed during the rainy season are significantly more likely to be food secure, although they have lower levels of dietary diversity. In Kenya, seed market participation had no significant effect on either household food security or dietary diversity, but output market participation had a significant and positive effect on the household’s food security. For the case of Ethiopia, in which marginal conditions and extreme poverty were examined for a year of drought, linking as well as bonding social capital was found to be a significant predictor of food security, although the channels through which they make this effect differ. Linking social capital facilitates the households’ access to food aid, whereas bonding social capital significantly limits access to it. Neither form of social capital has a significant effect on access to seed aid, but linking social capital is a positive predictor of a household’s ability to replant in the wake of a crop failure – an important means of achieving food security in the context of the study.

5. Implications and conclusions
The findings presented in this set of papers challenge some preconceived notions of the drivers of market participation and their implications for household welfare and on-farm diversity. One major finding is that the factors driving input market participation, defined as seed sourcing in local markets, are distinctly different from those driving output market participation, and the effects on-farm also vary. While market participation for seed was found to be negatively associated with on-farm diversity and as having no effect on household welfare, output market participation was positively associated with both diversity and welfare. This has implications for the design of agricultural development as well as crop diversity conservation policies. The findings reiterate the desirability of output market participation for improving household welfare, and suggest that it need not
lead to trade-offs with environmental benefits in the form of on-farm crop diversity. However, the variation in results across the studies also indicates the importance of context and location in determining the degree of trade-offs that can occur with greater output market integration. This, in turn, implies the need for fairly nuanced policies to support on-farm crop diversity that recognize the specific context and impacts of market integration across various crops and locations.

A second major finding is that the availability of genetic diversity, together with relevant information, is indeed an important factor determining farmers’ choice of accessing seed from local markets. Given the relatively low level of price variation for seed in local markets, however, this factor seems relatively unimportant in the choice of seed source, although transactions costs, particularly those associated with transport, are important. This suggests that policies to enhance the range of diversity and information available in seed supply sources, particularly in the informal seed sector, are likely to be important in promoting this source of seed. Nevertheless, the results from these papers also indicate that seed sourcing in local markets does not have appreciable positive impacts on household welfare, and in some cases has a negative impact on-farm level crop diversity. This obviously raises the question of the desirability and effectiveness of promoting this source of seed for achieving either development or environment outcomes. Yet, as argued in the introductory section to this paper, local markets are becoming an increasingly important seed source as social and environmental disruptions limit the capacity of traditional networks to supply seed in the informal sector, and wholesale transformation to the formal seed sector is not likely to be an economically viable solution for many crops and farming systems in developing countries in the near future. Thus, seeking to improve the capacity of local markets to serve as a source of informal seed is likely to be important in many developing country contexts.

The results in these papers suggest that social capital will be an important tool in addressing some of the shortcomings of local markets as a seed supply source; it can facilitate information flows and exchanges of crop genetic resources. Strengthening and expanding social capital through community-based interventions is an example of a non-market mechanism that may strengthen and improve the governance of local markets for supplying seed. The results in these papers suggest that enhancing social capital, and particularly forms that allow communities and farmers to link to broader networks of information and seed supplies, is also likely to generate positive benefits to household welfare as well as to the maintenance of on-farm crop diversity.

References

Audi, P., L. Nagarajan, R. Jones, and M. Ibrahim (2010), ‘Pigeonpea seed supply and diversity: a case study of local seed markets in Makueni District, Eastern


FAO (2010a), The Second State of the World of Plant Genetic Resources for Food and Agriculture, Rome: FAO.


