[MUSIC PLAYING] SPEAKER 1: Hello, and welcome to the Harvard Center for International Development's weekly podcast.

The majority of the world's 450 million smallholder farmers and the 2 billion people who depend on them live in rural villages in developing countries, growing crops at close to subsistence levels to feed their families. Small changes in agricultural processes can substantially improve productivity and profitability, but farmers continue to lack the advice they need to close the yield gap and maximize their incomes.

Mobile phone ownership and access to mobile phones are increasing in developing countries, presenting a huge opportunity to provide digital, agricultural advisory services. Today on CID speaker series podcast, Jason Keene, a student at the Harvard Kennedy School, interviews Jonathan Lehe, director of new programs at Precision Agriculture for Development, or PAD. Jonathan discusses how PAD is working to improve the lives of farmers in developing countries using a mobile phone platform.

JASON KEENE: Thanks, Jonathan, for joining us today. Can you briefly explain what Precision Agriculture for Development is and sort of how the nonprofit got its start?

JONATHAN LEHE: Sure. Thanks. So Precision Agriculture for Development is a US-based nonprofit. We're based here in Boston in the North End. And our mission is to help smallholder farmers in developing countries by providing them with customized agricultural advice through their mobile phones. We have a goal to reach 100 million farmers over the next several years. And right now, we're focused on seven countries in East Africa and South Asia.

JASON KEENE: And how did you initially establish proof of concept? And which markets were targeting? And how did you ultimately decide that those were the markets that you wanted to target?

JONATHAN LEHE: So our organization got its start right here on the Harvard campus. It grew out of research that was being done by two Harvard professors, Michael Kramer in the Economics Department and Shawn Cole in the Business School. And they both independently were evaluating other interventions to provide mobile phone-based agricultural extension to smallholder farmers. And independently, they both came to similar results, that this type of mobile phone based-advice could have big impacts in terms of farmers' yields and their incomes.

So they came together in 2016 to found this nonprofit. They saw an opportunity to do this at scale in a way that wasn't currently being done and with a breadth across a lot of different settings that wasn't currently being done, and also to bring some new research methods and new approaches to the idea of mobile phone based-advice, bringing constant experimentation and innovation to improve the service over time. In the three years that we were founded, we've been expanding every year and now reach seven countries and over a million farmers.

JASON KEENE: And you started in Kenya and India? Is that right? Are

those the two pilots?

JONATHAN LEHE: Yes, so in 2016 our first two projects were in Kenya and India. And in addition to the proof of concept in terms of the impact, we also needed to give ourselves a proof of concept in terms of demand and that we could do this at scale. So we've seen a high level of demand from both farmers and from other partner organizations that work with farmers.

So our two initial projects were in Busia in Western Kenya and Gujarat state in India. And we saw a high level of demand from them, that they would not only sign up for our service, but also use our service on an ongoing basis. We've also seen some early promising results that there's actually willingness to pay for our service among some foreign populations.

India was our first market really because that's a place where we see a huge potential for impact at scale. In fact, at scale is our north star, so we're really targeting geographies where we think we can reach huge numbers of farmers over the next several years.

We also needed to do a proof of concept in terms of the scale. And so to do that, we have gradually evolved from a direct service model, where we do the customer acquisition and we own the relationship with the farmers, towards more of a partnership model. And so we've also seen a high level of demand from partner organizations, governments, other non-profits, social enterprises, for-profit companies, to work with us to build this type of service and provide mobile agricultural advice to farmers. And that feeds directly into our ability to reach scale. So this dramatically reduces our customer acquisition cost and allows us to reach some of our farmers.

In terms of the markets that we want to reach, like I said, India is the largest country in the world in terms of number of smallholder farmers. And Ethiopia, Pakistan, and Bangladesh are also in the top six in terms of number of smallholder farmers in the world. So that has played a big role in driving where we've expanded to, and also plays a big role in terms of where we're looking to expand in the future.

Kenya was also one of our initial pilot countries just because we see their level of mobile phone penetration that you don't see in a lot of developing countries. It's close to 90%. And farmers use their phones there in innovative ways that other developing countries don't see. There's a huge culture of using SMS. There's a huge explosion of mobile money-- Safaricom's M-PESA product-- that has reached a level of saturation that other developing countries haven't seen. So we're sort of looking for a combination of countries that have large potential for scale and also large mobile phone penetration and an opportunity to use mobile technology.

JASON KEENE: That's a good segue to, I guess, the next question, which is, how does a typical farmer use mobile to get information about improving their crop yields and improving their farming practices? So what might that farmer be growing? What's sort of the typical size of the plot that that farmer would be working on? What are his or her biggest constraints? And then what does the SMS texts, or the voice,

or the application itself allow him or her to do that he or she would not be able to do otherwise?

JONATHAN LEHE: First let me talk about your questions about who the farmer is and what their plot looks like, and what they're growing. So, I mean, a typical farmer's plot that we're working with, it's one to five acres. They don't have access to irrigation. They don't have access to any sort of farming equipment. Most of them are living at near subsistence levels, and many of them making less than $1.25 per day. They also have large gaps between the amount of crop that they're currently producing and the potential yield that they could be producing on their land. So typically farmers are only producing about 30% to 50% of what they could on their land.

Some of these farmers have an area where they grow crops for their personal consumption and a separate area where they grow crops to sell to the market. But, to be honest, many are not selling any products to the market at all. They don't have any surplus.

So what is the farmer growing? Usually multiple crops, actually. In East Africa, the biggest crops that we're working with are maize and coffee. In India, the biggest crops that we're working with are cotton, cumin, rice, and, again, coffee. But a lot of farmers plant some things during different seasons, and then other crops during the other seasons.

And there's also a lot of intercropping. In [INAUDIBLE] state in India, for example, farmers are growing rice, but they're also growing horticulture crops. And, again, a lot of this plays into what they need to sell to market versus what they need for their own personal family consumption.

In Ethiopia, we work with 21 different crops. So much broader reach there. And we're also venturing into livestock. So many of our farmers are growing crops, and then they're also cultivating livestock as well. So in, Ethiopia, for example, we're helping to develop content for the government on dairy, beef, poultry, and beekeeping.

And then I think the third part of your question was about how users use the product. So that really depends on the delivery channel. So we have several different delivery channels that we use to provide information to farmers. So first is SMS. The second is voice call. And those sort of go hand-in-hand because they're both push systems where we actively push content out to farmers, and the farmer can passively receive it.

So in both cases, SMS and voice, farmers receive a regular, usually a weekly, message from us. And that's timed to the stage of an agricultural season that we're in. And so that not only tells farmers what they should be doing, but when they should be doing it, which outputs they should be using, in which combinations, in which quantities, at what time, and which farming practices they should do in that particular week. And we see high level of uptake of those push services.

And farmers can also receive those calls when the calls come in, but they can also dial into a help desk, and they can access those calls

later if they miss the call the first time. So farmers can dial into the help desk, and they can access the entire database of push calls that have been sent out to them over the years, and listen to any of them that they choose.

So that's on the push side. And then on the pull side, we use a technology called interactive voice response, or IVR, where farmers can dial into a system and select options from a menu by pressing keys on their phones. This is the kind of system where if I want to call my bank or my airline, I listen to a menu that says, press 1 for English, press 2 for Spanish, and then I can choose how to navigate those menus.

So similarly farmers can dial into an IVR system, and they can select what type of crop they want content about, what phase of the cropping cycle they want, whether they use irrigation or rain fed, and they can access the particular type of content that they're interested in. So that offers a lot of convenience and flexibility for the farmer. But the downside is it requires the farmer to take an active step. So we see lower uptake of that type of service compared to the push type of service.

And then lastly we've developed a mobile app. So that's the last way that farmers can interact with our service. And that gives them more advanced content than they could otherwise receive. Unfortunately, that's only available for smartphone users, which is about 20% of our user base in India, but lower in other countries.

JASON KEENE: So when you have farmers that don't even have access to cell phones, or don't own their own cell phone, how have you tried to encourage knowledge spillovers from your mobile users to neighbors and friends, to basically take advantage of the resources that you yourselves are providing them? And then are there additional other resources that you're trying to guide some of these farmers to? And maybe you can now talk a little bit about the range of different products you're offering in terms of weather-related systems or just crop information systems.

JONATHAN LEHE: Sure, so knowledge spillovers is a big thing that we try to encourage. So for one thing, not all farmers have phones. I'll give an example of Rwanda where it's probably the lowest mobile phone penetration of any of the countries that we work in. Only about half of farmers have phones. So there we really try to explicitly encourage farmers to not only adopt the recommendations themselves, but to tell their neighbors, tell other farmers in the community.

We've also found that message diversity has a big impact on encouraging farmers to share information with their neighbors. So if we have a certain message that we want to get out, but there are a few different ways that we could frame it-- so, for example, it could be lost framing versus gain framing-- we could phrase the message in different ways. We've found it's actually better to send different messages to different farmers in the community and then encourage them to talk to each other and share the different ways that the message was conveyed. And that has a bigger effect on spillovers than if we just sent a single message. So, in a lot of cases, we don't have any prior hypothesis about which framing of the message will be better. So

we found it's actually better to send a lot of different types of messages, rather than just select one.

You also asked about the additional resources and types of services that we send content about. Input use is a big one, just general farming practices. But a lot of our content is about how farmers can access different government services.

So, for example, the government of Punjab state in Pakistan, has asked us to put together a campaign to promote farmers accessing an input subsidy scheme. The government of West Bengal has asked us to put together a campaign to encourage farmers to use new irrigation technologies that have been made available. In three states in northern India, we're working on a campaign to provide information to farmers about how they can access equipment to collect crop residues so that they don't have to burn it, which is a huge driver of air pollution in North India.

In Rwanda, we're helping the government to promote a tree distribution campaign, where the government extension workers are distributing trees to farmers to reduce soil erosion and promote soil health. So a lot of governments are providing a lot of types of services to farmers, and I think this type of platform can play a big role in encouraging uptake of those services.

JASON KEENE: So it seems like your real comparative advantage is the digital platform and that as a tool. I guess my question is, three years in, are you thinking about this as from purely an agricultural perspective? Or do you believe that you're building a tool that can then be used to provide more information about education and health, for example, and just sort of deeper penetration into communities that might not have had the resources in the past to be able to take the fullest advantage of living their best life and making the most for themselves?

JONATHAN LEHE: That's a great question. I think that's a great observation. Fundamentally, our platform is sector agnostic. We've developed these platforms, these different services for agriculture. But I think over the last three years as we've built our user base of farmers, we've realized that these are regular people living their lives, and they have information needs on all sorts of different topics besides just agriculture.

So while we're focused on agriculture right now, and it's part of our mission statement that we help smallholder farmers, we are starting to actively think about how we could help smallholder farmers in ways other than just providing agricultural information. So I think there are particular sectors where there are more obvious synergies than others. So, for example, nutrition and health-- we're already encouraging farmers to diversify their crops. And, in some cases, that's to encourage them to grow more profitable crops. But in some cases, that's to encourage them to grow crops that are more nutritious, and that can provide them in their families with more balanced diet. And so that nutrition advice can have downstream health effects.

So I think we're providing health information about what health

services are available to them, information about how to compare the different schools that they can send their children to. I think there are a lot of different applications. And so far we've gone very deep in one type of application by using these platforms to give agricultural advice, but I think really there's no limit to what these platforms can be used for.

And we've seen interest among governments and other organizations in broadening the type of advice that we give, and we really see this platform as potentially a fundamentally new way that governments can talk to their citizens directly at scale.

JASON KEENE: Jonathan, thank you so much for being here today. It was a pleasure to talk to you and learn more about what Precision Agriculture for Development is working on. And we look forward to hearing more about what your nonprofit is doing in the years ahead.

JONATHAN LEHE: Thank you very much. Thanks for having me.

SPEAKER 1: If you want to learn more about CID's research and events, please visit cid.harvard.edu. See you next week.

[MUSIC PLAYING]