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DRIP IRRIGATION IN HONDURAS: FINDINGS & RECOMMENDATIONS

SCALING UP AGRICULTURAL TECHNOLOGIES FROM USAID'S FEED THE FUTURE

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COVER PHOTO

Credit: Marco Tulio Galvez, USAID

Caption: Strawberries under drip irrigation, Honduras

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Management Systems International
Corporate Offices
200 12th Street, South
Arlington, VA 22202 USA
Tel: + 1 703 979 7100

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E3 Analytics and Evaluation Project

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ACRONYMS

BFS	USAID's Bureau for Food Security
EDA	*El Programa de Entrenamiento y Desarrollo de Agricultores*
FTF	Feed the Future
GAP	Good Agricultural Practices
GOH	Government of Honduras
MCA	Millennium Challenge Account
MSI	Management Systems International
NGO	Non-Governmental Organization
USAID	United States Agency for International Development
ZOI	Zone of Influence

EXECUTIVE SUMMARY

Drip irrigation offers an attractive set of value propositions for poor and extremely poor farmers in the part of western Honduras known as the Dry Corridor, including the six departments identified as USAID's Feed the Future (FTF) Zone of Influence (ZOI). The USAID-funded ACCESO project has built a strong initial experience, over the past 3.5 years, using and adapting learnings and successes with drip irrigation from previous programs elsewhere in Honduras to the benefit of the poor and extremely poor in the ZOI. Drip irrigation and the complementary practices and supporting value chain ecosystem offer even the smallest and most resource-constrained producers an opportunity to intensify production of crops with improved productivity and yields, diversify crops produced to include higher margin horticulture - which can reduce and spread risk - and increase the number of harvests possible from each area of land, opening up the entire year to possible production.

This report provides findings from a scaling up assessment, requested by the USAID Mission in Honduras, in December 2014. It documents the critical components of the poorest farmers' experiences with drip irrigation to date within the ZOI, and identifies opportunities and weaknesses that may affect future scaling efforts and investments. The report outlines several major observations and recommendations. First, the initial ACCESO work in introducing and investing in irrigation forms a solid foundation on which to build further scaled access and adoption work. That said, 60 percent of the ACCESO irrigation investments with the poor and extremely poor have occurred within only the past twelve months of the project. More experience is needed with those last investments to continue learning and pushing forward modifications of the model and supporting services for further scaling.

Second, the potential reach of scaling and the market challenge that may or may not result cannot be determined at this time, as critical data points are lacking. The scaling team recommends that efforts be pushed forward to inventory water assets and document water balances within the watersheds as a fundamental input in quantifying potential scale. Also, detailed market assessments and mapping should be conducted and kept up to date for domestic and regional informal trade of horticulture and fruit (and other relevant irrigation crop opportunities including meat and dairy).

Third, the value chain ecosystem and the spaces necessary for further growth have largely existed during these initial years of introduction and investment work. The upstream space is an area already in place with the capacity and most of the capability necessary for scaling up. Reasonably-distributed access to drip irrigation components exists across the ZOI. What is needed upstream is a strong, experienced irrigation system design team(s) to specifically implement in the ZOI and learn across experiences with the target beneficiaries. System design should begin with appropriately-designed water assessments.

Buyers, brokers and wholesale packers exist for the formal and informal markets, and include some cooperatively-owned wholesale horticulture businesses. These existing private sector market actors have limited linkages with the smallest producers, and need to strengthen their business capacity and capability to be a consistent and reliable market access link. Scaling up irrigation access and adoption will require market access and linkages through buyers and markets not yet buying from these producers, as those linkages formed during ACCESO's pilot experience will likely grow their supply through already-established relationships with poor and extremely poor farmers and not through the addition of new producers. Horticulture production needs to be produced throughout the entire calendar year, with individual producers' harvests planned within a buyer's or packer's supply calendar.

As producers move into more diverse crop production, they will require training in the relevant product quality, post-harvest handling and packing based on the target market. This is an area of

technical assistance and implementation typically assumed by the buyers and packers fairly early on, once the business relationship has been established with producers.

Finance and access to production credit is a significant input to producers' abilities to fully utilize irrigation and benefit from the value offered by diversified production. Experiences to date in the ZOI have not indicated that finance and access to credit are significant limiting factors to the in-plot adoption and utilization of irrigation by the poor and extremely poor, assuming the shared high capital components including the water conduction and filtration are in place. There are currently several sources of finance available to producers, but with scaling it is unlikely that these sources will have the capacity to keep up with the expected demand for credit.

As irrigation access and adoption expands, further capitalization and enhanced management capability and professionalization of *caja rurales, or village banks,* may assist with the associated production capital needs of the farmers. Fees collected by water user groups for maintenance and future replacement of their irrigation systems could be used to capitalize an associated *caja rural* for irrigation members. The scaling team recommends that financial management and business planning support be provided both to the water user groups and to individual farming households to increase their capacity to handle larger sums of cash and accounts.

Historically in Honduras, the water source or watershed have not been considered as an integral part of the irrigation system. Investment in protecting the watershed is essential to ensure the irrigation system's long-term sustainability; water is the main element of the system. The water user groups within the communities are the key organizations for irrigation system investment and operation. While the first water user groups have functioned quite well, experience with their sustained capacity and capability over the medium term remains limited. At least one or two more years of existence for the earliest water user groups will be needed to better understand the potential limitations or risks of this model.

While drip irrigation is an efficient method of irrigating agricultural crops, irrigation development requires managing tensions with alternative uses for the water, and management and protection of the water source itself and the surrounding watershed. In experiences to date, the environmental space has posed limited issues, but it poses a risk for scaling of access and adoption of drip irrigation. Irrigation and water system design, along with user group written agreements, need to manage competing and conflicting watershed and water usage demands and practices, from design and support through implementation (including watershed usage and maintenance fees within the user group fee structure).

Agronomic production extension is important for producer awareness and adoption of the improved production practices required for capturing the value proposition from irrigation. NGOs and donor projects provide what production extension is available in the ZOI. The lack of experience with Good Agricultural Practices (GAP) was determined to be a limiting factor in previous irrigation abandonment. Any irrigation program will need to commit to partnerships and funding of associated agronomic extension over the medium term, to support the producers' sustained adoption and utilization of the drip irrigation technology.

Finally, drip irrigation does have the potential to lift poor and extremely poor households out of poverty in the ZOI. There is no clear commercial scaling pathway for drip irrigation for the poor and extremely poor. The cost and specific design and implementation aspects of each irrigation system make it unlikely that neighboring communities would be able to adopt the technology without external grant support, even though the upstream private sector is in place. The economic limitations of communities inhibit them from spontaneously adopting drip irrigation based on awareness of successful experiences in

nearby communities. Also, the absence of supporting market linkages and production extension technical assistance would result in too high a risk profile from stand-alone adoption. Projects and partnerships that offer a combination of the necessary goods (with some grant provision) and services of the technology package are likely to continue to play a leading role in the technology diffusion for the target client population. Partnerships between organizations, including donors, municipalities, NGOs, the private sector and other public sector actors can bring together strengths such that the entire package is offered at high quality, without gaps, but not being the burden of a single entity.

INTRODUCTION

Purpose of the Report

Feed the Future (FTF) is a Presidential Initiative and the U.S. Government's lead program to promote food security in low- and middle-income countries. It is implemented by several U.S. government agencies, led by USAID, in nineteen countries. Its primary goals are to reduce poverty, malnutrition and stunting among smallholder farmers. FTF has now passed the halfway point and USAID and its partners are working to ensure that the program is on track to scale up[1] impact based on the accomplishments of the first few years.

Drip irrigation is one of three technologies identified by the USAID Mission in Honduras with the potential to positively contribute to the reduction of poverty, malnutrition and stunting within the Zone of Influence (ZOI), the geography targeted for investment and impact.[2] USAID/Honduras requested through USAID's Bureau for Food Security (BFS) that a team, led by a scaling up expert from the E3 Analytics and Evaluation Project, examine irrigation access and adoption from supply chain, value chain and market systems points of view. The scaling up assessment specifically considered the perspective of critical supply chain and value chain stakeholders, identifying categories of important actors (distributors, producers, village banks, water user associations, finance, etc.) and their interests, incentives, relationships and the required supporting systems. This report outlines the viability and challenges of a commercial technology pathway for access and adoption of drip irrigation by the target beneficiaries: the poor and extremely poor within the six departments of western Honduras included in the FTF ZOI. The assessment identified key opportunities, risks and any critical missing information, partners or models necessary for scaling.

Background

The FTF investments in Honduras are focused in six of the poorest departments in the western part of the country, which are a part of the Dry Corridor: Copán, Santa Bárbara, Ocotopeque, Lempira, Intibucá and La Paz. The Dry Corridor is also a Government of Honduras (GOH) development priority and the Dry Corridor Alliance has been created between the GOH and key donors for development prioritization and coordination.

The principal USAID/Honduras FTF investment mechanism for agriculture technology access and adoption has been the ACCESO project, implemented by a Fintrac, Inc.-led consortium. ACCESO began in early 2011 and is currently in the final months of implementation, ending in the first quarter of 2015. High-level goals for the project included lifting more than 27,500 families out of poverty (17,550 from extreme poverty.) At the end of September 2014, ACCESO had successfully lifted 3,783 families out of poverty (working with 30,383 poor and extremely poor beneficiaries in total.)[3] Two active Requests for Proposals (RFPs) outline new FTF investments to continue poverty reduction efforts across the ZOI, dividing the six departments in two between the projects expected to launch in early 2015.

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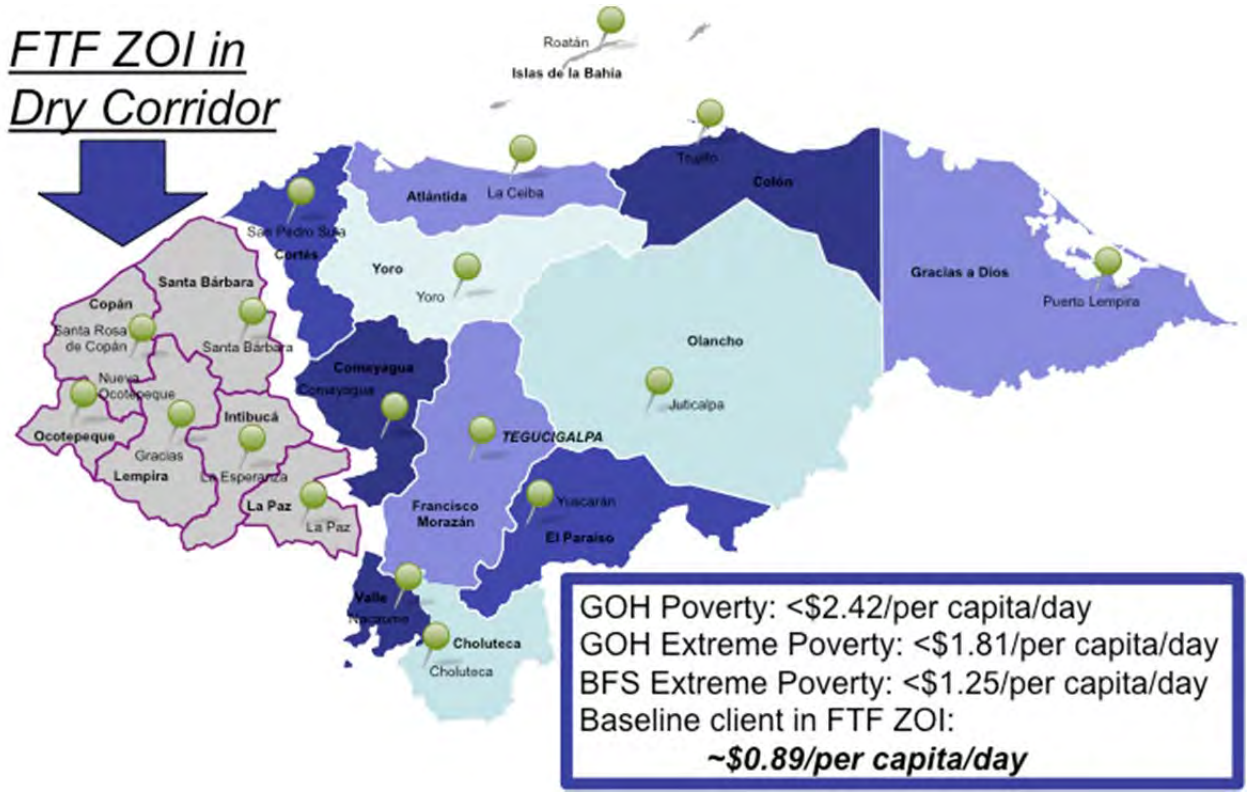
[1] USAID/BFS defines scaling up as having sustainable impact at population scale in the FTF Zone of Influence (ZOI) in that country. The MSI scaling up team further defines scaling up as the process of sustainably increasing the reach (and potentially scope or impact) of a promising or proven innovation, model or program with fidelity and quality, thereby retaining some or all of its demonstrated positive impact.

[2] The other two technologies are household-sized solar crop dryers and a package of healthy household technologies and practices.

[3] 2014 ACCESO Annual Report.

The GOH has defined the poverty level as at or below USD$2.42 per capita per day. Household incomes below USD$1.81 per capita per day are defined as extremely poor.[4] A baseline[5] conducted by ACCESO identified USD$.89 per capita per day as the baseline for the ACCESO clients, the FTF beneficiaries. Lifting a target beneficiary from poverty requires an additional USD$1.53 per capita per day (an average of five members in each family), or an increase of 172 percent in income.[6] The baseline analysis relied upon household surveys. Government of Honduras 2001 census data documented nearly 200,000 households within the ZOI living in poverty and extreme poverty. The three main crops within the ZOI are corn, beans, and coffee. The baseline found that each household averaged .94 *manzana* (.66ha) of land in bean production, .51 *manzana* (.36ha) of corn production, and 1.7 *manzanas* (1.19ha) of coffee production; with 3.15 *manzanas* average total area under production (2.21ha.)[7]



The ACCESO project continued many successful activities, technologies and commodity value chains from previous income and livelihoods projects in Honduras. Fintrac implemented a project prior to ACCESO known as *El Programa de Entrenamiento y Desarrollo de Agricultores* (EDA), funded by the Millennium Challenge Account (MCA)-Honduras. Under the EDA project, among other interventions, Fintrac designed appropriate drip irrigation systems, promoted access and adoption of drip irrigation by farmers and provided complementary training in irrigation management and production extension. The intervention area of the EDA project does not overlap with the current FTF ZOI, and the EDA-

[4] USAID/BFS defines the extreme poverty rate as $1.25 per capita per day.
[5] IFPRI Markets, Trade and Institutions Division, Evaluation of Feed the Future Intervention, ACCESO-Honduras, Preliminary Baseline Results, June 2013.
[6] Discussions with ACCESO included discussion of USD$3.25 per day per capita as a level at which resiliency may exist.
[7] Annex 3 has a table listing conversions between the main units of productive land areas used in Honduras: tareas, manzanas, and hectares.

supported farmers represented a different demographic with better access to resources – although still defined as small- and medium-size producers. Even with the different focus, the experience with EDA provided a preliminary pilot of smaller farmer utilization and benefit from drip irrigation, which until that point had predominantly been a technology for the largest-scale commercial producers. ACCESO intended to use and adapt the learnings and successes from the EDA project and other previous efforts to the benefit of the poor and extremely poor in the ZOI, including drip irrigation.

Team Composition and Approach

Scaling Up Team

The scaling up team for Honduras was led by Charity Hanif of Management Systems International, who is a scaling up specialist and the author this report. Other members of the field consultation team included: Jorge Reyes, USAID/Honduras Program Management Specialist with Food Security and Energy; Marco Tulio Galvez, USAID/Honduras Food Security Project Assistant; and Carlos Rivas, Senior Technical Expert for Natural Resource Management and Sustainable Productive Areas with USAID-funded ProParque. Field consultations took place between December 1 and 12, 2014 in five of the six departments within the ZOI: La Paz, Lempira, Intibuca, Santa Barbara and Copan. Field work for this assessment included 32 meetings with over 100 individuals, including producers and producer groups, input distributors and retailers, ACCESO staff and partners, produce buyers and brokers and key individuals in the public sector including the GOH's Ministry of Agriculture and representatives from the municipal level.

Scaling Up Assessment Approach

Each scaling up assessment conducted by the E3 Analytics and Evaluation Project team begins by sharpening the description of the 'what' to scale: the product, service, approach and intervention. Technologies are usually not individual products or goods, but rather a package of complementary products and supporting practices and/or services. Identification of the specific components of the technology package to be scaled includes a specific consideration of the efficacy, effectiveness and feasibility. Scaling up can only happen if success has been achieved at a pilot level.

The scaling up assessment is not an evaluation of programs or projects. Instead, the focus is on identifying and assessing the base for scaling and the way forward to reach scale. The assessment approach utilizes a spaces, drivers and pathways analytical framework that identifies the required drivers to move from pilot towards scale and contrasts the incentives facing the various critical stakeholders and adopters. The analysis identifies relevant opportunities and constraints, and both capacity and capability to grow to near population-level access and adoption in the required spaces for scaling up. These spaces include, but are not limited to, the upstream space, downstream space, financial and fiscal space, policy and enabling environment space, partner and value chain organization and capacity space, cultural space, partnership space and learning space. Only the most relevant to each assessment are detailed.

THE TECHNOLOGY PACKAGE

The Technology to be Scaled

At its most basic, a drip irrigation system can be defined as a set of physical components starting with a water source, water distribution network or water service line (also referred to in this report as a conduction line, to align with the Spanish term *conducción*), filters, control components, emission devices (drip emitters or drip tape) and other required connectors and small components. The experience in the FTF ZOI portion of the Dry Corridor most often includes a shared water source not physically located on the land of or owned by a group of water users who have formed a water user group or association to manage and benefit from the irrigation system. Thus, the irrigation systems most often include a group owned (or accessed) and maintained water source[8], a water conduction and distribution system and a main filtration unit, often automated.[9] Each producer also has a set of physical in-plot components, including the mainline pipe connected to the central distribution system, one or more smaller plot-sized filters, pipes, connectors and emission devices (drip emitters or drip tape; drip tape has been the most common to date.)

Automated Sand Filter for Irrigation System.
Credit: Charity Hanif, MSI

Because an irrigation system consists of both a shared set of components and individually-owned and utilized items dependent upon the function of the shared system, supporting practices, training and support are needed at both the group and individual levels. At the user group level, sufficient capability development is necessary to manage system maintenance, and collect and manage user fees for the maintenance and eventual replacement of shared system physical components. Figure 1 summarizes the technology package and the supporting activities.

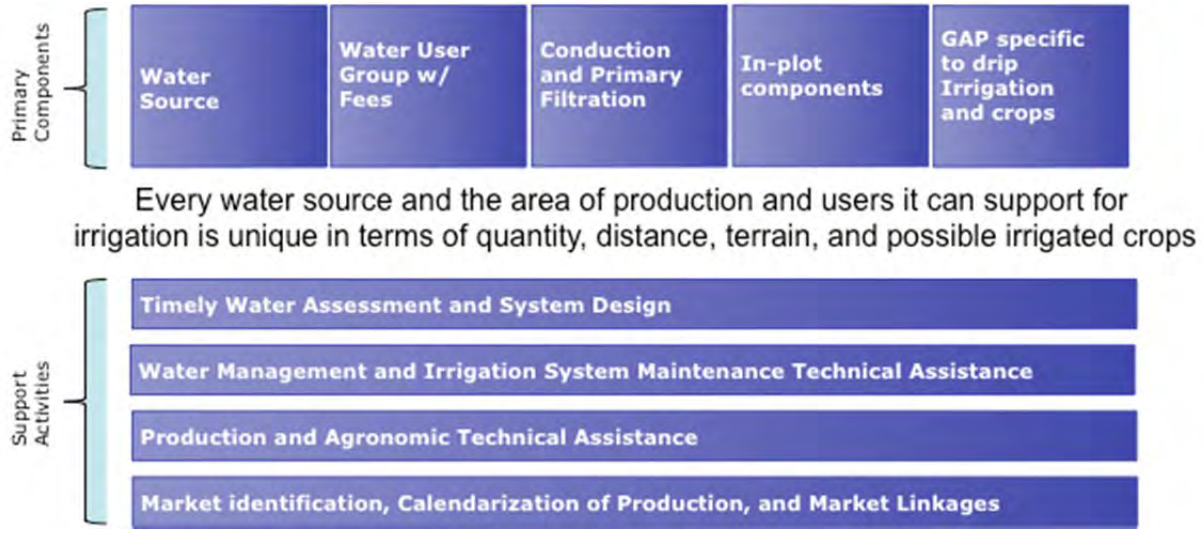
Supportive technical assistance is needed to train the user groups in system management and upkeep. Additional technical assistance is needed by the individual producers in crop production practices to ensure that irrigation is used efficiently and production practices adequately capture the improved productivity and quality that is possible. The three value propositions of drip irrigation for the producers are increased yields and productivity, diversified production and production throughout the entire calendar year. Drip irrigation provides an opportunity to produce new and more diverse crops with which farmers most likely have little to no previous production experience. Ongoing production extension is needed, particularly related to crop disease and pest management, as irrigated crops such as some horticulture crops are often higher value and more technically rigorous to produce. Irrigated farmers producing new crops over multiple seasons, who prior to irrigation had only produced during

[8] ACCESO estimates that approximately 10-15 percent of their target group with irrigation systems have their own water source and thus have no shared system components. In these few cases, the individual producers are not members of a water user group. They own and manage their entire system and must individually save resources for maintenance and future investment.

[9] The drip irrigation systems are high-pressure systems. The average ACCESO-supported system irrigates over eight hectares of land. All but two of the ACCESO-placed systems rely on gravity-based drip irrigation systems. Two systems in particularly low altitude communities have diesel pumps, which require more frequent maintenance and ongoing running costs. A handful of the gravity systems utilize hydraulic ram pumps. These are individually-owned systems where maintenance responsibility falls to an individual producer and/or household.

the one rainy season a year, require training in post-harvest handling and packing as well as new market linkages.

FIGURE 1: PHYSICAL INFRASTRUCTURE WITH SUPPORTING PRACTICES AND SERVICES



In summary, the drip irrigation technology package includes the physical components at a shared water user group level and within the producer's own in-plot level. In most cases, the technology package requires a strong functional water user group that collects and manages user fees, to install, maintain and re-invest in the shared water source and physical system components, as well as manage water allocation and usage by the individual members. The technology package for the producer also includes new production practices including the production of higher-value – and possibly higher-risk – products that may require specific post-harvest handling and packing to maximize value and meet market specifications, production over multiple seasons and linkages with markets where they have no previous experience.

Technology Introduction and Supporting Activities

The ACCESO project has led drip irrigation introduction activities in the FTF ZOI with poor and extremely poor farmers.[10] In its three and a half years of experience, ACCESO has installed approximately 150 irrigation systems or system rehabilitations.[11] About 5,000 poor and extremely poor farmers now have access to drip irrigation with ACCESO's promotion and investment. The project has pursued a technology introduction strategy that begins with technical assistance for production intensification and improved production practices prior to water user group organization and the

[10] Very limited irrigation existed in the ZOI prior to ACCESO. Some farmers, even the poor, had access to furrow or sprinkler irrigation. This irrigation is inefficient and was extremely limited geographically based on distance and elevation from a water source. The number of the target farmers with access to these alternative methods of irrigation prior to ACCESO was insignificant.

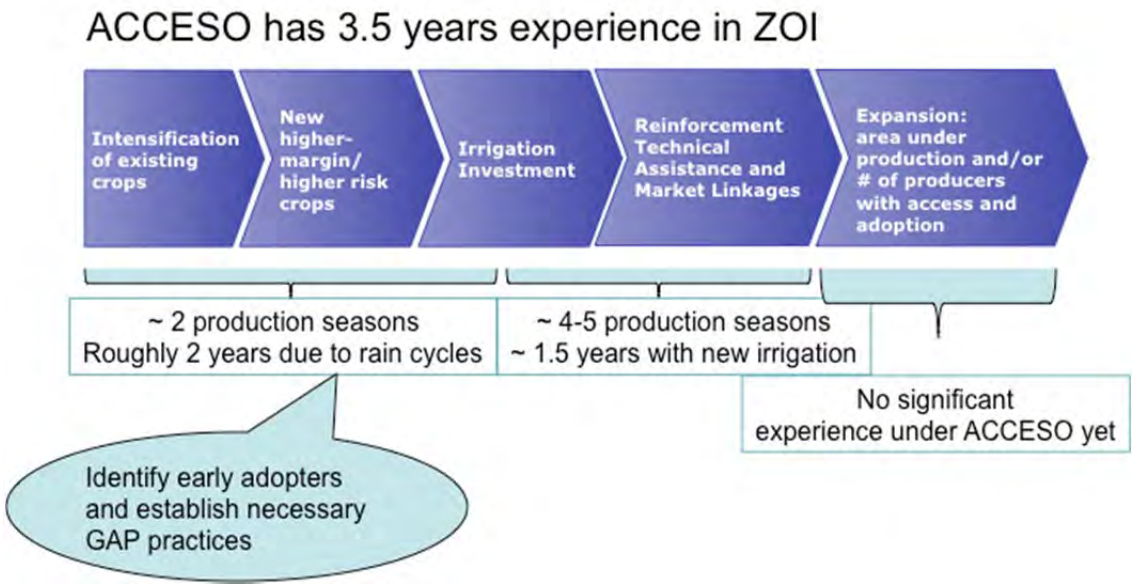
[11] There are approximately 150 group systems where shared water sources and distribution systems were included. The data indicates additional *parcelario* investments, which include a combination of in-plot grants for individual in-plot components connected to a shared water system as well as individual systems where the producer had direct access to a private water source. No breakout of these systems was easily available. The five rehabilitation grants were systems that had been abandoned for various reasons relevant to these and other abandoned or non-working irrigation systems, summarized in the Business Case section below.

installation of the physical irrigation system. Figure 2 indicates the sequence of ACCESO technical assistance and activities.

Initial technical assistance within a community focuses on introducing improved production practices for existing crops: principally corn, beans and coffee. In limited cases, the farmers have additional experience in producing potatoes, plantains and other rainfed crops. Working with farmers within a community over one or two crop cycles (up to two years with rainfed seasons), ACCESO encouraged farmers to experience crop intensification and improved productivity based on largely labor-intensive practices (land preparation and planting in beds, seeding rates and plant spacing, etc.) This time period and experience served three purposes:

- ACCESO technical staff developed strong trust-based relationships with the poor and extremely poor producers. This trust was necessary for the introduction and adoption of new practices and technologies.
- ACCESO staff developed a familiarity with community resources and terrain to determine whether irrigation was technically possible (water availability, terrain for gravity based system, right of way, etc.) for some or all of the active farmers within the community.
- The irrigation systems cost on average $33,148, including an average of $19,419 of ACCESO grant funding. The time also allowed ACCESO to determine producer interest, capacity to contribute to, and capability to adopt and utilize effectively the technology.

FIGURE 2: ACCESO SEQUENCE OF IRRIGATION INTRODUCTION AND SUPPORTING TECHNICAL ASSISTANCE



The technical design of the irrigation system has been community specific and depended on the communities where ACCESO was working – over 2,600 communities across the ZOI. The designs have not started from the perspective of the water source and its location, weighing all possible alternative water demands and geographies/plots that could be irrigated by the water source. Instead, ACCESO started the work in each community on crop intensification and crop diversification, where possible. Once in the community, building trust and becoming familiar with the productive assets, the ACCESO technical staff would discuss and ascertain with the producers if there were any viable surface water sources available for development of a drip irrigation system. Water sources are likely to be located outside of the immediate community or lands of the potential water user group members. At times,

they are located on private land or on public land at some distance from the community. The average ACCESO-installed system included 3.5km of conduction pipe, and 11 systems have more than 9km of conduction pipe.

The development of the water source and the necessary water delivery and conduction can require negotiations with local municipalities and other landowners. Some of the water capacity may be necessarily allocated to a private landowner over whose land the delivery mainline pipe will pass, in exchange for the easement. Those potential users are not automatically incorporated into the water user group and may or may not even be interested in joining. The conduction pipelines may cover a significant distance, passing other potential producers along the way. Because these other potential producers and/or landowners may not fit the profile of the ACCESO target groups (the poor and extremely poor), it is yet unclear if this will create issues or problems in the future.[12] The initial irrigation investments have been opportunistic across the entire range of potential investments within the ZOI, seeking to take advantage of those potential investments where there are no obvious conflicts or issues, and balanced with the identification of innovators and early technology adopters from within the community, based on the initial technical assistance offer by ACCESO extension teams.

ACCESO has used an extension agent model, with each extension agent visiting between 300 and 350 producers each week to provide the varied relevant technical assistance, including irrigation management, water user group capability, crop production, agronomic training and advice, and market access and linkage support.

Conclusions

While ACCESO has built a strong initial experience using and adapting learnings and successes with drip irrigation from previous projects elsewhere in Honduras, to the benefit of the poor and extremely poor in the ZOI, over 60 percent of the irrigation systems installed by ACCESO have occurred during the final two of the four phases of irrigation system investments, as summarized in Table 1. The components of the technology package are now well defined along with the necessary supporting activities. But the experiences to date with drip irrigation for the poor and extremely poor in the Dry Corridor remain early and there is still a lot to learn with regards to access and sustained adoption of irrigation and the relevant supporting value chain and ecosystem spaces, as the scaling up of the technology is pursued. This is discussed in further depth in subsequent sections of this report, particularly the Scaling Spaces.

TABLE 1: SUMMARY OF ACCESO IRRIGATION INVESTMENTS ACROSS THE FOUR PHASES OF THE PROJECT[13]

	Phase I	Phase II	Phase III	Phase IV	Total
# of systems	10%	24%	35%	31%	
Total irrigated hectares (potential)[14]	160	371	580	518	1,629
Total beneficiaries	370	1,839	1,631	1,444	5,284

[12] These issues are discussed further in the Policy Space and Environmental Spaces sections of this report.
[13] This summary includes hectares and beneficiaries for all ACCESO irrigation investments, while the subsequent table specifically utilizes those with conduction portions to the investments to understand cost for the large group systems.
[14] The irrigation investment tracking documents the irrigation system capacity at the time of approval/installation and not how much the area receives or has in-plot investment over time and utilization. Each system includes (as water capacity allows) water for producers to expand their area under irrigation through their own future investment.

THE BUSINESS CASE – EVIDENCE OF IMPACT/ADOPTION

Value Proposition for the Farmer

There are three value propositions from drip irrigation utilization for poor and extremely poor farmers:

- Increased yields and productivity
- Diversified production (new higher-value crops and diversified risk)
- Production throughout the calendar year – from one harvest per year to up to four harvests per year

The potential for varied combinations of crops and multiple production seasons creates complexity in quantifying the business case for the producer. Each experience to date has been fairly unique, with producers starting with different size areas under irrigation (from a single *tarea* up to 8 *tareas* or ½ *manzana*)[15] and a different set of products under irrigation. In addition, crop production cycles and rotations are of different enough lengths that it is not even possible to generalize the number of potential production seasons from each plot. For example, potatoes are planted and harvested over a 12-week production season (up to 4 crops could be produced if each had a 12-week production cycle), while Tabasco chiles and plantains may occupy the plot, from planting through final harvest, for up to 40 weeks, nearly a year. ACCESO clients typically produce 2 to 2.5 crops per year on each plot of land, utilizing an appropriate crop rotation.

ACCESO's phased technical assistance and technology introduction strategy increased yields and productivity starting prior to irrigation, through the intensification of the farmers' traditional crops (corn, beans and coffee) with improved practices. With the improved practices and techniques, ACCESO beneficiaries produced rainfed corn that yielded six times the departmental averages and three times the national average. Similarly, beans, coffee and other crops traditionally grown by the producer experienced increased yields and productivity, first through the improved practices introduced before irrigation, and then experienced further yield increases with irrigation. Coffee irrigated using drip technology is still a relatively new experience. The first ACCESO beneficiary to adopt drip irrigation of his coffee increased production from .8MT per *manzana* to 4.4MTper *manzana*.[16] In addition, the cupping of the resulting coffee remained very good; the quality did not appear to be negatively impacted by the irrigation. Additional farmers in each of the departments have been assisted to adopt drip irrigation under coffee as model farmers, to provide examples for neighbors and other departmental producers.

Corn and beans are the basic food crops within the Dry Corridor. By dramatically increasing yields through improved practices, the intensification of corn and beans reduces the area necessary to produce the families' household grain needs.[17] With irrigation, this opens up the opportunity for producers to

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[15] See Annex 3 for conversions related to the relevant areas of production in Honduras: *tareas*, *manzanas* and hectares. Annex 4 summarizes 134 of the ACCESO systems with conduction investments. Each producer averaged a potential seven *tareas* of irrigated area, though not all of the potentially irrigated land was developed with in-plot irrigation components at the time of installation.

[16] The actual area of coffee under drip irrigation was three *tareas*. See Annex 3 for conversion rates between the common areas of production used in Honduras.

[17] Average yield increase experienced by ACCESO client in corn is six times the departmental average. That means that the farmer will need 1/6 the area to produce the same amount of corn. The average household according to the baseline study has ½ *manzana* of corn, or eight *tareas*. If a family is able to produce the same (or a bit more) amount of corn on two *tareas*, the other six *tareas* could be irrigated for drop diversification. The same exercise in the beans could free up additional *tareas* for irrigation.

diversify production, adding different crops. These crops can vary from strawberries and radishes to potatoes and plantains, or even irrigated pasture and forage for the household dairy cows. Most of the horticulture crops cannot be produced without irrigation, or the risk of production without irrigation makes the crops unattractive given the high input investment costs required. Relatively small areas, such as a handful of *tareas* (440m^2 each), can be split between different crops requiring different values of input investments and production practices. This can offer varied production cycles as well as potential risks and margins. Most farmers reported continuing some rainfed maize and bean production (with the improved practices) on land not near the path of the irrigation conduction line, or that had not yet been placed into irrigation. Anecdotally, ACCESO has found that as some producers expand their area under drip irrigation (more than ½ *manzana*) and move into the highest-value horticulture products, corn and beans are integrated into the irrigated production planning as rotational crops, with the excess produced sold into local markets. The few farmers visited during the assessment who utilize this practice clearly understand that at that point of sophistication, the corn and beans cover their costs of production and feed the family but are not profitable in and of themselves. They produce more corn and beans under irrigation than they need for household consumption, but choose to due to the role the crops play in land management and crop rotation.

In addition to increasing the number of possible crops, irrigation opens an opportunity to produce up to four harvests a year. As noted earlier, crop production cycles and rotations are of different enough lengths that it is not possible to generalize the number of potential production seasons from each plot. The increased production, and all of the previously-mentioned dynamics of yield, crop diversity and longer harvest windows (either from multiple seasons or crops that produce over a longer period), must have market access. With crops of higher perishability, the timeliness of market access is as important. Market access and market linkages were mentioned in numerous interviews conducted by the assessment team as factors in previous attempts to promote investment in irrigation or where irrigation investments had been abandoned. This is analyzed further in the Downstream Spaces section of the report.

ACCESO has produced best-case crop production budgets for the many crops that their beneficiaries produce. A select subset is summarized in Table 2.[18]

TABLE 2: BEST-CASE CROP PRODUCTION BUDGETS FROM ACCESO

	Total Cost/*Tarea*	Labor/ *Tarea*	Potential Net Return/*Tarea*/Season	Net + Labor/*Tarea*
Lettuce	$312	$104	$70	$174
Potato	$334	$75	$165	$240
Plantain – Local Market	$355	$109	$160	$269
Cabbage	$308	$153	$36	$189
Pumpkin	$259	$55	$120	$175
Tabasco Chiles	$370	$245	$20	$265

The crop production budgets estimate total cost of production, including total associated labor costs. As the poor and extremely poor begin their experience with drip irrigation over small areas, often much of the labor is family labor. High labor crops and larger areas under irrigation do generate day labor opportunities within the communities, and some labor is hired/non-family. The labor components are

[18] Irrigation costs assume surface water, gravity-based high pressure systems that represent the vast majority of the ACCESO-installed systems. Systems pulling from wells or other water sources (rivers) that may be lower than the irrigated area, requiring diesel pumps, would change the potential net returns due to increased irrigation costs (diesel and maintenance to run the pumps).

highlighted in the table and added to the potential net return to indicate the possible total return on family labor per *tarea* if family labor is used. The actual potential return to the household will probably be somewhere between the potential net return and the net return plus labor, as the households will likely use as much family labor as they are able.

As noted previously, plantains and Tabasco chiles have longer harvest windows and occupy the land over a longer period of time, up to 35 to 40 weeks. The other crops highlighted have varied season cycles, but are likely to offer an opportunity for three to four harvests over the year for the same plot. As Table 2 highlights, potatoes are an extremely attractive crop, but with crop rotation, only one crop in three or four should be potatoes or a related crop (tomato, eggplant, pepper, etc.) due to disease risks.

TABLE 3: EXAMPLE OF POTENTIAL HOUSEHOLD RETURNS FROM A THREE-CROP ANNUAL ROTATION

	Potential Return	
Potato	$203	Return/*tarea*
Cabbage	$113	Return/*tarea*
Pumpkin	$148	Return/*tarea*
	$464	Return/year/*tarea*
Per capita/day	$0.25	Avg hh has 5 members
Three *tareas* under irrigation	$0.75	Per capita per day

Table 3 highlights one possible example of the impact of drip irrigation on household poverty. Three crops were chosen that could be produced in rotation on the same plot (1 *tarea*) over the course of the year to produce three crops. A rotation of potatoes, cabbage and pumpkins would produce $.25 per person per day per *tarea* for the household, assuming an average household size of five members. If three *tareas* of irrigation were available and these same crops were produced in rotation, which would improve risk management with each harvest resulting in a *tarea* of each crop, the household would have $.75 per capita per day. This equals 50 percent of the $1.53 per capita per day required to lift the baseline ACCESO beneficiary out of poverty ($.89 to $2.42.) Approximately 6 *tareas*, just less than ½ *manzana*, of area under irrigation have the potential to increase household income by the 170 percent necessary to reach $2.42 per capita day.[19][20]

Using this analysis, a ½ *manzana* area (8 *tareas*)[21] under irrigation is a target size for substantial poverty impact. Phase I ACCESO investments in irrigation either did not provide for any in-plot investments, or only for a single *tarea*. They also promoted the use of second-hand drip tape coming out of other Honduran horticultural production as a way to reduce the in-plot investment required by the producer. Those early producers have shown an interest in and willingness to expand the in-plot areas under irrigation, but a single *tarea* of cash income (see Table 2, between $35 and $165 per *tarea*) has not been sufficient for quick investment expansion. The costs of irrigation – both the overall shared water system and in-plot costs – are outlined in the following section. Subsequent ACCESO irrigation phases have

[19] Many producers continue to have rainfed corn and beans for household consumption elsewhere on their farms. Most farmers incorporating corn and beans in an irrigated rotation have more than ½ *manzana* under irrigation.
[20] As already noted on page 2, the baseline study found each household with an average of 3.15 manzanas total under production, nearly 5 times the amount needed under irrigation for the increase in household income as calculated here.
[21] While the example provided resulted in 6 *tareas* as the area necessary for lifting a household out of poverty, many consultations reported 8 *tareas* (½ *manzana)* as the minimum as a more conservative estimate, given the various risks associated with producing and marketing agricultural crops.

increased the area of in-plot grants provided by ACCESO investments. From two *tareas* to eight *tareas* (½ *manzana*) were included in Phases III and IV.[22] Early indications demonstrate a quicker expansion of irrigation by those same farmers above and beyond the original one to eight *tareas*.[23]

Another important note from Table 3 is the high input cost of the irrigated crops. Cash for seed, fertilizers, fumigation for pest and disease management, and supplemental labor are significant. For the 6 crops used as examples, total costs range between $259 and $370 per *tarea*. If a minimum of six *tareas* are necessary to reach a level capable of lifting the average poor or extremely poor producer households from poverty, that is a $1,900 cost of production or $2,500 cost of production for a ½ *manzana*. Production credit is absolutely critical for adoption of high-cost input irrigated crops. Access to credit is further discussed in the Financial Space analysis in a subsequent section of this report.

Cost of Irrigation

As noted earlier, the average length of water conduction pipeline installed with ACCESO support has been 3.5km, with a total length of about 564km of water delivery pipeline laid.[24] The average total cost of conduction per kilometer has been over $8,700 (ACCESO's grant contribution average was $5,509/km; much of the cost above the ACCESO grant investments were in-kind, including community labor to dig ditches and lay pipe.) The average total cost per hectare of land able to be irrigated by the systems was $3,800 (ACCESO contribution/ha was $1,907). The average total cost per producer/beneficiary, inclusive of all contributions, included at the time of installation is over $1,200.[25] (The analysis in Annex 4 shows that irrigation systems have the potential to irrigate an average of just over 7 *tareas* of land per beneficiary.)

The ACCESO grant portions of the irrigation investments have averaged 59 percent of the total costs. This excludes much of the technical planning, feasibility and design of the irrigation systems, which have entailed significant involvement and contributions from ACCESO's technical staff. The counterpart contributions to the total irrigation project costs have at times included cash or other major works, but mostly involve the extremely high labor required to dig the kilometers of ditches to lay the conduction and water delivery pipes. The irrigation investments have also excluded all project administration and complementary technical assistance. The costs only include the direct costs of the physical components and installation.

The size of the irrigation systems at times are designed based on the number of producers (and their productive land) in the community interested and willing to contribute matching labor and/or cash[26] and who have demonstrated initial experience with improved agricultural practices and crop intensification. Each system is obviously constrained by the water source capacity, but where possible the system design includes capacity both for initial in-plot irrigation needs of the interested producers and extra irrigation capacity for these producers to add additional *tareas* with in-plot irrigation investments in the future. ACCESO irrigation grants have purposefully sought to achieve the roughly 45 percent matching contributions to their own grant dollars with each system. This extends their own financial reach and

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[22] ACCESO has not promoted or invested in a standard irrigation system package. Some systems included in-plot irrigation components to cover two *tareas*; other systems included grants to cover four, six or eight *tareas* of in-plot irrigation.
[23] Phases III and IV have only occurred over the past calendar year and thus the producers have between one and four production seasons under irrigation. The decision to expand the grants to cover a larger in-plot area was a decision to speed income impact and ability of the farmers to invest further in irrigation and other capital investments. The outcomes of this experience remain outstanding and require additional productive seasons.
[24] Annex 4 includes a table summarizing the investments in irrigation conduction systems by the four Phases of irrigation installation under ACCESO.
[25] The poor and extremely poor have an average of just over $1,600 per year as a total household income ($0.89 per capita per day for a household average of five members).
[26] Cash in a few cases has come from other NGOs, municipalities or third parties active with the producers/community.

ensures commitment and ownership by the beneficiary producers. The interest and capability of the interested producers at the time of system design have been important inputs into the size of the final systems.

As a result of the need to have producers interested and committing to matching with labor or other contributions, as well as committing to organizing in a water user group where no prior producer group existed, the water source is often not maximized through the design and installation of a system to capitalize on the full irrigation potential. For example, a water source may be sufficient to fill a 6" or 8" pipe, but only a 4" pipe is laid that meets this group of producers' immediate needs and near-term irrigation growth. This minimizes investment in a potentially un- or under-utilized capital asset in the future, but also limits potential filling in scaling through the addition of later-adopting producers physically located near the system or any significant expansion of the area under irrigated production. Also, because of the high labor contribution by these early adopting producers who through the irrigation investment form a water user group, the group may not be open to adding new members in the future as the installation is already a sunk cost. Water user group agreements with an appropriate fee structure can encourage openness to this type of filling-in scaling. Such a fee structure may have an initial membership fee to offset the already sunk cost of installation, in addition to water use and/or regular irrigation subscriber fees. The scaling team recommends that future irrigation investments consider approaches to strategically plan for potential filling in scaling by 'over-sizing' irrigation systems and work to manage the incentives for the early adopters to leave open future irrigation access by their later adopting neighbors.[27] This is discussed further in the Organizational Space and Scaling Pathways sections of the report.

All of the ACCESO-supported systems to date have relied on gravity, except two that use diesel pumps. Within the gravity water systems, a handful use hydraulic ram pump technology. Utilization of gravity has reduced installation costs as well as ongoing maintenance and running costs. Diesel pumps are often underutilized or abandoned because cash is needed regularly for fuel and increases the cost of production.

Under the early phases of ACCESO irrigation investment, the in-plot investments were left up to the producers. At times, the grant component would include the necessary components for one to two *tareas* of drip irrigation. The early two investment phases also promoted the utilization of second-hand drip tape to reduce the entry cost for producers. As noted in Table 4, drip tape represents approximately 36 percent of the total cost of the in-plot components. Drip tape has the shortest lifespan of the components and usually needs to be replaced after two to three seasons.[28] Drip tape costs less than $20 per *tarea* and many farmers from the earlier phases reported conveniently purchasing replacement drip tape from *agropecuarias* (agriculture input retailers) in regional market centers.

TABLE 4: IRRIGATION INVESTMENT IN-PLOT PER ½ *MANZANA* AND *TAREA*

	US$	%
New Drip Tape (2-3 season lifespan)	$137	36%
Total 8 *tareas* (1/2 Mz)	$386	100%
Total per *tarea*	$48	

[27] Increasing size of conduction pipe from 4" to 6" or 8" (and the filters needed for such systems), would have a major cost difference and therefore reduce the number of systems that project funds could be used to invest in. That said, the ability for filling-in scaling, as outlined in the Organizational Space and Scaling Pathways section is severely limited without the additional upfront investment.

[28] Well maintained and cared for, drip tape can last up to five production seasons or so.

ACCESO's experience through the first two phases of irrigation investment identified that while producers did expand their areas of production under irrigation with their own capital after the first production seasons, the growth was not occurring quickly. Producer investment in the in-plot components was intended to build a sense of ownership and investment. The risk working with the poor and extremely poor in western Honduras comes in part from the history of relief work in the area, which has given away potentially productive assets in the past. A culture has developed, as in other areas around the world with years of relief and humanitarian programs, where grants and gifts may not be utilized or cared for over the medium-term. Programs, such as ACCESO has in the case of irrigation, require matching contributions or even full repayment of productive assets to ensure that the beneficiaries understand the value of the asset, including a personal financial interest in the utilization, maintenance and expected benefit. The income from one *tarea* of irrigated production does produce net returns, but not enough to quickly invest in subsequent *tareas* of irrigation. Based on this experience, ACCESO chose to invest more in in-plot areas per producer (grant funding) up to 8 *tareas*. Its initial experience granting components to cover a larger in-plot irrigated area per producer has been that even within only a couple of production seasons, producers will have the capital to further invest in productive assets – irrigation, cattle, etc. This increased rate of reinvestment by producers may balance out and counter the risk associated with a larger grant component, resulting in a reduced sense of ownership and value on the part of the producer. If the coming year continues to reinforce this early indication that larger in-plot grants are in fact resulting in increased producer investment in irrigation and other productive assets, then it would support continued granting of in-plot components, up to the 8 *tarea* level.

There have been decades of irrigation experience and while ACCESO is the largest and most relevant experience with the poor and extremely poor in the ZOI, other irrigation investments were visited and their experiences considered by the assessment team. There were a handful of constraints faced by previous irrigation projects and systems that were underutilized, abandoned or failed. These include:

- **Poor design**. There were examples where it appeared that the sale and installation of the technology (water pumping versus gravity based, for example) may have been prioritized over the local specific situation. Also noted was a lack of adequate consideration of community experience during the design: where the water is, practicalities of the geography, etc.
- **Lack of water**. The water capacity was assessed during the rainy season and faulty assumptions were made either based on anecdotal evidence or based on experiences elsewhere. These systems may be adequate to provide supplemental irrigation during rainfed seasons, but either are not appropriate for year-round irrigation or create water conflicts. Water assessment for system design must occur during March and April, the driest months.
- **Lack of production experience with Good Agricultural Practices (GAP) is critical for outcomes**. Irrigation systems were abandoned because of a lack of understanding as to how to irrigate crops and produce crops other than corn and beans. Higher-value irrigated crops require more technical production practices. These irrigation systems were abandoned due to an absence of supporting technical assistance, which they needed on an ongoing basis over many production seasons.
- **Poor irrigation management without a user fee structure**. Some donated systems failed due to a lack of maintenance and management. User groups may have been structured loosely to receive and benefit from an irrigation system without a structure in place to build capital and implement maintenance for future utilization. The irrigation asset was used while it worked, but a lack of clear ownership or structure left the system broken or decaying.
- **Lack of market access and linkages**. Market access was mentioned numerous times related to previous experience with irrigation. Intensive irrigated production of higher perishable horticulture requires timely market access. The producers need linkages to new markets for new products or they lose their input investment and abandon the irrigation systems.

Conclusions

Drip irrigation offers producers value through increased yields and productivity, an opportunity to diversify production and risk, and more annual harvests through irrigated production over the entire calendar year. The potential for varied combinations of crops and multiple production seasons creates complexity in quantifying the business case for the producer. Even so, ACCESO has demonstrated a strong business case for the poor and extremely poor farmers in the FTF ZOI from the adoption of drip irrigation. They initiate the introduction and adoption of irrigation and associated practices with crops already known through intensification and improved practices, which carry over to higher-value crops. With six to eight *tareas* of irrigated production, approximately ½ *manzana*, the potential exists to increase the household's income above the poverty line. The business case on the part of the farmers is further proven through their utilization and maintenance of their irrigation systems, and willingness to invest the resulting profits into the expansion of their own production areas under irrigation.

While the business case for the producer is clear, there are necessary scaling spaces, stakeholders and value chain roles to support scaled access and adoption of drip irrigation. The relevant analysis is discussed in the Scaling Spaces section of this report. These include the necessary access to production credit, water user groups, extension services and market linkages.

The high cost of conduction has required and will likely continue to require external grant financing. The lifespan of an irrigation system is at least 10 years, and for the poor and extremely poor, no commercial finance makes sense. The available donor and government grant funding, leveraging private sector service provision within the value chain ecosystem where the capability, capacity and incentives exist, will limit scaling. External grant funding also offers an opportunity to plan for and invest in excess irrigation capacity within the systems for future filling in scaling by building systems larger than necessary for the early adopter producers in the community. This is discussed further in the Scaling Pathways section of this report.

POTENTIAL SCALE: SUPPLY AND DEMAND

Demand for Drip Irrigation

The potential scaling up opportunity for drip irrigation among the poor and extremely poor within the ZOI and the subsequent estimation of expanded crop production resulting from intensification and diversified irrigated production should be determined by an overlay of a surface water inventory, segmentation of producers and land areas able to be irrigated by that water, and the potential increased crop production resulting from adoption of the technology. There are no existing inventories of available surface water sources, water volumes or associated areas and/or producers. Producers and land able to be irrigated by the available surface water and gravity-based systems (the lowest running cost and easiest to maintain) are technically constrained by water volume and geography. A complete zonal inventory is needed along with producer and area segmentation because, as discussed elsewhere in this report, there may be tensions between demands on water and water sources that often serve multiple communities, municipalities, and even other countries, such as El Salvador – as well as the fact that they serve the poor and others living within the ZOI.

The water potential is also uneven across the six departments. The more northern departments such as Copan and Santa Barbara may have more water resources, with as many as 60 to 80 percent of the poor and extremely poor with the potential to benefit from irrigation. La Paz and Intibuca have areas where there may be less surface water available in the driest seasons and gravity-fed systems from existing surface water sources may not cover nearly as many producers with drip irrigation, even though

drip irrigation is an extremely efficient irrigation method. In some places, a water inventory may identify more expensive, large infrastructure water harvesting opportunities (such as dams and reservoirs) that would be necessary to provide additional later-term scaling of the technology.

There are two current activities to inventory and assess water available for irrigation:

- USAID is initiating the development of a water inventory tool starting in January[29]
- CRS and CARE are doing an inventory and assessment with Howard Buffett Foundation financing; there is only partial overlap with a limited area in south of the ZOI.

Supply – Expanded Production at Scale

Similarly, significant data gaps exist in the necessary calculation of how much additional production would result from scaled access and adoption of drip irrigation. ACCESO has worked with a large portfolio of irrigated crops and each producer identifies their own basket of crops to produce. These have included various horticulture crops (potatoes, carrots, lettuce, radish, onions, green beans, etc), plantains for local market and export, and other export crops including passion fruit, sweet potato, and chiles. ACCESO's newest irrigated crop experiences include irrigated coffee and livestock, particularly a trial in partnership with a local supermarket chain for the poor to intensively grass fatten cattle using irrigated forage. The opening of plantain production opportunities within the ZOI is a result of a shift in traditional coastal plantain producing areas into oil palm production.

An estimated quantification of increased supply of scaled access and adoption of the technology is an important strategic question in most cases. For irrigation, the complexity of crops possible makes it impossible to calculate, but also less important since the diversification of production also diversifies the risk of adoption by producers. Unlike a technology that would possibly increase yields of a single crop by four to ten times and have adoption and achievement of targeted outcomes rely on market absorptive capacity, with irrigation producers are learning multiple crops and the skills to learn new crops as markets allow. As such, the scaling team recommends that no single crop be promoted over others and market identification and access across crops should continue to track scaled irrigation investments and resulting production, to ensure growth is manageable.

Demand – Market Size

Because irrigation supports the increased yields and productivity, increases the diversity of crops grown, and stretches productive seasons over the entire calendar year, there exists significant complexity in a seemingly straightforward quantification of the market's ability to absorb additional production from scaled technology access and adoption. ACCESO has worked with 10 main commodities, but has experience with at least 70 possible crops.

There are four levels of markets relevant to the poor and extremely poor farmers in the ZOI. The local markets are small community markets and the primary commercial centers for the farmers and their neighbors. The regional markets are the larger population centers, with market centers that serve both their own populations and as conduits to larger markets elsewhere. The largest domestic markets are San Pedro Sula and Tegucigalpa. Finally, export markets of significance include the U.S., various European countries and Central American markets include El Salvador and Guatemala. The large

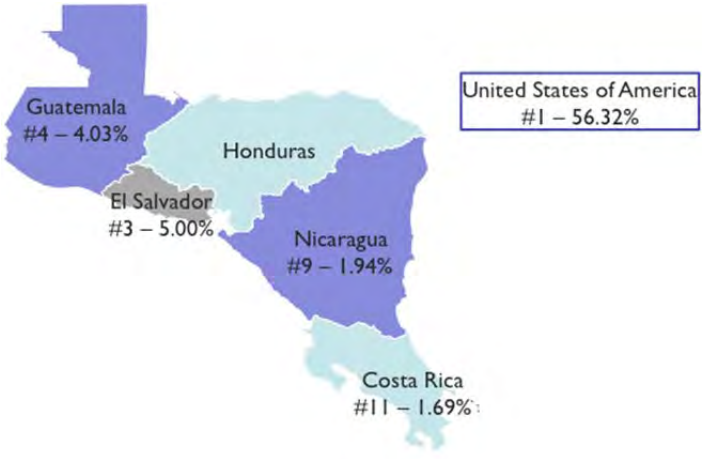
[29] The tool USAID is supporting will be used to identify suitable sites for the construction of small catchments, rainwater harvesting reservoirs and areas for supplemental irrigation. It will provide potential availability. It is not a tool for a detailed water inventory.

regional markets include large processors targeting products for domestic, regional or international consumers. Processors represent a smaller percent of demand in relation to fresh produce markets.

It is important to note that while ACCESO has been providing production extension assistance to tens of thousands of the poor and extremely poor over the past 3.5 years, only about 5,000 have gained access to irrigation, with about 50 percent of the newly irrigating farmers and 60 percent of the newly irrigated hectares producing irrigated crops for less than 12 months. The experience in the ZOI with significantly expanded production remains limited. That being said, so far local markets offer a significant entry opportunity for early adopters. These intra-community markets and local markets are very small. Often the smallest community markets may not have had many horticultural products on offer prior to irrigation, as they are very small markets away from the regional markets serving as market hubs. Farmers mentioned to the assessment team that prior to their own vegetable production, vegetables were scarce and often expensive in their local markets. However, these local markets are small volume and fairly quickly overwhelmed with expanded local production.

Supermarkets offer another limited-size market for the new irrigated production. Informal markets account for 70 percent of Honduran market, with the remaining 30 percent in formal markets such as supermarkets and horticulture processors. ACCESO beneficiaries sell about 40 percent into these limited formal markets (including coffee), with roughly 60 percent going into informal markets. Informal markets at all levels will remain critical to absorb expanded irrigated production.[30] This includes consideration of regional markets, particularly El Salvador. The ZOI is physically located along the border of El Salvador, particularly those areas further away from the Honduran market centers. While transportation access into El Salvador is uneven, lacking the dozens of border points, Salvadoran traders are active in the Honduras market centers, purchasing for the El Salvador market. In 2012, Honduras exported $6.43 million of tomatoes, which represented one of its largest agricultural products to El Salvador alongside $9.16 million of cheese and $5.66 million in beef. El Salvador is the largest regional trading partner of Honduras, representing 5 percent of its total exports (see Figure 3.) This regional trade predominantly occurs through traditional wholesale and retail channels, with less through formal supermarkets and processing companies.

FIGURE 3: REGIONAL HONDURAN EXPORT DESTINATIONS – GLOBAL RANK AND PERCENTAGE OF TOTAL EXPORT VALUE



[30] Annex 5 includes a map with the geographic distribution of time to market (markets defined as cities with populations above 25,000). The small community markets are located where the producers farm, among their neighbors and immediate communities.

Detailed assessments of the informal markets are needed, quantifying volumes traded, seasonality and prices, mapping traders and actors, and identifying opportunities for market expansion where new production can grow without a significant fight for market share. The scaling team suggests that these detailed market assessments focus on informal markets within Honduras, but also regional flow of trade into the large wholesale and retail marketplaces. ACCESO has not yet carried out any significant market assessments or mapping of these markets, although they have on a select group of export crops with more formal market linkages.

Conclusions and Recommendations

Unfortunately significant data are missing to adequately size the potential scale of drip irrigation access and adoption across the ZOI. The scaling team recommends that efforts be pushed forward to inventory water assets as a fundamental input in quantifying potential scale. Also, detailed market assessments and mapping should be conducted and kept up to date for domestic and regional informal trade of horticulture and fruit (and other relevant irrigation crop opportunities including meat and dairy).

SCALING SPACES: ECOSYSTEM ANALYSIS

Scaling up is not simply increasing access to and adoption of the technology package by an incremental number of additional farmers. Instead, scaling up in this case entails reaching population-level impact and benefit for the target poor and extremely poor farmers. Sufficient space is required for growth along the value chain and to sustainably achieve scaled technology access and adoption. In some parts of the value chain, this space needs to be created or strengthened. This section compares the spaces needed for scaling up with the existing value chain ecosystem and the current efforts and accomplishments to date of USAID's FTF projects (and those of other actors to create space for scale). Gaps are also identified. A particular emphasis is placed on the perspective of critical supply chain and value chain stakeholders; their interests, incentives, relationships and the required supporting systems. Both the capacity (reach or scale) and capability of these critical stakeholders have been considered in the analysis and conclusions provided in this section.

Capacity here is defined as the ability of a stakeholder or stakeholder category to deliver and operate at the targeted or desired scale, while capability is the ability of an organization or stakeholder category to deliver the technology package the way it was designed (fidelity), with the quality needed to achieve the expected impact. Partner and value chain organizations must exist in the critical stakeholder categories (for example input production and distribution, commodity processing and production credit) and have **both** the capacity and capability to successfully scale up.

Upstream Spaces

Production input and resource availability and accessibility (excluding finance and credit, which are addressed in a separate section) constitute the upstream space. These include the direct irrigation components and services as well as the seeds, agricultural chemicals, fertilizers, and labor required for producing crops under irrigation. The upstream space is an area already in place with the capacity and most of the capability necessary for scaling up.

There is already a strong private sector irrigation subsector, including the importation and manufacturing of irrigation components as well as distribution and retail. Reasonably distributed access to drip irrigation components exists across the ZOI. Even *agropecuarias* now carry drip components

and have good relationships with the large national irrigation companies. Drip components are available individually or in smaller units that are most appropriate for the small in-plot systems of the target poor and extremely poor individuals. During the field consultations, farmers expressed knowledge of where to buy the individual components as well as their affordability and convenience.

Interestingly, all components except the drip tape itself have experienced falling prices over the past five to seven years, as demand for drip irrigation has increased across Honduras with producers of all sizes. Drip tape costs have remained the same or have slightly increased, most likely due to the costs of raw ingredients. Some farmers reported using secondhand drip tape that originated in Honduran horticulture production located outside of the FTF ZOI. The secondhand drip tape was introduced to early-phase target farmers by ACCESO as a reduced-cost drip irrigation adoption strategy. Farmers continuing to use the secondhand drip tape mostly have some second- or third-hand connections to labor in these other horticulture operations. New drip tape has been purchased by ACCESO for in-plot grants during the most recent phases.

There are three large national Honduran irrigation companies. Each of these has been recently experimenting in the design of drip kits that seem to largely be driven by NGO and public sector purchases and potential purchases, and are designed around low-pressure drip for household garden-size areas. These kits pose a certain risk to broader poor and extremely poor drip irrigation adoption because the low-pressure design of the kits is unlikely to actually irrigate but rather moisten, resulting in a very different performance and experience than with a high-pressure, agricultural production focused design. The sales opportunity for the household garden kits from the perspective of the irrigation companies is quite attractive, as the public sector and NGOs have substantial funding available to purchase and distribute. It is not clear whether the companies are aware of or are considering the possibility that a negative experience on the part of the kit recipients may result in a negative impact on the future agricultural production drip irrigation market among the same population. Separate from the low-pressure household garden-sized drip kits, the components required for areas from one to four *tareas* of in-plot high-pressure irrigation are standard enough that these components could be packaged into an in-plot kit. One company is pursing this opportunity, but the components and set-up are quite simple and are already widely available in the appropriate unit sizes, so it is unclear whether there is much value to be added by selling it as a kit versus the individual components.

One area where the strong private sector is not necessarily best able to serve the poor and extremely poor is in overall system design: the community-size shared irrigation system beginning with the water source through distribution and filtration. The companies do have design teams with the technical capacity and significant experience for medium to large producers with their own integrated systems. These company design teams are expensive and may not be best suited to the needs of the poor and extremely poor, where critical skills should include community knowledge, stakeholder management and negotiation, and alternative design skills to balance and manage conflicting water usage demands (i.e., domestic water needs). A strong, experienced design team(s) is needed to specifically implement in the ZOI and learn across experiences with the target beneficiaries. ACCESO staff have been serving this niche in conjunction with select technical input from the companies. The narrow annual window for water capacity assessments – the driest period of March and April – will continue to be a design team capacity-limiting constraint as well, and may necessitate multiple agile teams with this capacity to quickly form, execute and dissolve at other times of the year. USAID/Honduras and other strategic partners must ensure that new activities and other mechanisms working to promote the adoption of drip irrigation technology in the FTF ZOI coordinate to perform these water capacity assessments expeditiously.

One final note is that because the upstream space is largely in place and capable of scaling (it is quite easy to find irrigation system components for sale in multiple markets across Honduras), there are irrigation investments that have been and will be made without the other supporting spaces in place. At least some of the abandoned irrigation systems have no design or performance flaws. They may have been affordable or external financing made through NGOs, public sector, or other donors. Spare parts may be easily obtained and installed for continued utilization. In these cases, the abandonment is caused by the lack of available agronomic production extension and market linkages, because the farmers do not realize the potential value propositions. The irrigation companies are not in a position to provide these necessary complementary services and assistance. The agricultural input retailers, which include the irrigation companies in some cases, do provide some production input finance such as seeds, agricultural chemicals and even small irrigation components for in-plot use. This is discussed further in the Financial and Fiscal Space section.

The input space is only one of the necessary spaces for scaling, and these necessary complementary services and assistance will need to come from other stakeholders, as outlined in subsequent sections.

Downstream Spaces

Traders, brokers, transportation and logistics, and other market stakeholders make up the downstream space. As outlined in the previous section on potential demand, both informal and formal markets offer opportunities for new irrigated production by poor and extremely poor farmers in the ZOI. ACCESO's experience to date has included linkages between the farmers and both formal and informal markets. While the scaling team recommends detailed market assessments to better quantify the demand and map market actors, there are a few key observations and conclusions based on the project's experience to date:

- Horticulture production needs to be produced throughout the entire calendar year, with individual producers' harvests planned within a buyer's or packer's supply calendar.
- Buyers, brokers and wholesale packers exist for the formal and informal markets, but have uneven linkages, capacity and capability to work with small producers. These include some cooperatively-owned wholesale horticulture businesses.
- As producers move into more diverse crop production, they will require training in the relevant product quality, post-harvest handling and packing based on the target market.

CAEOL, a cooperatively owned vegetable packer and wholesaler. Credit: Marco Tulio Galvez, USAID.

As previously noted, irrigation allows a farmer to produce a diverse basket of crops over the calendar year, with up to four crops per plot of land. While it is unlikely that each small farmer will have the land available to produce a sustained harvest of a crop each week over an entire year – nor is it desirable[31] -

[31] The experience to date with drip irrigation has seven *tareas* of irrigated land per producer.

most of the horticultural crops should be produced within a buyer's timetable or calendar. The formal markets work with their supplying producers to organize a steady flow of produce onto their shelves. The individual producers will work with the formal market buyer or the intermediary packer/broker on the basis of a calendarized supply plan to produce for a given window of time. Even in the informal market, brokers and buyers are working with groups of producers to organize their production to ensure a more even flow of product into the market. ACCESO has focused on building the capacity and capability to organize this at the broker/buyer level moving into the informal markets, to both the producers' and buyers' benefit. Many of these buyers would have formerly been known as *coyotes*, or middlemen. As irrigated production becomes possible with a calendarized production schedule, these middlemen become important and reliable market access points for producers. Not all of the middlemen have the capacity (often a matter of working capital, but also their markets' size) to absorb large quantities of production and move them to market all at once. Their own business growth requires better relationships with producers and a more organized and consistent supply to move larger volumes to market over a period of time.

Many farmgate buyers and small entrepreneurs exist (many traders and brokers at the local and regional market levels are women.)[32] Thus the problem exists not with the number of traders and brokers, but rather with their linkages with producers and their business capacity and capability to be a consistent and reliable market access link. These buyers (some of whom are existing cooperatively producer-owned packers/wholesalers) and small entrepreneurs serve an important role in aggregating the expanded and organized production (number of producers and area under production) needed to meet the demands of larger markets.

ACCESO has taken an active role in brokering and facilitating these market relationships, with informal markets and active traders (professionalizing some *coyotes*) and with the formal markets. Based on its experience to date, ACCESO estimates that it takes about two years to establish the consistent production volume and handling capacity between buyers and producers to continue the market linkage relationship and grow without additional producer technical assistance and service provision (i.e., identifying producers and production, calendarizing the production, following up on aggregation commitments) to buyers.

Current buyers will likely grow their businesses with small producers through the growth of their existing producers. Therefore those buyers and producers already 'graduated' from ACCESO facilitation support and expect to continue to grow their marketed volumes, but within their existing relationships. These buyers will be unlikely to add more small producers on their own, due to the risks and time required to build relationships/reliability. This means that scaling up irrigation access and adoption will require market access and linkages through new buyers and new markets.

As producers begin to produce a more diverse set of crops with irrigation and work with these market channels, they must learn the relevant quality, post-harvest handling and packing requirements. The formal markets have the most rigid quality and handling requirements, representing about 30 percent of the Honduran market. The informal markets absorb the product not taken by formal channels and sell product across the quality spectrum. However, this does not mean that there are no quality, handling or packing requirements. Buyers, working with producers, can ensure a longer shelf life and better presentation upon reaching the market centers through basic quality and handling. In some cases,

[32] Because this private sector exists, there has been no effort by ACCESO to form new, alternative organizations within this space. In many other FTF countries, either the market space does not exist or gaps in necessary volumes/capability of producers to access those market stakeholders have resulted in market-focused producer organizations and cooperatives. One ACCESO partner, FUNDER, has had prior programs in the ZOI developing producer-owned cooperative horticulture packing/wholesale businesses. As these cooperative businesses already existed, they have been strengthened and further professionalized with ACCESO support. These cooperative businesses already had, in some cases, more than a decade of existence and operation prior to ACCESO.

ACCESO has served the buyers by assisting them in training producers and following up on compliance and understanding. This is an area of technical assistance and implementation typically assumed by the buyers and packers fairly early on, once the business relationship has been established with producers.

Financial and Fiscal Space

As introduced in the Business Case section, finance and access to production credit is a significant input to producers' abilities to fully utilize irrigation and benefit from the value offered by diversified production. Traditional rainfed corn and beans had few to no cash inputs required. The costs per *tarea* of inputs of just the six crops presented as examples in Table 2 indicate a range of $260 to $370 per *tarea*. In-plot irrigation adds an additional $50 of capital investment needed per *tarea*, or $20 per *tarea* for new drip tape every two to three seasons. The length of credit needed for most of the irrigated crops is between 90 and 120 days, although some – such as Tabasco chili or plantain – may stretch longer than 12 months. That being said, experiences to date in the ZOI have not indicated that finance and access to credit are significant limiting factors to the adoption and utilization of irrigation by the poor and extremely poor. There are currently several sources of finance to the producers, but with scaling it is unlikely that these sources will have the capacity to keep up with demand for credit.

In ACCESO's experience, 70 percent of financing counted was for loans less than $500[33]. What is most likely is that producers have multiple lines of credit, utilizing each for smaller loans. For the early adopters, there has been significant buyer finance of production, particularly produce buyers and brokers from the informal market. With buyer finance, buyers or brokers will pre-finance the production inputs, such as seeds and agriculture chemicals, of the small farmers for part or all of their production of a particular crop. These buyers also have working capital constraints, needing their capital to purchase crops to turnover through their own markets. As a result, they are limited in the number of producers they can pre-finance with inputs. These buyers do not typically borrow money to on-lend to their producers, but lend within their own means to support and ensure their supply.

There has been more limited formal market production finance. One example of value chain production finance from the formal market is a three-legged arrangement between a cooperative business (broker/packer), supermarket and bank. The cooperative business manages the on-lending to its producer members for a small administrative fee. The credit is offered to the members as inputs and not as cash, whose value is deducted from product delivery at harvest. Less than 40 percent of the cooperative business's producers have utilized this credit, due to the high market interest rate charged (16 percent and up). The cooperative business reported that their other members access credit through local *cajas rurales* (village banks), or possibly through a relationship with a local *agropecuaria*.

Many farmers did report getting some input finance in-kind directly from a local *agropecuaria,* or even the retail arm of one of the larger national agriculture input companies. These arrangements are usually made with a much lower implicit interest rate, and require a relationship between the producer and the retailer. Often producers are able to get 30-day credit terms standard, though many are able to negotiate 3 to 4 months, depending on the crop. There are no stated interest rates, but the assessment team learned in interviews that at least some charged an implicit five percent fee for these credit sales of inputs. The retailers have limited capacity to offer this type of direct finance to their customers, but anecdotally the assessment team was told that they are all offering credit to their best-known customers (even the smallest ones.)

Caja rurales are another source of production capital, as they lend the smallest amounts of money and usually lend in cash. These village banks have small capital pools and are managed within the communities. Most were started during prior or ongoing NGO projects (CARE, World Vision, etc.). It

[33] ACCESO does not count much buyer finance from informal market actors.

is unclear if most would have the capacity to lend across their communities for horticulture production, given the high cost of inputs. Often their loan values are around $50. As irrigation access and adoption expands, further capitalization, management capability and professionalization of *cajas rurales* may assist with the associated production capital needs of the farmers.

Irrigation offers a new potential source for production credit. The water user fees collected by the water user groups for maintenance and future replacement of their irrigation systems could be used to capitalize an associated *caja rural* for irrigation members. ACCESO has early experience here. The water user group function and capabilities are discussed in the Organizational Space section. In terms of the opportunity for the financial space and necessary access to credit, these water user groups lack experience with larger sums of money, but the fee structure is intended to accumulate to a substantial balance for anticipated future costs associated with the irrigation system. In fact, at least some groups stopped collecting fees after accumulating the equivalent of approximately $4,500 (about 100,000 lempiras.) This arbitrary figure is low, given that a shared water user group irrigation system average cost is over $30,000 and should depreciate over 10 years, not counting costs for watershed management and maintenance costs or expansion investments. Large capital funds can also create tension and power struggles within a group. ACCESO has been working with a handful of water user groups to utilize the capital accumulated through fees for lending to members. This approach has not yet been proven through experience, but has the potential to generate capital in every irrigation system that could address at least some of the production and in-plot irrigation credit needed by the water users. The scaling team recommends that financial management and business planning be provided both to the water user group and to individual farming households, to increase their capacity to handle larger sums of cash and accounts.

Organizational Space

The water user groups within the communities are the key organizations for irrigation system investment and operation, and have formed and functioned well over the past 3.5 years. However, as Table 1 indicated, over 60 percent of the systems have been installed during the last two ACCESO irrigation investment phases. Thus, experience with the sustained capacity and capability of the water user groups over the medium term remains limited.

There is a culture within the ZOI for producers and neighbors to form community-level organizations and groups in order to access technical assistance, humanitarian relief and other public sector or NGO assistance. As highlighted briefly in the Business Case section, western Honduras has a history of relief work that has given away potentially productive assets. As such, there is not experience with the formation of strong community-level cooperatives or associations for economic purposes.[34]

With this landscape, where the upstream and downstream spaces appear to have sufficient actors present, ACCESO chose to focus organizational development around the practical needs of investing in and managing the shared productive asset, the irrigation system. Water user groups have been formed and formalized with the installation of the shared drip irrigation system. Many have been completely new groups of producers and neighbors, but some groups had previously existed with loose formality due to other NGOs or past humanitarian programs. The water user group members may include

[34] An exception, as noted in the Downstream Spaces analysis, is the few cooperative businesses developed and supported through their evolution over the past decade by the ACCESO partner, FUNDER. These cooperative businesses were formed as producer-owned commodity brokers and market linkages. They were professionalized from the beginning with early FUNDER funding paying for management and operational staff that transitioned to the cooperatives as their business plans and strategies were implemented. These cooperative businesses have continued to operate over the intervening years and ACCESO identified them as viable market access and linkage actors for further investment and support.

extended family or various community members. The irrigation system technical design limits the number of potential members (water capacity and the area of land able to be irrigated) and constrains membership to those with land within reach of the conduction line path. On the other hand, a higher number of interested members often reduces the amount of land each producer would be able to irrigate, rather than resulting in producers being left out due to water capacity constraints.

The water user groups determine a set of regulations that are codified into a signed agreement, known as *reglamentos*. Over the four phases of ACCESO irrigation investments, a template for the development of a water user group agreement was created. The *reglamentos* codified the terms of membership, fee structure and operational arrangement. The water user groups set the fees, although with later investments ACCESO strongly recommended that they set fees based on replacement costs for the system as amortized over 10 years. Most water user groups set a fee structure based on a set monthly subscription, rather than on use of water. Signed copies of the agreements are shared with the local municipalities.

The irrigation systems are fairly straightforward gravity-based systems with automated filtration units requiring little maintenance, and they have few to no running costs. The producer members are benefiting from the shared asset on a daily basis with year-round production. The majority of the components of the irrigation system are buried conduction pipeline, although the filtration units may be vulnerable to theft. The filtration components are typically protected by some secure fence or structure that must be managed by the group. While vulnerable to theft, they are large, bulky installed components that are not difficult to guard. The capital pool generated by member and usage fees represents the most complicated asset, with the potential to create conflict, and requires further capability development, as was outlined in the Financial and Fiscal Space section.

Some water user groups have organized capital to purchase the land around the water source, while others have organized reforestation initiatives to protect the watershed. The Environmental Space and Policy Space sections outline key areas where risks exist for the water user groups and where additional capability and activities may be needed during scaling.

Environmental Space

While drip irrigation is an efficient method of irrigating agricultural crops, irrigation development requires managing tensions with alternative uses for the water, and management and protection of the water source itself and the surrounding watershed. Ownership of the water source is discussed in the subsequent Policy Space section. The environmental space has posed limited issues in the ACCESO experience to date, but presents a risk for scaling of access and adoption of drip irrigation.

Watershed management is a shared responsibility. The key issues include:

- Protection of the surface water source, including forestation and erosion control
- Sensitivity and planning to address the competing priorities for water, both upstream and downstream
- Production practices within the watershed: use of pesticides and herbicides that may translocate throughout the watershed and impact other producers, and livestock management since intensive livestock production can create waste management issues
- Hygiene and sanitation, which may be not consistent across the watershed and impact producers and water users elsewhere in the watershed

In terms of potential conflicts, many poor producers still do not have reliable access to potable water for domestic needs. In these cases, the irrigation infrastructure may either create conflicts or be

repurposed for potable water, even though irrigation systems are not designed for potable use. Also, the capacity of the irrigation systems may compete during dry seasons with other water use, including natural resources (wildlife) and communities downstream, while during rainy seasons there are no conflicts. Water sources are not typically isolated within only one community, and as irrigation is further developed and scaled access achieved, increased conflicts are possible.

ACCESO's irrigation investments appear to have started opportunistically where fewer environmental (and even political) conflicts existed or potential conflicts were identified. This fact limits the experience even further and may result in a lack of prioritization of the potential risks by future irrigation investments. ACCESO technical assistance teams work with the water user groups through the irrigation system designs, the group's contributions to the investment and the installation, and provides ongoing support through operation. The management and conservation of the watersheds relevant to the irrigation system water sources have been addressed by the technical assistance teams within the water user group agreements, and by the water user groups in an ad hoc manner. The assessment team recommends that the skills of the technical assistance teams and even the irrigation design teams be enhanced with regards to the environmental space and the associated practical and cultural challenges. Watershed management and potential water use conflicts should be proactively included, from irrigation system design through water user group agreements and system operations. In order to have an effective water administration, water balances at the microwatershed level need to be incorporated at the time of water assessment. Water balances show water supply and demand through the year.

The environmental space is one that poses a significant risk during scaling up. The experience thus far has not resulted in any significant conflicts, but the assessment identified this area as one requiring more prioritization and specific learning strategies going forward. Irrigation and water system design, along with user group written agreements, need to manage competing and conflicting watershed and water usage demands and practices, from design and support through implementation, including watershed usage and maintenance fees within the user group fee structure. ACCESO has been ensuring that the local municipality has a copy of the water user group written agreements so that it can follow up if there are problems.

Municipal governments vary in effectiveness and engagement around water management. However, with increased experience and examples of drip irrigation for the poor and extremely poor (and its ability to significantly impact poverty), some municipalities have shown leadership in irrigation by facilitating watershed management and co-investing in irrigation systems. The assessment team suggests that this is an area to continue to build using successful examples and sharing learnings across communities, municipalities and departments.

One final note is worth discussing regarding water harvesting. ACCESO thus far has used existing sources of surface water for their irrigation systems. Other NGOs and initiatives have promoted small-scale water harvesting technologies. These small-scale water harvesting approaches are not appropriate for irrigation for technical reasons, but may be used for livestock watering and supplemental irrigation for rainfed crops. Water resources are not evenly spread throughout the ZOI (as the recommended water inventory would show.) In some areas (and as increased irrigation access and adoption pressure competes for water), large-scale water harvesting may be an option. Water harvesting for irrigation would concentrate on capturing and storing water in an effective and efficient manner during the rainy season (e.g., larger dams and reservoirs). Water harvesting will be expensive and is not likely to be cost effective for large numbers of communities. Surface water, where water harvesting is not necessary, offers the most near-term opportunities. This necessarily means that some communities will not be able to utilize drip irrigation.

Policy Space and the Enabling Environment

As with the environmental space, irrigation access and adoption have faced very few enabling environment challenges to date. Legally, all surface water belongs to the government. Well water ownership, on the other hand, is less clear. The ACCESO-supported irrigation systems rely on surface water and gravity-based systems to minimize running costs and technical complexity. Many of the irrigation systems are developing and utilizing surface water sources in the absence of oversight or legal inquiry/resistance. Water law already includes previsions to reduce tensions and potential conflicts. The local municipalities and the National Water Directorship need strengthening so they can oversee water allocations. This may reduce potential conflicts, but at the same time would slow down the process of access and adoption.

The ownership of the water source and water rights may pose a risk with scaling up, either as access and use challenges raised by other potential users for already-developed water sources, or as new water sources are considered for development. Water source management in some cases has been approached as water user groups purchasing the water source itself, although not necessarily including sufficient area for watershed management. As mentioned in the Environmental Space analysis, watersheds include lands with varied ownership and authority. The ownership and authority issues may require additional attention with scaling up, even though there have been few issues with the irrigation experience during ACCESO.

Extension Space

As introduced in the previous sections, agronomic production extension is important for producer awareness and adoption of the improved production practices required to capture the value proposition from irrigation. NGOs and donor projects provide what production extension is available in the ZOI. There is essentially no public sector extension. Alternative extension provision organizations simply do not exist or have not shown the capability to deliver the necessary production and irrigation system management technical assistance. The lack of experience with GAP was determined to be a limiting factor in previous irrigation abandonment. The higher-value irrigated crops require more technical production practices. Some irrigation systems installed prior to ACCESO were abandoned due to an absence of supporting technical assistance, which are needed on an ongoing basis over many production seasons.

Value chain stakeholders, both upstream and downstream, are unable to fill this need – although many have a limited number of agronomists on staff who engage even with small producers. Unfortunately it is not economical to provide the depth needed. These agronomists and technicians work with producers to schedule production in their supply calendar and provide limited support to producers with acute agronomic issues. In this void of alternatives, ACCESO and a few other donor programs have provided the production extension services. The ACCESO experience has been quite successful in farmer behavior change and adoption of the associated production practices. ACCESO technicians each serve approximately 300 producers with weekly visits, either with farmer groups in demonstrative lots or to their personal plots. While producers are in water user groups, the agronomic assistance is often delivered on an individual or smaller group basis within the same community. This model is high touch and high cost, with strong agronomic training of the technicians and back office support. Any irrigation program will need to commit to partnerships and funding of associated agronomic extension over the medium term to support the producers' sustained adoption and utilization of the drip irrigation technology.

Conclusions and Recommendations

A capable private sector exists across most of the required spaces for scaled growth of drip irrigation access and adoption. This section summarizes the key conclusions and recommendations from the Scaling Spaces analysis.

The upstream space is an area already in place with the capacity and most of the capability necessary for scaling up. Reasonably distributed access to drip irrigation components exists across the ZOI. What is needed upstream is a strong, experienced irrigation system design team(s) to specifically implement in the ZOI and learn across experiences with the target beneficiaries. System design should begin with an appropriately-designed water assessment.

Buyers, brokers and wholesale packers exist for the formal and informal markets, and include some cooperatively-owned wholesale horticulture businesses. These existing private sector market actors lack linkages with producers and need to strengthen their business capacity and capability to be a consistent and reliable market access link. Scaling up irrigation access and adoption will require market access and linkages through buyers and markets not yet buying from these producers, as those linkages formed during the pilot will likely grow their supply through the already-established relationships with the poor and extremely poor farmers and not through the addition of new producers. Horticulture production needs to be produced throughout the entire calendar year, with individual producers' harvests planned within a buyer's or packer's supply calendar.
As producers move into more diverse crop production, they will require training in the relevant product quality, post-harvest handling and packing based on the target market. This is an area of technical assistance and implementation typically assumed by the buyers and packers fairly early on, once the business relationship has been established with producers.

Finance and access to production credit are significant inputs to producers' abilities to fully utilize irrigation and benefit from the value offered by diversified production. The experience to date in the ZOI has not indicated that finance and access to credit are significant limiting factors to adoption and utilization of irrigation by the poor and extremely poor. There are currently several sources of finance available to the producers, but with scaling it is unlikely that these sources have the capacity to keep up with demand for credit.

As irrigation access and adoption expands, further capitalization, management capability and professionalization of *cajas rurales* may assist with the associated production capital needs of farmers. The water user fees collected by the water user groups for maintenance and future replacement of their irrigation systems could be used to capitalize an associated *caja rural* for irrigation members. Financial management and business planning support should be provided both to the water user groups and to individual farming households to increase their capacity to handle larger sums of cash and accounts.

The water user groups within the communities are the key organizations for irrigation system investment and operation. While the first water user groups have functioned quite well, their experience with sustained capacity and capability over the medium term remains limited. At least another year or two of existence for the earliest water user groups will be needed to better understand the potential limitations or risks of this model.

While drip irrigation is an efficient method of irrigating agricultural crops, irrigation development requires managing tensions with alternative uses for the water, and management and protection of the water source itself and the surrounding watershed. The environmental space has posed limited issues in the experience to date, but poses a risk for scaling of access and adoption of drip irrigation. Irrigation and water system design, along with user group written agreements, need to manage competing and

conflicting watershed and water usage demands and practices, from design and support through implementation, including watershed usage and maintenance fees within the user group fee structure.

Agronomic production extension is important for producer awareness and adoption of the improved production practices required to capture the value proposition from irrigation. NGOs and donor projects provide what production extension is available in the ZOI. The lack of experience with GAP was determined to be a limiting factor in previous irrigation abandonment. Any irrigation program will need to commit to partnerships and funding of associated agronomic extension over the medium term, to support the producers' sustained adoption and utilization of the drip irrigation technology.

SCALING PATHWAYS

Approach to Adoption and Diffusion

The assessment was asked to assess the viability and challenges of a commercial technology pathway for access and adoption of drip irrigation by the target beneficiaries, the poor and extremely poor within the six departments of the FTF ZOI. The spaces assessment in the previous section identified key opportunities, risks and any critical missing information, partners or models necessary for scaling. The general conclusion is that a commercial scaling pathway for drip irrigation is unlikely for the poor and extremely poor. The cost and specific design and implementation aspects of each irrigation system make it unlikely that neighboring communities would be able to adopt the technology without external grant support, even though the upstream private sector is in place. The economic limitations of communities inhibit them from spontaneously adopting drip irrigation based on awareness of successful experiences in nearby communities. The absence of supporting market linkages and production extension technical assistance would also result in too high a risk profile from stand-alone adoption. No commercial option exists for the production extension necessary.

There are two likely pathways for scaling. The first pathway is filling-in scaling; that is, adding farmers and area within irrigation systems. Filling-out scaling would be adding new irrigation systems to cover new farmers and areas. Both pathways require external grant funding and partnerships.

Filling-in scaling can occur when a system is designed and installed with excess irrigation capacity. The early adopters within a community may be the first 20 percent of producers adopting the improved production practices and eager to commit cost share labor and organize to receive an irrigation investment grant. Other producers will require additional time to learn from their neighbors' experiences with irrigation. However, once the irrigation system is in place, there is not always significant enough irrigation capacity to allow additional producers to access. There are geographical constraints as producers on the edges of communities may be physically too distant from the conduction line to be either early adopters or later filling-in scaling adopters. Yet there appears to be an opportunity to consider future filling-in scaling during system design and water user group agreements. This would open up irrigation access to late adopters within the same communities, as water resources allow.

Filling-out scaling will continue the ACCESO model of adding new systems in new communities to increase technology access and adoption with new farmers and new areas. The pilot experience under ACCESO has not been driven by an overarching scaling strategy based on a water inventory to identify strong resource opportunities, aligned with producers. The water inventory recommended in the previous section will allow for a strategic filling-out strategize to maximize the access and adoption driven by the underlying resource base. The filling-out scaling can also further leverage partnerships

with municipalities and other partners (including the GOH). Other partners can assist with increasing the reach of existing grant funding to increase the number of resources developed for the most producers.

In both the filling-in and filling-out cases, scaling will be limited by the availability of grant financing for the resource-intensive shared asset irrigation systems. The average system cost has been about $30,000 – an average of just over $1,200 per producer/beneficiary. Infrastructure grants are easier for some donors and stakeholders (such as the public sector) than the supporting activities and services, such as technical assistance, access to finance and water user group development. Municipalities and the GOH may find that working within partnerships that recognize and fund all of the necessary components and supporting activities may produce significant access and adoption of irrigation. However, as the analysis noted in the previous section, stand-alone irrigation infrastructure investments will not result in sustained scaled access and adoption.

ANNEX 1: SOW FOR THE SUPPORT TRIP

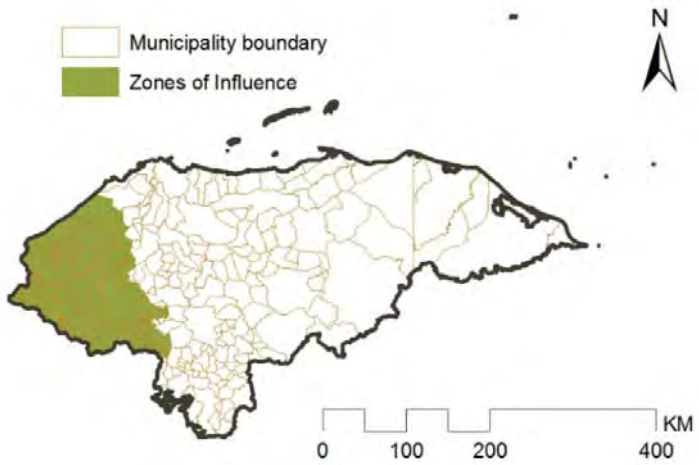
Statement of Work
Honduras FTF Irrigation Scaling Up Assessment
Scaling Up Support for BFS

1. Introduction

USAID's Bureau for Food Security (BFS) has requested support from the E3 Analytics and Evaluation Project[35] to identify, strengthen, and accelerate the scaling of agricultural innovations and technologies with selected USAID Missions around the world. The primary focus of this activity will be supporting the selected Missions to develop, refine, and successfully implement scaling strategies by providing on-site scaling support to selected Missions, as well as ongoing remote technical support as needed. As part of this activity, USAID/Honduras has requested that a team led by a scaling up expert from the E3 Analytics and Evaluation Project visit the Mission to conduct a Scaling Up Assessment from on/around December 1-15, 2014.

2. Background

Honduras is the second poorest country in the Western Hemisphere, with a poverty rate of 66 percent. One million of the extremely poor are concentrated in six departments in western Honduras (La Paz, Intibucá, Lempira, Ocotepeque, Copan, and Santa Barbara). These six departments also have the highest chronic undernutrition rates in the country, averaging above 50 percent compared to a national chronic undernutrition rate of 25 percent. USAID/Honduras has identified this area as the Feed the Future Zone of Influence for investment focus and impact.



The mountainous topography of this region enables a focus on a range of over 30 horticultural crops depending on the local micro-climate. Many households to be targeted have already dedicated their land to a combination of horticulture, coffee, and basic grains – making it possible to build on existing investments and experience while shifting crop mixes to maximize household income. Some parts of the West, particularly those in the dry shadows of mountains, may require investments to move water from mountain top sources to farmable lower slopes for commercial horticulture to be feasible.

[35] Management Systems International (MSI) is the lead implementer of the E3 Analytics and Evaluation Project.

USAID/Honduras has achieved some success in introducing drip irrigation to small farmers both outside of the ZOI and within. Technology access and adoption though has been incremental to date. Of the 35,000 smallholder farmers impacted by the FTF investments in Honduras, approximately 2,000 have adopted drip irrigation. Going forward, USAID and the Government of Honduras (GOH) will be investing around $20-30 million in irrigation access. And the GOH has plans to dedicate more to facilitate irrigation access - including through finance.

Irrigation is inherently complex including water access and governance, finance, distribution and maintenance, finance, and the value chains of the resulting production. USAID/Honduras is conducting a separate but complementary Sustainable Water Access assessment concurrently.

3. Scaling Up Assessment Objectives

USAID/Honduras has requested the Scaling Up Assessment to examine irrigation access and adoption from a supply chain, value chain, and market systems point of view. The Scaling Up Assessment will specifically consider the perspective of critical supply chain and value chain stakeholders, mapping the actors (distributors, producers, *caja rurales*, water user associations, finance, etc.), their interests, their incentives, their relationships, and the required supporting systems. The technology scaling up strategy will prioritize sustainable commercial technology pathways for access and adoption. The Assessment will determine potential commercial disincentives and distortions throughout the consultation.

4. Scaling Up Assessment Approach

Scaling up is defined as having sustainable impact at population scale in the FTF Zone of Influence (ZOI) in that country. Each scaling up assessment begins by sharpening the description of the 'what' to scale; the product, service, approach, and intervention. Most often technologies are not individual products or goods, but rather a package of complementary products and supporting practices and/or services. Identification of the specific components of the technology package to be scaled includes a specific consideration of the efficacy, effectiveness, and feasibility. Scaling up can only happen if success has been achieved at a pilot level.

Because the scaling up definition includes the specific objective of impact at population level scale, the assessment quantifies the scope of the ambition and potential in terms of numbers and geographical spread of intended adopters and beneficiaries. The business cases for adopters, and other critical access and adoption stakeholders, are assessed (for example, does a large enough end commodity market exist to support the producer business case in event of scaling up success?) The entire relevant value chain and supporting services are considered.

The scaling up assessment approach utilizes a spaces, drivers, and pathways analytical framework. The assessment identifies the drivers required to move from pilot towards scale and contrasts the incentives facing the various critical stakeholders and adopters.

The scaling up analysis identifies relevant opportunities and constraints in the required spaces for scaling up; is there sufficient space to grow? These spaces include the fiscal space, political space, policy space, partner and value chain organization and capacity space, cultural space, partnership space, and learning space. Only the most relevant to each assessment will be detailed.

Where appropriate, alternative pathways to achieve scale are also explored. The most relevant to agricultural value chains include specific approaches to pursue secondary adoption and spontaneous diffusion, and/or commercialization.

The analysis will identify specific relevant knowledge gaps and risks, and recommend both near-term and medium-term activities to support scaling up objectives and outcomes.

Each consultation relies upon a document review in preparation and for supporting data. The assessment is principally based upon a rapid key informant interview consultation process, with select focus group meetings where appropriate.

5. Resources and Timeline

The Scaling Up Assessment team will be led by a MSI scaling up consultant. The other team members will participate in the consultation meetings and contribute to understanding the context. The technical experts may be asked by the scaling up consultant to provide complementary concise technical analysis content as identified through the rapid key informant interview consultation process. It is anticipated that the local team members may also use their knowledge and contacts to assist with identifying and arranging for the most relevant consultation meetings.

Scaling Up Team

- MSI Scaling Up Consultant: Charity Hanif
- USAID/Honduras: Jorge Reyes, others TBD
- BFS/Washington: Inga Sydnor, Program Analyst, will accompany the team as an observer
- GOH Financial Expert: Technical expert familiar with the specific USAID irrigation finance experience and/or with other irrigation finance efforts by GOH, other donors, or private sector in the ZOI
- GOH Irrigation Expert: Technical expert familiar with the specific USAID irrigation experience and/or with other irrigation efforts by GOH, other donors, or private sector in the ZOI

Anticipated Timeline

Preparation

- November 3: Mission sends through documents and written background for background reading
- November 3 – November 26: Preparation (logistics, scheduling, and desk research)
- November 10: Scaling Up consultant shares indicative list of target meetings and interviewees for field work; specific individuals identified from desk research as able
- Conference call week of November 10th to discuss any questions, meetings, and logistics based on initial desk research.
- Conference call Nov 21, 24, or 25 to review draft agenda and finalize logistics. (USAID/Honduras to provide a draft agenda with specific meetings and field visits identified prior to call.)

Field Assessment

- December 1: USAID/Honduras kickoff meeting
- December 2 – 11: Stakeholder meetings and consultations
- **December 15: Deliverable #1: Short PowerPoint presentation of preliminary findings through out-brief with USAID/Honduras**

Report Timeline

- **January 7: Deliverable #2: Draft Scaling Assessment Report***
- January 9 – January 16: MSI Scaling Up Consultant available to respond to questions and submit revisions
- **January 23: Deliverable #3: Final Scaling Assessment Report****

*could be considered final report if USAID/Honduras and BFS/Washington have no questions or comments
**based on timely feedback and inquiries from USAID/Honduras and BFS/Washington

Resources and Background Documents Requested in Advance, as Available

- GOH and/or implementing partner data by district or appropriate local governance area
    - Total # of farmers, disaggregated by gender, area under production
    - area in hectares and # of farmers within that area with access to water or land appropriate for irrigation technology considered by USAID/Honduras (identifying which are already irrigating and by what means)
    - Production statistics by crop including # of farmers, yield average and yield disaggregated by farm size
- Relevant irrigation related and FTF program documents including workplans, mid-term evaluations, final reports, baseline or gender studies, and similar; horticulture value chain reports and studies also important
- Any previously conducted irrigation supply chain mapping or assessments
- SOW for the 'sustainable water access' assessment which is occurring parallel to this work
- GOH irrigation plans or related policies
- Other donor or loan program documents supporting irrigation in or near the ZOI
- GOH ag strategy relevant to ZOI
- Technical specifications for irrigation packages broadly speaking considered a part of the technology available or appropriate for target farmers
    - This would include specifications related to whether it is a kit or components
    - Size of area covered
    - All included components or related components which must be acquired for utilization
    - Appropriate for cultivation of which crops
    - Alternatives available in Honduras or which have been adopted by a different farmer profile
    - Associated finance or credit
    - Suppliers/distributors/manufacturers

6. Deliverables

1. **Short presentation of preliminary findings to USAID/Honduras: o/a December 15, 2014**

   The MSI scaling up consultant will prepare and deliver a PowerPoint presentation summarizing the preliminary findings to USAID/Honduras following the in-country consultation process. This will be an opportunity for USAID/Honduras and the consultant to identify any outstanding questions or areas of inquiry that may require relevant follow-up during the drafting of the final report.

2. **Draft Scaling Assessment Report: o/a January 7, 2015**

   The MSI scaling up consultant will prepare a report of approximately 15 pages, excluding annexes, that will outline the assessment findings utilizing the scaling up assessment framework described in the approach section of this SOW. It will be delivered 15 working days after the conclusion of the field visit. (This schedule includes Christmas and New Year's holidays.) This report will be presented in draft for USAID/Honduras and BFS/Washington review.

3. **Final Scaling Assessment Report: o/a January 23, 2015**

   USAID/Honduras will have approximately 5 working days following MSI's submission of the Draft Report to review and share any outstanding questions for a final revision and submission. In the event that no questions arise and BFS/Washington has no additional comments, the report will stand as final and approved as submitted.

7. Follow-up

Upon request, the MSI Scaling Up Consultant may be engaged for further support to integrate Assessment results and recommendations into existing or future programs, activities, and strategies. This option can be discussed throughout the assessment, with a new SOW defined upon Mission review of final Assessment findings and BFS/Washington acceptance of the SOW.

ANNEX 2:TRIP SCHEDULE

Date	Name of Site/Organization	Location	Purpose
Monday, 12/1	Inbrief with USAID/Honduras	Tegucigalpa	
	ACCESO Project	Tegucigalpa	Fintrac; primary FTF project with irrigation Policy Advisor
	Zamorano Agricultural University	Tegucigalpa	Research, ACCESO partner
	FUNDER	Tegucigalpa	NGO, ACCESO partner
Tuesday, 12/2	Dry Corridor Alliance partners; Ministry of Agriculture (SAG) and FHIS program (USAID-funded) PODER project	Tegucigalpa	Public Sector partners
	DICONSA		Irrigation Distributor
	Del Campo		Irrigation Distributor
	CAMOSA		Irrigation Distributor
Wednesday, 12/3	Hortifruti (Walmart)		Produce Buyer, Supermarket
	La Colonia		Produce Buyer, Supermarket
	Santa Rosita	Guajiquiro, La Paz	Producers
	ACCESO Project		
Thursday, 12/4	Planes	Cabañas, La Paz	Rehabilitated irrigation system – producers
	Mezcalitos	Marcala, La Paz	Irrigation system – producers
	El Chaguite	Yarula, La Paz	Individual irrigation system – producer
Friday, 12/5	Guise	Intibuca	Irrigation system - producers
	ECARAI		Producer owned producer packing and marketing company – specializing in potatoes
	APRALIN		Producer owned producer packing and marketing company – specializing in potatoes
	Small Ag Input Retail		Ag Input Retailer (including irrigation components)
	Los Olivos	Yamaranguila, Intibuca	Irrigation system – producers
Saturday, 12/6	Barrio Nuevo	Erandique, Lempira	Irrigation system – producers
	Mejocote	Gracias, Lempira	Irrigation system – producers

	Lagunilla	Gracias, Lempira	Irrigation system – producers
Sunday, 12/7	Scaling Up Team Meeting	Copan Ruinas, Copán	
Monday, 12/8	Cabañas	Copán	Irrigation system – producers
	Small Ag Input Retailers	Cabañas, Copán	
	Small Producer Buyer/Retailer	Cabañas, Copán	
	CAEOL		Producer owned produce packing and marketing company – varied hort
	La Guama	Nuevo Frontera, Santa Barbara	Irrigation system – individual producers (not water user group)
Tuesday, 12/9	El Jilote	Concepcion del Norte, Santa Barbara	Irrigation system – individual producer
	Las Breas	Chinda, Santa Barbara	Healthy Household technology package
	San Jose de Colinas	Santa Barbara	Irrigation system – producers
	ACCESO Project, COP	Siguatepeque	
	El Corral	Siguatepeque	Produce buyer – supermarket
Wednesday, 12/10	Guayaman	Jesus de Otoro, Intibuca	Irrigation system – producers; local mayor
	Aguanqueterique	La Paz	Community without irrigation system
Thursday, 12/11	CARE	Tegucigalpa	NGO, ACCESO Partner
Friday, 12/12	ACCESO Project	Tegucigalpa	

ANNEX 3: AREA CONVERSIONS RELEVANT TO AGRICULTURE IN HONDURAS

TABLE 5: AREA CONVERSIONS

Tarea	*Manzana*	Hectare	Meters squared
1.000	0.063	0.044	437.5
16.000	1.000	0.700	7,000
22.857	1.429	1.000	10000

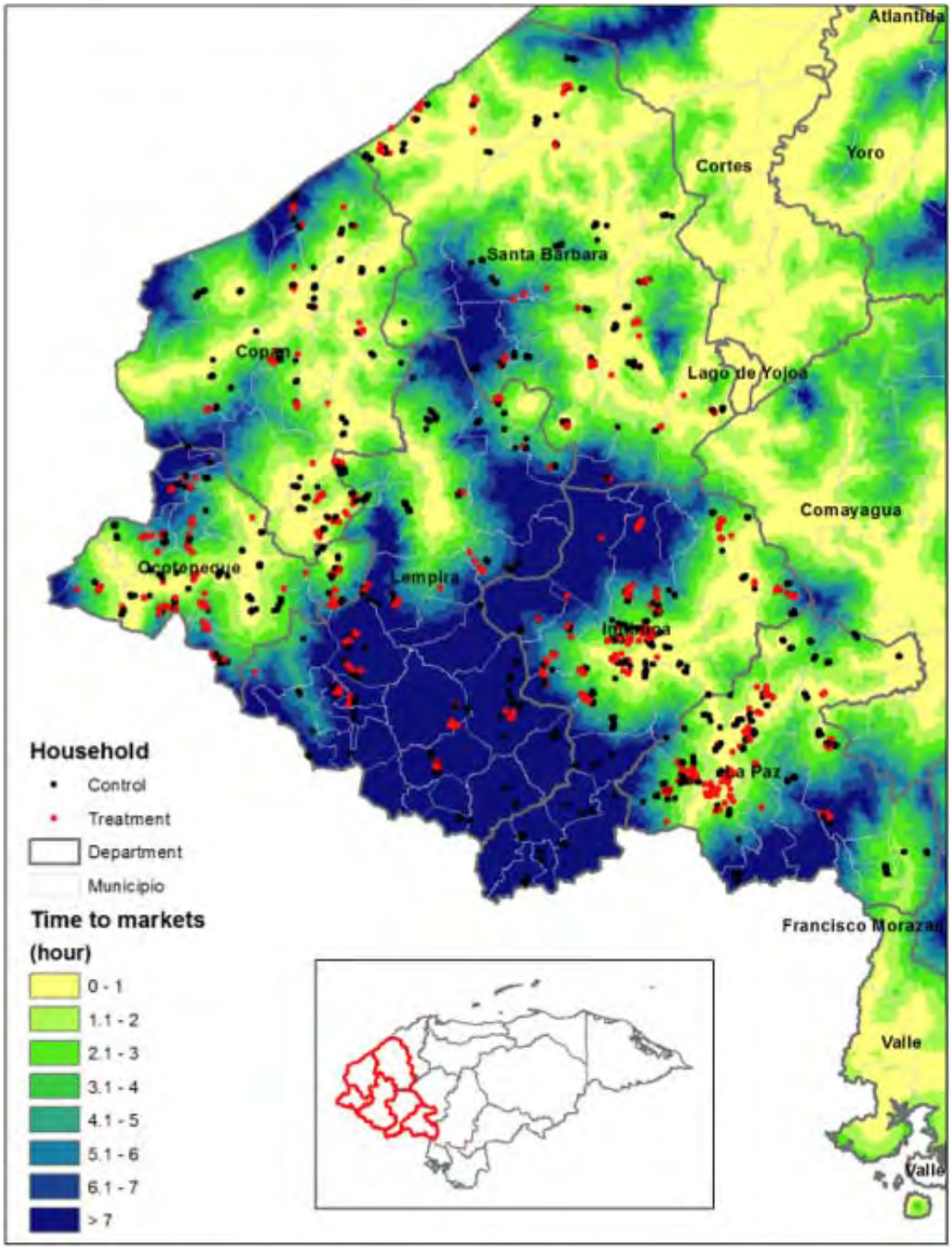
ANNEX 4: ACCESO IRRIGATION SYSTEM SUMMARY TABLE

Summary table of 134 of ACCESO-installed irrigation systems (*parcelarios* and others listed without conduction length reported were removed from the list of 150 provided for analysis purposes.)

	# of hectares system capable of irrigating	beneficiaries	hectare/ beneficiary	*tareas*/ beneficiary	conduction length (km)	Total Investment	ACCESO Contribution of Total (grant)	Total Cost/ hectare	Total Cost/ beneficiary	Total Cost/ km	ACCESO contribution/ hectare	ACCESO contribution /beneficiary	ACCESO contribution/km
Phase I	159	381	0.4	9.5	43.2	$407,347	$202,447	$2,563	$1,069	$9,433	$1,274	$531	$4,688
Phase II	247	1,319	0.2	4.3	108.6	$964,589	$423,418	$3,908	$731	$8,883	$1,716	$321	$3,899
Phase III	396	989	0.4	9.1	204.4	$2,015,939	$913,220	$5,096	$2,038	$9,864	$2,308	$923	$4,469
Phase IV	325	838	0.4	8.9	144.4	$988,523	$873,318	$3,044	$1,180	$6,847	$2,689	$1,042	$6,049
Total *(Averages)*	1,126	3,527	0.3	7.3	500.5	$4,376,398	$2,412,403	$3,886	$1,241	$8,744	$2,142	$684	$4,820

ANNEX 5: DISTANCE FROM MARKETS ACROSS THE ZOI

FIGURE 4: IFPRI BASELINE STUDY - GEOGRAPHIC DISTRIBUTION OF SAMPLE HOUSEHOLDS AND TIME TO MARKET (CITY WITH 25K+ POPULATION)



ANNEX 6: LITERATURE AND DOCUMENTS CONSULTED

Agriculture-Nutrition Field Note: Training to Integrate Agriculture and Nutrition in Honduras, SPRING Project, 2013

IFPRI Markets, Trade and Institutions Division, Evaluation of Feed the Future Intervention, ACCESO-Honduras, Preliminary Baseline Results, June 2013.

ACCESO Annual Report #03, October 2012-September 2013; Fintrac, September 2013.

ACCESO Brochure

RFP/ACS/USAID/QCBS/01-2014, Procurement of Consultant Services, Implementation of "Alianza para el Corredor Seco" Activity (ACS-USAID); Inversión Estratégica de Honduras (INVEST-H), September 2014.

RFP No. SOL-522-14-000001, MERCADO, USAID/Honduras, February 2014.

Vulnerability and Resilience to Climate Change in Western Honduras, ARCC, Tetra Tech, August 2014.

ACCESO Irrigation Components Examples, Spreadsheet

ACCESO costing of irrigation and solar dryer technologies

GOH Water Management Law

GOH InterInstitutional Committee Drought Plan – 2014

ENSAN

ACCESO Workplan, 2014

USAID/Honduras Feed the Future Multi-year Strategy, November 2011

ANNEX 7: OUTBRIEF PRESENTATION TO MISSION

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Scaling Up: Drip Irrigation in Honduras



Preliminary Findings

Presentation to USAID/Honduras and select partners

Charity Hanif, Scaling Up Consultant w/
Jorge Reyes, USAID
Marco Tulio Galvez, USAID
Carlos Rivas, ProParque

MSI MANAGEMENT SYSTEMS INTERNATIONAL
A SUBSIDIARY OF COFFEY INTERNATIONAL, LTD

15 December 2014

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Scaling Up Assessment

- examine irrigation access and adoption from a supply chain, value chain, and market systems point of view
  - Target clients for irrigation access and adoption are the poor and extremely poor within the Zone of Influence
  - Identify key opportunities, risks, and any critical missing information, partners, or models necessary for scaling;
- 32 consultation meetings with:
  - Producers and producer groups
  - Input distributors and retailers
  - ACCESO and partners
  - Government, including Municipality level
  - Produce buyers and brokers

Guiding principles of the conversation today

- This presentation is
  - Meant to present preliminary observations and analysis to **structure a discussion**
  - Intended to **reflect the majority of opinions** from interviews and the **data collected and analyzed** to date
  - **Not** a program evaluation

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What is Scaling Up?

- BFS Definition: Sustainable Impact near Population Level in the Zone of Influence

- working Scaling Up team definition:
  - **the process of sustainably increasing the reach (and potentially scope or impact) of a promising or proven innovation, model, or program with fidelity and quality, thereby retaining some or all of its demonstrated positive impact.**

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Scaling Up – key points

- Scaling up strategies are always innovation/context specific
- Scaling strategies usually require tradeoffs between
  - scale vs. impact,
  - cost vs. equity,
  - fidelity vs. adaptation
- Program implementation and management are different than scaling implementation and require different skills, and at times different organizations and partnerships
- Not everything is scalable

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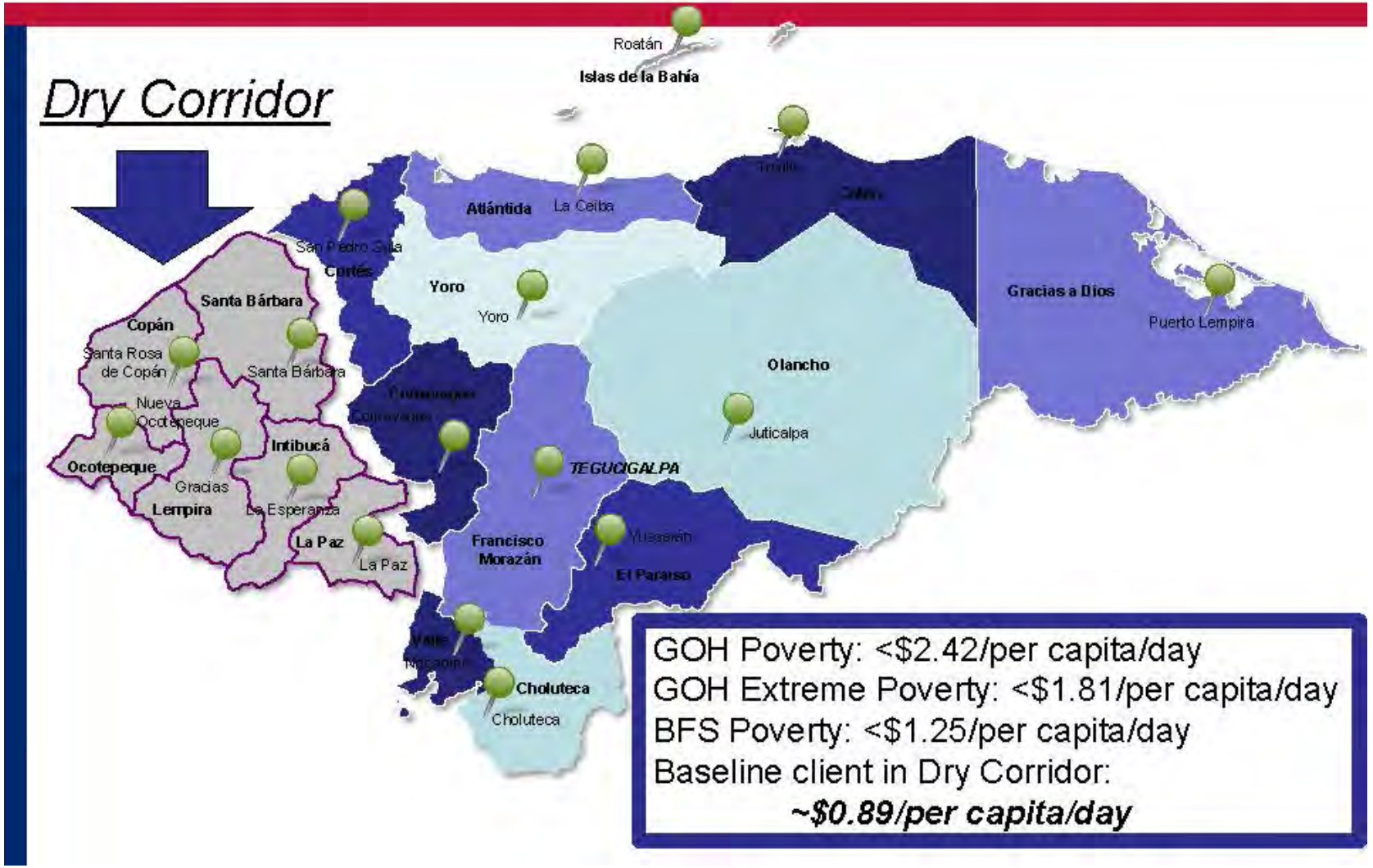
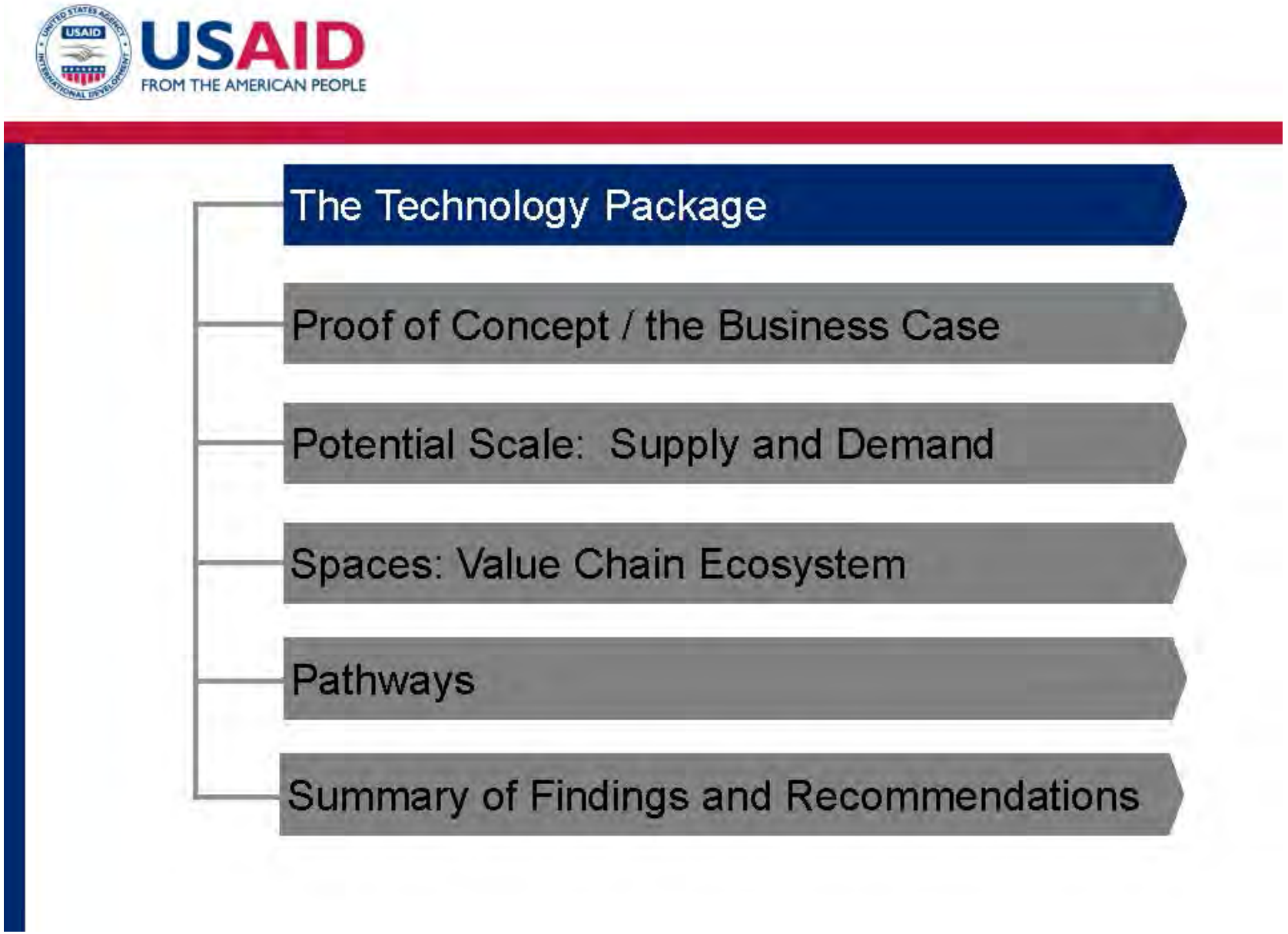
Where and Who

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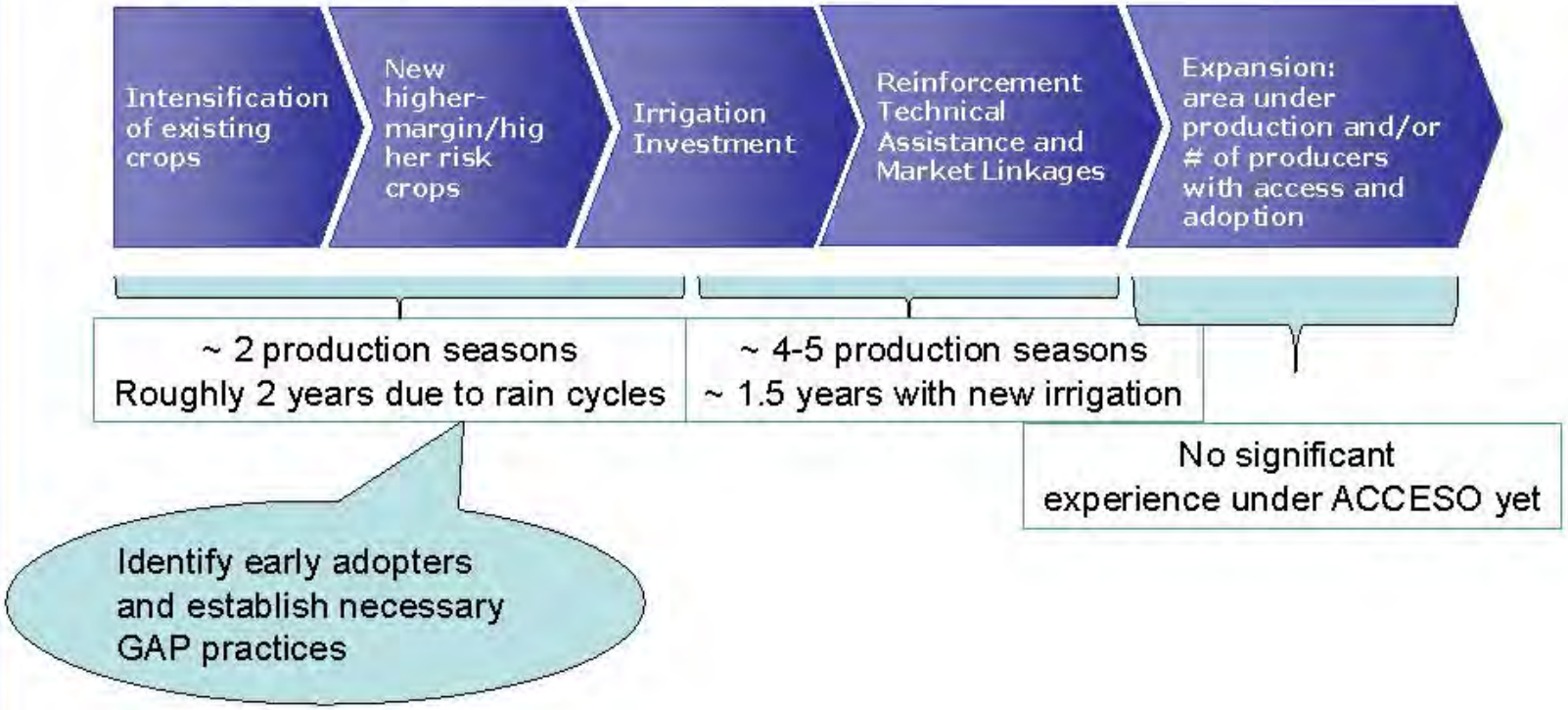
What is the *IT* to be scaled?

Physical Infrastructure with Supporting Practices and Services

Every water source and the area of production and users it can support for irrigation is unique in terms of quantity, distance, terrain, and possible irrigated crops

Water System – Model and Timeline

ACCESO has 3.5 years experience in ZOI



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ACCESO experience

- >5,000 poor or extremely poor producers with access to drip irrigation
- Majority (>80%) grouped in water user groups with shared water conduction and primary filtration system
- *4.5km average length of conduction from water source*; longest conduction length 31km
- Average total cost of conduction per irrigated hectare within system - $3,200/hectare (ACCESO donated portion average: $1,870/hectare)
- All but two irrigation systems rely on gravity (including handful of hydraulic ram pump.) Two systems with diesel pumps

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Automated System Filters

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In-Plot

- Early positive experience with second-hand drip tape (from sugar industry) to substantially reduce entry cost
- Plots include disk filter for each 8 tareas (440m^2/tarea) of tubes, connectors, and drip tape; average cost <$400 or ~$50/tarea (although some costs such as filter are fixed across all)
- In-plot set-up standard enough to be appropriate for kit or package development by distribution companies; opportunity during scaling and expansion

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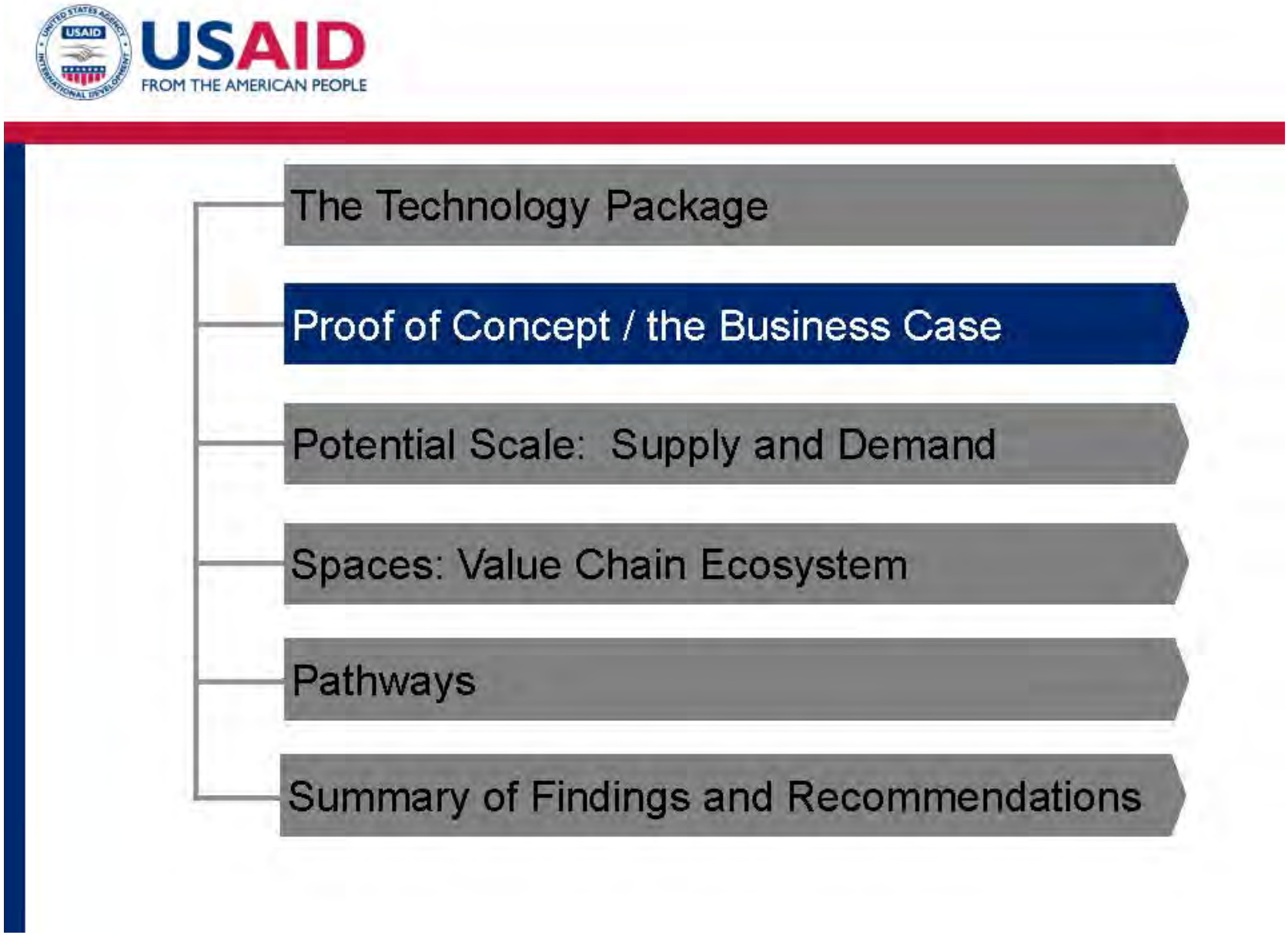
Why have prior investments failed

- Poor design
  - Lack of adequate consideration for community experience (where the water is, how the geography is, etc.)
- Lack of water (water assessment for system design must occur during March/April at driest point in season)
- Market access and linkages
- Lack of producer production experience with GAP critical for outcomes
- Absence of supporting technical assistance
  - Ongoing production extension
  - Irrigation management with user fee structure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Producer Returns

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Irrigated Crops

Complexity: Central benefit is opportunity for crop diversification and improved rotation through multiple production seasons per year

- Horticulture
  - Potatoes, Carrots, Lettuce, Radish, Onions, Green beans, etc
  - Export crops – Passion fruit, Tabasco chilies
- Plantains
- Irrigated maize and beans become rotational crop; typically maintain some more intensive (less area/better yields due to improved GAP) rainfed maize and beans for household consumption

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More recent experience with irrigation

- Coffee
  - New very positive experiences – yields from 18 quintales/manzana – 98 quintales/manzana; high quality cupping
- Livestock
  - Irrigated forage for improved small-scale dairy production with existing livestock owners
  - Initial trials with El Corral for small-scale cattle fattening with irrigated forage; second trial just completed.

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Returns – crop budgets

High cost input requirements

	Cost/tarea	Potential net return/tarea/season
Lettuce	$312	$70
Potato	$334	$165
Plantain – local market	$355	$160
Cabbage	$308	$36
Pumpkin	$259	$120
Tabasco Chili	$370	$20

Returns sufficient to invest in modest in-plot expansion

Need maize and bean #'s, livestock, traditional and irrigated coffee

Source: ACCESO. Includes best case production and sales; includes labor, which often is provided by family or shared within the community on small areas

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System Investment

- Cost of conduction for early adopters
  - $/hectare ~ $3,200; $/early adopter ~$920/beneficiary
- Risk of excluding later in-system scaling
  - Labor for conduction installation provided by early adopter farmers; significant upfront investment. Early producers may exclude new producers from joining system once installation labor already in place.
- In-plot investment requirements
  - ~$50/tarea
  - High labor investment first season to prepare land and build beds
  - Replace drip tape every 2-3+ seasons (roughly once a year with more productive seasons/year)

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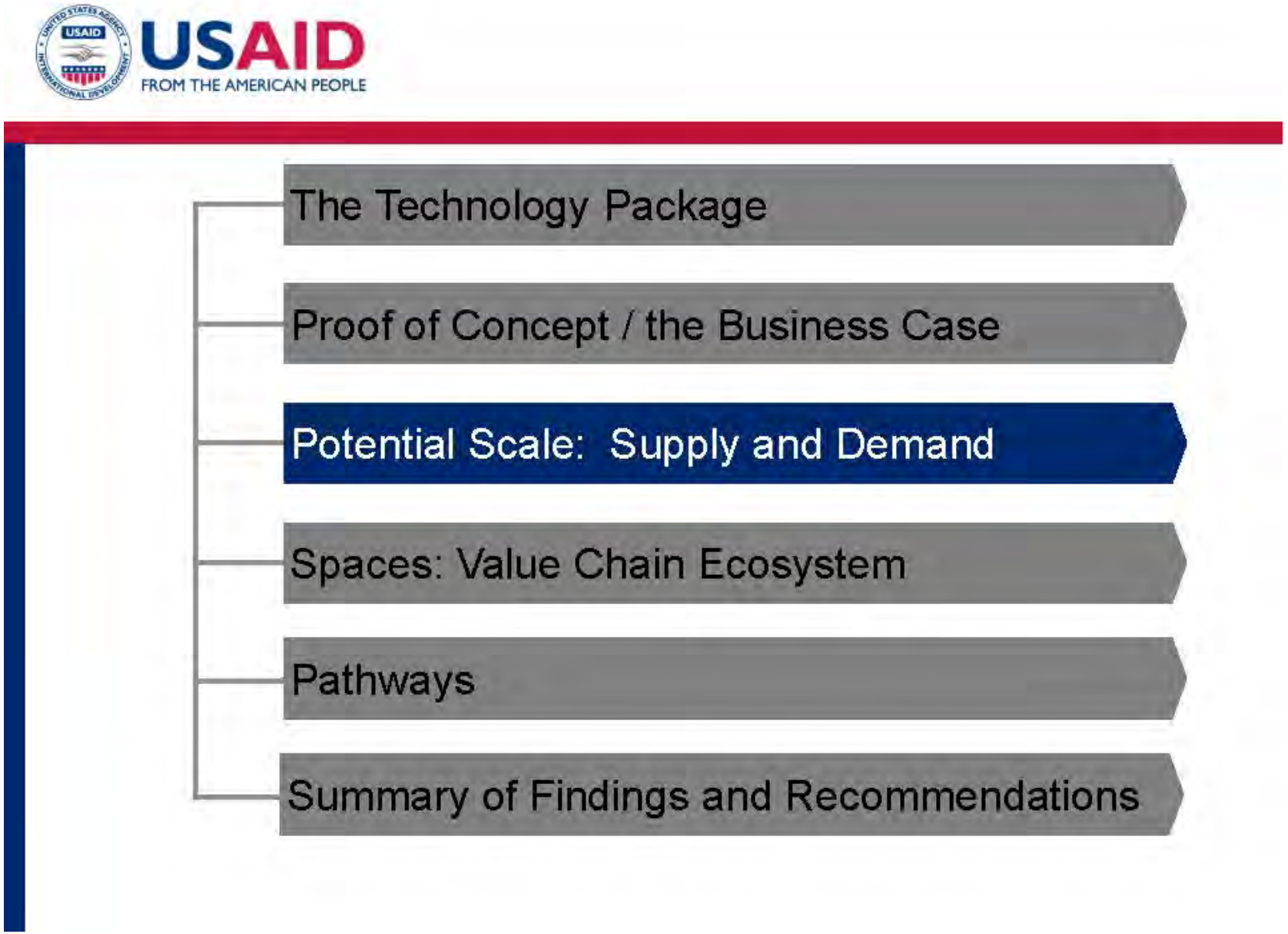
Learnings - Recommendations

- High cost of conduction requires external financing/grant
  - Opportunity to plan for and account for Filling In scaling
- Production credit absolutely critical for adoption of high cost input irrigated crops
- High perishability of many irrigated crops requires timely market linkages and access or risk product loss
- Individual area under irrigated production will increase (as system capacity allows), but slowly over many production cycles
  - Can speed this up through initial in-plot co-investment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Supply - # of producers and total area of land

Function of water availability and location

- No existing inventory of available water sources, water volumes, and associated area and/or producers
- Anecdotal support for between 60-80% of poor and extremely poor in ZOI with some water source available for at least 3 crops per year (though distance and capacity vary widely) [110,000 – 150,000 producers]
- Two current activities to inventory and assess water available for irrigation
  - USAID initiating the development of a tool starting in January
  - CRS and CARE doing an inventory and assessment with Howard Buffett Foundation financing; only partial overlap with limited area in south of ZOI

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Supply (con't)

ACCESO experience with improved ag practices -

- ~6,000 stars (including most of the 5,000 with access to irrigation thus far)
- ~10,000 good (progressing, but taking longer)
- ~18,000 laggards

Still early days – but assuming similar 20% early adopter trend: 23,000 – 30,000 producers with nearer term potential to benefit from irrigation

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Supply – Volume

with population level access and adoption: resulting increased production

- Informal markets account for 70% of Honduran market; 30% is formal
- ACCESO clients sell ~40% going into formal markets (includes coffee), ~60% going into informal markets
- Local markets offer significant opportunity for early adopters. Intra-community markets and local markets are very small.
- Expanded production will overwhelm local markets and need to reach regional markets. Slotting individual producer production into calendarized program for broker/buyer necessary to facilitate market access and logistics efficiency

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Supply – Volume

- Formal markets (including supermarkets and exports outside of region) offer more limited absorptive capacity for significant scaling (relatively smaller numbers of farmers growing high quality intensive volumes will be able to meet formal market needs in the near to medium term.)
- Lack of market mapping and quantification within domestic and regional markets
- Newer market opportunities ACCESO exploring:
  - Traditional plantain production areas are moving into palm
  - High cattle prices/rising beef prices – cattle fattening

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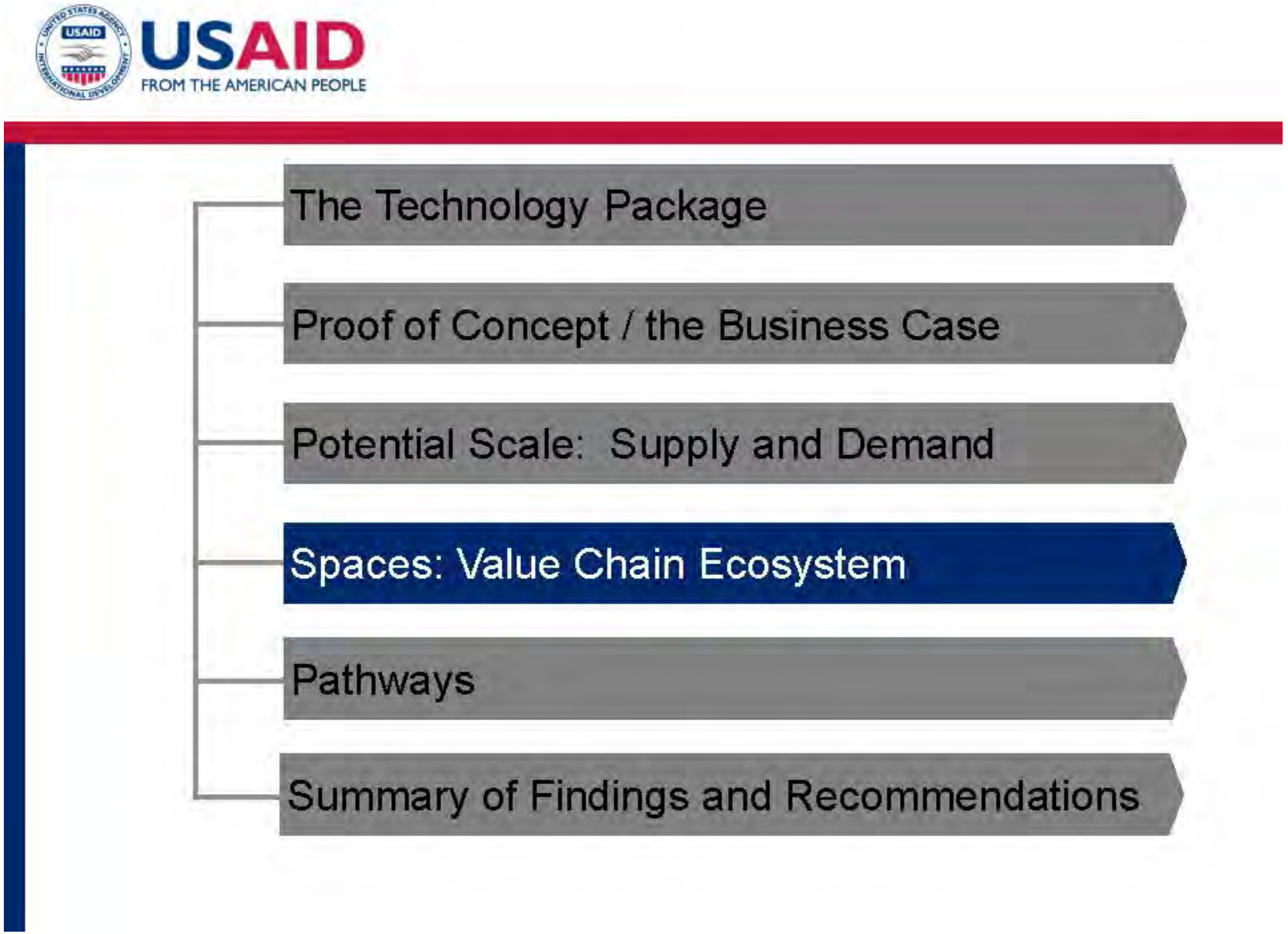
Learnings - Recommendations

- Push forward efforts to inventory water assets as fundamental input in quantifying potential scale
- Lack of market mapping and quantification within domestic and regional markets
  - Conduct and update market assessments and mapping for domestic and regional informal trade of horticulture and fruit (other relevant irrigation crop opportunities including meat and dairy)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Space to Scale

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Space to Scale

- **Capacity (Reach or Scale)** – ability of an organization or stakeholder to deliver and operate at the targeted or desired scale
- **Capability**: ability of an organization or stakeholder to deliver the technology package the way it was designed (fidelity), with quality to achieve the expected impact
- Partner and Value Chain organizations must exist and have to have **both** Capacity and Capability to successfully scale up.

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Observations where Space exists

Upstream Space – Inputs

- Strong and fairly distributed access to drip irrigation components
  - Even small agropecuarias now carry drip components and have good relationships with the large irrigation distributors
  - All components except the drip tape itself have experience falling prices as demand has increased over the past 5-7 years. Drip tape costs have remained the same or slightly increased – probably due to raw ingredient cost
  - Drip components are available individually or in smaller units; most appropriate for the small systems
  - Market for second hand drip tape; reduced cost entry point for adoption

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Observations where Space exists

Upstream Space – Inputs

- Design – company design expensive and may not be best suited to these clients
  - Their experience is with medium to larger systems for single users
  - Need strong, experienced design team specifically learning and implementing in ZOI w/ target client base (narrow annual window for water capacity assessments)
- Risk from drip kits on adoption and demotivation
  - Low pressure / design flaws; small size inadequate for meaningful returns
- Risk from stand alone irrigation investments (without supporting TA) – abandoned systems

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Observations where Space exists

Financial / Fiscal Space

- Significant buyer finance of production, particularly in the informal market
- Some input company finance of production through input finance
- Very limited formal market production finance. One example is three leg arrangement between a cooperative business (broker/packer), supermarket, and bank. Less than 40% of the cooperative business's producers access due to market rate interest charged.
- 70% of financing counted by ACCESO (they don't count much of the buyer finance from informal market) are for loans less than $500

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Observations where Space exists

Financial / Fiscal Space

- Utilize user group maintenance fund as capitalization for caja rural
  - Risk that caja rural may lose the maintenance/replacement fund with poor lending practices
  - Lack of experience with larger sums of money within the communities; group at risk of reducing or eliminating water user fees OR can create tension/power struggles within group; no significant experience with this to date
- Financial management and business planning should be provided both to the water user group and to individual farming households to increase capacity to handle larger sums of cash and accounts
  - Household level financial planning and business continuity planning have had positive gender outcomes in other countries

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Observations where Space exists

Enabling Environment Space

- Surface water legally belongs to government; well ownership is less clear
  - Many small-scale producer systems utilizing water in absence of oversight or legal inquiry/resistance; poses risk with scaling
- Watersheds cross lands with varied ownership and authority
- Municipal governments vary in effectiveness and engagement around water management
- *Some municipalities have shown leadership roles in irrigation by facilitating watershed management, and co-investing in irrigation systems.*

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Downstream Space

- Local markets offer entry point for early adopters. Local markets fairly quickly overwhelmed with expanded production.
- Many farmgate buyers and small entrepreneurs exist (many traders and brokers at the local and regional market level are women)
- Expanded and organized production (# of producers and area under production) needed for volume required to hit larger markets.

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Downstream Space

- ACCESO has taken an active role in brokering and facilitating market relationships.
  - Estimate it takes about 2 years to cement the volume and capacity between buyers and producers to continue relationship and grow without additional producer TA and service provision (identifying producers and production, calendarizing the production, following up on aggregation commitments, etc.) to buyer

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Downstream Space

- Current buyers will likely grow their business with small producers through growth of their existing producers. They will be unlikely to add more on their own due to risk and time required to build relationship/reliability.
  - Scale through new buyers/market
- Significant external support needed to expand buyer/broker capacity to work with large numbers of small producers; including managing calendarized production and facilitating input finance

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Environmental Space

- Watershed management
  - Protection of water source
  - Competing priorities for water both upstream and downstream
  - Production practices within watershed – use of pesticides and herbicides which may translocate throughout watershed and impact other producers
  - Livestock management – intensive livestock production can create waste management issues
  - Hygiene and sanitation may be not consistent along watershed and impact producers and water users elsewhere in watershed

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Environmental Space

- Tension with domestic water
- Water source management
  - Manage forestation and control of water source
  - Many springs are at some distance from client irrigation system and may be within another municipality or community
- Irrigation and water system design, along with user group reglamentos need to manage competing and conflicting watershed and water usage demands and practices from design and support through implementation; include watershed usage and maintenance fees within user group fee structure

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Environmental Space

- Water harvesting – need to concentrate on capturing and storing water in effective and efficient manner during rainy season; larger dams and reservoirs ; extremely expensive. Surface water where this isn't necessary offer the most near-term opportunities. Leaves out some communities
  - Small scale water harvesting not effective for irrigation due to volume, evaporation within reservoir, and plant evapotranspiration

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Extension/Information Space

- Limited extension capacity and capability. Organizations simply don't exist or haven't shown the capability to deliver the necessary production and irrigation system management technical assistance
- Value chain unable to fill (also not economical to the depth needed.) Projects largely filling this gap.
- ACCESO experience – 1 technician/~ 300 producers; visits once a week. High touch with strong agronomic training and back office support.

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Learnings - Recommendations

- Need strong, experienced irrigation and water system design team specifically learning and implementing in ZOI w/ target client base (narrow annual window for water capacity assessments)
- Active support for identification of new markets and capacity building with brokers/buyers for market linkages needed; no scalable model yet
- Invest in ongoing production technical assistance after irrigation installation

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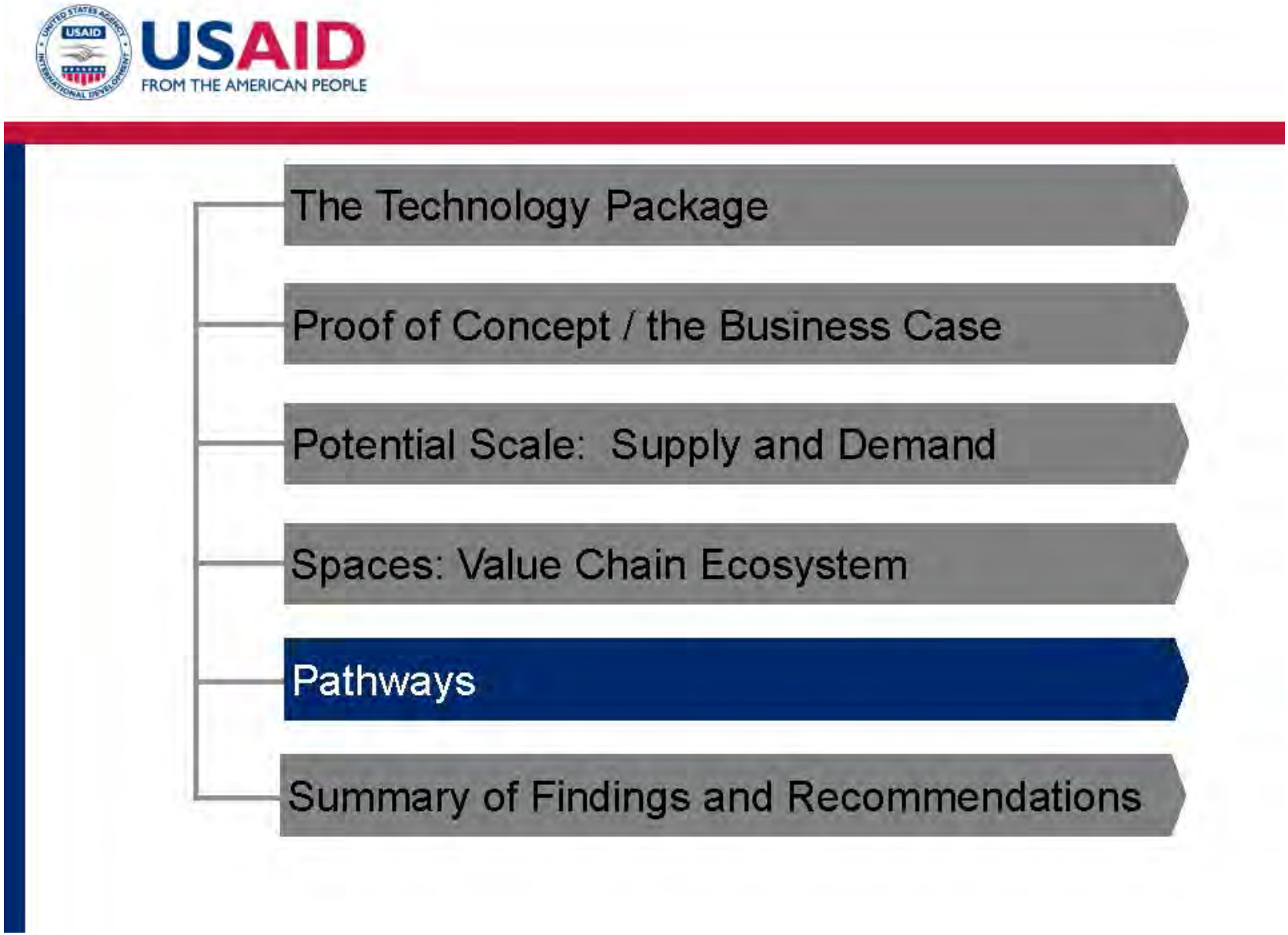
Learnings - Recommendations

- Utilize user group maintenance fund as capitalization for caja rural
- Financial management and business planning should be provided both to the water user group and to individual farming households to increase capacity to handle larger sums of cash and accounts
  - Household level financial planning and business continuity planning have had positive gender outcomes in other countries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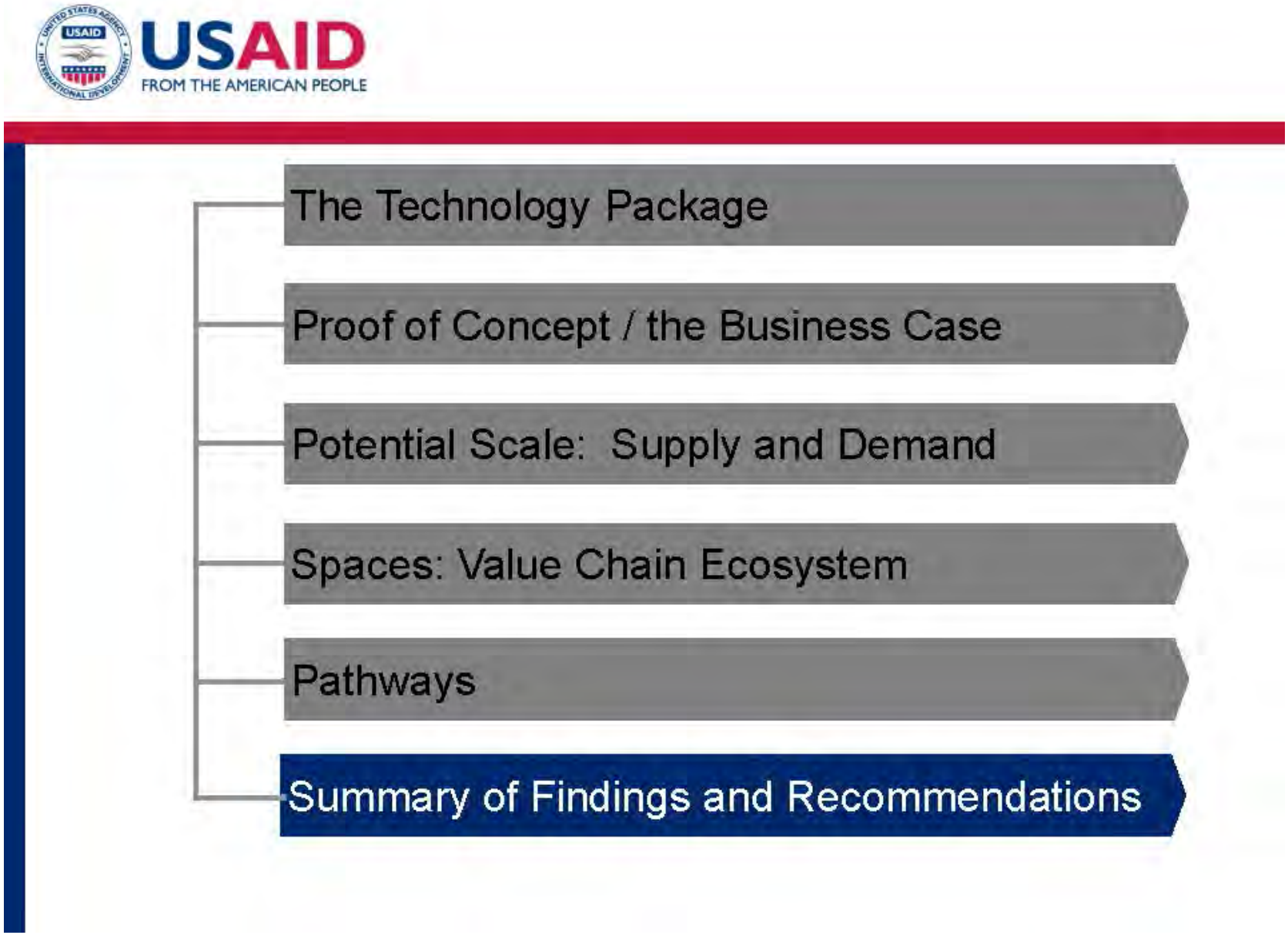
Pathways

Ag related scaling strategies usually involve combination of spontaneous adoption/indirect diffusion, strategic partnerships, and commercialization

- Cost and complexity of conduction and shared water resource management limit spontaneous adoption and pure commercialization opportunities
- Strategic partnerships and direct investment (including significant grant/co-funding) most likely pathway to scale
- Some 'Filling In' scaling possible with indirect diffusion through addition of new farmers (and planning for them) along larger capacity group irrigation systems
  - Involves willingness to risk capital by donors and co-funders as initial system investment would be larger than near-term users/beneficiaries to allow for future scale
  - Limited by water capacity and producer relative location to system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The Technology Package
Proof of Concept / the Business Case
Potential Scale: Supply and Demand
Spaces: Value Chain Ecosystem
Pathways
Summary of Findings and Recommendations

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Learnings - Recommendations

Early experience opportunistic – identifying early adopter/high performing farmers and communities with access to a water source

- Water system design should begin with appropriately timed water inventory
- Design and reglamentos should include plans to maximize utilization – considering opportunities for future 'filling in' scaling (including new producers)
- Need strong, experienced design team specifically learning and implementing in ZOI w/ target client base (narrow annual window for water capacity assessments)
- Irrigation and water system design, along with user group reglamentos need to manage competing and conflicting watershed and water usage demands and practices from design and support through implementation

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Learnings - Recommendations

- Take the time to ensure sufficient adoption of GAP and high labor practices prior to irrigation investment
- Invest in ongoing production technical assistance after irrigation installation
- Financial management and business planning should be provided both to the water user group and to individual farming households to increase capacity to handle larger sums of cash and accounts
  - Household level financial planning and business continuity planning have had positive gender outcomes in other countries

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Learnings - Recommendations

- Push forward efforts to inventory water assets as fundamental input in quantifying potential scale
- Conduct and update market assessments and mapping for domestic and regional informal trade of horticulture and fruit
- Active support for identification of new markets and capacity building with brokers/buyers for market linkages needed; no scalable model yet

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Thank You



Charity Hanif

Scaling Up Consultant, MSI

chanifmoz@hotmail.com or +1 (301) 642-3147

Charity Hanif

MANAGEMENT SYSTEMS INTERNATIONAL
A SUBSIDIARY OF COFFEY INTERNATIONAL, LTD

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