

Partnering for Innovation

Drip Irrigation in Smallholder Markets:

A cross-partnership study

AUGUST 2016

ABOUT FEED THE FUTURE PARTNERING FOR INNOVATION

Feed the Future Partnering for Innovation is a USAID-funded program that helps the private sector to scale and market agricultural technologies for smallholder farmers through investing in technology commercialization and knowledge exchange. The program also facilitates partnerships between USAID Missions and the private sector and provides business acceleration tools and services.

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Unpredictable access to water is one of the most significant impediments to optimizing productivity for the majority of the 500 million smallholders across the world. Rain-fed production systems are more likely to suffer crop failure, and struggle to maximize returns from transformational inputs such as hybrid seeds and fertilizers. Traditional irrigation practices such as surface flooding inefficiently deliver scarce water to the soil around crops rather than directly to the root system, resulting in poor uniformity of growth and negative agro-ecological impacts such as raised groundwater tables and soil salinization.

Drip irrigation technology offers the potential to address these dilemmas, as it delivers localized application of water to the crop when and where it is needed, leaving non-productive spots dry, providing weed control, reducing risks of fungal diseases, and increasing crop yields per volume of water applied. Drip lines can also deliver water soluble nutrients directly to the root system of crops, through a process known as fertigation, avoiding over-application of chemical fertilizers.

The potential productivity and income benefits that accrue to smallholder farmers from employing drip irrigation are unmistakable. Drip irrigation has been found to increase farmer yields compared to non-irrigated traditional production practices, save 30-40 percent on water usage, and reduce the cost of labor.ⁱ This typically means that smallholder farmers can more than double their net income within a year.

Despite the clear benefits of using drip irrigation, uptake in smallholder production systems has remained limited. In India, for example, less than 2 percent of farmers have drip irrigation systems in place.ⁱⁱ Similarly, in Africa, use of drip irrigation is limited almost exclusively to large-scale commercial farms. As such, there is significant untapped opportunity to expand the use of drip irrigation technologies to smallholder farmers, but several challenges have historically presented themselves across developing countries.

First, the design of systems is often not appropriately scaled-down and targeted towards the commercially viable smallholder producers, leading to retail price points that are out of reach for the majority of the market segment. Second, distribution of drip equipment to smallholder production areas (“the last mile”) is expensive, driving up costs and limiting rural availability to farmers. Third, farmers need improved technical capacity to manage drip systems, and to implement good agricultural practices that provide the foundation for drip to deliver on its full potential. Lastly, the financial sector rarely provides credit products with appropriate lending terms for a fixed asset with high upfront costs and prompt break-even but rapid depreciation. The Feed the Future Partnering for Innovation program has supported several commercial partnerships that attempt to address each of these issues and increase smallholder uptake of the technology.

Since 2013, Partnering for Innovation has partnered with three key global drip irrigation system manufacturers to address those key binding constraints identified in each country of operation, such as product design, access to finance, access to extension, and rural distribution. Partnering for Innovation has invested nearly \$1.8 million in seed capital with over \$1.3 million pledged by partners. This study discusses lessons learned from these partnerships and presents case studies for each partnership as well as for the USAID-funded Tanzania Agricultural Productivity Program, which worked with commercial drip irrigation companies to expand drip irrigation in Tanzania.

Table 1: Expected returns for Tanzanian smallholders investing in one acre drip irrigation system

	Onions	Tomatoes	Cabbage	Total
Cycle	5 months	4 months	3 months	12 months
Revenue (<i>domestic market</i>)	\$4,583	\$5,357	\$2,500	\$12,440
Operating Expenses	\$1,529	\$3,514	\$1,541	\$6,584
Net Income	\$3,054	\$1,843	\$959	\$5,856

Lessons on Commercializing Drip Irrigation in Smallholder Markets

1

Drip irrigation offers significant yield and income growth potential

Well-designed and properly managed drip irrigation systems increase productivity, improve water efficiency, and allow for year round production. Partnering for Innovation found that the cost versus the benefit of drip irrigation technology is one of the highest of any agricultural technology it assessed. This gives smallholder farmers enormous potential for increased income generation. In Tanzania, Fintrac found that a smallholder farmer investing between \$1,000 and \$1,500 in a one-acre drip irrigation system and rotating onion, tomato, and cabbage throughout a one year period, selling into domestic markets is expected to earn nearly \$6,000 in net income (see Table 1)ⁱⁱⁱ. Based on these figures, a farmer can be expected to easily pay back the cost of the drip irrigation system within the first year. Similarly, in Kenya, tests indicate that 500 square meter plots of onions under drip irrigation will yield increases of 150 percent, and by enabling multiple cropping seasons a year, a 578 percent increase in annual income is possible compared to traditional rain-fed cultivation.^{iv}

Drip irrigation is better suited to smallholders engaged in commercial farming

2

Not all smallholder farmers are the same, and drip irrigation may not be suitable for all smallholder farmers. The upfront costs and technical requirements may be a bridge too far for the most marginalized producers, at least in the early stage of improved technology adoption. There are a number of multinational agricultural corporations that have developed high-quality drip irrigation kits for the smallholder market. But calculating market demand by estimating the number of smallholders operating without access to irrigated water in each market may overstate the potential market demand. While these calculations may accurately profile long-term market potential, there is a sequence of maturity for farmer practices to be considered.

Smallholder farmers solely involved in the production of staple crops are not immediately suitable candidates for drip irrigation technology. These smallholders first need to move into the production of cash crops, obtain reliable access to a water source (catchment, well, borehole, or freshwater body), and then begin basic irrigation techniques and other good agricultural practices before they start using drip irrigation technology. This process takes time and requires ongoing technical assistance and extension support. Small-scale, commercially oriented producers in target markets may be a more promising entry point for commercial drip manufacturers and distributors than the most marginalized subsistence farmers.

3

Poorly targeted import duties drive up drip equipment costs

In a number of African countries, including Kenya, Tanzania, and Zambia, governments have exempted drip irrigation equipment from VAT in a bid to encourage imports and lower the cost of the technology for smallholder farmers. However, despite this exemption, primary components such as main lines and sub-main lines, typically made from PVC piping used in construction, are still subject to VAT in Tanzania. In Kenya and Zambia, the import of complete irrigation systems is exempt, but spare parts are subject to 16 percent VAT.^v The VAT schedules in each of these countries need to be updated to ensure all components of drip irrigation are exempt.

Price is a large determinant of market demand, but it is not the only determinant

4

Global drip manufacturer system designs have historically been targeted towards the large-scale export oriented producers of cash crops. Manufacturers and distributors are increasingly introducing smallholder focused products, but must continue to seek ways to make systems more affordable while maintaining functionality to meet demand of the commercially viable smallholder market segment. In essence, systems need to be scaled down, more affordable, and more adaptable for smallholder realities. The USAID Tanzania Agriculture Productivity Program (USAID-TAPP) simplified system designs among existing national distributors including Balton and Irrico by eliminating unnecessary 'bells and whistles' to lower the retail price of drip irrigation systems from an average of more than \$2,000 per acre to nearly \$1,000 per acre, successfully boosting smallholder adoption. In Zambia, Partnering for Innovation supported a modification of an established drip kit design, effectively bringing its retail cost down to \$200, yet significant challenges remained to increasing smallholder adoption at scale.

It is evident that drip technology is characterized by high price elasticity of demand among smallholder customers, but the cheapest drip systems do not automatically lead to rapid uptake. Effective farmer outreach strategies are needed to understand what local farmers need in terms of accompanying services. Partnering for Innovation experiences in Zambia suggest that marketing, distribution, and farmer education are just as, if not more, important than retail price point alone. Manufacturers and distributors must tailor their offerings to smallholders to account for price, functionality and simplicity, and accompanying services.

5

Comprehensive farm extension services are crucial to expand uptake and impact

Significant knowledge gaps exist in the small-scale market segment on how to use drip technology properly to maximize its benefits. Farmers need technical knowledge on drip system management to ensure its lasting benefits. With limited access to on-farm extension services in developing countries, manufacturers and distributors are likely to achieve greater customer loyalty and repeat purchases with at least basic information dissemination on system installation and maintenance. More broadly, drip irrigation systems should be viewed as a tool toward increased productivity, not as a standalone solution. Farmers need comprehensive technical assistance to apply good agricultural practices as a foundation for maximizing the productivity benefits of drip irrigation. As with the introduction of any new technology, the success and satisfaction of early adopters is critical to scaling up and building future demand.

A particularly obvious challenge for the private sector to bundle extension support with distribution are the razor-thin margins earned in targeting the smallholder market segment. The smallholder segment presents a mass-market opportunity in that substantial profits can only be realized through high sales volumes. Bundling farm-level extension services with product offerings adds labor and transportation costs that can erase distributor profit margins. Partnership with a development partner, non-profit, or government agency may more effectively provide farm extension in the initial stages of market entry.

6

Farmers need innovative financing products from willing commercial lenders

When the initial investment cost of the primary system components and accessories is out of reach for small-scale producers, credit is often necessary. While farm-level returns from drip investments are rapid, so is the depreciation of primary system components. This means drip system components rarely meet traditional collateral requirements, necessitating innovative small-scale loan products. Lender reluctance stems from preconceived notions of limited smallholder capacity, prevailing risk aversion in agricultural loan portfolios, and limited capacity within the local financial institutions themselves. Additionally, existing loan products from banks and other non-bank financial institutions are inappropriately structured for a unique asset like drip irrigation. Traditional repayment terms fail to account for the varied production cycles of high value crops that thrive under drip like fresh fruit and vegetables.

Development partners can play a key role in educating financial institutions on farmer return on investment opportunities associated with drip irrigation, and can support new loan product structures, particularly working capital loans and equipment credit specifically designed for drip. Manufacturers and distributors of drip technology can also play a key role in facilitating credit arrangements for their smallholder client network to expand uptake of their products—for instance, triangulation arrangements between input provider, lender, and output buyer can be structured to use offtake agreements as loan repayment guarantees. Additionally, inventory credit on lending from manufacturers and distributors to rural dealers also presents an opportunity to expand rural availability of the technology.

7

National-level distributors need networks of established rural agro-input dealers

Poor transportation infrastructure across rural production areas in developing countries adds significant costs for national distributors. In Zambia only 22 percent of roads are paved, while in Kenya only 14 percent are paved. These costs either squeeze distributor margins, or are passed down to smallholder customers through higher retail prices. At the Agribusiness Lab in Tanzania, distributors indicated that selling directly to the customer is the traditional business model when targeting larger scale clientele, but this strategy significantly adds costs to smallholder customer acquisition and retention. Geographical dispersion of customers adds to these transportation costs, but alternatively, the majority of smallholders are often unable to travel to a capital city to purchase and transport drip equipment themselves.

National-level drip distributors in developing country markets are likely to achieve higher rates of market penetration if they were to form relationships with a network of established dealers across key high-value production zones where a critical mass of commercially oriented smallholders are located. This approach, while more cost efficient, also presents new risks in terms of quality control and product messaging. To address these challenges, local dealers must be trained in drip system product awareness, operation, and maintenance so they can extend accurate and valuable information to a smallholder clientele. Doing so will require investments in time and resources from national-level distributors; however, this could also be an area where partnerships with development partners could yield win-win results.

Case Study I: Company A in Kenya

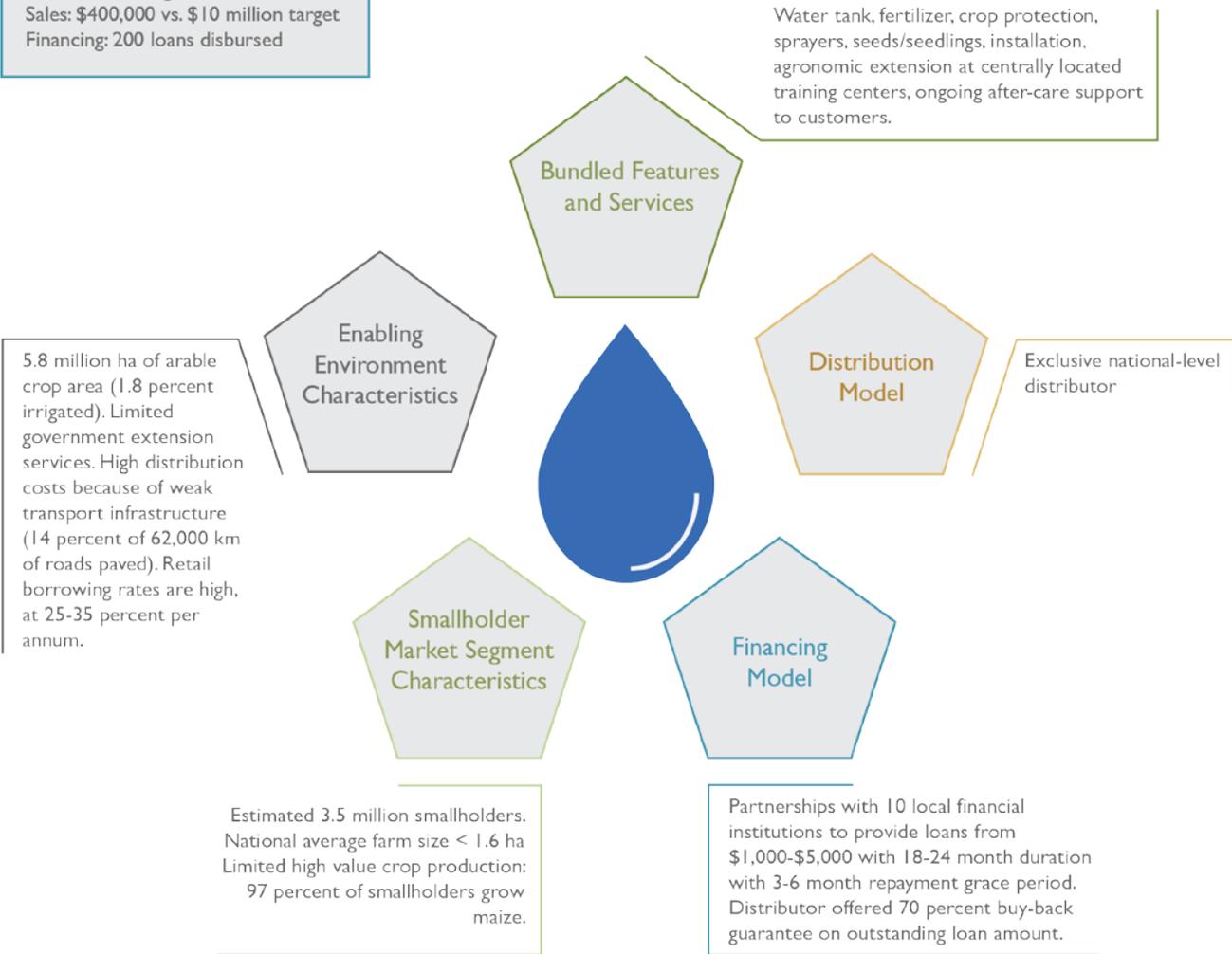
Country of Operation:
Kenya

Project Budget:
Partnering for Innovation: \$993,940
Partner: \$952,048

Project Duration:
30 months

Product Design and Retail Cost:
250m2 kit: \$1,191
500m2 kit: \$1,589
one acre kit: \$3,122

Results vs. Targets:
Sales: \$400,000 vs. \$10 million target
Financing: 200 loans disbursed



Summary

Company A is one of the world's largest drip irrigation equipment provider offering affordable, state-of-the-art drip irrigation systems for 250 square meter, 500 square meter, and one-acre models for smallholder farmers. Its products provide an all-in-one solution that includes the turbulent flow drip system, a water tank, crop nutrients, crop protection product, sprayers, seeds/seedlings, installation, training, and after-care customer support. The Company A system uses a low volume drip-irrigation technology that is effective for all types of crops, suitable for small plots, and has been shown to more than double yearly farmer income.

In 2013, Partnering for Innovation signed an agreement with Company A aimed at increasing Kenyan smallholder access to its drip irrigation systems by providing the systems through a bundled financial service package. Company A teamed with a financial services consulting firm, and with a company that is the exclusive distributor of Company A products in Kenya, to expand sales of drip irrigation systems designed to increase Kenyan smallholder farmer productivity and income.

The project was designed to develop an innovative drip equipment loan program in partnership with Kenyan commercial financial service providers; expand sales of drip irrigation equipment to smallholder farmers in Kenya with an aggressive target of \$10 million; and deliver technical and training service packages to smallholder farmer customers. The increased quality and volume of crops sold to designated markets both local and foreign was anticipated to substantially increase farmer income while the finance program was designed to increase smallholder access to drip technology during and beyond the life of the project through partnerships with local commercial banks.

The local distributor had primary responsibility for marketing the Company A systems and delivering technical assistance to smallholders. The distributor and Company A developed a marketing and communication strategy that focused on building community outreach through organizations already involved with smallholders. One of these groups organized field days with its 1,050 associated smallholders. The distributor opened its first training center in central Kenya staffed by local agronomists who are familiar with potential crop yields compared to traditional irrigation.

The financial services consulting firm was responsible for developing partnerships and designing financial packages with local financial institutions structuring repayments against increased cash flows from improved production. Estimates from previous Company A experience in South Asia suggested that loans could be paid off with increased cash flows in as quickly as one year. The firm first assessed the different financial services available in the Kenyan market and worked with financial institutions to develop memoranda of understanding (MOUs) for bundled financial services to provide smallholders with access to the Company A kits. The loan products offered were to be in the range of \$1,500 to \$5,000, 18-24 months in duration, with a three to six month grace period before repayment was to begin. As an additional incentive for banks to join the program, the distributor agreed to offer a 70 percent buy-back guarantee on any outstanding amounts of non-performing loans.

The financial services consulting firm and financial service partners developed a clear step-by-step application process for smallholders to purchase the drip kits under the loan program. By the end of the project, it had developed MOUs with 10 local financial institutions. Training was delivered to 120 bankers, 52 of them women, on calculating cash flow estimates and farmer payback schedules with the drip product. Despite this innovative design, the program failed to substantially increase loans to smallholder farmers for the drip packages. Only 200 loans at an average value of \$2,000 were approved during the 30 month program period, with the majority through the government-supported Youth Enterprise Development Fund, for a total of \$400,000 in new sales.

Positives	
Internal to partnership	<p>Strengths</p> <p>Proven technology: Company A's smallholder drip irrigation kit, has been successfully used to improve productivity for hundreds of thousands of small farmers worldwide.</p> <p>Extension model: In addition to the kit, Company A provides technical and agronomic support for farmers through central training centers and call center support targeted to suit local conditions and meet specific crop requirements.</p> <p>Financing model: The project successfully established partnerships with ten local commercial lenders to begin raising awareness of returns to drip, and sought to design loan products to suit smallholder cash flow profiles under drip.</p>
	<p>Opportunities</p> <p>Market size: There are 5.8 million ha of arable permanent cropping area in Kenya, and only 1.8 percent is irrigated. There are an estimated 3.5 million smallholders in Kenya, and the national average farm size is less than 1.6 ha.</p> <p>Export horticulture: EU markets, particularly the UK, have a long history of sourcing horticulture products from Kenyan producers. As expanding large-scale commercial farmland under cultivation becomes politically and socially unpalatable, smallholder outgrower arrangements will increase. To meet quality and quantity expectations, smallholders will need transformational input technologies such as drip irrigation.</p>
External Environment	<p>Weaknesses</p> <p>High price point: Retail costs include drip kits bundled with seed and fertilizer for one full season, and extension services. This results in an all-inclusive suite costing \$1,191 for 250m², \$1,589 for 500m², and \$3,122 for 1 acre. These price points are much higher than other systems on the market and may exceed the customers' perceived value proposition of products and services offered. It may be more important to introduce Kenyan smallholders to drip irrigation through a more affordable and/or simpler package.</p> <p>Limited lending: Despite financial sector partnerships, only the Youth Enterprise Development Fund disbursed significant loans. This may be because of a number of factors including financial sector partner reluctance to execute loans, as well as commissions requested by financial sector partners to approve loans, thereby increasing retail price further and potentially discouraging borrowing from farmers aware of the original retail price.</p>
	<p>Threats</p> <p>Financial sector: The Kenyan financial sector has traditionally avoided lending to the agriculture sector given aversion to covariate risk and perceived probabilities of default in the smallholder sector. Additionally, borrowing rates are significant for smallholders, at 25-35 percent per year in the formal financial sector. Rent-seeking is increasingly an issue.</p> <p>Transportation costs: Smallholder producers in Kenya are geographically dispersed across remote locations. Transportation infrastructure is severely limited with only 14 percent of roads paved, adding significant time and cost to rural distribution and extension efforts.</p> <p>Competition: Company A and its distributor face both entrenched and emerging competition for the smallholder market in Kenya given the cost of their drip system kits. Each offer products below the distributor's price point, although with less service provided.</p>
Negatives	

Case Study 2: Company B with NGO A in Zambia

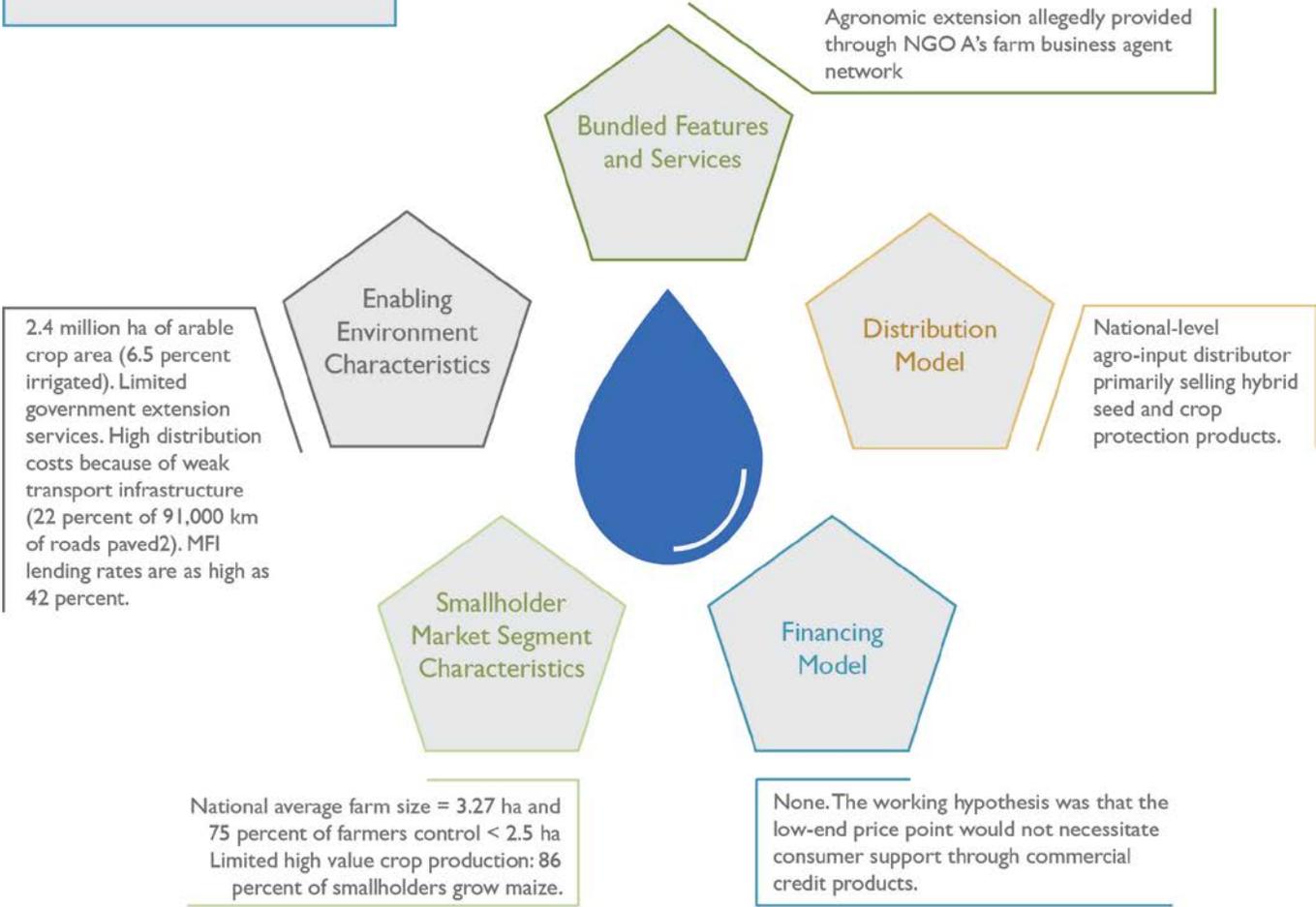
Country of Operation:
Zambia

Project Budget:
Partnering for Innovation: \$178,061
Partner: \$72,878

Project Duration:
18 months

Product Design and Retail Cost:
500m2 kit: \$200

Results vs. Targets:
Sales: 200 kits sold vs. 100 kits target



Summary

NGO A is an international non-profit organization with more than 30 years of experience building markets for agricultural products and services across the development world. NGO A has implemented more than 350 agriculture projects in Asia, Africa, and Latin America, and has distributed 2.5 million micro-irrigation technologies, benefiting more than 20 million people.

In 2013, NGO A partnered with the Company B, a U.S. multinational company with decades of experience developing large-scale drip irrigation products, to develop high quality smallholder-appropriate drip irrigation kits. At the time, the two primary companies providing smallholder drip irrigation systems in Zambia were Balton Group distributing Company A brand technology (from the previous case study), and Saro Agro distributing Company C brand technology. NGO A recognized that both these providers were largely concentrated around Lusaka and smallholder customers would need to travel a minimum of five hours to access drip technology. NGO A and Company B envisioned introducing a competitively priced drip product with a rural distribution strategy.

Between September 2013 and February 2015, Partnering for Innovation signed an agreement to modify and downsize the existing Company B drip irrigation kits and commercialize them through local rural distribution networks in Zambia. NGO A worked with Company B to successfully develop a 500-square meter drip kit product using the IDEO human centered design process to test the product with smallholder farmers, modify the product based on farmer feedback, and roll out a Company B branded drip kit for the Zambian market. Drip system components were exchanged for less expensive replacements or removed altogether, and field testing was conducted to ensure that the system maintained high quality and usability.

NGO A and Company B developed a distribution partnership with a major agricultural input supplier in Zambia with a well-established rural distribution network of 580 shops nationwide. This distributor was responsible for selling the drip kit through this existing customer network. Company B trained the distributor's staff on proper installation and maintenance of the Company B drip kits. The retail price to farmers was \$200 for a 500 square meter turbulent flow system, and additional 500 square meter extensions were sold separately.

The distributor was responsible for driving the overall marketing strategy for these drip kits, including the import of the drip products from Company B, promoting the value proposition of the product, selling the product through its distribution networks, and organizing promotional activities. The distributor also contracted with NGO A's farm business agent network to promote the drip kit and to provide farmer training and after-sales support to buyers. NGO A committed to deploying 125 agents to promote the drip kit and establish demonstration sites in key production zones to over 16,000 smallholders with whom they were already working in Zambia as a result of their fifteen years of work in that country.

Throughout the life of the partnership, the distributor ordered 528 drip kits from Company B for sale to smallholder farmers, and managed to sell 200 units through their distribution networks compared to an initial sales target of 100 units. A key challenge in the partnership was the acquisition of the distributor by a large multinational corporation. With this acquisition, the distributor had to shift away from promoting drip irrigation sales and instead focus on the marketing and distribution of seed and crop protection products prioritized by their new parent company. In addition, the new parent company restricted the marketing and sale of third-party products (including Company B's drip irrigation kits), which constrained Company B's ability to achieve its sales goals through its partnership with the distributor. Additionally, the limited promotional efforts by the farm business agents further constrained the sales potential.

<i>Positives</i>	
<i>Internal to partnership</i>	<p><u>Strengths</u></p> <p>Established networks: The design of the project considered the importance of working through an established distribution network, and an established extension network that was commission-based (NGO A's farm business agents). The distributor had a network of 580 agro-input supply shops across the country in their network. NGO A had an established 15-year presence in Zambia with a network of 125 farm business advisors to promote the technology and deliver extension support to more than 16,000 smallholder farmers. As discussed below, the strong design of this project differed from the implementation by the partners.</p>
	<p><u>Opportunities</u></p> <p>Land: There are 2.5 million ha of arable crop area across Zambia with only 6.5 percent irrigated. Farmers on average hold larger plots than neighboring countries, with a national average farm size of 3.27 ha (twice the size of Kenya's national average) and 75 percent of farmers are considered smallholders with 2.5 ha or less. Generally, this provides opportunity for farmers to diversify their production of staples (maize, beans, cassava) with higher value crops that would be technically and financially appropriate under drip systems.</p>
<i>External Environment</i>	<p><u>Weaknesses</u></p> <p>Product design: While the implementing partners envisioned that "smaller is better" in terms of drip design for smallholders, it turns out that this may not be the case in Zambia. Several stakeholders suggested that the kit was significantly too small compared to the average land under cultivation by commercially oriented smallholders. Farmers indicated that price was an indicator of quality, so the low price point may have messaged a perception of product inferiority.</p> <p>Execution by FBAs: Despite NGO A's established network of smallholders, and appropriate commission-based incentive pay for farm business advisors, it is apparent that the farm business advisors did not execute the delivery of technical support through product demonstration and promotion as required under the project.</p> <p>Syngenta acquisition: The acquisition of the distributor by the multinational had negative consequences that could not have been anticipated by the partners. The multinational's headquarters constrained the ability of the distributor to market the product in Zambia as required under the project.</p>
	<p><u>Threats</u></p> <p>Overreliance on staples: 86 percent of all farmers grow maize due in part to government subsidy, with additional staples under cultivation including cassava and beans. There is currently little cultivation of high value horticulture by small-scale producers. Diversification into high value horticulture requires long-term technical assistance at the farm level. It is technically feasible to grow staples under drip, but the returns are substantially lower relative to higher value crops, and often fail to provide the appropriate long-term investment incentives for smallholder producers.</p> <p>Competition: There are several commercial distributors of drip irrigation equipment in Zambia, as well as several others distributing unbranded Chinese products. Company B requires a significant promotional effort to raise awareness of the value proposition of its kit compared to competing products, and it must identify a dedicated distribution network to reach commercial smallholders efficiently.</p>
<i>Negatives</i>	

Case Study 3: Company C in Kenya

Country of Operation:
India

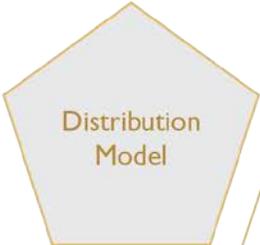
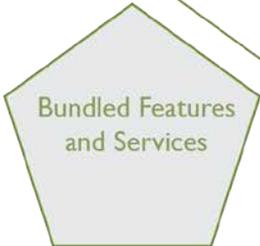
Project Budget:
Partnering for Innovation: \$400,000
Partner: \$327,350

Project Duration:
16 months

Product Design and Retail Cost:
1 acre kit: \$350
½ acre kit \$180

Results vs. Targets:
Sales: 1,229 Kits sold vs.
1,000 kits target

Pictorial installation manual included for do-it-yourself install in under 3 hours. Farmer training and video screenings at select locations across target geography. Kit customization available as needed for customer.



Network of district level agro-input dealers, and larger retail shops primarily in southwest India. Direct to exporters that managed outgrower schemes. 10 percent of sales outside India.

169 million ha of arable crop area (36 percent irrigated). Government subsidies of agro-inputs for domestic production. Well-funded but operationally challenged decentralized public extension services (ATMA) Ubiquitous MFIs and non-bank financial institutions



National average farm size = 1.55 ha
80 percent of 106 million farms are small-scale: 40 percent 'sub-marginal' (<.5 ha), 20 percent 'marginal' (.5-.99 ha), 20 percent 'small' (1.0-1.99 ha)
>50 percent of fruits/veg produced by farms <2.0 ha



None operational during project. Exploring partnership with crowd sourced microfinance. Nucleus producer to provide 100 percent of cost to Company C upfront, and microfinance institution funds 80 percent of retail product cost, and farmer provides remaining 20 percent.

Summary

The use of micro irrigation systems in India has increased at a rate of 27.3 percent between 2008 and 2013^{vi}. Despite the fast rate of adoption, market penetration remains very low; nonetheless, the potential market for drip irrigation technology is estimated to be 12.3 million farmers^{vii}. In an attempt to realize the potential, the government of India has committed to promoting drip irrigation in drylands and areas subject to salinization from surface flood irrigation methods. Under agricultural promotion policy implemented at the state level, 90 percent of the retail cost of drip irrigation equipment is subsidized, substantially increasing demand, and benefiting commercial providers approved to supply through the program, although potentially constraining competition from those who are not.

Company C is a US-based water technology company; since the conclusion of the partnership with Partnering for Innovation, it has been acquired by a major micro irrigation provider based in India. Company C produces high-quality, affordable drip irrigation systems for smallholder farmers. Its proprietary technology uses a low cost plastic tape and a laser hole-punching process that delivers uniform water flow. This technology is designed for low water pressure environments and does not require the use of drip irrigation emitters, thus substantially lowering the cost of the drip tape.

To support commercialization of Company C's drip irrigation product in the Indian market, Partnering for Innovation partnered with Company C to refine, test, manufacture, and market a low-cost, high quality, portable, do-it-yourself drip irrigation system for smallholder farmers in India. Company C was responsible for designing and producing the drip kit, building linkages with local distributors, and training its village-level sales force and local distributors on product use. The partnership established targets of 1,000 units to be distributed through local retailers as well as select export markets.

Following Partnering for Innovation support, Company C released the one-acre branded kit, an all-inclusive 'do it yourself' drip irrigation kit that includes pre-assembled components and a pictorial installation manual. This innovative design removed the need for a technical expert to install the system, effectively lowering both the cost of distribution as well as the cost of the product itself. In April 2014, Company C launched a basic, half-acre variation of the kit designed to reach marginalized farmers across India and sub-Saharan Africa. Base cost of the one acre kit is \$350, while the half-acre kit product is \$180.

In addition to the product launch, Company C provided farmer training and drip irrigation kit video screenings at selected districts across India. A number of these trainings were exclusively targeted at women. At the conclusion of the partnership in November 2014, Company C had successfully sold their drip kits to 1,229 smallholders through district level agro dealers, larger-scale agro-input retailers, and large-scale exporters managing smallholder outgrower schemes, primarily in southwest India. While India was the primary market, 10 percent of total sales were to markets outside India including Nigeria, Tanzania, Ghana, Sri Lanka, Kenya, Yemen, and Uganda. By September 2015, a total of 1,700 kits had been sold.

To address smallholder finance, Company C has designed an arrangement with an online crowdsource microfinance provider, and an organization that is a nucleus producer of fruits and vegetables working with smallholder outgrowers in India. Under the proposed model, the microfinance provider funds 80 percent of the retail cost of the drip kit, with 20 percent provided by farmers, and the nucleus producer pays Company C directly. At the close of the Partnering for Innovation project, this arrangement was not yet operational.

Positives	
Internal to partnership	<p>Strengths</p> <p>Product design: Company C offers high quality, patented technology design at an affordable retail price for smallholders. The kit is a simple do-it-yourself design that can be installed in under three hours by the farmer without expert advice required. The all-inclusive kit can be customized for farmers based on the bells and whistles that they want or do not want for their system.</p> <p>Distribution: Company C has leveraged existing networks of district level agro-dealers and larger scale retail outlets across a limited target geography throughout southwest India. It has also penetrated nucleus farm producers and exporters with smallholder outgrower schemes to expand distribution through their network. Finally, Company C has diversified their market exposure by expanding distribution beyond India to include several smallholder markets in Africa and Asia.</p>
	<p>Opportunities</p> <p>Market size: The Indian smallholder market segment is potentially massive. The national average farm size of 1.55 ha with nearly 89 million farms under 2ha. Company C conservatively estimates the market segment for drip technology currently stands at 12.3 million farmers. With just 1,229 units sold through the life of the project, the growth potential is staggering.</p> <p>Acquisition: An acquisition by an India-based irrigation provider is expected to allow the Company C brand name to remain while providing access to resources and local market knowledge of the nation's leading irrigation system provider. The parent company's resources are expected to additionally support growth in markets both within and outside India, particularly sub-Saharan Africa.</p> <p>Public sector services: The government of India is committed to providing farmer subsidies for agro-inputs, including a 90 percent subsidy for drip irrigation equipment, increasing demand for the technology. Additionally, the Agricultural Technology Management Agency (ATMA) is a well-funded source of farmer extension services which may prove to be a resource to leverage.</p>
External Environment	<p>Weaknesses</p> <p>Comprehensive extension: While farmers did not require installation support, it is likely that farmers moving into high value horticulture will require ongoing technical assistance to maximize the benefits of utilizing drip technology. Company C currently provides product specific video trainings at select locations, but farmers may also require more comprehensive trainings in good agricultural practices.</p> <p>Financing: While the proposed financing model with the microfinance institution and the nucleus producer is innovative and appears promising, it is as yet not operational and has yet to be proven. Until a sustainable farmer credit model is established, sales growth in the smallholder market segment may fail to meet its potential.</p>
	<p>Threats</p> <p>Competition: Company C currently appears to hold a comparative advantage in terms of price for quality in the Indian marketplace, but competition remains significant. While the parent company is said to maintain over 50 percent of the market, the scale of market potential has driven additional manufacturers into the market, presenting competitive threats, including Company A India.</p> <p>Acquisition: The unknowns associated with an acquisition by Jain create both an opportunity (as above) and a threat, as it remains to be seen how this partnership will affect the Company C product, its brand, its distribution strategy, and its efforts to provide education to farmers.</p>
Negatives	

Case Study 4: Tanzania Agricultural Productivity Program

A final example comes from a different development project, and provides insight into another way that the private sector can work with USAID to commercialize drip irrigation products in the smallholder market. The USAID Tanzania Agricultural Productivity Program (USAID-TAPP) was a smallholder horticulture development project implemented by Fintrac from 2009-2015 as part of the US government's Feed the Future initiative. The goal of the program was to raise rural incomes, improve nutrition, and expand access to markets across USAID's Zone of Influence. More than 61,000 rural families across Tanzania benefitted from the project through technology transfer, good agricultural practices training, and business skills development.^{viii}

USAID-TAPP was a leading promoter of drip irrigation for smallholder farmers across the Zone of Influence by partnering with commercial drip distributors and delivering demonstration-based farmer extension. The USAID-TAPP implementation model was based on the understanding that intensive and sustained agronomic training in good agricultural practices on farmer group demonstration plots would lead to improved farmer adoption of best practices, thereby increasing yields and incomes. A critical mass of farmer yield and production volume improvements attracted new buyers into key production catchments, thereby improving farmer access to markets and expanding their on-farm income. A package of technologies were introduced to smallholders, including hybrid seeds and seedlings, fertilizers, and crop protection products. For farmers where a sustained water source was available (nearby stream, river) or could be made available (water catchment, well, borehole), then drip irrigation was introduced as part of the farmer technology package.

On the demand side, USAID-TAPP established more than 300 demonstration plots for a variety of high value crops and a team of local agronomists provided technical assistance through up to three crop cycles. In partnership with Balton Ltd. (a Company A brand distributor) USAID-TAPP introduced a voucher system that covered 50 percent of the cost of the drip system. Farmers paid 50 percent in cash, and provided the voucher to Balton. Balton would then redeem the voucher directly with USAID-TAPP. To further raise awareness of products and providers, hundreds of farmer field days were organized where commercial input suppliers were given the opportunity to promote their equipment to project farmers. USAID-TAPP also provided contact lists of farmers interested in purchasing drip systems to drip distributors.

On the supply side, USAID-TAPP agronomists assisted a range of commercial distributors in scaling down the design of drip systems to be more suitable for smallholder farmers. It was evident that price points could be lowered through the use of lower-cost filters, thinner drip lines, home-made sand filters, and elimination of the "bells and whistles" that beginning smallholder farmers may find unnecessary. Project staff recognized that once a few vendors were able to lower the price of their drip systems, others followed suit to remain competitive. At the start of the USAID-TAPP project, the average one acre drip system sold for more than \$2,000. By 2015, project data indicated that farmers could access scaled down one acre drip systems for less than \$1,000 – a greater than 50 percent price reduction in less than five years. At the beginning of the project, there were zero project farmers that had been introduced to drip irrigation – by the end of the project, 6,400 farmers had adopted drip irrigation on their farms.

Positives	
Internal to partnership	<p>Strengths</p> <p>Farmer Extension: The USAID-TAPP extension model provides intensive and sustained demonstration-based training for farmers in GAPs through three production cycles.</p> <p>Farmer-Distributor linkages: USAID-TAPP facilitated training events that doubled as promotional events where commercial drip distributors could introduce their products to farmers and begin building commercial relationships in smallholder production catchments.</p> <p>Voucher Scheme: USAID-TAPP found a strong farmer response to pilot projects that used vouchers to subsidize the costs of drip irrigation kits for smallholders.</p>
	<p>Opportunities</p> <p>Water resources: Tanzania has abundant freshwater resources including three major lakes, nine river basins, and ample groundwater across much of the key smallholder production zones.</p> <p>SAGCOT: Substantial investment from the private sector in the agriculture sector is anticipated across the Southern Agricultural Growth Corridor (SAGCOT) a region ranging from Zanzibar through the southern highlands to the borders of Malawi, Zambia, and the Democratic Republic of Congo.</p>
External Environment	<p>Weaknesses</p> <p>Access to Finance: With USAID-TAPPs assistance in lowering the costs of drip kits to \$1,000, MFIs were willing to loan this amount but there were challenges in terms of repayment time and collateral. Since drip systems are a fixed asset, the loans need to be for at least 18 to 24 months, but rapid depreciation of drip tape limits its use as collateral. MFI's are used to typical loan terms that are from three months to a year. In practice, farmers got around this system by using saved money to buy the drip system and then taking loans to cover their cost of production.</p> <p>Availability in Southern Highlands: Despite high demand, willingness to invest, and enthusiasm among smallholder farmers, drip irrigation providers are slow to take advantage of this potential market. Irrigation providers are largely based in urban centers such as Arusha and Dar es Salaam, although demand from smallholders is driving a growing availability in Iringa, Mbeya, Morogoro, Kilimanjaro, and Zanzibar. Drip distributors are only slowly expanding their investments in rural distribution networks.</p>
	<p>Threats</p> <p>Shifts in donor funding: The USAID funded USAID-TAPP project was widely accepted to be a successful model for commercializing smallholder production through modern technology. Given the infancy of commercial vendors' investments in the southern highlands, they currently require close participation of the donor-funded project. It is important that USAID and other donors maintain this support without interruption lest they lose the momentum of commercial investment in these areas. Over the long term, it will be important that these commercial investments can be sustained beyond the life of USAID support.</p>
Negatives	

Endnotes

- ⁱFeed the Future Partnering for Innovation, AgTechXChange Technology Profile: Drip Irrigation, 2015.
- ⁱⁱ Company C, Partnering for Innovation Project Proposal, 7 March 2013.
- ⁱⁱⁱ Fintrac, 2016, Drip Irrigation: Potential Returns for Small Growers, Fintrac University.
- ^{iv} Feed the Future Partnering for Innovation, AgTechXChange Technology Profile: Drip Irrigation, 2015.
- ^v FAO, 2014, Kenya Irrigation Market Brief and Zambia Irrigation Market Brief.
- ^{vi} KEN Research, 2014, India Micro Irrigation System Market Report
- ^{vii} Partnering for Innovation, 2013, Standard Milestone Obligation Grant [Company C PI-SMOG-01-02]
- ^{viii} USAID, 2015, Tanzania Agricultural Productivity Program, Final Report, 2009 - 2015