



FACILITATING SEED SECTOR TRANSFORMATION IN AFRICA: KEY FINDINGS FROM THE LITERATURE

By

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BACKGROUND: Seed can play a critical role in increasing agricultural productivity: it determines the upper limit of crop yields and the productivity of all other agricultural inputs to the farming system. In the mid-1970s, governments and donors recognized the critical role of seed in agricultural transformation and began to provide substantial support for seed system development. Since then, FAO has invested \$80 million in 120 seed projects in 60 countries, the World Bank has supported more than 40 seed projects in Africa alone, and USAID has provided long-term support to public seed agencies in 57 countries.

Most of these resources were used to establish large-scale parastatal seed corporations, technical laboratories, processing plants and certification departments. In Africa these efforts achieved only limited success in a few crops such as hybrid maize and sorghum, leaving the majority of smallholders unserved. Parastatal seed systems supplied only about 10% of total seed planted each year. About 60-70% of seed used by African smallholders is saved on-farm, and the remaining 20-30% is borrowed or purchased locally.

The key problems faced by the large-scale parastatal seed organizations were (1) *high costs of production and distribution* related to consistently low levels of effective demand, and to the high cost of transport from centralized seed production facilities to rural areas; (2) *a relatively narrow range of crops/varieties* that did not meet smallholder needs; (3) *inconsistent seed quality*; and (4) *escalating financial problems* in

countries where government programs provided subsidized seed to farmers, but budgetary transfers to compensate parastatals for the subsidies were delayed or not made. As a result of these problems, seed parastatals grew increasingly dependent on state or donor subsidies during the 1980s. Many of them were subsequently dissolved and support to other components of the seed system was dramatically reduced as part of the structural adjustment programs implemented across Africa.

Although seed parastatals were not effective in meeting the needs of smallholders, up to now for-profit seed firms have been unable to fill the gap: smallholder access to improved varieties has worsened in a number of countries following economic reforms. Since the mid-1990s, non-governmental organizations (NGOs) have become increasingly active in varietal testing and promoting the development of smallholder seed firms.

Given the critical role that improved varieties play in increasing agricultural production, a key question is how to facilitate the development of a seed system that is capable of generating, producing and distributing new seed varieties that meet the needs of all farmers, in a cost-effective way.

OBJECTIVES AND METHODS: The objectives of this study are to conduct an extensive review of seed system development literature in order to (1) understand how seed systems evolve and (2) critically review organizational and institutional strategies for improving

seed systems.¹

WHAT IS THE SEED SYSTEM? The seed system (represented in Figure 1) is composed of organizations, individuals and institutions involved in different seed system functions, i.e., the development, multiplication, processing, storage, distribution and marketing of seeds. The seed system includes both informal (or traditional) and formal sectors. The informal sector is composed of individual farm households, each carrying out most seed system functions on its own, with little or no specialization. The formal sector, by contrast, is composed of public and private organizations with specialized roles in supplying new varieties. Different types of seeds flow from organizations and individuals in one stage of the seed chain to the next through separate informal and formal seed supply channels. Rules and regulations such as variety release procedures, intellectual property rights, certification programs, seed standards, and contract laws influence the structure, coordination and performance of the seed system.

A well-functioning seed system is defined as one that uses the appropriate combination of formal, informal, market and non-market channels to efficiently meet farmers' demand for quality seeds.

HOW SEED SYSTEMS EVOLVE: The seed system passes through several phases as it evolves from a traditional to an advanced system.

- In *phase 1*, the informal seed system predominates; most farmers save their own seed or obtain seed from nearby farmers or villages, and the rate of new varietal development and adoption of new seeds is low.
- During *phase 2*, seeds of improved varieties developed by the public sector begin to replace local varieties, use of complementary inputs (e.g., fertilizer) is limited but increasing, and an emerging private sector is involved in multiplication and distribution of public varieties.
- During *phase 3*, the private sector begins to play an active role in research and development (R&D), particularly in developing hybrids and seeds for specialized cash crops. Seed distribution systems become more organizationally varied and

decentralized, and many components of the mature seed system exist but the supply of seed from the formal sector still ranges from fair to poor.

- In *phase 4*, the agricultural sector as a whole and the seed system in particular are well developed. Commercial seed production and marketing are common, effective seed laws and regulations are in place, linkages with actors outside the seed sector are well established, and the use of improved seed is high.

Correspondingly, the rules, regulations, and infrastructure coordinating the components of the seed system evolve to allow organizations to specialize in different functions of the seed system. The public sector may specialize in basic research and research on subsistence crops, and in regulating the seed system, for example. The national and international private sectors increasingly focus on research, production and marketing of seed for hybrids, specialty crops, vegetable crops, and commercial food and fiber crops. NGOs try to fill the gap by concentrating on multiplication and distribution of seed for crops and farmers not targeted by the private sector.

The transformation process described above should not be interpreted as the simple linear progression of a national seed system from an informal to a formal system. Seed systems for different commodities follow distinct development paths as they move from one phase to the next, e.g., the path for a hybrid maize seed system will be different from that for millet or cowpea, and those systems may never reach the technical, organizational and institutional complexity of a hybrid maize seed system in phase 4. The seed system for maize in the advanced phase (such as in the U.S.) may be composed only of formal seed channels, with the private sector meeting the market demand for hybrid seed each season. On the other hand, seed systems for beans, wheat, cowpeas, and groundnuts, even in a mature phase, may have all the components of the seed system depicted in Figure 1, with both formal and informal sectors playing important roles in meeting the demand for seed.

STRATEGIES TO PROMOTE SEED SYSTEM DEVELOPMENT: Past donor and government efforts to improve African seed systems were based on a narrow view of the transformation process, focusing on

¹ This brief synthesizes the views of a number of authors of published and unpublished works. Complete citations for these references can be found in the report listed on the last page of this document.

SEED SUPPLY FUNCTIONS AND ORGANIZATIONS

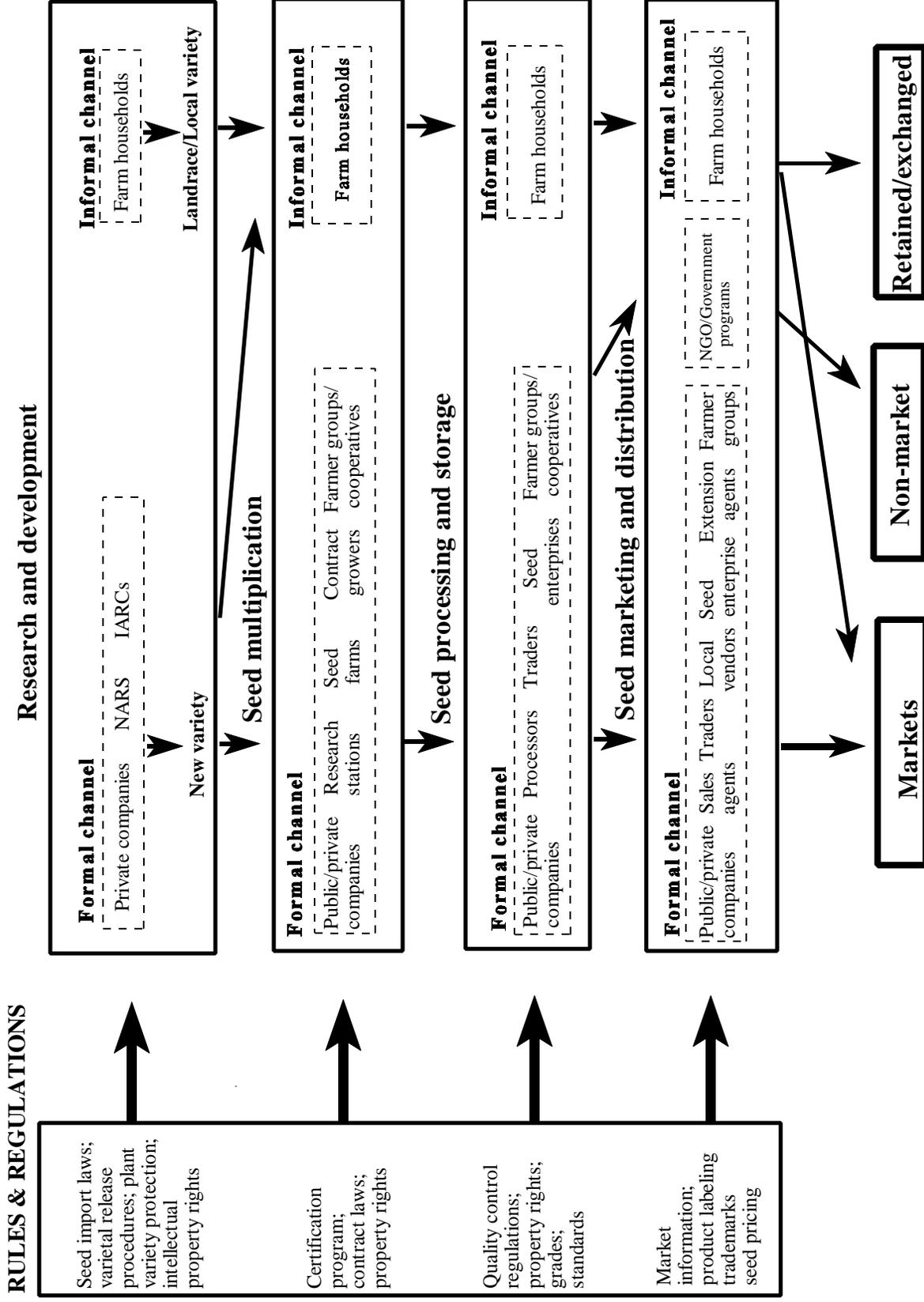


Figure 1. Seed System: An Organizational and Institutional Framework

the development of the formal sector. These organizations promoted the use of certified seeds and hybrids but were unsuccessful in building demand from the smallholder sector.

By contrast, a number of authors stress the complexity of each phase of seed sector development and the dynamic roles of a range of public, private, formal and informal seed organizations in meeting smallholder seed needs and facilitating the transformation process. There are three key points. First, during transformation, the importance of the informal seed sector will decline *relatively* (but not necessarily absolutely) as the seed system evolves. Second, *building horizontal linkages between the informal and formal sectors at each functional level* (e.g., research and development, seed production in Figure 1) *is a critical step* in facilitating transformation. Third, *the public sector has a vital role to play in the transformation process*, in: (a) providing public goods that are essential to the functioning of both formal and informal sectors, including basic research and adaptive and applied research targeted to crops and farmers that are of less interest to the private sector; (b) developing and enforcing regulations for a heterogeneous seed systems; (c) facilitating formal-informal sector linkages at different functional levels, including the promotion of new, more specialized private firms; and (d) distributing seed or seed vouchers following disasters.

Increasing effective demand for improved varieties among smallholders. The nature of seed demanded by farmers differs. Large- and medium-scale farmers use markets to purchase uniform genetic materials that are highly responsive to chemical inputs and embody specific characteristics (e.g., color, uniformity of grain size) rewarded by the market. By contrast, more subsistence-oriented smallholders may value characteristics such as drought tolerance, early maturity or good storage characteristics more than fertilizer responsiveness. Because of the small size of their landholdings, mixed cropping practices, and strategy of minimizing production risks by diversifying the variety base, smallholders also demand relatively small quantities of seed, but for a number of varieties of the same crop, and recycle seed over more seasons than larger commercial farmers.

Developing new varieties that have perceptible

yield/quality advantages over traditional varieties is important to offset the increased costs incurred by seed users in purchasing the seed. Successful past examples include the semi-dwarf wheat and rice varieties that triggered the Asian Green Revolution, flint hybrid maize in Malawi, CSH-1 hybrid sorghum, and MBH pearl millet in India.

Strategies to improve seed quality must begin with strengthening the public agricultural R&D sector on a long-term, sustainable basis. It will be especially important to build the capacity to move from homogeneous seed recommendations to the development and dissemination of varieties targeted to specific agroecological zones and the needs of different groups of farmers. To facilitate this process, target groups of farmers should be defined more precisely, zoning of breeding plots and field trials can be improved, and management incentive systems should be developed to reward researchers and extension agents when new technology is adopted by target groups.

Strengthening public and private extension programs to increase farmer knowledge about the benefits of using new seed and transmitting information about farmer preferences to researchers will also help increase the demand for new seed. Initiatives that improve post-harvest product utilization, expand output markets, and lower production risks are also important: seed users will be willing to pay more for new seed if their expected returns from planting the seed are increased by either lowering risks or increasing their revenues. Thus, measures to strengthen the downstream sectors of the economy are as important as strengthening the seed system itself.

Decreasing the cost of seed production and distribution. An important way to reduce the cost of seed production and distribution is to *promote the production of different seed commodities by seed suppliers likely to have a comparative advantage in producing them*. The relative importance of formal and informal seed suppliers is determined in part by biological and technical factors associated with seed production, multiplication, processing and distribution. In general, seed of self-pollinated crops (e.g., many grain legumes) can be easily multiplied by farmers and are more suited to dissemination through the informal seed system, regardless of the economic status of seed users. For cross-pollinated crops (e.g., maize, sorghum and

millet) both formal and informal seed systems are important.

In addition, crops that have a high multiplication factor and relatively low seeding rate, such as hybrid maize, sorghum and millet, are more attractive to the formal seed sector because fewer multiplications are required and, at each stage, there are smaller quantities to process, store and distribute. By contrast, grain legumes are characterized by low multiplication factors and high seeding rates, and these are consequently the least attractive crops for large centralized seed companies to handle.

The relative importance of formal and informal systems of seed supply will also depend on the availability of new varieties with significant yield and/or quality advantages. Recurrent sales of improved seed depend partly on the ability of the formal R&D system to provide a steady flow of new varieties to maintain farmer interest. In addition, the rate at which new varieties succumb to biotic stresses both in the field and during on-farm storage helps determine the level and frequency of purchases from the formal seed system by farmers. For example, wheat and rice are particularly susceptible to insect and disease pests, creating a demand for pest-resistant varieties as they are released from research systems.

Improving infrastructure, rules and regulations. Key to reducing the cost of producing and distributing seed is the improvement of transport and information infrastructure, and the revision/enforcement of laws and regulations to lower the risks and transactions costs of doing business in the seed sector, especially for smaller firms and farmer groups. For example, extension programs and labeling and quality regulations reduce the cost of getting reliable information about new varieties. Market information systems can also reduce seed suppliers' costs in discovering farmers' preferences, and the costs of inventory, storage, and waste are reduced if suppliers can anticipate farmer demands on time. Inappropriate laws and regulations may inhibit the emergence of private initiatives in seed production and marketing, e.g., agreements that award monopoly rights for all varieties developed by the public sector to one parastatal or private firm.

One challenge ahead will be to revise seed regulations in a way that facilitates the development of a

heterogeneous, competitive group of seed producers, while protecting the rights of all seed producers and consumers. Many regulations on the books today were fashioned for formal sector seed enterprises and discourage farmer-based seed production, e.g., stringent variety release procedures, plant breeder's rights and plant variety protection laws. For example, compulsory certification constrains the multiplication and distribution of seed of commodities, e.g., open-pollinated maize and sorghum, whose low seed yields and profit margins cannot absorb the costs of stringent and frequent inspections needed to comply with certification standards. Removing compulsory seed certification and restrictive trade licensing requirements would permit the production of quality seed by smallholders and sale among neighboring farmers. In addition, seed companies would be able to involve smallholders in contract seed production more easily.

Reduce the learning and transactions costs for new seed enterprises. Training new seed producers and reducing the cost of doing business for formal and informal seed sector participants are other important ways cut the cost of seed production and distribution. For example, several NGOs in Zimbabwe and Zambia, in partnership with the public extension service, (1) provide links from small seed producing firms to national and international research centers to get information and seed of appropriate varieties; (2) train and supervise farmers in seed production, selection, storage and marketing; (3) provide basic training on seed and bookkeeping to rural shopkeepers who are potential agents for formal sector seed suppliers; and (4) screen rural shopkeepers for creditworthiness, provide working capital for input stocks and aggregate orders to be filled by large input supply companies.

The government and donor community should support these activities but also ensure that new seed firms do not grow dependent on subsidies. The CARE AGENT program in Zimbabwe, for example, identifies and trains rural traders and initially guarantees credit for input stocks, but "graduates" traders to regular supplier credit as quickly as possible.

IMPLICATIONS FOR FARMERS, GOVERNMENT AND NGOs:

Role of farmers. Farmers need to be better integrated in every aspect of the seed system: as active participants in seed research and release processes, as vital links in seed production and distribution through farmer-to-farmer seed exchange networks, as independent seed entrepreneurs producing seed for the local market, and as contract seed producers and informed agents/seed traders linked with other private and public seed companies.

Role of government. The government now has a critical but different role to play in (1) providing public goods that promote efficient seed sector performance; (2) developing and enforcing regulations for a heterogeneous seed sector; (3) in the short- and medium-term, facilitating linkages between formal and informal sector seed suppliers as the seed system matures; and (4) direct distribution of seed or seed vouchers following disasters.

Public research and extension agencies also need to consider how to use subsidies to strengthen ties to subsistence farmers who may be unable to purchase seed through the market but could benefit significantly from access to varieties with improved drought and disease resistance. For crops/regions where there is currently no commercial seed market, disseminating seed directly to farmers so that they are absorbed into the traditional system of seed supply may be a more effective strategy than trying to supply it through the higher-cost market channels, if potential users are unlikely to be able to afford them.

Role of NGOs. NGOs have traditionally distributed relief seed after emergencies and functioned as a seed supply of last resort for farmers unserved by the public and for-profit private sectors. More recently, NGOs have also played a role in strengthening the informal seed system, providing a technical liaison with national and international research systems, educating farmers on better seed selection, storage and processing, and providing technical and financial assistance to rural seed enterprises. This support has increased farmer access to improved varieties following the contraction of government-sponsored research and seed supply services. Two cautions are necessary, however. First, because NGO programs are temporary, instead of relying on them to link smallholders and research

organizations, creating incentives and funding for research and extension systems to link with smallholder organizations directly would be better. Second, a more careful analysis of the economics and sustainability of the smallholder seed firms being promoted by NGOs is needed.

EMERGING ISSUES AND RESEARCH NEEDS:

Developing a seed system based on greater integration, broader participation, and decentralization is an attractive idea and a technically interesting strategy, but raises several issues. The first concern is the potential risk posed to small-scale seed entrepreneurs if seed stocks go unsold. Mechanisms for assessing the potential demand for seed and protecting the seed seller against the liability for unsold stocks need to be explored. A second issue involves the regulatory role of the government in an increasingly decentralized seed system. Key questions include: how will farmers be assured of the seed quality? How can seed enterprises and farmers be assured that their contracts will be honored?

Country-level case studies are needed to examine (1) the economics of smallholder seed organizations; and (2) the costs and benefits of alternative interventions to strengthen effective demand for improved varieties and improve formal-informal seed sector linkages, including measures to facilitate the establishment of private seed firms.

*Funding for this research was provided by the Productive Sector Growth and Environment Division, Office of Sustainable Development, Bureau for Africa, USAID (AFR/SD/PSGE). The research was conducted under the Food Security II Cooperative Agreement between AID/Global Bureau, Office of Agriculture and Food Security, and the Department of Agricultural Economics at Michigan State University. The views expressed in this document are exclusively those of the authors.

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This paper is a summary of a forthcoming report entitled: "Increasing Seed System Efficiency in Africa: Concepts, Strategies and Issues." Copies of the report can be obtained by writing to the authors at the Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.