

This Case Story was submitted to the 2016 CLA Case Competition. The competition was open to individuals and organizations affiliated with USAID and gave participants an opportunity to promote their work and contribute to good practice that advances our understanding of collaborating, learning, and adapting in action.

## Adapting Technologies to Reduce Grain Loss

**Fintrac Inc.**

**What is the general context in which the story takes place?**

Postharvest grain loss significantly constrains household food security across sub-Saharan Africa. Loss estimates vary widely by country; however, the African Postharvest Losses Information System estimates conservatively that volume losses across Africa range from 10-20 percent. In 2013, postharvest losses as a percent of total annual production were estimated to be almost 18 percent for maize, 12 percent for rice, 12 percent for sorghum, and nearly 10 percent for millet. Staple grain crops provide the foundation for household food security through both income generation and direct consumption by rural farming households. The continent produces more than 112 million tons of grain per year, and the grain sub-sector accounts for approximately 37 percent of incomes.

Hermetic technologies offer small-scale farming families effective, cost-efficient, and insecticide-free methods for on-farm storage. There is a range of suitable technologies capable of abating losses, but evidence suggests that low-volume hermetic bags are preferred to larger-scale technologies such as metal silos. In Kenya, several hermetic bag products are available to meet growing demand from small-scale farmers. Minimizing postharvest loss plays an important role in reducing production volumes needed to feed a growing population.



Staff and Farmer with PICS Bag. Credit: CARE.

**What was the main challenge or opportunity you were addressing with this CLA approach or activity?**

The scope of the postharvest loss problem in Africa has significant implications for food security, economic growth, and environmental degradation. Although hermetic storage is a proven technology for reducing on- and off-farm storage losses, uptake of such technologies in Africa has been limited. Opportunities to commercialize the technology include raising market awareness, easing rural logistic constraints, and facilitating access to value chain finance at the manufacturer, distributor, and local dealer levels.

Farmers and other market actors often tolerate postharvest losses due to the lack of systemic incentives to address the problem. Until output markets consistently reward producers for improved quality, they will be reluctant to invest in new technologies.

System-wide uptake of improved technologies depends on factors such as cost-benefit ratio; market knowledge; socioeconomic preferences; enterprise-level capacity; rural infrastructure and logistics; financial services; distribution and transport services; and the wider institutional environment. These factors vary depending on geographic, political, and cultural context. Consequently, a market system perspective is necessary to facilitate the commercialization of proven technologies to reduce postharvest losses.

Maize, a staple food crop in East Africa, accounts for 50 percent of caloric intake, and at least 70 percent of seeds are sourced from the previous harvest. In Kenya, total annual maize production fluctuates between 2.9 million and 3.4 million tons, valued at up to \$1 billion, but net imports of 350,000 tons cost the country more than \$130 million per year. Thus, the Kenyan Government sees achieving maize self-sufficiency and re-emerging as a regional exporter as main priorities.

With average farm sizes under 4 hectares, and average per-hectare maize yields declining from 2.2 tons in the 1990s to 1.74 tons in 2012, Kenyan farmers must optimize land to achieve the highest possible returns. But postharvest maize losses are particularly acute, with estimates ranging from 20-36 percent, drastically reducing the volume of maize available for consumption and trade. Reducing these losses is a critical piece in optimizing scarce resources and opening up land for new high-value production in horticulture and livestock.

**Describe the CLA approach or activity, explaining how the activity integrated collaborating, learning, adapting culture, processes, and/or resources as applicable.**

The commercialization of the Purdue Improved Crop Storage (PICS) bags for grain in Kenya did not happen overnight. The technology was initially developed through support from USAID's Collaborative Research Support Program with Purdue University in Cameroon from 1987-2002; it then received support from The Bill & Melinda Gates Foundation to expand across West Africa, followed by a further round of funding to adapt and expand it for maize storage across East Africa. By



2013, Kenya had not been explicitly included as a target country. Linking them to these efforts was the Feed the Future Partnering for Innovation (FTF-P4I) project, implemented by Fintrac.

In September 2013, FTF-P4I provided a 12-month grant to Purdue University to introduce and expand access to the storage bags for Kenyan smallholders. Purdue identified and provided exclusive national license rights to Bell Industries, a local private sector distributor. Under this model, Bell led production, marketing, and distribution, and maintained profits from sales, less the small annual licensing fee paid to Purdue. The FTF-P4I funding provided distributor training and resources for initial farmer demonstrations in key markets.

Meanwhile, under the USAID Kenya Agricultural Value Chain Enterprises (KAVES) project, also implemented by Fintrac, agronomists and postharvest specialists identified on-farm maize storage losses as a major constraint for client farmers and were exploring low-cost commercial solutions. KAVES conducted PICS field trials with smallholders and provided additional support to Bell to strengthen its rural distribution network and embedded extension services. The trial results confirmed the PICS brand was technically sound: Maize dried to appropriate moisture levels showed constant moisture and no infestation after 6 months of storage.

Bell quickly learned that once farmers understood how hermetic storage worked and observed its comparative benefits, they were quick to adopt the practice. Market demand for the bags spread so rapidly that it outpaced the capacity to fill orders. Sales jumped from 2,500 to 60,000 to 105,000; Bell is now projecting sales of 500,000 bags over the next 2 years.

After nearly 30 years of effort, the learning across USAID-supported and other initiatives, coupled with collaboration between Fintrac-implemented KAVES and FTF-P4I, consolidated the time lag for PICS commercialization in Kenya to a mere 2 years. Currently the market leader, PICS brand bags have the most significant commercial momentum at the small-scale farmer level Kenya has seen to date.

Since 2013, adoption has increased consistently and new companies have entered the market to provide consumers more choices. For example, Tanzanian manufacturer AtoZ Textile Mills recently introduced a new hermetic bag product into the market under the AgroZ® brand name. In Kenya, additional brands include the GrainPro SuperGrain bag, the Elite bag, and the IRRI Superbag. Each of these applies the same hermetic principle but differs in design.

**Were there any special considerations during implementation (e.g., necessary resources, implementation challenges or obstacles, and enabling factors)?**

The market potential for postharvest storage technologies in Kenya was high, but smallholder knowledge of the technology was missing and actual sales from the two suppliers of hermetic bags were negligible. Adoption of metal silos was likewise minimal, although several projects had been actively training small-scale fabricators.



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Following on-farm trials that confirmed the effectiveness of hermetic bags in eliminating nearly all loss, KAVES began promoting and commercializing the technology among smallholders. After an intensive pilot phase of direct farmer training, on-site demonstrations, and media messaging, adoption began to grow within 6 months.

For small-scale metal silos, KAVES conducted field trials, and trained 65 rural artisans in silo fabrication. Again, the technology proved to be technically efficient, but the price for farmers and farmer groups was prohibitive. Additionally, farming families indicated their preference for the relative mobility and discretion that grain storage bags provide. For these reasons, small-scale metal silos currently face several cost and distribution challenges that are limiting the scale of uptake among farming families.

Despite rapid end market demand growth, the most significant constraints to commercializing hermetic storage bags in Kenya were rural logistics and value chain finance. The high costs of transportation to rural production areas meant that already thin margins on hermetic bags at the national distributor level were squeezed further. To bring costs down, a more efficient distribution system was needed—something other than going directly to the consumer. Distributors needed to develop relationships with a network of rural dealers/stockists that would enable them to more efficiently reach widely dispersed small-scale farmers.

With extensive knowledge and networks in maize-producing areas, KAVES was in a unique position to facilitate access for distributors of hermetic storage bags to agrodealers in those communities. Distributor-led rural demonstration events in farming communities served the dual purpose of raising awareness among end users and enabling the distributor to rapidly identify hundreds of rural dealers who were interested in stocking the technology.

Fintrac values a field-based project culture to better understand on-the-ground constraints. Technical leads and line managers observed local realities to assess the progress from the rapid commercialization, and staff shared best practices across 22 counties and met regularly to discuss and adapt their training methods to maximize delivery and understanding.

**With your initial challenge/opportunity in mind, what have been the most significant outcomes, results, or impacts of the activity or approach to date?**

While transactional data alone should not be considered indicative of broad-based systemic change, it does offer an important indicator for tracking the commercial momentum of a given technology in the market. In the case of the PICS brand in the Kenyan market, exponential sales growth over a relatively short period clearly indicates robust demand for hermetic storage bags.

Initial sales targets under FTF-P4I's partnership with Purdue/Bell were 17,500 units by 2014, reflecting conservative expectations and limited commercial success prior to 2013. By the end of 2014, actual sales had exceeded targets by a multiple of 3.5, reaching 69,209 bags. One year later, sales had grown 200 percent and reached 215,248. Thanks to Fintrac's proprietary data management



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system, we have been able to track KAVES-supported farmers' influence on this exponential brand growth.

By June 2016, total unit sales of PICS bags exceeded 620,000, reaching an estimated 155,000 people. These bags represent up to 62,000 metric tons of maize stored by small-scale farming families. Sales by suppliers of other hermetic storage bag brands are estimated to add another 10 percent to the total uptake of the technology to date, and are expected to gain an increasing market share. This in itself indicates that hermetic bags have reached the commercialization tipping point where new products and actors are emerging regularly to respond to end market demand.

The unique model of licensing with a local company to manufacture, distribute, and sell a new technology in a new market is particularly impressive, considering vastly exceeded sales targets and target market for this product. Selecting the right private sector partner was critical to developing a suitable market strategy. Purdue University will continue working with Bell Industries to refine its commercialization strategy and distribution approach by expanding into Kenya and determining potential growth into other East African countries.

### What were the most important lessons learned?

Hermetic storage technologies offer a clear value proposition at both the small-scale farming family level and the national level. At the farm level, reduced losses increase availability of food and reduce the need to sell grain when prices are lowest and/or purchase grain when prices are highest. At the national level, reduced losses coupled with increased productivity reduces the demand for imported grain.

There had been limited commercial success of hermetic storage bags in the Kenyan market prior to support from FTF-P4I and KAVES. Rapid commercialization of the technology is now evident through actual product sales and the evolution of the competitive landscape. There are indications that the PICS brand bag has established early momentum as the market share leader, but new providers and products are entering the fray regularly.

Key challenges for private sector distributors of hermetic storage bag products will include expanding market demand to the population level through nationwide **consumer awareness campaigns**, establishing **efficient rural distribution networks**, and obtaining **working capital credit** through financial service providers and/or innovative value chain arrangements.

There are no quick wins when it comes to technology innovation and commercialization in Africa. Ultimately, success relies on a private sector-led process of testing, learning, and adapting. But development partners can play an important role in jump-starting the technology commercialization process through initial technical, logistical, and financing support to private sector actors committed and capable of serving the small-scale farmer market.



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**Any other critical information you'd like to share?**

PICS photo essay: <https://spark.adobe.com/page/yrCcg/>

PICS Network: <https://picsnetwork.org>

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