FINIAL REPORT

Transforming Smallholder Irrigation

A report on the results and lessons learned from the Scaling Up Productive Water Project

The Scaling Up Productive Water Project (SUPW), implemented by iDE, explored how to increase adoption of water-smart technology at the base of the pyramid. From this experience, a body of knowledge emerged that provides useful lessons and insights. This report highlights key results and learning from the project to further the dissemination of resource-smart micro-irrigation technologies to enable smallholder farmers around the world to increase their incomes, grow their businesses, and improve their lives.

For a comprehensive look at project learning on transforming smallholder irrigation, visit www.smallholderirrigation.ideglobal.org.
1 Introduction

Eighty percent of the world’s poor engage in agriculture for their livelihoods, most of them on plots of land as small as a half-acre. For over three decades, iDE has been creating business opportunities that disseminate resource-smart technology to enable these smallholder farmers to increase their incomes, grow their businesses, and improve their lives.

Micro-irrigation technology, and supporting equipment and services, provides the key to increasing farm production while reducing the impact on the natural environment. From 2009 through 2016, iDE and the Swiss Agency for Development and Cooperation (SDC) explored how to expand irrigation for small-scale farmers through the practical application of various business models in Central America, Africa, and Asia through Scaling Up Productive Water Phase II.

Overall, the project aimed to disseminate water-efficient micro-irrigation technologies to smallholder farmers through viable supply chains, with the necessary technical support and finance. During Phase 1, which ran from 2009 to 2013, iDE introduced over 25,000 smallholder farmers to affordable micro-irrigation technologies and other methods to improve their water efficiency and increase water productivity in Central America, West Africa, and Asia. During Phase 2, the objective was to consolidate the supply chains created and to make them economically viable. This involved creating a functional market system for productive, smallholder farmer irrigation using complementary bottom-up and top-down approaches:

- **Outcome 1**: Expand national distribution, product installation, and technical assistance of MIT solutions to smallholder farmers within emerging economy contexts.
- **Outcome 2**: Develop partnerships with multinational irrigation companies to facilitate effective investments in smallholder irrigation and, in partnership with the Swiss College of Agriculture, add to the body of evidence and tools for efficient water management by smallholders.
2 The Impacts of Scaling Up Productive Water

SUPW’s second phase was conceptualized to answer the question: Why is the growth of micro-irrigation technology not happening faster for smallholder farmers? The project’s theory of change was that a combination of market creation and market facilitation was necessary because a market for smallholder irrigation did not yet exist. While there is a conventional irrigation industry catering to middle and large scale farms, small farmers (below 1 hectare and particularly those on plots of less than 500 m2) historically neither benefited from innovative, affordable, and efficient irrigation technologies nor do they know how to use these technologies. And because low-income farmers are risk averse, they typically do not test such innovations, they only adopt once they have seen them first hand, understand them, and have seen the benefits of them.

Within this seven-year timeframe, the project was able to accelerate the development of productive, water-smart applications of micro-irrigation technologies that could contribute to climate-smart agriculture for small producers in Nicaragua, Burkina Faso, Honduras, Vietnam, Kyrgyzstan and Tajikistan. The most important result for SUPW was improving the lives of our customers: the rural farmers and small businesses that are among the world’s poorest. The project
measured its progress toward this result with a core set of key performance indicators, information management tools, and in-house research and evaluation capacity.

The Approach
The project used a range of approaches to stimulate micro-irrigation markets, depending on context. A key priority from its onset was to listen to every stakeholder—the suppliers, producers, retailers, end users, and others who might have an influence on the end customer—to create a holistic understanding of the links on the value chain and the roles of each market player. These approaches made sure to explicitly consider women’s empowerment and gender equity in solutions development. iDE then developed business solutions that made new connections and strengthened existing connections to achieve a more robust market ecosystem. These solutions were not the same across project countries; rather, these solutions were tailored to the conditions and needs of each market.

After conducting these market investigations in each of the project countries, iDE found that there were no existing commercial supply chains in place for smallholder irrigation solutions. SUPW Phase II consequently supported several different business models in different markets to bring micro-irrigation to scale, ranging from acting purely as a market facilitator on one end of the spectrum, establishing its own social enterprise on the other, to investigating both options.

Summary Achievements
Overall, through the regional and global initiatives, SUPW Phase II reached over 70,000 people across 14,360 households with affordable irrigation solutions delivered through robust delivery mechanisms in order to achieve its goal of increasing smallholder income and water efficiency at a global level. Across the target countries engaged by the project, iDE exceeded the optimistic sales targets in Vietnam and the conservative sales targets in Burkina Faso, while in Honduras, Nicaragua, Kyrgyzstan, and Tajikistan, iDE did not reach the conservative sales targets. However, the project actively created markets for micro-irrigation solutions across all relevant countries, wherein strategic, sustainable partnerships are in place to continue sales to smallholder farmers beyond the lifespan of the project and scale its impacts.

Furthermore, innovations that augment the project’s core achievement in market creation for micro-irrigation technologies across multiple countries include the Farm Business Advisor (FBA) model that addressed last mile distribution and integrated service needs, collaborations with large-scale micro-irrigation manufacturers that are bringing options to the market such as solar pumps and varying sizes of drip kits, and the creation of social enterprises to innovate new business models that profitably serve smallholder markets. And at a process innovation level, the project established user-centered processes to adapt technologies into viable products for smallholders, and tested alternative diffusion models for these technologies, learning what works and what doesn’t in order to inform both future aid programming and public and private sector stakeholders in emerging markets on how best to introduce and disseminate such critical solutions for smallholders in different contexts.

Translating Successes and Challenges into Lessons Learned
Solving the market development challenges facing smallholder farmers is an ambitious endeavor that will take decades. Nor is there one, single solution that is a “magic bullet” for the problem. Much of our recent research has provided us new understanding in why something did or didn’t
work. Fixing the supply chain, market failures, and knowledge gaps that underlie smallholder agriculture is a long-term mission—one that iDE remains passionately committed to.

By extrapolating the stories of success and challenge that have emerged over the SUPW lifespan, a number of new priority areas emerge that can serve to reflect on what has been achieved, while building on new lessons on how to improve diffusion of micro-irrigation solutions sustainably in a variety of smallholder farmer contexts going forward. These key insights build on the program’s success, and should inform future aid programming in this arena.

Analysis of the SUPW’s achievements in scale, impact and cost-effectiveness gleaned the following key insights:

1. **Co-create solutions with users**: When technology is designed to meet the needs of smallholders, they will invest in it. Drip irrigation packages were being offered at the smallest size (i.e., for home garden plots) and the largest (over 7,000 square meters), with nothing in between. Farmers need size and price options that meet their specific needs.

2. **Ensure supply through extension**: The supply chain has to be in place in order for sales to scale. Challenges to meeting supply, such as tariffs, logistics, and local retailer commitment, can be addressed through example, engagement, and expertise of businesses interested in making an impact.

3. **Drive success with services**: Equipment alone is not the answer. Micro-irrigation requires technical support if it is to be successful. To do so, services should be bundled with each sale.

4. **Link product to profit**: Farmers are reluctant to invest in expanding their production if they have no idea where to sell the increased harvest. By combining equipment sales with produce purchase guarantees in an outgrower model, farmers are more willing to try something new.

5. **Bridge the firm and farm**: The market potential for corporations to meet the needs of smallholders is billions of dollars. But to unlock that potential requires a substantial investment in reducing the barriers to entry that include distribution costs, market research, product reconfiguration, and product research and development.

6. **Prime the pump with the public sector**: Because of the challenges in scaling technical sales and service (and thus, achieving cost reductions), governments and bilaterals have a role in developing policy and technical assistance that can help the private sector overcome these hurdles. Microfinance and smart subsidies can help “prime the pump” of the irrigation market.
3 Insights from SUPW Phase II

3.1 Co-create solutions with users

When technology is designed to meet the needs of smallholders, they will invest in it. Drip irrigation packages were being offered at the smallest size (i.e., for home garden plots) and the largest (over 7,000 square meters), with nothing in between. Configuration of existing systems (e.g. line and emitter spacing) often did not meet requirements for local crops and cultivation practices. Farmers need configuration and price options that meet their specific needs.

When implemented correctly, micro-irrigation works—it saves water, increases yields, lessens weeds, and builds resilience. But successful implementation is not always simple or straightforward. From planning through installation and ongoing maintenance, micro-irrigation requires knowledge and understanding that does not currently reside in the large majority of small-scale farmers. To overcome this limitation, technology sales must be bundled with technical assistance while keeping the overall package affordable.

Project Results

- The project developed user-driven drip irrigation kit options for a variety of smallholder farmer use cases in several countries, including Honduras, Nicaragua, Burkina Faso, Vietnam, Kyrgyzstan, and Tajikistan, leading to 14,360 kits adopted by smallholders.

- The project supported the development of two solar pumping solutions – the Sunlight Pump from social enterprise ennos, and the SF1 Pump, distributed by social enterprise Futurepump. Each pump is ideal for a different set of field conditions relevant to smallholders.

Develop farmer-focused micro-irrigation technologies, and translate them into viable products. Under SUPW, iDE strove to make drip systems that fit the needs of rural farmers, could
be easily adapted by them, and maximized the limited energy resources found on rural farms. Adapting the technology to the context is important for smallholder farmers, who can’t afford to overbuy (i.e., purchase more equipment than they need) or to invest in inefficient technology. A promising option is to provide access to small, modular kits, that enable farmers to start small and then buy additional modules to increase coverage as they become familiar with the technology and increase their incomes. In Burkina Faso, modular kits offered farmers a relatively simple entry point to drip irrigation. 100m², 200m² and 500m² kits proved popular for first-time purchasers buying off the shelf from local retailers or through direct sales via local sales agents. One simple but important modification was to correct the spacing of laterals to match row and crop spacing typical on smallholder plots in rural Burkina.

In some cases, market research and smallholder consumer feedback identified a need to adapt or develop new technologies that previously did not exist for BoP smallholders. While off-the-shelf technologies such as solar pumps exist in many emerging markets, they are typically not oriented to smallholder needs and price points.

**SUPW Case: Designing to Context for Drip Kits in Burkina Faso**

In Burkina Faso, iDE worked with leaders (including The Toro Company) to develop a 500 square meter smallholder option, and with an Indian manufacturer to develop kits for even smaller plot sizes and smaller spacing (40 cm between lines instead of 1 m). From the start of the SUPW project, the Tech Center in iDE Burkina Faso was aiming to develop and market a lineup of low-cost micro-irrigation technologies to support broad-based application in smallholder agriculture, including water lifting, application, and storage technologies. Starting from 2011, the Burkina Faso team conducted studies to better understand trends in consumer demand.

At the beginning of the program, large kits sized 500 m² or higher made up over 50 percent of drip kit sales. By 2016, there was a significant shift with over half of kit sales being 100 m² or less in size, indicating that the fairly even split of larger and smaller systems was a sign of wider heterogeneity in farmer preferences important to consider in scaling adoption over the long run.

Establishing and executing clear processes to research and innovate customer-appropriate product solutions for smallholders. The project iterated technology adaptation across various country and market contexts, resulting in a methodology that incorporates three primary functions:

- **Assess the need for a new appropriate water technology**: While solar pumping is not a new technology, we found that the pumps available on local markets were geared to larger-scale applications, with corresponding energy requirements and pricing. Certain models also functioned poorly with the low-quality water typical of the open wells and surface water sources typical of many smallholder farms. iDE worked with partners to adapt and develop smallholder solar pumps simply because there was no existing appropriate solution on the market.

- **Collaborate with cutting-edge inventors and developers**: iDE field and global teams have a high level of technical competence, including hydrologists and irrigation engineers. However, adapting and developing more sophisticated technologies such as portable solar pumps requires iterative collaboration with technical teams of inventors and product designers such as PRACTICA Foundation (the SF1 pump) and the Berne University of Applied Sciences (Sunlight pump). These collaborations allow iDE to bring
design principles and deep farmer insights that leverage the technical skill and tools of our product development partners.

- **Field test directly with farmers to arrive at a viable minimum product**: the project then ensured that it did not design the relevant technologies in a vacuum, but explicitly tested prototypes in the field and gathered firsthand feedback from farmers. This was a success across all technologies promoted by the project because of a development model that was grounded in relationships with farmers built on sustained trust.

**SUPW Case: Solar solutions with ennos and the Sunlight Pump**

After the overwhelming success of disseminating over 2 million treadle pumps, iDE began as early as the mid-2000s to look for the next smallholder equipment revolution. The shift by farmers from treadle pumps to small petrol-powered pumps opened up an opportunity to research a motorized improvement that would be more efficient and affordable for small farmers.

With the assistance of the Swiss Agency for Development and Cooperation (SDC), iDE helped develop and test solar pumps optimized for the needs of smallholder farmers. One pump involved a design created at the Berne University of Applied Sciences in Bienne, a renowned solar lab that had previously developed a highly efficient solar racing car that won The World Solar Challenge 3000 km across Australia in 1990. iDE began to test this pump in the field in Bangladesh in 1990, and based on the feedback received, the University redesigned the pump, applying principles of Human Centered Design. New prototypes were then tested in Burkina Faso and Honduras.

In 2016, the University spun off a company, ennos, to mass produce and mass market the new pump, named the Sunlight Pump, which utilizes a robust progressive cavity pump and electronics that allow for flexible panel configurations between 100 to 300 Watts. The Sunlight Pump was specifically designed for smallholder farmers, with attention focused on making sure that it was user-friendly and highly efficient. At the maximum head of 40 meters, the Sunlight Pump still lifts about 9,000 liters per day with a 400 Watt panel (i.e., a load of 9 tons over 40 meters every day). Ennos has entered into a licensing agreement with Jain Irrigation Systems Ltd. for the manufacturing of the sunlight pump, and the two companies will work together to market and distribute the pump according to each partner’s strength.

In these kinds of development activities, it is important to establish distinct roles and responsibilities for the partnering organizations. For a technology to be successful in small farm situations, the engineers and designers must be flexible to adapt their offerings based on feedback from farmers and on-site testing. The Sunlight Pump was significantly improved and modified to make it more user-friendly and more sturdy for use under harsh field conditions.

iDE and partners bring viable technologies within reach for remote farmers—ensuring that user feedback is an important part of the development and human centered design principles are observed. By partnering with iDE, inventors can bridge the geographic and cultural divide between smallholder farmers and modern engineering practice.

**Balance “off-the-shelf” products with smallholder-centric versions.** The project’s R&D process was further complicated by the need to determine when to adopt technologies that were “off the shelf” already in the project contexts, and when new, more user-centered versions needed to be designed. SUPW found that for drip irrigation, the conventional wisdom that drip irrigation was already an off-the-shelf solution for smallholders was in fact not the case. In actuality, existing off-the-shelf systems around the world experienced clogs in lines and emitters when introduced into smallholder farmer use cases. Drip lines had been designed for water in the US or Europe,
which tended to be filtered, even agricultural water. Water in Asia and Africa has more and larger suspended particles. What was needed was an additional filtration system at the inlet to the drip lines. To do so, the project, with the support of the late Professor Jack Keller, one of the most renowned irrigation experts, developed a new low-pressure drip system for smallholders that operates at 0.1 bar (1 meter of hydrostatic water head) instead of 1 bar. Because it is a low pressure system, only a few filters are required because the microtubes do not clog. And while the micro-tubes, used as drippers, are less elegant than inline drippers they clog much less and, if they do clog, they can be easily cleaned.

**Lessons Learned**

**Prioritize Efficiency in Technology Adaptation.** SUPW learned that the efficiency of the R&D process is a critical element of a high-functioning adaptive management system that must be constantly prioritized and addressed in order for the program's strategy to be as impactful as possible. While the technology adaptations under SUPW were necessary to arrive at appropriate-scale/use versions for smallholder farmers, they were developed over extended periods of the project cycle, and not explicitly sequenced within the wider commercialization process.

**Balance R&D with Rollout and Continuously Refine Methodology.** In several cases, SUPW continued testing a technology through its lifecycle even when a viable alternative had already been developed and rolled out. For example, multiple solar pump technologies were tested in tandem over the course of the project, with an aim of ensuring that multiple solutions were available in project target markets. While creating competition in service of smallholders can be an important value addition to a market systems program, the project's resources and time may have been better spent on identifying and promoting a single “winner” technology as early as possible, in order to enable as much testing/refinement of the business models disseminating that technology. This selection of a “first-best” solution would not preclude further development and testing of alternative models, but would ensure efficiency and cost-effectiveness were maximized by promoting a technology to activation in the market at the earliest. Furthermore, the R&D process should be explicitly incorporated into process monitoring to ensure that it is being streamlined as much as possible over the course of the project.

**Segment Customers for Scale.** SUPW discovered that proper customer segmentation is critical within the R&D process. Thorough segmentation as early in the R&D process as possible is necessary to arrive at the right balance of product offerings that can meet the needs of not only smallholder farmers, but also relatively better-off farmers that may not address a poverty alleviation agenda, but are necessary to ensure a sustainable supply chain and business model for the water technologies can be established.

**Create Hubs for Testing.** Productive water programming needs to be able to "See to Believe" through ensuring that an effective R&D process can be implemented as close to farmers as possible. By testing and demonstrating multiple water technologies through localized tech centers, program management and field staff are able to assess a promising technology with an amount of skepticism, explore how it works, and iterate on its design to ensure it is fully "fit for purpose" in the local context before they begin to promote it to farmers. In addition, these spaces are critical to gather the necessary feedback and user experiences of risk-averse farmers who can provide necessary insights on the design that drive a minimum viable product that can be disseminated at scale and generate positive impacts.
3.2 Ensure supply chain through extension

The supply chain has to be in place in order for sales to scale. Challenges to meeting supply, such as tariffs, logistics, and local retailer commitment, can be addressed through example, engagement, and expertise of businesses interested in making an impact.

In its second phase, SUPW moved from pure learning and formative piloting of micro-irrigation solutions into direct diffusion and scaling for smallholder farmers across different markets. This inherently involved moving beyond the development of the technology itself and into establishing genuine supply chains through which market mechanisms could ensure farmers' access to these solutions. Overall, the project was successful in establishing key elements of a comprehensive supply chain in several countries. However, the sophistication of these different market infrastructures varied considerably based on local constraints/dynamics.

Project Results

- In Vietnam, the project’s network of retailers reported steady customer demand due to high referral rates, and the project’s wholesaler partner reported expanding his retail customer base up to 1,000 km away, and expanded customers sales not only smallholder farmers, but also national research institutes and mid-size commercial enterprises.

- iDEa has built a strong brand, raising awareness of and demand for small-scale irrigation solutions.

- iDEa’s business model integrates technical services with product delivery. Farmers, government and NGOs seek out iDEa’s expertise in design and operation of small-scale irrigation systems.

- In 2016, the Government of Nicaragua invited iDEa to participate in planning a national strategy for smallholder irrigation - a clear indication of the value and visibility iDEa is bringing to this important sector.

Introducing MIT through local markets can be achieved through engagement with existing actors, or social enterprise startup. SUPW’s results in establishing these supply chains was broadly positive. The project had its strongest success in supply chain development in Vietnam, where the market facilitation model employed allowed retailers to test the market viability of a new product while iDE shouldered the initial financial risk. If retailers realized financial gain from climate-smart technology, they were then encouraged to identify their own sourcing for micro-irrigation solution materials. One retailer who had the most efficient supply chain to source new products eventually became the project’s primary wholesaler; other retailers now tend to rely on this wholesaler for certain products. In Kyrgyzstan, iDE’s implementing partner, Helvetas, identified two wholesalers to supply and market drip irrigation kits. These wholesalers - Agro Bazar and Caply Plus – both act as retailers by directly selling to farmers and also identify additional retailers to boost the sales of drip irrigation.
SUPW Case: A flexible, sustainable supply chain in Vietnam

In 2010 in Vietnam, iDE stimulated the market by stocking farm supply retail shops with an initial shipment of any component of the micro-irrigation system the retailer did not supply, the most common being micro-sprinklers. This stock was imported by iDE from India and Myanmar and sold to suppliers at cost. Retailers didn’t have to pay for the stock when it was delivered to them, but only after they had sold it at whatever price they had set for it. iDE trained these retailers on micro-irrigation benefits and installation. iDE also encouraged the retailers to identify sources for similar materials locally to avoid having to import them into Vietnam, and they managed to obtain some materials in Ho Chi Minh City. Interestingly, the main advantage for retailers in stocking micro-sprinklers was increasing their pipe sales, which typically had a high profit margin.

This supply chain success (outside of product innovation) is due to two main factors:

1. **Establish diversity of suppliers:** Climate-smart technology was first made affordable and accessible to farmers through decentralized private sector distribution. iDE’s market development strategy enabled market competition, which promoted efficient and flexible sourcing strategies. For example, the project’s main wholesaler leveraged his business network in Ho Chi Minh City to shift between suppliers when he ordered monthly shipments. Additionally, retailers sourced micro-irrigation components from various suppliers. While there was only one project wholesaler, retailers chose this source for certain components due to convenience not necessity. This design promoted flexible supply chains where there are multiple brokers and supply channels in the system.

2. **Leverage public sector resources to build the market:** Second, iDE shifted the focus of public investment from direct subsidy to targeted, market-building promotion efforts. iDE made use of government project partners to spark the micro-irrigation market rather than become a lasting integral member of the supply chain. Retailers consistently reported the majority of their customers were already aware of climate-smart technology before entering their shop due to iDE’s promotion strategies.

As a result of these supply chain development efforts (integrated with co-created product innovation with retailers), farmers reported ease in finding low-cost, quality micro-irrigation materials and claimed that product longevity is actually 5+ years compared to iDE’s initial 3.5 year estimates. Retailers reported steady customer demand due to high referral rates, and the project’s wholesaler partner reported expanding his retail customer base. Although he typically sold to retailers in nearby vicinities (within 40km), he began to sell to as far away as in the Central Highlands, Hue, and Quang Tri (up to 1,000km). The wholesaler reported sales to not only smallholder farmers, but also national research institutes and mid-size commercial enterprises. Furthermore, iDE’s last-mile supply chain development efforts generated a niche micro-irrigation service. Many early micro-irrigation adopters became installation specialists to whom retailers and the Farmers’ Union refer new adopters. This helped sales grow while developing a sustainable marketplace that continues to make climate-smart technology available for rural farmers.

**Where markets were thin, SUPW supported social enterprise-driven solutions that could catalyze micro-irrigation adoption and market creation.** Social enterprises become necessary when existing companies have difficulty serving a segment of the population, either because the supply chain is broken or insufficient, or because delivery is costly or problematic. **Social enterprises can promote solutions that either influence the marketplace or fill the gap.** Since the social enterprise measures its success on impact first and profit second, it can fulfill these needs as long as it is able to cover its expenses and clear modest profits. With that in mind, SUPW Phase II
supported the development of social enterprises promoting micro-irrigation solutions including iDE’s Tecnologias in Nicaragua and Honduras, ennos globally, and Futurepump.

**SUPW established a global model of effective local service providers for micro-irrigation through Farm Business Advisors.** The project recognized early on that distribution and marketing of productive water solutions would not be effective without ensuring that a last mile distributor was present, and effectively developed *key providers at the local level through Farm Business Advisors*. iDE’s 34 years of experience supporting farmers’ production and livelihood made clear that farmers working individually in developing contexts lack strong access to markets and private sector actors. Input suppliers and buyers do not see financial value in engaging with individual farmers. As a result, farmers do not gain access to information or advisory services regarding the proper use and purchase of inputs, and the sales of outputs.

Recruited from the communities where they work, FBAs interact with neighboring small-scale farmers and help them to deal with the same challenges and issues that the FBAs face on their own plots. As a group, farmers have a stronger voice and input suppliers and buyers have a greater financial incentive to engage with them. FBAs also need to receive some benefit to ensure the model is sustainable. In a market facilitation model, FBAs are incentivized through commissions for every input purchase and output sale. In a social enterprise model, trained FBAs receive a salary for their services and may earn incentives based on sales achieved. FBAs can be even more effective when combined with *local collection centers that aggregate production and coordinate output marketing amongst smallholders*.

The results of integration of FBAs with MIT technology promotion were clear. In Burkina Faso, FBAs were identified by smallholders as the single greatest source of information on drip kits and their benefits. The FBA model has received global recognition and awards and has become an example of how the middle men and women are not inherently an obstruction to farmer success if they are providing a valuable and necessary service.

**Supply chains were more effectively established when they started deep before going wide.**

Bringing micro irrigation to market in developing countries requires a different approach than traditional sales techniques that focus on making a product available everywhere in massive quantities. Part of the reason for this is that micro-irrigation isn’t an impulse purchase for smallholder farmers. The purchasing decision requires for the farmer to decide to change his or her behavior, to switch from traditional watering methods to a more precise application that requires learning a new way to evaluate whether the crop is receiving enough water.

Accordingly, rather than trying to market the technology everywhere at once, *the project focused on particular areas and customers to build a base of knowledge and experience locally with the equipment*, then expanded into adjacent areas. Using centralized demonstration plots, SUPW showed and trained farmers on the correct installation and maintenance of MIT. And while SUPW learned the extent to which extension and advice was critical to an effective adoption and diffusion process for MIT (see below), some forms of marketing and distribution were demonstrated to be clearly less effective than others. When promoting the technology, SUPW found that wide ranging mass market advertising (i.e., radio and TV spots) were found to be the least successful in generating sales. The successful strategies were demonstrations organized at universities and other organizations, participation in trade fairs, implementing own events, and puppet shows near market centers.
Lessons Learned

Establishing a “one size fits all” global supply chain for micro-irrigation is risky. SUPW’s initial strategy to ensuring manufacturing and distribution of micro-irrigation at a multi-county level, dubbed Global Supply, was an entrepreneurial experiment that failed and yielded important lessons. When the project began to champion drip irrigation, the suppliers for drip components focused on large, industrial farms or very small household gardens. The first step was getting manufacturers to expand the range of components to meet smallholders needs. iDE envisioned scaling up access to drip irrigation beyond our regional programs through Global Supply, an arm of iDE that procured irrigation components directly from producers and then configured, distributed, and resold them to iDE country programs and external customers—both individuals and other NGOs.

When Global Supply began, none of the countries that SUPW was operating in had a micro-irrigation manufacturer or distributor that focused on providing kits that were scaled for or met the particular needs of the smallholder farmer. The creation of Global Supply was an ambitious response to this need. Despite some meaningful sales achievements, Global Supply struggled as it faced supply chain challenges in ensuring a consistently high quality product and required financial support through the SUPW grant to keep operations moving. A company review indicated that the sales were unlikely to repeat on a yearly basis, and the forecast for succeeding years was grim. The company review also revealed that global drip irrigation companies, such as Jain, Toro, and Netafim, had a more sophisticated manufacturing infrastructure and capacity to serve global customers at scale with higher quality products than Global Supply was able to do through its Indian manufacturer.

Based on this and others, iDE decided to shift its efforts to encourage these micro-irrigation companies, and others like them, to continue to modify their product offerings to address the specific requirements for small-scale agriculture, as well as create awareness in the industry of the potential for growth among this large segment of the agricultural market. In 2016, iDE discontinued Global Supply and invited stakeholders to join with it to jointly research and discover solutions for smallholder farmers by which everyone could benefit.

An effective micro-irrigation supply chain for smallholders needs to be clearly segmented and balance low- and middle-income farmers. Effectively marketing micro-irrigation solutions is a context-specific challenge, particularly in terms of branding and its relationships with the implementation approach (market facilitation or social enterprise). In Vietnam and Burkina Faso, SUPW experienced firsthand how difficult it can be to directly sell technology to poor farmers without previous establishing lower-risk customer bases. In Vietnam this was because truly poor rural households do not have any land, or the land is too small to warrant the expense of MIT – using a hose to water is not so time consuming or labor intensive in small gardens. In Burkina Faso, technology sales were low in rural areas as compared to less rural ones belonging to relatively wealthier communities and selling instead to organizations that distributed drip kits at a partial or full subsidy proved to be the only way to reach the extreme poor. Drought prone areas also saw a fall in sales and therefore a lower interest by local investors to take over the production/imports of micro-irrigation technology. For the sake of attracting local investment in micro-irrigation, it may therefore be important to first target less drought prone geographic areas and relatively less poor communities. Scaling the technology in such a demographic first may allow for more local investment, lower costs, and therefore a price that could make it more affordable for lower income communities. The project team in Vietnam has already begun using such an approach to attract more funding.
This is especially important for multi-country programming/business models such as SUPW Phase II where local socioeconomic conditions and market channels may result in significantly different cohorts of poor vs. non-poor early adopters in rolling out micro-irrigation solutions. In the current phase of the project, the proportion of adopters classified as likely to be living under USD 1.25 per day according to the Progress Out of Poverty Index varied from as low as 2% to as high as 53% across the project contexts.

Accordingly, similar to the insight that an R&D process should include non-poor customers where possible, distribution and marketing must be multifaceted to cover both middle-income and low-income customer segments, and sequenced in a strategic manner. Higher-income segments represent a critical bridge between the firm and the farm. That service delivery can take many forms. SDC and iDE deliberately investigated two market delivery methods during Phase II, and while both can be successful, the method chosen self-selects a differing target audience. Future implementations need to consider this when determining what will have the most impact in a particular region. In fact, it may be better to scale drip technology in middle-income communities in less drought prone areas first to encourage investment and buy in of market actors to help increase economies of scale and reduce product costs.

**SUPW Case: Customer segmentation in Burkina Faso**

As part of the Scaling-Up Productive Water project, the Burkina Faso team engaged in two different sales methods to deliver micro-irrigation technology (MIT):

1. A social enterprise model selling directly to consumers through Conseillers de Business Agricole (CBAs), based on iDE’s Farm Business Advisor model. For monitoring and evaluation purposes, we refer to these consumers as Direct Clients.

2. A market facilitation model selling indirectly through other organizations. For monitoring and evaluation purposes, we refer to these end consumers as Indirect Clients.

The social enterprise model of selling directly to clients reaches a particular type of farmer. This client is, on average, more educated, more urban, has greater economic opportunity, and is less reliant on agriculture as a primary source of income. Given this, direct sales are more efficient in terms of resources needed to achieve each sale. However, prioritizing volume of sales has a tradeoff with type of client reached.

The market facilitation model reaches indirect farmers through subsidized aid programs that have larger farm sizes, on average, but lower rates of irrigation. It is important to note that drip irrigation technology alone may be insufficient to maximize efficiency gains for this segment. Given indirect farmers’ high reliance on manual water withdrawal methods and their lack of access to a convenient water source, SUPW recognized that successful programming will need to incorporate these factors into future planning for this segment.

**Balancing individual and institutional sales is critical to successful scaling.** Throughout the implementation of SUPW, the annual growth in sales across most of the project countries was heavily contingent on the extent to which large-scale institutional purchases were negotiated during the year. In many cases, institutional purchases were important to establish awareness and an early critical mass of sales for local manufacturers/importers and dealers. However, longer-term sustainability depends on establishing a solid base of individual customers, served through direct sales and/or retail channels. While iDE did enter into and broker institutional sales
to stimulate markets for new technologies, we also identified some best practices for ensuring that such sales supported and did not undermine efforts to establish longer-term demand:

- **Ensuring adequate technical assistance**: Technical assistance is critical to establishing new smallholder technologies. Particularly in early stages of introduction, it is important that farmers have a positive experience with a new technology and a high level of handholding is recommended. In some cases, iDE declined procurement contracts that did not allow for significant complementary technical assistance, reasoning that the potential benefits of bulk purchases would be undercut by poor execution and negative farmer experiences.

- **Avoiding distribution mechanisms that subvert market creation efforts**: When supplying government or NGO programs, iDE has taken a careful approach of reviewing the program’s approach to promotion and distribution. iDE has supplied subsidized programs, but works with the implementing agencies to promote market-friendly practices and avoid broad give-away approaches that would undermine longer-term prospects for growth of a commercial micro-irrigation market.

- **Building capacity of institutional buyers to support micro-irrigation implementation and market creation**: iDE has offered technical backstopping to institutions in the early stages of market development. In Nicaragua and Burkina Faso, iDE teams worked closely with co-ops and other local organizations to train and support their staff in best practices and technical know-how. iDE teams also built institutions’ understanding of the need for a robust private sector, discouraging efforts to bypass local product and service providers.

**Establishing marketing hubs through Tech Centers can accelerate supply chain development.** Additionally, Tech Centers can be a focal point that helps other important stakeholders (i.e., government officials, funding partners) understand the technology and promotional activities. Having a centralized location to demonstrate and test technology is useful, especially in the early implementation phase. iDE recognizes that there’s a bell curve with technology adoption, where a small group of pioneers are eager to try new ideas and technologies on the left side of the curve, a vast majority who buy the technology once they’ve seen a proven example in the middle, and then a small group of stragglers who stay resistant to new technology either because of cost, perceived risk, or other factors on the right side. Finding and cultivating early adopters is critical for new ideas and technologies to take hold in the marketplace, and the Tech Centers act as magnets for the type of entrepreneur that is interested in taking the risk to reap early rewards with something new.

In Burkina Faso, the Tech Center on the outskirts of Ouagadougou was an important focal point for testing and adapting key technologies, but also for introduction and promotion of selected technologies to government officials and potential private sector partners. The research and demonstration sites at Zamorano University in Honduras played a similar role, building awareness and credibility for new and adapted micro-irrigation technologies.

### 3.3 Drive success with services

**Equipment alone is not the answer. Micro-irrigation requires technical support if it is to be successful. To do so, services should be bundled with each sale.**

The project’s experience facilitating uptake of micro-irrigation solutions indicated that sales alone do not ensure high yields, high incomes and greater water efficiency. Technical training is
imperative to ensure that farmers do not over water crops as the perceived ease of use and convenience of the technology can in fact incentivize over-irrigation and wasteful practices - a particular concern in areas with relatively scarce water resources at hand. Trainings also enable the proper installation of the technology to ensure optimal irrigation based on farm size and crop type. SUPW learned over the course of implementation that bundling extension support within the distribution model is critical to not only ensure the farmer can properly use the MIT, but also to ensure that profit margins for local service providers are adequate to create a sustainable supply system.

In addition, absent of very high sales volumes extension services are one of the only means to increase the profitability of local service providers. Enabling higher-income and efficiency opportunities related to micro-irrigation for smallholders involves a higher level of integration along the supply chain. SUPW observed this with bundling of technologies with technical assistance and financing, but increasingly recognized the importance of capturing margins from more commercial sales supported with enhanced technology, inputs and advice. This is especially important as technologies such as drip irrigation have become commoditized, offering only thin profit margins. The businesses that can leverage the production-enhancing benefits of improved technologies to offer a wider range of services and, in some cases, also share the earnings from high-value produce sales, are likely to be able to gain the most commercially while simultaneously improving the lives of smallholders in tangible ways.

**Project Results**

- In Nicaragua, the project’s extension model reduced the proportion of farmers in its coverage areas that do not receive any agricultural advice from 54% to only 9%.

- In Burkina Faso, between 45-57% of drip kit customers learned about the solution through FBAs, and over 75% received technical assistance and extension advice from FBAs. The strong results of FBA-facilitated advice to farmers for micro-irrigation enabled the Burkina Faso team to expand its extension network to over 250 FBAs, helping these retailers/distributors to develop private sector partnerships and sell seeds, fertilizers and drip kits.

- In Vietnam, when micro-irrigation users were asked for their feedback on the technology and agronomic services, 98% reported satisfaction with the product and 97% were satisfied with the services provided.
**Extension agents as retailers are critical to micro-irrigation adoption.** SUPW demonstrated proof of concept that beyond appropriate micro-irrigation solutions, the right kind of agents in the field who can provide advice, equipment, and post-sales assistance make the difference for rural farmers. The catalyst for poor farmers to increase their incomes is more than access to equipment and the financial means to purchase it. Even after technology is obtained, the farmer needs to understand how to install, use, and maintain it correctly. Micro-irrigation technology has a complexity to it that goes beyond traditional farming techniques. For example, the farmer has to learn new ways to judge whether or not a plant is receiving the right amount of water. SUPW demonstrated by its conclusion that every drip implementation must be complemented by technical service to help train farmers on how to be successful with the technology. Further, through this model, the project identified community-based young women and men for training as FBAs, with topic areas including conservation agriculture and drip irrigation, rainwater harvesting and the use of clean irrigation solutions such as photovoltaic solar pumps. By training these young entrepreneurs, the project built local capacity and skillsets to generate incomes and deter them from migrating to urban areas and even North America.

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**SUPW Case: Extension as a driver of adoption in Nicaragua**

SUPW-supported iDEaTecnologias in Nicaragua realized in 2010 that just bridging the market gap with the right equipment was not yielding the desired results. Even though the technology was sized correctly and kept simple, most Nicaraguan farmers lacked the necessary technical skills for cultivating with drip irrigation. Project research indicated that as many as 60% of farmers receive no relevant advice on irrigation practices. For this reason, iDEaTecnologias established a technical assistance component that has proved to be of crucial importance in increasing adoption and success rates.

iDEaTecnologias employs a small team of twelve, some of whom are technical agronomists responsible for providing crop management and equipment assistance. Technical support is delivered in two ways: by engaging groups of farmers through cooperatives, associations, and other community initiatives or by visiting and working with farmers individually.

When a farmer expresses an interest in an irrigation system, he or she is visited by an iDEaTecnologias technician who conducts an assessment of the farmer’s plot to evaluate the availability of water.

iDEa approaches sales ethically. When an initial assessment concludes that the farmer’s water supply will not support irrigation, Nadja Schäfl-Kraenzlin, General Manager of iDEaTecnologias, says, “We prefer to tell the farmer—and here lies in part the social responsibility of the enterprise—that there are no sufficient water sources and that therefore we would not recommend buying an irrigation system since it wouldn’t solve the problem.”

If there is a sufficient water supply, the iDEa technician designs an irrigation system based on the farmer’s specific needs and land conditions, defining the necessary equipment components and recommending the appropriate crops for which it should be used, providing crop management advice if the farmer is unused to growing that crop.

The results of this strategy illustrate the effectiveness of bundling extension with product marketing and distribution. Overall, satisfaction rates with FBA extension services were high amongst farmers, as 92-100% of client farmers who received FBA support were satisfied or very satisfied, and 89-100% percent client said they would recommend their FBA to a neighbor or friend.
Developing a clear and standardized advise/extension skillset was critical to adoption. In several SUPW countries, FBAs were established and trained to not only sell MIT equipment, but also to directly provide advisory services about seeds and technology to farmers and also create business plans for the season by matching buyer demand with farm capacity and input opportunities. Input suppliers benefit from having a sales agent marketing and selling their products in bulk and buyers benefit from receiving aggregate produce. Farmers gain from having strong relationships with buyers and input suppliers and are supported through greater access to information and technical know-how. All of these benefits means the increased production of quality products and greater livelihood for farmers. This is particularly important as the project learned that adopters clearly delineate the product from its supplier and perceived quality of service delivery. Yet there are indications that farmer satisfaction remains higher in regards to the product offering than the services also provided. In Vietnam, while 70% of client farmers recommended the micro-irrigation product, at one point the project team learned that only 43% would also recommend their micro-irrigation supplier, prompting review of quality control and monitoring of the service package offered with the product.

Further, SUPW contracted international experts to develop a framework for selling by FBAs that focuses on the problem and takes a customer through the steps they need to go through in order to know if purchasing a drip system is right for them. This process first helps the customer discover and think deeply about the problem of what not having water causes them, then helps them calculate the cost of leaving the problem unsolved, then points them to a solution, the iDE drip system, that solves the problem, and finally ends with a look at the value of that solution. This builds a logical and emotional case and compels people who need systems to make an intelligent decision to purchase a drip system or not.

Lessons Learned

The inclusion of services may be overlooked during market entry due to high cost. In Honduras, SUPW learned that the costs associated with incorporating services may incentivize stakeholders to exclude services, despite their vital benefit. One SUPW country team was in negotiations to close a significant deal with a government distribution program (2,500 units) and another NGO-led program (1,500 units). Ultimately, however, the team opted to decline these contracts, in large part due to an explicit lack of embedded support for technical assistance and follow up in the designs of both diffusion mechanisms. The project staff was concerned that in the absence of effective extension and advice, the market for MIT would be damaged by low consumer satisfaction and weak productivity due to sub-optimal use of the product.

Bundling matters for the supplier too. The challenges in managing and growing iDEal Global Supply uncovered that global drip irrigation companies continue to struggle with how to market to customers far away from urban centers and ensure these customers could successfully implement roll out of MIT solutions. Further, project research indicated that these companies could easily manage the supply chain issues, but would not enter the market until they had proof that it was mature enough for them to profit from it. iDE recognized that the real problem was incorporating the necessary technical training, input package, and assistance accessing output markets that last mile farmers needed for drip irrigation to be an attractive investment and effective technological solution in their specific context.

Anticipate a loss leader strategy in services inclusion during market entry. In spite of extensive global research indicating how costly service/extension inclusion is in pro-poor technology diffusion, SUPW learned through experimentation and adaptation through Phase II that while services are a critical component of the solution being offered to farmers in order to
ensure per capita impact, they are extremely significant cost centers on any distribution model. While services need to be included in the offering to farmers from the onset of an MIT promotion initiative, the program needs to be designed with high upfront costs to cover the labor and transportation costs associated with in-person extension service delivery. Furthermore, the profit margin for the local service provider/retailer must factor in an adequate compensation for these additional costs from the onset; reacting to these costs is highly challenging to the financial resourcing of the supply model. Explicit projections of the scale needed to reach breakeven on a services-embedded product offering must be developed at the design stage of an initiative in order to ensure that the cost-benefit balance of this strategy can be assessed and targeted from the onset of product activation in local markets.

3.4 Link product to profit

Farmers are reluctant to invest in expanding their production if they have no idea where to sell the increased harvest. By combining equipment sales with produce purchase guarantees in an outgrower model, farmers are more willing to try something new.

Farming is a risky business and may affect the livelihood of entire families given the high volatility of agricultural markets, potential pest invasions, and the vagaries of bad weather. Even organized farmers with a more modern approach are exposed to high risks and price volatility. In Nicaragua, SUPW introduced drip irrigation for plantain farmers in Southern Nicaragua. It took quite some time to convince them that irrigating with less water gave better yields, higher quality, and used much less labour for irrigation and weeding. These were the strongest arguments in the short run, because they are immediately visible. The other advantages—better yields and quality—became evident only after the 18 months period of growth of the plantain plants.

SUPW Case: Price fluctuations undermine adoption in Nicaragua

The first farmer to adopt drip under SUPW in Nicaragua was Francisco Ramon, who was more innovative and curious than the other farmers in Rivas. Slowly, the pioneering early adopters like Francisco convinced their neighbours, and some of them became retailers for iDEal Tecnologias. The farmers are organized in the Aplari cooperative and do the marketing jointly, with most of the plantain sold to neighbouring Costa Rica. However, the price fluctuations are extreme: in the best years, one “finger” – a plantain plant can have up to 50 fingers – was sold for 5 to 8 Cordobas (16 to 26 US cents), but in 2016 the price suddenly fell to 1 Cordoba (3 cents), less than the production costs. Those who had taken bank loans had to default and this prevented them from being able to obtain more loans in the future.

Project Results

- In Nicaragua, iDEal engaged in negotiations with Frutco AG, a Swiss company specializing in the production of fruit concentrates for baby food set up an outgrowing operation for 22-24,000 tons of passion fruit, tied to micro-irrigation technology use by smallholders.

Micro-irrigation solution adoption was correlated with more robust marketing channels. The project indicated that stronger output marketing channels for smallholders using micro-irrigation technologies may present an opportunity to reduce these risks that drive cautious behavior and reduced adoption of micro-irrigation. In Nicaragua, for example,
micro-irrigation adopters channeled on average approximately 80% of their production to sales, a 30% increase over non-adopters. Importantly, 37-40% of crop sales by adopters were channeled to local markets, 21-22% to commercial buyers, and 13-15% to marketing groups. These results also indicate that while outgrowing represents a potential sales opportunity, it is not the only channel to better linking micro-irrigation adoption with increased incomes.

**Linking micro-irrigation to efficiency and income gains is critical to encourage uptake at scale.** One of SUPW’s key consumer insights related to micro-irrigation solutions was that water efficiency is not usually considered the most significant value added of drip technology for farmers. Amongst most consumers, the convenience of micro-irrigation and the savings in time and labor as a result is considered the greatest incentive to purchase the technology. In Vietnam, farmers reported having more time to invest in secondary income generating activities. The iDE team also found that marketing the technology as one that allows for greater leisure time also proved very successful.

**SUPW had limited involvement with output marketing, but focused on addressing customer problems.** Over the course of the project, the emphasis was on establishing the core product/service mix, and the marketing and distribution model to deliver that solution to smallholders. However, it was recognized during the project that the type of selling that had taken place in the drip irrigation market in Nicaragua had started with basic product-led not problem-led conversations. In this format, the salesperson would sell by pitching the “features and benefits” of the product. The seller would focus on the technical aspects of the irrigation system, which could cause the customer to get bogged down in details. This could in turn lead to confusion for the buyer, especially when the buyer may be a rural producer who has limited education. This approach missed the real opportunity to create a “sense of urgency” in prospective buyers, and has been proven to be largely ineffective when trying to sell a new product that requires both a behavior change and a significant investment of resources from the prospect in order to purchase.

Accordingly, **SUPW staff increasingly focused on helping prospective customers to fully realize how much of a problem they have with their current situation and how much it is costing them to leave the problem unsolved.** Unless rural farmers understand how much money they are currently spending and how much fuel they are wasting, they will not have significant motivation to make a big purchasing decision to change. This is what is called a problem-led approach to selling, and it is the sales methodology we have embedded in both the sales strategy and the sales tools for iDEa.

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**SUPW Case: Effective smallholder engagement by Jain Irrigation**

One of the best examples for introducing drip irrigation with smallholders is SUPW’s Drip+ Alliance partner Jain’s work with onion farmers in India. Jain not only provides over 5,000 farmers with drip systems – on credit with a separate financial package – Jain also provides technical assistance plus seeds and a specially designed ox-driven sowing machine. Jain also buys back the onions and has setup one of the largest onion drying plants, processing up to 500 tons per day and marketing dried onions to many large food companies. A fully integrated model where smallholders are given access to credit, seeds, and technology (drip systems and the sowing machine) is one that ensures smallholders can be successful.
Moreover, this shift in sales focus toward problem-solving and opportunity identification has enabled FBAs to expand the farmers’ conception of their problems into output marketing as well, if support in output marketing can be bundled with purchase of an micro-irrigation offering. In doing so, farmers may be able to increasingly realize that an investment in a micro-irrigation solution today may yield direct benefits to their overall profitability within the agricultural business cycle, not only in terms of increased efficiency and yields during production, but lower transaction costs in output marketing thanks to the value-add service of their local micro-irrigation provider.

**Lessons learned**

*Local service providers can and should be key output marketing agents as well.* While across SUPW Phase II, FBAs were a critical actor in ensuring viable supply chains were established, in the project-supported countries their role in output marketing for farmers and farmers groups were limited. However, given the high costs associated with last mile delivery, and the fact that FBAs must directly interact with farmers prior to the application of micro-irrigation technologies and agricultural production itself, they are uniquely positioned, cost-effective market actors to articulate demand dynamics in local agricultural markets, forecast production trends amongst their farmer clients, and potentially relay this information to agricultural buyers (informal or formal) to broker mutually beneficial sales. While this mechanism is not outgrowing, it is a relatively low-cost, simple means through which greater planning and coordination can be introduced into the business cycle for the smallholder in order to reduce risk aversion and increase the likelihood of micro-irrigation adoption.

*Outgrowing models offer a strong means to link product and profit, but are complex and require significant market infrastructure.* Given the importance of extension advice and after-sales services support to adoption and successful technology use by smallholders, organizing a large number of smallholders in an outgrowing (or contract farming) model is a potential means to clearly incentivize farmers to adopt a micro-irrigation solution by integrating use as a precondition for secured purchase guarantees on subsequent agricultural outputs. Under SUPW Phase II, iDEal in Nicaragua engaged in negotiations with Fructo AG, a Swiss company specializing in the production of fruit concentrates for baby food, to source 22-24,000 tons of passion fruit across approximately 1,000 ha of smallholder-cultivated land. iDEal worked with Fructo to determine whether an outgrowing scheme could be developed that included the installation of drip irrigation, crop management advice, and intermediary services to financing organizations. The arrangement can enable smallholders to receive guarantees on both market access and a minimum price. iDEal would receive a commission on total sales, enabling more cost-effective operations to expand coverage across the country. And ultimately, more micro-irrigation solutions can be adopted by hundreds of smallholders, leading to water savings.

However, the establishment of an effective outgrowing model requires significant up-front investments by market actors and the development program/social enterprise. A comprehensive inputs and extension services package must be developed, negotiated with farmers, and effectively delivered. While extension entrepreneurs like FBAs can fill this gap, effective coordination and planning of the provision of these services requires extensive training and transport/distribution management. In addition, the lead firm and/or social enterprise/development project leading setup and implementation of the operation must typically have adequate financial resources and cash flow to finance necessary financial services support related to input and throughput services until harvest. Finally, outgrowing can also significantly increases risk for smallholders, as
under-performing production volumes can lead to financial penalties, insufficient income generated from sales, and contract disputes with the lead firm.

Accordingly, while outgrowing represents a high-potential opportunity for scaling micro-irrigation adoption, it requires significant investments and highly sophisticated partnerships between lead firms and development projects to be realistically achieved at scale.

**Water efficiency is not a significant driver of adoption.** Greater water efficiency was not considered important in most countries except amongst wealthier farmers in drought prone Burkina Faso. In fact, in Nicaragua, MIT proved to be more water inefficient as farmers were comfortable irrigating more than they normally would since it did not require any more labor. SUPW research partner Bern University of Applied Sciences’s School of Agricultural, Forest and Food Sciences (HAFL) conducted three controlled field plot trials in Nicaragua to test for the changes in water use efficiency among plantain producers, as well as vegetable producers. The preliminary results from these trials indicated that farmers are not experiencing a 25% increase in output per unit water, largely because of three reasons: they irrigate more than is necessary because of the simplicity of drip irrigation and because farmers expect to see the water saturating the soil; 2) irrigating with drip irrigation requires significant technical know-how – particularly when farmers are substituting into new crop types; and, 3) it is difficult for farmers to know how much water they have applied when they cannot rely on flow meters or orient themselves by a reservoir with a known volume. It is also difficult to see the irrigation so farmers tended to over water until they were sure it was sufficient.

### 3.5 Bridge the firm and farm

**The market potential for corporations to meet the needs of smallholders is billions of dollars. But to unlock that potential requires a substantial investment in reducing the barriers to entry that include distribution costs, market research, product reconfiguration, and product research and development.**

As one of the oldest human professions, it may seem strange that the agriculture sector needs a significant amount of investment for it to scale. But the issue is not investment in agriculture in the developed world. For example, companies focused on industrial farming are spending millions in research to incorporate weather tracking by GPS and satellites to ensure adequate water and fertilizer on specific plots of land or new hybrid crop varieties that resist pests. Meanwhile, investors have ignored the developing world, where agriculture is still being performed manually, without access to much technology at all. In order to jump-start these agricultural businesses, a significant number of investors is required, but not angel investors, who are not quite prepared for this challenge.

Large agricultural companies have typically focused on large farms as their primary market. As a representative for a multinational leader in micro-irrigation systems conveyed to the SUPW team, “If a salesperson lands in say Addis Ababa and has to choose whether he will go to the left and serve a 10,000 hectare sugar plantation or to the right with 500 smallholder farmers, he will obviously turn to the left.” Indeed, both international and domestic lead firms typically emphasize that developing profitable supply chains in emerging economy contexts that serve smallholder populations require a long term and costly effort, and may require long-term project support over a number of years due to the lack of current operations in the area and long distances from their existing operational locations.
These weak linkages between lead firms and smallholder populations drive relatively stagnant adoption of micro-irrigation solutions amongst smallholders, even when they are available. Lacking access to research and development (R&D) capacity, retailers and local providers offered highly limited product options. Although technically proven micro-irrigation solutions are abundant and well catalogued, local retailers/providers had no access to such knowledge outside the products promoted by local government and the development sector, leaving low-income rural consumers with limited micro-irrigation options. Local service providers also demonstrate low marketing capability in the absence of sustained social enterprise or lead firm support, resulting in passive, sluggish penetration into low-income customer segments. Weak linkages between local providers and lead firms have also limited critical insights into current and potential consumers that can encourage new and innovative micro-irrigation product offerings grounded in robust value and marketing propositions to low-income market segments.

Project Results

- In Nicaragua, the project facilitated a local manufacturer, R.C. Industrias, to receive training in India to enable the largest part of the manufacturing process for drip kits could take place locally. This enabled manufacturing of the PVC and the hoses locally, while parts like the microtubes still need to be imported. With local production, iDE.al has better control over the quality of the equipment, and works in partnership with R.C. Industrias to maintain quality and supply.

- SUPW established the Drip+ Alliance to coordinate and accelerate global promotion of micro-irrigation solutions for smallholders. Convened by iDE, the founding members of the Alliance include three major international drip irrigation manufacturers: The Toro Company, Jain Irrigation Systems Ltd., and Netafim.

- As a result of the Drip+ Alliance, the Swiss firm ennos has developed a partnership with Jain in India to manufacture the Sunlight pump. The manufacturing agreement is in place and Jain will begin production shortly. Simultaneously, ennos has developed a partnership with Netzsch, a German manufacturing firm, to design a different pump head for the Sunlight pump that is more efficient at higher lifts.

Where markets were robust, SUPW strengthened private sector involvement. Over its lifecycle, SUPW increasingly identified that beyond social enterprise delivery mechanisms alone, lead firms’ involvement was critical to improve access to micro-irrigation technologies internationally. At the onset of the project, the market for affordable MIT products in the project countries was fundamentally characterized by a lack of formal commercial linkages between local service providers and commercial firms with scalable, sustainable and dynamic products and business models. Relationships between local service providers and retailers with lead firms did not extend beyond larger-scale, commercial irrigation solutions. While a number of lead firms exist in these country contexts, interactions between retailers/providers and these lead firms has historically been limited, and lead firms do not provide substantial supporting services such as above the line marketing, sales training, or credit to local service providers or extension agents in similar style to FBAs.

Where markets were thin, SUPW demonstrated the potential through social enterprise. In those environments where lead firms did not extensively operate, SUPW broadly demonstrated that a social enterprise can help establish and maintain a well-functioning supply chain. Specifically, the project leveraged a social enterprise model in Nicaragua, Burkina Faso, and
Honduras. Social enterprises become necessary when private companies have difficulty serving a segment of the population, either because the supply chain is broken or insufficient, or because delivery is costly or problematic. Social enterprises can promote solutions that either influence the marketplace or fill the gap. Since the social enterprise measures its success on impact first and profit second, it can fulfill these needs as long as it is able to cover its expenses and clear modest profits.

**SUPW accelerated market entry by leveraging multi-sectoral global expertise.** At a global level, SUPW recognized that in order to scale micro-irrigation, it takes more than just being successful in selling one product through a social enterprise or market facilitation model, and it’s going to take more than just one organization to provide the support necessary. To that end, the project formed the Drip+ Alliance in 2016. The Alliance is a consortium of researchers, manufacturers, and stakeholders focusing on what changes have to occur in the marketplace to enable micro-irrigation technology to live up to its potential. The founding members of the Alliance include three major drip irrigation manufacturers: The Toro Company, Jain Irrigation Systems Ltd., and Netafim. iDE continues to direct the Alliance as the convenor.

### SUPW Case: Engaging lead firms in Nicaragua

iDEal Tecnologías was established in 2009 to help small and medium sized farmers increase their incomes by providing access to products such as low-pressure irrigation systems, knowledge on how to increase production, and facilitate farmers' access to markets. No local manufacturer produced irrigation equipment. iDEal initially imported all components from India, but was frustrated by the time it took to ship and receive the equipment through Nicaraguan customs. Quality issues were also of concern.

The enterprise sent a local Nicaraguan manufacturer, R.C. Industrias, for training in India, in order to create conditions under which the largest part of the manufacturing process could take place locally. This enabled manufacturing of the PVC and the hoses locally, while parts like the microtubes still need to be imported. With local production, iDEal has better control over the quality of the equipment, and works in partnership with R.C. Industrias to maintain quality and supply, sometimes advancing cash for the manufacturer to invest in raw materials, which is repaid with finished product.

R.C. Industrias has become a trusted partner who is very engaged in the success of iDEal, including writing and recording a marketing jingle that was broadcast daily on national radio. Given the slower-than-expected ramp up of drip sales and a large current inventory, the challenge for iDEal has been to maintain sufficient orders for the manufacturer to remain engaged.

Some farmers will buy/source mainlines form elsewhere for cheaper and then try to get microtubes from iDEal. Unfortunately, these cheaper mainlines are not the same quality as those produced by R.C. Industrias (i.e., the lines clog more easily, farmers have to irrigate for longer periods using them, the lines become brittle earlier). In contrast iDEal kits are durable, with lifespans longer than three years, compared to the competition that typically last for one or two years at the most.

Focusing on local manufacturing helps iDEal avoid the costly and time-consuming process of out-of-country shipments that often get delayed in customs for months. By having an inventory of components available, iDEal is able to deliver a system more quickly. Other suppliers can take up to four months to fulfill an order. iDEal’s focus on complete, custom systems shows their responsiveness to the local needs, relieving the buyer from having to purchase from multiple sources and mix and match components that may not have been designed to work together.
Working together, the Drip+ Alliance targets and addresses critical bottlenecks in the market for smallholder Drip+ solutions. Some of the key barriers to market and opportunities are:

- Generate insights on user needs and preferences
- Optimize product price and function
- Improve customer proposition
- Innovate business models to deliver range of support services
- Create distribution networks for products and support
- Fill financing gaps
- Access working capital for suppliers and intermediaries
- Integrate with offtake markets
- Counter negative perceptions (e.g. insufficient water delivery) with rigorous quantitative studies
- Highlight the pressures on water resources in many markets
- Define standards for smallholder-suitable drip technologies
- Review subsidy / giveaway programs that focus on product without adequate support
- Remove import duties that are driving up costs in some jurisdictions

Early results of the Drip+ Alliance are promising. For example, Jain Irrigation Systems has piloted a successful outgrower model in India that provides farmers seed-to-factory support. The Drip+ Alliance is researching if this successful prototype can be applied to high-value crops (e.g., cocoa, coffee, sugar) in other countries and connecting irrigation manufacturers to food industry professionals. Netafim has led the creation for international standards for smallholder drip irrigation. This has been submitted to the ISO governing body and is currently under consideration.

**Lessons Learned**

**There is more to be done to link lead firms to local service providers.** FBAs facilitated by the project have the potential to act as a link between lead firms and farmers by playing the role of freelance sales agents and/or dealers. In several SUPW-supported countries, lead firms are most often constrained in expanding into low-income market segments due to prohibitive staffing costs required to extend their formal distribution and sales networks. Accordingly, larger firms have a need to hire short-term, informal sales agents to meet or generate demand beyond their established dealer networks, or to increase procurement volumes. As a result, there exists an opportunity for FBAs to increasingly market themselves as an “open-source,” low-cost staffing solution for BoP markets accessible by any number of interested lead firms. Further, in the future FBAs may be well-positioned to organize and formalize groups of farmers in the future into outgrowing arrangements with lead firms, thereby overcoming the typical hesitancy of lead firms to conduct organization activities themselves observed.

### 3.6 Prime the pump with the private sector

**Because of the challenges in scaling technical sales and service (and thus, achieving cost reductions), governments and bilaterals have a role in developing policy and technical assistance that can help the private sector overcome these hurdles. Microfinance and smart subsidies can help “prime the pump” of the irrigation market.**

Conventional wisdom has often suggested that historically, government leaders thought their role in addressing the needs of the poor was to subsidize or give away livelihood improvements. The problem is when subsidies are expanded to services or items that form the basis for small
businesses. If the government provides products and services for free or subsidized, no private business can compete. Not all subsidies are bad, however. After building business models to sell drip irrigation in multiple regions on multiple continents, SUPW Phase II concluded that some form of subsidy is required to make the technology affordable for smallholder farmers.

While a number of international and domestic firms manufacture and/or distribute micro-irrigation products to public, private and development sector buyers, lead firms often highlight the importance of producer group and outgrowing schemes to profitably tap into low-income market segments, and social enterprises require significant capital to establish sustainable operations on a commercial basis without extended grant funding. As a result, most private mechanisms to promote and market micro-irrigation solutions are unwilling and/or unable to unilaterally establish distribution channels at scale due to onerous setup and maintenance costs. One important means to buy-down these financial risks for either type of provider is to reduce the cost burden in the short-run through smart subsidies from public sector actors. Enabling private suppliers to test and rollout their supply chains through temporary “smart subsidy” investments, particularly those that reduce human resources costs to establish a salesforce, is likely to generate more inclusive business opportunities, identify more ways to reduce risks and investment barriers to entry, and intensify penetration by commercial actors.

Alternatively, unlocking microfinance for smallholder customers offers the opportunity to ensure that providers of micro-irrigation solutions can more rapidly sell their technologies while avoiding the financial management hurdles, cash flow constraints, and transactions costs of providing credit directly to customers, or accepting significantly less robust sales. While challenging to introduce in practice, engaging with microfinance institutions often involves civil society or public sector stakeholders that directly manage or indirectly influence microcredit lending through regulatory mechanisms. Accordingly, the introduction of microfinance into any micro-irrigation diffusion model likely needs to include the public sector to accelerate access and utilization.

Project Results

- In Vietnam, iDE’s work was highly recognized by local government because of its contribution to efficient water use and the achievement in project model and effectiveness. As a result of the project, provincial leaders in the SUPW working areas committed $170,000 to assist 1,000 more families to install micro-irrigation systems. Further, in August 2016 the Prime Minister of Vietnam visited the project site to hear directly from a micro-irrigation customer on the value of the technology to smallholder agriculture.

- In Nicaragua, iDEal became the first enterprise to sell irrigation systems directly to the government. iDEal is participating in a government voucher system, where the government provides vouchers to the farmers to choose which company from which to buy an irrigation system. No other company in Nicaragua provides this service.

- In Tajikistan, SUPW has leveraged growing demand amongst farmers to promote MIT and install drip irrigation systems in 18 greenhouses by farmers and local suppliers, which encouraged the Sughd Region Chairman to allocate 3000 ha of land to establish fruit orchards using drip irrigation.

- In Honduras, SUPW completed a sale of 2,000 kits under the Emprende Sur project, an IFAD & OFID funded project in partnership with the Government of Honduras which aimed to increase access to irrigation equipment for 2,000 smallholder families. Under this mandate,
the Government of Honduras through the Ministry of Agriculture & Livestock has established a technical cooperation agreement with SUPW to identify, select and help establish integrated family gardens with the use of efficient drip irrigation equipment.

SUPW played an important role in facilitating cooperation between the public and private sectors in scaling micro-irrigation adoption. In both Nicaragua and Honduras, continued drought caused the government and development organizations to take a more active role in the promotion of efficient water use and water access for irrigation. Typically, these government schemes sourced products through larger commercial actors who distributed them to smallholder farmers without any training and after sales services, resulting in low adoption and use rates among farmers. However, when these products were sourced and distributed through SUPW-facilitated supply chains, farmers were provided with training as an embedded service and are included in a more substantial supply chain with other products they needed and wanted.

In some cases, the public sector was critical to customer screening and acquisition. In Vietnam, iDE partnered with local unions to demonstrate the power of irrigation technology to transform smallholder agriculture. When we first began working with the Farmer’s Union, for example, they were considered to be a weak organization that received little to no recognition from the provincial or federal government. The Farmer’s Union was able to help us promote micro-irrigation directly to farmers through their network, and once the uptake produced results, officials took notice. The Farmer’s Union received funding to expand their programs, and hosted multiple visits by highly elected officials eager to learn about what had happened. Once stakeholders in power are aware of the opportunities that micro-irrigation provides, they can begin to be advocates within the system to encourage changes to subsidy policies and taxation. The challenge remains getting their attention and the time necessary to engage in proper demonstrations and constructive discussions. Vietnam proved that this is possible by beginning locally.

**SUPW Case: Working with the government to scale in Vietnam**

In the Ninh Thuan province of Vietnam, SUPW Phase II used a market facilitation approach identifying one wholesaler that works with eleven retailers to supply micro-irrigation. iDE worked to strengthen the operations of these retailers identifying promotion and technical advisory services to farmers as the biggest challenge to sales.

iDE works closely with the government, the most viable market actor found, facilitating the Farmer’s Union to actively promote micro-irrigation technologies and train farmers in their correct installation and use.

Promotional activities carried out included technology demonstrations, village sales meetings and dissemination of information on micro-irrigation technology through communal loud-speaking systems. The Farmers’ Union attracted visits to project areas from agriculture departments, provincial leaders, and lead farmers from nine central, central highland, and southern provinces of Vietnam. All of these activities helped ensure all eleven retailers operated with a profit, as sales surpassed optimistic targets. As a result of the profit and promotion across other provinces, the wholesaler was also able to expand business to other provinces.
In general, public sector collaboration was demonstrated to significantly reduce market creation costs for micro-irrigation. In Honduras, continued drought has caused the government to take a more active role in the promotion of efficient water use and water access for irrigation. Typically, these government schemes source products through larger commercial actors who distribute them to smallholder farmers without any training and after sales services, resulting in low adoption and use rates among farmers. However, when the Ministry of Agriculture teamed up with iDE, farmers received training as an embedded service along with the product, which was offered as part of a substantial supply chain with other products they needed and wanted. iDE also was able to identify community-based young women and men who received training not only on conservation agriculture and drip irrigation, but also on rainwater harvesting and the use of clean irrigation solutions such as photovoltaic solar pumps.

Lessons Learned

Explicitly incorporate microfinance and smart subsidy options into supply chains/business models from onset of programming. In multiple SUPW Phase II countries, a balance of public and private sector involvement in the strategy was not explicitly included with the exception of Vietnam. The challenge of reaching global scale does not rest solely at the base of the pyramid. Before smallholder farmers can buy a micro-irrigation solution, it has to be easily available and affordable to them. For that to happen, government policies need to ensure that MIT is free from protective tariffs and isn’t subject to onerous restrictions to import or manufacture locally. Private companies need to ensure that equipment is available in a range of sizes or—even more useful—constructed in a modular nature to accommodate plots ranging from half-hectare to hundreds of hectares. These questions need to be answered at the start of programming, and continuously re-evaluated over the lifespan of the project.

Ensure government policy is incorporated into diffusion strategy. Governmental policies set up to protect local manufacturing can have a negative impact on smallholder farmers. For example, tariffs on plastic goods may have been established to encourage the development of a local plastics manufacturer dedicated to household goods containers (food storage, waste buckets, etc.) by increasing the cost of imported goods to match those made locally. But, because of the generalized nature of the legislation, the same tariff may also be applied to plastic goods like drip irrigation lines, which are not being manufactured locally, and thus simply increase the cost for no social benefit. Smallholders lack both the funding and organizational support to lobby national governments for policy changes that would increase their market access, but independent investment could be leveraged to influence key decision-makers.

In this arena, where possible the promotion of drip irrigation should be either be linked to existing water harvesting and water governance projects, or the water governance / water harvesting project should be the main program where the efficient use of water is an integrated component. This is now the case in Honduras where IDE is strongly involved in two major water harvesting and water governance projects of SDC. With this focus, irrigation systems sales become less prominent, but continue to play a role in more efficient use of water resources within the watershed.

However, programs that operate through significant or full subsidy/giveaway modalities should be analyzed carefully prior to direct collaboration with a markets-driven model. In some cases, technology diffusion that does not properly train and incentivize full adoption of the solution may be resource inefficient and harm consumer perceptions about the value propositions of MIT solutions. For example, in SUPW in Burkina Faso found that through 2l public sector-supported
civil society organizations that purchased drip kits indirectly for subsidized or giveaway provision to smallholder farmers, only 60 percent estimated that their clients were still using the drip kits after receiving them.

**Establish explicit channels to encourage key stakeholders to collaborate on the diffusion strategy through Public Private Development Partnerships.** Projects further promoting adoption of MIT at scale need to explicitly develop strategies to diversify the channels through which promoted technologies, and associated business/diffusion models are established and maintained. Aid programs should directly incorporate technical assistance activities that create collaborative spaces and channels connecting the private sector to key public and development programs in MIT promotion and water management more broadly. In effect, these activities should focus on developing strong public-private development partnerships grounded in integrating elements of the effective models into existing and upcoming irrigation programs. As a result, the initiative will inculcate amongst more “traditional” MIT organizations and programs an awareness of and ability to engage in private sector-led sanitation service delivery while at the same time achieving the pro-poor goals of their programs.

These activities should aim to stimulate national-level Public Private Development Partnerships (PPDP), endorsed by national and regional government bodies, that bring key stakeholders from the civil society, public and private sector together to promote PPDPs in MIT. Establishing semi-formal PPDP Platforms that can act as centralized hubs for multi-sectoral working groups, workshops and events focused on identifying gaps in improved MIT service delivery, bridging local and international best practice, and generating sustainable innovations and partnerships will address weaknesses in “go it alone” delivery models, and leverage a wider set of experience and resources addressing the same challenges. Furthermore, at the local level PPDPs between local government institutions and both local service providers and lead firms can be actively facilitated for improved service delivery and supporting services. Through this combination of national/regional PPDP Platforms and local PPDPs, the capacity of programs to channelize public funding for irrigation can be steered toward pro-poor collaborations with the private sanitation sector likely to yield more efficient and sustainable results.

**Do not neglect engaging with the public sector on tax policy and importation when globally disseminating micro-irrigation solutions.** The project repeatedly experienced challenges in the application of tax policy, often used to protect local manufacturing or production by leveling tariffs on foreign products. On the surface, it would seem that protectionist tax policies would be good for local farmers and manufacturers (i.e., ensuring they were not undercut in the market by cheaper foreign goods) and that free trade agreements favored large, well-established global businesses already working at scale. However, government legislation is rarely subtle and what starts with good intentions sometimes wreaked havoc in other parts of the market. For example, as iDE began promoting low-cost irrigation drip kits in the Kyrgyzstan market, we discovered that the kits, imported from India, faced high import duties even though there were no drip-kits manufactured or available locally. The kits, sized for small-scale farms, had been designated as a household plastic good, thus falling in the same category as plastic food storage (i.e., Tupperware), plastic dining and cooking utensils, and small household goods (e.g. waste bins, buckets). Accordingly, tax and importation issues should be integrally incorporated into project design from the onset of a project, and communications channels established directly with public officials and policy stakeholders in order to keep updated on changes (both potential and actual), and to enable adaptation of the project’s strategy and activities as these conditions either improve or worsen for scale promotion of micro-irrigation solutions.
4  Looking Forward: Strategic Opportunities Beyond SUPW Phase II

The key to successful agriculture remains what it has always been: water. And, because of this, enabling consistent access to and smart use of water remains the best hope for reducing poverty among the rural poor who will continue to rely on farming for their livelihoods. Given what iDE has learned over the last three decades, and especially after the most recent Scaling-Up Productive Water project funded by SDC, there is no single solution—no “silver bullet”—that works in all places and for all people.

By some estimates, there are nearly 600 million people in poverty who rely on their own agriculture for income. Charity can’t overcome this challenge due to the sheer numbers involved. Instead, sustainable implementations that can grow and scale are needed.

This was the challenge that the Swiss Agency for Development and Cooperation decided to tackle when they partnered with iDE for the Scaling-Up Productive Water project. Based on Phase I, which established that micro-irrigation technology had the potential for both income growth for smallholders (especially women) as well as addressing the increasing need for water efficiency, Phase II attempted to bring micro-irrigation to scale in a greater and more difficult variety of environments and market conditions.

The insights emerging from the SUPW experience demonstrate that while significant progress was achieved through the program, challenges still remain that limit the scale, impact and sustainability of the market creation and facilitation that SUPW has delivered in MIT solutions. Going forward, future efforts to address these issues should take several key considerations into account in the design and execution of R&D and diffusion models.
What does work, and what is needed, are:

- **Partnerships** — The time has come to end unilateral programs that act like they are in a vacuum where no other current project or organization is engaged. Governments, NGOs, and other well-meaning agencies must consider each other’s actions and identify each other’s strengths, so each can leverage the actions of others for the most success.

- **Knowledge Sharing** — Increasing people’s understanding of the issues around correct irrigation setup and maintenance helps reduce farmers’ risk. Similarly, sharing best practices for how to engage and encourage adoption of smart-resource technologies is key for governments, NGOs, and private sector to coordinate their market approaches.

- **Access to Finance** — While farmers do not need charity, they do need access to the capital that can help them jumpstart their production. While iDE encourages manufacturers to continually drive down equipment costs, there will always be a lower limit due to sunk costs of materials, labor, and transportation. Providing loans for smallholder farmers enables them to invest in the items they need that can immediately start earning them additional income.

- **Investment** — Capital is needed to provide loans, to engage in market research, to build market capacity, and to provide “gap” funding for social enterprises. Because of the challenges of these markets, private sector businesses tend to avoid them until there is enough evidence that profit can be made. In some cases, due to the expenses required to reach rural smallholders, the profit margin can be so miniscule that it will never be attractive to private sector, thus needing a social enterprise that focuses on impact first and profit second.

- **Research and Development** — Continuing efforts to research and develop new tools focused on meeting the needs of the rural farmer remains as well. New technologies may emerge, just as solar pumps have in the last decade, that have the potential to “leapfrog” a small farmer’s technical capability.

For more information, please contact us:

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