MARKET CREATION FOR GRAVITY-FED DRIP IRRIGATION
KYRGYZSTAN AND TAJIKISTAN

IN BRIEF

Name of Project
Scaling-up Productive Water – Market Creation for Micro Irrigation Technologies Project (MIT), Kyrgyzstan & Tajikistan

Project duration
Phase I: 2010-2013
Phase II: 2014-2016

Location
Kyrgyzstan: All Provinces
Tajikistan: Sughd Province

Implementer
HELVETAS Swiss Intercooperation (HELVETAS) with support of iDE

Donor(s)
iDE through funds from Swiss Agency for Development and Cooperation’s (SDC) Global Programme Water Initiatives

Resources
Phase I: CHF 360’000
Phase II: CHF 330’000

Development Goal
This project contributes to the reduction of poverty of the rural population depending on water resources by increasing their income and supports them in using irrigation water more productively

Specific Objectives
(1) Supply Chain: A financially self-sustaining supply chain is established
(2) Technical Capacities: Technical capacities of stakeholders in the value chain are built
(3) Promotion: MITs are effectively and efficiently promoted
(4) Access to Finance: Means to finance and buy MITs for farmers are in place

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MAIN RESULTS

- Over 550 gravity-fed drip systems sold worth over US$ 186'000 until the end of 2015
- Over 172 hectares put under drip & annual growth in sales turnover of over 95%
- Water savings of up to 70% compared to traditional flood and furrow irrigation
- Eight market actors created/supported that commercialize drip irrigation. Distribution network established in all provinces of Kyrgyzstan, plus Sughd Province of Tajikistan
- Drip systems are used for open-field vegetable cultivation, greenhouse vegetable cultivation and in fruit orchards
- Market research in Kyrgyzstan shows a market potential for drip irrigation of over US$ 10m within the next ten years. In Tajikistan, in Khatlon and Sughd Province only, this potential is over US$ 2.3m within the next ten years
- The project in both countries showed that only through the experiences from demo plots and from first customers, and consequently by positive word of mouth, the adoption of gravity-fed drip can be accelerated
- By the end of 2016, the project will generate a total estimated financial impact of around US$ 1’275’000; this represents a return on (project) investments of over 190%.
INTRODUCTION

This factsheet illustrates how joint efforts of iDE and HELVETAS introduced affordable gravity-fed drip irrigation in the Central Asian countries of Kyrgyzstan and Tajikistan by building up local and financially self-sustaining supply chains. Drip irrigation technology is presumed to be one of the most advanced and efficient irrigation practices. In Kyrgyzstan and Tajikistan, the technology was already introduced for the first time 40 years ago. However, after the collapse of the Soviet Union, Kolkhoz-managed drip irrigation schemes dilapidated and commercially supplied drip systems were too sophisticated and thus neither suitable nor affordable for smallholder farmers. Consequently, in 2010 there was no drip technology commercially available neither in the Kyrgyz nor in the Tajik market. Conventional drip manufacturers were not selling into these markets nor were any distribution networks being developed.

The drip systems that iDE and HELVETAS promote are innovative and differentiated from conventional high-cost drip especially in regards to their affordable and basic design. Gravity-fed drip can be up to ten times cheaper than conventional drip depending on plot and plant spacing and thus allows small and medium-scale fruit and vegetable farmers to take it up with less cost and risk. These affordable drip systems have an average life span of around five years, while some components (main lines, valves, filters, etc.), if properly maintained, can be used up to 15 years. They work without artificial pressure and are easily expandable for plots larger than 20 m². Gravity-fed drip has the same advantages as conventional drip. Collectively, these advantages allow having high impact on producing more food with less water and eventually to greatly enhance agricultural and water productivity.

The project innovation of iDE and HELVETAS is therefore twofold: (1) technological and (2) in regards to establishing financially sustainable supply chains.

iDE and HELVETAS work through local (commercial) partners that supply and assemble drip systems and are responsible for marketing and technical support; these partners constitute local and financially viable supply chains that enable sales of drip technology to grow also after the end of the project intervention. Particularly, iDE and HELVETAS apply market creation principles such as impartiality, transparency and no distortion of the market's core functions by subsidizing transaction or product costs. Any financial support to partners for technical capacity building and social marketing gradually declines based on business plans and sales turnover projections; and any support by the project to business partners needs to be co-financed by the latter, either in-cash or in-kind.

### Retail Price Ranges of gravity-fed Drip Systems in Kyrgyzstan

<table>
<thead>
<tr>
<th>Size, Spacing</th>
<th>Crop Types</th>
<th>Retail Price (w/o reservoir)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50sqm, 0.6 x 0.4m</td>
<td>Tomatoes, Cucumbers, Paprika</td>
<td>US$ 40-70</td>
</tr>
<tr>
<td>300sqm, 0.6 x 0.4m</td>
<td>Vegetable cultivation inside greenhouses</td>
<td>US$ 100-170</td>
</tr>
<tr>
<td>10'000sqm, 5 x 5m</td>
<td>Fruit orchards</td>
<td>US$ 700-1’200</td>
</tr>
</tbody>
</table>

In Kyrgyzstan, where the project started in 2010, the initial objective was to assess the profitability of drip irrigation technologies at all levels of the supply chain as well as the evaluation of the efficiency of drip irrigation technology at farm level. However, in light of the positive reaction and uptake of the technology by farmers already within a short period of two years, the project quickly evolved from a market testing into a market creation project. After five years, the project eventually allowed the introduction of affordable gravity-fed drip irrigation in Kyrgyzstan and Tajikistan through financially viable business models, thus enabling the production of more food with less water (“crop per drop”) in a sustainable manner.

“Market creation is a process and not a status, it will continue being so also after the end of this project.”

Urs Heierli, MSD Consulting
In both Tajikistan and Kyrgyzstan, agriculture is an essential source of economic growth; it produces about 20% of both countries’ GDP and occupies over 50% of the labor force. Nevertheless, poverty remains much more pronounced in rural agricultural areas. To increase the potential of the Kyrgyz and Tajik agriculture that engages and benefits the poor, the productivity of the agricultural sector needs to be increased overall, the reliability of irrigation water improved and the issues of degradation of the soil due to poor land management need to be addressed. Both countries have for instance severe problems with erosion and salinization, which negatively impacts on soil fertility. In Tajikistan for instance, 12% of Khatlon’s and 18% of Sughd’s irrigated lands have salinization problems. There are also frequent landslides, especially during the rainy season.

In addition, Kyrgyzstan and Tajikistan are upstream countries in a region where water use for agriculture is a source for conflict. Increasing water productivity upstream eventually increases water availability downstream. This is valid at regional, national and local level, i.e. along the same irrigation channel. The conflict potential is further exacerbated by global warming, which currently causes a sharp retreat of the glaciers. Annual water flow is expected to increase in the coming 15 years, but not evenly through the year. After 2030, less water flow is anticipated, combined with more scarcity and variation in summer rainfall. Extreme weather events are expected to increase, which means more years with water deficits. Various studies show that this is already happening. In both countries, canal networks provide over 70% of the irrigation water and often the head-end users have enough water, while the tail-end users have no security that they receive water at all.

Many mountain streams are already used to capacity. In Kyrgyzstan, the total arable area is about 1.4m ha (7% of total area), of which 80% is artificially irrigated. In the maximum-demand months of July and August, in practically all irrigation systems, only few farmers receive adequate water. In Tajikistan, the situation is worse – most farmers face water shortage up to 5–6 months per year. The arable area is about 1 million ha (also 7% of total area) and around 60% of it is artificially irrigated by canal infrastructure mainly dating from Soviet times or water boreholes. Groundwater tables in many regions are decreasing.

In Kyrgyzstan, over 98% of arable land (1.372m ha) is in small peasant farms and household plots. In 2011, there were around 345'000 peasant farms averaging 2.9 ha each and over 726'000 household plots averaging 0.11 ha each. Both types of farms hold legal property rights for their land holdings; there is thus incentive to invest long-term in these lands, including in irrigation infrastructure.

Also in Tajikistan since 1992, the government-led land reform process has motivated farmers to invest in their lands. In 2012, over 55’000 small and medium-size farms with land certificates (dekan farms) were operating, each with an average of about 10 ha of arable land. This is a fivefold increase since 2002. And the land reform process based on individual legal property rights continues into the period 2015-2017. Sughd and Khatlon provinces offer an especially high potential for irrigation technologies, because in 2012 90% of the irrigation water in Sughd and 26% in Khatlon needs to be pumped to fields or into higher level canals and irrigation water must be paid for by volume. This is unlike Kyrgyzstan where farmers pay a lump sum for irrigation water according to the area under cultivation. In contrast to Kyrgyzstan, in Sughd and Khatlon province of Tajikistan there is in consequence a strong economic incentive to save water.
In 2010, some irrigation technologies that enhance water productivity were available prior to the involvement of IDE and HELVETAS. However, these were not affordable for the average rural farmer earning less than US$ 3,000/year and they were only available in the Kyrgyz capital of Bishkek or in central cities of Tajikistan such as Khujand. Introducing affordable micro-irrigation technologies through financially viable and decentralized supply-chains was therefore necessary in both the Kyrgyz and Tajik context.

In short, the project is relevant in both countries, since affordable gravity-fed drip technology allows taking up cultivation also under difficult irrigation conditions. IDE and HELVETAS’ intervention will gradually extend the area of arable land and enable farmers to produce food and earn income while using water most productively. This in a context in which the (economic) importance of the agricultural sector is high, where there is a latent conflict potential for irrigation water and where reforms in property rights favor private investments in agricultural land.

PILOTING THE APPROACH IN TAJIKISTAN

In Tajikistan, in Sughd province in 2011, HELVETAS conducted trainings about gravity-fed drip and established a small demo plot on berry cultures in Khujand. There were, however, no funds to carry out follow-up activities to further promote the technology, build technical capacities of stakeholders and establish a distribution network.

Then in 2013, two additional demo plots were supported, in Isfara and Ghafurov districts, one in an apricot orchard and one on a vegetable plot for capsicum. Three field days were conducted as part of the promotion strategy and a countrywide market research that compiles quantitative and qualitative data showed especially high market potentials in Sughd and Khatlon provinces. A promising commercial wholesale partner based in Khujand was identified who – on his own initiative – started importing drip components from China and complemented them with locally manufactured components. Since then the project continued, additional drip suppliers were built up by the project and sales continued to pick up. By the end of 2015, 47 complete drip systems for orchards and vegetables were sold and installed, with a sales turnover of over US$ 46,000 at wholesale prices.
In Kyrgyzstan in 2010, the results of small-scale pilot activities showed that awareness about drip was very low and often limited to the stereotype that although it is an efficient form of irrigation, it is too expensive and sophisticated. Since then with a focused promotion strategy, sales grew annually by over 95% and by the end of 2015, over 550 gravity-fed drip systems were sold for a total area of around 172 ha in both Kyrgyzstan and Tajikistan. By December 2015, drip irrigation systems worth over US$ 186’000 at wholesale prices have been sold. In Kyrgyzstan, the distribution network – consisting of two commercial wholesalers and four retailers - expanded into all provinces, including the Northern provinces of Naryn, Chui, Talas and Issyk-Kul. Both the private and public sector (NGOs and the Kyrgyz government) are taking over drip irrigation in agricultural projects; and they procure the technologies through the commercial network that IDE and HELVETAS built up since 2010. Furthermore, the project showed that only through the experiences from demo plots and from first customers, and hence by positive word of mouth, the adoption of gravity-fed drip can be accelerated. In consequence, promoting and spreading awareness about these positive results and installing demo plots in additional areas will further increase the number of sales and lead to the adoption in an expanded context of Kyrgyzstan and since 2013 also Tajikistan.

During the period 2010-2015, farmers used drip irrigation in Kyrgyzstan and Tajikistan for the following practices:

1. preservation of existing, mostly rain-fed fruit and berry orchards where water is scarce, based on small hillside springs or on pumping;
2. cultivation of new fruit orchards or vegetables in fields which so far lie idle due to lack of water;
3. irrigation inside greenhouses for vegetable cultivation;
4. irrigation of household plots for subsistence agriculture.

Customer surveys in Kyrgyzstan show that farmers with different socio-economic backgrounds, using the technology for different purposes started to use it at different phases of the project. Also, the necessary behavior changes to adopt a new technology are different among customer segments and purposes. The first buyers were not the poorest people. At first, more innovative and risk-taking end users were targeted by the sales partners of IDE and HELVETAS. Poorer customers are typically risk avoiding; they usually must see a product operating successfully with their neighbors before they risk buying and using it. Also regarding the cultivation of new fields, Kyrgyz farmers are cultivating only in well-irrigated areas. Consequently, drip technology needs to continue being popularized before even innovative farmers will start using it in areas where irrigation water scarcity is severe.

In order to understand how the creation of a financially sustainable market worked over the five years from 2010 up to 2015 and how eventually also the poor benefit, a simple product lifecycle analysis as depicted in above graph helps.

In 2009/2010 during the R&D phase, sales were zero and only prototypes were thoroughly tested in demo plots for various crops. There were only expenditures by IDE and HELVETAS and no sales took place. No private sector partner invested in the technology. However, already in 2010 market research and farmer interviews showed that over 5% of 120 interviewed farmers were readily
willing to invest into drip irrigation. These farmers are – in rural marketing terms – innovators and early adopters, they have a high level of curiosity and are able to take some (financial) risks due to their somewhat higher socio-economic status. In Kyrgyzstan, these farmers are so called opinion-leaders that neighbours often follow suit and either cultivate fruit orchards (1-5 ha), open-ground vegetables (>500m²) or own a greenhouse (>300m²), usually for cash crop production.

In 2011/12 in the *introduction phase*, the product was test-marketed. The first customers and the first sellers came in and the supply chain started developing. Early majority farmers, who saw drip technology effectively working in neighbouring fields or during field days, wanted to adopt it in their fields on their own and started buying. In this phase extensive demonstrations, testing and promotional efforts to create interest and to motivate stakeholders to enter the business was necessary. However, sales volumes were still low and there were still no considerable profits in the supply chain. iDE and HELVETAS thus continued its intervention by financially supporting the process.

In the *maturation phase*, mainstream customers including poorer farmers are targeted with appropriate marketing campaigns, sales start picking up and profits along the whole supply chain – from manufacturer to the farmer - are increasingly possible. More actors are seeing the potential of the technology and join the supply chain. In rural marketing terms during this phase, late-majority farmers who tend to be poorer than the average and have less capacity to take risks also start buying the technology. In Kyrgyzstan, these farmers live in rather remote and mountainous areas and their livelihood is often based on keeping livestock.

During phase II (2014-2016), the project aims at moving further up the maturation phase, possibly even reaching the *saturation phase* during which a wide part of the potential customers, including poorer smallholders are served and the sales growth may start to flatten or even decline. Supply chain stakeholders thus will have either to come up with additional products or to move to other (product) areas. From a poverty alleviation and agricultural productivity point of view, however, the positive social and environmental impact of gravity-fed drip will continue even after the market is saturated and sales are flattening, as farmers continue to adopt the technology in their fields, thus benefiting economically while at the same time considerably improving water productivity in the Kyrgyz agricultural sector. Only during the saturation phase, laggards start adopting the technology. These farmers are – due to whatever reason – averse to any risks and changes and in the Kyrgyz context have comparatively small landholdings of up to 0.5 hectares only. They market only parts of their produce in local markets and mainly use the food they grow for home-consumption. Living in remote mountainous areas, their livelihood is mostly based on keeping livestock.

If the project intervention of iDE and HELVETAS reaches a point with characterization of the saturation phase, market creation objectives are accomplished and in consequence, there is no need any more for financial project support to stakeholders in the market. Based on this concept of a product lifecycle, during the period 2010-2015, iDE and HELVETAS have sped up the cycle for gravity-fed drip in Kyrgyzstan by working on (1) supply chain management, (2) technical capacity building, (3) promotion and awareness generation as well as on (4) access to finance. The next chapter illustrates these main outputs of the intervention by iDE and HELVETAS in more detail.
In both Kyrgyzstan and Tajikistan throughout the intervention-period, iDE and HELVETAS focus on four main outputs: (1) the set-up of the supply chain, (2) technical capacity building, (3) promotion and (4) access to finance. Adjacent graphic shows the scheme according to which the supply chain is set-up in Kyrgyzstan and at what level the project intervenes by what means.

**SUPPLY CHAIN**

iDE and HELVETAS aim at building an efficient and sustainable supply chain and do not want to deliver a product directly for one time only. The objective therefore was to build up long term reliable supply channels capable of serving an existing and growing demand for gravity-fed drip irrigation by Kyrgyz and Tajik farmers. Following were the main activities conducted by the project to set-up the supply chain:

- Identification and elaboration of a supply and distribution system, from the component manufacturer to the client-farmer, as illustrated in above graphic. The graphic is indicative only; for instance, if there is potential and enough market demand, there can also be a third and fourth wholesaler, and farmers might buy directly from wholesalers without moving through retailers;
- Support to the wholesaler(s)/importer(s) as key player(s) who develop the subsequent national and regional supply chain; also attract retailers with different organizational set-ups (NGOs, agro shops, individual (women-)sellers, etc.) to identify the most competitive ones;
- Limited financial support for human resources at wholesale level, due to the high work load, especially at initial stages of the market creation process;
- Provision of loans (not grants) for hardware purchase and importation based on a convincing business plans; including the establishment and management of a revolving fund for hardware purchase and importation with a transparent exit strategy;
- Facilitation of linkages and development of collaboration mechanisms between supply chain stakeholders. The project facilitates a jointly developed sales policy between retailers and wholesalers (e.g. no price dumping, in case of sales to donor-funded projects, these sales need to be for demonstrational purposes) and facilitates linkages and communication with new supply chain actors (e.g. component manufacturers in China, transport companies, new retailers, etc.);
- Profitability analysis at wholesale, retail and farmer level in order to assess the economic viability of the supply chain at all levels;
- Setting of transparent pricing mechanism that allow for financial benefits at all levels of the supply chain while safeguarding the affordability of the technologies for local smallholder farmers, including customer and sales data tracking;
- Link and support the wholesalers to bank institutions for future financing of investments and to investigate and set-up potential microfinance products for micro-irrigation technologies.

**TECHNICAL CAPACITIES**

To stipulate demand and eventually to create a market for gravity-fed drip in Kyrgyzstan and Tajikistan, the establishment of efficient supply chains are not sufficient; but the adaptation of drip irrigation technologies to local contexts (Research & Development), the design of a drip system according to the requirements of a specific plot, the installation, operation and maintenance require qualified knowledge and advice. Following were the main activities conducted to increase the technical capacities of all stakeholders involved:
• Training of trainers in planning, design, installation and maintenance of drip irrigation systems, including the elaboration of training materials (design and end-user manuals);
• Trainings of farmers on irrigation regimes and water productivity;
• Research & development of various forms of drip irrigation technologies with the aim to widen the product portfolio;
• Coaching of partner organizations in business planning, supply chain management and marketing & sales.

Financial support for activities in the frame of technical capacity building is to gradually decline based on business plan and sales turnover projections. In this way, project partners need to include expenses for technical capacities into their (gross) sales margin already at early stages of the market creation process.

PROMOTION

In order to create demand for gravity-fed drip in Kyrgyzstan and Tajikistan, demonstrations in many locations combined with field days are necessary in combination with various additional promotional activities. Following were the main activities conducted to increase awareness about drip irrigation in general and to create demand:
• Market research about geographic focus area, key crops, target groups and research and analysis of existing market systems;
• Financial and technical support for supply chain stakeholders for initial promotion and awareness building campaigns to create product demand, e.g. through local TV and radio channels, demo-plots and open field days;
• Publication of catalogs of drip materials, banners and leaflets informing about the technology, main advantages and challenges;
• Lobbying at government level, e.g. on the reduction of customs duties on imports of irrigation components or on government-supported drip irrigation demo plots and for the support of local manufacturing of drip components;
• Assessment of expected impact at farm level and eventually on rural poverty in Kyrgyzstan and Tajikistan.

Similar to support for technical capacity building, co-financing schemes and financial support for promotional activities and materials are to gradually decline and expenses must be taken over by project partners as soon as possible, respectively written into their (gross) sales margin.

ACCESS TO FINANCE

Access to finance supports stakeholders in the supply chain to provide farmers both with formal and informal means to finance micro-irrigation technologies. Formal means refer to institutional loan products of micro-loan organizations that are apt for irrigation technologies; informal means refer to financing opportunities through leasing schemes or paying by installments that are offered directly to the farmers by the wholesale or retail partners. Following are the main activities conducted by iDE and HELVETAS to increase access to finance for farmers:
• Identification of existing loan products & elaboration of new loan products in collaboration with micro-finance institutions and wholesale and retail partners;
• Identification of saving funds and field farmer schools that facilitate access to finance;
• Information campaigns about options for financial support;
• Provision of loans (not grants) as security assets to both formal and informal micro-loan schemes.

FACTSHEET Market Creation for Gravity-Fed Drip Irrigation / Kyrgyzstan and Tajikistan
Both in Kyrgyzstan and Tajikistan, iDE and HELVETAS work with a large number of client farmers that buy drip irrigation technologies. Measuring results and changes both at farm and supply chain level is mostly based upon data collected by the supply chain partners and farmers themselves. This implies that the data collected at supply chain level must be important to the commercial partners (e.g. business information of value for management) and at farm level important to the farmers (basic data about the increase in agricultural and water productivity).

**FARM LEVEL**

The cost for gravity-fed drip at farm level depends on two main factors:

1. the size of the system and
2. the plant spacing/spacing between the drip laterals

As shown, unit costs thus differ between drip systems for orchards and drip systems for vegetables and greenhouses. At retail prices, gravity-fed drip irrigation systems sell at around US$ 1’000/ha for orchards with a 5m x 5m planting scheme and at around US$ 2’000/ha for vegetables with a 0.6m x 0.4m planting scheme.

Already in 2010/11, the feedback about gravity-fed drip of first clients was positive, especially in terms of water (up to 80%) and labor saving (up to 600%), yield increases (up to 100%) and gross income gains (up to 500%). There were some quality issues with the imported materials from India and concerns, especially of smallholders about the price. Nevertheless, market analysis clearly showed that pressurized conventional drip is too expensive for the Kyrgyz market, and often too sophisticated to maintain at farm level.

Further, in 2012 during an internal evaluation, farmers using gravity-fed drip irrigation on vegetable plots reported the following results in their plots:

- Savings of labor: 250-800%
- Savings of fertilizers: 100-200%
- Savings of electricity for water pump
- Less diseases and pests, i.e. savings of herbicides, pesticides and fungicides
- Faster growth of young orchard seedlings

In regards to the savings of electricity, one has to understand that farmers often need to pump irrigation water to a level from where it can flow down to their fields, both for furrow and drip irrigation. These pump systems usually depend on external energy sources – mainly electric, less often diesel. Usually dating from Soviet times, these pumps are not energy-efficient and often cannot connect to a renewable energy source. In Tajikistan, this is reflected in the comparatively high cost of irrigation water. In Kyrgyzstan, farmers pay a lump sum according to their land size, but often install and maintain privately owned pumping systems. As up to 80% of irrigation water is saved compared to furrow irrigation, gravity-fed drip saves costs and energy for pumping and subsequently increase the profitability of farming.

In 2013, another difference-in-difference analysis between drip and furrow irrigation on open-field tomato cultivation in the dry-continental climate of Osh, which is typical for agricultural lands in Kyrgyzstan, and Tajikistan, measured the following impressive results:

- Water savings: Two-thirds of the water is saved (33.8m³/100m² vs. 100.3m³/100m²)
- Yield improvements: around 100% (1.5t/100m² vs. 0.7t/100m²)
- Gross income gain: 750%
The study measured the gross income so much higher because with drip irrigation farmers are able to plant tomato seedlings an entire month earlier (mid-March, in comparison to mid-April); in consequence, they are able to harvest a full month earlier, when market prices are higher. Moreover, the crop quality is better due to a more regular irrigation regime and the produce thus fetches higher prices in local markets. In terms of market access, Kyrgyzstan and Tajikistan are fortunate contexts to work in for farmers, since they can easily find buyers for cash crops, for which there is a large and growing national and international demand. In addition, winter prices can exceed summer ones by up to 20 times, as in winter almost all fresh vegetables are imported. This is also reflected in high growth rates of over 250% in the greenhouse sector during the period 2007-2012 in both countries.

The aggregate effect of these results in the field guarantees for high enough returns on investment at the farm level in order to amortize a drip system within one to two production cycles depending on the crop type, market access and market prices, assuming that there is no force majeure (droughts, floods or diseases). This is in sharp contrast to conventional pressurized drip irrigation systems, which are up to ten times more expensive, and where therefore the amortization may take up to ten production cycles.

Notwithstanding these positive results at farm level, it is important to note that in the case a farmer has very low current yields, the economic justification of using gravity-fed drip depends mainly on the additional yield triggered by the use of drip. This additional yield has two components: (1) present yields per ha, and (2) percentage increase in yields due to drip. If present yields are too low, no increase in yields will make gravity-fed drip economically justified; in such a case, many lower-cost improvements – better varieties, correct fertilization, integrated pest control and good cultural practices – should be done first. If yields are already higher, the economic justification of gravity-fed drip will depend on the yield increases and needs to be proven to potential clients. And the threshold for the economic justification depends on and needs to be determined for each crop separately.

**SUPPLY CHAIN LEVEL**

In Kyrgyzstan, iDE and HELVETAS piloted the set-up of the supply-chain and the business model in collaboration with the wholesaler Agro Bazar based in the Southern city of Osh during 2011-2013. Therefore, detailed financial data about this company is available from that period.

As an initial remark, it is important to note first that each commercial stakeholder in the supply chain has also other income sources besides the commercialization of drip irrigation and second that the partners with whom iDE and HELVETAS collaborated already existed prior to this intervention. Accordingly, the sales of drip irrigation add to the overall profitability of those institutions and their interest is therefore high in continuing to sell micro-irrigation technologies also after the end of the financial support received throughout this project.

The supply-chain partners – wholesalers and retailers – pay by themselves all operational expenses for their staff, warehouse and office infrastructure, maintenance of the distribution network and other administrative expenses. Partners cover those costs by their gross sales margin when selling drip. iDE and HELVETAS initially supported the partners with a financial contribution that depended on sales results; and iDE and HELVETAS manage a revolving fund that supports partners with loans for the importation of drip technologies in order to have enough initial stock. This revolving fund is to be disintegrated prior to the end of the project intervention, as the partners are building up their own working capital.

Analyzing the profitability within the supply chain in more detail, Agro Bazar had actual annual operational costs in 2013 of around US$ 5’000. Given an average 30% gross margin on the landed costs of the drip system components, an annual sales turnover of around US$ 17’000 therefore allowed covering all operational costs at wholesale level in order to market and sell drip systems.
However, these operational costs do not account for all annual fixed and variable costs that occurred. During 2011-2013, iDE and HELVETAS subsidized those additional fixed and variable costs that were necessary to create the market. Full annual fixed and variable costs for Agro Bazar in 2013 were in fact US$ 11’500, which includes the financial support that Agro Bazar received form iDE and HELVETAS for the establishment of the supply chain, technical capacity building, promotion and for facilitating access to finance. At an average gross margin of 30%, these full annual costs require an annual sales turnover of around US$ 38’300 for Agro Bazar to be financially sustainable.

<table>
<thead>
<tr>
<th>Agro Bazar’s key profitability indicators (both with and w/o support by iDE/HELVETAS)</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Total 2010-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of systems sold (NUMBER)</td>
<td>35</td>
<td>64</td>
<td>101</td>
<td>200</td>
</tr>
<tr>
<td>Sales turnover in US$</td>
<td>$4’600</td>
<td>$11’500</td>
<td>$21’000</td>
<td>$37’100</td>
</tr>
<tr>
<td>Gross margin (average of 30% of sales turnover)</td>
<td>$3’380</td>
<td>$3’450</td>
<td>$6’300</td>
<td>$11’130</td>
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<tr>
<td>Operational costs without support by iDE/HELVETAS (OP. COST)</td>
<td>$2’500</td>
<td>$3’750</td>
<td>$5’000</td>
<td>$11’250</td>
</tr>
<tr>
<td>Full annual fixed and variable costs including support by iDE/HELVETAS (FULL COST)</td>
<td>$5’500</td>
<td>$11’000</td>
<td>$11’500</td>
<td>$28’000</td>
</tr>
<tr>
<td>Annual net profit / loss not accounting for the support by iDE/HELVETAS (GROSS MARGIN minus OP. COST)</td>
<td>-$1’120</td>
<td>-$300</td>
<td>$1’300</td>
<td>-$120</td>
</tr>
<tr>
<td>Percentage of full fixed and variable costs covered by gross margin (GROSS MARGIN/FULL COST)</td>
<td>25%</td>
<td>31%</td>
<td>54%</td>
<td>39%</td>
</tr>
<tr>
<td>Annual net profit / loss accounting for the support by iDE/HELVETAS (GROSS MARGIN minus FULL COST)</td>
<td>-$4’120</td>
<td>-$7’550</td>
<td>-$5’200</td>
<td>-$16’870</td>
</tr>
<tr>
<td>Percentage of operational costs covered by gross margin (GROSS MARGIN/OP. COST)</td>
<td>55%</td>
<td>92%</td>
<td>126%</td>
<td>98%</td>
</tr>
<tr>
<td>Annual net profit / loss per system not accounting for the support by iDE/HELVETAS</td>
<td>-$32</td>
<td>-$4,68</td>
<td>$12,87</td>
<td>-$0.6</td>
</tr>
<tr>
<td>Annual net profit / loss per system accounting for the support by iDE/HELVETAS</td>
<td>-$117</td>
<td>-$117</td>
<td>-$51</td>
<td>-$84</td>
</tr>
</tbody>
</table>

In 2013, the sales of Agro Bazar in Kyrgyzstan at wholesale value were US$ 21’000 for 101 drip systems of various sizes that had unit costs between US$ 50 for 100 m² and US$1’500 for 1.5 ha. A full unit cost analysis in 2013 - calculating with full fixed and variable costs - would thus indicate costs of US$ 113 per system (US$ 11’500 divided by 101 systems sold) in order to store, market, distribute and sell one unit in the Kyrgyz market. Such unit costs are obviously very high at the initial stages of the market creation process, but as the sale numbers go up, those costs will come down; for instance in 2011 those costs were at US$ 157 per system (US$ 5’500 divided by 35 systems sold).

Looking at the annual net profit and loss statement of Agro Bazar throughout the period 2011-2014, the financial break-even point is in reach both when accounting for the financial support received by iDE and HELVETAS as well as without accounting for that support. In fact, in 2013, Agro Bazar already made a small annual profit of US$ 1’300 if one does not account for the support received by the project for the establishment of the supply chain, technical capacity building, promotion and for facilitating access to finance.

Because iDE and HELVETAS apply a business model that aims ultimately at reaching also poorer customer segments, raising sharply the gross margin at wholesale level is not an option to raise profitability within the supply chain, since it would make the technology prohibitively expensive for some customers. However, it is important to note that Agro Bazar does apply different margins depending on the specific component of a drip system, and therefore the 30% gross margin represents an average only.

If one projects the profitability analysis into the future and assumes that (1) Agro Bazar’s gross margin stays at around 30%, (2) annual sales turnover grows by yearly 30% and (3) that full annual fixed and variable costs including the support by iDE/HELVETAS do not increase, the prospects regarding Agro Bazar’s financial sustainability and profitability are positive. Under those three assumptions, by the end of 2016, the gross sales margin of Agro Bazar will cover 100% of the full fixed and variable costs, including operational expenses and expenses for promotion, technical capacity building, supply chain management and for facilitating access to finance. In fact, Agro Bazar will be covering all those expenses that iDE and HELVETAS have financially supported since 2010 and furthermore by 2016, Agro Bazar will have an annual profit of US$ 2’200, which represents a 5% profit margin (see graph “Profitability Projections”).

EXTERNAL FUNDING AND RETURNS IN TERMS OF INCOME GENERATED

Below table “External Funding” shows the funding (in CHF) that was available to iDE and HELVETAS during the period 2010-2015 to create a market for affordable drip irrigation systems in Kyrgyzstan and Tajikistan and the table points out the three main outputs that iDE and HELVETAS invested in. The Swiss Agency for Development and Cooperation’s (SDC) Global Water Initiative
During the years 2010-2015, the overall resources spent on activities in the frame of the three main outputs (1) supply chain, (2) capacity building and (3) promotion were similar. However, over 45% of the overall budget 2010-2015 accounted for operational expenses for national and international staff. This includes expenses for project operational costs; mainly expenses for office and car as well as overhead and resources for monitoring and documentation of the market creation approach. Those operational resources were necessary to implement a consistent private sector development methodology, and hence iDE and HELVETAS invested them to build up technical and marketing capacities of the iDE and HELVETAS staff that implemented the project and the staff of the commercial supply chain partners and to assist in promotional efforts. As a result, iDE and HELVETAS had to spend fewer resources for actual ‘activities’ within the main outputs. Furthermore, the commercial project partners were required to co-finance all activities to create a market and as the market evolved, market transactions increasingly covered expenses for activities, or, in other words, project partners were able to cover them by their gross margin on sales.

Nevertheless, by supporting project partners in creating the supply chain, in technical capacity building and for promotion, iDE and HELVETAS covered parts of the necessary investments of the commercial project partners to create the market and to generate initial demand (see “Supply Chain Level Analysis”). However, if the sales of affordable drip irrigation systems continue to grow as expected already in the short run, financial support by iDE and HELVETAS for the supply chain creation, technical capacity building and for promotion will decrease as project partners are gradually taking over these expenses.

If one looks at the total external funding of over CHF 588’000 for the period 2010-2015 and contrasts it with a total sales turnover of only around CHF 186’000 for the same period, the overall efforts of iDE and HELVETAS to create a market for gravity-fed drip irrigation systems in Kyrgyzstan and Tajikistan at first glance seem expensive. Moreover, in 2016 the project will spend another CHF 80’000 to consolidate and phase out its efforts. The funding for 2016 will also continue covering operational expenses and subsidizing necessary investments of the commercial project partners (see table “Planned external funding 2016”).

Taking a closer look however, the market creation approach of iDE and HELVETAS is convincing because it continues to generate income and impact year by year, also beyond the project end in 2016. For instance, let us look at the entire period of the intervention 2010-2016 and assumes the following:

1. Net financial returns by drip irrigation at farm level are US$ 0.5 per square meter of drip irrigation installed; this net financial return at farm level accounts for the water savings, increased yield and crop quality and savings in labor requirements that a drip users experiences in his/her plot compared to furrow irrigation.

2. Conservative sales projections for 2016 are 200 drip irrigation systems for a total area of over 37 hectares for both Kyrgyzstan and Tajikistan. These are conservative sales estimates by the project partners in Kyrgyzstan and Tajikistan based on their market knowledge.

Under those two assumptions, by the end of 2016, the project intervention by iDE and HELVETAS will have generated a total estimated financial impact of around US$ 1’273’400 which represents the sales turnover at wholesale level plus the net income generated at farm level. Compared to total project investments of iDE and HELVETAS of around US$ 668’000, this represents a return on (project) investments of over 190% (see table “Sales and Returns”).

### External Funding

<table>
<thead>
<tr>
<th>Output Type</th>
<th>2010/11</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>Total 2010-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Staff Costs</td>
<td>CHF 15’000</td>
<td>CHF 32’000</td>
<td>CHF 35’000</td>
<td>CHF 40’000</td>
<td>CHF 35’000</td>
<td>CHF 157’000</td>
</tr>
<tr>
<td>Consultant Cost</td>
<td>CHF 10’000</td>
<td>CHF 20’000</td>
<td>CHF 42’000</td>
<td>CHF 35’000</td>
<td>CHF 20’000</td>
<td>CHF 127’000</td>
</tr>
<tr>
<td>1 Output: Supply Chain</td>
<td>CHF 13’000</td>
<td>CHF 32’500</td>
<td>CHF 25’000</td>
<td>CHF 20’000</td>
<td>CHF 20’000</td>
<td>CHF 110’500</td>
</tr>
<tr>
<td>2 Output: Capacity Building</td>
<td>CHF 13’000</td>
<td>CHF 25’000</td>
<td>CHF 25’000</td>
<td>CHF 15’000</td>
<td>CHF 10’000</td>
<td>CHF 88’000</td>
</tr>
<tr>
<td>3 Output: Promotion</td>
<td>CHF 13’000</td>
<td>CHF 32’500</td>
<td>CHF 25’000</td>
<td>CHF 20’000</td>
<td>CHF 15’000</td>
<td>CHF 105’500</td>
</tr>
<tr>
<td><strong>Total external funding</strong></td>
<td>CHF 64’000</td>
<td>CHF 142’000</td>
<td>CHF 152’000</td>
<td>CHF 130’000</td>
<td>CHF 100’000</td>
<td>CHF 588’000</td>
</tr>
</tbody>
</table>

### Planned External Funding 2016

<table>
<thead>
<tr>
<th>Output Type</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Staff Costs</td>
<td>CHF 35’000</td>
</tr>
<tr>
<td>Consultant Cost</td>
<td></td>
</tr>
<tr>
<td>Output: Supply Chain</td>
<td>CHF 15’000</td>
</tr>
<tr>
<td>Output: Capacity Building</td>
<td>CHF 10’000</td>
</tr>
<tr>
<td>Output: Promotion</td>
<td>CHF 20’000</td>
</tr>
<tr>
<td><strong>Total external funding used</strong></td>
<td>CHF 80’000</td>
</tr>
</tbody>
</table>
To summarize, creating financially viable supply chains in both Kyrgyzstan and Tajikistan over a period of six years 2010-2016 will have required a total of US$ 668’000 in external funding by iDE and HELVETAS. However, as illustrated in the table “Sales and Returns”, the external funding is already decreasing in the period 2015-2016. And, because the commercial project partners will be increasingly able to cover by their gross margins on sales the necessary costs and investments to continue creating the market, accordingly the respective return on project investments will grow during 2016.

By the end of 2016, iDE and HELVETAS will completely withdraw their external financial support, while Kyrgyz and Tajik market stakeholders will continue to exist and serve a growing demand for drip irrigation systems by farmer-clients. This in consequence further increases the return on project investments, most probably far beyond the end of the project intervention. Therefore, it is reasonable to conclude that compared to more conventional project approaches, which may cost considerably more and which will end after a few years without creating financially sustainable markets, the establishment of supply chains that last and grow seem to be a very efficient investment. The international donor community should thus continue to invest in such market creation approaches and iDE and HELVETAS are grateful for the support of SDC and all others who have contributed to the successful outcome of this project.
PROJECT MANAGEMENT

PROJECT TEAM: ROLES & RESPONSIBILITIES

iDE and HELVETAS implement this project with a small and dedicated project team that is responsible for project coordination, planning, monitoring and evaluation. The project team for both Kyrgyzstan and Tajikistan consists of a part time iDE Programme Coordinator, two part time HELVETAS project managers based in Kyrgyzstan and Tajikistan, and intermittent technical support by iDE and HELVETAS consultants. For accountancy and legal technicalities, the project team relies on the infrastructure of both HELVETAS in Kyrgyzstan and in Tajikistan.

A steering committee is the highest body of the project. Both iDE and HELVETAS steer this project. The project management submits yearly progress reports and annual implementation plans and budgets for approval. The committee provides strategic orientation, assures alignment to iDE’s and HELVETAS’ global strategies and contributes to coordination with other stakeholders.

Overall, in order to monitor the performance of the project, including the technological innovation and the sustainability of the supply chain, the project team monitored the following indicators:

- Sales turnover
- Number and type of farmer-clients
- Area under drip
- Financial viability of the supply chain
- Context monitoring

OUTCOME MAPPING

The management principles of the iDE and HELVETAS market creation approach can be illustrated applying outcome mapping principles. Outcome mapping focuses on actors – so called boundary partners – who drive and maintain the changes/objectives of the intervention. Outcome mapping recognizes the boundaries of influence of iDE and HELVETAS and specifies outcomes as changes of behavior in the system in which the project acts. Outcome mapping looks as at the system in which the intervention takes place as a whole and differentiates between sphere of control, sphere of influence and sphere of interest.

Boundary partners can be individuals, groups or organizations with whom iDE and HELVETAS interact directly and want to influence in order to anticipate change. Change is defined as changed behavior, attitudes, relationships and actions. iDE and HELVETAS work with boundary partners in their sphere of influence to effect change but the project team does not control them. By establishing a supply chain, the project team works directly with the following boundary partners: (1) wholesalers, (2) retailers and (3) to a lesser extent farmers. Eventually, iDE and HELVETAS reach women and men farmer clients (beneficiaries) through these boundary partners and thus causes change of behavior both in the sphere of influence and in the sphere of interest.

- To be transparent to the project team and to provide data about profitability (fixed and variable costs, gross margins on sales)
- To be accountable for product storage and quality, and to provide product warranty to retailers and to other client organizations. In case of direct sales to farmers, to provide product warranty to client farmers and to elaborate a transparent sales policy that is shared with retail partners;
- In case of direct sales to other donor- or government-funded projects, to adhere to smart subsidy principles that do not affect the overall market creation process (see box “subsidies – what is smart and what is distorting”)

WHOLESALE: ROLES & RESPONSIBILITIES

Within the frame of the intervention, the commercial wholesale partners of iDE and HELVETAS are responsible to fulfill the following roles and to act according to the following principles:

- To organize wholesale functions according to agreed yearly action plans and based on business plan projections;
- To cover cost for human resources, administration, all costs related to storage and distribution. As mentioned, initial support by iDE and HELVETAS for human resources is possible, due to the high work load at wholesale level;
- To negotiate the gross margin on sales at wholesale level with the project team based on business plan projections and actual sales turnovers;

RETAIL: ROLES & RESPONSIBILITIES

At retail level of the supply chain, commercial project partners of iDE and HELVETAS are responsible to fulfill the following roles and to act according to the following principles:

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MARKET BASED APPROACHES AND BEHAVIOR CHANGE

Payazidin Jooshov is a soviet educated PhD irrigation engineer. He was first exposed to IDE’s and HELVETAS’ market creation approach at the start of the intervention in 2010. He was skeptical, arguing that there needs to be stronger government involvement. Working for ZOKI, Payazidin Jooshov was responsible for wholesaling drip technology. ZOKI being a not-for profit legal entity with an orientation towards donor mandates, was however not (yet) ready for those private sector activities and at the beginning of 2012, IDE and HELVETAS handed over the responsibility for wholesaling to a commercially orientated cooperative. Payazidin Jooshov continued to be involved in the project; and more and more he became aware of the commercial potential of the technology as well as his personal comparative advantage selling the technology, since he is one of the few technical irrigation experts in the country. In 2013, Payazidin Jooshov sold over US$ 10,000 worth of drip irrigation materials. Eventually convinced by those positive results in 2014, Payazidin Jooshov registered his private drip irrigation business that aims at serving farmers in the North of Kyrgyzstan. Based on his vast technical knowledge, Payazidin Jooshov is now pro-actively promoting drip irrigation towards both the Kyrgyz government and public. For him, being exposed to IDE’s and HELVETAS’ market-creation principles was a new challenge, but eventually he was convinced and adapted successfully.

- To set the pricing in order that the gross margin on sales is high enough to cover costs for installation and consultancy for farmer-clients. Initially, IDE and HELVETAS financially support such expenses, but with a clearly communicated exit-strategy;
- To respect a minimum price equal to the procurement price when selling both to farmer-clients and institutions;
- To cover costs for human resources, administration, and all costs related to storage and distribution;
- To be transparent to the project team in data about profitability (fixed and variable costs, gross margins, etc.) and about sales performance;
- To offer technical support and product warranty to farmer-clients and institutions that needs to be covered by the retailer’s margin on sales;
- In case of direct sales to other donor- or government-funded projects, to adhere to smart subsidy principles that do not affect the overall market creation process (see box “subsidies – what is smart and what is distorting”)

SUBSIDIES – WHAT IS SMART AND WHAT IS DISTORTING?
One of the key beliefs of IDE and HELVETAS is not to make free-gifts. Ideally, commercial partners will sell affordable technologies to customers and those will be able to make enough money to be able to pay back their investments within a reasonable period. Reality is often not so ideal, and IDE and HELVETAS had to find ways how to cope with this reality. Subsidising the product price is not a solution, because it distorts the market, privileges the happy few and is not a sustainable operation. Therefore, so-called smart subsidies target the transaction costs – and not the product costs. Such subsidies are welcome and needed: they promote innovations, provide access to poor farmers and they are sustainable. The following principles served as guideline in regards to subsidies throughout the intervention of IDE and HELVETAS in Kyrgyzstan and Tajikistan:

1. Market creation stage: If the technology is introduced for the first time, subsidies or fully financed systems are more justified than in mature markets with mature customers. For example commercial and better-off apricot or vegetable farmers must acquire the systems at full cost;
2. Poor vs. non-poor customers: Although it is not easy to distinguish between poor and non-poor customers, subsidies should mostly be targeted to poor farmers. Subsidies are especially justified if the purpose is improving the food security situation;
3. Contributions: All customers should contribute, either by cash or in-kind, e.g. by work. Preferably, drip systems should be given on a loan base and customers should pay back all or at least partially;
4. Supply chain: The technologies must be available on a long-term basis through a viable supply chain with a decentralized network of rural retailers. Direct delivery from wholesale level to a NGO or a government program can undercut this retailer network. It is thus preferable that the delivery involves the retailers. In case there is no retailer, the project will use the larger orders to create a retailer in the area, whenever possible. These decentralized retailers are also responsible for the provision of spare parts and technical advice;
5. Technical trainings: New customers that have no experience in using drip need training. This training should be financed by an institutional customers and can be provided by either the project or local retail partners;
6. Monitoring: all customers should be included in the monitoring system and retailers and institutional customers should adhere to the minimal monitoring required by the project. Moreover, HELVETAS and IDE must be able to measure the impact of those programs through a sample of in-depth interviews.
A COLLABORATIVE APPROACH

iDE and HELVETAS have implemented this project with the help of numerous partners. Such a collaborative approach assured that each partner generated multiplying effects by building on existing strengths and networks. As mentioned, the main implementer in both Kyrgyzstan and Tajikistan is the Swiss NGO HELVETAS. In the frame of the iDE-HELVETAS collaboration, the role of iDE is to render specific technical support services and HELVETAS has the lead in project management and coordination. Specifically, IDE provides the following inputs:

- Support in the identification of suitable market actors;
- Identification and adaptation of suitable micro-irrigation technologies and where to source from;
- Establishment of the initial supply chain through iDE Global Supply;
- Technical capacity building about drip irrigation of stakeholders in the supply chain and of farmer end-users;
- Provision of software tools, such as a water wheel at crop level, a water efficiency tool at farm level and a Water User Master Plan at watershed level;
- Development of business plans at all levels of the supply chain.

In addition, in Kyrgyzstan iDE and HELVETAS cooperate with the following partners:

- **For-profit Cooperative Agro Bazar**; founded in Osh in 2008, this cooperative supplies greenhouses, irrigation technologies, micro-credits and provides market access to Kazakhstan and Russia for its member farmers.

- **For-profit Cooperative Caplya Plus**; a cooperative based in Bishkek, supplying and installing gravity-fed drip and consulting services for agricultural production. Two irrigation specialists founded it in 2013.

- **Not-for-profit NGO Centre for Training, Consultancy and Innovation (ZOKI)**; founded in 2001 as an agricultural extension service provider, ZOKI works directly with farmers and organizations in the spheres of irrigation, agricultural management and finance, livestock, and processing.

- **Not-for-profit NGO Kyrgyz Forest and Land Users Association**; founded in 2010 in Bishkek, AFLU has piloted gravity-fed drip on demo plots in the provinces of Issyk Kul, Batken and Osh. It maintains good relations with Turkish component manufacturers of gravity-fed drip systems.

- **Not-for-profit NGO Rural Advisory Services Jalalabad**; based in Jalalabad, through its network of advisors, this NGO maintains a close relationship with the rural population, even in remote districts. It is responsible for promotion, sale, design and installation as well as training about drip irrigation.

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3 [http://www.ide.org/OurTechnologies/GlobalSupply.aspx](http://www.ide.org/OurTechnologies/GlobalSupply.aspx)
In Tajikistan since 2013, iDE and HELVETAS cooperate with two main local partners:

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not-for-profit NGO Neksigol Mushovir</strong></td>
<td>based in Khujand since 2009 Neksigol is providing extension services to farmers and consultancy to companies along agricultural value chains, including advising on improved water productivity. Neksigol is responsible for technical capacity building and promotion.</td>
</tr>
<tr>
<td><strong>For-profit Private Entrepreneur Umed Sharipov</strong></td>
<td>based in Khujand since 2009, Umed Sharipov provides complete systems for gravity-fed drip irrigation. He holds an MBA in agro-business from Germany and further studies in Israel's Centre for International Cooperation about gravity-fed drip. Umed Sharipov is responsible for supply chain management and wholesale and retail functions.</td>
</tr>
</tbody>
</table>

As mentioned, IDE and HELVETAS configured their intervention in the four main components of: (1) supply chain, (2) technical capacity, (3) promotion and (4) access to finance. Such a project set-up allows exploiting synergies with additional partners, since other projects and potential partners can put emphasis on the components they consider necessary and that fit their agendas. IDE and HELVETAS document the successes and lessons learned in Kyrgyzstan and Tajikistan also with the aim to replicate the market creation approach in other countries. Both IDE and HELVETAS are interested in a long-term collaboration in countries with high thematic and operational complementarity.
As illustrated, gravity-fed drip irrigation systems are designed for farmers marketing their crops, and are only secondary for subsistence agriculture and home gardening. This has proven to be especially true during the introduction phase of the technology in the Kyrgyz and Tajik context. Once the technology is popularized poorer farmers will also adopt and benefit, e.g. for home kitchen and subsistence farming in remote areas.

If we look at the wider market prospects of drip irrigation technology in Kyrgyzstan, these are promising. According to estimates from ZOKI in the Kyrgyz province of Batken only, there is potential to put over 100’000 hectares of land under drip irrigation given the local climatic and soil conditions. In the province of Issyk-Kul, more than 70’000 hectares of arable land are suitable for drip irrigation. In both provinces, the potential for drip irrigation mainly lies in the fruit and berry sector, which depends on national as well as international market demand for these crops. Obviously, these are very optimistic estimates. Nevertheless, if it is assumed that only 0.5% of the arable land in Kyrgyzstan will be irrigated by drip irrigation within the next 10 years, this reflects a total area of around 7’000 hectares. Under this 0.5% assumption, the market potential for drip irrigation in Kyrgyzstan is thus over US$ 10m within the next ten years.

Also in Tajikistan, there exists a significant potential for the expansion of drip irrigation in the four agricultural subsectors of (1) greenhouses (2) open-field vegetable agriculture (3) permanent crops where irrigation is based on small hillside springs or on pumping and (4) household plots. Adjacent map visualizes results from a market research about drip irrigation conducted throughout 2013. Government and local NGO staff as well as farmers were asked to provide a percentage rate at district level about the arable land under water stress. Water stress in the questionnaire was defined as arable land that currently is not sufficiently irrigated by farmers due to climate change, run-down irrigation infrastructure, high costs for pumping or too high costs for irrigation water. The map clearly points out the main areas of the intervention by iDE and HELVETAS in Tajikistan, which are the province of Khatlon in the south and the province of Sughd in the north. The entire Sughd province also offers high potential for drip, because in 2012 mechanical pumps moved around 90% of the irrigation water.

Analyzing the Tajik agricultural sector overall, it is striking that in the period 2007 up to 2012, there has been a strong growth in the area of orchards, whereas the area of annual crops slightly decreased. However, during 2007-2012, in Khatlon and Sughd, the area of crops that are apt for drip irrigation grew continuously and considerably. In Sughd province, the total area of arable land cultivated by crops apt for drip irrigation grew by around 10% or about 8’000 hectares in the period 2007-2012. More distinctively in Khatlon province, the total area of arable land cultivated by crops apt for drip irrigation grew by more than 60% during the same period which represents over 30’000 hectares.

To sum up the Tajik case, if it is assumed that only 1% of the land that is in 2012 irrigated by pumps in the provinces of Khatlon and Sughd is put under drip irrigation within the next 10 years, this reflects a total area of around 2’300 hectares. Under this 1% assumption, the market potential for drip irrigation in those two provinces only, is thus over US$ 2,3m within the next ten years.

Those facts show that there is indeed a considerable total addressable market in both countries. These market potentials are large enough in order to start manufacturing many of the components of a gravity-fed drip system locally in Kyrgyzstan and Tajikistan, while assuring economies of scale. Since 2013, various stakeholders in Kyrgyzstan are investigating manufacturing options, and in

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Tajikistan most of the tubing for main lines and drip laterals are already locally sourced in the city of Khujand. More in-country production will further add value to the local and regional economies and from a marketing point of view allows positioning the technology as local made in Kyrgyzstan or made in Tajikistan.

Those large market potentials in both countries also call for a close context monitoring of the market development and in case the private sector picks up and invests even faster than expected, for an early exit strategy of iDE’s and HELVETAS’ resources. Consequently, in Tajikistan already since early stages of the market creation process in 2013, iDE and HELVETAS focus more and more resources on the challenge how to reach subsistence farmers (family gardens) with commercially supplied drip irrigation. The aim is to determine a model that shows how to reach the socio-economic bottom of the pyramid of smallholder farmers through a financially sustainable supply chain in both Kyrgyzstan and Tajikistan.

The following two textboxes summarize the main challenges and opportunities that remain for iDE and HELVETAS during the year 2016.

<table>
<thead>
<tr>
<th>CHALLENGES</th>
<th>OPPORTUNITIES</th>
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<tbody>
<tr>
<td><strong>Reaching the poor</strong>: Poorer farmers have to avoid risks and wait until they are sure that a new technological solution works. In addition, while awareness has been established in many places, other especially remote areas have so far not much practical experience. The challenge is to reach these poorer farmers with commercially supplied gravity-fed drip irrigation.</td>
<td><strong>Increasing water costs</strong>: According to a post-Soviet sharing agreement both Kyrgyzstan and Tajikistan have the right to 25% of the water that originates in their territory. They use the entire amount, with utilization being skewed heavily in favor of agriculture (over 90%). If this sharing agreement is re-negotiated coupled with the effects of climate change, there will be less irrigation water available in the mid-long term. Consequently, water in the region will become more scarce and expensive, thus incentivizing farmers to use it more productively.</td>
</tr>
<tr>
<td><strong>Deteriorating Infrastructure</strong>: The irrigation infrastructure is rapidly deteriorating. In both countries over 80% of irrigation is based on canal networks, into which often water needs to be pumped. These Soviet-era gravity canal systems are mostly in bad repair. As a result, a large part of the irrigated area does not have sufficient water during the maximum demand season. Not even if a farmer irrigates with drip irrigation.</td>
<td><strong>Agricultural sector growth</strong>: In the Kyrgyz and Tajik agricultural sector, from 2007 to 2012, there has been a strong growth in cultivated area, both in the vegetable and in the orchard (fruit and berry) sectors. As the sector further grows, its need for adequate irrigation technologies will grow as well.</td>
</tr>
<tr>
<td><strong>Low agricultural productivity</strong>: Farmers usually practice flood or furrow irrigation, which are little productive in terms of water and yield. Also, most of the rural poor practice subsistence or semi-subsistence farming and depend on a multifunctional agriculture, mainly based on livestock farming that does not have a strong focus on productivity increase. There are many other (simpler) interventions to increase water and agricultural productivity prior to introducing drip irrigation.</td>
<td><strong>Lack of agricultural labour</strong>: Low income from agriculture causes migration. Especially - but not only - young men are migrating both in country to urban centers, and abroad. Therefore agricultural labor force has become a limiting factor. There is thus an increased need for labour-saving technologies such as drip irrigation. Particularly women will benefit of drip, because migration also impacted on the role of women in agriculture; tasks that had a male connotation such as irrigation are nowadays being conducted by women.</td>
</tr>
<tr>
<td><strong>Social Perceptions</strong>: In Central Asia, water is considered a resource free of charge (“gift of God”), and farmers hold that only the irrigation infrastructure should be paid for. If the irrigation canals work, often the head-end users have plenty of water, while the tail-end users lack water. In addition, many farmers do not have much knowledge about how to irrigate efficiently and water charges are usually based on the area irrigated, not the quantity used, so there is little financial incentive to invest in technologies that save water.</td>
<td><strong>Scaling-up with other projects &amp; programmes</strong>: As the awareness about the advantage of drip in the Kyrgyz and Tajik public increases, also other projects and programmes will take over drip irrigation in their activities. In Kyrgyzstan and Tajikistan, the Agha Khan Foundation, the Kumtor Gold Company, EBRD, USAID, GIZ and the Rural Advisory Services Jalalabad are or have been implementing projects with a drip irrigation component.</td>
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• ZOKI (2013): Исследования эффективности технологии капельного орошения. П.Жоошов, К.Абдраимов. Бишкек.