

RESEARCH FOR DEVELOPMENT: HOW THREE INNOVATION LABS ARE DRIVING IMPACT

PRESENTATION TRANSCRIPT

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Ahmed Kablan:

Hello everyone. Thank you for joining us today at this webinar, where we're looking at how we have three examples or three innovation labs driving innovation and just wanting to achieve the global food strategy. Today we have three innovation lab, as Julie mentioned, the Nutrition Innovation ... Feed the Future Innovation Lab for Nutrition, Soybean Innovation Lab, and the Post-Harvest Loss Reduction Innovation Lab. But basing in this webinar, and we will begin this series of webinars where we will be looking ... where we looked first an in person meeting in DC at how this innovation lab are driving impact. And today we are targeting the audience from outside DC and in the field and in the mission. And the goal of this is to see how they are ... these innovation labs, are research programs, and together they present how the US university and ... responding and driving the goals of the US global food security strategy, and enhancing in-country capacity to improve food security, nutrition, and women empowerment.

We will have three speakers from the Nutrition Innovation Lab. We have Dr. Patrick Webb, and we have slides as you can see his ... yeah, his bio from on the slide. Dr. Webb is a professor at Friedman School of Nutrition at Tufts University. He's the director of the Feed the Future Innovation Lab for Nutrition. He's also principal investigator for the food for peace and the food aid quality review.

We also have with us, Dr. Peter Goldsmith, who is the director of the Feed the Future Innovation Lab for Soybean, value chain at the University of Illinois. Also, Dr. Goldsmith is currently director for Food and Agribusiness Management program at the University of Illinois, and a fellow of the International Food and Agribusiness Management Association.

We also we have with us Miss Dena Bunnell from the Feed the Future Innovation Lab for Post-Harvest Loss Reduction. She's the program coordinator for Post-Harvest Loss at the Kansas State University. Previously she worked as Agriculture Advisor at USDA, FAS Foreign Ag services in Kabul, and she has a Master International Agriculture Development from the University of Davis.

And, as Julie mentioned, if you have any question or comments, please post it on the chat box. And now, I will leave it to the first speaker, Dr. Patrick Webb.

Patrick Webb:

Thanks you, Ahmed. And hello everyone. Let me know if I'm not talking loudly enough. I note that there's at least one person joining from Africa, not North America, so kudos there. And we hope others will join from around the world.

I'm the director for the Innovation Lab for Nutrition. And in a very short 15 minutes I have, I want to communicate that nutrition is fundamental everything that USAID is doing, but not just in terms of the outcomes of interest, like child stunting or maternal anemia that are within the monitoring and evaluation framework. Nutrition, as many of you know, cuts across many other domains, especially domains like gender, like wash, like education, in achieving improved nutrition through not just healthy diets, but also improved caring practices and behaviors relating to choice of water sources and so on. These all matter to nutrition.

But what I'm really gonna focus on here is how nutrition also runs along the entire value chain. So while our work in the nutrition lab is not focused on individual commodities, because they happen to be nutritious, say animal source foods, or millets or pulses. What we are focused on is how investments in improving on the farm practices and storage post-harvest and transformation of foods, how all of those also can relate to nutrition, and how attention to certain concerns in nutrition ... the main one I'm gonna focus on is food safety in the context of mycotoxins ... natural molds in foods ... how those kind of concerns about the quality and safety of foods that people eat very closely links up the research and programmatic concerns of nutrition, but also post-harvest losses, the various ag research agendas, farm improvements, and so on.

So let me quickly go across broadly, and then narrow down. Huge strides being made in reducing all forms of stunting, let's say, and to some extent wasting. But the circle here points that, while we are making some progress in reducing child stunting, okay, it's not fast enough, there is a huge growth in malnutrition, malnutrition in all its forms, if you factor in the growing overweight and obesity, and the persistence of large scale micronutrient deficiencies, particularly iron deficiencies anemia, Vitamin A deficiencies, zinc and so on. So, when we talk nutrition, we've got to understand that there are many forms of nutrition, that while quality of diets is actually an underpinning of all of these forms, it's not the only contributor or any solution, but it's one of, that we have to tailor programming in our thinking and our research to be able to address these very large numbers of affected.

Now the global food security strategy is very clear that there are links across from food based or agriculture led economic growth, which makes certain kinds of food more available or more affordable or more accessible. So there's a whole bolus, the green circle there, of research and programming activities seeking to achieve that. It has to be linked to an environment in which policies and programs strengthen the

resilience of food systems, of communities of individuals to better manage risks of many kinds, of shocks, and climate change and so on, the blue circle. And then the orange circle sees a well nourished population not just as an outcome, but an input to the first two. So, we need to find ways to achieve minimal, minimally nutritious diets that are affordable. We need to make sure they're safe. We need to make sure that people are knowledgeable and able to act in ways that improve nutrition overall.

So those three circles map out the three main themes of the Nutrition Innovation Lab, which cuts across that large research strategic agenda of USA and it's partners. And one is how do we better understand the kinds of investments and the kinds of programming that are supportive of agriculture, to have positive impacts on nutrition and reduced negative impacts on nutrition. So nutrition sensitive programming, I think, in the sense, and multi sector interventions, large scale or scaled up activities that try to improve both diets and nutrition through an agricultural lens. So we're doing research on that.

We also do research on the policy environments, the kinds of policies that countries need, but especially the capacities, capabilities, incentives, disincentives for civil servants and other agents of change to implement those policies in ways that can promote agricultural, but also reduce vulnerability to shocks and improve resilience.

And then thirdly, I use the term biological mechanisms, but really to point out that nutrition isn't just about food or nutrients, it's about what our human bodies do with those. And we need, actually, to know a lot more than we do, given that we're not concerned with all forms of malnutrition, not just one or other in silos.

The Nutrition Innovation Lab has four focus countries, particular Nepal and Uganda, but we also have a large research, operations research programming in Bangladesh, and working in Malawi. We have additional activities in green which are other countries around the world where targets of opportunity, largely driven by the missions themselves, have led to either individual studies or ongoing engagement, both in Southeast Asia and Africa, and actively exploring additional new study sites in places like Cambodia, Afghanistan, and Mozambique. So, we're Africa and Asia, obviously, but with very distinct focus in a few countries. I have a red circle around Nepal because that's the one I'm going to focus on in this case, simply because a lack of time.

Now in Nepal, it's not just one study, it's not just one issue that is being addressed. That's the same with the other countries. I'm just showing here that we have research in 26 ... at least 26 locations across Nepal which, in effect, represent a

research that allows us to explore in quite some depth, complex issues that require us to be in situ, interacting with, in this case in Nepal, close to 4000 households from one year to the next. So we're doing longitudinal panel surveys that address agricultural investments and those impacts on diets, livelihoods, and nutrition. We're looking ... there are different colors, you can see, in the legend and on the map, that different kinds of programs, some supported by USAID, others by other donors, that will have impacts on what is happening at the household level in terms of investment choices, and the ability to impact on nutrition.

A lot of that is longitudinal, a lot of that is trying to track improvements in birth outcomes, in stunting, wasting, in maternal BMI, and so on, in relation to the kinds of Ag programming, the kinds of choices made with agricultural outputs. Do they ... do have ... choose to eat these commodities or sell them. Or is it better to specialize or to diversify? Many of the key questions in nutrition sensitive agriculture are directly being addressed through this research. But I want to focus that little circle, again, red circle in the southwest, one specific study in Banki district which is looking at mycotoxins, it's looking at aflatoxins, which we know are naturally occurring molds that occur on maize and peanuts and peppers, and many other foods, including rice. These are natural toxins that are highly carcinogen. But there is a lot of attention, these days, to the potential for mycotoxins to be affecting birth outcomes, and then linear growth of children.

So what we're looking for in this study, we're following 1600 women through their pregnancies to look at the effect of aflatoxin in their blood. So, through their diet, what are the rates of aflatoxin in their blood? Does that correlate with birth outcomes? And do those birth outcomes then correlate with the growth of children, so we can actually finally better understand if aflatoxins play a role, or not, in stunting through various mechanisms.

So, this particular graph simply shows AFB-1, that's aflatoxin. And the levels in that location in Nepal are clearly way higher at certain times in the year, the December period onwards into spring, which is several months after harvest, and significantly different from the period pre harvest and during harvest. And all that says ... suggests at this point ... is that the households we're looking at, 1648 households, the levels of aflatoxin in the blood of the women in those households is highly correlated by season, which suggests they are consuming foods that have been stored for many months, already.

So we'll be teasing out to what extent where the levels of ... is that relating to poor farm management, to poor choices about what to store, and how to store it. But

then what you do if you have moldy foods in your store, what happens to that? What do you do? Do you eat it? Do you feed it to your cattle? Do you destroy it? Do you sell it. We have a problem, because the rates of exposure in these women, these pregnant women, or these women at pregnancy is extremely high. About 94 percent of the women in this sample have detectable levels of aflatoxin in their blood.

What I'm showing here is that actually the levels are highest among the younger women who are pregnant. So we're seeing a lot of pregnancies among what we would call adolescent girls, and that is pretty significant, potentially affecting not only their own health and nutrition, but it may be affecting the first birth of many of these young women. And we have to understand why is that? Is it because there are certain food restrictions that are forcing them to eat the aflatoxin laden foods? Are they eating foods in the fields that others are not? These are things that we need to tease out. But there is clearly a problem here, and we have to focus on aflatoxin among all pregnant women, but especially in the younger ages.

We have ... these are not publish data yet. These are just hot off the press from a sub sample. We are seeing that there is a statistically significant correlation between rates of aflatoxin in the blood of the mothers during pregnancy, and low birth weight. So there is a correlation with birth outcomes at the five percent level. We're still exploring the data, but this is one of the first prospective findings that we can ... as opposed to cross sectional ... that we can report on this. So I think it really linked the agriculture and food systems issues around aflatoxin with the human concerns. And we need to find ways to address this, as a human problem in relation to nutrition.

With multivariate analysis, I'll be very ... stopping very quickly ... the odds of having a low birth weight influence, they include short maternal stature, being a girl. But they also include having high rates of aflatoxin in the blood. Even once you account for all the covariants, it's still a significant parameter, when counting the other things. Improved education, improved diet diversity, improved status of the mother, they all seem to be correlated with less risk of low birth weight. But the point here, low birth weight is correlated with, independently and significantly with aflatoxin in the blood.

Just a final one, actually jumping to Uganda, we also have found that infants in Uganda from mothers who had both ... were both HIV positive and high rates of aflatoxin, had significantly lower rate of Aids or stunting, higher stunting, than those who were born of women who were HIV negative. So there's something here

linking the food coming from the field, stored, with what certain categories of women consume, and their own health and behavior, and then the outcomes and the stunting of their children. This means we need to be very careful about what we do in promoting certain kinds of crops. We need to be very careful about farm management and storage.

Finally, environmental enteropathy is linked to this, as to other kinds of problems. Don't worry too much about the slide. The point is here that looking at the leaky gut of 40 children almost in Uganda found of quite variety of outcomes, 21 percent with no leaky gut, but 22 percent for the year. Interestingly, those households where the children had the leakiest guts, were ones that allowed sheep and goats wandering around inside their home, sometimes slept inside their home. And that was correlated with higher stunting and wasting which, again, suggests something about the environment, and the food system ... in this case livestock system ... that children are growing up in.

So the final points, agriculture productivity, we need ... they are important, absolutely important to resolve all forms of malnutrition. But at the same time, they are only part of the solution, and we have to understand how that part of the solution carries risks or threats that are health based. They are driven through the mycotoxins that come through the food supply. They affect wash, they are affecting pathogens that are brought in with livestock. So even if there are more nutritious crops available, or animal source foods available, we need to better understand how vulnerable populations eat those kinds of foods, and how their bodies absorb or not, the kinds of foods to achieve the kinds of results we want to see. Lower stunting, lower anemia, lower, higher MUAC BMI for women. This matters immensely for all of the goals of the global food security strategy. And I will stop there.

Adam S: All right. Thank you so much, Patrick. That was great. Peter, it's over to you, now.

Peter Goldsmith: Hello. I think it's working now.

Julie MacCartee: Yes, Peter. We can hear you now.

Peter Goldsmith:

Hey, thank you so much for inviting me and the team from the Soybean Innovation Lab to participate in this great event. My talk today, they asked us to speak for about 15 minutes. We'll focus ... I really want to think about strategy, and think about the global food security strategy, obviously following from the feed the future strategy, about how innovation labs have redefined themselves, and how they have made themselves, per the strategy, much more relevant to really drove impact. And I'm gonna use SIL, the Soybean Innovation Lab, as an example, and then two just brief case studies of two of our lead researchers and their work to give you a sense of what this new model looks like. So, do have your ears alert to a strategic shift, and a redesign, which is what I'm going to describe.

So, I will provide a brief overview of the Soybean Innovation Lab. But really my focus is how SIL's an expression of the feed the future and the global food security strategies. And we're matching what we've explicitly designed and oriented ourselves to match evidence in technology, which is what the global food strategy feels is necessary, a greater use of evidence, but also blending it with development pace. University, instead of sitting further in the background doing longer term studies, is really trying to match development's pace, and be relevant to the practitioner on the ground.

So the first walk away is that USAID, via the SIL model, has found that sweet spot for integrating sorely needed evidence and robust findings directly piped into, in real time, the development system. That's through partnerships directly with practitioners. And the second walk away for my university friends and administrators is I think we've found a way for universities to have a structure and provide structure and strategic guidance on how to become directly engaged in the development system. So we move away from this periphery where we've traditionally been on training graduate students, improving university institutions, which all very important, contributing long cycle research, also very important. But this is a new role, an additional role. So that's a quick, the walk aways for today's talk.

The innovation lab, SIL, is in its fourth year. University of Illinois is the lead. We're partnered with Mississippi State University, University of Missouri, and the International Institute for Tropical Ag in Ibadan. What we do, our mission is to establish a foundation for soybean development in the developing world, principally Africa. So we provide technical knowledge, and associated, appropriate technologies to make successful those trying to develop soybean in emerging markets. So we don't work with farmers, we work with researchers, extensionists, the private sector, contractors, NGOs, who, of course, many of whom are working with farmers, helping them be successful. There's a lot of interest in developing soybean. SIL sits

in the background providing the technology and evidence to help those practitioners be successful. Our expertise is very narrow. We stick to our knitting. We focus on producing and utilizing soybean in the tropics. That's what we do well.

Our scope, we focus on the soybean value chain. So we focus from inputs, inoculum, and so forth, all the way through livestock and human nutrition. We started out when we initiated the project in five countries. We're now in 13 countries, working in partnership with the private sector, with contractors, USAID mission contractors, local NGOs, et cetera.

So, just to step back a bit, and these are large documents, and I'm sure some have read them who are ... it's important in their jobs. But many of us have not. And there's explicit strategies that drive what we do at the Innovation Labs, how we're designed, and what we're meant to accomplish. And originally, when we started, there was the feed the future strategy, and the global food security strategy. What these ... when they ... when these spoke to the labs, they're strategies for a variety of mechanisms USAID employs, but the labs, it was about research for development. How the research and the expertise that we have at the universities can be relevant and improve development outcomes. And the strategies explicitly are calling, as well as independent reviews from the National Science Foundation, for greater evidence to be deployed in the development programs. Rather than just initiating a development project, try to base them on evidence, fact, and precedent, and proven mechanisms and process. So that's what the strategy is urging the development system, but also guidance for the innovation labs.

And SIL, as an example, the soybean as an example, these are some slides showing just the tremendous demand for soy, the tremendous growth for soybean globally. The upper left graph just shows that soybean has been the fastest growing crop the last 20 years, about a third faster than the next crop, which is rape canola. So there's tremendous interest. The right hand slide, the map is a lot of soybean development in Latin America, and a lot of work has shown that there's great potential for soy in Africa, as well. And then the below slide is some price data that we work with in Ghana, just showing the strength of prices in Africa. The prices are very strong. That deep red line is the price in Chicago, and the other lines are local prices in Ghana. So prices are very good. So demand is very good. And this caused back, a number of years ago, a lot of interest in using soy as a development mechanism, to drive economic development, to reduce poverty and reduce malnutrition.

But, in the enthusiasm to develop soy, there was a lack of evidence used. So a lot of the projects struggled, yields remained low, and so USAID very smartly, back in

2012, initiated an RFP which was an attempt to get the evidence horse back in front of the development cart. And that's where SIL comes in, and that's the genesis of the Soybean Innovation Lab.

We explicitly designed SIL with ten key tactical approaches. This is listening to what the GFSS research for development strategies were asking us. We designed our model appropriately. So SIL only works through partnerships with practitioners. All of our work is in-country, meaning in Africa. We're also in Pakistan and Indonesia. We work only in partnerships in-country.

These are faculty who run these programs. These aren't generalists, these aren't temporary contractors and so forth. These are faculty who have spent a lifetime working in a particular area. They directly engage the practitioners, which is a real treat, a real nice relationship, especially for the faculty engaging with practitioners in that hands on experience, and that feedback, but also the practitioners to have real expertise right at their fingertips. These specialist faculty members ... you're gonna meet two of them a little bit later ... write proposals, manage the projects, are actively engaged in-country. And this is a very exciting role for them, and for the labs and universities historically a different role.

We're very good listeners. Because we partner, we listen, we listen, we listen, we listen, first, second, and third, and we're very much needs driven. What skills can we brought to solve the practitioner's problem? We're very grounded. We're on the ground with our partners, addressing the problems that they pose to us. We're very much sustained and focused and engaged with our partners. These are not short term projects. These are long term. We've now been three and a half years, and we've really built very strong relationships, as mentors, teachers, and trainers.

We deliver very applied research. We're not about publications. We're about servicing the needs of our practitioner clients who are trying to develop soybean, whether they be a researcher at a NAR, as an extensionist, or private sector firm. And we value the disciplines. We have plant breeders, we have nutritionists, we have economists, we have anthropologists, working with disciplinary strength in a multidisciplinary setting. So we cluster activities, and we think this is very important. You don't just pop in and pop out in lots of locations. We're very clustered so that the ... we get good feedback, and learning, and the different disciplines learn from each other. So we think these are good ten ... ten good rules for how an innovation lab can have impact directly with their practitioner partners.

We have a organizational structure. These are ... you're not meant to read these ...

but these different colors are a sample of the kind of partners that each of our discipline area programs has. They only work through partnerships. Lots of partnerships.

These are faculty lead units, as I mentioned. Our innovation lab is not a granting organization. In the past, some of the labs and the, are granting organizations. SIL is not. This is a managed program, executing strategy through ten business units. So we have a common culture, and present a common culture to our client practitioners. And the lesson is that universities can be responsive to development needs, and bring to bear the expertise of leading faculty. So it's pretty cool.

Let me give you two examples before I close out. Dr. Ragsdale is at Mississippi State University. She heads up our managed research area seven, which is women's empowerment and gender. She's a professor, she's an anthropologist, just a tremendous faculty member down at MSU. She partners with Catholic Relief Services, and she's really answering a fundamental question that practitioners struggle with, because gender is such an important issue in agriculture.

When you introduce a crop like soybean, which is very different from a native staple, it is going to have significant disruptive effects on the social fabric of, whether it be the household, the household economy, communities, because markets are so important. Technology is transferred from private sector, and as well as extensionists, which are male dominated. Mechanization becomes important because scale is necessary for small holders to compete. And women's integration with mechanization is not well understood. So this, introducing a commercial crop, soybean, is normatively very different than working with native staples. And that's what Dr. Ragsdale, her body of work, and her collaboration, and her partnership is meant to guide practitioners and help them achieve gender balance, and be gender sensitive because soy is not a traditional crop, and well understood, especially from a social or anthropological sense. So that's Dr. Ragsdale.

And finally, I give you an example of Dr. Andrade, who's a nutritionist. He leads our managed research area five on human nutrition. He partners with the Catholic Relief Services, with University for Development Studies, a university in northern Ghana. And he's working with a pre commercial product that's called ComFa, which is from orange flesh. It's a weaning food developed from orange flesh sweet potato. The question was, from the practitioner, about adapting this weaning food to improve the nutrition, because it was low in protein. And complementing it with soy elevates the protein. And the question was would that not only make it nutritionally better, but how would it function for women processing and producing

the weaning food, and would it be acceptable to children? And so that's where Dr. Andrade fits right in with the practitioner looking to develop and enhance a ComFa product, weaning food product. So this is another example of a faculty member, an expert working directly with and injecting himself directly into the development process, to provide evidence, and good science.

So that's all I had for today. Thanks so much, again, for the opportunity to visit with you. Look forward to your questions, and I'll turn it back to the organizers.

Dena Bunnell: Okay. Thanks, everybody. This is ... my name is Dena Bunnell. I'm with the Post-Harvest Loss Innovation Lab. And so, thanks everyone for joining us this morning. A special shout out, I think, to our west coast colleagues, 'cause it's very early there. So kudos to you for calling in this morning.

I'm going to talk a bit about ...

Male: ... your audio is a little bit low. Are you ... I seem to recall, I seem to think you're using a headset. Can you make sure that it's positioned near your mouth, and/or just speak up a little bit. If so, thank you. And if she's still ... if her volume is still a little bit low, folks, she is not in the same location that I am. You might just have to turn up the volume on your computer. Okay. Thank you.

Dena Bunnell: Sure. Sorry. I will try to speak up. And so, yeah. So I'm just gonna talk a few minutes about post-harvest loss and its impact, and the work that we're doing, and how that fits in to the global food security strategy and beyond.

So, post-harvest losses have a tremendous impact both in quantity, but also in quality loss for the product. And those losses occur in food safety, nutrition, and economic implications. If you ... The photo on the slide here, it's one of my favorite photos, 'cause I think it is a great example of those implications really shown in one snapshot there. The photo on the left is a handful of chickpeas. This is out of our project in Ethiopia that has been hermetically stored, and on the right is a traditional stored chickpea that's been infested with insects. And you can see, if you can see little white dots on those chickpeas, those are actually insect eggs. And so, it's pretty easy to anticipate in this situation that the product on the right could have some very serious potential food safety implications, which we'll talk about a bit

more later. But, as well, they're shriveled. You can tell that the nutritional capacity of those chickpeas is really reduced by this. They've been eaten through by these insects. And if you took these chickpeas to market, obviously there would be some economic implications to that. So it just really epitomizes the importance of proper post-harvest storage in these types of crops. And losses are estimated up to one third in developing economies. And that's for stored crops. Horticultural crops, of course, can be even higher than that.

But the evidence base so far is really scant, and methodologies haven't been as robust as they could be. And so, that's one of our areas of focus in our lab. And many interventions are available. And a lot of the work that we've been done has been to test ones that exist, or develop new ones that are appropriate for the food situations in which we're working.

So the Post-Harvest Loss Innovation Lab is based at Kansas State University, although we are a robust consortium of US based and universities and organizations in the countries in which we work. And, as I mentioned, we focus on stored crops, grains, legumes, seeds, et cetera. And we have ... our key technical areas are in drying, storage, and mycotoxin assessments. And a big component of that is moisture measurement, as well. And in addition we have cross cutting, topics in capacity building, really focusing on the human institutional capacity building in the countries in which we're working. To date, we have worked with 19 graduate students in the local universities in the countries where we work, as well as here in the United States, here at K State, as well as Oklahoma State, University of Nebraska. And we also focus on nutrition and gender, which we'll get into a bit later, and also a big emphasis on engagement, and really leveraging the extension capacity of the land grant university system, to focus on effective education and adoption in the work that we're doing.

And so to date we have trained upwards of 5000 participants through training and workshops in our focus countries, and tested a variety of different post-harvest technologies. And in addition, we have a robust public/private partnership strategy where we're working with international companies, like John Deere, and Romer Labs, and most recently, Mars, particularly their global food safety lab, as well as local companies where we're working.

And so, our focus countries are ... if I can ... there we go. So, our four core countries that span the link of our five year project are Guatemala, Ghana, Ethiopia, and Bangladesh. In addition to that, we had a buy in project that has been ended in Afghanistan where we did a mycotoxin assessment on wheat, raisins and tree nuts.

And we just recently started new projects in Nepal and Honduras, where we're doing mycotoxin assessments there, as well.

So in our program, in year one we really focus on establishing these baseline surveys, of assessing what the post-harvest losses were, and what those impacts really were, and developing partnerships in-country. And in years two and three, we focused on doing the research and adaptation of the post-harvest technologies that we're working with. Now we're moving into years four and five, and we're really focused on piloting those adapted technologies, and scaling up and encouraging adoption of these technologies, and really focusing on the ability to get these technologies in the hands of users.

Some of the different technologies that we've tested, as I mentioned before, have been on drying, storage, and moisture. This has included the solar-biomass hybrid dryer, which was actually a technology designed chiefly by an engineer in Ghana at the KNUST University in Ghana. And so that's a new technology that we've developed, whereas the STR dryer is a technology we have in Bangladesh that we've actually modified that from a dryer that was being used in Vietnam, and they actually ... our team at the Bangladesh Agricultural University played a huge role in modifying that dryer to conditions appropriate for our communities in Bangladesh.

And so we've really had a focus on having integrated technology packages, so that we're addressing not just one piece of the post-harvest game, but more broadly. And so you see our Bangladesh program has STR dryer that I just described, and partnering with that, a focus on hermetic seed storage, using grain GrainPro bags, and picks bags, which of you are familiar with. And so that's a really good example of us taking those off-the-shelf technologies and testing them, and making them fit in the environments in which we're working.

In Ghana, we have the ... So the photos that you see are that solar-biomass dryer that I mentioned. It's a greenhouse type set up, and it actually uses solar to dry and disinfect the grain. And when solar's not available, it has a biomass furnace as well. And so, as I mentioned, that was designed in-country. And we're coupling that with the EMC moisture meter, which we're using across our project countries. And that was actually designed by one of our partners at USDA ARS. And so, in our Ghana program, it's a really good example of some of these new technologies that we've developed, really focusing at the aggregator level on this program, and really trying to make an impact across the value chain.

And so, as we move forward, we'll continue to take these integrated approaches,

focusing on enhancing the national capacity, and then, as we continue, have a greater focus in addressing these mycotoxins, really trying to identify what the risks are, and how we can map those in the future. And I'll talk about that a bit more when we ... we'll talk about our Nepal project. But really trying to integrate throughout the process, from all the actors in that value chain, how we can have a comprehensive approach to reducing post losses, and improving food security.

So specifically related to nutrition, we have tried to have a big impact, in both the food safety and the nutritional impacts of proper post-harvest loss, and as an integrated approach. And that includes some work through a value addition, which we have some outstanding researchers here at Kansas State University that have done some pioneering work in extrusion, as one opportunity to do that, particularly with our Ethiopia program. And then, of course, we have a strong emphasis in the food safety aspect of this, as well.

And so you heard a bit about this already from Patrick, but aflatoxin is a major threat to food and nutritional security, and one of which the impacts of are becoming better known. But a lot of research still needs to be done. And so, mycotoxins ... which aflatoxin is the most well known, of course ... are fungal metabolites. It's estimated that they can impact up to 25 percent of the global food supply. So the problem is vast. It is ... chronic exposure has been causal linked to cancer, and correlated linked to stunting and amino suppression. And acute exposure can even lead to death. And it has a huge impact on agriculture health trade and environment. And worst of all, when it comes to aflatoxins, is that they're often undetectable, or invisible to the naked eye, which makes both the detection and the education piece surrounding mycotoxin particularly challenging. And, in addition to that, some of our work that we've done ... in Guatemala, for example ...

So as we measure aflatoxin, we look at parts per billion and things like this. But something that we discovered we often need to think about is not just the levels in a particular sample, but what are the actual consumption patterns of the populations in which we're working? So, in Guatemala aflatoxin levels in our initial analysis have suggested that levels are below in the western highlands where we work, are below that threshold. However, because maize is such a key component of the diet, there are significant concerns that the actual ingestion of aflatoxins may be higher than those original tests indicate.

And so, one of the areas in which we're really trying to lead the way in this mycotoxin detection and mapping is through our new project that we're starting in Nepal, and through which we're collaborating with a variety of partners, including

the Nutrition Innovation Lab, and then also the Mars Global Food Safety Lab, which is located in China, and really working with them on enhancing the capacity of our national partners to better detect and analyze mycotoxins in the food supply. And so, this project will be assessing aflatoxins in nuts, spices, dried chilies, as well as wheat and maize and peanuts.

And so it really is covering a vast portion of the food supply, as well as livestock feed in Nepal, and seeking to characterize ... identify the issues, characterize the fungal toxins that are present, and then, most importantly, really seeking to come up with short, medium, and long term intervention strategies. And so, once we have identified the problem, really taking that next step in this process, of what do we do now? How do we protect the most vulnerable? In what ways can we not just reduce the level of aflatoxin, but looking at things like, what are alternative uses that we can have for these products, where we may never get aflatoxins completely out of the food supply. But if we can find a way to repurpose those in a way that reduces the danger for human consumption, what are some of those avenues in which we can do that?

And so, that's really a approach that we're taking with our project in Nepal, and using that analysis and risk mapping and all of the tools available to us to understand that, and as well as the vast expertise of the Nutrition Innovation Lab, and their really robust presence in Nepal that Patrick talked about earlier.

Moving on briefly to some of the ways that we've been trying to address gender roles in our post-harvest work, this is an area in which even the existing literature in gender's role in agriculture really has not had a presence in the post-harvest realm. And so, what we tried to do in our project was better understand the role of women in agricultural, but specifically the role of women in post-harvest activities. And so in three of our project countries, we conducted surveys and focus group discussions with our communities in which we were working. And we used the women's empowerment in agricultural index as a foundation, but we modified that survey to include questions about their roles in post-harvest, and how that impacts their lives. And we did it in this focus group situation, rather than just household surveys, to get a community perspective of this.

And so those focus group discussions, in Ghana, we have interviews ... a combination of surveys and focus group discussions with 418 farmers, 240 in Ethiopia, and 209 in Bangladesh. And those focus groups were a variety of all women's groups, all men's groups, and mixed groups. And we came up ... and that research is ongoing ... but some of the initial findings were particularly interesting.

Some were a bit obvious but, for example, it really confirmed what we suspected about women's role in post-harvest. And it found that 88 percent of post-harvest work in Ethiopia is done by women. In Bangladesh, during harvest season, women spend 90 percent of their time on post-harvest activities. And there's really, the time poverty distinction between men and women was really found to be incredibly stark in Ethiopia. For example, women were found to spend 15 to 18 hours a day working, whereas it was 7 to 9 for men.

In addition to that, another really interesting finding ... and this happened across the focus groups, regardless of whether they were mixed gender or not ... is that women don't view themselves as the primary farmer. Men are viewed as the farmer, and women are seen as auxiliaries. And so I think that's an important point that we need to think about how perceptions are impacting that work, as well, not just how men view women, or vice ... but also how women view themselves.

Another interesting finding was that in Ethiopia, for example, they have this joint land certification program that was really seeking to give women better access to land. However, what our initial survey found, was that that policy did not actually lead to women having control over the land. And so, it's an important reminder that policy does not necessarily equal behavior change. And as we continue to work in these areas, we need to think about the impact of that, both creating the policy environment that allows change to take place, but there also has to be behavior change at a community level that happens at the same time.

And finally on those gender surveys, the other really important finding that is easy to forget when we talk about gender, is that disempowerment is not something that is only affecting women in these communities. Oftentimes, both men and women are disempowered. The disempowerment is often greater for women. But, for example, in Ghana, our survey showed that men were actually less empowered than women in resource decisions and access to credit, largely because of the introduction of women's savings groups, and those types of organizations. But women remained more disempowered in production and income decisions, for example.

And so some of the ways we've tried to actualize some of these findings include focus on women and enterprises. So, for example, in our hermetic seed storage training in Bangladesh, what has happened is that 95 percent of the women who were trained in hermetically storing seed have saved that seed, rather than purchasing from the market at much lower germination levels. And then, in addition to that, another 20 percent of those who saved their own seed, then sold that excess seed. And so there's some really economic implications that could occur

there. The question remaining, who has access to those economic gains? Whether because the women are the ones selling the seed, do they still have access to that actual money. And that's something that I think is hard to know.

And we also focused on really demand driven research, focusing on adapting the technologies that we already have to make them work better for the people that need them most. For example in Bangladesh, rice is a major time burden for women. And so our research team at Bangladesh Agricultural University is now doing research on our STR dryer to see whether they can make it usable for parboiled rice, as well, instead just paddy rice.

And so I need to wrap up. But just to briefly touch again on the global food security strategy, we really ... post-harvest loss really finds itself across all of these objectives, sustainable and inclusive growth, strength and resilience, and a well nourished population for all the reasons that we've already discussed. I think, in particular, we have a really strong opportunity to increase resilience among our populations in terms of having a better quality and higher quantity of food, both for consumption, and for storage and the market.

And finally I'll just end with, while our key objective is improving people's livelihood, we also have the opportunity of a dual benefit from the work that we do. And particularly in the current political environment that we're in, I think it's worth highlighting that we really do have an immense return on investment here in the US for the work that we're doing. And that includes at a research level, in terms of we basically our work in this field really gives us a global laboratory to identify pests and disease, improve crop breeding, a variety of other things, in addition, to the stability and trade opportunities that exist when people have better livelihoods and better access to more economic opportunities. And so I think that that's important to keep in mind as we do this work, that this ... we have an ability to improve livelihoods across the spectrum.

And that's all I've got. So I will turn it back over.

[End of Audio]