Integrating the transfer of skills, knowledge and technology for low-cost micro-irrigation

A concept based on recent experience

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1 SIMPLE THINGS CAN BE DEMANDING

Low-cost micro-irrigation technologies have great potential to contribute to improving the livelihoods of poor households by enabling them to earn additional cash income or to grow more food for themselves.

Micro-irrigation kits look so simple that one is tempted to believe that a transfer of the technology would be the simplest thing in the world. However, it is not sufficient to hand out kits if poor people are to make true use of the opportunities that low-cost micro-irrigation technologies offer. Rather there are some important points to be observed, for example:

Supply issues: To make the equipment available widely and on a longer term, independent profitable supply chains in the private sector need to be in place. A market for micro-irrigation equipment with many suppliers and many demanders needs to be created. Fostering the establishment of a profitable supply chain may be like a "walk on the tight rope": to be profitable, a dealer or an assembler of micro-irrigation kits needs to have a certain volume of sales, but this volume cannot not be reached unless the clients have seen the kits operating for a while, according to the AIDA model. The use of low-cost micro-irrigation systems is likely to increase yield, crop quality and thus income, but it is hard to communicate this to farmers before they experience it themselves.

The AIDA model				
A wareness	It takes some time to create awareness to attract early adopters.			
nformation	It takes more time till a new customer has all the information she/he needs.			
D esire	Only when people have all the information together they may desire it also.			
A ction	And it may even take more time to take action, because they may need to get the money first.			

- Agronomic and marketing issues: A new irrigation technology brings about the need for adaptations in the whole cropping and marketing system. Small farmers who are used to grow mainly crops for home consumption, need support for a move from subsistence crops to high value marketable crops. The adaptation may be difficult also where people already grow vegetables, but they do it in a different way, and they are used to irrigate in the way they always did. Or they may not be used to grow vegetables, and they may have a lot of questions about how to grow and/or how to market them. They may need information about what types and varieties have the best price potential, how to get access to good seeds, how to apply fertiliser and manage pests, and how to get the produce to the market at the right time and in the best way.
- Water use issues: Micro-irrigation saves water, but it also allows to grow vegetables by using drinking water, and in water scarce areas this may cause conflicts with the neighbours. The distribution of water and the questions of water rights should be studied before introducing micro-irrigation to avoid conflicts and tension. Also potential ecological effects should be assessed.

A dissemination strategy that wants to achieve widespread, profitable use of the technology needs to employ a market creation approach. This means the integration of all these issues - a profitable supply chain in the private sector, accompanied by opportunities to acquire the skills and knowledge that

allow profitable use of the technology, and an understanding of the risks and possible undesirable effects.

In summary a market creation process for low-cost micro-irrigation aims at building a system that allows poor farmers access to all services that are essential to make profitable use of the technology. And this is not only the hardware but also software or know-how. The graph below shows how this may look.



This paper focuses on the process to build the supply chain for the hardware, but indicates also how the skills and knowledge needs of the users can be integrated in the process. Thus it first presents some principles about the development of markets and on interventions to foster market creation. Then it outlines a systematic step-by-step process for creating a market for micro-irrigation technology and shows how such a market creation process can be facilitated and accompanied.

The paper combines marketing theory, experience with establishing supply chains for treadle pumps and micro-irrigation technology in India, Bangladesh and Nepal, and from a pilot initiative to introduce low-cost micro-irrigation in Eritrea.¹

¹ In these cases IDE (International Development Enterprises), and, in Eritrea, CDE (Centre for Development and Environment, University of Berne) perform(ed) the facilitator role. There are other organisations that employ similar market creation approaches.

2 CREATING A MARKET – THE BASICS

2.1 Product cycle and supply chain development

Introducing micro-irrigation through a market creation approach needs time, and different interventions at each stage. Different phases in the development of markets have to be distinguished. The "product cycle and supply chain development graph"² is based on conventional marketing theory, basically on the theory of the product cycle³ which is itself developed on the theory of dissemination of innovations. This theory recognises different phases in the development of a market for a new product.



² Urs Heierli, Paul Polak: "Poverty Alleviation as a Business – The Market Creation Approach to Development", Berne, SDC, May 2000.

- R&D (research and development) phase: A new product needs to be adapted to the local situation and thoroughly tested. For low cost micro-irrigation this means, for example, putting a system into the fields of twenty potential users for a full growing season, learning from them what the problems are in using it, and changing the design of the system to resolve the problems. In the R&D phase sales are virtually zero. The expenditures are an investment in future sales.
- Introduction phase: In the introduction phase the first players in the supply chain and the first buyers come in. Those who are willing to buy and those who are willing to sell are typically "innovators" who like to be pioneers. Bermann⁴ calls the "early sellers" the "scouts". The innovators on both sides are risk-takers, enterprising people, rather better-off, and not the poorest who are (and have to be) much more cautious and conservative. Sales volumes are low, and at this level of sales it is impossible to make profits. This phase requires extensive demonstration and testing efforts.
- Market creation phase: In this phase sales pick up and this is usually the time, when early adopters step in. Now profits can be made. On the supply side, the so-called "troops" join the chain and the higher the sales, the more people want to join. Promotion of the product as such makes it widely popular. The product is mainstreamed. One has to recognise, however, that the diffusion of innovations is often not a smooth and continuous process (see also section 2.2 and 4.2.1).
- Consolidation and withdrawal: A market creation approach aims at supply chains that are sustainable on a long-term. Once a critical mass is achieved, sales may go on without further generic promotion of the product, and the supply chain may be profitable enough to sustain itself. But it may be necessary to strengthen the chain in various ways. Suppliers may need capacity development in the form of Business Development Services (BDS) (for payment), or they may need assistance in organising themselves, or mediation support for policy dialogue with the government. Myriads of other minor and major problems may need evening out.

The withdrawal should be carefully planned, and it is indeed a danger to stay too long in the picture (especially if the role of the facilitator is distorting the market, which should be avoided at any time). On the other hand, one often steps out too early, just before the take-off. Market creation approaches need time, especially those related to agricultural products: as each potential buyer is observing other buyers, it will always need at least one season till a new buyer converts his/her desire into action.

2.2 Process of innovation adoption

The theory on the dissemination of innovations bases on the observation that people behave differently in their purchasing patterns. New products are first purchased by innovators; then early adopters follow, before an early majority joins in. Finally the late majority and ultimately the laggards follow. Rural poor customers are usually extremely conservative and cautious buyers, and it will take much more time for them to buy than young urban consumers who strive to be the first ones to have a certain gadget.

³ Philip Kotler: "Principles of Marketing", Prentice Hall India, 1999, p. 272 ff.

⁴ Barry Bermann: "Marketing Channels", John Wiley, New York, 1996, p. 472



A refinement of the innovation dissemination theory⁵ points out that the transition between the different groups of adopters often does not happen smoothly. This is especially so for new technologies that require complex changes in some behavioural patterns. As there are considerable differences between the consumption patterns of these groups, there may be some chasms in the product cycle curve, notably at the transition between each of these adopter groups or markets.

2.3 What may be publicly funded and what not

In a market creation process it is essential that market development is not undermined by imprudent subsidies with public funds. Public funds must be used only for functions for which no private funds are made available. In the case of low-cost micro-irrigation such considerations are of particular meaning regarding product promotion.

We should distinguish between the introduction of a new product in an area and the introduction of a specific branded variety of such a product. For instance to introduce the treadle pump or a microirrigation system as such, **generic promotion** of the product is required. Once the system is known, then each manufacturer, assembler, dealer or installer may introduce his/her specific variety of the product through specific **branded promotion**. Generic promotion has the character of a public good, and thus private sector actors are unlikely to invest in it, whereas specific promotion is a private good for which the private sector makes funds available if sufficient profits are to be expected.

In other words, the R&D and promotion of a new technology like low cost drip irrigation systems or the treadle pump as such through social marketing (demonstrations, awareness creation, mass media etc.) needs to be publicly funded, whereas the promotion of a specific brand of the concerned technology, must not be subsidised. It is justified and not distorting the market to open up opportunities for many private suppliers, but it is distorting to subsidise one single private company (and not the competitors).

⁵ Geoffrey Moore: "Crossing the Chasm", Oxford, 1991

Of course, it would be desirable to also be able to recover the costs of R&D, introduction and generic promotion. But, as shown above, in the R&D and introduction phase no profits can be made. Every enterprise is making losses when introducing a new product or opening a new market. These losses can only be recovered over time by incorporating sufficient margin into the product price. There are two simple reasons why it is unlikely that the investments in R&D and generic promotion for a technology like low-cost micro-irrigation can be recovered, and why it thus is unrealistic to expect private enterprises to invest in it.

To have a chance to recover the investment, products need to be made unique through branding, patenting etc. However, the technologies we are talking about, are so simple that they can be easily copied. Even if they are patented, in many developing countries patent rights cannot be enforced. Flyby-night copycats will copy the technology, sell the copies, and disappear before the person with the patent can do anything about it. Once the market begins to take off and the "troops" join the supply chain, the copy-cats will also join. They will usually sell lower quality at lower prices, and they will lower the profits of the chain. This will exactly be the process of broad popularisation.

The other reason is that the margins are too narrow and the products (which must be before all affordable) too cheap. Opening up a new market easily takes 2-3 years and costs 200'000 to 300'000 US\$. It would be optimistic to expect sales to reach 10'000 per year after that period. With a system that costs 25 \$ and includes a margin of say 5 \$ thus at most 50'000 \$ can be recovered annually. For a large company this is not interesting, and small companies may not be willing and able to bear the risk of such an investment.

However, for a donor agency, it is well worth to invest 200'000 or 300'000 \$ into market creation, because they measure benefits in terms of poverty reduction, and the sale of 10'000 systems per year results in at least one million \$ more income for poor people every year.

3 FACILITATING THE PROCESS OF MARKET CREATION

3.1 Institutional requirements

The role of a facilitator of a market creation process is a challenging one and demands varying competencies, among them:

- Committment and resources to accompany the process over many years,
- a good sense and related skills for marketing,
- enterprise development knowhow,
- technical knowhow for micro-irrigation,
- sound agricultural knowhow including the skills for adaptive experimentation,
- knowhow on options for agricultural support services.

Of course, often the local agencies that engage in the facilitator's role may not have all the necessary competencies available within their organisations, and this is also not necessary. Specialist know-how can be acquired through consultants who backstop and support the process (facilitation of facilitation). However, the committeent for an engagement of several years, and the willingness and ability to make some resources available, i.e. the ownership in the undertaking, must be anchored locally.

3.2 Changing roles over time: from "do!" to "let others do!"

In the market creation process the role of the facilitating agency must change over time, i.e. between the introduction phase and the market establishment phase. And this change over time is a true challenge for the facilitator. The facilitator must initially be a doer and then gradually withdraw and hand over to the private supply chain.

The only way to introduce a new product is to make it known in the market through demonstrations. As there is no supply chain yet, the facilitating agency needs to do this job, including the R&D activities. In the introduction phase of a product, the agency must do the things and import material, sell and install demonstrations kits, show to the people – above all to innovators and leaders, not to the poor – the usefulness and the viability of the technologies. At the same time, the facilitator must sort out a myriad of small problems with customs, missing spare parts, technological adaptations, etc.

Later on, when the market starts to take off, the facilitator must change its role, withdraw and let the others do. Sometimes, this means real withdrawal, as there is always a risk to dominate the market and to distort it.

It is very demanding for an agency to withdraw just at the time when the initiative becomes successful and let the competitors do the job. For a young marketing professional, it must be heartbreaking to see that just when s/he has prepared the market to emerge, s/he should let go …! Competition may be merciless and cut the cost (and often the quality) significantly. A facilitating agency might be tempted to fight such undercutting and "unfair" competition, but in fact the emerging competition is exactly the sign for success in the creation of a market.

The diagram below that is based on IDE's experience as a market creation facilitator in various places in India and Nepal⁶, shows exactly this trend. Observations with interventions that have gone on over different time periods show three stages in the initial market creation process.



In an organic cotton project in Maikaal and in sericulture areas of Kolar, both in India, IDE had initiated the early introduction of micro-irrigation technology and then stopped direct intervention. Only some time later competition suddenly started to emerge and brought down the costs significantly and thus increased the affordability. In Maikaal, drip systems (introduced by IDE through local dealers) initially cost Rs. 12'000 per acre; today, the farmers buy them at Rs. 5'000, and there seems to be fierce competition.

It is evident that a market creation process requires more time than donor agencies usually want to spend on an intervention. It is worth mentioning that donor support was withdrawn in Kolar as well as Maikaal before the market take-off.

⁶ Jack Keller and Tushaar Shah: "Micro-irrigation and the poor", presentation of findings of a rapid appraisal during the seminar on micro-irrigation in Berne, May 2001

4 A STEP BY STEP MARKET CREATION PROCESS

In this chapter a practical step by step process to be followed by organisations to facilitate the creation of markets is outlined. The table below gives a first overview of the steps.

Introduction phase	Raising interest – sample testing
(1 - 3 years)	Awareness creation, demonstrations/tests, preliminary situation and feasibility assessment
	Systematic dissemination of information and wide demonstration, experimentation and adaptation, in depth analysis of potentials and feasibility
	Preparing for large-scale dissemination, supply chain development and marketing strategy, technology perfection
Market establishment phase	Achieving a critical mass – from innovators to early adopters
(3 - 5 years)	Agricultural intensification
	Strengthening the supply chain
Consolidation and withdrawal (2 - 3 years)	Achieving sustainability of the supply chain

4.1 Introduction phase (1-3 years)

The introduction phase aims at introducing the technology with the target users through demonstrations and tests, and at the same time should allow for learning, studying agronomic and economic issues, and experimentation. It should lead to fine-tuning and adaptation of the technology to the specific circumstances.

For each step the aims, the main activities to be conducted and the requirements that need to be fulfilled are given. Whenever the required capacities are not available locally, external support by people with respective experiences, is strongly recommended.

4.1.1 Raising interest – sample testing

This first step aims at raising the interest of a core group of people in the new technology. In order to make people understand what micro-irrigation is about, practical demonstrations have to be arranged. They need be able to see and touch the equipment. The demonstrations need to be complemented with information and instructions for use.

So far, sample bucket kits have been sent to a targeted audience for testing, and this has in most cases helped to develop sufficient interest in a follow-up phase. In the early days, the sample kits were not accompanied with good documentation and illustrated installation manuals, and this led to mistakes in their use.

Requirements:

- 2-5 kits including a package of basic information and illustrated manuals. The costs for this are minimal, in the range of 200-300 \$.
- Basic agricultural and micro-irrigation know-how.

4.1.2 Awareness creation, tests and preliminary situation analysis

The aim of this step is to create awareness about the technology with a wider audience and at the same time gather basic information that allow a preliminary judgement about the feasibility of the technology in the local farming systems.

Tests with a larger number of kits and people are conducted, in different crops during a full cropping period. This includes the collection and analysis of basic agronomic data. A first look at agricultural markets and the potential of increasing farm incomes, is taken. Potential supply chain actors may be identified. The availability of materials locally, their prices, qualities, import regimes, duties, etc. are analyzed in order to determine as soon as possible the future retail price, and to decide whether it is most feasible to import the whole kits or only the materials, produce everything locally, or just assemble locally etc. Social and ecological issues that may emerge are identified.

Requirements:

- Around 25 kits including documentation. These cost approx. \$ 500 (excluding shipping; shipping cost are around \$ 1000 depending on the location).
- Local partners with interest, time and commitment. The testing sites should be selected carefully and involve competent and motivated people or institutions (e.g. innovative farmers, horticulturists, agricultural schools).
- Know-how about local agriculture and about adaptive experimentation.
- Solid know-how on the use of micro-irrigation technologies.
- Know-how for appraisal of supply chain issues.
- Know-how for the appraisal of social (power-relations, gender, water rights), and ecological (soil erosion, salinization, rainfall patterns) issues, etc.

4.1.3 Systematic dissemination of information, wide demonstration and testing, and analysis of potential and feasibility

This step aims at demonstrating the opportunities that the technology offers to a wide range of possible users, and at an in-depth assessment of the potential of the technology in the area. The step takes at least one cropping season, but may also require 2 or 3 seasons.

It includes tests with some 250 kits. This may warrant the involvement of further local partner institutions. While the first 25 kits can be given away free of cost or for a nominal fee, in this step clear criteria need to be set on who will be selected for the tests, what the conditions to obtain a kit for testing are, and what price the testers have to pay (based on estimates on the final cost). If the price is subsidised this needs to be made very explicit and transparent.

The most feasible design for a profitable supply chain needs to be elaborated, e.g. identification of promising partners (e.g. importers, manufacturers, distributors, dealers), materials and their sources, options for production or import, best form in which to import material, the cost of different options, etc.

Moreover the appraisal activities initiated in the previous step are refined, based on the previous learning. Agricultural production and marketing options are investigated (producing more, producing new things, market in a different way). Existing suppliers of advisory and information services, inputs, credit, etc. need to be identified, and gaps be recognised. Solutions for social and ecological issues need to be sought.

Specific requirements for this step

• Ca. 250 kits.

- Documentation in local language.
- Specialist know-how about adaptive experimentation for production and marketing issues.
- Specialist know-how for supply chain design.
- Know-how on options for agricultural services.
- Specialist know-how for solutions of social and ecological issues etc.

The requirements of the previous step continue to be necessary.

4.1.4 Preparing for dissemination – supply chain development and marketing strategy, technology "perfection"

The aim of this phase is to initiate the supply chain, design a mass marketing strategy and to further adapt the technology as well as the agricultural production and marketing options, based on the learning of the previous phase.

This phase of supply chain development and marketing strategy definition should give a clear picture about the economics of local manufacturing/assembly of kits, of margins for the supply chain and thus about pricing. This must be followed by facilitating the establishment of a sustainable private sector supply chain consisting of manufacturers or importers, ditributors, dealers, and technicians to install the equipment.

In this phase, some sizeable orders of kits should be executed, and test marketing on commercial terms should take place. It should now not be the facilitating agency anymore who sells the kits, but a dealer; however, the facilitating agency may still have to import the kits or the materials.

Further, a marketing strategy should be elaborated in this phase answering most questions on the four P of marketing (product, price, place and promotion).

Specific requirements of this step

Specialist business and marketing know-how.

4.2 Market creation phase (3-5 years)

After 1-2 years for the introduction phase, a 3-5 years market creation phase follows. It has the objective to create a critical mass of demand and supply, and to make the supply channel work on its own, and it aims at making all links in the chain viable and profitable.

The steps in this phase do not follow each other, but need to happen parallel (unlike in the introduction phase where a sequence of steps was presented).

4.2.1 Achieving a critical mass – from "innovators" to "early adopters"

The introduction phase targeted the "innovators"; the market creation phase must target the "mainstream" consumers/users, starting with the early adopters, then the early majority and the late majority.

Generic promotion at an increasing scale comes in. However, the stage when early adopters are coming in, is usually not yet a case for large-scale communication campaigns through mass media.

Mass media campaigns make sense only for promotion to early and late majority, and unless there are in a certain area some 10'000 units, one can not talk of the "early majority".

As explained in section 2.2 markets may not evolve smoothly. Often chasms appear in the transition from one adopter type to the next one that are difficult to overcome.

Whereas innovators buy something because it is new, the early adopters behave differently. They buy it, if they see a good potential that it may be useful. The early majority is more conservative, they buy once the benefits are proven, and they look upon somebody else from the early majority; they would never imitate an innovator in his/her eagerness to be the first to buy. Before some members of the early majority have purchased, nobody from these group will buy, and this is why there is chasm to cross which is very difficult. Similarly, the late majority will only buy, once almost everybody else has it, and the laggards will finally come, when they really do not have a choice any more.

Special strategies to cross the chasm need to be employed. These often require institutional support. If not at one stage or the other, institutional support from the government (recognised technology) or research institutions (recommended technology) will come, the chasms may not be crossed. This makes it important to involve public institutions and representatives of the "establishment" early in the process.

An important aspect is credit. If loans are available that allow buying the kits with an instalment scheme rather than a large up-front payment, the affordability rises drastically. Usually it is better to tap existing credit schemes and retail the loans through suitable available structures than to establish separate product-specific credit lines.

4.2.2 Agricultural intensification

At this stage, it is again important not to only look at the micro-irrigation technology but at the cropping system as a whole. This means that agricultural intensification should be at the centre. This is also the time when marketing issues may get on the agenda. The results of the investigations on cropping and marketing opportunities and practices made in the introduction phase need to be communicated. Advice, information and inputs need to be accessible for the mass of farmers. This can be achieved through existing institutions, or by fostering the building of new service providers that may or may not be integrated with the supply chain for the equipment.

4.2.3 Strengthening the supply chain, dealing with competition

During this phase the facilitating organisation faces the challenge that it must definitely shift its **role from a doer to a facilitator**. It should be a goal of the facilitator to promote competition and not to suppress it.

To satisfy the growing demand for the product, the supply chain needs to be strengthened. It is necessary to involve more and more dealers. It may be feasible to join hands with existing supply chains of products related to agriculture rather than build up separate chains. Among these may be dealership networks (for instance of input companies), hardware stores, or local seed and nursery vendors. The dealers need to be trained and brought on board in a professional way. Marketing technologies and methodologies from the corporate sector can be well used for this purpose.

Once a critical mass is there (10'000 and more units in a geographical area of say 50'000 km²), the supply chain may be supported with promotion campaigns through mass media. Generic promotion should make the product known widely with the masses of the early and late majorities. These

majorities must have sufficient functioning examples in the neighbourhood to see and touch so that they may become convinced and buy it too.

A communication strategy that defines the right messages to be spread and the means to do so should be devised. This may include written materials such as posters, leaflets etc. but also videos and theatre performances, video vans, etc.

The communication activities must always go hand in hand with the supply chain. If a product is not available within reasonable distance in an area, it is pointless to advertise it. It is very helpful if the dealers of an area are present during promotional events at the local level (village theatre, movies, demonstrations etc.).

4.3 Consolidation and withdrawal (2-3 years)

It is important to plan the withdrawal phase early enough. There is a danger to withdraw too early or too late. Only market knowledge can say when the right moment has come.

When the sales curve reaches saturation and it is predictable that sales will decline, then the time of withdrawal is given – or the entry with new products. Both options are valid: one may say, now it is enough, our efforts were successful, we can now withdraw. The other option is to say: we have now established a supply chain and this chain is good for many other things as well, for example for other new products.

The sustainability of the supply chain is tricky to judge. It may be sustainable in the sense that the suppliers do their own advertising and specific brand promotion. This will be sufficient to maintain a market, but it is unlikely that the suppliers – especially if they are small enterprises – will engage in generic promotion in new areas and open up new markets for their products. It may also be that the supply chain is not prepared to face stiff competition and that – without external support – the sales will go down. On the other hand, it may prevent competitors to join if the facilitating organisation remains too long in the supply chain.

In any case, the facilitating organisation should monitor – through market research – where the supply chain stands, and whether it is likely to be sustainable or not.

In many cases, the competition emerged only a few years after withdrawal, and sometimes after closure of a project. Sometimes, projects were even considered a failure during their lifetime, because the sales did not increase very fast and the market was only created afterwards. It may easily take some 5-10 years until a market really takes off. An example for this are, for instance, bicycles in Nicaragua, which have been introduced through development agencies in the 1980s with low-cost bicycles imported from India and assembled locally from CKD (completely knocked down) parts. Another example is the vibrant market that emerged for Lorena stove chimneys in Honduras, some 5 years after the closure of the project that had introduced and promoted them.