



# INCREASING RESILIENCE THROUGH IMPROVED ON-FARM STORAGE

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PRESENTATION TRANSCRIPT

JANUARY 21, 2016

*Julie MacCartee:* Good morning, everyone. On behalf of the Agrilinks team, I'd like to welcome you to the January Ag Sector Council Seminar titled Increasing Resilience Through Improved On-Farm Storage. We're very excited to have a great panel of speakers, Aviva, Betsy, and Parasto, who are joining us in our webinar control room right here in Washington, DC, and are excited to discuss the AgResults Project and the topic of post-harvest on-farm storage for small holder farmers. So with that, I would like to introduce Aviva Kutnick, who is a USAID Foreign Service agriculture officer, working in the USAID Bureau for Food Security's Office of Market and Partnership Innovation. She is the USAID donor representative on the AgResults steering committee.

*Aviva Kutnick:* Thanks, Julie. I'm glad to be here today and looking forward to today's discussion.

*Julie MacCartee:* So Aviva, why is post-harvest storage so important to the Feed the Future initiative?

*Aviva Kutnick:* Sure. That's a great question. What's the connection between post-harvest storage and Feed the Future? Generally, post-harvest storage increases the quantity and quality of food that farming households produce for sale and that they consume at home. Even without increasing yields or production volumes, if we were just able to reduce post-harvest losses, there would still be a substantial gain to be had. The problem of post-harvest grain losses in Sub Saharan Africa is large. On a macro level, losses are estimated at \$1.6 billion US per year, which is around 14 or so percent of the \$11 billion global grain market. And in Kenya, which is a country we'll delve into during the discussion today, post-harvest losses are estimated in the range of 9 to 15 percent, and perhaps even more for small holder farmers.

More nutritious food and increased incomes for smallholder farmers are key objectives of Feed the Future, which as you know, Julie, is the US government's Global Hunger and Food Security initiative focused in selected countries in Africa, Asia, and Latin America. Post-harvest storage activities are under the Feed the Future objective of accelerating inclusive agriculture sector growth. USAID improved post-harvest storage are through three different areas.

The first is improving agriculture productivity. Second is expanding markets and trade, and the – of the households and vulnerable communities. We support many activities promoting post-harvest market infrastructure such as cold storage, grain silos, warehousing, processing facilities, fewer roads, and more. And today, our discussion will focus on storage on the on-farm level.

*Julie MacCartee:* Okay, so storage is a tool to achieve agriculture and nutrition objectives under the Feed the Future initiative. In that vein, we wanted to pull up two kind of fun poll questions just to get our audience thinking about two issues we will be discussing during the webinar today. So for those of you joining, if you wouldn't mind just letting us know what you think, where you think the greater value lies

for smallholder farmers and using on-farm storage, and also where you think development dollars could be more efficiently spent.

*Aviva Kutnick:*

On-farm storage can help households in multiple ways. Firstly, on-farm storage allows households to save grain for sale during off-season at higher prices, which means more money in farmers' pockets. Quality storage can further reduce losses caused by spoilage and pests when needed, and not just at harvest time. Thirdly, quality storage can also improve food quality and safety. Just to review quickly, firstly, it allows households to store grain for sale during off-season to realize higher prices. Secondly, on-farm storage benefits households as food or grain stored on-farm is generally close to the household and can be available for consumption when needed, not just at harvest time. And thirdly, quality storage can improve food quality and safety. So on-farm storage can help farming households through an income effect, more money from off-season sales, and a nutrition effect.

More and safer foods available at the households and in the community. Additionally, on-farm storage promotes resilience. I know, a bit of a buzzword these days, but still an all too important concept. This is one way that Feed the Future supports communities and households to better withstand unpredictable weather, flooding, catastrophes, volatile grain prices, and other shocks. On-farm storage targets the value added benefits of post-harvest storage directly to the small holder rather than other parts of the value chain.

*Julie MacCartee:*

Thank you, Aviva. So just one more question for you. USAID supports several activities under Feed the Future that work in this area. Can you just tell us a little bit about them?

*Aviva Kutnick:*

Sure, Julie. Indeed we do. Both here at USAID headquarters in Washington, DC, as well as in our field missions abroad. Here in DC in USAID's Bureau for Food Security, on the research and development side, we support two innovation labs. One for reduction of post-harvest loss with Kansas State University, and another with Purdue University focusing on food processing. In the missions, there are numerous projects. For example, a post-harvest handling and storage project in Rwanda, and the KAVES Project in Kenya, which works with farmers to increase demand for on-storage.

No doubt there are also many other examples of which we'd like to hear more about from webinar participants today in the chat box during the discussion.

*Julie MacCartee:*

What about your office market in partnership innovations at AID?

*Aviva Kutnick:*

Through the office I worked in at USAID, we support private sector and businesses to expand the commercial availability of on-farm storage in the marketplace. USAID supports a project called AflaSTOP, post-harvest drying and storage for Aflatoxin prevention that identifies the best storage options for

small holders and then markets them commercially through African businesses. And of course, AgResults, which we are here to learn more about today.

*Julie MacCartee:* So lastly, what makes AgResults unique?

*Aviva Kutnick:* AgResults is a multi-donor fund that offers prizes to the private sector to promote food security, health, and nutrition. Two unique elements, I would say, are its prize methodology and a rigorous monitoring and impact evaluation alongside the private sector prizes. I think I'll leave it there and introduce our speakers today to learn more about this topic. Our first speaker is Parasto Hamed, who is the field manager on AgResults. She manages the Kenya, Uganda, and Zambia projects.

After that, we'll hear from Betsy Ness-Edelstein. Betsy specializes in evaluation of agriculture, nutrition, and micro-finance programs. In her research on post-harvest loss, she authored the Kenya country chapter of a report on high potential intervention points for reducing post-harvest loss in African food systems. And then we'll hear joined remotely by Tulika Narayan. Tulika Narayan is an agriculture and development economist and co-director of the Policy Analysis Method Center at Abt Associates, with over 15 years of experience conducting economic analysis to support agriculture and low emissions development. And with that, I'll turn it over to Parasto for the first presentation.

*Parasto Hamed:* Thank you, Aviva. As Aviva mentioned, I'll be discussing the AgResults Kenya On-Farm Storage Pilot. The AgResults project, as was mentioned, is an \$18 million multi-donor initiative that implements pilots that incentivized high impact innovation. The program is set up in a pyramid system, headed by the steering committee, which is providing top inputs and oversights of a pilot. The top of the pyramid is also there with the World Bank, which is a trustee, and they are managing the funds. The secretariat interacts with the pilots on a day-to-day basis and manages the overall implementation of the pilot. At the bottom of the pyramid, you'll find the pilot managers who are on the ground running the pilot and working directly with the implementing organization.

Abt Associates works independently as an entity evaluating and measuring the impact of the AgResults pilot. The AgResults – currently, AgResults has six pilots, and they are global pilots, and there's one pilot that is currently on hold. The Nigeria AflaSAFE pilot focuses on incentivizing the adoption of AflaSAFE by smallholder maize farmers which eliminates the harmful toxins in name. Uganda legume seeds pilot is designed to work with seed companies to improve Ugandan farmers' access to government certified quality seeds – seed varieties. The Kenya on the farm storage pilot we'll be discussing in upcoming slides.

The fourth pilot is the Zambia bio-fortified maize pilot, which is designed to support the introduction of bio-fortified pro-Vitamin A maize into the commercial world and urban markets through incentive prizes for milling companies. The Brucellosis pilot aimed to encourage the development of

improved safe low cost and effective registered Brucellosis vaccines. The sixth and final approved pilot is the Vietnam Greenhouse Gas Emissions Reduction pilot, which is designed to identify new approaches for reducing greenhouse gas emissions and increase yield in rice cultivation by promoting tools to produce for products and practices not commercially available.

Finally, the one pilot on hold is the Newcastle pilot, Newcastle Vaccine Pilot, which is designed to increase vaccination levels and create a market for vaccine delivery to reduce the prevalence of a Newcastle disease.

The pull mechanism is being used to create a rewards based system that shines a light on the problem and incentivizes the private sector actors to invest in technologies they normally would not invest in. By tapping into these talents available in the market, the pilots are able to get different perspectives and ideas. This system inspires the participants to take risks on new technologies by improving existing technologies in order to receive the award. This approach is in contrast with the traditional development approach that uses grant models to determine the inputs and processes. The pull mechanism rewards achievement – is an achievement of predefined results without preference to the strategies and the technologies involved in achieving these results.

The Kenya On-Farm Storage Pilot uses the pull mechanism to address post-harvest loss which is a major problem throughout Sub Saharan Africa, which was already mentioned. Annually, there's an estimated \$1.6 billion post-harvest loss caused by spoilage and pests. Large grain bores and other pests significantly damage – cause significant damage in Sub Saharan Africa and play a large role in the amount of loss in the eastern region of Kenya. There are easy solutions to post-harvest loss, but due to market barriers, the solutions are not currently available to smallholder farmers. The high cost in marketing and promotion of storage technologies reduces the incentive for private sector companies to develop affordable solutions for smallholder farmers.

And due to the lack of exposure and limited access to these technologies, smallholder farmers are not aware of the improved storage solutions that can be provided to them. The Kenya On-Farm Storage Pilot has a \$7.5 million prize to create incentives for solvers in the private sector to develop solutions that will increase smallholder farmer income and will improve their overall livelihood. By creating a technologically agnostic framework, Ag Results incentivizes the creation and adaptation of technologies which help catalyze a sustainable market for storage devices for smallholder farmers. The pilot is testing an innovative model of engaging private sector actors to serve the needs of smallholder farmers.

The potential future of applicability to deliver – delivery of other goods and services. The pilot award payment system is based on implementers achieving the pre-determined sales threshold. Pilots have been broken – the pilot has been broken up into two different award payment divisions, and this is divided

by region. The Rift Valley has a mid and end award payment, whereas the eastern region only has one payment at the end of the pilot. This is due to the lead-time required for research and development for a product that is large grain bore proof. To the Rift Valley, the midpoint award is given to the first five implementers that sell up to 21,000 metric tons of storage for any single device.

Each of the five implementers will receive a \$750,000 performance based strand. The award will be proportionally distributed and will be a distribution of \$1 million based on the capacity sold. The end award in the eastern region will also apply to all implementers that sell 21,000 metric tons of storage of any single storage device, and the reward will be proportionally distributed distribution of \$3 million based on the capacity sold.

To calculate the storage sold for a single device, the pilot has created an equation that equals the sales of units multiplied by the storage capacity in kilograms multiplied by the assumed life in years, which equals the minimum threshold of 21,000 metric tons. The technologies currently being used in the pilot are hermetically sealed bags, plastic tanks, and metal silos. Additional technologies may be added throughout the life of the pilot with the addition of new implementers. The storage devices must have a storage capacity between 90 kilograms to 540 kilograms and must be affordable to smallholder farmers.

They must also ensure the pests will be eliminated soon after the storage containers are filled, and that there will not be pest infestation within four to six months of storing the grains. Also, there should be no adverse effect to the grain quality while the grain is being stored. To show an example of the calculations using the useful life of the technology. We'll be using the metal silo. The metal silo has approximately 20 years of useful life and stores up to 540 kilograms of grain. To reach the 21,000 metric tons, there would need to be 2,593 units sold. The pilot activities began in May 2015, and they will continue until July 2018.

The mid and end pilot rewards will be distributed after market surveys are completed, and then implementer sales data are verified, which means the final payout will not take place until 2019. Throughout the life of the project, there will be sales audits and surveys that will help verify sales and also provide market data share for smallholder farmers in each region, which will help calculate the shares for all smallholder farmers. Other times will take place after major harvest, and the sales there will be verified in each audit and will cumulate and track – will be accumulated and tracked by the project management team.

The pilot will set up a multi-verification system as it \_\_\_\_ of implementers' inability to disaggregate sales by specific consumer types, which is caused by the multi-layered distribution and sales networks. Without significant investment and time and money and resources, implementers would not be able to trace the sales of their products. Throughout the life of the project, there will be a

multi-layered verification process that will audit and verify sales reports provided by the implementer. These audits and surveys will help substantiate sales numbers and will also provide market share data for smallholder farmers in each region. And to help calculate the overall sales of smallholder farmers. The secretariat will bring on it an independent verifier which will ensure the number of the sales numbers are correct and to reduce the burden that would be placed on the pilot manager verifier.

By following the verification method, the pilot will be able to determine the allocation of the midpoint and endpoint pilot prizes in each region. The Kenya On-Farm Storage pilot expects to impact approximately 480,000 smallholder farmers and generate at least 172,000 metric tons of storage capacity, which will generate approximately \$14 million in benefits for smallholder farmers. The pilot also expects to see an impact in the implementers by allowing them to set up their products and marketing strategies that can be used after the completion of the pilot. The overall increase in storage capacity will directly impact smallholder farmers by improving their food security, but also giving them the ability to generate income by allowing them to store grain and sell them when the market prices are higher.

The storage will also allow smallholder farmers to store grains until they are needed for personal consumption to reduce the need to purchase grains at high prices. The safely stored maize will also have a higher quality, which will allow smallholder farmers to demand higher prices. With these incentives, farmers will see the benefits of increasing their production. Finally, as previously mentioned, through the improved storage of grains, farmers will also be able to improve their health by reducing the need to spray their stored grains with pesticide. They will also be able to reduce the prevalence of Aflatoxin through properly sealed storage devices that will reduce oxygen available, which will prevent the buildup of Aflatoxin.

*Julie MacCartee:* Great, thank you so much, Parasto. We are transitioning now to our second speaker, Betsy Ness-Edelstein from Abt Associates who will continue a discussion of the external evaluation of the AgResults Kenya On-Farm Storage pilot.

*Betsy Ness-Edelstein:* Thank you. So I am Betsy Ness-Edelstein with Abt Associates. I am part of the external evaluation team for the AgResults Initiative, which is a really exciting position to be in on AgResults in particular because unlike many programs, AgResults actually has learning as part of its log frame as an outcome. It's a really exciting thing to have learning as such a central focus. Usually you have a log frame with development outcomes in it, and then learning is sort of something that's more to the side, and here it's really central. So we're excited to be involved and to be talking about it today. I'll talk a little bit about the AgResults learning agenda to get started, and the evaluation questions that we're addressing. I'll talk about our evaluation timeline and where we are in the

evaluation right now to situate what results we have and what we're still hypothesizing about.

We're talking about the economic theory a little bit behind the AgResults model because that's really the foundation for our evaluation design and how we're looking at how AgResults addresses market failures. Specifically focusing on the Kenya case. I'll talk a little bit more about development hypothesis and expected impacts, elaborating a bit more on what Parasto has been discussing. I'll talk about our evaluation design. I'll touch on how we're addressing some of those evaluation questions. I will present some baseline findings, things that we can address right now that we know now, and then I'll move on to talk about what we're going to be paying close attention to during the pilot, and what we'll be assessing at in line. So the things that we're paying particular attention to. Then I'll end on some early lesson learning around the design and implementation of this type of pull mechanism pilot, focusing on the Kenya case in particular.

Okay, so the AgResults evaluation has seven core evaluation questions, and I'll focus today on just a couple of them. So broadly, I'll start with talking about the impact of AgResults on private sector involvement in the development and uptake of on-farm storage. Put otherwise, what is the impact of AgResults on the market for on-farm storage in Kenya. We'll also talk a little bit about the impact of AgResults on smallholders. That means the impact that AgResults has on their adoption of new technologies, and then also what impact they see from having adopted those new technologies.

Other questions in the AgResults learning agenda concerns sustainability and cost effectiveness, which I won't focus on today, although I'm happy to answer questions as to how we'll address those as we go forward. And then finally, as I said, I'll end by discussing some of the early lessons that we're developing around AgResults, which is a kind of constant work in progress developing these lessons learned as we go. So this is a visual depiction of the timeline of our AgResults evaluation for Kenya. As you can see from the shaded portion, we're just now at the end of our baseline data collection phase. We're now actually processing the baseline data that we got from the field in Kenya. We'll conduct in-line data collection and analysis after the pilot ends in 2018. So for today, since we're still in the baseline phase, we'll mostly be discussing our expectations and hypothesis about the pilot, but obviously, things haven't really happened yet. The pilot has only begun about six months ago, or maybe a little bit more than that.

So we'll be discussing a little bit about the baseline results and where things are right now. But all the findings we present today are still sort of preliminary as we're still analyzing and processing baseline data. But of course, we'd love to come back in three years and tell you all about the final results once we've had a chance to see how the pilot ends and to an in-line impact evaluation and see what the final impact has been on smallholders. So back to the beginning. The

evaluation framework that we're using is really based on the economic perspective of how this – how the total mechanisms are designed to address market failures, which means for one or more reasons, the market has failed to develop. I've got a bubble graphic that's actually not showing up, but I'll tell you it sort of displays the interplay between the low demand for on-farm storage, the low supply of on-farm storage, and policy and institutional environment.

So in Kenya, this is a schematic that we apply to all of the AgResults pilots. In Kenya, we specifically think the demand and supply side are key. The policy and institutional side in Kenya is actually in pretty decent shape when it comes to on-farm storage. There's not really a regulatory barrier to developing that market. But on the demand side, smallholders have a couple of significant constraints to market participation. First of all, there's extremely low awareness of improved on-farm storage technologies, even those that are already available in Kenya. And a couple of them have been available for years and in some cases, even a decade or more. But awareness is low, and awareness is also low of post-harvest issues and post-harvest management more broadly.

That includes not only storage devices, but different practices and things that they can do to mitigate post-harvest loss. Second, and also very importantly, farmers are constrained in their liquidity. They don't have funds necessarily to purchase expensive new products, and their credit constraints, there aren't good loan products for farmers to purchase these technologies that have been developed. Then on the supply side, the main constraint for firms is the upfront investment that they have to make to create that awareness and set up marketing and distribution. The AgResults incentive comes in to operate really only at the supply side, the idea being that upfront investment barrier will be mitigated by the prize at the end.

And the idea is that these firms are savvy and they have resources that they can draw upon to address the constraints that smallholders face. So AgResults does not address the smallholder part of the puzzle directly. They are leaving it to the firms to figure out strategies to reach smallholders. If the pilot works as planned, then smallholders will become aware and start to adopt these technologies in a sustainable market for on-farm storage will have been created. So this is the theoretical model of how things will unfold.

So I'll go in a little bit deeper into the development hypothesis of how we think that things may unfold in practice. Parasto touched on this at the end of her talk, but when we go and design our evaluation, the first step is to do a lot of formative research. So the early activities involve doing an extensive set of desk research and also going to Kenya, and we did a lot of interviews with farmers to understand their activities and practices and refine our understanding of the pilots' expected impact by gathering qualitative data about their current activities and how they're likely to respond to the private sector market for on-farm storage.

So on the left here, we talk about the market impact that we expect to see, and that's largely in line with what we were discussing earlier that firms will invest in product development and marketing, will work hard to strengthen their distribution networks and create those networks if it's a firm that's new to Kenya. And we actually are seeing that already. The firms are starting to engage in that way. And it's our expectation that because they are making those investments and are going to see a profitable market in Kenya, they will continue to market and sell these technologies after the pilots conclude. That's really key.

The pilot is not only aiming to put on-farm storage into the hands of smallholders while it's going on. It's seeking to create a sustainable market. So the smallholder impact side is similar to what we discussed in the expected impact slide just now, but we've also refined some of those expectations based on our formative research a little bit. So absolutely we think we're going to see a gain in smallholders' awareness of post-harvest loss issues and on-farm storage technologies. We do think we're going to see a lot of purchasing of on-farm storage technologies, especially better off smallholders, and I say that because we know that these are expensive technologies for smallholders to purchase.

Their normal storage bags, if they do purchase them, are usually about 50 Kenya shillings. The cheapest of the new technologies is about 300 shillings, and at 100 shillings to the dollar, that still seems fairly cheap. But if you think about it from the smallholder perspective, that's about six times what they're used to paying. So they really have to see that these are effective and they have to know there's going to be value for them down the road if they invest in these that they're actually going to save grain and it will benefit – sorry, that it will benefit them in the long run. We also are expecting to see reduced food insecurity, and we think that's going to be one of the really key areas of improvement for farmers.

In food security terms, we see that as improved availability with fewer or shorter periods of lean consumption and smoother food stock and less running out of maize at the end of their season or right before their next lending season. We also, as Parasto mentioned, went and spoke with farmers. One thing we didn't actually expect when we started doing formative research is farmers, when we presented the idea of improved on-farm storage is that one of the things that's really interesting to them is that they may be able to store without using pesticide dust, and that was something that wasn't a huge focus in the original business plan for AgResults, but turned out to be really important to farmers.

They know that pesticides may be harmful to their health. They know that they may not be using them correctly, and they told us this is an interesting type of technology for the maize that they keep for consumption. Maize is a staple crop in Kenya, so farmers tend to keep a lot of their maize for consumption, and that's really appealing to them because they think pesticides are harmful to

their family, and they're looking forward to not having to use pesticides or to using less of them. One thing we don't necessarily expect to see, at least in the short-term, is a change in their maize sales patterns. That's because, like I said, farmers are first of all very consumption oriented in the parts of Kenya that we're talking about, particularly the smallholder famers.

And also because they often tend to sell at the time that they do for reasons that are unconnected to the market or to fear of storage losses. So when you ask them, "Why did you make the sale at this time," they give reasons like, "I needed the cash for school fees," or, "To pay off a certain loan." Or they say that's when a trader comes to buy. They don't necessarily have the means to transport maize themselves, so when a trader comes to the front gate and says, "I'll purchase the maize from you today at the price that it goes for today," that's when they sell and that's why they sell at that time. So in food security terms, the access piece is something we don't necessarily expect to move in the short-term, and we think that we may be able to see changes in the longer-term as farmers start to get used to the idea of storing longer and they see a little bit more flexibility in the market because of that. But we will definitely keep track of that to see how it pans out in the short-term.

So I won't focus too much in detail the – on evaluation design, and I know that most people are – I know most people in the audience are agriculture folks and not evaluation folks, but I will just touch on this, and I'm happy to answer questions later if people have them. First, on the evaluation design for the market impact side of things, we based our evaluation on a structure conduct performance framework, which has a graphic that you can't see unfortunately. But basically, it's a theoretical framework that describes how markets and value chains function.

So the structure of the market includes things like regulatory conditions, underlying numbers and types of market actors. The conduct is the way that firms engage in the market, and then performance is the extent to which the market is functioning well, the way that firms are performing, and then the AgResults pilot to which the market resolves underlying problems targeted by AgResults. So in terms of data, we're using a lot of qualitative data in conversations with the market actors, as well as secondary data with things like prices and inputs, things like that.

So moving onto the smallholder impact evaluation, this is a sort of basic schematic that shows how our evaluation design is going to work. We're using a quasi-experimental design called Interrupted Time Series. Often in impact evaluation, it has a control or comparison group that people are probably thinking of right now. So that would be comprised of non-beneficiaries, against which you would compare the treatment group. In Kenya, we found that AgResults is operating in most of the major maize growing areas of Kenya, which makes a lot of sense. It's a private sector market. You want firms to be able to

operate in the places that are going to be most profitable to them. So it doesn't make sense to restrict their ability to sell in places where people might want to buy from them.

Other maize growing areas that are outside of the pilot areas we could have used as a comparison group, but we found that they were very different from the AgResults areas in important ways, like the size of farms or the commercial orientation of farmers. So we decided they weren't really a good comparison group, and we decided actually not to use a comparison group of farmers at all, but instead to opt for this interrupted time series design. This means we're using multiple pre and post data points before and after the intervention to construct a time trend.

So you can see on the left hand side of that diagram, there's a solid line that shows the time trend, and then after the pilots start, we expect to see a jump in the adoption of new technologies, in food security, and things like that. So that's represented by that green bracket. Then the dotted line on the right side is a projection of what the time trend might look like. This is just a simplified diagram to show the intuition behind their design. In reality, the trend lines might not be straight, they may have different slopes. This is something we're actually going to go and measure once we – once the pilot has finished. So we've done our baseline and we have those pre-intervention points already, collected data on those, and then we'll go back after the end of the pilot and collect data to see what actually happens.

And I'll just mention briefly we are also collecting data on what we call an unaffected outcome, and that's maize yields. That's something we think is going to be influenced by everything that influences the pilot. So things like rainfall and all those things that affect farmers will also affect maize yields. And it shows us something of a comparison. I just want to mention that, but we'll not depict it here because it's going to add another layer of complexity, and I think people probably want to move on to hear about findings.

So baseline findings are not surprisingly, we see a strong expected willingness to engage in this market, and we know that firms have been interested for a long time in entering the Kenyan market has been a little bit daunted by the investment, but we've already seen that they're starting to engage and that they're excited about it. Their strategies, we think, are going to be largely distribute through farmers, organizations, and commercial distributors. And those are things that they've done in the past. They find it a lot easier to partner with organizations that are closer to farmers directly rather than doing direct sales or another model. We think they're going to focus on established or high potential markets, which is not surprising.

They're private sector firms and it's certainly their prerogative to go to the places where they think they're going to have the most success right away. They're trying to sell a lot of storage quickly. We have heard from them there

might be a possible preference or risk value over eastern, potentially partly because of the incentive structure that Parasto went through earlier, but also because larger grain borer is a lot more prevalent in eastern, and so farmers have a bigger challenge in the technologies developed for eastern have to be LGB proof, and that's another challenge. Then finally, we see that the private sector may not reach the most disadvantaged buyers, including women, and that's not to say that it necessarily is set up to do that.

It is maybe by design that slightly better off farmers may be participating, but we will be looking at how things roll out if slightly better off farmers are the early adopters. We're going to be looking at how technologies then disperse into those less advantaged groups. On the smallholder side, uptake and awareness surprisingly are low even among those products that are already on the market, and there are quite a few of them that have been in Kenya for a little while already. We see less than five percent uptake in both of those regions. Smallholders just haven't been purchasing them yet, and most of the technologies that farmers do have, if they have these already, have been distributed by various NGOs or other organizations, religious groups that have been promoting them or subsidizing them.

And they have not actually been purchasing them for the most part. There is a little bit of an upward trend, though, in both regions for all of the on-farm storage, so it's true that they're already starting to see a little bit of an increase, although like I said, the rate of adoption so far is very low. Less than five percent in those places. So moving on to the impact, what we're really going to be looking for. First, will the private sector successfully address smallholder awareness and financing constraints? We mentioned this is a really important component earlier that smallholders are constrained and AgResults rely pretty much entirely on the private sector to figure out how to get them the ability to purchase these technologies.

Some of them are talking to banks, trying to partner with banks to create loan products that would apply directly to their products. But we're going to have to see how this plays out. Farmers need to be convinced that the investment is worth it, and if they don't have the cash, firms need to work with them to figure out how they're going to purchase these products. Second, will smallholders use the new technologies properly and effectively? Something we haven't talked too much about today is that grain needs to be in good condition before you store it for the storage to be effective. The grain has to be clean, it has to be dry to the right moisture content before you even load it into the bags. So you can see in this photo, there's a PICS bag, which is one of the storage technologies in AgResults, and it's tied up correctly. You can see that it is in a raised granary, so it's raised off the ground, which is good. Helps to prevent rodents and things from getting in. But it is sort of in a pile of various things, and maybe not exactly the best storage practice.

So that's something that farmers are going to have to really pay attention to is not only putting it in the bag, but then storing these technologies in the right conditions. Farmers also tend to want to use these bags for the grain they will consume. So what does that mean in practice? It means that they're going to be going into that grain bag and removing maize to go to the miller as they need it. So they're going to actually be opening and closing these bags on a regular basis. That's not really the laboratory condition. So it remains to be seen how that's going to affect the effectiveness of the technologies when farmers are going in and opening them up. Do insects get in? Do we have other problems? That's something we're going to look at closely.

Then like I said, the pilot is not designed to reach disadvantaged groups, but we really want to look at how this rolls out. If larger, better off farmers are the early adopters, will there be uptake by disadvantaged groups later on once they see technologies being affected? Will people start to pick things up once they become more commonplace? We're really excited to see what happens there. And then finally, since smallholders are still consumption oriented, farmers are motivated by their cash needs mostly or their trader timing, so we're going to of course be looking to see if there's an impact on the timing of their maize sales, of the prices they receive, and their revenue.

So finally, I will end just briefly on some early lessons that we're learning, and I want to emphasize that this is all our work in progress thoughts on what we're seeing so far. This is still a pretty new pilot, and we're going to be paying lots of attention as it rolls forward. But so far, one of the first things that we think is really important and that we're seeing in Kenya is to understand what the key market failure really is. So AgResults cannot address every part of the market failure, so we have to anticipate what market failures the pull may not address, and in Kenya, it's set up I think very well. The private sector is interested already. We know that. They're daunted by the upfront investment, but to move onto that second point, Kenya is targeting private sector firms that do have the ability to address the other constraints that caused the market failures. So these firms have access to financing, even though the prize comes at the end if they need financing. These are large firms that do have access to other types of financing to pay for their upfront investments.

They have the ability, they're savvy, to market and distribute new technology. They know how to set up distribution networks. And they want to. And they have the ability to address smallholder constraints. They know how to partner with firms to do awareness creation. Sorry, to partner with NGOs or with government entities to do awareness creation. They are working with banks to try and figure out financing options. Some of them may finance some of these products directly. We're waiting to see how they end up doing it, but they are being creative, and we can see that they're up to this challenge we think.

Another lesson learned is that there is going to be a trade off in the design between development impact and market impact. So a lot of us in the development community are used to thinking, first and foremost, about the poorest beneficiaries. A pull mechanism has a challenge in reaching the poorest beneficiaries because there's a competing interest in developing a sustainable market through the private sector. The private sector has to feel like they are going to be able to do that. They have to feel like there's something in it for them, and that they can do this quickly, and reasonably easily. So we need to realize that building a sustainable market may not be able to fully focus on the poorest of the poor, that private sector firms may need to address better our farmers first.

Then there's the issue of designing the right incentive. So obviously, it has to be adequate to attract that private sector participation. So in Kenya, that seems to be playing out nicely, the private sector is clearly by their participation showing that they think that the incentive that they're going to be eligible for is enough to offset the risk or upfront investments that they have to make. The incentive has to be cost effective, and when I say that, we're thinking about cost effectiveness against what a push mechanism would be.

So the cost of doing a pull mechanism extend to not only the payout, but also to the administrative and verification cost. When we talk about incentive design, in Kenya, the incentive is limited to smallholder farmers. So not all sales will count, and that means that verification can be very expensive and complex. As you heard about before, verification becomes more complex, and therefore more expensive the more you add conditions onto what the incentive is designed to cover. So we want to always kind of balance that development and market impact piece. And then finally, there's always this question to push or not to push.

We all want the pilot to succeed. We all want to see smallholders access technologies that will benefit them, and we really do want that sustainable market to develop. We wouldn't be here if we didn't, but we have to be a little bit hands off to see if this pull mechanism is going to work. Especially since AgResults is operating through pilots and this hasn't really been tried in agriculture very much before. So really, we want to see if the pilot can succeed without a lot of push. In Kenya, there is not a lot of push going on. There is some LGB testing of the technologies, but for the most part, AgResults is not doing any broad based awareness campaigns, anything like that, even though the private sector wants push downs – I'm sure the private sector would love, and they've told us, "We would love you to come out and raise awareness about post-harvest issues in general, things that would help us to market our technologies."

AgResults is not doing that. And implementers, the firms are still responding, they're still being creative, and they're figuring it out. So it's important to stand

strong and let the private sector do this itself, even though they may be used to getting donor funds or getting subsidies in the past for the same products and maybe even in the same country saying, "You're going to be able to figure this out," and then being a little bit hands off seems to be working well in Kenya. So with that, I think Kenya is a great test case for pull mechanisms, and thanks everybody for letting me discuss for a little bit, and I'm happy to take questions.

*Julie MacCartee:*

Thank you so much, Betsy. That was very interesting, and I think your lesson points definitely addressed a lot of the questions that have come in through the chat box. But we have had a lot of questions, so we'll hopefully get to as many as we can. We would like to invite a special guest to give the first response, first question, and that is Bob Rabatsky, who is director of the Feed the Future Partnering for Innovation Program.

*Bob Rabatsky:*

Thanks for that introduction and the opportunity to provide a few comments and a kickoff question. Hello to many of you that I know out in the chat room. Happy 2016. It's great to see that you're all involved in this particular presentation. And thanks a lot to the presenters. Wonderful points made by all, and certainly highlighting a big challenge not only in Kenya, but obviously facing smallholder farmers worldwide, and that's just generally how you protect your investment in producing food and make sure that it gets to market in good condition.

Obviously a huge problem in Sub Saharan Africa, you know, multi-billion dollar problem, losing 14 percent or 15 percent on average of grains is – that's significant. So that presents a very good opportunity for companies who are trying to enter this market and sell products. I agree with Betsy when she said Kenya is a really good country to try this out. You know, it's got a decent private sector oriented policy environment. It's business friendly. There are an amazing number of innovators and small businesses starting up. They don't call it the Silicon Savannah for nothing. I think that the smallholder sector there is probably as advanced as you'll find smallholder sectors in the countries where we work with Feed the Future, a thriving ag sector, and they have a good network of just distributors who can get technology like this out to farmers on a commercial basis.

And I know you were talking about how you pushed this technology, how do farmers learn about this, and I think that this is really, really a critical issue that your program, my program is also trying to address through their partners, and it represents a huge upfront cost. There is very little extension going on, and so any kind of training needs to be done by these companies who are really offering the technology or by donor projects or other projects that have an interest in promoting it. So smallholder farmers, generally speaking, will invest in technology, in better technology, but they need to be shown the benefits of it over the cost.

And for these three systems that I think I think were presented today, that's a very important point. The storage bags are very low cost. They don't necessarily – they won't get the longevity that the plastic or metal containers will, so they may lose points on that one in your evaluation, but still, it makes it very accessible to small farmers, although \$3.00 is a lot to spend upfront. You can show these farmers where that \$3.00 investment will pay off quickly, and that's very important for anyone promoting the technology. And price is very, very important. So you know, it'd be interesting to see how your partners are addressing price and affordability of the product, which is a key factor.

And there are strategies you can use to address affordability. So you don't necessarily have to sell a product outright. You can do some sort of barter or exchange. There's certainly financing available, although in Kenya, financing is quite expensive these days, 18 to 20 percent interest, and not necessarily available to small farmers. Rental and leasing ideas or pay per use could also be explored. There are companies trying this with other technologies, solar panels and things like that, and since these are portable devices, if someone is not paying their monthly rent on the device, it's easy to come in and take it away.

And also maybe for the more expensive ones, you could look at aggregation points and selling to community groups instead of to individuals. So I guess I'll sum up there and put the first question out there because there are a lot of very good questions in the chat box. I understand that you're paying – you're incentivizing these companies through sales and payments based on those sales, but I didn't hear that there was any kind of upfront investment being made. So how are the companies actually doing this education, getting this word out that these products are beneficial, and therefore creating market demand? You know, outright advertising in marketing strategies and education. These are really important when you're introducing new technologies, and I'm curious to learn more how that is being done. I'll leave it at there, thanks.

*Julie MacCartee:* Great, thank you, Bob. To our speakers, would you be able to address Bob's question about education?

*Betsy Ness-Edelstein:* The firms are in large part not planning necessarily to do this themselves. They're using established networks and, in some cases, government entities with already firm relationships with farmers. They're working with NGOs. They I think are planning some various campaigns for you and things like that. But I don't know. Parasto, you wanted to add anything?

*Parasto Hamed:* Yeah, from what we've been told, they're going to be working with the sales – most of the equipment are being distributed to sales points. So I think it's –