
One Acre Fund

Theory of Change for the Adoption of New Technologies

Goldilocks Toolkit

Innovations for Poverty Action
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Right-fit monitoring and evaluation (M&E) systems embody the principles of Credible, Actionable, Responsible, and Transportable, or CART. In the Goldilocks case study series, we examine the M&E systems of several innovative organizations and explore how the CART Principles can work in practice.

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One Acre Fund: Theory of Change for the Adoption of New Technologies

Over the last decade, agricultural productivity of smallholder farmers throughout Africa has remained stagnant – often constrained by lack of access to improved agricultural technologies and well-functioning markets.¹ One Acre Fund is an East Africa-based NGO that seeks to address barriers to improved agricultural productivity of smallholder farmers and to reduce poverty. Its core program offers farmers a set of services and agricultural inputs that include financing, agricultural training (extension services), and post-harvest storage. The organization currently serves approximately 280,000 farmers in Kenya, Rwanda, Burundi, and Tanzania and aims to reach one million farmers by 2020.

One Acre Fund's measurement approach focuses on activity tracking and monitoring to assess how their model works in practice. This tracking data is used to improve the program and to scale it to new areas. The organization enhances the credibility of their impact analyses through the routine use of

comparison groups to estimate its impact on farmers, rather than relying on before-and-after measurement. One Acre Fund works to ensure the credibility of the data it gathers, for example, measuring harvest output by weighing crops rather than relying on self-reported data.

The organization has experimented with a variety of methods to build credible comparison groups for its impact analysis. It is transparent about the strengths and weaknesses of its preferred approach, publishing its

experience with different methods on the organization's website.²

In this case study, we highlight One Acre Fund's experience measuring impact and engaging in actionable monitoring and testing to learn which products and services to add to the One Acre Fund bundle. We recommend that One Acre Fund continue to refine its theory of change and M&E strategy to include more information on the costs and benefits to farms, as well as the assumptions and risks of their model.



What They Do

One Acre Fund provides a bundle of four agricultural inputs and services to smallholder farmers in several East African countries:

1. Credit for farm inputs: Farmers receive improved seeds and fertilizers on credit and repay One Acre Fund on a flexible repayment schedule throughout the season and after their harvest.

2. Distribution of seed and fertilizer: One Acre Fund delivers the inputs within walking distance of farmers' homes to ensure that all farmers can access them.

3. Training on agricultural practices: After delivering inputs, field staff teach farmers agricultural practices designed to increase yields (such as one seed per hole with appropriate distance between plants, for example).

4. Market facilitation: One Acre Fund helps farmers get better prices for their crops by assembling farmers into groups to increase leverage with traders and by storing crops after the harvest so that farmers can get higher prices a few months later.

Theory of Change

One Acre Fund offers a package of inputs and services designed to improve farmers' agricultural knowledge, attitudes, and practices. If adopted, the new practices should result in increased

harvests for the farmers. A larger harvest should reduce hunger in the household and allow for investments in human capital, such as education, and physical capital, such as farm equipment. With

more productive people and farms, farmers can increase their overall household income and achieve a higher standard of living.

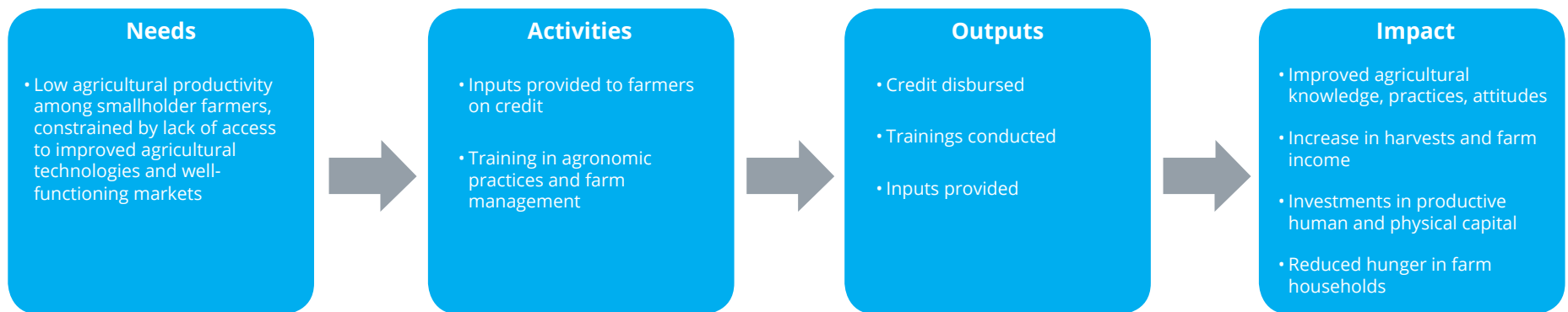


FIGURE 1. THEORY OF CHANGE* *Organizations use a variety of methods to present their theories of change. To standardize our discussion of these cases, we present our own simplified version of One Acre Fund's theory of change here, based on discussions with the organization.

Activity Monitoring

Activity monitoring at One Acre Fund provides information to managers on the quality of program implementation. Borrowing a term from the business world, One Acre Fund uses key performance indicators, or KPIs, to track the performance of teams and individual staff members. Field officers collect data weekly to measure the KPIs, which include loan repayment data, farmer meeting attendance, farmer planting and harvesting behavior, and farmer training activities. The metrics can vary according to the season, program focus, or a particular immediate need.

Field managers review the KPIs during weekly staff meetings and use them to make decisions about staff performance, program implementation, and program design. For example, if a field officer reports a high percentage of clients

falling behind on credit payments, a field manager may visit the site to examine the context for the low repayment rates and offer guidance to the officer to improve repayment. Managers tend to use the KPI reports as an indicator of issues that need further investigation. Because KPIs are reported frequently, managers have an opportunity to address implementation issues quickly. One downside of the current KPIs is that they are self-reported, which may entail some measurement error.

In addition to the weekly KPI data, the M&E team conducts an extensive planting compliance survey each year that assesses farmer fidelity to the agricultural practices that One Acre Fund promotes. Where possible, field directors use data from this compliance survey to assess field officer or field

manager performance. The main purpose of this survey is to check overall implementation, make adjustments as needed, and improve the model.

For example, early on in the life of the program, data from a compliance survey in Burundi showed very low farmer compliance with core practices, which would significantly dampen any impact the program could have on harvests. To address the issue, the field office planted “model gardens” and encouraged farmers to experiment with new planting methods on a small part of their land. Over time, the model gardens appeared to work, and farmers began applying the techniques to more and more of their land.

Measuring Impact

One Acre Fund estimates the impact of its programs by multiplying the total number of farmers in the program by the average impact per farmer.

$$\text{Total Impact} = (\text{Number of farmers}) \times (\text{Impact per farmer})^3$$

Impact per farmer is defined as the difference in farm profits (revenues minus costs) between participating farmers and comparison farmers in the same geographical area. The comparison group serves as a control for weather and other seasonal effects that might affect harvests.

One Acre Fund collects data on farm revenue and costs from program participants and a comparison group. The construction of the comparison group differs by country, but generally consists of “likely to enroll” farmers (those in neighboring areas with similar crops as enrolled farmers). These groups face similar agro-ecological conditions as participating farmers. One Acre Fund openly acknowledges the potential for selection bias—farmers who choose to enroll, or enroll early, are likely to be different on a number of characteristics than those who enroll later or not at all—and is exploring other options for constructing comparison groups.

1. Farm costs: To collect cost data, One Acre Fund conducts a farm-level survey for each of the main supported crops that collects comprehensive data on seed and fertilizer costs, the number of labor days used,⁴ and interest payments. The survey also records the land size dedicated to One Acre Fund-supported crops and the overall land size.

2. Farm revenue: Revenue data comes from a farm-level survey of crop yields of supported crops. For each farm in the sample, enumerators measure the harvest on two small randomly selected land plots with One Acre Fund crops under cultivation.⁵ Rather than relying

on self-reported information, One Acre Fund staff weigh the harvest from the two plots. Then they estimate the farm revenue from the promoted crops by multiplying the total area under cultivation by the current local market value of the crops.

Subtracting costs from revenues yields an estimate of the profit (net income) per farmer of producing supported crops. Comparing net profits for One Acre Fund farmers and the comparison group farmers results in the “impact per farmer” metric that the organization reports. On average, the organization reports that participating in the program results in a 50 percent increase in net income for the activities One Acre Fund supports. One Acre Fund publishes a breakdown of the results on its website.⁶

In Table 1, the “impact” rows report net income differences on plots planted with crops One Acre Fund supports, rather than overall farm profitability or household income. The average impact per farmer estimate does not take into account the costs that One Acre Fund incurs to run the program — though

TABLE 1: ONE ACRE FUND IMPACT REPORTING

	2013 (ACTUAL)	2014 (ACTUAL)	2015 (PROJECTED)	2016 (PROJECTED)
SCALE FARM FAMILIES SERVED	130,400	203,600	305,000	420,000
FULL-TIME STAFF	1,900	2,343	3,000	3,500
AVERAGE IMPACT PER FARMER: \$ GAIN IN FARM PROFIT	\$135	\$128	\$135	\$135
% GAIN IN FARM PROFIT	47%	57%	50%	50%

the organization estimates a social return on investment, which does take program costs into account.⁷ Reported impact does not include income from other crops under cultivation or income generated by other household activities, however the vast amount of a farmer’s land is typically dedicated to crops under

One Acre Fund cultivation. To focus on the new farming practices, it is possible that farmers make tradeoffs between other household investments or change how members of the household use their time. Measuring this would require an in-depth household survey.

Increasing farmer profits is just one of One Acre Fund's goals. To understand whether higher profits translate into increased income, reduced hunger, and lower household poverty, a more comprehensive impact measurement would take into account tradeoffs that households make on other plots or for other activities to attain higher yields.

One Acre Fund is considering supplementing their current impact reporting with data from a "Quality of Life" survey that gathers data on a wider set of measures of household well-being. The survey collects data on quality of life metrics including consumption, education, nutrition, and wealth from One Acre Fund participants and a comparison group.⁸

Information from this survey will help the organization better understand what happens within the household as it adopts the One Acre Fund program. However, this data still may be insufficient to estimate total household costs and revenues as well as the tradeoffs households make in adopting new farming practices.

Building a Credible Counterfactual

One Acre Fund recognizes that finding a valid comparison group for client farmers is "the number-one barrier to accurate impact evaluation for most non-profit organizations."⁹ Comparison farmers could differ from One Acre Fund farmers in a number of ways that may affect farm profits, such as motivation or their tolerance for risk. **Aware of the selection issues, the M&E team has experimented with five different approaches to improve their estimates of impact.**

1. Newly enrolled farmers as a comparison group: In Burundi, the M&E team sampled farmers who had just enrolled in the program as the comparison group. The main assumption was that newly enrolled and current farmers should be very similar because both have chosen to enter the program. However, the timing of their decision to enroll could signal some differences in terms of motivation or risk aversion. If previously enrolled farmers are more entrepreneurial or willing to take risks,

their outcomes may differ from those of newly enrolled farmers.

2. "Likely-to-enroll" farmers as a comparison group: In Kenya, the M&E team selects a comparison group by asking current clients to identify farmers who, in the client's opinion, were "likely to enroll" in the following year. This turned out to be an imperfect way to identify farmers who were going to enroll since only 40 percent¹⁰ of those identified actually enrolled in the subsequent season. However, those who did join and those who did not appeared quite similar in observable metrics — including average land size, amount of fertilizer used and baseline yields in all main crops. But just as the "newly enrolled" farmers may be different in important ways from farmers who are current clients, farmers who decide to join later than currently-enrolled farmers are likely to be different in important but unobservable ways.

3. Randomly selected comparison group: One Acre Fund conducted two small-sample randomized controlled trials (RCT) in Western Kenya.¹¹ The

primary goal of these studies was to compare the findings from small RCTs to the results from the quasi-experimental methods. The results were fairly consistent across methods, increasing One Acre Fund's confidence in results from quasi-experimental methods. The experience also provided valuable lessons for future randomized evaluations, such as the need for a larger sample and the importance of reducing attrition over the course of the evaluation.

4. Comparison group from propensity score matching: In Kenya, the M&E team used demographic characteristics such as family size, gender, land size, and wealth that predict participation in the program to match One Acre Fund farmers with the neighboring non-participating farmers, who comprised a comparison group. After the harvest, the team found 36-percent higher maize yields among participant farmers relative to the comparison group. Propensity score matching depends on a strong assumption: that the decision to not participate in the program was due to chance. Despite this assumption, One

Acre Fund believes this method has operational advantages over the other methods and intends to incorporate it into their regular impact evaluations in the future.

5. Comparison group through difference-in-differences: In Kenya and Tanzania, the M&E team planned a study that compared the change in yields from 2013 to 2014 among farmers who participated to those who stayed out of the program. This study was not completed because staff were unable to track a sufficient number of farmers. However, the team used the experience to develop guidance for impact evaluations, including better training for enumerators and a system to assign unique identifiers to farmers in the sample. The team will attempt to use the method in another evaluation in 2015.

One Acre Fund found similar yield gains among participating farmers across all the methods described above. As a result, the M&E team gained more confidence in selecting a quasi-experimental method to give a credible estimate of impact. Going forward, One Acre Fund plans to

use randomized evaluations in limited circumstances as a means of verifying results found with other methods.

Operational Research

One Acre Fund applies rigorous methods to operational questions, in addition to measuring the impact of its core program. The product innovations unit is responsible for identifying new products, crops, or techniques that have the potential to improve the program. The unit tests and adapts each product or service *idea* through a four-phase “innovations trial” to determine whether it should be scaled within the program and how to roll it out.

The phases of an innovations trial include:

Phase 0 Literature Review: An extensive literature review is conducted to identify all current

knowledge related to the product. It allows One Acre Fund to consider the potential impact, simplicity, adoptability, and scalability of different models.

Phase 1 Small Pilots: The pilots are usually conducted with 0-1,000 farm families, and consist of research station trials, surveys and focus groups. These pilots generate early lessons on simplicity and impact.

Phase 2 Intermediate Pilot: The technology is expanded to 500-2,000 farmers to learn whether households will adopt the new offering and what influences their

adoption. These pilots focus on finalizing estimates of impact and simplicity and allow One Acre Fund to assess operability and adoption. For non-agricultural products, such as solar lights and cook stoves, One Acre Fund will often use random assignment of the technology to farmers to learn about potential impact.

Phase 3 Advanced Pilot: The technology is scaled to 5,000-40,000 farmers in one to five districts, often with design changes based on lessons from phases 1 and 2. At this stage, One Acre Fund may use A|B tests, where two variants are given to similar groups of users,

and whichever group performs better is continued. One Acre Fund uses this technique to compare different planting methods or packing distribution, and may also test different behavioral nudges. One Acre Fund assesses adoption and customer satisfaction, and also begins to learn how to operationalize the technology at scale.

Phase 4 Mass adoption: If a trial is proven successful, the organization begins a large-scale roll-out across the full program, which includes a significant investment in the final refinement of the new product or service, including training techniques, marketing techniques, physical tools, and agronomic tests. Phase 4 projects also include a heavy logistical component and may include large-scale impact assessments. This Phase tests whether the technology can be effectively implemented at full scale.

Goldilocks Recommendations

Overall, One Acre Fund has an excellent M&E system. The organization gathers high-quality, actionable monitoring data and puts them to use in program management and improvement. The system reflects the principle of transportability because One Acre Fund is transparent in its successes and failures, measuring the organization will likely help other agricultural programs improve their impact measurement approaches. Finally, One Acre Fund devotes considerable effort to measuring the impact of its programs, trying a number of different approaches to find an evaluation method that fits its needs and capacities. We see the greatest room for improvement in the credibility of the impact evaluations — which could also increase the responsibility of the organization’s data collection plan

by ensuring the benefits of the data outweigh the costs of collecting it.

Credible: Collect high quality data and accurately analyze the data.

One Acre Fund invests significant resources in producing credible data and overcoming the measurement challenges around its core impact metrics--crop yields and farm costs--by physically weighing crops and carefully collecting cost data.

One Acre Fund has also invested in a number of quasi-experimental and non-experimental impact evaluations. While thoughtfully designed and executed, each method has limitations in terms of

the credibility of the results it produces. Similarly, the small-scale RCTs previously conducted face credibility challenges due to the small sample size, which limits the confidence in the results.

We recommend that One Acre Fund continue to use randomization to test product innovations, and explore opportunities for another RCT at a larger scale when a larger scale-up is planned. Similarly, we recommend that the planned large-scale survey of household effects be a large-sample RCT to validate the welfare impacts of the model with sufficient power across communities and bolster confidence in previously measured effects.

In the meantime, we support One Acre Fund’s efforts to study the broader

impacts of the program.

Actionable: Commit to act on the data you collect.

We have no specific recommendations to improve the actionability of One Acre Fund data. Based on our assessment, the organization collects high-quality monitoring data and uses them actively on a regular (even weekly) basis. This allows staff to address management and implementation issues quickly.

Responsible: Ensure the benefits of data collection outweigh the costs.

The organization has invested significant resources in measuring the impact of its program using several different methods. Although these studies appear to support One Acre Fund's model, the results are still open to questions because of the way the counterfactual is defined. Conducting another RCT at a large scale could be a responsible investment for One Acre Fund because it would generate credible evidence on the impact of its program.

A single, highly credible study could also reduce the need to spend resources on future quasi-experimental evaluations and re-focus One Acre Fund's resources towards operational research or a cost-benefit analysis of farmer decisions to adopt One Acre Fund's practices.

Transportable: Collect data that will generate knowledge for other programs.

One Acre Fund has the potential to generate highly transportable knowledge for its own programs and others like it. One Acre Fund is transparent about its theory of change and the data it collects to support it. By collecting credible data—such as the weight of farmer harvests—and assiduously documenting farmer adoption and compliance levels, the organization is able to closely track the early stages of its theory of change.

To improve the transportability of this knowledge, however, we recommend that One Acre Fund refine its theory of change—particularly in the output and outcome stages—to be more explicit

about the assumptions around farm production and household welfare impacts. The theory of change assumes that increases in income from the crops and techniques One Acre Fund promotes will improve the wellbeing of the entire household and that overall household income will increase. However, the theory is not clear about how the program increases overall household income, nor how these increases translate into subsequent reductions in hunger. To do so, it would have to address any tradeoffs farmers and households may make to achieve higher yields on One Acre Fund plots, and which farmers the organization targets for participation, among other things. A detailed cost-benefit survey would allow the organization to track these assumptions and further refine the theory.

This refinement, in conjunction with One Acre Fund's existing transparency, would allow other organizations to better understand how the organization operates and the mechanisms through which its programs influence household well-being.

One Acre Fund Responds

We applaud the efforts undertaken by Innovations for Poverty Action to highlight the principles of credible, actionable, responsible, and transportable monitoring and evaluation work. We strongly believe that improved measurement practices in the field will lead directly to better programs and a better world. We at One Acre Fund strive, however imperfectly, to incorporate these principles in our work and are pleased to have feedback on how to further improve our efforts.

We currently conduct randomized evaluations for targeted purposes and are very open to the recommendation that we should expand use of this measurement method. We currently use random assignment regularly, when it is

not too disruptive to our core program to test, for example, new product additions to our core program. We have also conducted two smaller randomized evaluations of our agricultural program in Kenya in order to verify the quasi-experimental measurement methods that we normally employ. These RCTs had some challenges which are highlighted in detail on our website, but we feel that overall the results were in line with the results from our quasi-experimental measurement studies. We generally prefer quasi-experimental measurement methods because we can achieve an enormous breadth of coverage across all countries and crops—we annually weigh the harvests of more than 10,000 test or control farmers across many crops and countries—and this allows us

to more fully understand and improve our program. Conversely randomized evaluations cover a smaller expansion area and require us to enroll farmers and then delay delivering our agriculture package to farmers in the control group for a year – potentially creating reputational issues. Because we could not replace our annual M&E efforts with randomized evaluations, these would entail an additional expense. Nonetheless we agree with the recommendation that it is important to strengthen our use of randomized evaluations in the future, in particular to confirm the accuracy of the quasi-experimental methods we regularly employ.

The second recommendation is to be more explicit about the assumptions on

farm production and household welfare impacts so as to address any tradeoffs farmers make to achieve higher yields on One Acre Fund plots. We agree that this is an important inquiry. In fact, part of our regular M&E efforts assess the impacts on the land that our farmers cultivate without our inputs and training. In addition, we have two large studies currently underway to help us better understand the full profile of our farmers and how their program participation affects various facets of their lives. The first is a longitudinal Quality of Life study in which we will be studying changes over time across a range of spheres including income, health, education, and nutrition, for our farmers compared to similarly situated farmers in their area. We will also be completing a study of incomes and expenditures of farmers in largest program in Kenya. Both of these studies will provide us with a more nuanced understanding of the trade-offs and benefits our farmers face due to program participation.

Lessons for Others

1. Be explicit about theory of change assumptions and risks.

When developing a theory of change, organizations should be explicit about the underlying assumptions, risks, and potential unintended consequences of the program. Participation in a program often triggers or requires a change in behavior or practices that can lead to unexpected tradeoffs or unanticipated consequences. Therefore, a program's theory of change should consider up front how these potential tradeoffs could affect the welfare of beneficiaries and their families.

2. Prioritize the collection of credible data.

Ensuring data credibility is often not a priority for organizations, especially when compared to measuring impact. However, credible data is critical for an actionable and responsible M&E system. Investing resources to ensure that the data are accurate and valid—that they accurately capture what one is seeking to measure—is crucial. Sometimes this means avoiding shortcuts that result in poor data quality and investing additional resources in accurate measurement, especially for programs where outcomes are notoriously difficult to measure, such as incomes and agricultural yields.

3. Consider conducting one good RCT rather than multiple quasi- or non-experimental studies.

Conducting large-scale RCTs can often be logistically challenging and daunting. Various quasi-experimental and non-experimental impact evaluation methods offer an alternative but they have less credibility than RCTs and are just as expensive to implement. Instead of investing resources in quasi-experimental evaluations with weak credibility, it may be worthwhile for an organization to invest in one well-designed rigorous impact evaluation that will produce credible evidence on program effectiveness.

Endnotes

1. Fan, S., Brzeska, J., Keyzer, M., & Halsema, A.. (2013). From Subsistence to Profit. Transforming Smallholder Farms. *International Food Policy Research Institute*. Available at: <http://www.ifpri.org/sites/default/files/publications/pr26.pdf>.
2. To search One Acre Fund's library, visit <http://www.oneacrefund.org/library/search-results/search&category=impact/Impact>.
3. Forti, M., & Youn, A. (2014). Social Good = Scale x Impact (Who Knew?) Availble at: http://www.ssireview.org/blog/entry/social_good_scale_x_impact_who_knew.
4. Number of person-days (including family members, paid and unpaid work, help from neighbors and relatives) used at different stages of agricultural production multiplied by the local daily wage rate and the likelihood of being hired.
5. Enumerators generally use a 10 x 10 foot wooden box to measure out the land plots participating in the survey.
6. The reported figures on the website refer to the dollar and percent gain in farm profit. See <http://www.oneacrefund.org/results/impact>.
7. One Acre Fund estimates its social return on investment to be ratio of the average impact generated per client (net profits on One Acre Fund crops) to the net cost per client, which it uses to compare its programs across type and geography. See http://ssir.org/articles/entry/measuring_social_return_on_investment_before_you_invest.
8. The survey will run in Kenya and Rwanda for at least 3 years at a sample of 2,400 (1200 in control and 1200 in treatment) in each.
9. One Acre Fund 2013 Performance Report. <https://www.oneacrefund.org/results/the-reports>.
10. One Acre Fund believes that the 40 percent enrollment rate was an anomaly and can be attributed to the fact that the package offered as part of the 2014 program was restricted and not as attractive to the farmers.
11. For instance, in the 2014 study, randomization was done across six farmer communities that signed up for the One Acre Fund Program (4 treatment and 2 control), with approximately 1,200 farmers. A statistical procedure called bootstrapping was used to account for the low number of clusters.