



Partnering for Innovation

Bringing Seeds to Market

A study of partnerships commercializing seed technologies in the smallholder farmer market



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ABOUT FEED THE FUTURE PARTNERING FOR INNOVATION

Feed the Future Partnering for Innovation is a USAID-funded program that helps the private sector to scale and market agricultural technologies for smallholder farmers through investing in technology commercialization and knowledge exchange. The program also facilitates partnerships between USAID Missions and the private sector and provides business acceleration tools and services.

DISCLAIMER

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Executive Summary

Between 2014 and 2016, Feed the Future Partnering for Innovation, through its competitively awarded innovation fund financing, has supported seven different partnerships designed to stimulate commercial seed markets in Feed the Future countries, including Mozambique, Malawi, Zambia, Kenya, Tanzania, Uganda, and Guatemala. The value of these partnerships totals \$36.4 million including more than \$20 million in partner leverage. Each of these partnerships presents valuable context-specific lessons, as well as lessons that are applicable across countries and technologies. The objective of this study is to distill lessons from these partnerships to inform both private sector investors and the international donor community on past challenges and successful approaches to commercializing seed systems for smallholder farmers. The study has yielded several important findings, including:

Lessons Commercializing Seed Systems

- Increasing farmer demand for seed requires developing farmer awareness through local demonstrations and farmer field days, seed company marketing and distribution capacity, production credit availability, and farmer capacity building to ensure best practices are employed to maximize returns from seed.
- Increasing seed supply requires breeder seed availability and maintenance, and foundation and certified seed multiplication. Consultative Group on International Agricultural Research (CGIAR) members are pivotal for breeder seed development.
- Smallholder outgrower models can work for local commercial seed production, but this model presents several challenges, particularly in developing outgrower capacity to multiply seed in accordance with varietal requirements, introducing water management practices to mitigate unpredictable rainfall, and ensuring that seed quality is maintained during the production cycle.
- Expanding rural distribution networks requires an investment in developing agrodealer technical know-how in the advantages of the improved seed, as well as capacity and business skills to manage a profitable business.
- A policy framework for seed markets should include an effective varietal release process, inspection and quality assurance system, and appropriate plant breeder rights.
- Government sponsored seed subsidies and giveaways for crops that have commercial potential are generally distorting private markets and dampening market demand for improved seeds. Voucher programs that work through private seed companies and agrodealers will provide farmers a choice in the marketplace, but need to be sufficiently targeted and timed to not distort the development of a private seed sector.
- Accurate seed demand forecasting is needed to close the loop between supply and demand. This includes projections of amounts of seed needed to be produced annually, the timing of delivery to correspond with the planting season, and plans for distribution to reach as many last mile customers as is economically feasible.

Lessons Designing and Managing Seed Commercialization Partnerships

- Aligning development objectives and commercial objectives up front can help maximize new product adoption.
- Commercial partners in a lead role are critical to sustainable and scalable results.
- Project targets should be based on commercial projections that are reasonably attainable, and allow for changes in implementation approaches to adapt to economic and climatic events.
- Milestone-based payment mechanisms that mirror commercial metrics (smallholder sales, production volumes, etc.) create incentives that private companies understand and can act on.
- Donor monitoring and reporting requirements can be streamlined and integrated with commercial partners' internal systems to minimize additional costs while still advancing business objectives.
- Direct partnerships with commercial companies can be more effective at meeting seed production and smallholder farmer targets, while nonprofit partners can provide important contributions in accessing, demonstrating, and training in new seed technologies through their program networks while simultaneously meeting their development objectives.

- Regular monitoring including phone calls and field visits by the investor are critical to troubleshoot and resolve implementation challenges.
- A seed commercialization process requires several growing seasons to adequately demonstrate, train, and scale to the wider smallholder population. Attention should be given to agriculture production cycles and dates when negotiating projects that have time sensitive production/sales volume targets. Plan early in a program cycle for post-project sustainability and support needs.

Study Objectives & Methodology

This study is not an assessment of performance or impact of Partnering for Innovation partnerships. Instead, it examines the different models deployed for supporting seed commercialization across different technologies and market contexts, and distills lessons learned for partnership model design and management for similar development projects. Observations and conclusions are based on a comprehensive document review and semi-structured interviews with implementing partners, Partnering for Innovation staff, and other key stakeholders from August to October 2016.

For private sector agribusinesses interested in investing in smallholder seed technologies, this study presents an overview of the business models perceived to be working, in which contexts, and provides recommendations to achieve commercial objectives based on practical challenges faced. For international development practitioners, this study highlights the key factors to consider in designing and managing donor mechanisms to facilitate the successful commercialization of seed technologies.

Background and Literature Review

An Overview of Smallholder Seed Systems

Access to improved seed is an important step in increasing smallholder productivity through enhanced yields, increasing income by meeting buyers' varietal preferences, increasing nutrition through vitamin enriched varieties, and increasing resilience through varietal tolerance in the face of infestation and climate pressures. Understanding the systems that produce and deliver appropriate seed varieties in a timely manner to farmers and the factors that drive the success of those systems is therefore paramount.

It is widely understood that smallholder farmers in developing countries source seed from both formal and informal seed systems. The formal seed system entails a chain of research and development, plant breeding, seed certification, and marketing and distribution through recognized outlets. Well-functioning formal systems are governed by a regulatory environment intended to ensure quality and sanitary standards and to maintain varietal identity.ⁱ Alternatively, the informal seed sector is locally organized such that farmers produce, disseminate, and procure seed themselves whether by reusing their own harvest, bartering within social networks, or through local grain traders.ⁱⁱ Formal systems recognize the important distinction between seed and grain, while informal systems rarely do.

The formal seed market worldwide is estimated to be valued at \$45 billion annually while the informal sector has been estimated to be valued between \$6-15 billion annuallyⁱⁱⁱ; however, sub-Saharan Africa's share of the global seed trade is estimated to be less than 2 percent.^{iv} It has been estimated that smallholder farmers in sub-Saharan Africa currently access up to 90 percent of their seed from informal systems with 51 percent of that sourced from local markets. The same study suggests that 55 percent of smallholder seed is paid for with cash, while approximately 33 percent is reused from farmers' own stocks.^v

This indicates that smallholder farmers are already making important investments in purchasing improved seed. This latent yet growing demand can create the incentive for the private sector, both globally and through local agribusinesses, to invest in developing, producing, and distributing improved seed.

Nonetheless, market demand varies by country and crop. For instance, local markets are the predominant source for legumes, providing nearly 66 percent of all seed, whereas reusing seed is more important for crops such as sweet potato where approximately 80 percent of all cuttings are reused, sorghum and millet which present fewer on-farm storage challenges than legumes and larger grains, as well as indigenous vegetables and oil crops^{vi}. To

illustrate variances across countries, it is estimated that smallholder farmers in Malawi access only 28 percent of their seed from their own stock and 49.5 percent from local markets and agrodealers, whereas smallholder farmers in Zimbabwe access up to 42 percent of seed from their own stock and only 15 percent from local markets and agrodealers.^{vii} In Kenya, maize seed markets are considered more mature and robust, with hybrid maize estimated to account for 70 percent of all certified seed used.^{viii}

Challenges and Lessons Learned: Seed Technology Commercialization

Challenges

To increase access and availability of improved seed for smallholders, more effective and efficient formal seed systems are needed that are adapted to the local context and integrated with existing local systems where relevant. It is often the case that local seed businesses have a competitive advantage in reaching rural smallholder farmers because of their proximity to farming communities and their understanding of the local context, but several barriers continue to hold back their development, and the development of the formal seed sector overall. In sub-Saharan Africa, several persistent but surmountable challenges are evident^{ix, x}:

1. **Enterprise-level challenges to establishing and operating a seed company:** High initial fixed costs (production, processing, and packaging), limited access to credit, unreliable research, unqualified technical staff, and insufficient or inaccurate demand projections needed to coordinate supply-distribution logistics, and lack of marketing capabilities.
2. **Production level limitations to achieving sufficient supply of high quality seed:** Sufficient and suitable access to land (providing natural buffers to prevent cross-pollination), access to clean plant material, limited production credit, poor outgrower production practices, and reliance on rain-fed conditions.
3. **Logistical and financial constraints to establishing efficient distribution networks:** Limited retail networks and rural points of sale, weak agrodealer technical capacity including poor storage and limited knowledge transfer to farmers, and limited access to value chain credit such as supplier credit, inventory finance, etc.
4. **Limited farmer demand for improved seed:** A majority of smallholders are accustomed to reusing grain as seed, and have not recognized the marginal value of improved seed - due in part to lack of knowledge, poor quality seed or free seed from governments or donor projects in the market, and limited output market demand constraining investment incentives.
5. **Unaccommodating enabling environment for seed sector development:** Varietal release, registration, certification, and inspection systems influence the quality and reliability of seed on the market, burdensome import policies and procedures can dissuade imports of improved plant material, crop export limitations suppress output prices and thus input investment incentives, seed subsidy programs often dampen farmer willingness to pay and/or agribusiness investment incentives, intellectual property rights influence incentives for R&D of new varieties, transportation and productivity infrastructure (e.g. roads and irrigation) increase costs along the value chain, and farmer organization participation in seed markets often requires a cohesive legal framework that is lacking.

Public vs. Private Sector Roles: Lessons Learned

The logic behind public sector sponsored seed subsidy programs is clear – they are intended to overcome farmer liquidity constraints and risk aversion by temporarily reducing or eliminating farmers' financial cost of testing a new technology. In theory, as the subsidy is removed, farmers will have observed the benefits of the new technology, and their willingness to pay for these benefits in the private marketplace will expand. The resulting increase in farmer demand should incentivize private sector input providers to target these market segments with the new technology on a commercial basis.

The Abdul Latif Jameel Poverty Action Lab (J-PAL) at the Massachusetts Institute of Technology (MIT) has examined whether public sector-sponsored seed subsidy programs do in fact have the expected positive effects on long-term input system development. Importantly, J-PAL found that subsidies initially intended to be temporary often become de facto permanent. Rather than stimulating investment, permanent or pseudo permanent subsidies lead to the substitution effect whereby farmers save liquid assets rather than increasing their investment in seed and other inputs^{xi}. They found that while subsidies can have the short-term effect of increasing uptake of a technology, these gains were not observed to persist, nor did the programs catalyze sustained farmer investment beyond the subsidy.

Alternatively, a United States Agency for International Development (USAID) case study in Zambia illustrated that appropriately designed subsidy programs can have a positive effect on scaling up farmer demand for seed^{xii}. These divergent views suggest an important lesson: the design and implementation of a seed subsidy program matter in terms of the program's potential to sustainably stimulate farmer demand and private sector investment in seed markets. Generally, subsidy programs that utilize redeemable seed vouchers, engage commercial seed companies, utilize existing private distribution channels, provide product choice for farmers in the marketplace, are sufficiently funded, and are temporary (e.g. time-bound) are seen as having a greater potential to stimulate rather than distort private markets.

The Bill and Melinda Gates Foundation and USAID recently completed a study (Foundation, March 2015) providing a helpful framework for considering the roles of the public and private sectors to suggest models for formal seed system development based on the inherent characteristics of the seed itself and the context of the market. Determining the public vs. private model that will be most effective in developing seed systems will to a great extent depend on the public good characteristics vs. private good characteristics that a particular seed variety possesses, such as excludability (the ability to prevent a consumer from using a good) and rivalry (whether consumption of a good by one prevents the consumption of that same good by another.)

Similarly, examining the level of demand for seed against its marginal economic value – specifically, its profitability for a farmer - will determine if private sector dominance, public sector dominance, or public/private collaboration can be expected to be more successful.

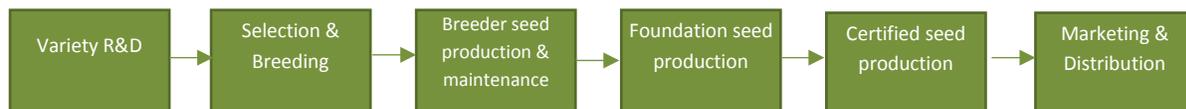
The four main models for seed system development identified by the Gates Foundation and USAID are as follows^{xiii}:

1. **Private sector dominant model** – high level of demand and high marginal economic value
 - Examples include hybrid maize, horticultural crops, and flowers
2. **Public private collaboration model** – high level of demand and low marginal economic value
 - Examples include groundnut, cowpea, common bean, cassava, sweet potato

3. **Niche private sector model** – Low level of demand and high marginal economic value
 - Examples include sorghum or cassava for beer brewing, cotton
4. **Public sector dominant model** – low level of demand and low marginal economic value
 - Examples include: OPV sorghum, teff

This study from the Gates Foundation and USAID also lays out the critical stages of the seed value chain, and suggests that determining which agent is best suited to invest in a particular activity should be determined by who derives the value from the activity (e.g. whether investment leads to public or private gains). The critical stages of the chain are shown in Diagram 1.

Diagram 1: Stages of the Seed Value Chain



Through the aforementioned case study in Zambia, USAID examined the factors that contributed to achieving scale in the commercialization of drought resistant hybrid maize seed technology that falls in the private sector dominant model. This study distilled lessons that help explain how the formal seed sector in Zambia achieved a 60 percent adoption rate of drought tolerant maize varieties between 2006 and 2015. Consistent with the Gates Foundation and USAID study on early generation seed, the case study in Zambia found that the primary factors that drove the commercialization of seed technology were the intrinsic characteristics of the seed itself and the characteristics of the market system. Specific factors (characteristics of the seed and the market) that drove success in the formal seed system in Zambia included: ^{xiv}

- Seed varieties required minimal changes in existing agriculture practices
- Relatively low investment requirements
- Easily perceived value through demonstration
- Enabling environment encouraged the formation of commercial seed enterprises
- Public sector support for seed certification
- Stable/reliable output market for farmers
- The private sector was willing to invest with little/no direct government or NGO support
- Seed innovations are introduced to private sector by research institutions
- Marketing and distribution are led by the private sector
- Focus on seed innovations with broad appeal and existing farmer demand
- Temporary public sector and donor subsidies offset initial costs and risks of adoption

These lessons from past initiatives provide a useful framework for analysis and highlight critical issues of importance for assessing current efforts to advance seed market development for smallholders. The following section will draw upon these lessons and issues to review six different partnerships under the Partnering for Innovation program to commercialize smallholder seed technologies.

Review of Partnering for Innovation Partnerships in the Seed Sector

Partnering for Innovation has invested in eight partnerships that are commercially launching and/or scaling seed technologies for smallholder farmers. These partnerships span seven Feed the Future countries – Kenya, Tanzania, Uganda, Zambia, Mozambique, Malawi, and Guatemala – as well as Ukraine. The partnerships examined in this study are summarized in Table I below, providing an overview of the lead and supporting partners, the breakdown of project investments, the focus technology, and the expected results of the partnership.

This study has not explicitly examined the partnerships in Guatemala or Ukraine. The Guatemala partnership with lead partner Servicios de Post-Cosecha has only recently been initiated (the project work plan had just been submitted at the time of this study) and was too early in its implementation to yield lessons learned. The Ukraine partnership was determined to be quite unique in several ways from the other partnerships in Feed the Future countries, and was therefore recommended to be excluded from this study.

AATF: Imazapyr Resistant Maize Seed Commercialization in Kenya, Tanzania, and Uganda

Partnership Design

Striga is a parasitic weed that causes up to 80 percent losses in maize yields in the Lake Victoria region of Africa, and is estimated to affect approximately 1.4 million hectares of land under cultivation across Kenya, Tanzania, and Uganda.^{xv} Imazapyr is an effective herbicide treatment to combat striga, but can kill or reduce germination rates in maize seed, so an imazapyr resistant (IR) maize seed was developed through a collaboration between BASF, the International Maize and Wheat Improvement Centre (CIMMYT), and the Weizmann Institute of Science. While IR maize varieties had been released and registered in Kenya, Tanzania, and Uganda, weak technical skills and lack of proper equipment constrained multiplication and seed treatment efforts. Additionally, rural distribution networks and farmer uptake was extremely limited.

Partnering for Innovation awarded a partnership through a competitive bid process to the African Agricultural Technology Foundation (AATF), a private nonprofit organization based in Nairobi, Kenya with implementing partners CIMMYT, a global nonprofit member of the CGIAR, BASF, a global crop protection agribusiness, and seven local commercial seed companies, each working through a network of smallholder outgrowers and rural agrodealers.

AATF leads partnership oversight, identifies and engages local seed companies, delivers training in seed production to seed companies, ensures certified seed is produced as expected by the seed companies, supports the establishment of demonstration plots, and delivers training in storage, handling, and marketing to agrodealers. CIMMYT provides breeder seed to the seed companies that are multiplying the IR maize varieties and delivers technical assistance to seed companies on maintaining parental lines. BASF sells powder form herbicide to the seed companies and delivers advisory services in safe practices to seed companies on seed coating, including the use of improved equipment. Local seed companies conduct seed multiplication through in-house basic seed production and smallholder outgrower certified seed production, product marketing through demonstration sites, print, and radio, and rural distribution through in-house branches and independent rural agrodealers.

Overcoming Market Barriers

This section outlines the key challenges at different points in the market system, steps being taken to overcome these challenges, and further recommendations to overcome these barriers as described by implementing partners during interviews for this study.

Market System Level	Challenges Faced by Partners	Partner Solutions and Recommendations
Seed Production	<p>Maintaining breeder seed: Each local seed company receives approximately 15-20 kg of breeder seed (first level) upfront from CIMMYT at no fee; however, seed companies producing basic seed (second level) have experienced high losses due to environmental events, specifically droughts and pest infestation. They are returning to CIMMYT for more breeder seed, but CIMMYT has limited stocks and limited land available to expand production of breeder seed.</p> <p>Outgrower production capacity: Following basic seed production, seed companies are working with smallholder outgrowers who multiply basic seed to produce certified seed (third level), but even commercially-oriented</p>	<p>Seed companies are being trained comprehensively in basic seed production to maintain the breeder seed, including crop protection while the crop is very young. To address other environmental challenges, the ideal solution is protected production (greenhouse) and drip irrigation, although the financial resource requirements are high for local companies. Protected production would also shorten the time span required for multiplication and commercialization.</p> <p>Seed companies are supported to expand their field production teams to deliver training and hands-on support to outgrowers in certified seed production practices. Outgrowers also need access to finance to invest in farms (e.g. tractors, planters, drip</p>

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	<p>smallholders have limited knowledge and resources to produce certified seed at the quality and volumes required. Droughts have occasionally caused significant outgrower seed losses.</p> <p>Seed processing: IR maize requires a processing stage where the certified seed is coated with imazapyr. It is important for seed companies to separate IR maize seed from other seed in their facility, requiring dedicated seed dressing equipment to avoid contamination of other non-IR seed. Additionally, the quality of the IR-maize seed relies on appropriate imazapyr coating. Over-coating will reduce germination rates, and under-coating will reduce effectiveness.</p>	<p>irrigation). In Kenya this year, Kenya Seed and FreshCo are multiplying under furrow irrigation while Elgon is multiplying under drip irrigation.</p> <p>With Partnering for Innovation funding, the seed companies have been equipped with dedicated seed dressing equipment for IR maize. BASF provides advisory services each season to seed companies on proper equipment utilization. Continued capacity building of seed companies remains necessary to ensure supply of high quality seed on the market.</p>
Farmer Demand	<p>Limited marketing capacity: The area of striga infestation is vast (1.4 million ha. in East Africa alone), covering different agro-ecological zones. There are organizational capacity constraints and financial limitations for seed companies to stimulate awareness and raise demand across such a vast area.</p>	<p>Different awareness raising methods and mediums have been tested and rolled out, including travelling agriculture shows and fairs and farm-level demonstration, print, and radio talk shows. Radio talk shows enable partners to reach larger numbers of farmers with a smaller investment, but in-person events are seen as more effective to transfer technical knowledge</p>
	<p>Unique handling requirements: The handling requirements for IR maize (e.g. wearing gloves during planting) are a challenge for farmers who are often reluctant to change their handling practices.</p>	<p>The product packaging is designed and priced to overcome this resistance, as best practices require that gloves are included in the packaging and pricing. Nonetheless, AATF supports seed companies to deliver awareness raising and training of farmers on demonstration plots in proper handling.</p>
	<p>High relative costs and farmer risk aversion: The cost of IR maize seed is higher than traditional improved varieties, and may be viewed as prohibitive for the poorest farmers. It is also more complex to use, requiring gloves for planting, additional fertilization, and weeding to be most effective. Risk averse farmers are reluctant to shift to IR maize for their entire maize plot.</p>	<p>Seed companies are introducing smaller (2kg) packets of seed to make the seed more accessible to smallholder farmers. Additionally, Kenya Seed in Kenya and Meru Agro in Tanzania will introduce 200g promotional packs of IR maize seed as a sample packet for the smallest, most risk averse farmers to test the seed. Additionally, as new companies come to market with IR maize this could ultimately drive prices down, but it is too early to quantify the impact of competition on price.</p>
Rural Distribution	<p>Agrodealer capacity limitations: Larger seed companies may employ an in-house brick and mortar retail distribution model; however, the rural reach of such a model is constrained. An agrodealer distribution model is therefore common across Kenya, Tanzania, and Uganda given their expansive rural presence. Agrodealers have been observed to inadequately store the IR maize product (e.g. in close proximity to non-IR seed) and are ill equipped to deliver the necessary information to smallholder buyers.</p>	<p>Over the next two seasons, agrodealers will begin receiving trainings from AATF to increase their awareness of proper storage and handling requirements, and to increase their capacity to deliver basic product information to smallholder customers. One seed company interviewed for this study recommended prioritizing regular trainings for shop keepers, rather than shop owners, as they are on the 'front line' with the customers on a daily basis. Partnering for Innovation is providing technical assistance to develop training resources for use by agrodealers in advising farmers on best practices in using IR maize.</p>

	<p>Inventory credit for dealers: Small agrodealers face challenges managing inventory given their limited and inconsistent cash flow. They tend to prioritize stocking product that they know will sell rapidly. With a new technology like IR maize, dealers are reluctant to extend cash for a product with a limited shelf life, and for which they have weak demand projections (thereby increasing inventory risk).</p>	<p>Seed companies have begun extending product on consignment to agrodealers, but are faced with uncertain repayment due to dealer credibility concerns. A risk sharing facility for supplier credit may alleviate this market coordination failure.</p>
Enabling Environment	<p>Government extension and messaging: National and local government extension services are massively under-resourced across the striga infestation area. There is currently limited government sponsored information dissemination regarding striga treatment options</p>	<p>Given the public value of controlling striga across such a vast area, local governments are needed to expand awareness messaging regarding IR maize technologies.</p>
	<p>Subsidies: Existing subsidy programs do not provide enough choice for farmers in the input marketplace, and rarely are broad enough to include products such as IR maize. Given the early stage of this technology, subsidies were identified by interviewees as potentially playing a role in stimulating initial demand more broadly. Nonetheless, the ineffectiveness and distortive effects of past and current input subsidy programs were identified by interviewees as a significant concern as well.</p>	<p>Seed companies recommend that temporary voucher programs may play a role in stimulating demand in striga infestation areas. Any program would need to be facilitated through existing seed companies and agrodealers and designed to provide farmers a choice of improved seed products, including IR maize, available in the marketplace. Sufficient funding is necessary to ensure that government is appropriately reimbursing input supply companies for vouchers, and the lifespan of the program should be time-bound.</p>

Commercial Outlook

All of the partners interviewed for this study, including both commercial seed companies and nonprofit organizations, expressed a positive outlook for IR maize in East Africa. While demand for IR maize remains a small fraction of the overall market for maize seed in East Africa, it is evident to seed companies investing in this technology that farmer demand is rising, and IR maize is seen as the most promising existing technology to combat striga across an estimated 1.4 million hectares of infestation. In fact, demand is evidently outpacing supply. So while expanding awareness and demand remains important to reaching scale, a more critical first step is for seed companies to address their supply-side constraints so that they can meet existing demand. Seed companies recognize that ‘push-pull’ technology is an alternative to IR maize technology; however, it is seen as a more labor intensive alternative, so farmer awareness and uptake remains very limited. A biological product that could compete with IR maize on the market is also being developed, but is currently in the testing phase and will not reach the market for at least several years.

Company A: Legume Seed Commercialization in Zambia

Partnership Design

Zambian smallholders are heavily reliant on maize for food and income, and lack sufficient farm-level diversification to guard against maize price volatility. It is estimated that 86 percent of smallholder farmers grow maize^{xvi}, and although legumes are an important component of a diversified farming system there is estimated to be insufficient supply of certified OPV seed for groundnut, soy, common bean, sunflower, and cowpea available to meet market demand.

Company A is a small and growing Zambian seed company and is currently the largest supplier of legume varieties in Zambia. Company A sees rising demand from farmers for improved legume seed; however, it currently has limited capital available to expand in-house seed multiplication efforts, and as a result has been forced to import seed from neighboring countries in past years.

To address this production constraint, Partnering for Innovation partnered with Company A to: 1) advance their investments in smallholder outgrower multiplication of certified seed; 2) market the seed through farm-level demonstration plots; and 3) distribute seed through a local agro-dealer network model. The project aims to contract 220 seed producers and sell 600MT of certified legume seed to 60,000 smallholder producers. At this point, Company A does not require additional partners in order to introduce the contract grower scheme, but has partnered with a local NGO to introduce drip irrigation to some outgrowers to evaluate the impact of this technology on seed production yields and to mitigate the risk of drought.

Overcoming Market Barriers

This section outlines the key challenges at different points in the market system, and the steps being taken by these partners as well as further recommendations to overcome barriers.

Market System Level	Challenges Faced by Partners	Partner Solutions and Recommendations
Seed Production	Outgrower capacity and logistics: Company A has recognized several challenges with working with smallholder outgrowers including: 1) high cost to aggregate supply from small and dispersed production areas; 2) lack of uniformity of quality across outgrowers; and 3) smallholders lack capital to invest in irrigation technologies	Company A developed a partnership with Vision Fund to finance drip irrigation for 50 outgrowers. It also intends to move towards larger outgrowers who have access to irrigation facilities to reduce on-farm losses, streamline logistics, and improve uniformity of quality. Medium-sized producers (5-50ha) are viewed as more appropriate.
	Equipment to sort and store seed: Smallholder-grown seed lacks uniformity, adding time and cost to sorting. Additionally, legumes need to be stored in temperatures below 30 degrees Celsius (varies by legume type) to maintain germination rates.	Company A has already placed an order for mechanical sorting equipment and has begun constructing a new storage facility.
	Access to capital: Financial markets exhibit high degrees of instability in Zambia, with financing rates currently ranging from 30-40 percent. As Company A's profit margins are only 40 percent, they need to push profit margins up (with higher cost seed, or lower production costs) to access credit profitably.	Working with small outgrowers squeezes margins so Company A is considering expanding work with medium-sized outgrowers. Additionally, it is seeking "patient capital", a long-term impact investor to help navigate their challenges.
Farmer Demand	Demand projections: Farmer demand for certified legume seed is seen as relatively high, particularly from medium-sized farmers; however,	The Seed Traders Association that represents seed companies across Zambia, has been doing demand projections, but they are already two years behind

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	availability of supply when it is needed is limited. Seed companies do not have accurate projections of demand – volumes demanded, in which areas, at what time of the year – to program their production and distribution logistics accordingly	due to lack of financial and human resources. Currently, seed companies are doing their own independent surveys of farmers to gauge demand, and Partnering for Innovation is developing a market assessment training to improve Company A's capacity in this area.
Rural Distribution	Agrodealer creditworthiness: Agrodealers are small, disorganized, and lack access to credit to finance their inventory purchases. As most agrodealers lack sufficient cash flow to purchase seed inventory, Company A has provided seed on consignment. The repayment rates on consignment arrangements have been unacceptably low. This causes a cash crunch when Company A needs to pay its outgrowers.	Company A is seeking to build business relationships with larger, more credible agrodealers. It is supplying seed in bulk to the government, NGOs, and larger wholesalers. Additionally, it is expanding its in-house retail distribution network slowly, and in the meantime is prioritizing working with larger wholesalers.
Enabling Environment	Subsidies: Current subsidies give farmers little choice in the market for seed. They are typically supported to access maize seed only. This entrenches farmer reliance on maize, and disincentivizes legume seed development investments from private seed companies.	The government is phasing out traditional seed vouchers, and introducing an e-voucher program that gives farmers a choice of the type of seed to access. The e-voucher system appears to be more effective, but is only operating in 39 out of 100 districts currently.
	Access to credit: Smallholder producer reliance on rain-fed production systems creates significant challenges for certified seed outgrower programs. Producers currently lack the capital to invest in farm level mechanization technologies such as drip irrigation that would alleviate this reliance.	An agricultural finance risk sharing mechanism that incentivizes financial institutions to lend to seed producers would shorten the seed development process (from breeder seed to basic seed to certified seed) from three to four years to two years by reducing reliance on seasonal rain.

Commercial Outlook

Company A maintains a very positive outlook on the certified OPV legume seed market in Zambia, but larger seed companies remain reluctant to enter the certified OPV seed market, as they see greater value in the hybrid market. So Company A views its primary competition for certified OPV legume seed as farmer recycled seed. It is estimated that 70 percent of legume seed in the market is recycled, while 30 percent is certified. So while the long-term goal is to expand farmer demand, the short- to medium-term goal is to expand production to meet existing demand. Because demand is currently outpacing supply, there is a seed deficit in the market which is leading to zero sum tactics by less scrupulous seed companies, including 'underpacking' seed packages (e.g. selling a 10kg bag with only 9kg). Company A has land available to begin in-house basic seed production, but it needs financing to prepare the land and develop a seed production facility. Even though Company A entered the market only a few years ago, it believes it can effectively compete on price and distribution, so it continues to seek ways to expand its rural reach and lower distribution costs.

NGO One: Legume Seed Commercialization in Mozambique

Partnership Design

Agriculture in Mozambique is almost entirely dominated by smallholder farmers, with more than 95 percent of total farming area cultivated by an estimated 3.8 million small-scale farmers^{xvii}. Despite its importance, smallholder agriculture remains woefully inefficient, with little investment from the private sector, and gains have mainly been achieved through expansion of land under cultivation rather than through productivity. It is estimated that only 20 percent of smallholders sell their crops on the market, which clearly reduces demand for improved inputs, evidenced by less than 10 percent of farmers utilizing improved seed.^{xviii}

Partnering for Innovation partnered with NGO One and two local commercial seed companies to expand the production, marketing, and distribution of certified OPV legume seed including soybean, pigeon pea, sesame, and cowpea. NGO One coordinates the production, marketing, and distribution efforts of local seed company partners and supports the development of three different distribution models: community based service providers, central hub distributors, and direct sales through seed fairs. The two seed companies produce certified OPV legume seed through own production facilities and smallholder outgrowers and expand seed distribution networks through independent retail and wholesale and dealers and seed fairs.

Overcoming Market Barriers

This section outlines the key challenges at different points in the market system, steps being taken by partners, and further recommendations to overcome these barriers as described by implementing partners:

Market System Level	Challenges Faced by Partners	Partner Solutions and Recommendations
Seed Production	Smallholder outgrower capacity: Most smallholder farmers in northern Mozambique are not commercially oriented and are very limited in terms of technical capacity to produce certified seed.	One seed company is increasing the number of technicians working with farmers to deliver technical training, and also trying to foster relationships with larger, more commercially oriented farmers in the area, although there are not many.
	Environmental threats: The outgrower catchment area is reliant on one growing season, and prone to drought. Smallholder farmers do not have access to irrigation, causing significant losses and difficulty meeting supply projections. A single growing season dramatically limits the size of the market.	Introducing small-scale drip irrigation to outgrowers (starting at 0.25 to 0.5 ha). Farmer understanding on how to operate, maintain and service the systems remains limited, and operating costs are high.
	Outgrower side-selling: Competitive traders in the area convince smallholders to side-sell seed as grain outside their contract with the seed companies. There was one case cited of an outgrower side-selling three quarters of his harvest to an independent trader, and only selling one quarter of his harvest to the seed company despite the seed company providing inputs and training.	Seed companies are increasingly diligent about screening to find credible farmers willing and interested to enter into long term mutually beneficial supply relationships. Lack of trust and weak contract laws remain a challenge.
Farmer Demand	Recycled seed: Recycled seed remains significant competition for certified OPV legume seed.	Promoting certified seed via radio, mobile ag fairs, and demo plots with field schools. Uncertain output markets and poor quality seed in the market continue to constrain farmer willingness to invest in seed.

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Rural Distribution	<p>Low margins working with agrodealers: Partners have realized that the margins of working through a dispersed network of small-scale rural agrodealers are just too thin. Covering a large area and distributing small quantities to each dealer presented an untenable cost structure.</p> <p>Working capital: Agrodealers have limited capital to finance their inventory purchases. One of the seed companies was providing seed on consignment to smaller agrodealers, but found that repayment rates were too low.</p>	<p>NGO One had to subsidize seed distribution from seed companies to the community based service providers so this small rural agrodealer network model has basically been abandoned. They are now supporting more efficient distribution networks such as a seed fair model where agrodealers and farmers can buy seed directly, and a central hub model where seed companies sell to larger wholesalers who then deal to smaller agrodealers.</p> <p>One of the seed companies is providing incentives for cash payments from dealers through price discounts. NGO One is working with Banco Oportunidad de Mocambique to support agrodealer applications for working capital loans (though this appears only viable for large dealers with high turnover, and Banco Oportunidad is stretched thin as the only willing ag lender). Seed could be sold on consignment to larger agrodealers, although this presents a potentially unsustainable risk for seed companies.</p>
Enabling Environment	<p>Seed distribution programs: Government and NGO seed distribution programs providing free seed dampen demand for seed. These programs are often driven by political patronage, and undermine private distribution systems. Government buys seed from large companies via contract, stores seed in a central government warehouse in reportedly poor conditions then distributes too late for timely planting. Resulting poor yields reduce demand for improved seed.</p>	<p>Stakeholders suggest that government and NGOs engage local seed companies and existing agrodealer networks in a voucher-based seed subsidy program rather than government-led handouts. The FAO is reported to have rolled out a seed voucher scheme in collaboration with private input companies and existing distribution networks that has been observed to work more effectively than free seed distribution programs.</p>

Commercial Outlook

Despite a challenging enabling environment, including a worsening conflict situation, stakeholders' outlook for the seed sector in Mozambique remains somewhat positive. While farmer demand is recognized as limited and a continuing challenge, it has been shown to be higher than initially expected. The seed market up to now has ostensibly been protected because government and NGOs buy seed directly, and companies have not had to compete in an open market environment. But this dynamic is slowly changing as private companies are gradually learning to market seed to smallholders the way other companies market their products. While few reputable competitors are operating in this space, the market is faced with several companies offering non-certified seed of very poor quality (typically just grain, rather than seed) which has the effect of reducing demand for quality seed and farmer willingness to pay. Nonetheless, companies that prove capable of providing quality seed at an affordable price for smallholders are expected to generate repeat seasonal business supporting their continued growth.

Company B: Orange-Fleshed Sweet Potato Commercialization in Malawi

Partnership Design

Sweet potato in Malawi has traditionally only been used for household consumption and informal market sales, given limited commercial demand. Approximately 3 percent of sweet potato in Malawi is estimated to be the orange-fleshed varieties, while the vast majority are white-fleshed and yellow-fleshed varieties. Given the high content of vitamin A in the orange-fleshed varieties and the high level of vitamin A deficiency in Malawi, there remains a significant public health objective to promote adoption by farmers.

Company B is a food processing company that produces biscuits, potato chips, bread and other snack items for the domestic market. It has identified an opportunity to commercialize orange-fleshed sweet potato (OFSP) through OFSP-based products such as sweet potato chips, puree, and flour. Because the volume of OFSP produced in Malawi is very low and is mainly used for household consumption, Company B needs to increase local production to meet the company's increasing processing capacity. By creating the end market demand for OFSP, Company B is creating incentives for smallholder farmers to expand their production for both commercial use and with the assumption that some will be kept for home consumption. A current constraint is that the availability of good quality plant material remains too low to meet output volume targets. It is anticipated that over time and with current demand farmers will use their own vine stock to increase production.

Partnering for Innovation partnered with Company B, with support from the International Potato Centre (CIP), to expand smallholder access to OFSP plant material, source OFSP from smallholder producers, and invest in OFSP product value addition for domestic markets. Company B buys OFSP from smallholder farmers and processes raw material into OFSP value-added products such as potato chips, bread, flour, and puree. CIP provides Company B and its smallholder outgrowers with clean, virus-free OFSP tissue culture on a non-commercial basis.

Overcoming Market Barriers

This section outlines the key challenges at different points in the market system, and the steps being taken by these partners as well as further recommendations to overcome barriers.

Market System Level	Challenges Faced by Partners	Partner Solutions and Recommendations
Seed Production	<p>Varietal traits: Early stage OFSP varietal development focused on nutritional content, but was not focused on suitability for processing, so some available varieties have a high moisture content that limits their effectiveness for processing, limiting the amount of OFSP appropriate for processing.</p>	<p>Next generation varietal development and vine distribution need to consider traits that are appropriate for both consumption and for processing.</p>
	<p>Capacity: Because this initiative represents the first effort to commercialize OFSP in Malawi, there remains an insufficient volume of plant material available to meet processing capacity. While farm extension was not designed to be part of this project, it remains needed. Farmer returns from growing OFSP should exceed alternative crops in order to drive adoption.</p>	<p>There needs to be a large scale plant material multiplication effort, led by Company B and smallholder producers. Company B has invested in its own greenhouse to multiply clean tissue culture bred by CIP, and they plan to expand multiplication on their own land, and provide material to smallholders for third stage multiplication. These efforts are not yet underway. Potential to explore engagement with One Acre Fund for local extension and access to inputs to expand multiplication and production capacity.</p>

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Farmer Demand	Willingness to Pay: Because OFSP is essentially a new crop for smallholder farmers, they currently are not willing to pay for plant material. Local (white- and yellow-fleshed) varieties are available that that smallholder farming families consume in the household. Prices for OFSP must exceed local varieties to spur more production.	Company B's efforts to build a vertically integrated model are designed to stimulate farmer interest in growing OFSP commercially by providing a consistent and stable output market channel for producers. Currently farmers receive OFSP plant material for free, and they either reuse it in subsequent seasons, or are obtaining 2 nd generation material from neighbors in the informal market. CIP implements a separate USAID-funded project focused on OFSP multiplication which benefits this program as well.
Rural Distribution and Offtake Logistics	Commercial distribution of plant material is not currently in place given the limited demand. Plant material is being distributed by CIP on a non-commercial basis, and farmers are only given one bundle - an amount sufficient for home consumption but not commercial production.	There is currently not a viable path to distribute plant material commercially given the absence of farmer demand, but if output market demand (from Company B, and other buyers) continues to grow relative to supply, then farmer demand for plant material can be expected to grow.
	Smallholder offtake logistics: there are two main challenges for Company B expanding offtake from smallholders: 1) OFSP production is rainfed and seasonal, leading to lumpy volumes available throughout the year (adding cost to operate processing equipment far below capacity), and 2) unit transportation costs are very high due to weight per value of OFSP.	Year round production could be achieved through irrigation, but it is unclear if there would be positive returns on investment for farmers to grow OFSP under drip irrigation. To keep transportation costs down, Company B has been forced to source OFSP from a smaller catchment area in the south. While this keeps unit costs down, it constrains the volumes available for processing and limits the number of smallholder producers that can access this market.
Enabling Environment	Prioritization of maize over OFSP: the government has established maize as a priority due to its role as the primary staple crop and thus its contribution to household food security. However, this has led to neglect of other crops that could support household food and nutrition security such as OFSP.	Company B is lobbying for greater government support for OFSP production through awareness programs and support for farmer-led seed multiplication. Where floods or droughts are a challenge, and maize crop failure is common, OFSP can be an important substitute for maize and a tool for farmer resilience. CIP also is promoting OFSP for its contribution to improved nutrition.

Commercial Outlook

Stakeholders are cautiously optimistic about the commercial outlook for OFSP in Malawi. There is a potentially significant opportunity to substitute wheat flour with OFSP flour. As wheat flour is imported, the gains from import substitution could be substantial. The commercial opportunities for other OFSP products, particularly puree, are viewed as modest. What is clear from this initiative is that the demand for seed will grow as long as there is a reliable output market; however, farmer willingness to pay for quality plant material is weak at the moment. Aggregate processing capacity for OFSP products remains low, as Company B is the only main industrial processor in the market – small cooperatives with artisanal processing facilities are operating at very low volumes. The challenges of sourcing, transporting, and processing existing varieties are likely limiting the entry of industrial competitors. Even without competition, sourcing sufficient volumes to meet existing processing capacity remains a challenge for Company B, pointing to the need for a more robust seed multiplication effort.

NGO Two: Agro Input Distribution in Mozambique

Partnership Design

Utilization of improved inputs, particularly certified seed, among smallholder producers in Mozambique remains extremely limited. While smallholder farms account for 97 percent of the total cultivated area in the country, only 10 percent of smallholder farmers use improved seed varieties – amounting to a market size of 9,000MT of certified seed, 80 percent of which is distributed through the government and NGOs, and only 20 percent (approximately 1,800 tons) through commercial channels^{xix}.

To expand smallholder farmer uptake of improved seed, Partnering for Innovation partnered with nonprofit NGO Two and a commercial agribusiness. The project is designed to expand improved seed and other agro input distribution to smallholders through a network of rural farm business advisors (FBAs). There is not a particular crop or seed variety targeted for commercialization on this project, as it employs a broader focus on marketing and distributing a range of seed such as maize, legumes, and vegetables, and other agro input products. NGO Two identifies, establishes, and trains community-based FBAs as ‘last mile’ community-level input dealers, extension agents, and aggregators/traders and facilitates input promotion events with FBAs such as demonstration sites and road shows (community days) for different seed varieties.

Overcoming Market Barriers

This section outlines the key challenges at different points in the market system, and the steps being taken by these partners as well as further recommendations to overcome barriers.

Market System Level	Challenges Faced by Partners	Partner Solutions and Recommendations
Seed Production	Risk and cost: The commercial agribusiness sees vertical integration through local seed production, particularly via smallholder outgrowers, as a risk it is unwilling to take. Farmer skill level is very low, so seed quality and volumes are difficult to forecast. Addressing this challenge requires a long term investment that commercial companies are increasingly unwilling to finance on their own.	Rather than producing its own seed, the commercial agribusiness is sourcing seed from reputable regional sources. It is importing seed from SeedCo in Zimbabwe, but only small quantities to reduce its risk. Although importing small quantities increases unit costs and squeezes margins further, it ensures a supply of seed for sale.
Farmer Demand	Returns dictate demand: Farmer returns on seed investments determine their continued demand. Generally, farmers are unable to maximize returns from seeds because they are not applying good agriculture practices or using critical inputs like fertilizer. Additionally, government distribution of poor quality seed and grain being marketed as seed in the local marketplace negatively impacts yields and farmer perceptions of what they believe to be certified seed. Current volumes of demand are not sufficient to incentivize significant private sector investment.	Agrodealers stock and distribute a diverse range of agro inputs, including fertilizer and agrochemicals, that can increase returns from seed, and support continued demand. FBAs that are trained in basic agronomic skills sell inputs under a commission-based agreement with agrodealers, and provide farm-level advice to farmers via demonstration sites.

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Rural Distribution	<p>Capacity of rural agrodealers: Illiteracy in local communities is a major problem, and it is difficult to identify literate community members to manage an agrodealer and offtake business, as this requires financial acumen and inventory management. Additionally, FBAs are not very adept at marketing their services to smallholders.</p>	<p>Careful selection of FBAs is important, prioritizing literacy. NGO Two delivers basic business training to FBAs - including managing their inventory and setting input/output prices to achieve positive margins. It also supports FBAs to attend and engage in agricultural fairs and demonstration events. FBAs also require training in good agriculture practices to be able to extend these skills to their customers.</p>
Enabling Environment	<p>Government distribution programs: Government seed handout programs appear to be negatively impacting farmer willingness to pay for seed, and seed company willingness to invest. Seed distribution is often a political tool, and poor quality seed leads to low yields. Where government seed distribution floods the market, seed companies report losing their investment.</p>	<p>Seed markets only have a chance of developing where government handouts are not taking place, so geographic targeting is important. Reform of government sponsored programs is an important step. Growing quality awareness and brand awareness should partially offset the impact of poor quality government-distributed seed as the seed market develops.</p>
	<p>Increasing conflict: Partners report that the rising political conflict in the central and northern provinces of Mozambique is more challenging and disruptive than expected.</p>	<p>Field staff and extension agents have been pulled out of certain central and northern districts for their safety. Seed markets are not expected to develop in the areas where active conflict is taking place.</p>
	<p>Currency devaluation: The rapid devaluation of the local currency has drastically increased real import costs.</p>	<p>National fiscal policy requires reform. The commercial agribusiness is accepting increased costs of imports to reduce perceived risk of losses from local production. To offset this impact, rising import prices incentivizes local seed production.</p>

Commercial Outlook

Despite a challenging business landscape, partners maintain a tempered optimism for seed market potential in Mozambique. The competition for high-quality certified seed in Mozambique is limited and continuing to decline, although some local seed companies are emerging. The commercial seed company working with NGO Two will continue to invest in Mozambique, but it is trading carefully with a greater awareness of business and political risks. A new Partnering for Innovation partnership is supporting Sociedade Beneficiamento Sementes (SBS), a startup soybean seed company in Gurue. Competition is not the primary challenge for investors in the Mozambican seed sector – low farmer demand for high quality seed and farmers’ general inability to distinguish between high-quality and low-quality seed are the main constraining factors. Farmer perceptions of improved seed have been spoiled by poor quality product available in the market and distributed at no cost by government. The market for high quality seed at a reasonable profit margin for this seed company is considered extremely small, but partners suggest there are pockets of commercially-oriented farmers that have secure output markets. These producers (not currently quantified) represent a viable market segment to target with certified varieties of seed and other agro inputs.

Company C: Agro Input Distribution in Mozambique

Partnership Design

One of the critical constraints to stimulating smallholder demand for agro inputs in Mozambique is the absence of reliable output markets for smallholder farmers. It is estimated that only 20 percent of Mozambican smallholders sell their crops on the market, and less than 10 percent of farmers utilize improved seed^{xx}. These metrics are clearly very closely related, as farmers without a stable market for their output are less likely to invest scarce financial resources in improved inputs.

Company C is a commodity trader, and therefore primarily interested in smallholder offtake of crops such as maize, beans, pigeon peas, sesame, and cashew. The company recognizes that its offtaking operation is dependent on farmer access to the right agro inputs at the right time. Partnering for Innovation partnered with Company C to establish at least 23 rural agro input distribution centers reaching 22,900 smallholder in key production areas. Commercial investment is a critical component of this activity, and Company C has committed to invest over \$13 million. Company C is establishing at least 23 independent rural shops run by Mozambican entrepreneurs that combine aggregation and warehousing, input sales, and equipment rentals. It is also providing infrastructure for shops and basic business training to entrepreneurs. Subpartner Agro-Tractors Limited (ATL) is the vendor for distribution and servicing of mechanization implements and Technobrain is a software company that developed a mobile platform that provides market and weather information to farmers.

Overcoming Market Barriers

This section outlines the key challenges at different points in the market system, and the steps being taken by these partners as well as further recommendations to overcome barriers.

Market System Level	Challenges Faced by Partners	Partner Solutions and Recommendations
Seed Supply	Not a core business: Intentionally, Company C does not concentrate on local seed production, and is not interested in competing in the seed market. Seed production is outside its core business focus, and it is disinterested in vertical integration given the associated costs and risks.	Instead of vertically integrating, Company C facilitates access between seed companies (domestic and regional) and entrepreneurs running agro input shops. Company C was not appropriately vetting the seed types/brands sold in agro input shops. Partnering for Innovation has facilitated supplier relationships with its seed company subpartners in Mozambique.
Farmer Demand	Relies on output market demand: Farmer demand for seed ultimately is driven by output market demand.	Company C is one of the largest buyers for smallholder output in Mozambique. Its interest in inputs is only to increase volumes of offtake available. The agro input shops are located with warehouses where offtake bought by Company C is stored. Company C buys from village and district level commodity aggregators.
	Narrow window of demand: Rainfed production areas in the north only experience one planting season per year, which translates to a one month window for farmer demand. Seed sales are therefore seasonal and are unable to sustain a business through the year.	Agro input shops are focusing on a wide range of agro input technologies, seeking to provide a one-stop shop for smallholders. Inventory management is important to ensure sufficient stocks during demand windows.

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Rural Distribution	<p>Thin profit margins: Rural agro input shops are expected to generate narrow profit margins, suggesting that large volumes of sales are necessary.</p>	<p>Agro input shop entrepreneurs are given training in basic business skills, inventory management, and pricing so that they may manage their margins appropriately. Additionally, shops are placed in key production areas with large numbers of farmers, and will boost offseason sales by selling consumer products such as soap, cooking oil, etc.</p>
	<p>Entrepreneurs want salaries: After selecting entrepreneurs to run the agro input shops, many requested a salary from Company C. It was evident that they did not fully understand the entrepreneurship-driven model, or it was not effectively communicated.</p>	<p>Company C partnered with a local NGO to identify women entrepreneurs that they could train and support as they established these input shops.</p>
Enabling Environment	<p>Perception of free seed: Farmers are accustomed to either re-using seed or receiving free seed from the government and NGOs. Buying seeds is often perceived as an unnecessary expense by farmers.</p>	<p>Agro input shops diversify their offerings to generate sales in non-seed inputs.</p>

Commercial Outlook

Company C is not competing in the seed market, and has not expressed interest in expanding its investment in the seed market in Mozambique. Company C sees the demand for seed as very small, due mainly to the practice of reusing seed and the proliferation of seed handouts by government and NGOs. Nonetheless, its experience provides valuable insights into the opportunities and challenges to stimulate smallholder uptake of improved input technologies in Mozambique. The Company C partnership ultimately illustrates that offtake demand is a prerequisite for farmer input investments. Company C has observed significant (albeit latent) potential in the agro input market where output demand is high, but more can be done by the public sector to create incentives for new buyers (particularly value addition enterprises) to emerge.

Summary of Lessons Learned Across Partnerships

Understanding Seed Market Systems

Market context matters – Seed market dynamics are not the same across countries, or even within countries. A clear understanding of end market demand, agro-ecological conditions across production zones, existing socioeconomics, appropriate business model (e.g. use of outgrowers), and the prevailing enabling environment are necessary to gauge commercial potential and design investments appropriately.

Intrinsic characteristics of the seed matter – Not all seed technologies are the same. Some exhibit ‘private good’ characteristics while others exhibit ‘public good’ characteristics. For instance, the genetic profile of certain technologies will reduce second and third generation germination rates, thereby incentivizing agribusiness investment and promoting market participation rather than seed recycling from farmers. Some seeds are easily stored, and therefore harvested grain is reused as seed rather than purchasing potentially higher yielding varieties. Alternatively, other seed types/varieties are more challenging to store, lending themselves to continuing purchase each planting season, which creates farmer demand for commercial seed. In sum, the varietal characteristics must be understood clearly to determine the potential for private sector led commercialization efforts.

Increasing farmer demand for seed requires a clear and stable output market, seed company capacity to demonstrate and market the advantages of the technology to farmers, and farmers’ capacity to implement good agricultural practices to maximize their output returns from seed investments.

Increasing seed supply requires availability and access to breeder seed (*first level*), capacity to multiply foundation seed/basic seed (*second level*), and capacity to multiply certified seed (*third level*). Protected production systems with appropriate farm isolation, farm mechanization, and access to irrigation will reduce environmental challenges and accelerate seed technology commercialization.

Expanding rural distribution networks requires agrodealers to have the technical capacity to understand the benefits of the technology and how to communicate to the farmer as front line extension workers and agrodealer business capacity to manage cash flow or access inventory credit. Consignment between seed companies and independent agrodealers often fails due to poor management and/or borrower credibility issues.

Improving the enabling environment for seed markets requires a public policy framework for seed development encompassing an efficient/effective varietal release process and accessible catalog of released varieties, inspection and quality assurance system, and appropriate plant breeder rights. Government-sponsored seed subsidies are generally viewed as distortive for markets and tend to be politically motivated, but how they are implemented also matters – engaging seed companies, providing farmer choice, and ensuring that subsidies are temporary and time bound would go a long way to improving these programs. Restrictive import policies can increase product costs, and restrictive export policies reduce farmer incentives to invest.

Accurate demand forecasting is needed to close the loop between supply and demand – this includes projections of specifically how much seed of specific varieties is needed, where, and when. This will address many issues holding back seed market development. If a seed company overshoots its production targets it risks having to manage expensive inventory; if it undershoots its target it risks losing market share. Seed must be available when and where farmers demand it, at the appropriate volumes, in order for seed companies to produce appropriate volumes and for agrodealers to avoid inventory losses. While demand projections are a ‘public good,’ government resources and capacity to do them well is limited. Partnerships between seed companies and farmer associations may help bridge the information gap.

Operationalizing Partnerships for Seed Technology Commercialization

Setting and Managing Targets: Establishing and overseeing project targets are crucial responsibilities for implementing a successful seed technology commercialization partnership. It is important that targets are reasonably attainable, adaptive, and based on commercial projections. Below are several lessons learned for appropriately setting and managing partner performance targets:

- The milestone payment structure of the partner agreements provides a strong incentive for partners to achieve commercial targets on time. Time-bound performance milestones are critical, although Partnering for Innovation has learned that contract flexibility to account for market-related performance delays can be beneficial. For instance, performance milestones may be cumulative over the life of a project to trigger a payment “when attained.”
- Commercial targets are set based on market projections at the time a proposal is written or contract negotiations are taking place, but markets are dynamic and constantly changing. Where environmental events (drought, flood, etc.), political events (conflict, etc.), or market events (output markets dry up, competition increases, currency devalues, etc.) take place unexpectedly, Partnering for Innovation employs flexibility to modify originally established commercial targets.
- Under nonprofit-led partnerships, setting and managing targets may be more challenging as these organizations do not ultimately have control over commercial partner performance.
- Seasonality is a critical consideration in setting and managing targets. Partnering for Innovation has streamlined processes to complete partnership negotiations within 60 days, ensuring an accurate forecast of project commencement, and the alignment of project implementation and milestone due dates with planting/growing seasons.

Engaging Private Sector Partners: Private sector partners are absolutely crucial in any commercialization initiative. They are the actors with the market incentive to produce, process, and distribute seeds in the marketplace that result in attaining scale and sustainability. Below are several lessons learned for structuring private sector participation in donor funded initiatives in the seed sector:

- Commercial actors, from global agribusinesses to local seed companies and rural agrodealers, are the entities that will continue activities beyond the life of the project if and when technologies are determined to be profitable without donor subsidy.
- Aligning development objectives and commercial objectives upfront is important. Commercial actors set targets based on volume or value, rather than social indicators. In some cases, development objectives of engaging smallholders in their supply chain may run counter to partners’ commercial objectives of meeting volume targets profitably. Companies may prefer to work with fewer larger suppliers/producers as outgrowers, as their capabilities are higher and this reduces transaction costs for their business.
- Commercial partners are often unfamiliar with donor reporting requirements. Narrative written reports and donor-oriented monitoring and evaluation methodologies are often distinct from their internal systems and processes for monitoring their commercial performance. Partnering for Innovation structures partnership agreements to minimize commercial partner reporting requirements, focusing on their sales and procurement records as means of verification connected to milestone payments that can be provided through monthly sales and financial reporting.
- Partnerships with commercial, for-profit companies as lead partners and nonprofit supporting partners may be challenging in terms of managing pass-through funds. Direct communication between Partnering for

Innovation, the lead partner, and supporting partners ensures pass-through arrangements can be carried out to fulfil partners' expected roles.

- USAID Mission staff play a critical role in reaching out and engaging lead firms in their country of operation ahead of Partnering for Innovation calls for proposals. Missions have supported Partnering for Innovation bidders' conferences, posted solicitations in local newspapers, and distributed email blasts to commercial contacts to raise awareness of solicitations. Staff have also coordinated engagement with ongoing field projects focused on smallholder production, market access, and enabling environment reform.

Engaging Nonprofit Partners: Nonprofit organizations, whether they are local or international NGOs, are often an important bridge between a global partnership program and the private sector. Below are several lessons learned from engaging nonprofit partners in seed technology commercialization initiatives:

- Commercially-oriented seed companies are often unaware of and unconnected with donor-funded procurement processes, so nonprofit partners can play an important role in organizing local private sector consortia and facilitating their initial investments in seed technologies.
- Nonprofit partners bring experience managing donor-funded projects; however, Partnering for Innovation has simplified the application, negotiation, and partnership process and has effectively lessened the importance of the donor awareness/experience that nonprofits bring to the table. Directly engaging with commercial partners often offers efficiency in lines of reporting and project resource utilization.
- Nonprofit partners do not typically risk their own capital in seed markets. Milestone-based payment mechanisms often work better led by commercial partners than nonprofit partners, because the latter do not expend working capital to support costs prior to accomplishing a target. Commercial partners view these costs as business related investments. Nonprofits may also promote sourcing and distribution arrangements to meet development goals that without a donor subsidy would not be commercially viable.

Partnership Interaction: Milestone-based projects operating in one or more complex market environment require close collaboration between implementing partners, local USAID and other development partner teams, and the Partnering for Innovation team. Below are several lessons learned related to partnership interaction:

- Partners that have past or existing working relationships may be more immediately productive than partnerships with no previous working relationship.
- Periodic visits from Partnering for Innovation and lead partners to remote project sites are crucial to understand and rapidly address any practical challenges faced on the ground. Familiarity and understanding of field realities could be supported further with in-country Partnering for Innovation staff.
- Commercial sector partners are often unaccustomed to the level of oversight necessary on donor funded initiatives, but recognize and appreciate its utility when interaction is focused on advancing commercial objectives and performance.
- Implementing partners are interested in learning from other similar projects in the seed sector although they recognized that context-specific and competitive factors in their market of operation create practical challenges in applying lessons learned across countries.
- Commercial partners often require support to transition and scale from project support to longer-term financing options, including donor capital, impact investors, or traditional credit markets.

Endnotes

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