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FINDING THE BEST FIT

One Acre Fund's integration of digital tools in Kenya

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FINDING THE BEST FIT
ONE ACRE FUND'S INTEGRATION OF DIGITAL TOOLS IN KENYA
GLOSSARY

API	Application Program Interface is a set of routines, protocols, and tools for building software applications
FO	Field Officer
GPS	Global Positioning System, is a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world.
MNO	Mobile Network Operators
M-PESA	M-PESA is a mobile phone-based money transfer, financing and microfinancing service, launched in 2007 by Vodafone for Safaricom and Vodacom, the largest mobile network operators in Kenya and Tanzania
M&E	Monitoring and Evaluation
OAF	One Acre Fund
PICS	Purdue Improved Crop Storage bags are fertilizers storage bags for seeds of maize, other crops, and trees
3G	a mobile communications standard that allows mobile phones, computers, and other portable electronic devices to access the Internet wirelessly
4G	a mobile communications standard intended to replace 3G, allowing wireless Internet access at a much higher speed

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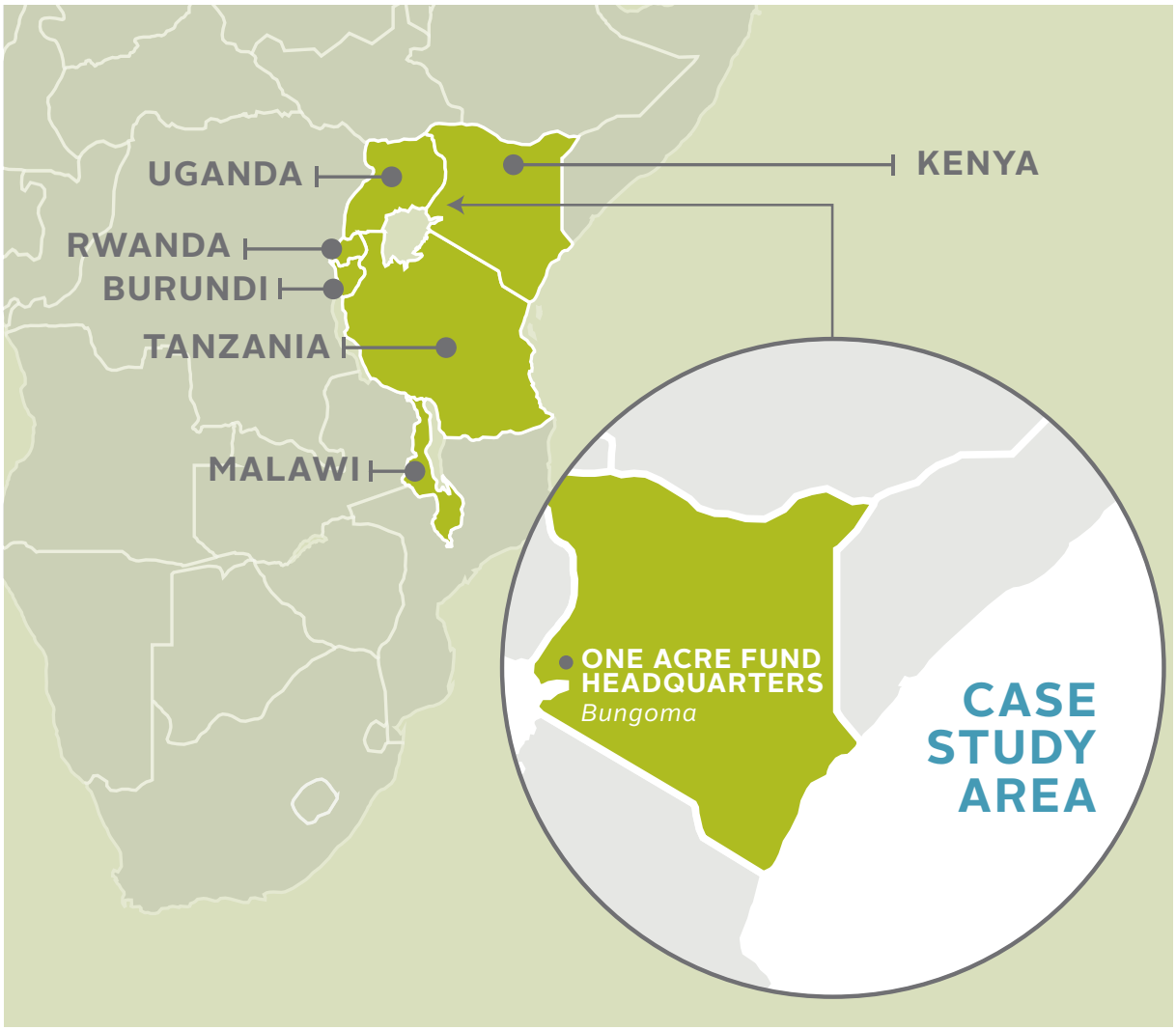
Digital Development for Feed the Future is a collaboration between USAID's Global Development Lab and Bureau for Food Security and is focused on integrating a suite of coordinated digital tools and technologies into Feed the Future activities to accelerate agriculture-led economic growth and improved nutrition. Feed the Future is America's initiative to combat global hunger and poverty.

ONE ACRE FUND
COUNTRIES OF OPERATION



This case study is part of a series highlighting the integration of digital technologies into agricultural programs. Over the past ten years, and particularly over the past five, the use of mobile phones and Internet-based, digital tools in farming activities has sky-rocketed. This is largely due to the widespread adoption of mobile phones in developing and emerging markets, coupled with the increased spread of 3G and 4G connectivity. What has emerged is a broad set of digitally-based applications that have driven greater financial inclusion, more precision agriculture, better data collection and analytics, and more effective information dissemination. Agricultural organizations and programs are increasingly embracing these tools to advance their goals. Each case study in this series looks at different approaches to adoption and how the tools are impacting organizational culture, operations, and programming.

OVERVIEW

In 2006, One Acre Fund (OAF) began with a pilot in western Kenya to increase the profits 40 farm families earned from their fields by providing them with financing for high-quality agricultural inputs and non-agricultural products (Box 1). Over the subsequent ten years, the organization has grown to serve over 445,000 farmers across six countries in East and Southern Africa.[1] In Kenya alone, the organization now serves more than 200,000 farmers.[2] This growth had been made possible by a tireless focus on impact, measured via increased yields and farm profit; scale, with a focus on increasing the number of farmers served in each area; and financial sustainability for the organization. By 2020, OAF aims to serve at least one million farm families in Africa.

OAF's ability to improve the lives of smallholder farmers at scale is enhanced by the integration of digital tools and services. The spread of mobile technologies and expansion of digital infrastructure allow agricultural investments to reach men and women farmers more efficiently and effectively, while empowering them to lead more productive and resilient lives. Digital tools reduce barriers and distance to markets, lower transaction costs, improve feedback and communication among actors, and enhance yields. They accelerate the achievement of agricultural development goals, such as Feed the Future's goal of inclusive agricultural growth.

This case study tells the story of how digital tools are enabling OAF to accelerate achievement of its goals. It begins with an overview of the digital landscape in Kenya. Then it describes the organization's overall approach to digital integration and specifically its experience integrating various digital tools and approaches in its operations in Kenya. It reviews the impact of digital tools on the organization's operations and staff, and it offers lessons learned about its digital integration experience—drawn from the reflections of staff and clients.

THE DIGITAL LANDSCAPE

Kenya's mobile ecosystem makes it a prime market for integrating digital tools. The country's thriving mobile

1 One Acre Fund is operating in Kenya, Rwanda, Burundi, Tanzania, Malawi, and Uganda.
2 In 2012, USAID/Kenya awarded two grants to OAF (totaling an estimated $3.5 million), through the Global Development Alliance and the Development Grants Program, to scale up operations in Kenya.

BOX 1.
ONE ACRE FUND COMPREHENSIVE SERVICE MODEL

FINANCING FOR FARM INPUTS

Farmers receive asset-based financing in the form of agricultural and non-agricultural products. This includes seeds for maize, other crops, and trees as well as fertilizer, storage bags (e.g., Purdue Improved Crop Storage [PICS] bags), drying sheets, solar lamps, funeral insurance, sanitary pads, and cookstoves.

DISTRIBUTION

For two months of the year, OAF is fully engaged in distributing inputs and products to more than 2,000 rural sites throughout East and Southern Africa.

TRAINING

Farmers attend weekly agronomic trainings delivered by more than 2,000 rural Field Officers.

MARKET FACILITATION

OAF helps farmers to maximize farm profits by encouraging them to time the sale of their grain to take advantage of off-season prices.

ecosystem offers low costs for voice, messaging, and data packages built on top of a widely used mobile money platform and forward-leaning, pro-ICT policy reforms.

In 2015, there were an estimated 36.3 million mobile connections in Kenya, equivalent to about 78 percent of the population (GSMA Intelligence 2015).[3]
The number of unique mobile subscribers in 2014 was estimated at 42 percent of the population, with very little difference in subscriber penetration between men and women (44 and 41 percent respectively) (GSMA 2015b). The country has one of the lowest gender gaps in mobile phone ownership—only 7 percent—largely attributed to the popularity and value proposition of a financial app known as MPesa, which drove mobile phone adoption and compelled women to want to own and learn how to use a mobile phone (GSMA 2015b). Both 3G and 4G coverage is expanding, estimated at 19 percent of the country in 2015. Three mobile network operators (MNOs) are now active

3 To understand how to measure mobile penetration, please see: https://www.gsmaintelligence.com/research/2014/05/measuring-mobile-penetration/430/.

Monitoring and Evaluation enumerator Isaac Masebo interviews smallholder farmer Diana Nalianya about which crops she grows in her field and why as part of a survey to help One Acre Fund learn more about the farmers they serve. Isaac uses a tablet to record Diana's answers. Photo: Hailey Tucker, One Acre Fund

in the country: Airtel, Orange, and Safaricom. This has contributed to a 70 percent price drop in the last four years (GSMA Intelligence).

Despite the presence of multiple MNOs, Safaricom dominates the market and is credited with creating one of the most mature mobile money markets. Safaricom introduced MPesa in 2007 as a tool to allow users to transfer money using SMS. Over half the population now uses the system at least once a month, with men and women using the service with the same frequency (GSMA 2015a). Safaricom has since built a range of additional financial products and services to allow users to save, receive loans and pay for goods and services from over 36,000 merchants (Matheson 2016; GSMA 2015a).

This landscape provides an ideal environment for testing how to integrate digital tools effectively. On the one hand, the widespread access to and familiarity with mobile phones and mobile money allows OAF to introduce farmer-facing digital tools with little training. In fact, the typical Kenyan OAF farmer—a woman in her mid-40s with only a few years of schooling—is likely to have a mobile phone. In 2016, approximately 96 percent of OAF clients in Kenya owned a mobile phone (OAF 2016a). On the other hand, Safaricom's dominant position in the market makes it a strong partner for supporting digital integration. Many men and women farmers are either already Safaricom clients or are willing to join Safaricom. MPesa gave OAF a robust and well-known platform upon which to roll out mobile loan repayment. In addition, OAF only needed to create a single application program interface (API) to allow Safaricom's servers to access MPesa data. With more market actors, OAF would have had to contract an API aggregator to access the servers of different companies. Over the years, OAF and Safaricom have developed a good working relationship built around their mutual interest in increasing the number of digital transactions among farmers. Together, they are working to increase the density of MPesa agents in districts where OAF is operating to facilitate MPesa use. While the digital market in Kenya has allowed for considerable adoption of digital tools to the benefit of OAF's business model, it is worth noting that such conditions also exist in

other markets, including in other countries where OAF is working.

APPROACH TO DIGITAL INTEGRATION

OAF expects to serve more than a million farmers by 2020. To reach this goal, it is refining its service model to increase efficiency, enhance impact, and ensure financial sustainability. Innovation and integration of digital tools are critical to this endeavor and are embedded deep within the fabric of the organization.

OAF's approach to digital integration fits within an organization-wide innovation framework that tests a range of products and services (Box 2). The organization is enthusiastic about identifying cost-effective ways of serving greater numbers of farmers more efficiently, and digital tools provide an avenue for doing just that.

Their integration is not haphazard. Each tool is tested with a clear end goal or process improvement in mind, which connects to the organization's focus on impact, scale, and sustainability. If a tool can help advance at least one of those goals, then it will be examined closely. Multi-year trials test the efficacy of tools and identify operational challenges and barriers to scale. The trials may compare the performance of digital tools against current process efficiency and accuracy, financial costs, and Field Officer (FO) impact and user-friendliness. Each trial is uniquely structured for the specific digital tool under examination.

OAF is using digital tools at different—and sometime multiple—points in the value chain to deliver information, collect data, identify products tailored to different geographic needs, and facilitate financial

BOX 2.
OAF TRIALS FOR DIGITAL TOOLS

The steps below outline the process used for agricultural product and service trials. A similar process is used for other trials.

PHASE 1 aims to test the efficacy of the product. For an agricultural product, this is carried out via a nursery trial.

PHASE 2 consists of 100-farmer side-by-side trials to test the product with OAF farmers against a control group. At this stage, the trial begins to test the correct usage of the product by farmers.

PHASE 3 expands the number of farmers. During these 1,000-farmer trials, farmer adoptability is tested (e.g., how many farmers will purchase or use the service), while still ensuring the burden of proof for efficacy and correct usage. The trials also consider some operability issues, such as whether training or new staff are required to support rollout.

PHASE 4 includes 10,000-farmer trials to test the operability of the product. Can it be taken to scale? Are the right partners in place? The criteria tested under previous phases (or the burden of proof) must continue to hold.

TABLE 1.
SAMPLE OF OAF DIGITAL TOOLS

DIGITAL TOOL	TYPE OF DIGITAL TOOL	VALUE CHAIN STAGE
Mobile repayment to facilitate loan payments via mobile phone	Transactions	Inputs
Mobile data collection to increase accuracy and efficiency	Data collection	Cross-cutting
Tablet enrollment to increase the ease, speed, and accuracy of registering new and returning clients	Data collection, Information exchange, Precision agriculture, Transactions	Planning, Inputs
Crop health application for diagnosis and treatment of diseases and pests	Precision agriculture, Information exchange	On-farm production
Infrared spectroscopy with SMS to deliver timely and targeted agricultural information to farmers	Data collection, Information exchange, Precision agriculture	On-farm production

transactions. A sample of the tools adopted by OAF over the last five years is summarized in Table 1, followed by a discussion of each below.

Mobile repayment: 2016 was OAF's first cashless repayment season using MPesa to receive funds directly from its farmers in Kenya. Previously, clients deposited cash at weekly meetings with their FOs, who hand-wrote receipts for all transactions. FOs retained the cash until their own weekly meeting where it was collected, recorded, and handed off to be delivered to the bank. Payments also had to be recorded and reconciled in OAF's system. This whole process could take up to 16 days. It was a time-consuming and burdensome activity for FOs and created opportunity for fraud, loss of cash or transcription and recording errors (Waldron and Amusin forthcoming). Because OAF was operating in an environment with one of the world's most popular mobile money systems, the question was eventually asked whether it would it be possible to reduce or eliminate these barriers and sustain the high loan repayment rate by having farmers transfer funds digitally.

This was the focus of a multi-year trial that began in 2014 to examine the impact and opportunity of a cashless and digital system for loan repayment. OAF was most concerned with sustaining the

loan repayment rate—a critical component of the organization's financial sustainability—but the trial also examined whether mobile repayment would improve customer satisfaction and FO bandwidth. It began by enabling FOs to send cash collected from farmers via MPesa to OAF. This did not improve efficiency, security, or leakage issues, and repayment reconciliation still took up to 16 days. The significant shift occurred when farmers could send their payments directly to OAF. This dramatically reduced the amount of time FOs spent collecting money and consequently changed their role. Prior to MPesa, FOs spent 214 minutes per week on repayment, compared to 116 minutes with MPesa (a nearly 50 percent decrease). FOs could now focus on delivering farm trainings and marketing products. Additionally, OAF saw an "84 percent [reduction of] costs on collections" because the process needed fewer bookkeepers to handle payments (Waldron and Amusin forthcoming).[4] The move was right for the organization and right for the farmers, 100 percent of whom expressed preference for mobile repayment over cash. Most importantly, there was no drop in the repayment rate.

Mobile data collection: OAF decided to move to mobile data collection in 2014. Unlike other innovations, this move did not require a long trial. The organization's commitment to demonstrating impact requires a robust Monitoring and Evaluation (M&E) system. OAF conducts three large annual surveys in all its countries of operation, in addition to the data collection efforts required for its various trials. Data are important to the organization and a process that ensures rapid, accurate, and cost-effective data collection is, as one staff member explained, "a no-brainer." Staff were confident that, in terms of costs, they would break even in a few years but gain immediately from improvements in data quality and accuracy. Furthermore, staff knew of other organizations who had made the switch successfully.

> *"I would advise other practitioners to use CommCare because it can be very helpful. It keeps records for a long period of time. You can track back years. When you use that you also save time. We used to do the data entry manually. Now you save time and it reduces errors. And it's also a way of learning and progressing. You can acquire new skills."*
>
> *Eric, CommCare Associate*

The M&E team tested mobile tablets with just three enumerators before transitioning the team of 80 staff. Most enumerators were already familiar with smartphones, so limited training was required in how to use tablets. There were few problems with charging, breakages, or glitches with the software. The tablets were loaded with the off-the-shelf, customizable software platform CommCare[5], which allowed for a cost-effective transition to mobile data collection over investing in a custom-built platform. Where connectivity is available, CommCare also allows for real-time uploads, making it possible for data analysis to inform decisions rapidly. The 2016 drought in Kenya highlighted the advantages of real-time data collection. Enumerators collected data on yields every day during the harvest, which were fed into a weekly yield tracker

4 Although 49 staff lost their jobs as bookkeepers and treasurers, OAF was able to re-hire or transfer 45 of them to new roles (Waldron and Amusin forthcoming).

5 CommCare is an open source mobile application originally designed to support frontline health workers. The software, which can be used on smartphones, tablets, and Java-enabled phones, is used to collect data. See https://www.commcarehq.org/home/ for more information.

by district. These data were shared organization-wide and with leadership and allowed the team to manage the impact of the drought on farmers. Specifically, the data allowed the organization to monitor and project when production targets would fall below the threshold that would activate a crop insurance payout. With this information, OAF worked with the insurance companies to minimize any delays in farmers receiving their insurance payouts.

Tablet enrollment: At the beginning of every 'long rain' season, FOs spend four weeks enrolling returning and new clients. This is done using paper contracts filled out by FOs by hand to document client information like credit eligibility and client selection of agricultural and non-agricultural products. At weekly meetings, FOs submit contracts to a team for review. They are then sent to headquarters for another review before being entered into Roster, OAF's custom-built software used to track client information. This process takes two weeks if no errors are found. If errors are discovered, the contract is returned to the FO, who may need to contact the farmer to correct it, and the process begins again. During the 2014 season, OAF tested whether mobile tablets might improve the efficiency and accuracy of this process. The trial was conducted in one district with eight tablet sites and 42 control sites. FOs received training, a solar charging station, and Samsung 4 tablets loaded with a CommCare survey that pre-populated basic data for existing clients. The results revealed that FOs at trial sites met or surpassed enrollment targets, enrolling an average of 8 percent more clients than in control sites. Data errors related to group name, client first and last name, and total credit were lower in the pre-populated survey (6 percent) than the paper surveys without the pre-population (13 percent). FOs experienced few challenges operating the tablets. There were no breakages or thefts.

In 2016, a larger trial was implemented in two districts with 85 FOs. A new in-house, custom-built enrollment application replaced the CommCare survey software. While off-the-shelf apps are suitable for many organizations, OAF operations require an app that can seamlessly integrate with other existing internal data systems. And with operations in multiple countries (and therefore multiple languages), as well as a growing product line, the organization needed an app allowing a high degree of customization. The expanded trial was designed to test whether tablet enrollment would reduce costs, improve efficiency, and increase FO bandwidth. Findings from the trial were grouped into five areas, each with its own set of performance indicators: FO experience with tablets; FO data accuracy; operations; tablet effect on pre- and post-qualification enrollment; and bean upselling.[6] The trial demonstrated that using a tablet to enroll farmers was faster and more accurate than traditional enrollment. Strong FOs took less than 3 minutes, while weak FOs took between 5 and 10 minutes to enroll a client. Among tablet-based contracts written for clients, 35 percent were correct (farmer-reported order matched information in the database) compared to 24 percent in the control group. In 2017, OAF Kenya will scale up the tablet enrollment process to five districts.

Crop health application: Using satellite data, ground sensors, and GPS-based crop monitoring data, extension agents and farmers can apply precise solutions to improve local productivity. OAF is testing several innovations to provide targeted information

6 The trial tested whether pop-up messages on the tablet could increase bean adoption by nudging FOs to offer them to farmers.

Mathew Khaemba and Everline Wakhungu, One Acre Fund farmers, practice repayment using their mobile phones. Photo: Hailey Tucker, One Acre Fund

and customized products to farmers. One such innovation is an application to support crop health. The crop health app uses mobile technology to connect FOs with crop health experts. Using the app, an FO can take photos of a plant exhibiting a symptom of disease or damage and send them via a phone or tablet to a crop health team for visual diagnosis. The hope is that eventually a farmer will be able to take a photo of a diseased leaf and receive an automatic response generated by a machine learning algorithm. Accuracy should increase over time. The ability to monitor crop health with real-time, geo-specific data has huge implications for the organization. Geotagged information makes it possible to understand the scope of disease and prepare targeted solutions. It presents the opportunity to increase yields further, deepening OAF's impact. The app is currently in early trial stages and being tested in two districts to understand the feasibility of incorporation into FOs' work stream

Infrared spectroscopy with SMS: In 2015, OAF conducted a study on soil health in Kenya and Rwanda, collecting over 2,400 soil samples from client and comparison farmers. The study revealed sub-optimal levels of micronutrients, pH, and carbon in clients' soils—deficiencies that reduce yields in the short-term and threaten long-term sustainable production (OAF 2016a). With better soil quality information, geo-specific fertilizer blends can be made available and additional products (like lime) can be offered to farmers where soil acidity is a problem.

For its 2015 study, OAF sent the samples to the World Agroforestry Center Spectral Diagnostics lab for analysis using costly wet chemistry techniques (OAF 2016a). Now, however, OAF has an in-house mid-infrared lab at their headquarters in Bungoma to test soils using soil spectroscopy at less than US $2 per sample (On and Lowes 2016). Infrared light is used to detect key long wavelengths whose peaks and valleys correlate with the presence and intensity of different elements in the soil. These data are used to run statistical models and make soil chemistry predictions.

This information allows OAF to identify inputs for land with different soil attributes. To improve soil health though, OAF needs to convince farmers to adopt different agricultural technologies. This is the focus of a current trial, now in Phase 3 and operating across a

single district, that aims to understand the impact of using SMS messages to increase adoption of lime in areas with acidic soil. OAF agricultural trials have shown that micro-dosing with agricultural lime can increase yields up to 40 percent, but adoption is now less than 2 percent (On and Lowes 2016). Geo-spatial information on soil acidity reveals wide variation, making generalized messages to farmers not ideal. (Only some of those farmers would likely see the benefit of lime on yields.) The trial is currently running, with OAF farmers randomly assigned to treatment and control groups. Farmers in the treatment group receive messages about the pH of their soil and how to address the issues, with the hope that they will apply lime to their fields. If this works, OAF could nudge these farmers before the next cropping season about the value of purchasing and adopting lime, so they remember to purchase lime during the enrollment process.

UNDERSTANDING THE IMPACT OF DIGITAL TOOLS

"Impact is our North Star" is a common refrain at OAF. The organization is committed to demonstrating the impact of its interventions and invests heavily in an M&E system that allows it "to prove and improve its impact" (OAF 2016a). While digital tools do not feature as a prominent or explicit part of the overall impact story, they are behind-the-scenes elements that make growth, impact and innovation possible.

"It's been able to make what we do possible and support our basic operations."

Emily, Senior Program Manager, Program Innovations Department

Successful digital tools create pathways to impact, scale and sustainability (Table 2). Some of these pathways are short and direct; for example, mobile repayment facilitates repayment rates and the organization's financial sustainability. Others, like the SMS messages about lime, can be measured using indicators that monitor technology adoption (e.g., lime, fertilizer, etc.) and ultimately yield. Other impacts are seen through operational efficiency gains that reduce costs, streamline processes, and improve the delivery of program components. Enrolling clients on tablets is easier, saves time, and reduces costs compared to paper-based enrollment. The immediate impact here is not on farmer yields or profits, but on how efficiently the organization operates (Table 3). Moving to mobile money, adopting tablets for M&E, and shifting from paper-based to electronic enrollment platforms are innovations with immediate operational gains. These gains ultimately tie back to OAF's core mission by improving the data gathered about OAF clients that can drive impact, scale and sustainability. In different ways, each digital tool contributes to the organization's ability to improve performance.

Trials are designed to test these improvements using a range of indicators to evaluate the digital tool's impact on the program's operations, customer service and adoption rates. Table 3 provides a sample of the indicators used to test the burden of proof in the tablet enrollment trial. The gains made by moving to tablet enrollment, whether additional number of farmers enrolled, reduced time or increased accuracy, all point to the value added of the digital tool.

The integration of digital tools has had an impact on staff as well; FOs have arguably benefited the most. The shift to mobile money allows FOs to dedicate more time to training farmers, improving their customer service and marketing products that can increase farmer profit and well-being. It has alleviated the

burden of tracking repayment and collecting money. FOs agree that mobile technology makes their job easier, reduces the risk associated with carrying cash and frees up time so they can move around their district more efficiently to meet with their farmers.

Additionally, evidence suggests the use of digital tools has positively influenced FOs' perception of themselves. The tablet enrollment trial found that use of tablets improved both farmers' impression of the FOs and FO morale. During the 2015 enrollment contract period, one female FO said she feels "more professional" and she can "approach a farmer with confidence and with the knowledge that [she] will get the attention [she] deserves" (OAF n.d.). Another female FO explained that farmers attend her meeting because "they are curious and always turn up to see how the tablet works" (OAF n.d.). In describing these changing perceptions, a senior program manager observed, "People see technology as the wave of the future," and integrating digital tools into client-facing operations allows farmers and FOs to see themselves as part of this future.

Importantly, digital tools facilitate OAF's ability to stay true to its tagline: "Farmers First." Clients are better served with products and services that are tailored to their needs. Digital tools have freed up resources, allowing the organization to dedicate more time directly to the client and provide information upon which to make better decisions. The crop health app and the infrared spectroscopy research will potentially allow OAF to provide specific farmers more accurate recommendations on how to respond to pests and

TABLE 2.
DIGITAL TOOLS THAT SUPPORT IMPACT, SCALE, AND SUSTAINABILITY

MOBILE DATA COLLECTION	MOBILE REPAYMENT
Impact: Data quality is significantly improved and faster analysis allows the organization to make refinements to the program as challenges emerge.	**Impact**: FOs' time can be reconfigured to make room for higher-impact activities, such as training.
Scale: Tablets allow the organization to add new districts and facilitate data collection at a distance.	**Scale**: Instead of spending time collecting cash payments, FOs can serve more farmers.
Sustainability: Tablets reduce the need to hire staff for data entry and reconciliation.	**Sustainability**: Mobile repayment reduces the need to hire staff for repayment reconciliation and reduces leakages.

TABLE 3. SAMPLE INDICATORS FOR TABLET ENROLLMENT TRIAL

AREA	SAMPLE INDICATOR(S) FOR BURDEN OF PROOF	SAMPLE FINDINGS
FO experience with tablets	<9 min/contract for an FO to complete	Strong FOs enrolled farmers in less than 3 minutes, while weak FOs took between 5 and 10 minutes
	>80% of FOs prefer tablets to paper	94% of FOs preferred using tablets for contract signing
	<10% of FOs report feeling unsafe with tablets	62% of FOs trusted their data more with tablets
	<8 times an FO had contract delays due to inability to charge	10% of FOs reported always feeling unsafe with tablets
		There were no delays caused by charging issues in submitting contracts
FO data accuracy	% of non-matching contracts between trial and control should be comparable	Among tablet contracts, 35% were correct (farmer-reported order matched database) compared to 24% among control
	% of farmers with complaints in trial and control districts should be comparable	0.05% of farmer had concerns or complaints from trial districts compared to 0.09% from control sites

soil deficiencies on their farms. Tailored fertilizer and pest management solutions will be made possible by investments in geotagging the locations of farms and specific soil analyses. Furthermore, with each additional digital data point and connections between data points, OAF can make more decisions and improvements. Geotagging the location of farmers can help identify input delivery sites "within walking distance." Tracking client adoption patterns can streamline marketing efforts by focusing on products that have elicited a strong response.

"Making MPesa payments is safer for me. I prefer to do it myself instead of giving the money to my Field Officer."

Lynette, OAF Farmer

While some of these upgrades impact the client indirectly, the introduction of digital repayments has been very direct. It shifted some of the power dynamics within the organization—a change noted repeatedly by farmers. From the perspective of the farmer, when group leaders and FOs collected cash,

they also controlled the information about farmer repayment. There was opportunity for fraud or loss. Farmers had to wait up to 16 days to have their repayments confirmed. The process required high levels of trust among the farmers, group leaders, FOs, and OAF. Mobile repayment changed the equation for farmers, who can now make payments and receive confirmation of receipt within two days. Both men and women farmers valued this shift in the control of the loan repayment.

LESSONS LEARNED

Staff at OAF now have a greater appreciation for the challenges and opportunities involved in a digital integration process. This section outlines lessons learned from their experience with the digital tools highlighted in this case study. It is organized around the Principles for Digital Development, a set of principles outlined by donors and the development community to guide and inform technology-enabled development programs.[7]

"Whenever you have a little bit of cash, you can pay."

Dennis, OAF Farmer

PRINCIPLE ONE: DESIGN WITH USER

OAF understands the importance of designing with and for the user. Farmers are not only paying clients; during trials, they are co-innovators and as FOs, they are staff (OAF 2016b). They are central to the organization's operations, sustainability and innovation. User-friendliness, or ease of adoption and navigation, is an important criterion for the design and selection of digital tools. Tools need to be designed with simple user interfaces. For example, mobile phone applications should use as few menus as possible. However, even an organization with a strong user-centered orientation can miss opportunities to engage the user at different steps. In preparation for tablet enrollment, a significant amount of testing was done in-house. Nevertheless, the trial revealed missed opportunities to test FO behavior with the app and make appropriate adjustments to the code. For example, the tool was not designed to respond to a user who did not understand that an app's response may be slow. If the FO hit certain fields multiple times out of impatience, the app would freeze. This is being resolved for the upcoming season.

PRINCIPLE TWO: UNDERSTAND THE ECOSYSTEM

Initially there was hesitation about whether it was appropriate or possible to integrate digital into rural smallholder agriculture contexts. Would farmers be able to charge devices? Would devices be stolen or broken? How long would it take for FOs to learn new applications? When concerns are added about whether the mobile landscape is developed enough to support digital tools, integration issues can become intimidating.

This case study has focused on Kenya, where the mobile landscape provides an ideal context for pursuing digital upgrades. However, projects or organizations operating in other countries need not shy away from such investments. For OAF, greater operational complexity (such as lower mobile phone or mobile money adoption) has not been a deterrent, but rather has driven creativity to fill infrastructure gaps.

7 See: http://digitalprinciples.org/

OAF's trials have provided a structured and systematic process for moving through such obstacles. In Rwanda, where cell phone adoption is lower than in Kenya, OAF conducted a series of trials in 2014 to test whether clients would purchase phones on credit.
It is now working with the MNOs to increase the number of agents in rural areas and exploring if these agents can also provide mobile phone charging services to increase the value proposition for mobile phone adoption.

PRINCIPLE THREE:
DESIGN FOR SCALE

Designing for scale requires, in part, flexible tools with the capacity for customization and growth while maintaining technological robustness. The Roster tablet enrollment app provides an example of this flexibility. It houses and tracks client information such as name, residence, products ordered and repayment history. The system is flexible enough to allow for some customization across the six countries in Africa where OAF operates. This is important because it means the system can grow with the organization.

However, technology can only provide for a certain amount of flexibility before stability is jeopardized. After a certain number of changes, software will often "break" more easily or become harder to update. Finding the right balance between a software's flexibility and stability can often lead to larger conversations about operational procedures within an organization as a whole. One recent example at OAF involved how the organization defined "returning client" for its software across multiple countries. In Rwanda, a farmer was classified as "returning" if he or she had been a client in any previous year, while in Kenya, a "returning client" was an individual who had been part of the program in the past year. OAF determines credit and product eligibility based on the farmer's previous enrollment history, so that a returning client is eligible for higher amounts of credit and higher-priced products. Roster (and other data collection software) allow for customization by country to accommodate for some variations, such as the different kinds of products available in each country. However, variation in the definition of "returning client" created significant challenges because this overarching categorical label impacts the calculation of credit and other subsequent data points. To solve this problem, OAF could have created flexibility in the definition of this basic client demographic data point, as well as flexibility later in the software to accommodate variations. The decision was made not to make the software overly complex but rather to weigh the benefits of having countries agree on a uniform definition of "returning client." OAF chose to make this organizational adjustment.

PRINCIPLE FIVE:
BE DATA DRIVEN

This is an area where OAF acknowledges that internal capacity is lower than desired. The organization now handles about 40 to 50 million data points collected for surveys and trials. While individual data sets are useful for answering the specific questions for which they were designed, connecting datasets would expand the information about individual farmers and exponentially increase the organization's ability to refine the program and understand impact. Automatic integration and aggregation features were cited as characteristics of good digital tools because they make it possible to rapidly get information out of a database and use it for decision making. Staff recognize the need to be more data driven and to invest in data warehousing, automated analysis and data accessibility and integration.

PRINCIPLE NINE:
BE COLLABORATIVE

During the course of a single season, the farmer unknowingly passes through the hands of multiple OAF units. Different departments handle enrollment, FO training, input delivery and loan repayment. Certain digital tools, like those targeting process upgrades, cut across the farmer's experience and therefore require the involvement of multiple units. The tablet enrollment trial required the participation of seven departments and encountered coordination and communication challenges. To overcome some of these challenges, OAF has a product manager position to coordinate between the in-house software development team and other departments. This individual is responsible for identifying technology needs that match organizational priorities and providing feedback on the feasibility of new requests. The organization also has a working group with participants from different teams that can clarify appropriate communication channels and keep teams informed of progress, challenges, and questions—helping to smooth the trial process. There is still room for improvement in this area though. The organization recognizes that it has a fast-paced culture, which makes collaboration between internal and external stakeholders challenging.

BOX 3.
REFLECTIONS ON THE MOST IMPORTANT DIGITAL DATA POINT

During the development of this case study, OAF staff were asked what they considered to be the most important digital data point about a farmer. Their responses generated the following wish list (in their words here) of desirable data points:

GEO-TAGGED YIELD. We want to know how much is being produced and where—without doing crop cuts. It would allow us to create a machine learning algorithm with GPS points to predict yields. And the data could be crossed with soil sample research to help develop custom fertilizer blends.

GEO-TAGGED CLIENTS OR HOUSEHOLDS. This is huge because then you can better target our expansion efforts. We think we have a potential to increase client density within a site where we are already operating. Knowing how many households are clients within a specific site now would help us target non-client households.

A UNIQUE FARMER ID. This would allow us to integrate all the data about a specific farmer. With this information, we would be able to understand the longer-term impact of the program—what happens to a farmer in our program year after year.

IT'S NOT SO MUCH ABOUT THE DATA POINT, AS THE ABILITY TO USE DATA FOR PREDICTIVE MODELING. We would like to be able to provide information about the ideal time for planting or for selling their maize. I would like to see more predictive modeling. Is this going to be a drought year? When is the rain likely to come? Should you plant now? Should you sell now?

Photo: Hailey Tucker, One Acre Fund

CONCLUSION

OAF counts continual growth and improvement among its core values. The organization's sharp focus on impact, scale and financial sustainability to improve the lives of as many smallholder farmers as possible drives this learning. OAF's experiences integrating digital tools reflects this commitment.

As the organization grows, constant attention will be required to find better ways to streamline and upgrade its many systems and processes, and digital integration will play a crucial role. Ultimately, OAF sees digital technology not as an end in itself, but rather as a means of achieving the broader goals of facilitating efficiency, decision making and bottom-line service to farmers. The organization already has a pipeline of staff-generated ideas about how to expand the use of digital tools. Many of these ideas build upon the use of current tools, like mobile tablets. This an indication that as an organization begins to integrate digital tools, opportunities for further expansion and integration become available.

Going forward, it will be important for the organization to tailor digital tools to specific country contexts. While operating in Kenya has some advantages, the digital landscapes differ in other countries where OAF operates. Furthermore, every country where OAF operates must address its own needs, customs and agricultural practices. This presents new challenges but also opportunities for sharing the learning presented in this case study. OAF will continue working to customize and integrate a range of digital tools to meet the varying and evolving needs of its clients. While not everything it tries will be successful, measured experimentation is likely to create incremental changes that ultimately will facilitate the organization's goals and broaden its impact on farmers.

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