



# TOWARD RURAL PROSPERITY

A REPORT ON THE RURAL PROSPERITY INITIATIVE

A PARTNERSHIP OF **iDE** AND THE BILL & MELINDA GATES FOUNDATION

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## How do we bring transformative technologies and services to millions of poor smallholder farmers living in poverty?

Supported by the Bill & Melinda Gates Foundation, iDE undertook the Rural Prosperity Initiative to answer this question. From 2007-2010, the Initiative focused on Nepal, Myanmar, Ethiopia and Zambia. The recently completed second phase (2011-2013) focused entirely on Africa, continuing the work in Ethiopia and Zambia, and starting a new project in Ghana.

The focus on Africa reflects the fact that, per capita and per hectare, Sub-Saharan Africa has the lowest application rates of improved agricultural practices and technology in the world. This results in persistently low productivity and income, which stunt growth and opportunities for millions of smallholder farmers. Many smallholders continue to irrigate small plots by hand. Even a relatively small 40m X 25m garden requires irrigators to carry roughly two tonnes of water per day, a burden of drudgery that falls mainly on women and girls. Combined with few, poor quality inputs, inefficient crop management and limited access to markets, it is no wonder that smallholders struggle to meet their basic needs.

The situation is complex and there is certainly no silver bullet. The Rural Prosperity Initiative was an ambitious project, funding innovation in areas where few have succeeded. As such, it has had its share of failures as well as success. Through both phases of the project, iDE and its partners have made considerable progress in developing, testing and – in many cases – bringing to market innovations with the potential to improve smallholder livelihoods at scale.

This report summarizes the results from each of the country initiatives funded in the second phase of the Rural Prosperity Initiative (RPI2) and identifies future investment opportunities to scale up the lessons learned through RPI2. More detailed impact evaluation reports for each country are available from iDE.

The innovations and future investment opportunities we highlight here fall into three main categories: affordable irrigation technology, credit and last-mile delivery of smallholder products and services. Across these innovations, iDE has demonstrated impact. Achieving significant scale remains the focus of our next round of innovation and investment, and the focus of the opportunities highlighted in this report.

## AFFORDABLE IRRIGATION TECHNOLOGY

Through the RPI investments, we have made significant progress toward identifying and bringing to market the next generation of smallholder irrigation technologies – particularly solar.

### FINDINGS

- Affordable irrigation technology enables smallholder farmers to cultivate **high-value vegetable crops** during the dry season increasing and diversifying household income. Despite their to smallholder livelihoods, agricultural development policies and programs often overlook household irrigation technologies in favour of large-scale irrigation schemes.
- While an initial focus of the RPI investments, the **treadle pump** is a niche technology in Africa and very unlikely to be adopted at a fraction of the scale seen in South Asia. The higher cost in Africa, and labour-intensive operation, make it much less competitive with fuel pumps or emerging renewable options.
- With the exception of Ethiopia, iDE has largely moved away from supporting **local manufacturing** of irrigation products in Africa, largely driven by cost and quality challenges. The move toward motorized solutions that require efficient precision manufacturing will only continue the trend of sourcing technologies from international hubs of manufacturing (mainly India and China).
- There have been breakthroughs with renewable technologies, particularly **solar pumps** designed specifically to the requirements of small-plot vegetable farmers:
  - The solar thermal pump has evolved into the **Sunflower Pump** - a universal piston pumping platform, that can use steam, PV or grid power and offers deeper lift (up to 20m) for \$400;
  - The **Sunlight Pump** is a portable option for shallower lift (up to 8m) with a likely retail price of \$700.
- **Innovative business models** are necessary to take emerging technologies to scale. Renewable technologies offer a better payoff for farmers in the long run, but require creative delivery options that include financing, pay-as-you-go and rent-to-own.
- **Manual well-drilling** offers low-cost access to shallow and medium-depth groundwater in suitable conditions. iDE estimates the potential for 75,000 farmers to benefit over the next five years in Ethiopia alone. Other African countries are adopting this technology as well, through the efforts of iDE and others.
- **Business partnerships** offer the potential to scale up promising technologies leveraging firms' R&D, distribution and marketing capacity. Current partnerships with Toro and FuturePump are examples of businesses taking innovations from RPI2 country initiatives to global scale.
- iDE has articulated a strategy for making smallholder irrigation a central pillar of rural electrification. Particularly in Ghana, there is high potential for **grid-based pumping** to reach large numbers of smallholders in the next 5-10 years.

### INVESTMENT PRIORITIES

- **Developing innovative business models to bring renewable-energy pump solutions to scale;**
- **Bringing manual well drilling to scale;**
- **Developing a smallholder orientation within large technology firms;**
- **Expanding grid-based irrigation.**

## CREDIT

iDE worked with finance partners in each country to introduce innovative, tailored finance products for smallholders, who were previously un-served or under-served by existing finance options. This experience has identified some principles for effective smallholder finance:

- **Focus on high value crops** offering margins that support full recovery on loans. Irrigated horticulture is a better bet than low-margin field crops.
- **Offer loan terms that reflect the reality of smallholder cash flows.** Most successful products include a grace period during the maturation period, followed by regular payments when crops are producing marketable vegetables (generally in the 3-6 month window).
- **Integrate financing with other services** that have a proven impact on productivity and income. Finance providers see the association with iDE-promoted technologies and services as a significant risk mitigation strategy. Thus, farmers served by Farm Business Advisors, using improved irrigation technology, etc. are better risks for lenders.

At the same time, iDE has identified the following constraints to scaling up smallholder finance:

- **Capacity issues with micro-finance and community banking institutions.** iDE's experiences in the RPI countries and elsewhere have highlighted constraints due to often unstable and inefficient internal management, limiting profitability and growth.
- **Reliance on subsidized supports** for finance delivery and allied services. In pilots, iDE field staff has provided services to finance institutions, including identification of farmers and organization of farmer groups. As long as these supports are in place, they represent a constraint, as access to finance will only scale within the scope of these supports.
- **Capital constraints faced by micro-finance and community banking institutions.** Local lending institutions often have high reserve requirements set by the Central Bank which translates to high collateral requirements for farmers taking loans and limits the capacity of lenders to service a large number of clients.

## INVESTMENT PRIORITIES

- **Addressing capacity issues within micro-finance and community banking institutions;**
- **Building delivery mechanisms that integrate smallholder solutions with financing;**
- **Addressing capital constraints faced by micro-finance and community banking institutions.**

## SMALLHOLDER SERVICES

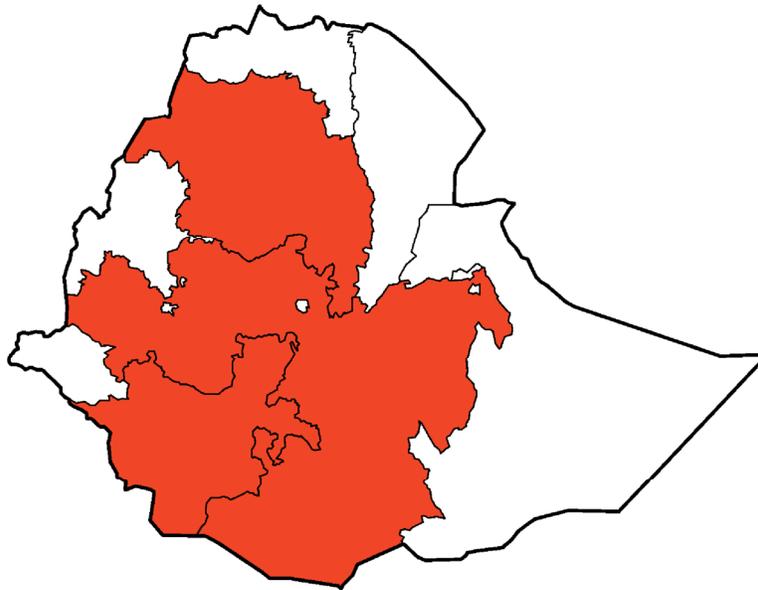
Particularly in Zambia and Ethiopia, iDE has adapted lessons learned from the successful Cambodia Farm Business Advisor (FBA) model to develop a mobile network for last-mile delivery of products and services to smallholders.

- Linking village entrepreneurs to suppliers using sales commissions offers the opportunity to greatly expand the reach of bricks-and-mortar outlets into rural areas;
- Training FBAs on a range of agronomic, technical and business skills gives farmers access to product with embedded advice, helping them to optimize their results;
- Focusing on repeated transactions builds trust between FBA and client, and aligns incentives: FBAs have a vested interest in their clients' success;
- A functioning FBA network offers a platform for the delivery of a broader range of services. In Zambia, FBAs have connected farmers to finance, sanitation services and a range of other products.

Other investments are currently helping us to take the next steps to scale up FBA services, but there is still a need for further investment to expand and refine the model.

## INVESTMENT PRIORITIES

- **Developing and testing business models that use FBAs as an integrated platform for delivering a range of products and services to rural customers, including rural lighting, health products and WASH solutions;**
- **Identifying and developing private sector 'hubs' for FBA services;**
- **Developing information technology solutions that enhance last-mile distribution.**



## ETHIOPIA

iDE has worked in Ethiopia since 2007, with investment from the Bill & Melinda Gates Foundation since the founding of the program

Since its inception, iDE Ethiopia has been a hub of technology innovation. Support from the Bill & Melinda Gates Foundation has fostered innovation for the Ethiopia program and iDE globally, including manual well drilling, rope and washer irrigation pumps, solar thermal pumping and gated row irrigation.

iDE rehabilitated the treadle pump – previously a shoddy, overpriced product in Ethiopia – by introducing new, simpler designs with exacting standards for quality. The technology now finds a small but effective niche with shallow groundwater and surface water irrigators. iDE’s understanding, from extensive interactions with smallholder farmers, is that many purchase treadle pumps as way to gain additional income that enables them to purchase a motorized pump in the near future.

iDE Ethiopia has also provided leadership in the design of new smallholder finance products in partnership with local micro-finance institutions.



## MANUAL WELL DRILLING

Over the course of the Rural Prosperity Initiative investments, iDE Ethiopia has refined a model for training and equipping manual well drillers to provide low-cost boreholes for smallholders. While manual well drilling was previously practiced in some areas of Africa (e.g. Sudan, Nigeria) the Bill & Melinda Gates investment has been key to developing this as a scalable strategy for groundwater access in Sub-Saharan Africa. iDE Ethiopia drew on the experience of drillers in Sudan, but also brought drilling experience and expertise from the Gangetic Plain in Nepal to work with fledgling teams in Ethiopia.

Since 2008, iDE has trained 150 people in manual well drilling techniques. Over that period, a total of 20 teams have drilled over 1,600 low-cost boreholes for rural customers. 12 teams of manual well drillers are currently actively providing drilling services to smallholders.

Whereas mechanized drilling requires an investment of \$1,200-1,600 for a 6-12m borehole, manual drilling offers a similar service for less than 1/10 the price (\$20-200). iDE has also demonstrated the profitability of the investment for manual well-drilling teams, who are able to earn a 12-month return of \$2,750 off an initial materials investment of \$1,250.

Manual well-drilling is not suitable for all environments. The maximum depth is approximately 50m. Also, drilling teams cannot penetrate cobble or hard stone layers in excess of 5-10cm or soft stone layers in excess of 30cm. However, iDE estimates a potential for 75,000 farmers served within five years and a million farmers in 15 years.

#### INVESTMENTS REQUIRED FOR SCALE-UP

To take manual well-drilling to scale, there are two key areas for investment, further detailed in a paper published through the IWMI-led Ag Water Management Solutions project (IWMI Working Paper 155)<sup>1</sup>:

##### *Map the local hydrogeology*

One of the key investments necessary to see manual well drilling scale up is more detailed mapping of groundwater resources, soil and hydro-geologic conditions at sub-national scale. Good spatial data greatly increase the hit rate (iDE-trained teams achieved a success rate of 80 percent during the pilot phase, when sites were carefully chosen using the best available groundwater data), which is a key determinant of profitability.

UNICEF is now mapping the feasibility of manual well drilling in 12 Sub-Saharan African countries, and is working in partnership with iDE in Ethiopia.

##### *Support the expansion of private sector drilling*

Developing a thriving private manual drilling industry in Ethiopia will require investments in the following areas:

- **Creating demand** through demonstrations and extension with smallholders – most of whom are currently unaware of the benefits and affordability of manual well drilling services
- **Training** manual drillers at sufficient scale to create competition. iDE Ethiopia has developed Ethiopia's first field-based training curriculum. The four-month course is highly practical and selects for those individuals willing to invest the time and resources required to be successful.

iDE Ethiopia has also spread its knowledge through consulting assignments to train and support trainers:

- Trained 25 trainers selected from the five different regions of Ethiopia by the Ministry of Water, Irrigation and Energy;
  - Trained 125 people in partnership with UNICEF (Amhara, Tigray, Oromia, and SNNP regions), SOS (Amhara, and SNNP region) and the University of Nebraska (Harar);
  - Consulting support for other manual well drilling programs in Somaliland, Tanzania and Uganda;
  - iDE Mozambique is now scaling up manual well drilling, with consulting support from iDE Ethiopia.
- **Stimulating value chains and finance.** Initially, iDE played a very hands-on role in managing the procurement and distribution of key supplies required for manual well drilling operations. This puts constraints on the scaling up of services. Thus, further investment in developing local supply chains is a vital step in fostering a national-scale drilling industry. Given the cost of entry for new drilling teams, working capital finance is a critical need and opportunity for investment in scaling up.
  - **Monitoring** the development and use of groundwater resources. As access to shallow groundwater expands through manual well drilling services, the government must develop adequate monitoring and regulation systems to ensure that drilling is not endangering water resources. For example, high-density drilling may create interference among wells, leading to seasonal water conflicts.

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<sup>1</sup> [http://awm-solutions.iwmi.org/Data/Sites/3/Documents/PDF/Country\\_Docs/ethiopia/wp155-\(latest-version\).pdf](http://awm-solutions.iwmi.org/Data/Sites/3/Documents/PDF/Country_Docs/ethiopia/wp155-(latest-version).pdf)



## ROPE AND WASHER PUMPS

The rope and washer pump is not a new technology. However, iDE focused on how to adapt the pump for higher-volume irrigation applications, while also reducing the cost of purchase and installation. Through several structural design modifications, and by coupling installation with the manual well-drilling initiative, iDE successfully improved the design while also lowering the cost.

Over the past five years, this has proven to be one of the most successful small-scale water technologies in iDE Ethiopia's line-up. The pump offers farmers low-cost access to groundwater in areas where water is more than 8m below the surface – the maximum depth for any suction pump, manual or motorized. iDE has worked with manufacturers to standardize production, and demand has proven to be strong, for both agricultural and domestic applications. The rope and washer pump is also one of the key technologies in iDE Ethiopia's emerging WASH program.

## WOMEN-CENTERED DESIGN

One of the results of the first RPI investment was the formal embedding of Human Centered Design (HCD) within iDE's core product and program design process. HCD principles and practices enable us to develop a deep understanding of users' needs and aspirations to design solutions that are desirable, technically feasible and economically viable. This aligns with and augments the user orientation that iDE has always had.

Because women are often the primary small-plot vegetable producers and users of micro-irrigation technology, we held targeted deep dives with female users of agricultural products and services to ensure our products met their specific needs.

When designing the rope and washer pump for irrigation, iDE experimented with a pedal-powered version as a more ergonomic solution for large-volume pumping. However, at the prototype stage, Ethiopian women told us that the pedaling position was culturally inappropriate. It was clear that, despite some functional advances with the pedal version, a re-design of the hand-crank version for improved flow was the best solution. The pump is easy for both women and men to operate, and has been iDE Ethiopia's best-selling irrigation technology innovation to-date.



*Bringing the steam engine into the 21<sup>st</sup> century with the solar thermal pump*



*The Sunflower pump is a universal piston pump that can use a variety of power sources*

## THE SUNFLOWER PUMP

iDE has been pursuing alternative pumping solutions, which offer lower operating costs and a smaller ecological footprint than the fuel (petrol or diesel) pump. Electric grid and PV options are two significant areas of research and development, which we have done extensive work on in Ghana and other iDE countries. One unique alternative that iDE developed with support from the Bill & Melinda Gates Foundation in Ethiopia is the solar thermal pump. Rather than using PV cells, this pump converts solar energy directly into steam, which powers a small steam pump. This pump is good for deeper groundwater applications in areas where PV panels are abnormally expensive or difficult to acquire.

The pump is meeting its original cost target; an initial pilot launch in Kenya is selling pumps at around \$400. Return-on-investment calculations based on field testing indicate a highly competitive<sup>2</sup> return over four years compared with fuel-based alternatives, when paired with a drip system for water distribution.

iDE, along with Practica Foundation and FuturePump Limited, with support from the Liberty Foundation, USAID, Swiss Agency for Development and Cooperation and the Renewable Energy & Energy Efficiency Partnership are marketing the latest iteration of the pump as a universal pumping platform. The design retains the piston pump from the original solar thermal models, but allows the user to connect the pump to a variety of power sources: the thermal solar steam engine or an electric motor powered by a PV cell or grid electricity where available. The fly wheel also has a handle to allow the user to manually operate the pump without any auxiliary power source.

The universal platform is now branded as the Sunflower Pump. With an initial focus on market penetration in Kenya, Zambia, Nepal and Honduras, this venture is a good example of a technology with global potential. This pump leverages the initial investments by Bill & Melinda Gates Foundation and iDE to develop and field test an innovative solar pump in Ethiopia, in the same way that the portable Sunlight pump grew out of efforts to develop and test PV pumps in Ghana.

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<sup>2</sup> Results indicate a net return of \$4,000 for solar vs \$2,750 for fuel, over four years of use.



## GATED ROW IRRIGATION

Another technology with global potential that was originally developed and tested in Ethiopia is the piped mini-row or gated row (GRow) irrigation system. This system uses lay-flat hose and a length of PVC pipe with outlet holes to deliver water simultaneously to a set of rows in a field. By moving the outlet pipe systematically through the field and rotating it 180° to irrigate on both sides of the pipe, farmers can efficiently irrigate with minimal losses due to seepage in traditional delivery canals.

iDE has tested the technology more recently in Mozambique and Nepal. While the initial trials in Mozambique indicated weak demand, there is significant interest in Nepal. The Nepal team will continue testing and developing GRow for the local market.

## SUPPLY CHAINS AND RURAL MARKETING

Progress in Ethiopia is not only about technology development. As in Zambia, iDE has continued to innovate strategies for bringing low-cost smallholder technologies to market in Ethiopia, including mobile agents.

### SUPPLY CHAIN DEVELOPMENT

iDE has worked with local manufacturers to introduce product innovations, streamline manufacturing processes, encourage a smallholder customer focus and strengthen quality assurance processes. To-date, iDE Ethiopia has accomplished the following with support from the Bill & Melinda Gates Foundation:

- Trained, certified and equipped 5 pump manufacturers located in district towns. These businesses are in close proximity to farmers and are selling their products at affordable prices. The emphasis on quality has been critical, as the smallholder market for irrigation technologies has been damaged in the past by sub-standard and over-priced product (challenges that iDE had to overcome in the early years of this investment).
- Established 6 retailers, who are selling to farmers further away from district towns. These retailers provide a critical link between the district-level manufacturers and more remote farmers.
- Trained 99 village mechanics who now offer pump installation and maintenance at the *kebele* (village association) level. This after-sales support was largely unheard of with previous smallholder technology give-away programs that did little or nothing to establish and develop private-sector support and service channels.
- Certified 20 manual well-drilling teams
- Trained seven women's groups on vegetable seed production

### COMMUNITY MARKETING AGENTS

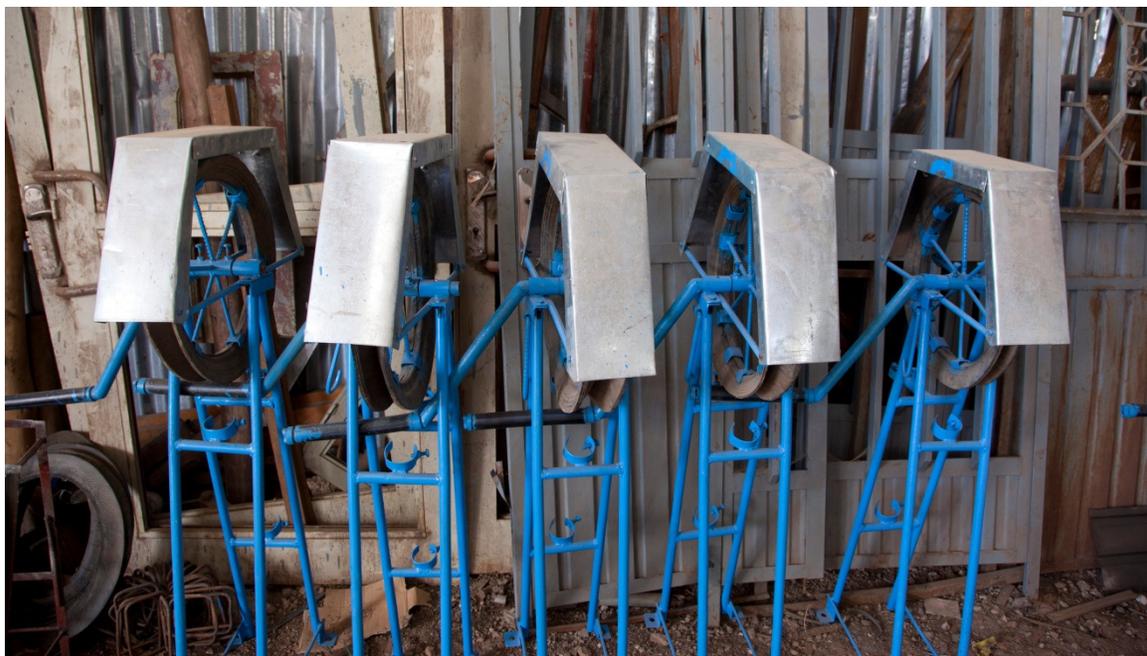
iDE Ethiopia has developed its own version of the Farm Business Advisor. Dubbed “Community Marketing Agents”, these are mobile entrepreneurs who market, sell and service smallholder technologies. Many of these agents are landless rural youth, who have few prospects due to the lack of job opportunities. iDE trained 173 community marketing agents, including 4 women, in sales and marketing, technology installation and maintenance, and basic agronomy. Like the Farm Business Advisors in Zambia and elsewhere, they are able to advise farmers on crop selection and best agricultural practices in order to optimize their use of inputs and irrigation technologies, maximizing their productivity and income.

In addition to sales and support for irrigation, the community marketing agents have also been a critical link for farmers to other services and inputs such as credit, seed, fertilizer and technical advice.

### DIGITAL GREEN

As part of a focus on rural marketing, iDE is working with Digital Green – another investment of the Bill & Melinda Gates Foundation. Digital Green offers low-cost video technology and training for rural marketing and extension applications. Trained staff members work with farmers to conceive, shoot and edit short videos in the field. Using a pico projector, they show these videos in people's homes, attracting crowds to see their local “movie stars” discussing best agricultural technologies and practices. Videos are a great medium for reaching illiterate farmers, especially women, with extension services. Digital Green's experience in India has shown that a higher percentage of women attend the video screenings than men.

The Digital Green partnership also offers opportunities to begin generating “big data” on smallholder practice, as the training modules move toward integrated mobile devices that track views and user data.



## TECHNOLOGY SALES

Overall, the rural promotion work has reached 25,000 farmers to-date. Over 9,500 farmers received support in the form of advice, credit, output marketing or technology.

Technology sales over the history of the program are as follows:

	2007	2008	2009	2010	2011	2012	2013	Grand Total
PUMP - ROPE	2	204	320	1,366	1,289	850	601	4,632
DRIP IRRIGATION	330	2,903	30	116	38	6		3,423
PUMP - TREADLE	238	160	221	455	681	276	523	2,554
IRRIGATION - WELLS			52	100	315	159	391	1,017
PUMP - OTHER	93	191	10	5	2	4		305
IRRIGATION - STORAGE			22	34	18			74
PUMP - MOTOR				10				10
<b>TOTAL</b>	<b>663</b>	<b>3,458</b>	<b>655</b>	<b>2,086</b>	<b>2,343</b>	<b>1,295</b>	<b>1,515</b>	<b>12,015</b>

Over the past three years of RPI2, iDE Ethiopia's technology and supply chain development efforts have led directly to the sale of 5,153 technologies. In addition to this, we have learned that more than 2,800 additional clients reached by community marketing agents with other services and advice are sharing technologies purchased by registered customers, often using them on a rotational basis. This is one way that families are spreading out the cost of technology purchases. iDE is pursuing more formal rental and pay-as-you-go markets as a way of broadening access to productive technologies. Of the total 8,000 technology users (purchases plus shared users) 1,084 (13%) are women.

The total sales for the past three years fall short of the original target of 10,500 units. Challenges include limited access to credit and increased materials costs, which led to price increases for the technologies. For example, over the past three years, the price of a rope and washer pump has climbed 25 percent from ETB 1,400 (\$80) to ETB 1,800 (\$100).

## RURAL CREDIT

As in many other countries, access to finance is a major constraint on smallholders' ability to invest and move up to market-oriented production. When iDE began the Rural Prosperity Initiative in Ethiopia in 2007, there was no product on the market with appropriate terms and conditions for vegetable growers. iDE worked with microfinance partner Buusaa Gonofa to develop and pilot test an appropriate finance product for smallholder vegetable producers.

The process led to two loan options: one for purchasing micro-irrigation equipment and another for purchasing vegetable inputs. The products have the following features:

- Flexible repayment period: In order to allow farmers to structure repayment around their production schedule, the loans offer flexibility to determine the schedule of payments within a 12-month period, with a fixed interest rate (18% for micro-irrigation loans and 24% for input loans);
- Loan sizes vary from ETB 1,500-3,000 (\$80-160) depending on type of equipment purchased (in the case of irrigation loans) and scale of production (in the case of input loans);
- An MoU details the respective roles of iDE and the finance institution. Linking the loans with improved technology, production practices and marketing channels offered through the Rural Prosperity Initiative greatly reduces the risk for the finance institution.

Approximately 60 percent of technology customers used credit from these sources. With repayment rates above 99 percent, other finance providers became interested in this opportunity. Eight finance institutions now offer micro-irrigation and/or vegetable input loans with a similar structure.

The success of the loans remains dependent on iDE services. While this reduces risk for the finance institution, it also places constraints on the scaling up of rural credit (the loan program cannot grow faster than the scope of iDE services). The challenge now is to increasingly integrate these loan products with private agricultural services, which lower the credit risk to lenders and will reduce iDE's role (and the limit it places on scale) over time.

Another limit on scaling up rural credit at this point is access to capital by the microfinance institutions. The Government of Ethiopia has put restrictions on the amount of loan capital available to microfinance institutions as the commercial and national banks of Ethiopia are over-stretched due to large investments in mega-projects.



*This roadside stand just outside of Ziway sells 300-400 kilograms of onions daily, and typically restocks its supply once a week. The farmer cooperative associated with this stall consists of 22 members, all of whom are women.*

## OUTPUT MARKETING

iDE has supported the development of farmer marketing groups, with a focus on particular high-value vegetables (e.g. onions, tomatoes, peppers, etc.). These groups aggregate supply and bring product to main trading routes in order to encourage more direct links with traders.

iDE conducted a market study, which identified some of the key constraints facing smallholder producers. On the basis of this study, iDE conducted zone, woreda and kebele workshops to discuss the issues with traders, processors, development agents, unions and government officials. This resulted in the creation of a “Market Linkage Task Force” that is responsible to enact changes to the marketing system to ensure fair access for small-scale producers.

Farmer business organizations and cooperatives offer a way for smallholders to bulk up their individual production to a level that is of interest to larger buyers. Grading and quality control also increase the group’s ability to capture higher prices with traders. Over the course of the project, iDE helped 26 such organizations to get established, with training on management and marketing. Of these, seven women’s groups were trained on both marketing as well as quality seed production, providing a critical service in the vegetable supply chain.

In the Rift Valley, farmer cooperatives have set up roadside vegetable stalls. The stalls act as collection points for farmers who need a set location to sell their produce. These stalls also add value by providing a buffer for price increases and food shortages, as items are bought in bulk and can be stored for an extended period.

## IMPACT

Through the course of the original Rural Prosperity Initiative investment (2007-2010) iDE conducted initial evaluations of the impact of smallholder irrigation technologies and allied services on smallholder productivity and income. These studies found client income increases of roughly \$300 per year.

As part of the final evaluation of the second phase of RPI funding, iDE conducted a quasi-experimental study to measure the current level of impact on farmer productivity and income (over the first 12 months post adoption). In addition to this, we used the opportunity to follow up on households from the original studies to measure longer-term impacts (over five years).

### IDE'S MARKET-BASED APPROACH IS REACHING POOR HOUSEHOLDS

One critique of market-based approaches is that they fail to reach poor households. In recent years, iDE has used the Progress out of Poverty Index<sup>3</sup> (PPI) to estimate the proportion of clients falling below the poverty line. As shown in Table 1, a high percentage of farmers fall below the poverty line. As is evident from the values and the significance test results, there is no significant difference in the poverty profile of clients and non-client.<sup>4</sup>

Table 1. Proportion of clients and non-clients by poverty category

	Treatment	Control	p Diff
Less than \$1.00 (PPP)	17%	17%	NS
Less than \$1.25 (PPP)	35%	34%	NS
Less than \$2.50 (PPP)	87%	84%	NS

### CLIENTS HAVE SIGNIFICANTLY INCREASED THEIR IRRIGATED AREA

As shown in Figure 1, clients increased their overall irrigated area, across all three key water sources. By contrast, non-client controls did not increase their irrigated area.

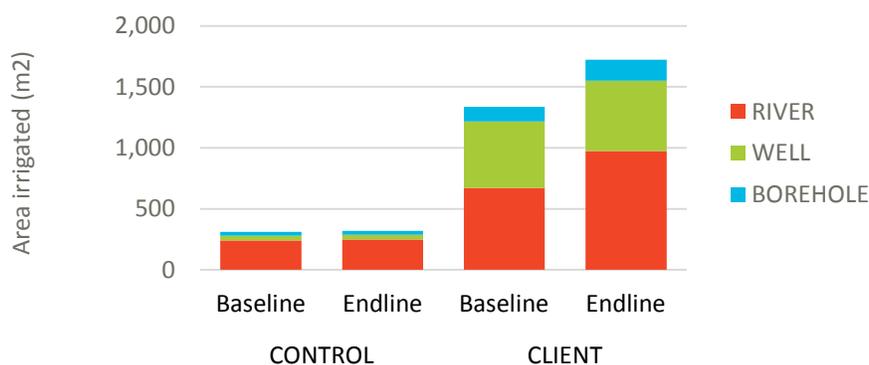


Figure 1. Area irrigated by clients and non-client controls at baseline and endline, by water source.

<sup>3</sup> The Progress out of Poverty Index (PPI) is a tool developed by the Grameen Foundation to estimate the likelihood that a household falls below standard poverty lines, based on a score generated by a 10-item inventory of observable household characteristics. [www.progressoutofpoverty.org](http://www.progressoutofpoverty.org)

<sup>4</sup> This is a snapshot taken at endline. We do not have baseline PPI data for this sample, and so cannot comment on changes over the first 12 months. Further, the sensitivity of the PPI to short-term changes has not yet been established.

CLIENTS HAVE SIGNIFICANTLY INCREASED THEIR USE OF TECHNOLOGY AND SERVICES

We asked about use of a range of technologies, services and practices at baseline and endline. As expected, clients demonstrated a higher increase in use than controls across most categories (Figure 2). Our impact evaluation showed that pumping water and watering were tasks equally shared by women and men. Further, we believe that respondents under-reported women’s share of irrigation.<sup>5</sup> The increased use of treadle pumps and rope and washer pumps is important to note as they help to reduce the drudgery associated with bucket farming for both female and male farmers.

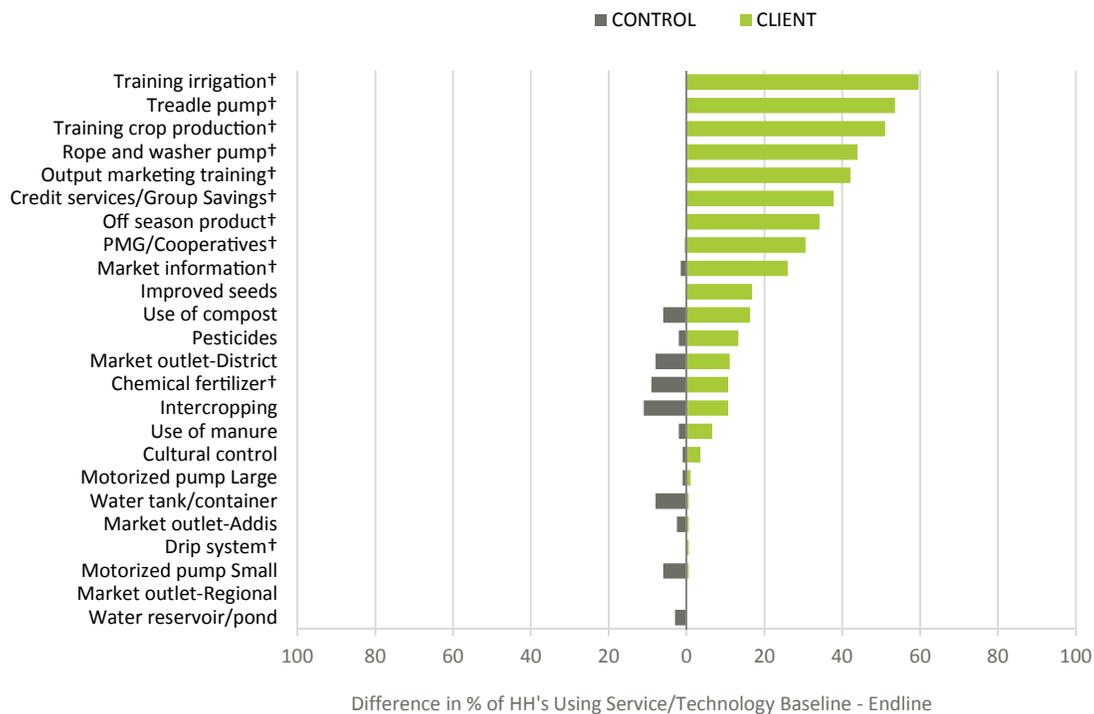


Figure 2. Change in percent of client and control households reporting use of agricultural technologies, services and practices between baseline and endline

† denotes a component of the iDE service package

<sup>5</sup> The survey had three options: “men only”, “women only” and “equally shared”. We believe that respondents tended to report “equally shared” when both genders participated, even if work was not evenly shared. iDE’s survey work in Zambia suggests that women spend more time irrigating than men; this also matches field staff perceptions in Ethiopia.

### CLIENTS DEMONSTRATE SIGNIFICANTLY HIGHER CROP INCOME

The provision of services and irrigation technologies to households under the RPI2 project is not determined by randomization, but by standard market access and self-selection. However, we collected data from households in villages where RPI2 is operating and from a matched set of comparison households in nearby, non-RPI2 villages. The dataset design exhibits some of the characteristics of a controlled experiment, in that there are localities and households that have access to technologies and services and some that do not have access, but the decision to adopt is not determined by randomization.

The analysis found that impact estimates were robust across two different estimators: propensity score matching using difference-in-differences and regression model coefficients that are consistent estimators of the difference in differences measures of the average treatment effect on the treated.

As shown in Figure 3, gross crop revenues increased by \$395 for irrigated crops and by \$573 for all crops (all estimates in PPP). The increase in irrigated crop revenue was significant at the 99% level, whereas the apparent increase in non-irrigated crop revenue was not significant.



Figure 3. Average increase in gross revenues from crop production among clients, compared with matched controls, non-irrigated, irrigated and total crop revenues.

When looking at non-irrigated crop revenues by *woreda*, we see some evidence of significant impacts in all but one *woreda*, suggesting that results from Abichu Guna'a are rendering the global results insignificant. If we exclude Abichu Guna'a households from the analysis, we see a significant impact of \$158 across the other *woredas*. As in other countries, this lends some support to the hypothesis that investments in high-value irrigated horticulture are also leading to increases in non-irrigated, field crop productivity and income. This is a hypothesis that iDE needs to test more rigorously, but makes intuitive sense.

Table 2: Non- Irrigated Crop Income Impact Estimates Market Rate Adjusted USD, By Woreda

Woreda - Non-Irrigated	Impact Estimate	Robust Standard Error	Significance
Kore	\$236.14	106.62	**
Kofele	\$109.25	63.62	*
Aleltu	\$310.91	145.74	**
Abichu Guna'a	-\$205.36	129.58	NS

Note: t-test on the equality of means: NS = Not Significant, \* = 10%, \*\* = 5% & \*\*\*=1% levels of significance

In order to calculate attributable net crop income, we subtracted production costs, including inputs, labour, transport and rental costs. The overall impact of the RPI2 investment on net crop income was \$699 (significant at the 99% level). The fact that the difference in net income was greater than the difference in gross revenues is an indication that client farmers saw a bigger jump in their relative productivity per unit of input cost than did controls.

#### USE OF IMPROVED SEED APPEARS TO SIGNIFICANTLY IMPROVE IRRIGATED CROP OUTCOMES

When we compare users of improved seed with those who used unimproved varieties, we see a strong effect of improved seed on irrigated crop revenues. In fact, our evaluation showed that the impact on households that do use improved seeds is more than four times larger than those households that irrigate but do not use improved seed. The fact that controls using improved seed did not see this effect suggests an interaction of improved seed and other measures to improve crop production. This underscores the importance of farmers having access to various components of improved production – technology, crop management and inputs.

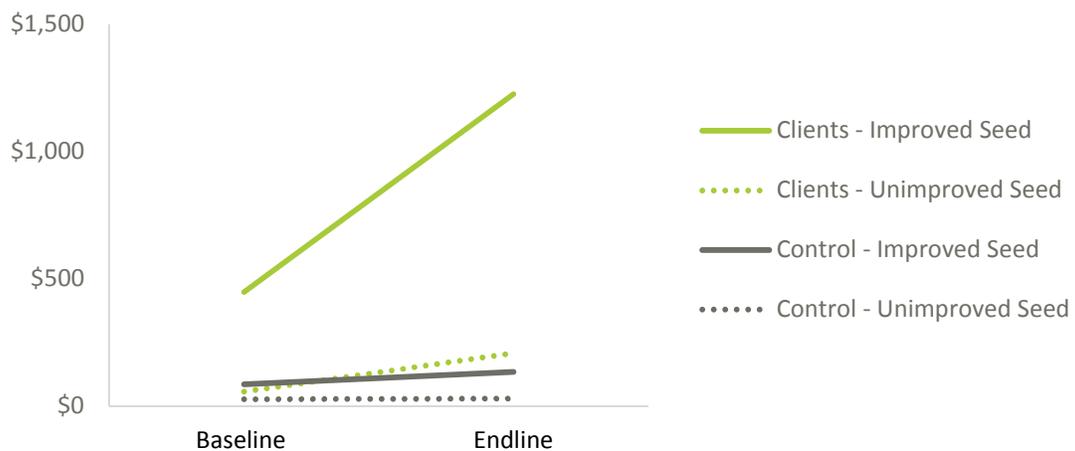


Figure 4. Change in irrigated crop revenues (\$PPP) comparing clients and controls with and without improved seed

IMPACTS AND EXPANSION OF ACCESS TO TECHNOLOGY APPEAR TO CONTINUE OVER THE LONG-TERM

As part of the analysis, we re-visited client and control households for whom we had income data from the first round of surveys, with data going back to 2007. While the original plan was to conduct a matched analysis of impact, we found that over 50 percent of the original controls had adopted an irrigation technology in the ensuing period, diluting estimates of effect size. This is a challenge for the analysis, but indicates that access to technology continued to expand beyond the original project.

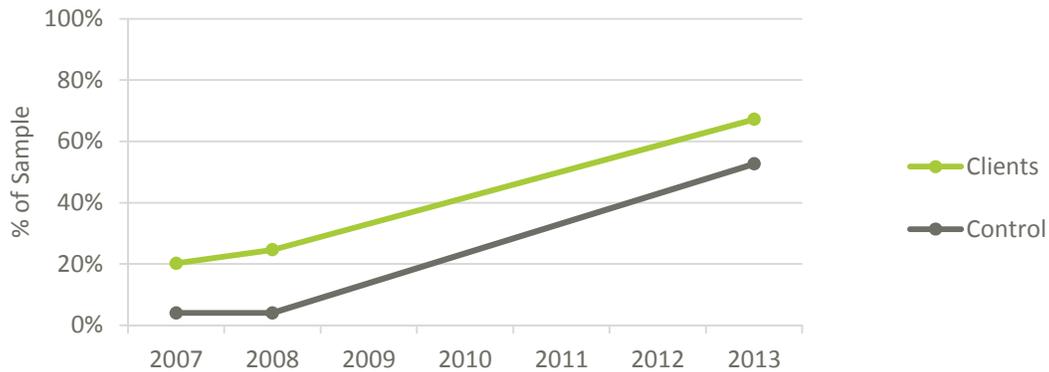


Figure 5. Proportion of micro-irrigation technology ownership: client and control samples 2007-2013

Comparing client and control gross revenues from irrigated and non-irrigated crops, we see a steady and continued increase in irrigated incomes over time among controls, mirroring the uptake of micro-irrigation technologies among that group following the original study. The control group’s non-irrigated crop revenue dropped significantly. It is unclear what exactly is buffering clients against this same drop, but possibly suggests some protective effect experienced by clients.

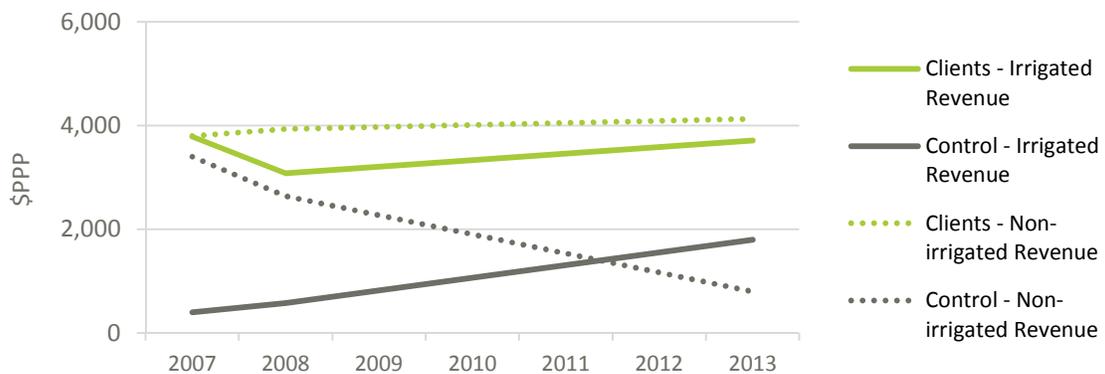


Figure 6. Comparison of Client and Control irrigated and non-irrigated annual gross crop revenues (\$PPP)

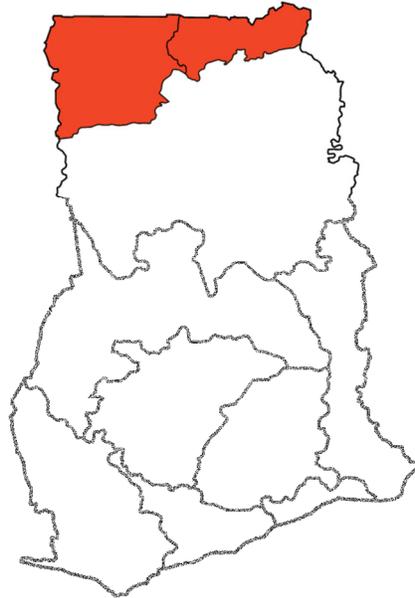
Comparing changes in client and non-client crop profit (subtracting input and production costs), we find a difference of close to \$1,500 in annual income over the five-year period 2008-2013 (client crop profits rose by \$700, while controls’ crop profit dropped by \$780). However, due to the low sample size and high variance, the difference is not statistically significant.

While issues with sample size and the uptake of irrigation technologies by controls make it difficult to draw strong conclusions at this time, it appears that income impacts measured in the original project have at least been sustained in subsequent years, supporting the claim that income increases through this market-based intervention are long-lasting.



## SUMMARY OF ACHIEVEMENTS AND OPPORTUNITIES

- The investments in iDE Ethiopia’s technology development program have yielded some important innovations – both for Ethiopia and globally. Some of these innovations are now being taken to the next level of scale through investments that build on the original Bill & Melinda Gates Foundation funding.
- As in other iDE country programs, the iDE Ethiopia program has identified the importance of mobile agents to deliver a broader spectrum of technology, inputs and advice to smallholders;
- The importance of a broader range of services and inputs is underscored by the finding that increases in irrigated crop income were much higher among users of improved seed;
- As with other African programs, iDE Ethiopia has demonstrated significant impact of improved access to micro-irrigation technology for smallholders: \$700 (PPP) increase in annual income. Research in Ethiopia demonstrates that as households increase their income they also increase their asset base, especially livestock, and improve their household nutrition through the increased consumption of vegetables and protein. However, the focus of innovation must shift to taking these gains to national and regional scale.



## GHANA

iDE has worked in Ghana since 2009. The program was initially established with funding from the Bill & Melinda Gates Foundation, and was part of the second Rural Prosperity Initiative investment through 2013, with significant co-investments from the Swiss Agency for Development and Cooperation, Canadian Department of Foreign Affairs Trade and Development and Swedish International Development Agency. iDE identified Ghana – and specifically the Upper East and Upper West Regions – as high potential for irrigated horticulture based on a combination of factors, including population, access to markets and shallow groundwater.

Studies conducted through the Bill & Melinda Gates Foundation-funded Agricultural Water Management Solutions project estimated that there are 1.85 million farm households, managing over 2.3 million ha of potentially irrigable land, who would benefit from expanded access to irrigation across Ghana.<sup>6</sup> In Upper East Region – iDE’s main area of operations in 2010-2013 – approximately 25 percent of smallholders currently use shallow groundwater for irrigation.<sup>7</sup> More efficient and accessible irrigation solutions can expand the number of farmers moving from manual water application to using more efficient irrigation technologies that help improve the productivity and incomes of Ghanaian bucket farmers.

iDE’s work in Ghana began with a focus on developing local manufacturing and distribution of treadle pumps, but has evolved into a strategy that includes alternative motorized pumping options, rural credit and pest management solutions. These are all necessary components for maximizing water productivity and smallholder incomes in Ghana’s upper regions.

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<sup>6</sup> Nemara et al. 2012. *Adoption of water lifting technologies for agricultural production in Ghana: implications for investments in smallholder irrigation systems*. IWMI.

<sup>7</sup> Nemara. 2012. *Agricultural Use of Shallow Groundwater in Ghana: A Promising Smallholder Livelihood Strategy*. IWMI

Reports available at [www.awm-solutions.iwmi.org](http://www.awm-solutions.iwmi.org)

## BEYOND THE TREADLE PUMP

At the outset of the Ghana program, iDE began working with manufacturers in Kumasi to produce stationary suction treadle pumps, similar to the model that was very popular in South Asia. The strategy was to introduce a pump that was significantly less expensive than the models on the market at the time, and to expand access through a distribution and retail network. Existing models – mainly of the mobile pressure pump variety – were selling for \$175, whereas the model introduced by iDE sold for \$65 (still roughly triple the retail price in South Asia for a similar pump, but a significant cost reduction for Africa).

In order to “prime the pump” in the market, iDE offered purchase guarantees to the manufacturers and arranged for financing through ECLOF – a church-based micro-finance institution, which iDE introduced to the Upper East Region. iDE also linked retailers in the north with the manufacturers, communicating orders and arranging transport.

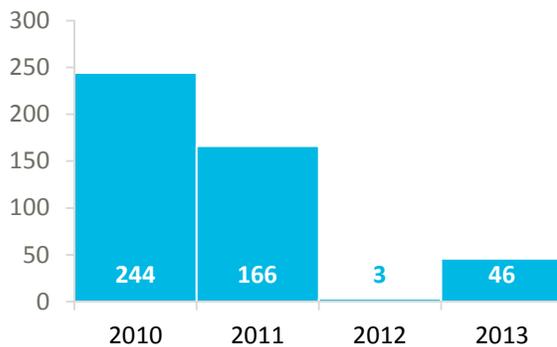


Figure 7. Treadle pump unit sales in Ghana: 2010-2013

shown in Figure 7, sales fell. Again, there were issues with the timely issuing of loans. A newcomer to the area, ECLOF faced some challenges mobilizing and collecting on loans.

However, it was also becoming apparent that the treadle pump is not a preferred technology as originally thought. Despite the cost savings on initial capital investment and operating costs, farmers expressed a strong preference for motorized pumping options. With petrol pumps selling for as little as \$140, the treadle pump was not offering significant savings relative to its functional limitations. In addition, there were issues with well depth dropping below the maximum suction depth of a treadle pump (6-8m) during the dry season, leaving some farmers to revert to bucket lifting or to abandon their irrigated plots entirely.

A further indication of smallholder preference was field staff reports that some farmers were taking loans to purchase treadle pumps because they were interested in establishing a history with the micro-finance institution – and the possibility of further agricultural lending in future – and not because they had an interest in the technology itself. Thus, iDE Ghana began to focus more on improving access to agricultural credit and developing alternative low-cost mechanized pumping options that offered greater lift capacity.

Despite the price reduction relative to other pumps, the price of the pump still required that most customers secure financing. In the first year of sales (300 pumps sold in late 2010 / early 2011) iDE concluded that finance was the limiting factor, as it took the micro-finance partner time to scale up its application review and approval process. At the same time, feedback from customers indicated that they would prefer a mobile pump that could be moved to different locations and also carried back to the house at night for security.

In the second year (2011-2012) iDE introduced a mobile suction pump, again based on models marketed in South and South-East Asia. As

## PUMP ALTERNATIVES – SOLAR

### THE CONTEXT

Current off-grid motorized pumping options – petrol or diesel pumps – are usually over-sized for customers’ wells and fields, and have recurring fuel costs (~\$1 per day to irrigate 1,000m<sup>2</sup>). In Ghana, petrol pumps are often used with rivers and reservoirs, but not as often with dug wells as they cannot keep up with these fast pumps. Many wells in Africa can only support 0.1 - 0.5 liters / sec.



*The solar-powered Sunlight pump is optimized for small-scale vegetable irrigation.*

### THE CHALLENGE

Our challenge was to develop a renewable-powered alternative to the fuel-powered pump that is economically viable, technically feasible, and desirable to the customer. Original design parameters were as follows:

- It should pump enough water to support a garden of 1,000 square meters, from a water depth of 12 meters;
- The customer should be able to pay it off in a year; better yet, in a single growing season;
- Customers are willing to pay more for a solar-powered pump than a manual pump (\$65-100), but may not pay much more than the closest available diesel or petrol pump (\$170).

### WHY CHOOSE SOLAR PUMPING?

- No recurring fuel costs
- Improved use of limited water resources. Because solar pumps pump water more slowly, over a longer period of time, farmers use more efficient water management techniques such as drip irrigation, doubling “crop per drop”;
- May have healthier and more bountiful produce, an observed advantage of using drip;
- Solar components require minimal maintenance over a decade, whereas a fuel pump requires significant maintenance and may need to be replaced after four years of use;
- PV cells can be used for a broader range of applications, including cell phone charging and lighting

### WHY MIGHT SOME CUSTOMER NOT CHOOSE SOLAR PUMPING?

- Initial investment cost is higher than for fuel pump solutions
- The timing of a PV-powered pump’s water output and slower flow requires changes in irrigation methods. Water should feed either into a drip system, or into a bin for periodic use.

### SOLAR SOLUTIONS

Building on the initial investment by the Bill & Melinda Gates Foundation, iDE has worked on a variety of solar pumps, recognizing the range of user requirements. There are two well-developed options:

- The Sunflower Pump offers in situ lift up to 20m, developed in partnership with PRACTICA, Renewable Energy and Energy Efficiency Partnership, USAID Powering Agriculture and FuturePump;
- The Sunlight Pump (pictured above) is a portable model with shallower lift (up to 8m), developed with the Solar Power Association of Switzerland, Swiss Caritas and SDC.

#### FINANCIAL VIABILITY

The Sunflower Pump costs approximately \$400, while the Sunlight Pump is currently priced around \$700. While this represents significant progress for an affordable PV pump set, it is not competitive as a cash purchase option for most smallholders, who have very constrained cash flows.

However, innovations in business model may bring solar pumping to a much broader market. Comparing a solar pump plus drip irrigation system with a fuel pump using flood irrigation,<sup>8</sup> we find a significant increase in profitability within the second year (assuming in both cases a 1000m<sup>2</sup> plot, expanded to 2,000m<sup>2</sup> in the second year).

Area	Year 1 1,000m <sup>2</sup>	Year 2 2,000m <sup>2</sup>	Year 3 2,000m <sup>2</sup>	Year 4 2,000m <sup>2</sup>	
SOLAR	Solar Pump	(\$400)			
	Drip Kit	(\$300)	(\$300)		
	Fuel				
	Crop Sales <sup>9</sup>	\$720	\$1,440	\$1,440	\$1,440
	Net	\$20	\$1,140	\$1,440	\$1,440
<b>TOTAL</b>				<b>\$4,040</b>	
FUEL	Engine Pump	(\$160)			
	Drip Kit				
	Fuel <sup>10,11</sup>	(\$185)	(\$370)	(\$370)	(\$370)
	Crop Sales	\$600	\$1,200	\$1,200	\$1,200
	Net	\$255	\$830	\$830	\$830
<b>TOTAL</b>				<b>\$2,745</b>	

#### FINANCE OPTIONS

Three possible options for ownership and/or use of solar pump sets are as follows:

Option	Down Payment	Rent-to-own or Pay-as-you-go	Notes
Complete package – purchased	\$400	-	Uncompetitive with fuel pump price
Pump purchased, panel provided as fee-for-service	\$100	\$150/season	Requires finance, collection, maintenance capabilities
10% down, remainder PAYG	\$40	\$10-12/week	Requires finance, collection, maintenance capabilities

<sup>8</sup> Farmers typically do not use drip irrigation with fuel pumps as the higher flow rates make it more challenging and - in the farmer's perception – unnecessary. Thus, the analysis focuses on most-likely scenarios. An analysis of fuel pump plus drip also favours solar, although the difference is obviously smaller.

<sup>9</sup> Assumes 20 percent increase in productivity with drip irrigation

<sup>10</sup> 1 litre of fuel per 1,000m<sup>2</sup>

<sup>11</sup> Irrigating every day for 180 days

## PUMP ALTERNATIVES – GRID

When iDE customers have access to the electrical grid, the simplest and most efficient method to lift and move water is an AC electric pump. However, few iDE customers have access to the electrical grid, and even when they do constraints exist which can make these pumps less attractive. Through the research and work in Ghana, iDE has identified strategies to reduce these constraints and to encourage the commercial agricultural use of rural electricity for irrigation.

Out of iDE's African programs, and indeed, out of most African countries, Ghana stands apart in its persistent and effective push towards rural electrification. In 1990, the government announced a 30 year initiative to bring electricity access to the entire country. At the time, only 15 percent of the population had electricity access. By 2012, 72 percent of the population had access to electricity, with urban rates three to four times greater than those in rural areas.

Many of these electrical lines are specified for domestic use: lights, phones, radios. Stringing lines to the fields for productive irrigation is not permitted, though undoubtedly is done in some areas.



*Figure 8. AC pumps like this submersible model selling for GHS 90 (\$45) offer affordable, deeper lift options for smallholders with access to grid power*

#### IDE'S VISION FOR BRINGING AC ELECTRICAL PUMPING TO SMALLHOLDERS

iDE envisions a two-part strategy for getting electrical irrigation pumps into the hands of dollar-a-day farmers, for the purpose of wealth-creation via dry-season agriculture.

The first part is a policy issue: getting the policies and standards in place so that the grid is expanded not only to our customers' homes, but also to their fields, for legitimate commercial agricultural use.

The second part is applying iDE's PRISM<sup>12</sup> methodology to identify the market bottlenecks, the existing supply chain players, and determine a plan to establish a solid working supply chain to distribute and market the best affordable AC electric pumps.

#### POLICY

In 2013, President Obama announced Power Africa – an initiative to double the number of people with access to power in Sub-Saharan Africa. Ghana is one of the six focus countries for this program. Within Power Africa's broad mandate, there is room for iDE and partners to advocate for a focus on smallholder irrigation as a critical driver of rural electrification.

This effort will require partners to identify the policy-makers and other influential stakeholders in Ghana, benchmark other countries, and rally partners around a vision to permit and even encourage smallholder use of electricity to irrigate their fields in the dry season. The proposed strategy includes four key elements:

- Develop a policy that allows and encourages electric use for productive agricultural use,
- Modify existing grid-expansion plans, and setting additional goals,
- Set pricing strategies (domestic vs. commercial use rates, the use of subsidies) as well as metering methods,
- Develop standards for outdoor electrical connections that are safe, affordable and convenient.

#### PRISM

The policy phase is necessary to provide farmers *access* to electricity. The second phase is to establish a supply chain to provide products so that farmers can *use* the electricity. To do this, iDE will use its PRISM process. PRISM is a set of tools that are used to develop an understanding of the unique situation of the rural poor and to create sustainable opportunities through market-oriented interventions. PRISM asks and answers four basic questions to develop pro-poor market systems:

- What market opportunities can small farm families take advantage of?
- What constraints prevent small farm families from participating in these market opportunities?
- What small enterprises exist or can be created to address those constraints?
- What assistance is required to help those enterprises better serve the needs of small farm families?

The combination of an enabling policy environment and a smallholder-oriented private sector offering affordable access to grid-based irrigation solutions offers a unique opportunity to dramatically increase smallholder productivity and income across large areas of rural Ghana.

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<sup>12</sup> *Prosperity Realized through Irrigation and Smallholder Markets*

## CREDIT

### A NEW FINANCE PRODUCT FOR MARKET VEGETABLE PRODUCTION

Access to agricultural credit remains difficult in rural Ghana. Financial institutions regard these as high-risk loans, which are generally expensive to administer. When iDE Ghana began its operations in the north, there were no appropriate finance products available for market vegetable production.

iDE initially partnered with ECLOF to provide financing for treadle pump purchases. The results were disappointing, with repayment rates barely above 50 percent and delays in approvals. Following an analysis of the initial failures, iDE determined that there were issues with the provider (ECLOF was new to the area, under-resourced its field operations and underwent organizational restructuring during the pilot phase) and with the product (particularly the tie-in with treadle pumps).

Working with new partners,<sup>13</sup> iDE focused on developing loans tailored for irrigated vegetable production. As a result, iDE helped to launch a new loan product with an interest rate of 13-15 percent, payable in three monthly instalments, following an initial grace period of three months (reflecting the realities of vegetable farmer cash flows) at an average loan size of GHS 205 (\$90).

### PROMISING RESULTS

Overall, the results indicate that these loans meet a need among farmers seeking to commercialize small-plot, high-value horticultural production:

- As shown in Figure 9, the number of clients accessing agricultural loans has climbed steadily, with over 1,600 clients in 2013 (roughly double the number of loans in 2012);
- 45 percent of loan beneficiaries are women. Approval rates are slightly higher for women;
- 95 percent recovery on receivables (capital plus interest);
- Lenders expressed a high level of satisfaction with loan performance;
- 95 percent of farmers surveyed said they were “highly satisfied” or “somewhat satisfied”;
- Women report the following specific benefits:
  - Increased connection with other women through the loan groups, with an increase in the traditional practice of groups helping with members’ farm work (*Nnoboaa*);
  - Fewer men leaving the home in search of work during the dry season;
  - Increased independence with access to capital for their own dry season vegetable production as women in these regions have their own gardens.
  - Development of a savings culture as women’s groups have begun managing their own small savings and loans, enabling members to invest in micro-business opportunities.

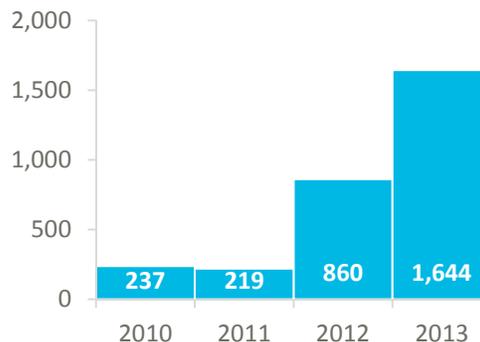


Figure 9. Number of clients accessing agricultural loans through iDE credit partnerships 2010-2013

<sup>13</sup> By the end of 2013, iDE was working with 12 micro-finance institutions and rural banks across Upper East and Upper West regions

#### INNOVATIONS FOR SMALLHOLDERS

There are a few innovations that make this loan product very interesting for smallholders who want to move into more commercial vegetable production:

- The repayment schedule is built around the production and harvest cycle, including a three-month grace period during crop maturation and regular payments while marketing produce;
- A strong emphasis on timely disbursement when farmers need the cash for seeding and field preparation. Approval times were approximately two weeks, although some institutions took as long as one month – an area for improvement;
- A focus on high-margin vegetable production. Previous agricultural credit focused almost exclusively on lower-margin field crops (e.g. maize, millet, sorghum), which represents a high risk to lenders, given prevailing interest rates and weather fluctuations;
- The integration of credit offerings with iDE services greatly improves the probability of loan recovery. Farmer groups using iDE-promoted technologies and practices are preferred clients for finance institutions. Essentially, iDE clients are self-selecting as profitable farmers, who represent a sound business opportunity for finance institutions.

#### CHALLENGES FOR SCALING UP

While iDE has demonstrated successful loan disbursement and recovery on a pilot basis, there remain significant challenges for taking these innovations to scale.

- Liquidity constraints for small and medium-sized finance institutions are hampering the scale of credit offerings. Disbursements represent approximately 33 percent of applications. Banks indicate that lack of capital is a significant limiting factor to the volume of loans provided;
- Internal management constraints for many small and medium-sized institutions create inefficiencies and delays, which are a serious risk for agricultural credit;
- Profitability of the loans for finance institutions may need to increase for credit to reach significant scale. At 95 percent recovery rates, the interest rate may need to increase to ensure a sufficient return on capital. This is complicated by the current high inflation in Ghana;
- iDE services (particularly field staff helping to organize groups and identify farmers) currently make vegetable finance an attractive proposition to the finance institutions. This introduces a constraint on scale, as access to loans will only grow as quickly as iDE is able to scale its field operations. Finance institutions must build the capacity of their own staff to provide these services in place of iDE.

iDE believes that it is possible to overcome these challenges. Targeted investments to address these issues represent a significant opportunity to transform high-value agriculture for smallholders in Ghana. iDE is working in partnership with international micro-finance organizations to identify further investment opportunities to take smallholder finance to the next level.

## PEST MANAGEMENT

In discussions with clients, iDE field staff identified pest losses as a major source of lost productivity and income. Smallholders have limited resources to invest in chemical solutions and often lack the knowledge to correctly apply them, leading to health and environmental concerns, as well as wasted money.

iDE partnered with a local entomologist to develop a basic curriculum for alternative pest management practices. The goal is to improve the effectiveness of non-chemical pest control as well as optimize farmers' use of recommended chemicals, and improve their use of pesticide safety practices.

iDE field staff organized local dealers and government extension workers to deliver training and discuss challenges in the delivery of appropriate product and information. On the basis of training, iDE accredited dealers and encouraged farmers to seek product and advice from those businesses. To-date, iDE has accredited 10 input dealers (2 women) in Upper East and 7 input dealers (2 women) in Upper West Region. iDE has also trained 10 Ministry of Agriculture and Food extension workers (6 in Upper East and 4 in Upper West Region)

As a result, farmers are sourcing more of their pest control solutions from accredited dealers and receiving better advice on pest management

iDE staff also worked with lead farmers in participating farmer groups to raise awareness about best practices in pest control. As shown in Figure 10, lead farmers and extension workers, with support from iDE staff, have trained over 8,750 farmers in the past three years. Women make up close to 40 percent of the trainees.

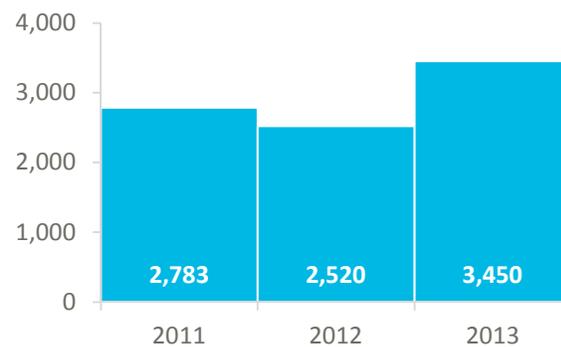


Figure 10. Number of farmers trained in improved pest management practices 2011-2013

## IMPACT

The RPI2 final evaluation was the first completed impact evaluation of iDE’s work in Ghana. In early 2014, iDE conducted a final evaluation of the second phase of RPI funding, using a quasi-experimental approach to measure the attributable impact of program innovations. We interviewed a total of 1,067 farmers:<sup>14</sup> evenly split between clients, non-clients in program areas (spillover) and non-clients outside program areas (controls).

The instrument aimed to estimate farmer productivity and income at baseline and 12 months after accessing iDE services (primarily credit and farmer training).

### IDE’S MARKET-BASED APPROACH IS REACHING POOR HOUSEHOLDS

One critique of market-based approaches is that they fail to reach poor households. In recent years, iDE has used the Progress out of Poverty Index<sup>15</sup> to estimate the proportion of clients falling below the poverty line. As shown in Table 3, a high percentage of farmers fall below the poverty line. Based on these estimates, it is safe to say that iDE’s offerings in Ghana are reaching a high percentage of poor households. It also appears that the sample is balanced between client, control and spillover groups (all have roughly the same distribution of households falling below the poverty lines).

*Table 3. Proportion of clients and non-clients by poverty category*

	Control	Spillover	Clients
Less than \$1.25 (PPP)	46%	53%	54%
Less than \$2.50 (PPP)	84%	86%	86%

<sup>14</sup> Although the original sampling plan called for 50 percent male and 50 percent female respondents, the final sample was closer to 65 percent male and 35 percent female. We asked randomly selected farmers to meet at a central location for interviewing. Although we specifically asked households to send the female head, many households sent the male head of the family.

<sup>15</sup> The Progress out of Poverty Index (PPI) is a tool developed by the Grameen Foundation to estimate the likelihood that a household falls below standard poverty lines, based on a score generated by a 10-item inventory of observable household characteristics. [www.progressoutofpoverty.org](http://www.progressoutofpoverty.org)

CLIENTS HAVE SIGNIFICANTLY INCREASED CROP MARGINS AFTER 12 MONTHS

A general comparison of client, spillover and control farmers shows that all groups appear to have very healthy crop margins. The control group, consisting of farmers from new farmer groups in Upper West Region, appear to be generating more revenue than the treatment (client) and spillover (client neighbour) farmers in Upper East Region. Because of the regional differences, we compare treatment and spillover with the controls, but also compare clients with spillover farmers, as they are drawn from the same communities.

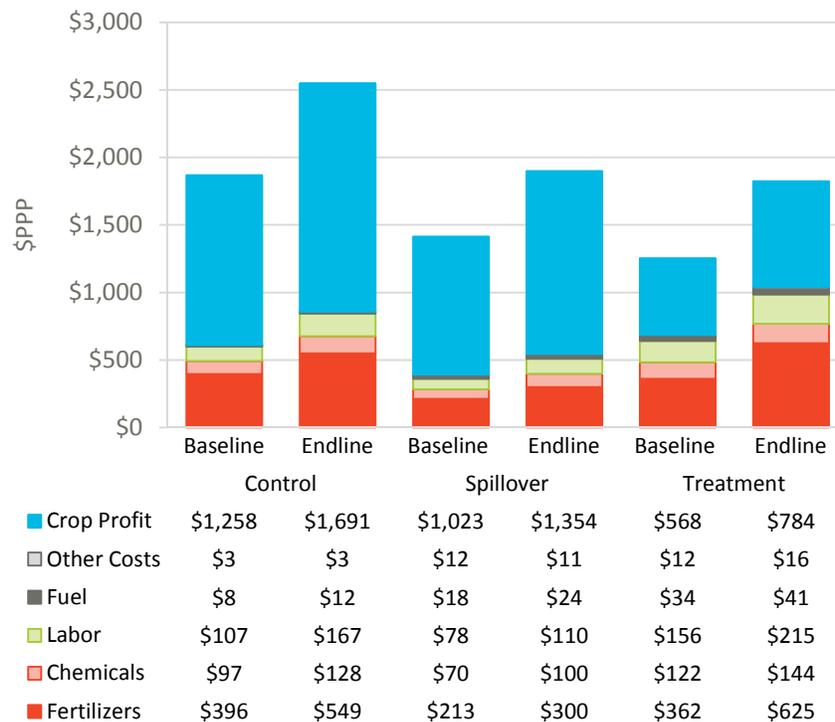


Figure 11. Breakdown of crop costs and margins (average cost per farmer in \$PPP by experimental group)

The provision of services and irrigation technologies to households under the RPI2 project is not determined by randomization, but by standard market access and self-selection. However, we collected data from households in villages where RPI2 is operating and from a matched set of comparison households in nearby, non-RPI2 villages. The dataset design exhibits some of the characteristics of a controlled experiment, in that there are localities and households that have access to technologies and services and some that do not have access, but the decision to adopt is not determined by randomization.

The analysis found that impact estimates were robust across two different estimators: propensity score matching using difference-in-differences and regression model coefficients that are consistent estimators of the difference in differences measures of the average treatment effect on the treated.

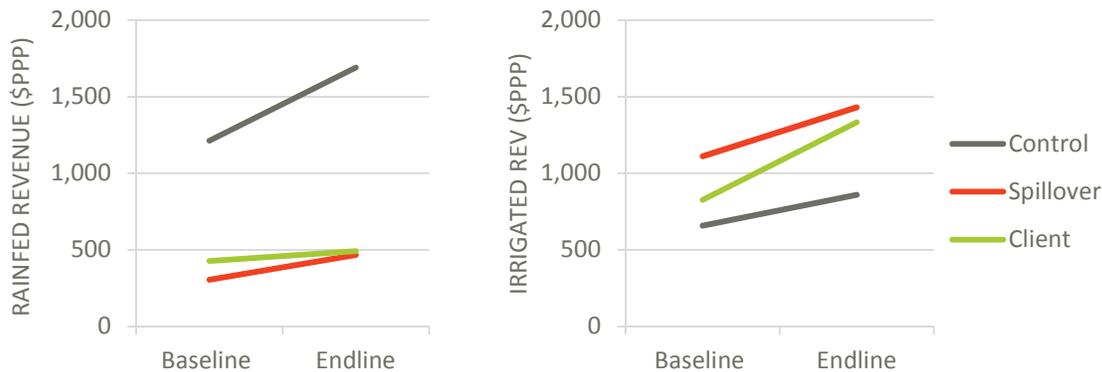


Figure 12. Average gross revenue for rain-fed and irrigated crops (\$PPP) at baseline and endline by experimental group.

As shown in Figure 12, clients saw their gross irrigated crop revenue increase by \$480<sup>16</sup> (over 50 percent increase). The other groups also saw significant increases, although of a smaller magnitude. Client and spillover groups had higher irrigated revenues at baseline than the control group.

Clients and their neighbours saw very little increase in rainfed crop revenue over the same period, whereas the control group had much higher baseline revenues and a much higher increase in rainfed revenue between baseline and endline.<sup>17</sup> The rainfed results underscore possible regional differences between the control and client/spillover groups.

A matched analysis of clients and controls finds a significant impact on irrigated revenue (\$394)<sup>18</sup> and a larger negative impact on rainfed crop revenue (-\$891). As already noted, the observed changes in rainfed crop revenues are likely due to regional effects. The overall impact on crop revenue is not significant.

When we instead compare clients with the spillover group (which is similar to the control groups used in Zambia and Ethiopia) we find a marginally significant impact on irrigated crop revenue (\$250<sup>19</sup>) and smaller but significant negative impact on rainfed crop revenue (-\$142<sup>20</sup>). The matched differences in overall crop revenue were non-significant.

In order to calculate attributable net crop income, we subtracted production costs, including inputs, labour, transport and rental costs. The overall impact of the RPI2 investment on net crop income was not significant for either the clients versus control or clients versus spillover comparisons.

Given that the Ghana program is continuing to mature its offerings in terms of credit, farmer advice and technology, it is not surprising that we do not yet see the same robust impact results observed in Ethiopia and Zambia.

The challenge for Ghana is to bring the most promising innovations to market and demonstrate significant impact on smallholder productivity and incomes. This evaluation suggests that we are on the right track, particularly in terms of increasing irrigated crop revenue, but have not yet fully refined these innovations.

<sup>16</sup> Significant at 99%

<sup>17</sup> Control and spillover increases are significant at 99%; client increase is significant at 95%

<sup>18</sup> Significant at 95%

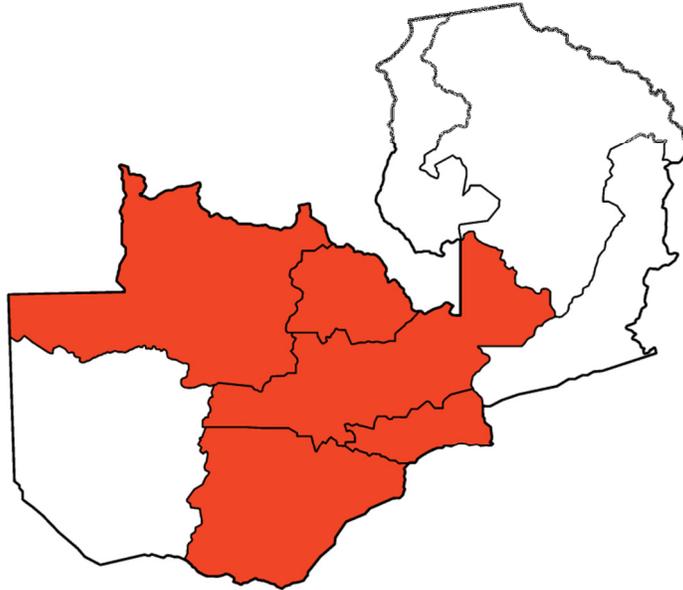
<sup>19</sup> Significant at 90% for two estimators, non-significant for one estimator

<sup>20</sup> Significant at 95% for two estimators, non-significant for one estimator



## SUMMARY OF ACHIEVEMENTS AND OPPORTUNITIES

- Ghana is a particularly high-potential country for investment in smallholder agriculture. The proximity of markets, availability of shallow groundwater and expanding rural electrification offer opportunities for high-value irrigated horticulture unlike many other African countries;
- Over the course of the RPI2 investment, iDE has moved from a focus on treadle pump manufacturing and distribution to innovations in alternative pump technologies – particularly solar and AC electric pumps, which offer the prospect of greater lift and profitability for smallholders. With significant gains in the design of the technology, the next frontier is demonstrating a viable business model that incorporates pay-as-you go and/or rent-to-own arrangements to take renewable energy pumping to scale;
- It is clear that there is strong demand for agricultural credit in the northern regions of Ghana. iDE has demonstrated to local banks and micro-finance institutions that it is possible to manage credit risk with improved farm management and field follow-up. The experience has identified current constraints and opportunities for scaling up smallholders' access to finance for high-value vegetable production.



## ZAMBIA

iDE has worked in Zambia since 1997, with investment from the Bill & Melinda Gates Foundation since 2007. As iDE's first African program, iDE Zambia set out to significantly increase smallholder incomes at scale, adapting affordable micro-irrigation technology, supply chain development and market access strategies that have achieved success in South and South-East Asia. Thanks to the support of the Bill & Melinda Gates Foundation, along with other allied investments, iDE has been able to develop and demonstrate innovations in the delivery of rural products and services that are having a significant impact on poor, rural households.

iDE's strategy in Zambia has shifted from a relatively narrow focus on delivery of micro-irrigation equipment (primarily locally manufactured treadle pumps) to a broader platform for delivering rural products and services in an efficient and effective way.

## THE END OF THE ASSEMBLY LINE

During the first phase of the Rural Prosperity Initiative (2007-2010) iDE made a strong effort to get local pump manufacturing operating at scale in Zambia. This had been the model in South Asia, where large numbers of small-scale manufacturers made and sold treadle pumps, and were primary drivers of the significant scale achieved in Bangladesh, India and Nepal. iDE Zambia designed and launched a new pump named the “Mosi-O-Tunya”, the local name for Victoria Falls. The pump promised a 20 percent cost reduction and higher output compared with competing models, such as KickStart’s MoneyMaker.



The Mosi-O-Tunya treadle pump, launched by iDE in 2009

As shown in Figure 13, treadle pump sales in Zambia never really took off as hoped over the course of the two RPI investments, with the high point being little more than 1,000 sales in 2011.

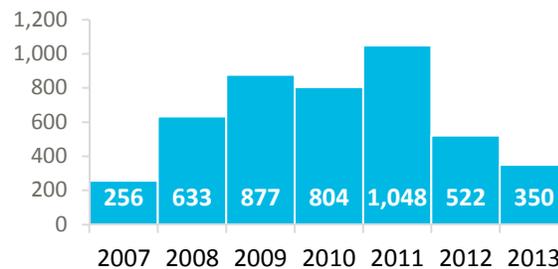


Figure 13. Treadle pump unit sales in Zambia: 2007-2013

Local manufacturers were unable to manufacture either the number or quality of pumps required. Further, they were unable to compete on both price and quality with imported pumps. In early 2011, a Mosi-O-Tunya pump (with inlet and outlet hose plus a foot valve) cost ZMK 950,000 (\$195), but the true cost (without hidden subsidies) was closer to ZMK 1.2 million (\$250), the price of its main competitor, the MoneyMaker. At the same time, a motorized pump was selling for ZMK 1.5 million (\$310).

Further, in order to deal with limited manufacturer capital and procurement capacity, iDE provided raw materials on credit, guaranteed offtake and did most of the distribution and marketing. As a result, the manufacturers saw themselves more as contract suppliers to iDE than serving a competitive smallholder market.

At the same time, better quality imported pumps were becoming increasingly available on the Zambian commercial market – a testament to iDE’s earlier work demonstrating to the private sector that demand existed.



Figure 14. Cumulative technology sales versus project target

Facing these challenges, iDE pulled the plug on local pump manufacturing efforts in mid-2011. Since then, iDE has focused on addressing obstacles to the delivery of a broader range of agricultural products and services, including inefficient distribution channels, a lack of agricultural financing and poor market information.

As shown in Figure 14, this approach has helped iDE Zambia ramp up its irrigation technology sales overall.



## THE FARM BUSINESS ADVISOR

Building on the success of iDE Cambodia's Farm Business Advisor (FBA) innovation, iDE Zambia introduced a similar concept. Zambia's FBA model now promises to reach large numbers of Zambian smallholder farmers with a range of livelihood-enhancing products and services that are effectively marketed, efficiently delivered and enriched with relevant advice and support.

Eight years ago, iDE was working with farmer groups as a way to reach large numbers of farmers with relatively small investments in staff time and travel. Instead of staff-led promotion and training in communities, iDE now focuses its resources on recruiting and training FBAs – motivated and capable individuals who receive training on a range of topics from agronomy to sales and business management, and who provide connections to local distributors and retailers, credit providers and, in some cases, output markets. The FBA then becomes the primary point of contact between village farmers and other value chain actors.

For the input supplier, an FBA offers the opportunity to expand market penetration into more rural areas, with relatively little additional cost. For the farmer, the FBA offers much more convenient access to products plus advice that enables them to optimize their use of those inputs.

The FBA also plays an important role as a trusted source for reliable inputs in markets where weak regulation and exploitative business practices often leave smallholders vulnerable to sub-standard or even fraudulent product.

In return for offering this service, the FBA receives a sales commission from input suppliers. Initially, iDE brokers these arrangements, but then steps back to allow the FBA and suppliers to manage their own contracts. Corporate funding from RLG International has supported the development of a formal training curriculum, which is helping to boost the spread of this approach.

As a result of RPI2 investment, over 130 FBAs are serving 80-120 farmers each. In the next four years, iDE Zambia is aiming to scale up FBA services to over 500 FBAs (serving 60,000 farming households) operating in seven of Zambia's ten provinces. iDE Zambia has secured grant funding from both the EU and SIDA to do this - taking the Bill & Melinda Gates Foundation's investment to the next level. The FBA approach will be developed to include additional sub-sectors, including small livestock and selected field crops, where there is the potential for FBAs to help smallholder farmers diversify their production from subsistence cropping into more lucrative income generating activities.



#### DEMONSTRATING THE POSSIBLE

From our existing work in Zambia and elsewhere several things are clear.

- There is potential for FBAs to bridge the ‘last mile’ – distributing inputs, advice and finance – and the ‘first mile’ – mending fragmented smallholder agricultural value chains by helping farmers to market a range of products and services.
- The FBA model offers potential for sustainability and growth of smallholder services, as it is driven by commissions and/or margins on sales transactions, rather than subsidies.
- The FBA-client relationship offers localized and trusted support, a rarity in markets frequently characterized by one-off, exploitative transactions between suppliers and farmers.
- FBA networks offer a platform to provide a broader range of other products and services, including rural finance, market information, personal solar products and water and sanitation, all of which iDE is actively pursuing.

## CREDIT

iDE Zambia’s experience to date with the FBA model indicates that FBAs can play a vital role connecting their clients to providers of agricultural credit. Early on, FBAs realized that unless farmers could finance their purchases of equipment and inputs for vegetable production, their sales - and earned commissions - would be low. They started to act as key points of contact between the farmers that they served and micro-finance institution (MFI) loan officers. As this relationship has grown, FBAs have become essential in mobilizing farmers; educating them about micro-finance and their obligations; advising loan officers when farmers are ready for loans; assisting farmers in completing the necessary paper work; and encouraging repayment. This role has been recognized by iDE’s key micro-finance partners, Vision Fund and CETZAM, who have agreed to pay FBAs a commission for each loan fully recovered.

As shown in Figure 15, the number of loans approved has increased over the past two years. In 2012, MFI partners approved just over 800 loans facilitated through FBAs (22% of over 3,700 applications). In 2013, over 1,000 farmers accessed loans (36% of close to 2,900 applications). iDE continues to work with MFI partners to improve the efficiency of loan processing and to refine the loan products themselves. While agricultural loans are still not widely available, iDE is working to improve the risk profile by linking loans to FBA services that improve farmer productivity and income, making them better credit risks for MFIs.

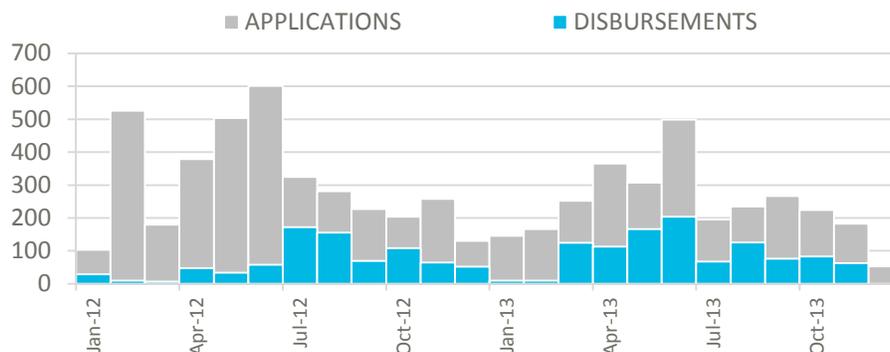


Figure 15. Monthly applications and disbursements of farmer loans: 2012-2013

At this stage one of the limiting factors for scaling up access to agricultural credit is the internal management capacity of local MFIs (this mirrors iDE’s experience in other country programs). iDE’s first partner, CETZAM, has undergone senior management changes in the past year that have created some instability and limited the organization’s effectiveness in growing its agricultural credit operations. Two other organizations stepped into the gap in 2013. The social enterprise Rent-to-Own offers equipment hire on an installment plan. A package of motorized pump plus 50m poly pipe is ZMW 3,500 (\$700) with a six month term and 5 percent monthly interest. VisionFund Zambia is offering more general agricultural loans at ZMW 1,800 (\$360) with a six-month term and 3.5 percent monthly interest. Recovery rates were above 90 percent in Lusaka and Copperbelt, but below 70 percent in Southern.

While we have focused on getting the product right, it is clear that there is still a need for significant improvements in the efficiency of our partners’ field operations if we are to achieve real scale.

## OTHER SERVICES

As a network of trusted advisors who have repeated and frequent interactions with their clients in rural communities, FBAs offer a channel for delivering a range of allied services to farmers.

### MARKET INFORMATION

iDE has worked with an ICT group to design and develop a mobile phone-based service for farmers. Branded “LimaLinks”, this is a mobile market information and inventory tracking system used by traders and farmers. Farmers can track sales of their produce on their phones and also get information on market prices and demand. By linking the market information to real transactions, the system aims to provide real time and reliable market data, in contrast to systems that rely on market surveys. This project is funded separately by the Bill & Melinda Gates Foundation, but leverages the farmer networks and FBAs developed through RPI2.

### WATER, SANITATION AND HYGIENE (WASH)

iDE is now exploring how to leverage FBA networks to deliver WASH services. UNICEF has funded a pilot project to test the delivery of improved latrines through the sales networks that iDE developed in RPI2. This is aligned with a growing interest in integrated delivery of rural services and underscores the fact that the real developments in Zambia are less about water technologies per se and more about the delivery mechanism – which has much broader application to a range of products and services (WASH, health products,<sup>21</sup> rural lighting, agricultural technologies and inputs, advice, etc.).

Of particular interest is the opportunity to leverage both the cash generated from horticultural activities, and the credit worthiness that this affords smallholders, for investment in other social goods such as latrines – investments for which lenders would not normally be prepared to extend standalone credit. As iDE Zambia scales up both its FBA and WASH programmes it will be actively seeking to integrate both sales networks with credit provision. This is an exciting opportunity to link smallholder prosperity and better access to life-enhancing products and services. This integrated delivery model directly addresses the nexus of WASH, food security and nutrition, which is increasingly recognized as critical to a range of health outcomes, particularly for young children.

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<sup>21</sup> For example iDE Zambia has recently started working with the NGO Cola Life ([www.colalife.org](http://www.colalife.org)) which is successfully using existing commercial supply chains to distribute and sell ORS and zinc to combat the effects of diarrhea in children.

## IMPACT

In 2011, iDE conducted an evaluation of the first phase of RPI funding, using a quasi-experimental (propensity score matching) design to match clients and non-clients. That study found an increase of \$410 (PPP)<sup>22</sup> among farmers who had purchased an iDE-promoted micro-irrigation technology and received training through the program.

In 2014, iDE conducted a final evaluation of the second phase of RPI funding, using a similar quasi-experimental approach to measure the attributable impact of program innovations. We followed a cohort of 368 clients and non-clients to measure their productivity and income at baseline (time of purchase) and again one year later, in order to estimate the average impact of FBA services and technology over the first 12 months post-purchase.

### IDE'S MARKET-BASED APPROACH IS REACHING POOR HOUSEHOLDS

One critique of market-based approaches is that they fail to reach poor households. In recent years, iDE has used the Progress out of Poverty Index<sup>23</sup> to estimate the proportion of clients falling below the poverty line. Unfortunately, the PPI was not yet available for Zambia at baseline. Thus, we only have endline results. As shown in Table 4, a very high percentage of farmers fall below the poverty line. The proportions of clients and non-clients below each poverty line are significantly different ( $p < 0.01$ ). However, as we do not have the baseline data, we do not know if this is because clients were already better off to begin with, or now score higher as a result of their increased income due to the intervention. In any case, it is safe to say that iDE's offerings in Zambia are reaching a high percentage of poor households.

Table 4. Proportion of clients and non-clients by poverty category

	Treatment	Control	p Diff
Less than \$1.25 (PPP)	70%	81%	<0.01
Less than \$2.00 (PPP)	86%	93%	<0.01
Less than \$2.50 (PPP)	92%	96%	<0.01

<sup>22</sup> PPP = Purchasing Power Parity. We calculate PPP \$ equivalents using exchange rates published by the IMF World Economic Outlook. These rates are standardized to an international basket of consumer goods to estimate the relative purchasing power of a USD in each country.

<sup>23</sup> The Progress out of Poverty Index (PPI) is a tool developed by the Grameen Foundation to estimate the likelihood that a household falls below standard poverty lines, based on a score generated by a ten-item inventory of observable household characteristics. [www.progressoutofpoverty.org](http://www.progressoutofpoverty.org)

CLIENTS HAVE SIGNIFICANTLY INCREASED THEIR CROP INCOMES WITH HIGHER INPUTS

A general comparison of client and control farmers shows that, while gross crop incomes were similar at baseline, client farmers increased their crop revenues while control revenues actually decreased. This despite an increase in input expenditure by both groups (significantly higher among clients). The main driver of input costs is fertilizer. As shown in Figure 16, despite a significant increase in input costs, client farmers increased their margins on crop production relative to baseline.

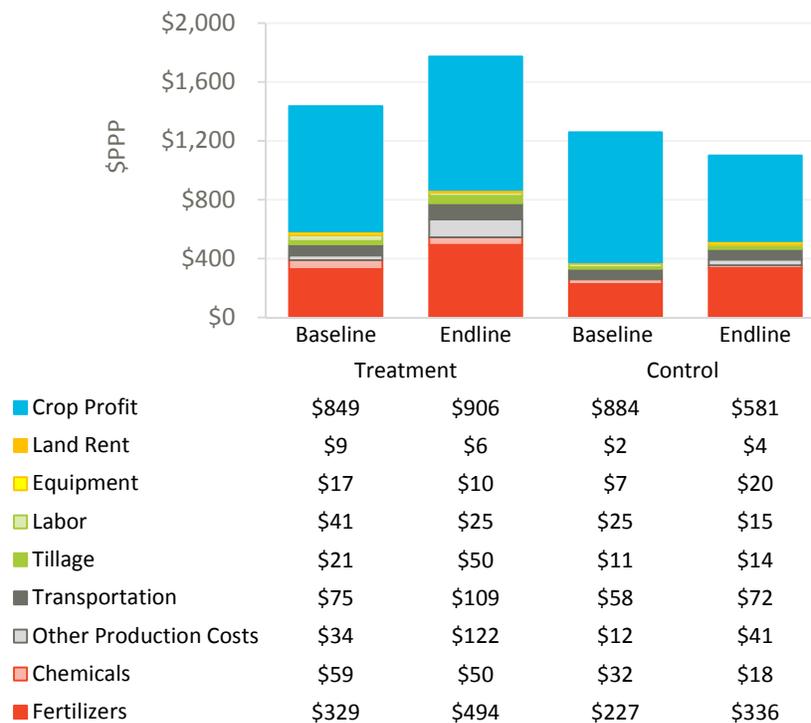


Figure 16. Breakdown of crop costs and margins (average cost per farmer in \$PPP) by experimental group

The provision of services and irrigation technologies to households under the RPI2 project is not determined by randomization, but by standard market access and self-selection. However, we collected data from households in villages where RPI2 is operating and from a matched set of comparison households in nearby, non-RPI2 villages. The dataset design exhibits some of the characteristics of a controlled experiment, in that there are localities and households that have access to technologies and services and some that do not have access, but the decision to adopt is not determined by randomization.

The analysis found that impact estimates were robust across two different estimators: propensity score matching using difference-in-differences and regression model coefficients that are consistent estimators of the difference in differences measures of the average treatment effect on the treated.

Over the course of RPI2, our evaluation revealed a significant shift from bucket / manual irrigation to hosepipes for both treatment and control groups.

As shown in Figure 17, gross crop revenues increased by \$480 for irrigated crops and by \$268 for non-irrigated crops, with a total increase of \$748 (all estimates in PPP). The increase in irrigated crop revenue was significant at the 99% level, whereas the increase in non-irrigated crop revenue was significant at the 90% level.

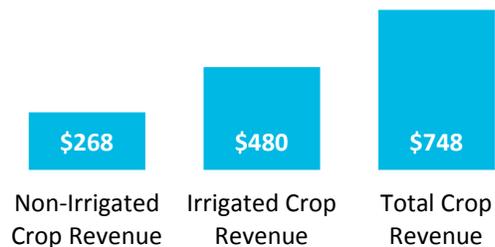


Figure 17. Increased gross crop revenues in \$PPP

The increase in non-irrigated crop revenue is interesting as iDE's main focus is on high-value, irrigated horticulture. However, there is a plausible case to be made that farmers use additional income from irrigated vegetables to improve their non-irrigated field crop production. When asked about their spending priorities, farmers reported that re-investing in their agricultural production was one of their top three priorities, along with food and household expenditures and children's education.

In order to calculate attributable net crop income, we subtracted production costs, including inputs, labour, transport and rental costs. The overall impact of the RPI2 investment on net crop income was \$518 (significant at the 99% level). As with the first phase of RPI, iDE has consistently demonstrated the impact of improved technology and farmer services on smallholder productivity and incomes.

From an evaluation perspective, iDE is now finalizing plans and seeking funding for an in-depth study of the impact of specific FBA services on farmer productivity and incomes, identifying the particular characteristics of successful FBAs.

The challenge that remains is how to take this to national scale in Zambia, bringing this impact to the large number of smallholder farm families who continue to struggle to find a sustainable path out of poverty.



## SUMMARY OF ACHIEVEMENTS AND OPPORTUNITIES

- Over the course of the RPI2 investment, iDE has moved from a focus on micro-irrigation technology sales to a broader platform for last-mile rural product and service delivery – our first African Farm Business Advisor program;
- A mobile network of rural entrepreneurs offering last-mile and first-mile services to smallholders also provides a platform to offer or enhance a range of allied services, including rural credit, market information and private sector water and sanitation solutions;
- The combination of farmer services and technology offered through iDE’s FBA networks consistently demonstrate significant impacts on smallholder productivity and income – in excess of \$500 of additional annual crop profit.
- While iDE’s offerings have demonstrated impact, the current challenge is to scale up these services within Zambia and more generally in Sub-Saharan Africa. Recent investments from the EU and SIDA are helping to take this next step and build on the innovations and advances made possible through the Bill & Melinda Gates Foundation investments over the past seven years. Further investments will be necessary to realize the potential of the innovations developed through the Rural Prosperity Initiative.

## THE WAY FORWARD: INVESTMENTS FOR RURAL PROSPERITY

The analysis of each of the three RPI2 country initiatives has identified some common themes and priorities for further investment to take the next steps toward rural prosperity in Africa. iDE has demonstrated the impact of several innovations on smallholder productivity and income. Achieving significant scale remains the focus of our next round of innovation and the priority for further investment. These findings echo many of the recommendations of the AgWater Solutions Project, funded by the Bill & Melinda Gates Foundation, and of which iDE was a core member.

The investment priorities identified in this report are not only exciting opportunities to make progress but also imperatives to act. Smallholders themselves are already making investments. Public and private investors with an interest in seeing them prosper must follow their lead.

### AFFORDABLE IRRIGATION TECHNOLOGY

Through the RPI investments, we have made significant progress toward identifying and bringing to market the next generation of smallholder irrigation technologies – particularly solar. Priority investments include:

- **Developing innovative business models to bring renewable-energy pump solutions to scale:** The Sunflower and Sunlight pumps represent a significant step forward in affordability, but still require creative financing and pay-as-you-go options to help smallholders realize their longer-term savings and profit potential.
- **Bringing manual well drilling to scale:** Manual well drilling offers low-cost access to shallow and medium-depth groundwater in suitable conditions. Going to scale requires investments in detailed groundwater mapping by government or donors, training of private manual well-drillers and financing for drillers and their suppliers.
- **Developing a smallholder orientation within large technology firms:** iDE has developed business partnerships with significant irrigation companies. Funding through RPI and other projects has enabled iDE to bring extensive smallholder customer knowledge and field connections to firms that have the capacity to manufacture and distribute affordable solutions at scale. Further investment will continue progress toward private sector-led provision of smallholder products and services.
- **Expanding grid-based irrigation:** iDE has articulated a strategy for making smallholder irrigation a central pillar of rural electrification. Particularly in Ghana, there is high potential for grid-based pumping to reach large numbers of smallholders in the next 5-10 years. Priority investments will focus on advocating for smallholder-oriented policies and harnessing iDE's PRISM approach to ensure that private sector providers will be able to meet demand for smallholder electrical pumping solutions.

## CREDIT

Working with lending partners, iDE has made significant progress toward identifying finance solutions that work for smallholders. There is significant demand for credit oriented toward high-value, small-plot production. Without access to credit, most smallholder solutions will not reach scale. Priority investments include:

- **Addressing capacity issues within micro-finance and community banking institutions:** iDE's experiences in the RPI countries and elsewhere have highlighted constraints due to unstable and inefficient internal management, limiting profitability and growth.
- **Building delivery mechanisms that integrate smallholder solutions with financing:** Linking credit to proven smallholder solutions greatly reduces risk and increases the likelihood of profitability for both farmer and lender. In piloting, iDE has strengthened these links. The priority now is to identify private-sector mechanisms to integrate these vital ingredients for success.
- **Addressing capital constraints faced by micro-finance and community banking institutions:** Many lenders face serious capital constraints. Priority investments may include direct infusions of capital and/or identifying effective mechanisms to liberate lending capital at national and local levels.

## SMALLHOLDER SERVICES

Particularly in Zambia and Ethiopia, iDE has adapted lessons learned from iDE's successful Cambodia Farm Business Advisor (FBA) model to develop a mobile network for last-mile delivery of products and services to smallholders. Priority investments include:

- **Developing and testing business models that use FBAs as an integrated platform** for delivering a range of products and services to rural customers, including rural lighting, health products and WASH solutions.
- **Identifying and developing private sector 'hubs' for FBA services:** iDE has continued to play a key role in the recruitment, training and ongoing advising of FBAs. The next step is to identify appropriate incentives and structures for private sector actors to take ownership of networks of private entrepreneurs delivering products and services in rural areas – an 'Avon for Africa' – building on the experience of iDE, Living Goods and others working with mobile sales networks.
- **Developing information technology solutions that enhance last-mile distribution:** With initiatives like LimaLinks in Zambia and Digital Green in Ethiopia, iDE has demonstrated the potential for digital solutions to add value to rural marketing and smallholder value chains. There is significant potential, but many challenges remain to link technological know-how with solutions driven by the real-world needs, priorities and aspirations of smallholders.





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